Design and Development of the Textile Fashion Coordination System
--- a communication aid for the customer and the salesclerk in real shop ---

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Abstract

We describe design and development of the textile fashion coordination system. This system is also a communication aid for both a salesclerk and a customer. The system presents visual information about the merchandises and the customer's own clothes. The customer and the salesclerk can perform fashion coordination interactively and visually on the system screen. To evaluate a developed system, we have conducted a psychological subjective assessment. We observed and analyzed subjects' behavior and conversation. The assessment result suggests usefulness of the system.

1. Introduction

When people purchases merchandise in a textile fashion shop, he or she tends to coordinate his/her own clothes to the merchandise, searching and selecting for the desirable one. This is a quite common behavior in an actual shopping. However, sometimes customers are not able to remember clear images, colors or styles of their own clothes, or they are difficult to explain such exact information to a salesclerk. In this research, we focus on this problem. We assume that the problem is one of communication difficulty between a shop customer and a salesclerk. We intend to develop a communication aid system for both customer and salesclerk. The system aims to support textile fashion coordination in a shopping situation that is a kind of collaborative work of the customer and the salesclerk, namely main objective of their conversation is talking about a coordination of the customer's preference and the merchandise. This is a major aspect of the communication aid of our proposed system.

The proposed system presents information about the merchandises in store and the customer's own properties, such as shirts and pants, for a coordination purpose. Principle idea of this system is a combination of a small handheld device (PDA, mobile phone, digital music player and so on) that can store photographs of customer's own clothes and a larger scale display based merchandise information system in the shop. In our scenario the customer carries the handheld device to the shop, and transfers his/her clothes photographs to the information system. The customer will access the visual information about own clothes on either the handheld device or the larger screen of the information system to recall the remembrance about purchased clothes. The customer also can perform fashion coordination interactively and visually on the screen. The salesclerk also uses the system and accesses both the customer information and the merchandise information for coordination or communication purpose.

This paper describes design and development of our proposed textile fashion coordination system and also describes an interim result of an experimental evaluation of the system. In this system design, we focused on the effective information assistance for the collaborative works of the customer and the salesclerk. Also, we intended to make a practical system for the actual shop in the system development. To evaluate a developed system, we conducted a psychological subjective assessment. This subjective assessment was performed by an observation method.

In the following sections 2 to 4, we briefly introduce related works followed by the system design and the implementation. Then the subjective experiment, its result, and discussion are reported.

2. Related Works

In the Internet-commerce (I-commerce) or Electric-commerce (E-commerce) systems and applications research areas, there are a proposal of shopping assistance system [1] and a behavioral user analysis research of the I-commerce shopping [2,3]. Hypothetical commercial marketing models in the E-commerce [4,5] are often referred in the business field [6]. Basically, these works were targeting the information based virtual world, but neither in the real world nor for the real things. Mean-

while, in the recommendation system [7], there is a fashion coordination assistance system [8] that recommends a choice of clothes from user's past experience. This system supports the coordination in real-world daily lives, but it is not for shopping aid. Consequently, we propose a system that coordinates real merchandise in a real shop and real private properties, which is a quite unique approach in terms of face-to-face recommendation aids and remembrance augmenting communication aids.

In the wearable computing system, there are some memorizing systems for daily events. Kawamura et al. [9] developed a wearable computer that remembered what the wearer saw and grabbed for later recalling. However, this system did not address to exploit such memory for communication aid in a group work style. Mase et al. [10] proposed the ubiquitous experience media for experience recording and sharing using wearable and ubiquitous sensing systems. It used recorded events of experiences, but didn't mention the usage of tangible objects such as purchased clothes as a communication aid. These wearable applications are somewhat similar to the recommendation system, but their major objectives are in life logging.

3. An Overview of the Coordination System

Figure 1 shows the system configuration. The coordination system consists of a merchandise information system in the shop and a customer's handheld device (currently, Apple iPod^{TM}). This merchandise information system is a database system. This database system manages various data records of the merchandise, sizes and colors, brochure pictures, retail price, current stock in the shop and so on. Another notable feature of this merchandise information system is an application of larger scale displays with a touch panel (Figure 1). This is a public display system that aims to be a collaborative workplace for the coordination and the communication. Our developed system functionality runs on a combination of the larger scale information display system and the customer's handheld device. As we mentioned previously, iPod, a handheld device, stores photographs of the customer's own clothes. This photo storage can be a personal and a portable database of the customer's own properties. This database will be called the personal property database in the latter section. For the coordination and the communication support, we intend to integrate previously mentioned two databases, merchandise database and personal property database. This is an essential idea of our coordination system. Our coordination system supports shopping and communication between a customer and a salesclerk at the real shop.

In our coordination system, the customer carries a handheld device (iPod) that stores the personal property database to the shop and he or she browses the personal property database on the iPod for a while. The customer

manually connects it to the merchandise information system in the shop. Then, customer's data virtually transfer to the merchandise information system and the databases migrate automatically, where personal privacy should be kept safe on the final product. As a result of the database migration, the merchandise information system can access the visual information of each database records. So, it is able to perform a fashion coordination of the customer's own clothes and the merchandise interactively and visually on the large display screen (Figure 1).

In our previous work [11], we have investigated a customer's behavior in a shopping, using an interview and a questionnaire. We have evaluated a value of information in a shopping situation from the result of this investigation. According to this evaluation, we have concluded that the information assistance was effective for the remembrance aid for the customer, and also such the assistance was able to support an evaluation of the visual factors, such as styles and colors of the clothes, in the coordination process.
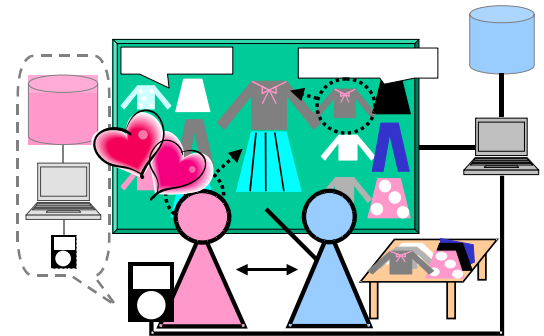

Figure 1. System Configuration

4. System Implementation

Figure 2 shows a block diagram of the system software. The system consists of following four software subsystem modules, (1) a system control module, (2) a communication module for the handheld device, (3) a database management module and (4) an interaction module. These subsystem modules run on the merchandise information system shown in figure 1. The handheld device plays a role of peripheral storage in the system hardware components.

A system control module manages whole functions and data flow in the system. Under the control of the system control module, rest of the module cooperates simultaneously. A communication module controls data transfer from the handheld device (iPod) and manages data consistency between the iPod and the merchandise information system on the main memory. This module also

controls to write back coordination results from the system to the iPod. When the customer connects the iPod to the merchandise information system, this communication module transfers photographs of the customer's own clothes to the system, and then the module delegates a control privilege to a database management module. Then, the database management module migrates data records of the merchandises and the customer's own personal properties. Above these processes proceed automatically, during the iPod connection. Once database migration is completed, users, both the customer and the salesclerk, can coordinate a combination of the merchandise and the customer's own property on the screen visually (Figure 3). Currently, we use a MySQL^{TM} [12] as a database engine.

An interaction module provides a user interface on a larger scale public display with a touch panel as a pointing device. Currently, we use a 50 inches XGA Fujitsu P50XCA11JH plasma wall display. The merchandise information system runs on Apple PowerBook G4 (1.33GHz, 1.25GB, MacOS-X10.4).
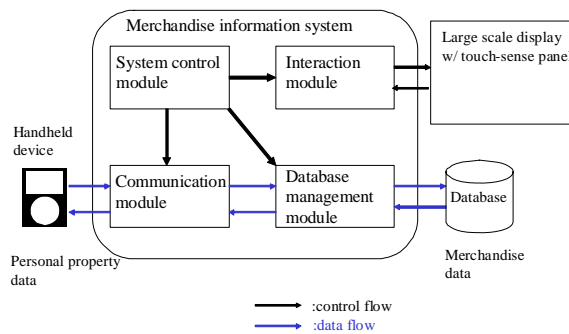

Figure 2. Software Configuration

Figure 3. Example of the Coordination

As shown in figure 3, the system provides three-pane style coordination workspace on the screen. On the left side of the screen, there are pictures of customer's own clothes. On the right side, there are merchandises with their related information, such as sizes, color variations, retail price, brochure picture, model wearing picture and so on. And then, center of the screen is a coordination space. Both the customer and the salesclerk can coordinate a visual combination of the customer's own clothes and the merchandises on the screen, by using a point-and-click interaction on the touch panel. Below the three-pane coordination workspace, there is a display area for temporally keeping an interim coordinated combination pictures. This aims to be a remembrance aid in the coordination and communication process. User can keep a voluntary combination of the coordination, clicking a radio-button on the screen. Also, user can save these results to the handheld device, using writing back functionality of the communication module. Figure 4 shows a control flow of the whole system and a data flow in each subsystem modules.

Currently, we have developed above mentioned software modules and system in Java (JVM1.5) program with MySQL Connector/J5.1.0 JDBC driver library [12] on the previously mentioned PowerBook G4 system.
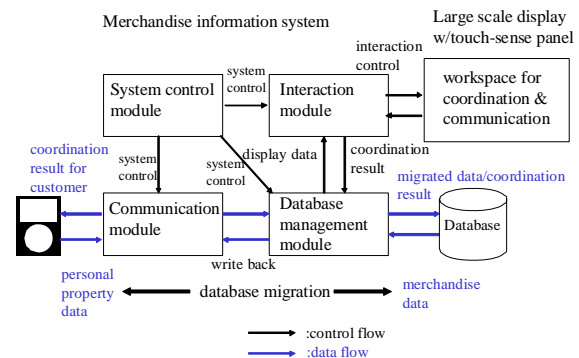

Figure 4. Control and Data Flows in the system

5. Subjective Assessment for the Prototype Development System

To evaluate the current prototype development system, we have conducted a psychological subjective assessment. Basically, it was a behavioral analysis of the subjects. In this subjective assessment, we used an observation method. We observed and recorded the subjects' behavior and the conversation in shopping task. We also used a questionnaire about their subjective impressions.

5.1. Principal Idea of the System Evaluation

As we mentioned previously, our coordination system aims to support a communication between the customer and the salesclerk. This objective, communication aid, is a major point of the evaluation. We designed to evaluate

the effectiveness or usefulness of this communication aid at the shopping situation. This is a main purpose of the subjective assessment. To evaluate such system effort for the communication, we focused on the conversation between the customer and the salesclerk in the usage of our developed coordination system.

We prepared simulated temporal shop facilities with our coordination system in our laboratory for the assessment environment. We also arranged two kind subjects, one was a customer and another was a salesclerk. All the salesclerk subjects had work experience in an actual fashion shop. We asked nine customer subjects and three salesclerk subjects in this evaluation. We matched customer subject and salesclerk subject, and gave a shopping task that included fashion coordination and decision making for purchasing them. We observed and recorded their behavior and conversation in the task, by using video and audio equipments. After a shopping task, we asked their subjective impressions. To evaluate the effectiveness of the communication aid in our system, we analyze these recorded behavior and conversation, focusing on the influence and effort of the system assistance in the task.

5.2. Subjective Assessment

According to above mentioned principle idea and assessment method, we have conducted following subjective assessment. Figure 5 shows an assessment environment and figure 6 shows the task being performed. In the assessment environment (Figure 5), this large display screen is a workplace for the visual coordination and a communication medium between the salesclerk and the customer. Before the assessment, we ordered each customer subject to take photographs of his/her own clothes almost 1 week before the assessment. We stored these photographs into an iPod and prepared a personal property database of each subject, after manually subtracting a background and normalizing a size of each photograph by using photo-retouch software. These preparation processes for the personal property database was proceeded before the assessment.

The assessment was conducted as following steps. At first, we gave a system usage instruction to a salesclerk subject. For simplifying an assessment procedure, we decided that a salesclerk subject only operated the system during the assessment. Also, we gave an instruction about the assessment procedure and a task plot to both the customer subject and the salesclerk subject before the shopping task. A salesclerk subject was waiting in the simulated shop and a customer subject walked into there like an actual shopping. And then, a shopping task was performed. During the shopping task, we recorded subjects' behavior and their conversation on video and logged system operation. After the shopping task, we asked subjective impressions about the assessment and the system, through a questionnaire.

Detailed shopping task is as followings;

(1) Customer subject carries an iPod to the simulated shop.

(2) Customer subject looks around the shop. This is a given instruction as an assessment procedure.

(3) Customer subject watches printed sales brochure of the merchandises in the shop. This is another given instruction. Printed sales brochure is an alternative for the real merchandise. Customer subject may use an iPod for remembrance aid at this moment.

(4) Salesclerk subject speaks to the customer subject and manually connects an iPod to the merchandise information system. Database migration takes for a while. Salesclerk subject and customer subject may start a conversation freely.

(5) Start a shopping conversation.

(6) When customer subject decides to purchase, shopping task is finished. Multiple purchasing is allowed.

In this assessment, we used merchandise photographs and their related data from the Yahoo!^{TM} shopping internet site (Japan) [13]. We used popular top 50th ranking data of this site. We simply asked an ordinary conversation in the task performing without any restrictions.
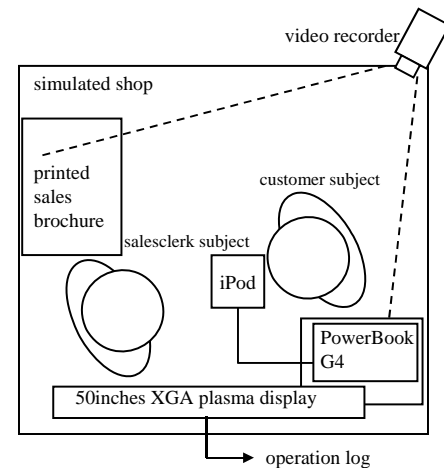

Figure 5. Assessment Environment

Figure 6. Task Performing

5.3. Task Condition and Subject

When people purchases goods in an actual shop, people shows lots of shopping styles with various intentions and motivations. So, we used following three conditions as shopping patterns. We intended to observe and analyze the difference in these conditions.

Condition-A (Own clothes oriented): Customer subjects tend to coordinate to their own clothes at the shopping.

Condition-B (Desired image oriented): Customer subjects tend to image their desirable merchandise at the shopping.

Condition-C (No particular plan): There is no specific intention or motivation for the purchase like a window-shopping.

We gave these conditional intentions to a customer subject as a task plot before the shopping task. In the assessment, we formed following three pairs of the subjects (Table 1). All the subjects were female (20's – 40's), because we have already confirmed that there was no remarkable gender difference in the shopping behavior from our previous work [11].

Table 1. List of the Subject Pair & Task Condition

| Salesclerk1	Customer 01 (***Condition-A***)	Customer 02 (***Condition-B***)	Customer 03 (***Condition-C***)
Salesclerk 2	Customer 04 (***Condition-A***)	Customer 05 (***Condition-B***)	Customer 06 (***Condition-C***)
Salesclerk 3	Customer 07 (***Condition-A***)	Customer 08 (***Condition-B***)	Customer 09 (***Condition-C***)

5.4. Results and Discussion
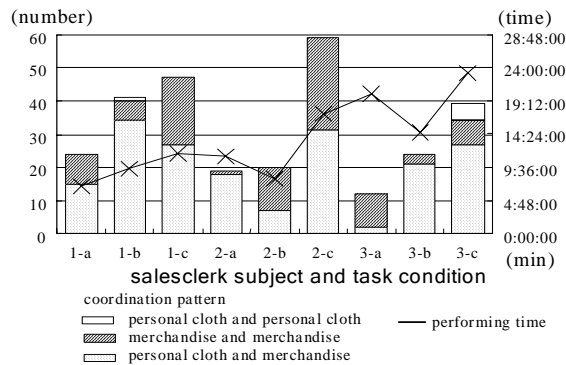
Figure 7. Overall Task Performing time and Total number of coordination trials

Figure 7 shows overall task performing time and total number of coordination trials in each condition. As shown in here, coordination of the personal own cloth and the merchandise was most frequently performed in any conditions. This result suggests that a major interest of their purchasing intention is in a coordinating a personal own cloth to merchandise. This presumption is well corresponding to our expected aim of this research program, that is, communication aid in the fashion coordination. So, it is to say that the result shows a kind of weak indication

of the effectiveness of our system. Also shown in figure 7, condition ***C*** (subject pair*: 1-c, 2-c, and 3-c*) obviously took much longer time than conditions ***A*** and ***B***. This result suggests that a lack of a specific intention for the purchasing introduces much more coordination trials and much longer conversation with a salesclerk. We might assume that the customer subjects tend to select desirable merchandise through the coordination trials and its accompanied communication process in the condition ***C***.

Next, we consider the conversation analysis. We analyzed recorded subjects' conversation during the task. Figure 8 is an example of the conversation analysis result. This shows total amount of the utterance and comparison of the conversation topics during the task. As shown in here, their major topics were visually oriented colors and shapes of the merchandises. Comparing the subject-*01* and subject-*09*, there is a quite difference inside the conversation. We assume that the different (given) purchasing intention makes such difference.
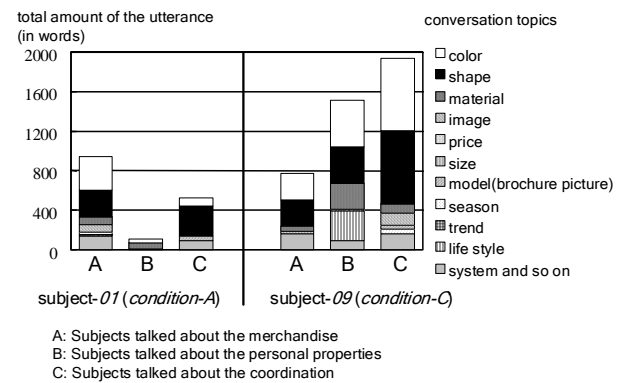
Figure 8. Result of the conversation analysis
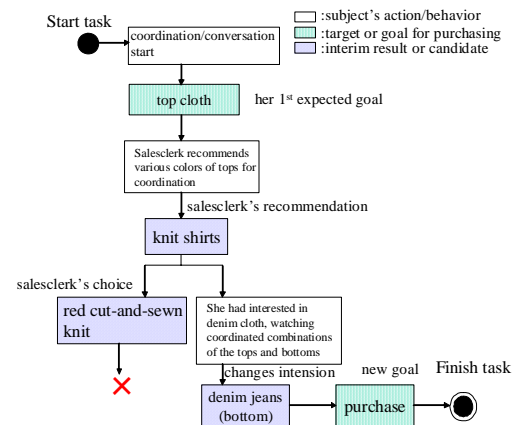
Figure 9. An example of the decision-making flow for the purchase (subject-03)

Figure 9 shows a flow of the decision making for the purchase. The flow is a result of the conversation analysis of the customer subject-*03* (in condition ***C***). A notable

point of this flow analysis is a transition of the purchasing intention and a newly appeared decision goal. As shown in there, she (subject-*03*) planned to purchase a top cloth at the beginning, however she finally decided to purchase a bottom (denim jeans). Satisfying a customer's initial intention, the salesclerk recommended various tops on the system screen, and salesclerk's choice was a red cut-and-sewn knit shirts. Although they talked about tops coordination actively, the customer seemed to reach to have a different thought caused by the displayed coordination. She interested in a denim cloth. This transition of the intention is clearly confirmed from the recorded conversation. So, she changed her goal in the decision process. Her final purchase was denim jeans. She seemed to satisfy her purchase in the conversation. This is quite interesting phenomenon. This is a clear example of the influence of a communication process to a thinking process. Combining with an observed communication activities in their system usage, we can consider that our developed communication aid system also supports a decision making process, that is, the presented visual information is an effective cue for thinking an alternative.

As a result of the above interim analysis, we think it is necessary to improve the assessment indices and methodology to carry out more precise quantitative evaluation. Another important point is a system security. Our coordination system uses customer's private photographs. It may cause a privacy issue. We have to consider the data security and safety in the system functionality seriously. These are future objectives of this research.

After the shopping task, we asked subjective impressions to the subject. According to their reported impressions, some indicated system usefulness regarding a presence of visual information, a persuasive information representation and an effective merchandise selection feature from the customer subjects. Also, there are some positive comments from the salesclerk subjects. For instance, a salesclerk subject said that she could understand customer's taste from the information of customer's own properties, but not all from a wearing cloth at that moment.

6. Conclusion

In this paper, we described design and development of the textile fashion coordination system. This system is also a communication support system for both a salesclerk and a customer. The system represents visual information about the merchandises and the customer's own properties for a coordination purpose. This coordination is a kind of collaborative work of the salesclerk and the customer. We intended to make an effective information assistance system for this cooperative coordination process. This is a main objective of our research program. Principal idea of this system is a combination of a small handheld device that stores photographs of customer's

own clothes and a larger scale display based merchandise information system in the shop. The system migrates and correspond these two, personal own clothes and merchandises, information. Then, the salesclerk and the customer can perform fashion coordination interactively and visually on the screen. We have developed prototype coordination system. We conducted an experimental evaluation of the developed system. Our coordination system aims to support a communication between the customer and the salesclerk. So, we intended to evaluate an effectiveness of this communication aid in the coordination process. To evaluate this, we have conducted psychological subjective assessment using an observation method. We observed and analyzed subjects' behavior and conversation. An assessment result suggests a usefulness of the system and positive impressions to the system, along with a system improvement for the future development.

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