

USER PREFERENCES OF NUMERIC ENTRY METHODS FOR INTERACTIVE VOICE RESPONSE SYSTEMS

Young Sam Ryu¹, Ha-Chin Yi², Sean Dozier¹, Pranitha Matthey³

¹*Department of Engineering & Technology*

²*Department of Finance & Economics*

³*Department of Computer Science*

Texas State University-San Marcos

601 University Drive

San Marcos, TX 78666

Abstract: Voice recognition features adopted by Interactive Voice Response Systems (IVRS) are becoming more comprehensive and popular with the advancement of Automatic Speech Recognition (ASR) technology. The purpose of this study was to investigate the user preferences of the numeric entry method for IVRS. The study investigated the relationships between the individual characteristics of users and the preference of their entry methods. According to the results of this study, typing is still preferred to speaking as the numeric input method to IVRS. Also, when users are making calls with their cell phones, their preference for typing becomes more significant. Thus, this study showed that IVRS systems should be able to accept touch tone entry as an input method although the systems feature highly sophisticated voice recognition system. However, there was no strong evidence that the individual difference variables played a significant role in the preference. *Copyright © 2002 IFAC*

Keywords: interactive voice response, user preference, numeric entry interface

1. INTRODUCTION

An Interactive Voice Response System (IVRS) is defined as “computerized system that allows a person, typically a telephone caller, to select an option from a voice menu and otherwise interface with a computer system” (“Interactive voice response”, 2006) and the system plays “pre-recorded voice prompts to which the person types a number on a telephone keypad to select the option chosen, or speaks simple answers such as “yes”, “no”, or numbers in answer to the voice prompts” (“Interactive voice response”, 2006).

IVRS was introduced in the 1980s and it has been widely used in services such as balance inquiry, ticket booking, and caller routing, because it is not only cheaper than live operators, but also reduces the number of employees and handles more calls (Dulude, 2000).

As quoted in the definition above, the IVRS accepts two types of numeric data entry, one is touch tone entry and the other is voice entry, which is known by Automatic Speech Recognition (ASR), and provides appropriate responses. The typical numeric data entries are social security numbers, credit card numbers, and driver license numbers.

The voice recognition feature adopted by IVRS is becoming more comprehensive and popular with the

advancement of ASR technology. For example, users are asked to speak in the form of a natural sentence to complete their desired tasks with IVRS. The number of the undesirable experiences of repetitive announcements and delays or unconditional hang-up by improper navigation has been decreased with the advanced and more user-friendly voice interface. Also, numeric data entry error might arise during IVR dialogues from the use of touch tone keypad (Lund, 1999).

However, some users may still prefer typing to speaking in the case of entering a series of numbers such as credit card numbers and social security numbers. For example, a user might be afraid of repeating the 16-digit credit card number in case the system may misunderstand a digit or two during the entry. Therefore, he or she opts to use the touch tone keypad to complete the task.

The purpose of this study was to investigate the user’s preference of the numeric entry method for IVRS. The study investigated the relationships between the individual characteristics of users and the preference of their entry methods. For example, age difference may contribute to the disparity of the preference. Elderly users who have the problem of hands shivering and short term memory loss would prefer voice entry to touch tone entry. Younger users who use text message systems in cell phones often would prefer touch tone.

Since there are numerous applications using numeric data entry, such as a major interface for the system such as Automatic Teller Machines (ATM), electronic ticketing system at an airport, and electronic door lock system, the results of this study would provide useful guidelines to design the multi-modal numeric data entry interface for those application systems.

2. METHOD

2.1 Participants

A total of one hundred fourteen participants completed the survey. Mean of the age of the participants was 24.18 ($SD = 6.88$). There were sixty seven males and forty seven females. Various education backgrounds are considered such as engineering and science (44), business (28), and other social science majors (32). Ninety four of them were native English speakers and twenty of them were non native English speakers. Most of the participants are college students at Texas State University. Eighty participants (70%) were Caucasians, seventeen (15%) were Asians, and twelve (10%) were Hispanics. Total of 99 respondents have retained a computer experiences of either 5 to 10 years or 10 to 15 years. A cellular phone usage is almost necessity in modern time because most of respondents are currently using a cellular phone (110). Among them, total of 106 respondents have text message capability in their cellular phone. Among those who have text message system, total of 72 use text messages on a daily basis

2.2 Procedure

Participants were asked a range of demographic questions and questions relating to the users' exposure to the technologies including computer, cell phone and IVRS. Then, they were asked to indicate their preference of the numeric entry methods in their everyday use of IVRS. Users were given four scenarios and asked to imagine themselves in those scenarios and answer the questions. The first usage scenario was that the users are at home using a home phone to call a credit card company, then the IVRS asks the users to provide a 16-digit credit card number. The question was which method they would choose to input the numbers. The second scenario was that the users are in a bus and use a cell phone to call a credit card company, then the IVRS asks the users to provide a 16-digit credit card number. The third was that users use a home phone to provide the last 4 digits of their Social Security Number. The fourth was that users use cell phone to provide the last 4 digits of their Social Security Number.

3. RESULT

Scenario 1. For the use of home phone to call a credit card company and to enter a 16-digit credit card

number, 70% of the participants preferred typing as the numeric input method. Three possible alternatives are given: typing, saying, or "depends on the mood." The Chi-square hypothesis test is conducted, where the null hypothesis is equal proportions among three alternatives. The chi-square test statistics is 70.95 and p-value is below .0001 with a sample size of 114, therefore rejecting the null hypothesis. This implies that the level of preferences among three alternatives is not likely to be equal.

Within the typing-preference group, 26% chose typing because they believe it is accurate and fast, 22% chose it because it is easier, 8% chose it because saying is problematic, and 3% feel it is a secure method. On the other hand, 19% of the participants preferred speaking as the numeric input method, in which 86% chose speaking because it is easier. The result of hypothesis testing shows that there is a significant statistical association between the preference of entry method and the reasons of selection for particular entry system, $\chi^2(8, N = 105) = 52.47, p < .0001$.

Scenario 2. For the use of a cell phone to call a credit card company and to enter a 16-digit credit card number, 95% of the participants preferred typing, $\chi^2(1, N = 114) = 98.56, p < .0001$, in which 50% chose it because they feel it is more secure, 12% chose it to avoid making noise and 37% chose it due to other reasons (e.g., easier, greater accuracy and faster, and speaking is problematic). The remainder of the participants (5%) indicated no preference and none of them preferred speaking as the input method. Unlike the case of Scenario 2, there was no significant statistical association between the preference of entry method and the reasons of selection for particular entry system.

Scenario 3. For the use of home phone to enter the relatively short numbers, such as the last 4 digits of their Social Security Number, 62% of the participants preferred typing, $\chi^2(2, N = 114) = 49.95, p < .0001$, in which 24% chose it because it is easier and 10% chose it because it is accurate and fast. On the other hand, 29% of the participants chose speaking as the input method, in which 57% chose it because it is easier. Also, there was a significant statistical association between the preference of entry method and the reasons of selection for particular entry system, $\chi^2(8, N = 99) = 30.92, p < .0001$.

Scenario 4. For the use of cell phone to enter the last 4 digits of their Social Security Number, 84% of the participants preferred typing, $\chi^2(2, N = 112) = 138.77, p < .0001$, in which 58% chose it because they feel it is more secure and 41% chose it due to various reasons (e.g., easier and to avoid making noise). The other 10% preferred speaking, in which 27% of them chose it because it is easier. Also, there was a significant statistical association between the

preference of entry method and the reasons of selection for particular entry system, $\chi^2(6, N = 106) = 17.99, p < .0063$.

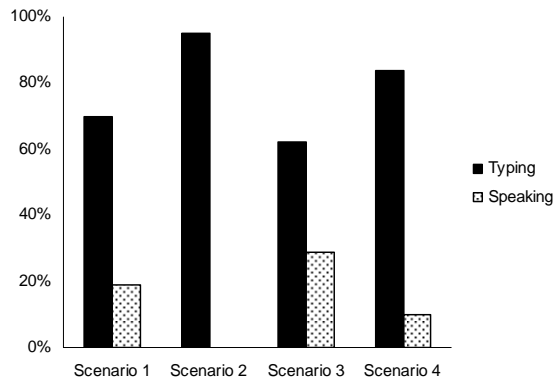


Fig. 1. Summary of the preferences of numeric entry method for all scenarios

Based on the results obtained in the four different scenarios, there were more users who preferred typing to users who preferred speaking as the numeric input method to IVRS (Fig. 1). Also, more users preferred typing in the case of using a cell phone than in the case of using a home phone. The major reasons users preferred typing was that they feel more secure (Scenario 1, 2, and 4) and that it is easier (Scenario 3).

4. DISCUSSION

Gender. Gender is one of the common individual difference variables, along with age. The difference in the level of satisfaction between males and females is significant during their use of different multimedia interfaces (Venkatesh & Morris, 2000). Since the user's satisfaction in using specific interfaces may increase when the user has options to choose the specific interface he or she prefers, it is important to know the user preferences and let the system have the preferable choices available. However, there was no significant difference across gender regarding the preference.

Language. Users with English as their native language may feel comfortable in speaking to IVRS, whereas users with English as their second language may find it difficult to speak to the system. For example, non-native English speakers may have the fear of mispronouncing one or two digits among 16 digits of credit card number that leads to a voice recognition error. In that case, the users need to speak the long list of numbers all over again. Native English speakers may have higher confidence of performing voice entry than non-native English speakers. Only two of the 20 non-native speakers preferred speaking to typing in the scenarios 1, and four of the 20 in the scenario 3. However, there was no statistical significance with the preference because the small number of non-native English

speakers. If we could collect large enough number of non-native English speaker as participants, it is likely that there will be statistical significance with the preference.

Cell phone and text messaging usage. This experience variable could be a good indicator of user preferences of numeric entry methods. Users who have a cell phone and who use text messaging feature frequently may be familiar with the touch tone entry method of the IVRS because of the familiarity of typing keys. They may not face much difficulty in typing a number on a telephone keypad to select an option. Such users may prefer touch tone data entry to voice entry. However, there is one more constraint in this case. A thumb is used for text messaging in the cell phone, whereas an index finger is used for typing numbers on the touch tone keypad of regular phones. According to the results of this study, there was no significant evidence that the frequency of text message use affected the preference of numeric entry method.

5. CONCLUSION

Typing is still preferred to speaking as the numeric input method for IVRS although numerous IVRS systems are adopting voice recognition only systems. Also, when users make calls with their cell phones, their preference for typing becomes more significant. Thus, this study showed that IVRS systems should be able of accepting touch tone entry (typing) as an input method although the systems feature highly sophisticated voice recognition systems. However, there was no strong evidence that the individual difference variables played a significant role for the preference. The authors would like to indicate that it might be due to the lack of diversity as well as large enough numbers in the population of the participants. Thus, continuation of collecting data from diverse population will help us to find the role of individual difference variables for the preference.

On the other hand, future research will include laboratory based usability tests using the scenario such that user preferences surveyed would be compared to users' actual behaviors. Also, it would be worthwhile to investigate how users would prefer to deal with live operators instead of IVRS when users provide numerical information verbally.

REFERENCES

- Dulude, L. (2000). *Usability of Interactive Voice Response Systems in real-life tasks performed by old and young women*. Carleton University, Carleton.
- Interactive voice response. (2006). *Wikipedia, The Free Encyclopedia*. Retrieved October 10, 2006, from

http://en.wikipedia.org/w/index.php?title=Interactive_voice_response&oldid=79727037

- Lund, A. M. (1999). Why do people dial wrong numbers? In D. J. Bonneau (Ed.), *Human factors and voice interactive systems* (pp. 187-203). Boston, MA: Kluwer Academic.
- Venkatesh, V., & Morris, M. G. (2000). Why Don't Men Ever Stop to Ask for Directions? Gender, Social Influence, and their role in Technology Acceptance and Usage Behaviour. *Management Information System Quarterly*, 24(1), 115-139.