# DESIGNING A STUDY CONCERNING THE FUNCTIONS OF SHARABLE PERSONAL MEMORIES

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**ABSTRACT**

User support for shopping trips is a vivid area of research. With respect to the increasing use of sensor technology in this domain, it is of interest how a user may benefit from automatically captured data describing her or other people's shopping actions. In this article, we report on a study concerning the sharing of so-called digital memories during grocery shopping. Our report comprises a brief description of a software-based shopping environment used to observe and support users, a discussion of our hypotheses regarding the application of digital memories in this setting, the study method, and a first preview on results achieved this way.

**KEYWORDS**

User evaluation, digital assistant, augmented memory

## 1. INTRODUCTION

Shopping comprises a broad range of situations where users have to make decisions, e.g., which products are actually needed, which stores are most likely to offer some kind of product and where the product is cheapest. This makes the setting attractive for research in the area of user support, which is reflected by a considerable amount of activities from research and industry (see, for instance, Krafft, 2005).

An interesting aspect of shopping is that a people can build decisions based on various sources, such as advertisements in a store or recommendations from other people. Both approaches have been addressed by related research; for instance, Schmitz et al. (2008) discuss an example of an intelligent recommender service within a sensor-equipped store. In parallel, the popularity of services such as movielens (http://movielens.org/) illustrates people's interest in publishing to and retrieving product-related information from others. Finally, there is also the word of mouth – explicit product recommendations submitted to the user by friends, a service typically offered by state-of-the-art shopping sites.

In SHAREDLIFE, which is funded by the German Ministry of Education and Research under grant 01 IW F03, we want to research the capturing and the exploitation of such "sharable" information. In the following, we report on a selected aspect of this ongoing work – a study concerning the application of recommendations from different kinds of information channels, ranging from smart advertisements over public annotations of other customers to personal recommendations of trusted people.

## 2. STUDY ENVIRONMENT

In order to study the application of SHAREDLIFE during grocery shopping, we needed an environment where our participants could perform shopping actions. One option would have been to observe the users' interaction with the system via a mobile client in real stores. However, this approach was deemed too complicated for a number of reasons. Firstly, it would have implied a significant loss of control during the study, since we did not find an easy way to accurately track user actions (such as "user picked product") during the shopping trip and would not have had the option to tailor the store's product offer to the participants' shopping task. Secondly, evaluating the results would have been much more complicated,

because a basis for comparing the results was neither readily available, nor straightforward to set up. Thirdly, preparing the study would have required a larger logistic effort.

Another option would have been an experimental shopping environment equipped with RFID technology. Plate et al. (2006) have already shown in a similar context that digital memories can contribute to user support in an instrumented shopping environment. Unfortunately, that approach would have seriously limited the users' choices among products and stores.

To alleviate these shortcomings, we decided to perform the study in a software-based emulation of stores. This allowed us to minimize the organizational efforts, to provide location-based services bound to the individual stores, to offer a broad range of products and to tailor that offer in support the study. Our "Virtual Stores" are a compromise between real stores and Internet stores. Thus, features common to Internet stores like Amazon (see, for instance, Linden et al., 2003) such as quick access to products by means of in-site search or links between products in different categories are not supported, because such actions are not possible while shopping in real life. Instead, moving between products in different categories in the Virtual Stores takes time, exactly as it would in reality. The UI emulates a grocery store's product offer and aisles, while at the same time avoiding the fine-grained interactions of a 3D environment as suggested by Zhao et al. (2004). This is especially significant, as many shoppers have only limited experience with computers. Consequently, the amount of time required to train participants to navigate through an online 3D-store would have been much greater, which in turn would have pushed the duration of an evaluation session well past the intended 90 minutes.

## 3. TECHNICAL SETUP

The SHAREDLIFE prototype allows its user to exploit various information sources in order to build a "digital memory" during grocery shopping and cooking. Here, "information sources" address in the very first place intelligent environments with the ability to capture and interpret user actions. The memory consists of various kinds of data, including a "personal journal", which provides the user with a diary-like view on user actions ("events") observed and recorded by the system, and annotations, which have been attached by the user to information in the personal journal.

The prototype assists users in sharing memories in various ways. Following feedback from initial small-scale studies, memories of different users are strictly separated. The exchange of information from the personal journal requires an email-like communication between users; the approach provides a high level of control through access logs and rules. In parallel, users may annotate that information with personal and public ratings and comments. Public annotations are permanently accessible by every user – however, in order to learn about the annotated content, the respective user has to come into contact with the annotated resource, for instance, by inspecting it in a store.

The digital memory is accessed via a mobile device with Internet access, which we simulated in the study by a separate monitor displaying the SHAREDLIFE user interface. Typical features of the user interface include query for events, products, and recipes from the user's personal journal. For the purpose of the study, we limited the set of user (and store) actions to "cooking recipe", "looking at product", "buying products", and "recommending products". Other people's memories can be combined with this data in various, data-dependent ways. For each known (referenced by entries in the user's personal journal) product, the user may inspect public annotations made by other users. In addition, the user may redirect queries for product-related events to other people in order to retrieve a related subset of events, which is then merged with the user's personal journal. In addition, the user may ask other people for recommendations regarding a known product.

With respect to the shopping study, we completed the system with several shopping-related functions – including a shopping list which can be filled with individual products from the memory as well as the ingredients listed in a known recipe. Furthermore, we configured SHAREDLIFE to display automatically on the "mobile device" functions applicable to a product the user is looking at.

SHAREDLIFE is communicating with the Virtual Stores selected data; beside that, both applications are clearly separated. The communication to the stores comprises the submission of the shopping list and the information needs expressed by the user (e.g., recommendations for a product contained in the memory). In addition to the requested data, the stores submit observed user actions to SHAREDLIFE as well as any recommendations made by the store.

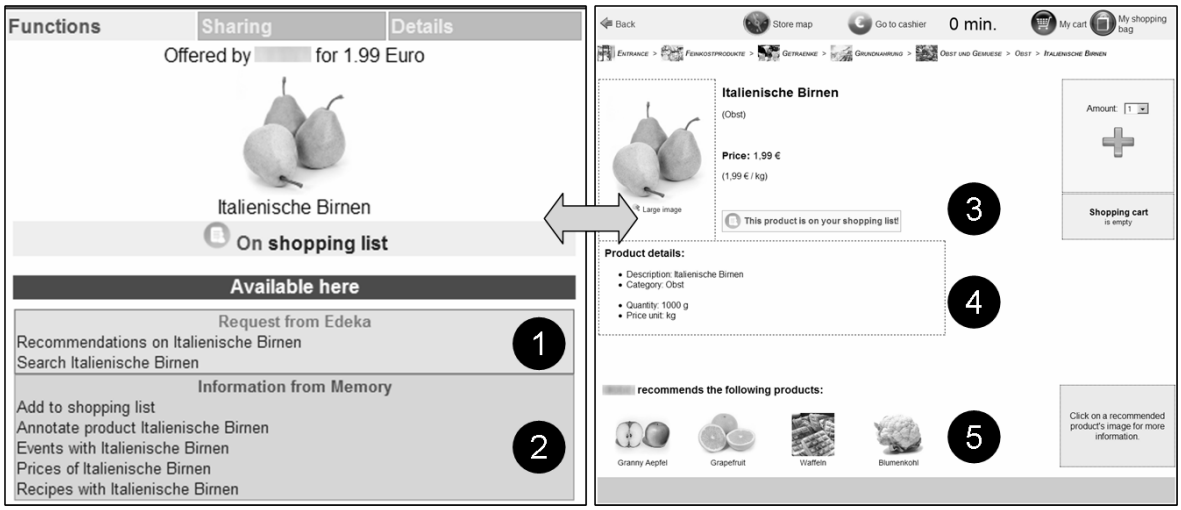


Figure 1. Interaction between SHAREDLIFE (left) and the Virtual Stores (right): (1) store services available to SHAREDLIFE; (2) memory-related actions available to the user; (3) shopping list reminder; (4) product details; (5) recommendations from the store.

## 4. STUDY METHOD

One of the major goals of the evaluation study was to test if digital memories of other people are beneficial for decision support while grocery shopping. Furthermore, we wanted to learn if SHAREDLIFE presents such memories in a meaningful and easily understandable way. We were further interested to test whether users find SHAREDLIFE helpful during shopping – and how they employ the various kinds of sharable information in order to solve their shopping task. Regarding the Virtual Stores, we were interested to test the users' reaction to the interface and to verify if participants found all typical shopping actions well-represented without being distracted by the simulative nature of the software.

We were interested in obtaining qualitative data (e.g., from open questions on the surveys, direct observations of participants, interactions logs etc.) and quantitative data from application logs (e.g., the time taken to complete the shopping phase, number of visited stores, amount of money spent while shopping).

For the evaluation study we recruited 20 participants with ages ranging from 19 to 37 years old, with a mean of 23.35 years old. The two major requirements for recruitment were a good knowledge of English and basic experience with computers. In preparation for the scenario, participants were asked to write down 4 grocery products that they would like to purchase the next time they would go shopping, and to select 1 out of 4 offered recipes.

Participants were asked to complete a typical shopping scenario. They were told that they are expecting some friends for dinner and that they should prepare the previously chosen recipe. In order to accomplish this task, they had to locate and purchase all the ingredients of the recipe in the Virtual Stores within 30 minutes and with a minimal amount of money. Additionally, they were asked to purchase the 4 products they had written down in the beginning of the study. The scenario was considered to be completed successfully if the participant managed to buy all products on the shopping list in time, while spending as little money as possible. After the shopping phase, participants were required to fill out two questionnaires concerning the scenario and the study in general.

During shopping, each participant was provided with a minimal personal memory, containing only the recipe she had previously selected. Furthermore, the participant had two predefined sharing partners: a friend, who is trustworthy and also an expert in preparing the recipe, and a stranger. Each of these sharing partners' memories provided shopping actions and annotations related to ingredients mentioned in the recipe. These could be exploited during shopping, for example in order to obtain events with the ingredients or recommendations on a specific product. This information addressed products from any store, which was in contrast to support provided by stores, which was based on the locally available product offer.

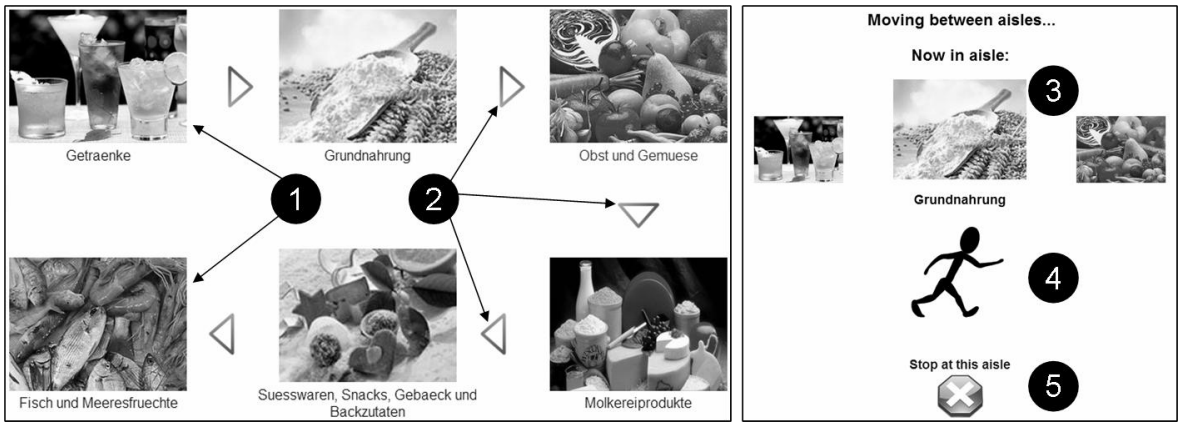


**Figure 2. Aisles in a store (left) and moving between aisles (right): (1) store aisles; (2) arrows show the path that the user must follow in the store; (3) current aisle; (4) animation; (5) option to stop at the current aisle**

Upon entering a Virtual Store, SHAREDLIFE switched from a general display of events to one tailored to shopping assistance. Additionally, the user's shopping list was automatically sent to the store, which highlighted the aisles where the required ingredients were located. While looking at a specific product, SHAREDLIFE displayed all known information about it, as well as showing possible actions. At the same time, the store offered product recommendations to aid users in deciding what other products to buy (Figure 1).

A major requirement for the study was to ensure that users have the opportunity to draw on, and possibly make use of other people's memories while grocery shopping. Consequently, the scenario had to provide multiple occasions in which it makes sense to request information from peers, e.g., when faced with multiple brands of a product which is on the user's shopping list. In parallel, we wanted to provide users with a realistic shopping experience and make sure that we obtain meaningful results. In order to address these requirements, we made several decisions concerning the realization of the scenario.

**Time penalties**: Entering a Virtual Store does not happen instantaneously; instead, the user must wait an amount of time comparable to the time it would take in real life to move from her present location to the entrance of that store. To simulate the passing of time, participants were required to find a ticket with the name of the store they wanted to visit in a bowl filled with "fake" tickets. This penalty, corroborated with the fact that the participant has a limited amount of time in which to complete her shopping trip, should make it more attractive for users to carefully plan the trip, and ask for recommendations before heading for a store.

**Aisle route**: In order to make the study more realistic, the stores are represented as a path of aisles. Users start at the entrance and must pass through all the aisles in order to reach the cashier and finally the exit. This compels users to optimize their way around the store, in order to purchase all necessary products in the least amount of time. In order to guide the user, an icon is displayed next to aisles which contain items on the user's shopping list. Moving between aisles in a store also takes time on the one hand side and it provides the customer with an opportunity to discover products. This is implemented in the form of an animation, in which the aisles passed are displayed to the participant (Figure 2).

**Smart Stores**: This study focused on the value of sharable memories. However, the plain availability of digital product data enables kinds of user support, which are beneficial to the user, but do not necessarily require shared data or action histories. Therefore, we decided to enrich the Virtual Stores with features known from smart shopping environments, in particular, product recommendations and navigation support. These services can be customized by using digital memories accessible through SharedLife. Both features of the stores and of SHAREDLIFE were addressed separately in the questionnaires in order to allow for a clear interpretation of the participants' feedback. This way, feedback regarding SharedLife can be interpreted as feedback concerning the application of digital memories.

**Product recommendations**: We were especially interested to test whether users are prone to ask their friends for recommendations, rather than follow those of the store. Therefore, the scenario made two types of recommendations available to the user. First, she can ask other people. Second, on every product page, the store recommends without request from the user up to 4 products which are in some way related to the item the user is currently viewing.

**Product and product types**: Both SHAREDLIFE and the Virtual Stores distinguish between a type of product and its brands. For example, when adding the ingredients of a recipe to the shopping list, SHAREDLIFE will take into account the product type (e.g., rice), rather than a specific brand. Moreover, different brands of products usually cost differently, and are usually available at different stores. This was necessary in order to allow users some degree of freedom and to emphasize the need to acquire additional information from the stores or shared memories.

## 5. DISCUSSION AND CONCLUSION

This article presents a work in progress; although the evaluation study has been conducted, a thorough analysis of the results has not yet been performed at the moment of this writing. Preliminary results show that over 80% of the participants considered the Virtual Stores' UI to be easy or very easy to understand and to use. This result in especially encouraging, since before the study a possible concern was that the Virtual Stores' interface might be confusing for users which have experience browsing typical online stores. The interaction between SHAREDLIFE and the Virtual Stores was judged by the majority of participants to be natural, with only 5 participants saying that the interaction is either unnatural or very unnatural. The answers received by the participants when requesting information from other SHAREDLIFE users were deemed helpful or very helpful by 9 of the participants; however, 5 participants were unhappy with the answers received, while 4 did not receive any answer to their requests. Overall, 13 participants (65%) considered that SHAREDLIFE was useful to them while shopping. The large majority of the participants also noted the fact that there was not enough time to get acquainted with all the features offered by SHAREDLIFE, while at the same time finish the shopping phase in time; as a result, between 25-33% of participants used only a small subset of the sharing features offered by the system, relying mostly on the stores to find the needed products.

The approach described in this paper can be considered complementary to real-life or mockup studies. It allowed the examiners to track easily the user's progress during the evaluation. This, in turn, helps to prevent situations where important data goes unobserved due to a lack of control over the study. Interestingly, the positive feedback on the store's interface could also be interpreted as a sign that the approach could also be of interest for user interfaces deployed in real life stores in order to enhance customers' shopping experience. For the future, we are planning to complete the presented study with results achieved in an intelligent environment in order to learn more about the functions of sharable memories.

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