Development of a Simulator for Interactive Voice Response Systems and its Experiences

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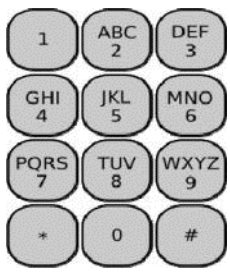
Abstract. Without thorough analysis of the data concerning users and their behaviors, it could be tricky to develop usable and convenient systems that fit their needs. To date, interactive voice response (IVR) systems have been well-known for their inconvenience, in spite of their wide usage. A primary reason for it is that little attention to understanding of their users has been paid. In this context, a more concern about usability and user data analysis is urgently requested in research community. This paper presents an IVR system simulator that we developed, by which one enables efficient and rich usability tests, as well as acquisition and analysis of user data in relation to IVR systems. Further, the paper discusses the lessons we have learnt from the experiences of using the simulator to explore usability problems of IVR systems.

Keywords: Human Computer Interaction (HCI), Interactive Voice Response System (IVR), Simulation, Touch Tone Interface (TTI), Usability.

1 Introduction

Primary interface types of interactive voice response (IVR) systems are touch-tone interface (TTI) and voice user interface (VUI).



(Fig. 1) Touch-tone interface

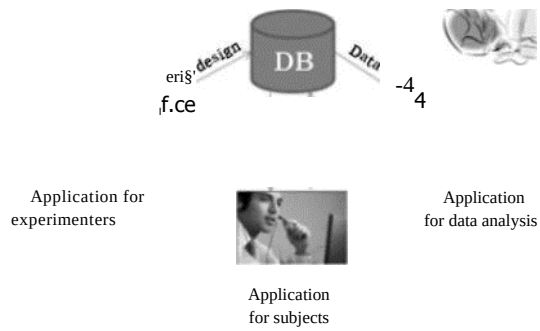
There are a large number of IVR systems-based applications with this simple interface, e.g. to check orders and reservation status, carry out surveys, and pay for

and transfer fees, etc. To date, while IVR systems have been widely used, the level of user satisfaction with IVR systems is still low. In fact, many usability problems in IVR systems have been reported. For example, users are likely to get lost when the paths are ambiguous [1], and have a great difficulty to sense an overview of the menu structure. In particular, interaction with IVR systems has some inherent usability problems such as linearity, transcience, ambiguity, and minimal feedback [2].

The usability test simulator that we develop and present in this paper is software to perform experiments to study IVR system usability and analyze the user data. The simulator is useful to build an experimental user test in a more flexible way, and can overcome traditional ways of studying users where it is impossible to test various contexts and tasks in a freer way. This paper discusses the IVR system simulator and the lessons we have learnt in relation to its usage experiences.

2 IVR system simulator

When there is a tool that aids to understand IVR system users, user studies would be more facilitated. The IVR system simulator provides an environment for the design of a mock task and users' performance of the task. By using the simulator, we expect that researchers and practitioners will gain some help to understand IVR system usability and design the IVR system interface. The IVR system simulator consists of three distinctive applications: (1) an experimenter's application to design experiments, (2) a caller's (or subject's) application to perform the task, (3) and a data analysis application.



(Fig. 2) Three applications forming the IVR system simulator

Experimenter's application. There are three major functions in it. Firstly, it supports workflow design. The experimenter can explain each node for the item by defining workflow. It also helps to define and organize the menu structure and voice contents. Secondly, the application helps to be aware of the task path that the user takes. Thirdly, the experimenter can organize questionnaire forms that the user fills.

Caller's application. By this application, the caller inputs his or her demographic and personal information, which will be used during the data analysis phase. Using the interface shown in Figure 4, the caller performs a given task. During the

experiment, subjects use the head set, the microphone, and the mouse. Finally, the information about the actions, the path, and related time are logged. Subjects also answer the questionnaire with the application.

Data analysis application. This application supports four types of analysis. Firstly, an analysis of callers is provided, by which one can confirm and analyze callers' personal information. Secondly, there is an analysis for workflow. There, the experimenter can see the callers' path, and sense an overview of the menu structure. Thirdly, there is a task analysis module. About each task, one can observe the number of callers' mistakes of pressing wrong keys, the elapsed task time, and see callers' personal information. Fourthly, the experimenter can confirm basic statistical results on answers to the questionnaire, which can also be exported by an Excel format.

3 Experiences

Previously, we had conducted two user studies about IVR systems. First, we carried out a user study to find hindrance factors of menu structure in IVR systems without the simulator, where subjects performed two tasks using real IVR systems, and answered 19 questions in the questionnaire survey [3]. Second, a user study where the simulator was utilized to explore usability problems of IVR systems [4]. Here, it seems meaningful to discuss our experiences of usage of the simulator, by comparing the first study without the simulator (the non-simulator study, NSS) and the second study with the simulator in this paper (the simulator study, SS). Among many lessons that we have learnt, we briefly present the most important lesson that while we have much freedom to design rich and meaningful experiments, we should also pay the associated cost for it.

Freedom to design experiemnts. With no doubt, the study with the simulator (SS) has a lot of freedom to plan experiments. Because the simulator provides ways of designing experimental tasks, researchers can freely design the menu structure, words, volumes, and the like according to their research purposes. This is clearly a distinctive advantage of SS that cannot be achieved in the non-simulator study (NSS). In NSS, experimenters had to use existing IVR systems so that they could not change any parts of the menu structure and words in them. Their research is certainly restricted to design tasks to ask subjects to do. However, the simulator provides a lot of potential to explore new research interests and realms due to freedom of experiment design. In fact, our team could imagine various interesting experimental settings, e.g. feedback support by voice, overview support in the menu structure, several different volume control, comparison between easy tasks vs. complex tasks, comparison among different types of tasks, etc. Without simulator, such an imagination may not be allowed with traditional ways of studying alone. Further, easy data collection and analysis are a great advantage that we can gain from SS. In particular, support for the path that the user has taken was useful and interesting when we performed retrospective ways to understand users' behaviors and thoughts along with it.

Cost for experiments. While advantages with the simulator are clear enough, our negative experience from the two studies is that their cost was substantially large. In NSS, since we have taken IVR systems which were already built for the user test, there is no need for an effort to newly establish the testing systems. As we discussed it, NSS could not allow us to do rich and flexible ways of studying users, but it enabled easy and fast experimental settings. On the other hand, whereas experimenters are bestowed freedom to design experiments with nearly no limit, such freedom brought about cost to a large extent. As a matter of fact, cognitive overloads to design each menu structure including selection of proper words and record voices were much more than we anticipated in the beginning In particular, to design a user test experiment using the simulator required a substantial amount of time. In the worst case, it may demand the same period of time as to design a real IVR system. This cost was an unexpected difficulty, but we realized that it became the most important problem when we work together with the simulator.

4 Conclusion

The wide acceptance of IVR systems is due to the industrial need to reduce costs by employing IVR systems for customer care on one hand, and to technological development on the other hand. In spite of their success, however, understanding users' desire for convenient interaction with the systems has been largely ignored. As a matter of fact, few studies have focused on the usability or user-oriented design of IVR systems. To develop usable and convenient systems that fit their needs, it is essential to analyze the data concerning users and their behaviors. This paper has presented an IVR system simulator to perform efficient and rich usability tests. It undoubtedly provides us with much freedom to design rich and meaningful usability experiments. In spite of this advantage, however, experiment designers should also pay the associated cost for it to a large extent.

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