
Burn Your Memory Away: One-time Use Video Capture and Storage Device to Encourage Memory Appreciation

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figure 1. A matchstick-like video capture and storage device that will burn itself away after being used.

Abstract

Nowadays, easy access to technology enables many of us to obsessively document lives. Much of the captured digital content is often disregarded and forgotten on storage devices, with no concerns of cost or decay. Can we design technology that helps people better appreciate captured memories? What would people do if they only had one more chance to relive past memories? In this paper, we present a prototype design, *PY-ROM*, a matchstick-like video recording and storage device that burns itself away after being used. This encourages designers to consider lifecycles and human-computer relationships by integrating physical properties into augmenting everyday objects.

Keywords

Memory, ubiquitous computing, augmented object, video capture, matchstick

ACM Classification Keywords

H.5.2. User Interfaces.

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Introduction

The vision of ubiquitous computing (UbiComp) [21] is about embedding computing into objects of everyday living such that it enriches our interaction with computers and improves our daily lives. Current HCI and UbiComp research often assumes permanent deployment of digital-augmented devices that interact with users over a long time period [1][11]. Examples include context-aware objects that sense environments or human behaviors and bring awareness to users, objects that show general information as ambient displays, or devices that keep life logs for users. Although this design is valuable in assisting users in everyday interactions, people are gradually exposed to the danger of information overloading as devices become pervasive and accepted in daily lives [10]. In addition, since the digital content provided by these devices never decay as physical objects, this may cause people to lose interests and attentions to the digital functions given the constant supply of information. In the future, will people still value the capabilities of UbiComp devices and the information they supply?

In psychology studies, the Scarcity Principle explains how people increase their desires when they realize the opportunities become less available or something becomes difficult to get [4], including limited quantity, resource, and time. This is especially applied in marketing, economics, and persuasion. Very often, people do not know how precious things are until they are gone. People do not pay attention or cherish things that are easy to obtain, because they come easily without taking us much efforts. Similarly, we see this trend how people use digital technology and devices when cost gets down and quantities increase.

Should technology encourage people to become more mindful and better appreciate using devices and accessing digital content? Could technology enable people to be aware of "less is more" [14] by adding some physical properties of traditional everyday objects to electronic devices? To address these questions, we looked to the domain of recording *memories*. In this day and age, we obsessively document our lives given easy access to technology. While these electronic devices used to capture our everyday moments have more value than plain physical objects, the captured digital content is often devalued and forgotten while stored on mass storage devices. Can we design a technology that helps people appreciate the captured memories?

In this paper, we present a prototype design named *PY-ROM*. "Pyr" means fire in Greek, and "ROM" stands for "Real Ordinary Memory." PY-ROM is a matchstick-like video recording and storage device with the one-time ritualistic use of "burning" the device itself away.

Three factors influenced our design of PY-ROM. First, given the trend that technology can be embedded into micro-scale objects at a constantly lowering price, we believe that devices can be eventually similar to ordinary disposable objects. Second, based on the Scarcity Principle in psychology, we envision its unique design will encourage people to have more appreciation of the captured moments and enrich their everyday life experience. Third, we propose to use such an example to encourage designers to take the life cycle of an everyday interactive device into consideration and to bring better user experience.

How We Have Documented Our Life

There are many special moments in our everyday lives that people want to remember, especially social occasions such as birthday parties, farewells, travel, or little surprises with families and friends. However, current technology enables people to obsessively document their lives. Using digital cameras, cell phones, and camcorders, we can quickly and easily record snapshots and videos of our daily lives. We record memories with a philosophy of "more is more" [6]. We choose digital cameras with the highest megapixels, we often mindlessly take many pictures [5], and we store our pictures and video on hard drives or online platforms at virtually no cost and limitless quantity. At the same time, the digitally stored media does not age or degrade like physical objects, while it can also be easily manipulated, duplicated, or deleted. As a result, the recorded media are often forgotten somewhere in the digital world.

Looking back to the age with no digital technology, people treasured their life moments more. The cost of devices and films made recording less pervasive [3]. When taking photos, people took limited numbers at carefully selected moments. Since they did not assume any digital recording that could later replay these moments easily, they tried to keep precious moments in their minds and could recall and narrative the stories thoroughly when browsing every physical photo in decorated photo albums.

Still, in this digital age, people find similar ways to make their recorded memories more special. Some people choose to display selected photos using digital picture frames, while others prefer to have physical copies to keep. A study has shown that even though

people take many more photos today with digital cameras, they still make the same number of print photos as in the past, which suggests that people print out physical copies of their digital photos [6]. This allows people to give the photos special significance to set them apart from the massive numbers of captured digital photos.

We question: do people favor physical photos because of their irreplaceable properties [15]? Whether advancements of technology and the pervasiveness of mass digital files easily lose meaning to our life because of the non-scarcity? We then want to raise an extreme question for people to ponder: if you only have one more chance to relive past memories, what would you do?

Document Lives in an Extreme Way: Burn The Memory Away

We propose a device that combines digital and physical capabilities and pushes the format of media capture device to an extreme: a memory that "burns" itself away physically after recording and displaying a video clip. In the past, before the conveniences of modern technology, people invented rituals and ceremonies to celebrate the special events so that they can remember the events more significantly. One thing that was often used in rituals was fire. Fire has many, almost mystic qualities. It is bright and warm and dances as if it were alive. Fire is also ephemeral; when its fuel burns out, the fire dies. Because of that, fire is often associated with memories. For example, it is also often used during special occasions such as lighting up candles on a birthday cake with a match to represent hopes, and candles in the dark power-failure nights with family. To trigger fire, the matchstick is the most common and is



figure 2. “She struck another match against the wall. It burned brightly, and when the light fell upon the wall it became transparent like a thin veil, and she could see through it into a room. On the table a snow-white cloth was spread, and on it stood a shining dinner service.” [2] (image from [17])

itself associated with the channeling of precious memories; in Hans Christian Andersen's tale "The Little Match Girl" [2], the light of the matchstick is a fleeting projection of memories and hopes (figure 2).

Because of fire's associations with rituals and the matchstick's association with memories, we base our interface on the matchstick. We choose video recording as the digital function instead of photography because of its attribute of continued burning time, and the easy interaction without explicit inputs for users to decide the timing of individual photos.

Further, we identify five suitable attributes of matchsticks for our design to bring the concept of “less is more” to media capture:

- **Natural and intuitive interaction:** Unlike common electronic objects with too many buttons, matches are simple physical objects whose use is familiar to people. People know to swipe a match to light it and know that lighting a match causes fire, which produces light and warmth. Also, they know when the fire starts (from igniting) and when the fire ends (by burning out the material), which is important for an interactive device as indicators.
- **Connection with tradition:** The match has been commonly used for a long time in human history [22], appearing in China in AD 577 and Europe in AD 1530. People are still using it to this day, usually in connection with tradition and past memories, such as birthday parties in childhood, an old-style matchbox, dinners in restaurants, etc. Therefore, the match is suitable to encourage people to reconnect with their past memories.

- **One-time use:** The one-time use property of matches encourages the user to savor the memory contained in the burning match. When people see the match (device) burning into ashes, they can easily realize its unrecoverable attribute, which is opposite from the easy “undo” function in the ordinary digital world.
- **Suitable burn time:** With the limited length of the wooden stick, the burn time of a match is comparable to the length of short video clips commonly recorded by personal digital cameras [6]. Thus, the burn time of a match makes it ideal as a representation for recording memories of brief moments.
- **Portability:** Matchsticks are portable and easily stored because of its size and shape. As physical objects, they can also be tagged and annotated to be distinctive from each other, allowing people to store and share memories contained within the matches. This enables people to use the device in different occasions.

One-time Use Matchstick Design

Based on the above design rationale, we proposed a two-sided matchstick design, *PY-ROM*, to record video using one side and replay the recorded memory using the other side with only one-time use. We believe that as computation power can be embedded into micro-scale objects, the idea of precious devices and user interfaces will be challenged as user interfaces merge with such an everyday mundane object, realizing the vision of ubiquitous computing.

Figure 3 shows the prototype design of our matches in an ordinary matchbox. Each matchstick has two ends: one for recording (orange) and one for playing (green). Each match represents a unique recorded memory, and

users can collect and organize their stored memories by grouping them in matchboxes.

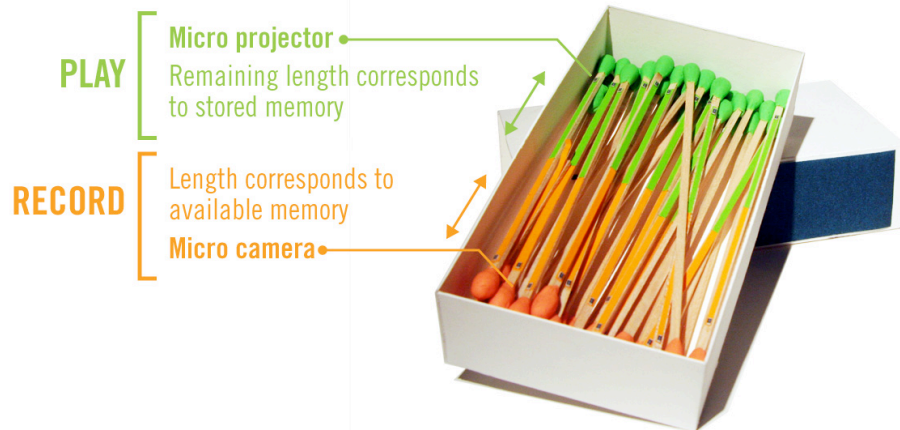


figure 3. PY-ROM matchsticks with recording (the orange side with micro-camera and microphone) and playing (the green side with micro-projector) functions in a matchbox

Step1: Memory Recording

To capture a memory or message, the user swipes the recording side (colored orange) of the match, lighting it on fire and triggering the embedded camera and microphone to start recording. As the match burns, the recording devices move down along the length of the matchstick in response to the heating from the burning until the recording side is burnt out (figure 4), i.e. the time the recording side of the match can be burnt is the length of video the user can record. After burning the recording side, the recorded video is stored in electronic memory located at the middle part of the matchstick, waiting to be accessed by lighting the playing side of the match.



figure 4. Light up the recording side of a PY-ROM match to record a precious moment with a micro-camera.

Step2: Recorded Memory Playback

To play the recorded memory, the user swipes the playing side (colored green) of the match, lighting it on fire and triggering the micro-projector and audio player to play the recorded video (figure 5). Similarly, the projector will move down along the matchstick in response to the heat, avoiding destruction from the fire. The time the playing side of the match can be burned stands for the length of the recorded video the user can see. If user extinguishes the fire in the middle of the playback, the remaining content can be played the next time the PY-ROM stick is ignited.



figure 5. Light up the playing side of a PY-ROM match to replay the recorded memory with a micro-projector.

Implementation

The challenge of implementing such a design falls on how we can make the match-like device look natural and ordinary yet functional and usable at the same time. Though we have not yet put our proposed design into working prototypes, it is practical to realize the basic idea into matchstick size. First of all, for the recording video, the CMOS camera is now available for embedding into everyday objects, and the recorded data can either be stored in embedded memory, or transmitted to a server through a wireless connection with file identification. Second, for playing the recorded video, since currently the state-of-the-art of embedded projectors is about cell-phone size instead of micro-scale, we can either use 1) an embedded OLED on a matchbox, or 2) the concept of everywhere display by IBM of projecting content onto everyday surfaces [16]. Third, to trigger recording and playing, although we may not actually burn out the device for prototyping (considering reusability for user testing and cost), we can sense the user's swiping action by embedding a pressure sensor and accelerometer on the match-head. At the same time, an embedded LED light will be used to indicate to users that the match is functioning. To better demonstrate and evaluate our design with user studies, we will soon build prototypes based on available technology.

Suggested Applied Context

With such an interaction design, users can rethink the meaning of media capture and its preciousness when documenting their everyday lives. In addition, they can also freely use this memory capture device in social situation with families and friends. Figure 6 shows some examples: 1) friends can record their birthday messages respectively and collect them to give as a gift

to the birthday person. With a micro-projector, they can enjoy the recorded message all together. In addition, using such an ordinary-looking object, they can also record the happy moment more naturally during the birthday party. 2) A recorded match can even be a mystery surprise as a gift sent by physical mail, to share a message or event invitation with friends. 3) It can also be presented during a moment of farewell so that the departing friend can play and recall the precious memory from before. This ritual action can help users reconnect with their friends. All in all, ordinary but special moments can be uniquely captured and played using a match-like device, along with deeper meanings.



figure 6. (a) Playing the PY-ROM matches with captured blessings from friends at the birthday party for everyone's enjoyment. (b) Receiving a mystery PY-ROM gift in the mailbox. (c)(d) Lighting up a PY-ROM farewell gift to remind the past moments.

Design Implication and Discussion

Based on our design process and the experience of demonstrating to the Fall 2008 Tangible Interfaces class of around 30 people (including faculties, guests, and students) at the Media Lab, we summarized comments and discussion about the nature of captured memories with one-time use and implication to interactive devices.

Appreciating precious memories while aware of limited chances to replay

We believe that by reminding people the preciousness of the media using an ordinary everyday object with natural interaction, people can be more aware when they capture the memory and bring more meanings to it. We also believe that when we keep the design simple, users can explore more ways to use it in their everyday lives, in addition to the scenarios we presented. For examples, people can use the match as a diary to document their lives, record and relieve moments, share their interesting experiences, etc. In an extreme case, people can burn their precious objects (such as photos and personal messages) to release their sad memories and record the burning moment at the same time so that the matchstick becomes the only remained record of the memory (figure 7). People might also use one match to record another playing match because they still want to keep the memory after one play. This encourages people to rethink the trade-off of keeping or burning memories. We want to keep the usage of the *PY-ROM* matches open and flexible, allowing people to interpret and create uses on their own.

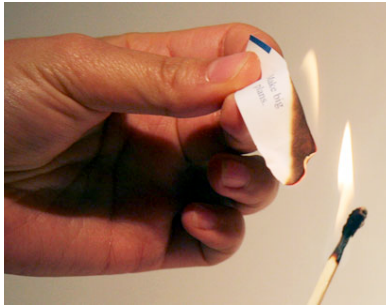


figure 7. On an extreme occasion, user can eliminate the original object such as a photo or a message by burning it with a *PY-ROM* match, which captures it in a video at the same time.

Bringing personal attachments to matchsticks

When a match has been recorded with a memory, we do not automatically annotate any information such as date, time, or location on it. We want to give people the freedom to manually label it with their own styles, e.g. write notes on the stick, attach a paper tag, place in a special box, etc. (figure 8) This may enhance their relationship to the device, bring surprises, and even encourage people to ponder its meaning to them. They might try to recall their memory before playing, and to figure out the content, instead of just quickly browsing digital files using computers, cameras, cell phones, or attached files in emails as we do now.



figure 8. Different ways to annotate and store the recorded *PY-ROM* matchsticks as ordinary physical objects.

Design choices: making decision for users?

In this design, we face various design choices that we must make, including the length of recording time, only one-time use, etc. Should we make these limitations, or bring more flexibility and more choices to users? Instead of changing the design itself, we suggest several similar design alternatives that users can

choose from. For example, we can provide different sizes of matchsticks that represent different length of recording time, and we can provide a matchbook that copies the memory of one matchstick so that users can preserve limited numbers of the same memory in different places. By doing so, we can explore more possibilities for users to enrich their lives with a simple design.

Not a replacement of current devices

Similar to most augmented objects, we want to emphasize that this is not to replace any current media capture or storage devices, but rather offers an alternative for when we want to remember something more meaningful in our daily lives. Our design itself serves a different goal (blend in everyday lives with ritual use) from existing video capture devices (high quality, easy access, etc.).

Bringing physical properties to interactive devices

At last, we envision our design of bringing physical properties of everyday objects such as one-time use and burning physically, may provide another design consideration to HCI research. While the advantages of digital content include its permanence and pervasiveness, those traditional attributes of physical objects may also be beneficial, such as to remind people the values and history of things. For example, people say, "bit rot", when they face some problems with a computer program or digital files that they haven't used for a long time. Can bit really rot? Can digital content decay as time goes on? By carefully designing and combining properties of physical and digital objects, it is possible to make people rethink the human-computer relationship and the value of technology. More examples of potential HCI

applications include decaying the digital content but allowing users to bring back the original copy with certain interactions, giving weights to objects according to different sizes of digital content, etc. We believe that technology will be closer and closer to human needs, as we identify and consider the important attributes people care about.

Related Work

There are different research, designs, and products that aim to provide different experience moving from traditional objects to digital ones with original physical attributes. For example, the product Hono Candle imitates the interaction with a real candle: users can "light up" the digital candle by swiping it with a match-like stick, and then physically blow the candle to turn it off [12]. The I/O Brush is a digital paint brush to pick up color, texture, and movement from any surfaces in physical environment [19]. Another such work is William Gibson's "Agrippa", a poem that comes on as a floppy disk, which erases itself as the user plays the poem, also aims to provide only short-time use of content storage [8]. However, we choose different representation of everyday objects using a match because of its proper attributes related to memory and appreciation (see page 4), and put our design forward to encourage people to treasure their memory through interacting with such as everyday device.

There is also much work that assists users to record memories and histories using everyday objects. The History Tablecloth augments the traditional tablecloth by recording and displaying how long an object has been left on a table [7]. Spyn augments the activity of knitting by recording, playback, and sharing the handcraft process to support storytelling [18].

SenseCam is a wearable camera that keeps taking images as a log for user to alleviate memory loss [20]. The Digital Family Portrait provides qualitative visualizations of a family elder's daily life over the past few weeks using iconic imagery on the picture frame [13]. Last, Gustulyak designs a year calendar made of real ordinary matches (with no technology). Each match represents one unique day, and users can ignite it day by day to rethink the lives [9]. Our work differs from them by focusing on providing a media to help people document and appreciate their daily special moments.

Conclusion and Future Work

In this paper, we present a matchstick-like device that can record video and replay the recorded content with only one-time use, which encourages people to appreciate their important moments and brings more meaning to their everyday lives. We'd like to use this example to bring designers another element of "appreciation" to consider when designing augmented everyday objects.

In the near future, we would like to make use of available technology to embed micro-scale cameras and memory storage into a physical match, and show the content by an embedded OLED display on a matchbox or projecting onto any surface. In this way, we can perform a preliminary user study to understand how people may want to interact with such a device and to see if this can positively affect their habits, lifestyles, and mindsets toward appreciating memory and lives.

Please find our conceptual video available at:
<http://web.media.mit.edu/~peggychi/PYROM-match.mov>

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