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You Must Remember This

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With great interest, I have been observing the developments in continuous *lifelong capture*, which has been gaining momentum over the last few years. By lifelong capture, I refer to someone digitally logging every moment and element of their lives, a usually permanent recording of an activity by a participant in the activity. This process often results in the unanticipated capture of valuable moments.

So why is this happening now, 60 years after Vannevar Bush's famous article "As We May Think"?[1] First, we've achieved adequate compression techniques, network bandwidth, and storage, resulting in a more prolific role of digital audio, video, and real-time data streams in our everyday life. Second, through the miniaturization of cameras and screens, the commercialization and mass production of recording tools let us passively capture events without having to operate recording equipment or even consciously record. At last year's ACM Multimedia conference, the two best-known protagonists of this research direction, Gordon Bell, of Microsoft Bay Area Research Center, and Steve Mann, of the University of Toronto, gave compelling presentations on the state of the art.[2] Although both represent different focal points within the lifelong capture universe, they clearly described the advances already achieved with respect to capture, retrieval, organization, and search. They also addressed, to some extent, the challenges we face within these issues. The presentations were so stimulating that a lot of additional thoughts and associations crossed my mind, which left me feeling, surprisingly, uneasy.

Plug in baby

Among the growing number of lifelog projects (see the "Related Work on Lifelogging" sidebar for more information), the MyLifeBits project is one of the better known.

The project began as an attempt to make the life of Gordon Bell paperless, but it soon grew into the generation of a personal lifetime digital collection.[3] Within this project, everything available from his life is digitized, such as articles, books, cards, CDs, letters, memos, music, papers, photos, posters, paintings, presentations, home movies, videotaped lectures, voice recordings, email, and calendar events. More recently, Bell has begun copying everytime he attends a chat session, visits a Web page, makes a telephone call, and listens to a TV or radio program. Finally, Bell mounts cameras on his hat and glasses to save the previous 30 seconds of an event on video when he presses a button (see Figure 1).

MyLifeBits was inspired by the Memex system Vannevar Bush envisioned and thus focuses on creating software, with specifications for typed links, text, and audio–visual annotations, embedded in an underlying database. In particular, links and annotations can be automatically generated

Figure 1. Gordon Bell with cameras on his hat and glasses.

Editor's Note

This column introduces the two most prominent approaches to lifelogging, namely MyLifeBits and EyeTap. These approaches deal with the problem of establishing media-based memory structures that address the cognition of audio–visual data with respect to comprehension and, in some aspects, interpretation. Here I discuss my struggle with the experiential value of the collected data and its durability in those approaches.

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on a large scale. For example, Bell stores the photos he takes with his camera in JPEG format, including the automatically generated annotations such as date, time, location, and camera manufacturer. Sensors also exist that provide values, such as GPS location, consisting of date and time, latitude, longitude, elevation, and precision. Date and time correlation between photos and GPS readings are then used by the system to set the location in the photos whenever possible. The project aims to move toward 24/7 continuous recording of audio, images, video, and sensors (including health-monitoring devices).

Cyborglogging

On first sight, the EyeTap approach by Steve Mann might not seem very different to MyLifeBits (for more information see http://eyetap.org/). Over the last 30 years, however, Mann has gone beyond the mere use of a wearable camera and display. (See related work[4] for details on the technology and social impact.) EyeTap devices (see Figures 2 and 3) manage to modify the light that passes through the eye, where a diverter (which might be a double-sided mirror or a beamsplitter) places the camera's center of projection at (in an optical sense) the center of projection of the lens of the wearer's eye. This lets the system present a computer-mediated version of the real-world scene to the wearer. When no computer mediation is used, EyeTap video can be displayed to users in such a way that they see what they would otherwise have been without the device.

Such types of ubiquitous devices, which Mann has been using himself for the last 30 years, are essential to seriously achieve lifelong capture

Figure 2. EyeTap eyeglasses, worn by Steve Mann, with illusory transparent frames, where the frames pass directly over the eyes and the wearer sees "through" the frames by way of computer-controlled laser light that resynthesizes rays of eyeward-bound light.

Related Work on Lifelogging

For a general overview of projects, see the *Proceedings of the First ACM Workshop on Continuous Archival and Retrieval of Personal Experiences* (ACM Press, 2004), http://portal.acm.org/citation.cfm?id.

The following is a list of specific projects in this area:

- Nokia lifelog project: http://news.bbc.co.uk/2/hi/technology/3497596.stm and http://www.forum.nokia.com/main/0,,016-2070,00.html?model=6620.

- HP casual capture project: http://news.com.com/2100-1041_3-1009127.html and http://www.hpl.hp.com/research/mmsl/projects/bristol/index.html.

- Microsoft MyLifeBits project: http://research.microsoft.com/barc/mediapresence/MyLifeBits.aspx.

- Steve Mann Eyetap project: http://www.eyetap.org/.

These sites investigate privacy issues in lifelog systems:

- Applied Dreams Workshop on Surveillance and Sousveillance, held at the Interaction Design Institute Ivrea in collaboration with the Hitachi Design Centre, Milano: http://www.interaction-ivrea.it/en/projects/applied/2003-04/hitachi/index.asp.

- W.C. Cheng, L. Golubchik, and D.G. Kay, "Total Recall: Are Privacy Changes Inevitable?," *Proc. First ACM Workshop on Continuous Archival and Retrieval of Personal Experiences*, ACM Press, 2004, pp. 86-92; http://bourbon.usc.edu/iml/recall/papers/.

And one ambitious lifelogging project didn't survive: http://www.wired.com/news/privacy/0,1848,62158,00.html?tw=wn_polihead_3.

Figure 3. EyeTap visual prosthetic worn by Steve Mann, where the camera-in-the-eye appearance makes use of the fact that rays of eyeward-bound light are diverted into a camera (actually mounted on the nose bridge and pointing toward the wearer's right eye).

because they let wearers record what they see over an entire lifetime. Combined with a wearable computer and adequate retrieval software, it's then possible to have an on-demand photographic memory that takes over the task of memorizing ordinary details that might only later become important. For instance, the devices can facilitate personal safety by providing visual evidence of crimes. Moreover, in settings where surveillance already exists, *sousveillance* (or recording of an activity by a participant in the activity) can help prevent the surveillance recordings from being taken out of context. In all these cases, EyeTap serves as a reality-recording device.

Yet, it also has other uses. The EyeTap devices also let the wearer expressively and artistically interpret the world. Mann describes this as *mediated reality*. Because the developed devices capture and simultaneously display material, it's possible to alter the visual appearance of the sight by modifying, adding, or removing the visual content. For example, we can add computer-generated information—such as memory clues in the form of notes and images related to a site we visit 20 years after we lived there—to the scene currently under exploration. In other words, we can add information to a scene for which we currently would need tools, such as a monitor, PDA, or cellular phone. The advantage is that the wearer is freed from the restrictions of additional attention such as demanding computer equipment. Moreover, it's possible to remove real-world objects from the scene, such as advertisement banners. Thus, mediated reality lets users implement a visual filter.

Mann has additionally developed mechanisms to transform the camera into a form of personal capture device that lets users personally interpret reality by merging forms of painting, computer graphics, and photography. The idea here is to combine different exposures of the same subject matter to generate light–vector paintings. Users can do this during or after shooting footage and thus capture as many exposures as necessary. At the end, there's a final image as well as the underlying data set of separately adjustable exposures, both of which can be transmitted to others for further manipulation.

Merging MyLifeBits and EyeTap into one system seems to be the next step, especially as MyLifeBits focuses on generating and organizing metadata, whereas the EyeTap technology addresses intelligent image processing. The challenge remains, though, namely how can we index the gathered material so that we can instantly access a lifetime's worth of material without endless searching? (Mann talks about adequate retrieval software but doesn't address the issue of indexing, and MyLifeBits addresses indexing on a low semantic level.)

Although I like both approaches because they try to solve the problem of establishing media-based memory structures,[5] there are two issues regarding these approaches I struggle with: the experiential value of the collected data and its durability.

Walking in my shoes

Mann makes the point that using lifelog technology for a couple of years results in a changed view of the world because more reality layers are available than we're currently used to. Reviewing recorded, everyday personal interactions, family images, or other information items, such as notes, at any time might lend itself to a human experience with greater intensity and enjoyment. It would be interesting to see, though, what happens if we switched off such devices. (Mann explains he's so dependent on EyeTap that he wouldn't do that.) Despite predictable short-term nausea, would the nonuser feel deprived? Would it be more difficult to establish meaning based on existing episodic and semantic memory structures, as we would do anyway, even with advanced logging technology? That's perhaps a question only Mann can answer at the moment.

I agree that an individual's experience can be enhanced or relived through logging technology, but I disagree that this technology can help us share experiences. Because the collected material is no longer locked in the individual's memory, we can argue that we're now able to let other people participate in our perception of the world. This idea of letting other people share an event from within somebody else is only partially correct. The context established during capture results in an alteration—which can't be executed several times—of the cognitive map and/or related cognitive processes of the one who has the experience. Thus, the captured material only provides the external context and excludes the internal context. It is, however, this inner world model that lets us interpret and evaluate the sources based on the comparison with existing memory structures. As the inner context naturally differs among humans, so does the experience of presented material, especially if one person participated in an event and another did not. The representation problem gets a bit more problematic if we consider mediated real-

ity. Here the original creator might know about the altered parts of the material, but also might not, which can cause problems if the accuracy of the material is crucial—for example, in a court case.

The essential point is that with current technology we can only turn parts of the human memory inside out, namely what is called the *episodic memory*, excluding the emotions that affect a memory's quality. To make an experience transferable, we must make the relation between external and internal context explicit. This means, however, making the interplay between episodic and semantic memory (the memory of facts and concepts) explicit. And even if that is possible, the attempt of using such knowledge is illusionary because it would take more than a lifetime to analyze it. I think it's realistic to assume that even devoted anthropologists prefer to live their own lives rather then devoting them to analyzing another person's life.

I forgot to remember to forget

Looking at the relationship between episodic and semantic memory, we see that logging technology might cause other tribulations.

I'm convinced that most real-time input still would make it into the brain while logging because cameras and other interfaces can't block our perceptions. However, it seems fair to assume that over time users would start to separate their memories as larger fractions of contextual memory in the form of textual, visual, and audible information offloaded to a wearable computer. Mainly, we will externally store the material normally destined for the episodic memory.

Episodic memory, however, ties together items in semantic memory. For example, semantic memory will tell you what your dog looks and sounds like and that dogs like to chase sticks. All episodic memories concerning your dog will reference this single semantic representation of "dog" and, likewise, all new experiences with your dog will modify your single semantic representation of your dog. Experts agree that our episodic memory only needs one exposure to an episode for us to remember it, and in contrast, semantic memory requires multiple exposures. Hence, it would be interesting to see how a gradual disintegration between the two types of memory influences the interplay between them. This is particularly important because episodic memories are refined into semantic memories over time. In this process, most of the episodic information about a particular event is generalized and the context of specific events is lost. The question then becomes, Does additional technology empower humans or lead them into chronic amnesia?

Even more troublesome, I find the concept of *nonforgetting* inherent in all lifelog approaches. Forgetting, as I understand it, is more than just the inability to access information in memory. Forgetting is also the ability to alter memories or ignore them altogether. *Fugue amnesia* is one example that's usually triggered by a traumatic event that a person's mind is unable to properly process. Usually, the memory slowly or suddenly returns a few days later, although memory of the trauma may remain incomplete.

Forgetting makes our life bearable and is closely related to cultural concepts, such as forgiveness and absolution. I wonder if removing this human imperfection, namely to forget, would do more harm than good. If lifelogging was the norm, then switching logging technology off might not be an option any longer. If that happens, how would we break social rules and norms—which are the strongest sources in creative work—if we feel that such steps could be used against us? If everything we do is recorded and generally accessible, do we edit our behavior accordingly? Most likely, yes and as a result, we enter a conformist society.

Yet, this is exactly what makes lifelog research so interesting. It forces us to reflect on what it is that makes us human, and I'm sure that numerous surprises are waiting to be revealed **MM**

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