"Did you pack your keys?" Smart Objects and Forgetfulness

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Figure 1: MessageBag prototypes, 'Kelly' version.

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Abstract
There is little attention given to forgetfulness in a healthy population. However, forgetfulness is not only associated with feelings of embarrassment and shame, but is also a cause for concern when it begins to affect our daily lives. Many people describe it as having an "off" day. We explore augmenting everyday objects to assist us in our daily routines, ultimately to examine the question: *Can a smart object alleviate those negative feelings and lead us to a less stressful life?*

Author Keywords
distributed cognition, forgetfulness, prospective memory, interaction, wearables

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

General Terms
Interactivity

Introduction
Our concept is to augment an everyday item, in this case a bag, as a useful way to help someone remember to pack important items for their journey. To date, we have made a series of early stage prototypes to investigate the best

way to achieve this. One current prototype (Figure 2) involves a set of ten light-emitting diodes (LEDs), piezo and Radio Frequency Identification Reader (RFID) connected to a small circuit board. This enables tagged items (prewritten with a unique identification number) to be identified. A scanned tag turns off the corresponding colour LED, giving the user a visual cue (e.g. from across a room) as to what items remain to be packed.

Forgetfulness and Memory

Negative consequences can be an everyday occurrence for people who believe they are forgetful: *"Forgetting led to failures in social interactions and influenced their proper performance of everyday tasks. As such they reported that forgetfulness changed their lives, producing worries and feelings of shame and embarrassment, and creating the need to establish new practices in everyday life. At the same time, forgetfulness decreased their ability to establish new practices."* [**?**].

A study of 1871 volunteers [**?**] demonstrated that 40% had perceived forgetfulness and 70% of those were worried about their forgetfulness. Users who believed they were forgetful reported greatest impact: the greater this belief, the more they insist it is a problem and the greater their feelings of stress and embarrassment in their daily lives. This shows a need for solutions for healthy individuals.

Although the concept of devices to reduce forgetfulness is not new, approaches divide between (a) aids for people affected by dementia, brain injury etc. [**?**]; and (b) information management approaches typically embodied as hardware or software systems added to or separate from the user's everyday life. Hardware solutions tend to be clunky in nature, requiring some degree of learning (PDAs, item locators or voice prompters) and tend to be very large (e.g. large button phones, pill bottles with reminder alerts [**?**]); software solutions (To Dos, Reminders) proliferate but are still not sufficient to help us remember. In contrast, therefore, our approach is focused on healthy adult individuals, and on technology which fits in seamlessly with their everyday routine, requiring no additional cognitive load or learning. *"A good designer makes sure that appropriate actions are perceptible and inappropriate ones invisible"* [**?**].

Our Approach

In our society, bags vary in nature from backpacks to wheeled luggage, sports bags, kids totes and designer purses; but none can communicate to us what is inside them, and through this lack of information, we frequently forget items we need or waste our time checking what we did pack. Our concept, *Message Bag*, aims to improve the way we currently use them, through recognition over recall in order to reduce the load on the user's memory [**?**].

Ubiquitous computing allows us to look at the traditional bag in a new way, by embedding technology to support the user through the ability to communicate with them, notifying them of the things that are in fact packed within.

Ease and intuitiveness of use is a key consideration: we know that forgetfulness makes it harder to learn new routines. Additionally, our design is inspired by research in distributed cognition [**?**]: we aim to ease the cognitive burden on the user with an aim to dissolve boundaries of the individual. We can see bag + individual user as a single distributed cognitive system, spreading cognitive load from user to bag. Only in the case that they forget an important item, do they then need to act upon it.

Figure 2: Message Bag as a built prototype housing a RFID reader connected to a circuit board and a corresponding tag system. There are 10 main LEDs with the rightmost 5 being for physical items that need to be with you on your journey, and the leftmost 5 correspond to tracking things you need to do / buy etc, via a written form tag, which is contained on the exterior of the bag. The LEDs are illuminated when the item is not packed (or has not been completed), and there is a further white LED to communicate to the user that the bag has power and is operational. Additionally a 'beep' sound lets them know that the item has been successfully scanned in.

Technical Implementation

Our Message Bag interface visually consists of LEDs for communication (see Figure 2). Placing items in the bag turns off the LED. Additional components include a Teensy Board and ID-12 RFID reader with embedded coiled antenna. Tags have a microchip storing a 12-byte unique id and coiled antenna that can communicate with the reader via radio frequencies. The reader (25x26x6mm) and tag(s) are small; tags are placed on real-world items, including mobile phone, key fob, lipstick, notebook and wallet in our prototype. The piezo is used as an audio cue to alert the user when an item is successfully scanned.

Discussion and Future Work

Several issues highlighted in this section are brought about through testing by several users in the wild over various weeks, using Rapid Iterative Testing and Evaluation (RITE) method [**?**]. One main issue highlighted that users often asked if they could *"put it on my bag"*; so a device which can be attached to and/or moved between their own personal choice of bag may be required for some needs. They did also want further guidance on using and setting up the bag. We look to address some of the feedback in our future work.

Flexibility & Profiles For this latter issue, we have developed a new prototype (see Figure 3) that can be attached to the user's own bag. It can also be used to reach into the bag to scan the items in it, thus dealing with the reader working range issue. A related issue is the use of user profiles to apply to particular journeys or activities – e.g. 'gym', 'work' or 'vacation' – with relevant items for each. A button or switch per profile on the device would then allow them to attach it to their gym bag one day and their work bag the next. Lastly, we also look at creating a bag for only a few essential items to be tagged (5 in our prototype) in a fashionable way, fitting in with the users personal social situation (see Figure 1).

Figure 3: Future work; this portable system can be placed on a bag of your choice by attaching it with the keyring.

Activity/Context Dependence Profiles could be supported by linking to a Global Positioning System (GPS) / location service. Could location be used to trigger a change of profile and corresponding items? Similarly, could Near Field Communication (NFC) be used as a trigger? Could we place tags in locations, our car or bedroom for example, and use these are triggers for the bag to reveal items that need to be packed?

Social Context Could we ultimately integrate a network into the bag? This could permit access to the user's personal network. Can their friends on Twitter help by sending appropriate messages? Could a community on Flickr trigger things through photographs? Can a text message from family keep them from forgetting an important item or place to be? As well as accepting incoming messages, the bag could then also communicate more directly to the user: if I can't go to the gym without my gym card, when I leave the house it sends me a tweet telling me to pick it up.

Hardware We are also examining the current hardware specifications to reduce weight/size (via e.g. smaller screens and circuit boards), and balance cost appropriately. We are currently investigating a low power LCD that only uses 3 ports and 5V.

Conclusion

Through our current work, we can see how this device can be used by users in a natural way to help them to alleviate those negative feelings that happen when they forget essential items. There are also a lot of exciting developments still to explore and feel there is great scope for future discussions and work in this field.

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