

## Analyzing Interaction in Remote Joint Shopping System

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### Abstract

Remote Joint Shopping System is a remote communication prototype for a joint shopping scenario in which the communication always involves the environment and objects. This system is to offer a sensation shared by the two geographically separated users that they are co-located together going for a shopping in the same world. Although it might require varieties of aspects to fully realize such sensation, in this prototype we intend to support users to accomplish a shopping task together with help of gestural interaction so as to make users feel a close connection and aware a certain extent of togetherness. In this paper, we introduce our user study and analysis of the Remote Joint Shopping System. The major purpose of this study is to investigate the human-to-human interaction between users and test whether this system could assist the remote collaboration.

Keywords: remote communication, joint shopping, gesture

### 1 Introduction

Nowadays, remote communication is extensively used at work or in daily life to increase the productivity and to improve the performance of the instant communication. It allows the users from the different locations to communicate and collaborate together as a team. It is a cost-effective way that can truly help users to get an instant solution for any type of problem [1, 2]. However, existing commercial video communication systems mostly only provide a capture of the user's face which helps little to focus on the other information like body language or the ambient or distant objects. Although might possible with current technologies, there are few platforms offer a way for users to achieve effective gestural communication. When users want to describe the objects or directions in the scene, only using verbal description might be challenging. Such constraints make it difficult for users to get a common perception or feel like staying together.

To solve these problem, we proposed our remote communication design. Remote Joint Shopping System is our prototype -- a remote communication system design for a joint shopping scenario [3]. It aims to help the users in separated positions get a feeling of shopping together during a mobile communication in a physical shopping environment.

In this paper, we introduce our user study and analysis of the user communication in Remote Joint Shopping System. The major purpose of this study is to investigate the human-to-human interaction between users and test whether this system could assist the remote collaboration.

### 2 Remote Joint Shopping System

It designed for two users in separated places: an in-store user goes to a physical shopping world, such as a store, to which an in-house user staying in a house locating far apart accesses with an immersive shopping experience. The in-house user could be someone elderly who has mobility problems or just have difficulties in reaching the remote places. He/she may ask the in-store user who might be one of his/her friends or family to buy something in the store.

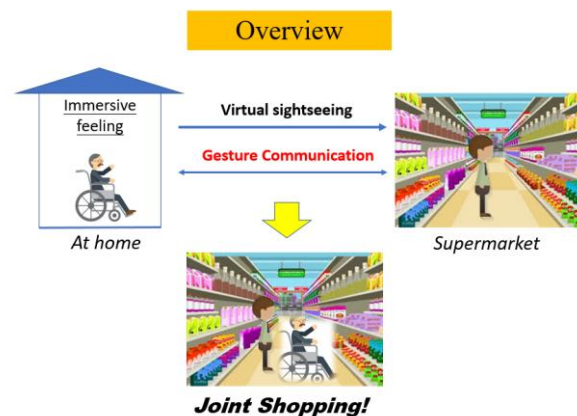


Figure 1. Remote Joint Shopping System

Some previous researchers have demonstrated that hand gesture is helpful in remote communication in different approaches [4 – 7]. We find that users intend to use hand gestures to describe direction information or point out objects especially in the spatial scene, which might make the conversation smoothly.

To enhance the human-to-human interaction, we develop an effective two-way gestural communication approach which could be used in a mobile condition. This system allows the in-house user to perform a free hand gestural input, without limitation of hand postures, in the immersive shopping world with a first-person perspective. His/her precise gestures would present to the in-store user with a side-looking perspective. On the other hand, a capture of the in-store user's hand gestures is easily accessed by the in-house user. Additionally, we support the in-house user to use practical control functions with hand gestures in order to improve user's observation ability and enhance the immersive feeling.

Different from traditional video communication techniques, this system allows the users have free manipulations of independent viewpoint. We construct a virtual shopping environment, in which the in-house user gets a 360° panoramic view of the physical venue and simply control the viewpoint by head movement. It gives a feel of being

personally in the scene. For the in-store user, we introduce the augmented reality technique. With the use of a pair of smart glasses, our system presents the 3D air gestures superimposing in the physical world, which still allows a clear view of the surrounding.

### 3 Study Design

#### 3.1 Participant

We recruited eight participants. All of them have regular computer skills. They were divided into 4 pairs. Each pair had two roles: an in-house user and an in-store user.

#### 3.2 Task and Procedure

In each pair, one participant stayed in the laboratory (the in-house user), the other one went to a store (the in-store user). Participants were allowed to practice using the system for 20 minutes before starting the experiment.

The study task was going to a stationery store to purchase a little gift which could interest both participants (such as a pencil box). In each pair, both participants were allowed a fully free viewpoint control. The in-store participant walked around and communicate with the in-house partner, and the latter might request the former to move or do some operations like pick up and show some objects in hands. The in-house user's subsystem was connected to the cabled Internet, while the in-store user's subsystem used a wireless connection. During the experiment, participants were allowed a speech communication via the voice call. The time limitation of each experiment was 30 minutes.

After each experiment, all four pairs of participants were asked to fill out a questionnaire including 5 questions to get the user feedback. The participants graded each question from 1 to 5 (1 = very negative, 5 = very positive).

### 4 Results and Analysis

In our user study, all four pairs of participants completed the task within the stipulated time.

Figure 2 shows the results of our questionnaires. We divided the results into two groups--the in-house users and the in-store users. We calculate the average score of each question in each group.

Question 1 and Question 2 indicate that both in-house and in-store users could perform gestures to transmit their intentions and achieve a smooth communication through our system. The results of Q3 suggest that users generally found it is effortless to achieve a communication. Q4 indicates that the users could be aware of the partner's attention condition easily which provides the possibility to join in the same scenery and continue to communicate as well as to keep a close connection. Result of Q5 demonstrates that, by using our system, users could get a close relation and receive common perceptions, as well as might feel co-located.

	Question	In-house user	In-store user
1	I could easily transmit instructions by gestures.	3.5	4.5
2	I could quickly understand the intentions of my partner.	4.5	3.25
3	I felt the system operation was easy enough.	3.75	4.5
4	I could quickly know my partner's focusing direction.	4.5	3.25
5	I felt being with my partner together in same place.	3.5	3.75

Figure 2. Questionnaire Result

In the post-task interviews, the in-house participants reported that they could experience an immersive shopping feeling and felt personally on the scene to some extent. The in-store participants also agreed that presenting the in-house participant's 3D gestures in the physical world was intuitive and understandable enough to reduce the miscommunication.

In general, the average scores of all questions were graded highly by the in-house participants as well as the in-store participants, which meant our user study got a positive overall result. This might signify that our system designs are reasonable and practical.

### 5 Conclusions

In this paper, we introduce our user study and analysis of the Remote Joint Shopping System. The major purpose of this study is to investigate the human-to-human interaction between users and test whether this system could assist the remote collaboration. It demonstrates that being supported by the two-way gestural interaction and attention awareness mechanism, both users could effectively transmit instructions which relate to the physical world and could achieve a smooth remote collaboration. Users could get a close connection when accomplishing a shopping task together.

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