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MoCoShoP: supporting mobile and collaborative shopping and planning of interiors

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Abstract. We present MoCoShoP, a system that supports the collaborative process of shopping and planning furniture and interior items. The system consists of a mobile application running on the users' mobile phones and an interactive surface application deployed on shared planning desks in the furniture retail store environment. Users belonging together share a virtual shopping cart. By scanning labels attached to furniture items with their phones that are of interest, users can inspect item details (e.g., dimensions, available colors) with the mobile application and add items to their shopping cart. The shared planning desk allows users to collaboratively review collected items and create possible arrangements of items on a floor plan. Finally, users can store furniture arrangements for later inspection. In this work, we contribute the design and a prototype implementation of MoCoShoP. Results of a first evaluation indicate that users appreciate how they can collect and share data during the process of shopping and how it supports collaborative planning.

Keywords. Mobile phones, interactive surface, collaboration, shopping assistant, collaborative planning.

1 Introduction

Online shopping is more popular than ever and recent numbers indicate that this trend is continuing [3]. The list of reasons for this success includes high flexibility for customers who wish to compare prices of products, access to detailed information on products (e.g., availability, possible configurations, dimensions), and social aspects such as easy access to other customers' ratings and reports on experiences with a product.

Many types and groups of products are well suited for online shopping. For instance, previews on media files such as music or movies can be provided and thus, customers get a clear idea of what they are going to purchase. However, other artifacts cannot be previewed in an adequate way due to their specific physicality or other inherent aspects that cannot be communicated. Accordingly, many customers prefer visiting retail stores as they allow the touching, testing, and experiencing of a product.

This is in particular the case for pieces of furniture that must fit into an existing setting of other previously acquired pieces of furniture. Additionally, they need to meet the customer's personal criteria such as taste or comfort. In retail stores, customers can check these criteria and gain hands-on experience with products. On the downside, retail stores have different drawbacks compared to online shops: detailed product information such as prices, available configurations, etc. are difficult to access. Also, planning how different products would fit into a room with existing pieces of furniture is difficult.

We present MoCoShoP, a system that allows customers to experience the advantages of retail stores (e.g., physical and hands-on experiencing of products) and combines these with the benefits of online shopping (e.g., information access, social shopping). MoCoShoP provides a mobile client application that runs on the customers' mobile phones, which allows for access of product information via network and provides a shared shopping cart (e.g., with family members) if desired. Further, the system provides an interactive planning desk which supports collaborative creating of product arrangements and floor plans containing the collected products. In the following, we illustrate the usage of MoCoShoP with a usage scenario.

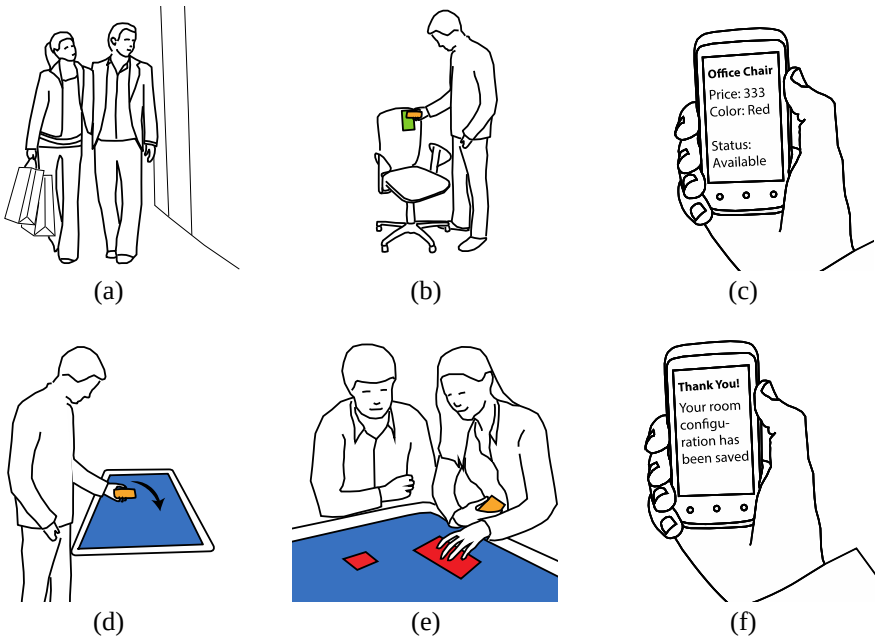


Fig. 1. Usage scenario for MoCoShoP: Multiple users go shopping together (a). Users pick up information by scanning labels (b) and (c). Users transfer collected items to a planning desk (d) and create plans containing interesting products (e). Finally, they save a planning arrangement and purchase items (f).

Scenario: Alice and Bob are planning to buy additional pieces of furniture for their office. In order to look for possible items, they go to a furniture retail store (see Fig.

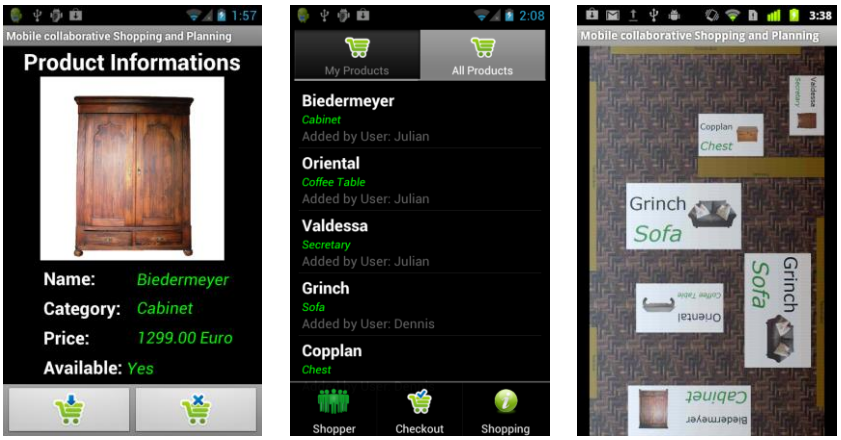
1a). Both Alice and Bob use the MoCoShoP mobile client on their mobile phones to scan and check out prices and available settings of products (Fig. 1b and 1c). When they have collected and added enough items to their cart, they approach the collaborative planning desk and transfer the items to the desk through a touch gesture (Fig. 1d). On the planning desk, Alice and Bob try different configurations and floor plans with selected products (Fig. 1e). When they agree on a configuration including which items to buy, they save the configuration back to their mobile phones (see Fig. 1f) allowing for further item collection or for the purchase of the selected items.

In this work, we contribute the design and a first implementation of MoCoShoP. Further, we contribute the results of an initial user study.

2 MoCoShoP Application

The design goals of MoCoShoP are (a) supporting quick information access in retail environments, (b) providing awareness of other users actions to support collaboration, (c) support for collaborative planning and reviewing of potential room plans including purchasable furniture items.

In order to meet these design goals, MoCoShoP includes two components for interaction: a personal mobile client application for each user and a shared interactive planning desk.



(a) (b) (c)

Fig. 2. The MoCoShoP mobile application: (a) Product details screen after scanning a product label. (b) Shared shopping cart overview. (c) A floor plan of a configured room including arranged pieces of furniture.

2.1 Personal Mobile Client

The mobile client runs as an application on the user's mobile phone. It allows users to scan product labels in order to access related detailed information. In order to scan a

product ID, the user holds the phone close to the corresponding label which allows the phone to read a Near Field Communication (NFC) tag that is integrated into the label. NFC is based on the Radio-Frequency Identification technology and allows storing of data on a chip that is powered via a capacitive field created by the reading device. This technology is included recently in an increasing number of smartphones (e.g., Nexus 4). As an alternative, printed barcodes could be used to include a larger number of potential smartphones (e.g., the iPhone). When a product label has been scanned, the application retrieves product details and provides an overview (see Fig. 2a). Users can choose to add the product to their shopping cart or simply reject the product. Multiple users can create a joint shopping session which allows them to add products to a shared shopping cart (see Fig. 2b). By selecting an item from the product list in the shopping cart, users can inspect the corresponding product information or delete the item. The mobile client also allows the storage of product lists and floor plan configurations that were created on the shared planning desk (see Fig. 2c).

2.2 Collaborative Planning Desk

When users have added potentially interesting products to their shopping cart, they can transition their shopping activity towards a planning activity which is supported by MoCoShoP through the collaborative planning desk. The planning desk is an application that is running on an interactive multi-touch surface, allowing multiple users to work together. First, one user of a group touches the planning desk on the device border with their mobile phone. The mobile phone reads a specific NFC tag which initiates the transfer of collected product IDs to the planning desk application.

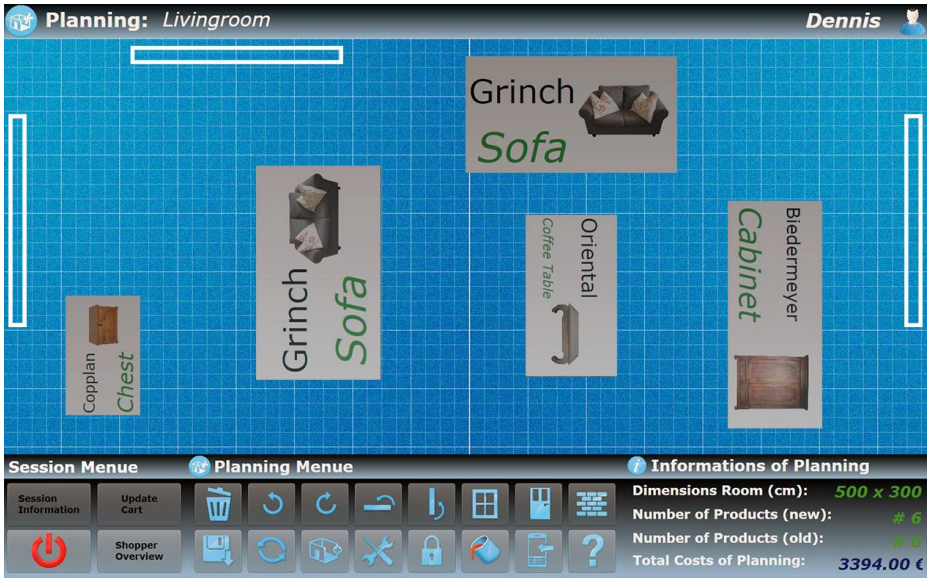


Fig. 3. The collaborative planning desk application provides a touch-based interface.

The planning desk application provides a large canvas which represents a floor plan of the room which the user would like to configure, and thereby plan which pieces of furniture would fit into it (see Fig. 3). The application allows users to quickly rearrange and configure such a floor plan. The interface provides information such as how much money the items cost that are included in the current configuration. In addition, the application provides a number of tools that support the users throughout the planning task. For instance, buttons which rotate items, align, or delete them are provided. Finally, when users are satisfied with their design, the store, the floor plan, and the data are transferred back to their mobile devices.

3 User Study

We conducted an initial user study in order to gain insights on if and how users would appreciate such a collaborative shopping and planning system such as MoCoShoP. In particular, our aim was to gain an understanding of how the system would support collaboration during the shopping and the planning process of furnishing when compared to the current practice of using pen and paper in order to collect information and plan during the shopping process.

Session Organization. Initially, participants were introduced to the aim of the study. Then, participants performed two practical task in counterbalanced order. Once they used the MoCoShoP system and once they used only pen and paper. This pen and paper condition was selected for comparison as it represents an approach most users are familiar with. In order to investigate the collaboration support by MoCoShoP, participants would perform these tasks as pairs of two. After finishing each task, participants were asked to fill out a questionnaire regarding their experiences with the used approach.

Practical Tasks. Participants performed one task with each condition (MoCoShoP; pen and paper). The tasks required participants to select, collect, and plan furniture items for a room (a living room and a bedroom). Both tasks were similar in terms of the actions required: first, users were given instructions such as how much money they could spend and what pieces of furniture should be included. Second, the two participants started walking through the experimental shopping environment. We equipped two laboratory rooms with 69 labels attached to the walls representing available furniture items (see Fig. 4a). There, participants looked for items suitable for their planning task. Whenever participants found interesting items they could add them to their shopping lists. When using MoCoShoP, they used smartphones which were provided with the mobile client application installed. In the pen and paper condition, participants were required to take notes manually (see Fig. 4c). Further, participants should plan a room layout including the selected pieces of furniture one time

with the MoCoShoP planning desk (see Fig. 4b) and one time using pen and paper (see Fig. 4d).

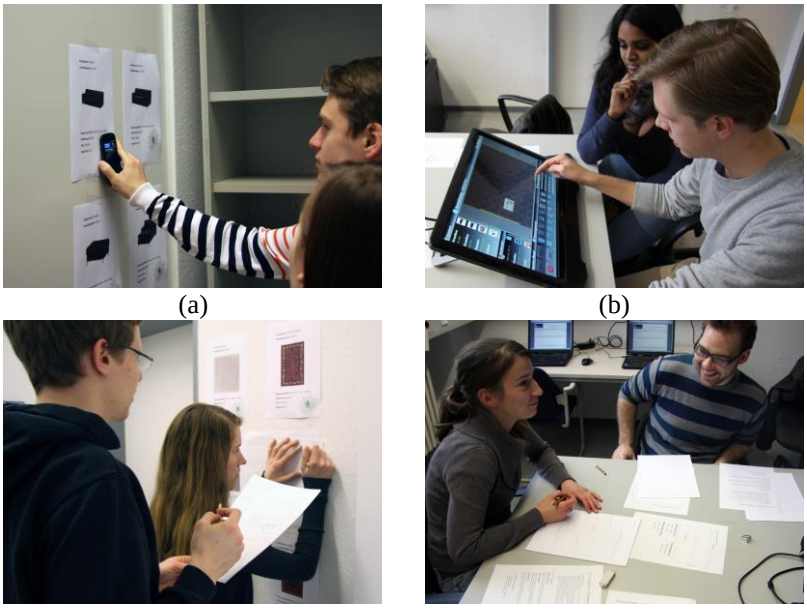


Fig. 4. Interaction during the evaluation tasks: (a) Using the personal mobile client to collect product information. (b) Collaboration on the planning desk. (c) and (d): Collecting information and planning a room outline using pen and paper.

Apparatus Implementation. We implemented a prototype of MoCoShoP for the study. The mobile client application was developed for the Android platform running on a Samsung Nexus S (4" screen, 800×480 px) mobile phone that provides an NFC module for the scanning of product labels. The collaborative planning desk (Dell ST2220T, 22" screen (1920×××1080 px)) was developed based on the Microsoft Surface 2.0 SDK which provides support for multi-touch interfaces. For the storage and management of product information, a web server provided an interface for the retrieval of corresponding information. Further, a session management server was implemented to store information related to shopping sessions (e.g., list of items in a shared shopping cart).

Participants. We recruited 14 participants who worked in pairs of two. They were aged between 23 and 33 years old and seven of them were female.

3.1 Results

All participants expressed that they liked how fast it was to access product information by scanning a label. Several users expressed that a shared shopping cart is

helpful in situations when collaborators split up to search for different products by creating a kind of awareness for the other users' activity or location. As expected, most participants appreciated the flexibility provided by the planning desk application which allows users to create many different confections easily.

13 participants stated that shopping and planning furniture items is a collaborative activity they perform together with other people. This reinforces the identified design goal that collaboration support is needed for shopping for furniture items.

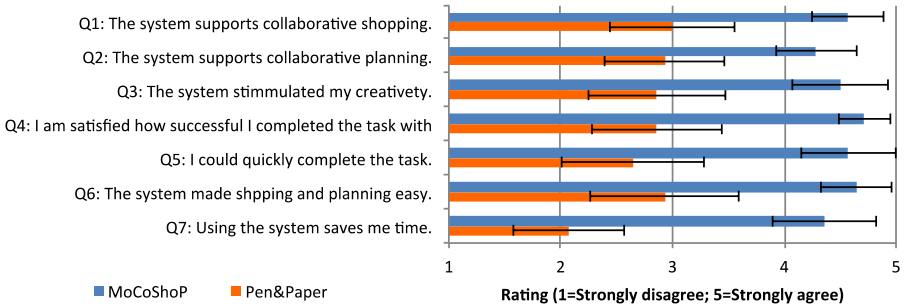


Fig. 5. Post-hoc questions comparing MoCoShoP and the pen and paper condition (Error bars indicate the standard deviation).

Participants rated MoCoShoP significantly higher (on a 5-point scale; 5=best; tested using the Wilcoxon Signed Ranks test) compared to the pen and paper condition regarding the support for collaborative shopping ($z=-3.13$; $p=.002$), collaborative planning ($z=-2.87$; $p=.004$), and perceived creativity stimulation ($z=-3.1$; $p=.002$) (see Fig. 5). Further, participants rated MoCoShoP significantly higher in terms of successful task completion ($z=-3.22$; $p=.001$), time required to complete the task ($z=-3.21$; $p=.001$), support to make the task easy ($z=3.21$; $p=.003$), and the perceived system ability to save the user time ($z=-3.33$; $p=.001$).

4 Related Work

The concept and interaction techniques applied for MoCoShoP are grounded in a number of existing and related works. Early work by Rekimoto investigated the pick and drop interaction technique [4]. The touch and interact technique advances the touch-based interaction to mobile phones based on NFC technology [2]. PhoneTouch generalizes cross-device (touch-based) interaction [5] as adopted by MoCoShoP.

Mobile phones have been demonstrated to be suitable devices for mobile recommendation systems to overcome the limitations of traditional retail stores [6].

Additionally, mobile phones have been used [1] for the visualization of customer-specific information on products (e.g., a diabetes shopping assistant). Similar to MoCoShoP, the system SoloFind allows users to collect information on products in a retail store for further inspection on a kiosk computer [7]. In contrast, MoCoShoP

incorporates different classes of devices for specific tasks, allows in- formation access via the mobile device, and supports collaboration on the shared planning desk.

5 Discussion and Conclusion

We presented MoCoShoP, a system that supports customers in retail stores during the process of collecting information on potentially interesting pieces of furniture, and further, during the process of planning how the collected products could fit into their devised layout. While the personal mobile devices are used for information collection, the large interactive surface is used for collaboration and shared discussion.

Our prototype implementation of MoCoShoP demonstrates that the effort for deploying such a system is moderate and existing environments can be easily augmented: product labels with either integrated NFC tags or simply printed barcodes are low-cost factors and interactive surfaces to be used as planning desks will be relatively cheap as technology matures. MoCoShoP combines the benefits of e-commerce and traditional retail stores to improve the user experience.

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