OLDER PEOPLE AND TELEPHONY-BASED SPEECH SYSTEM DIALOGUES

MARY P. ZAJICEK
School of Technology, Oxford Brookes University, Wheatley Campus, Oxford OX33 1HX, UK
mzajicek@brookes.ac.uk

Abstract. This paper addresses the challenge of enabling older adults to participate in telephony based speech systems. Older people often have little knowledge of technology and suffer age associated impairment particularly memory and sight. The solution presented uses VoiceXML to provide Web access over the telephone, where the first time older dialogue user has to learn how to interact with a speech system. This paper focuses on the usability of the VoiceXML dialogues for older adults and the challenge of embedding context sensitive help and instructions within them. The paper also suggests encapsulating good interface design for older people in the form of patterns.

1. Introduction

The focus of this paper is the challenge of designing telephonic speech dialogues, in this case using Voice XML over the Web, for older adults. This user group is different from mainstream users in many ways. They are difficult to integrate into the design process, are frequently inexperienced with technology and an unknown for system designers.

This paper reports experiments carried out at Age Concern Oxfordshire using a VoiceXML system, which enables clients to access the Web from their own homes, over the phone. Although telephone access to the Web for older adults promises widening accessibility and inclusion, its effectiveness for this user group depends on the usability of the VoiceXML dialogues themselves.

2. The Challenge of Older Adults and Technology

Older adults form a significant proportion of the population numbering some 10.8 million in the UK (Office National Statistics, 2008), with one person in

six aged over sixty-five, a figure that is predicted to rise to one in four by 2031. Additionally almost half of the older population is aged at least seventy-five, with even larger relative increases being experienced in people over eighty-five.

Ageing can result in a combination of accessibility issues. Declines in sensory, perceptual, motor and cognitive abilities that occur with the normal ageing process have implications for dialogue design. Many of these are catalogued Morris (1994), Czaja (1996) and Hawthorn (2000) who have described the different declines in abilities that occur with age and the implications of these for human-computer interface design. However, very little research has been carried out into what makes a speech interface easy to use by older adults.

3. The Voice Access Booking System (VABS)

The Voice Access Booking System (VABS), built for Age Concern Oxfordshire, was based upon a Web accessible database which holds the bookings for IT taster sessions at the Age Resource Desk. The speech dialogue allows the user to phone up to book a taster session with a reminder call, book a taster session without a reminder call, cancel a taster session and notify the database if they are going to be late, using a VoiceXML dialogue which interacts with the database. The system will also phone clients to remind them of an upcoming appointment.

VoiceXML (http://www.w3.org/TR/voicexml20/) offers the dialogue builder, simple building blocks known as form and menu, and a set of grammars. The challenge for the dialogue builder is to use these components to construct a successful dialogue, which older adults can use unaided in their own homes, to organise their own taster session appointments. Sample Voice XML code is shown below:

Sample Voice Output tag:

<prompt>On which day do you wish to book?</prompt>

Sample User Input capture tag with restricted grammar:

<grammar type="application/x-gsl"> [monday tuesday wednesday thursday friday] </grammar>

Sample 1st Error Recovery Cycle tag - concise:

<nomatch count="1">Your day was not recognised. Please say a day from Monday to Friday.</nomatch>

4. Usability Issues in Dialogue Design

An important challenge for the dialogue designer is to provide context sensitive instructions to help the older adult to use the dialogue. Another major usability aim is to keep output messages as short as possible (Zajicek and Morrissey, 2000) and provide positive feedback to users.

Context Sensitive Help - When using the dialogue older adults were able at any time to say help and the system would jump to help instructions. Context sensitive help areas are distributed throughout the dialogue and instruction takes the form of explanatory text relating to the current state. For example:

Area 1 – This system uses voice recognition to understand your commands that should be spoken clearly. Giving your name helps the system to locate your current sessions and gives you access to more functions. You need to contact the centre during office hours to register your name.
Area 2 – This system is designed to offer users the ability to book or cancel a computer taster session. Speak your commands clearly and try to use the words given in the question.
Area 3 – Sessions are generally available from Monday to Friday. Please state only one of these days clearly.

Embedded Help/Information - An important usability issue is how to let the user know the required format of inputted data, for example that call reminders are possible only on the hour. Help information is embedded in an error recovery loop in order to avoid lengthy introductory messages for those that already know how to use the system.

Use of Defaults - Default input is used when the user's own data input is unsuccessful. For example the message '*Unable to determine a time for a reminder call. Would 7 pm be OK?*' offers a possible retrieval of the task by offering a default booking time for a call rather than allow the user to leave the dialogue without having completed their task.

This approach contrasts with that of a standard telephone answering system in which users frequently have to start the call all over again if they make an error or forget something.

Confirmatory Sentences - Used to make the user feel in control of their interaction. For example. '*Please confirm that you want a call reminder at <time>*', or '*Thank you. You will receive a call at your registered number at <time> the day before your session'*. Defaults and confirmatory sentences also provide the user with positive reinforcement.

5. Dialogue Evaluation

The optimum and worst potential routes were traced, for each possible task. Fatal errors that return the user to the main menu or the operator are denoted by an '^{F}', one for each potential error.

TABLE 1: Optimum, and worst case number of steps for each task.

Task	Optimum	Worst
1. Guest Main Menu.	9	18^{F}
2. Registered Main Menu.	5	14^{F}
3. Guest booking, yes to call.	6 + 1	$16^{FF} + 1$
4. Registered booking, yes to call.	6 + 4	$16^{FF} + 9^{F}$
6. Registered booking, no to call.	6	16^{FF}
7. Guest cancellation.	7	12^{FFF}
8. Registered cancellation.	1-4	$1 - \infty$
9. Guest late.	1	1
10. Registered late.	4	6

TABLE 2: Number of steps for each user by task.

Task	User 1	User 2	User 3	User 4	User 5	User 6
1. Guest Main Menu.						9
2. Registered Main Menu.	7	5	7	7	5	
3. Guest booking, yes to call.						10 + 1
4. Registered booking, yes to call.	11 + 6^{F}	11 + 9	13 + 5		13 + 7	
6. Registered booking, no to call.				16		
7. Guest cancellation.						12
8. Registered cancellation.		4	4			
9. Guest late.						1
10. Registered late.		5				

The figures indicate that the dialogue supports some tasks better than others. *Task 9: Guest late*, for example is supported so well that the user can carry it out in one step and cannot go wrong. Whereas with *Task 8: Registered cancellation*, the user could remain in a continuous loop. Table 2 sets out the actual number of steps taken by test users, showing that the two users who tried Task 8 both carried it out in 4 steps. This demonstrates that the number of possible steps in a dialogue cannot be used alone as a usability measure. The designer aims to reduce the number of user steps and ultimately make them the same as the optimum path. This is particularly

challenging for data entry tasks where input recognition quality is not easy to predict or control.

The dialogues were tested with six users at Age Concern Oxfordshire. Table 2 shows the number of nodes on the route visited to successfully complete each task. One fatal error was encountered throughout the tests. One user asked for help and then proceeded to answer the next prompt successfully. *Task 3: Guest booking, yes to call*, and *Task 4: Registered booking, yes to call*, were the most problematic because they rely on voice recognition alone for data entry. The user paths for those tasks that did not involve data entry were much nearer to the optimum score.

6. Patterns of Dialogue Design for older Adults

More older people will need to use ITC in the future to satisfy legal requirements (ADA, 1990), avoid social exclusion and enable them to live more independently. Many interface designers require pointers to good design for older people, a user group which is significantly different from the mainstream user groups as a result of age associated changes. There is currently no detailed body of knowledge from which interface designers can learn how to design for this user group.

A robust set of design patterns is therefore a particularly important requirement for those designing systems for use by older people. A set of clear and informative patterns together with information on how the patterns may be used together in a system i.e. the pattern language, would enable interface designers to access best practice and help them to create sympathetic and successful designs for older people.

Importantly the patterns will reflect the experience of older people through experimentation and observation, which the designers themselves are lacking. This in itself will nurture good design and provide a framework for analysis and discussion.

6.1. EXAMPLE PATTERNS

Patterns for speech systems have different characteristics from the more visually orientated graphical user interface patterns of Tidwell (2002) and van Welie (2002), and indeed the architectural patterns of Alexander (1979). The usability of the dialogue depends on its structure and the quality of the output messages.

Eight patterns have been developed by the author, which deal with the quality of output messages in speech systems for older people, and can be formed in either pre-recorded or synthetic speech. They are categorized according to function, *Menu Choice Message, Confirmatory Message,*

Default Message, Context Sensitive Help Message, Talk Through Message, and *Explanation Message* together with the dialogue structure patterns *Error Recovery Loop* and *Partition Input Message*. There is insufficient space here to set out individual patterns, but they can be found at http://cms.brookes.ac.uk/computing/research/advancedinterfaces/Projects/patterns.html and also appear in (Zajicek, 2004)

7. Conclusion

This paper represents first attempts at addressing the challenge of older adults' use of interactive speech systems. Many of the principles described can apply equally to other forms of interface for older adults. It is hoped that others who research and develop systems for older people will consider formulating their valuable knowledge and results in an appropriate pattern form, thus enabling the older adult community to be well served with usable designs.

References

ACO Age Concern Website: 2008, http://www.ageconcern.org.uk (last accessed 4.1.2008).

ADA: 1990, *Americans with Disabilities Act of 1990*, US Public Law 1990 101-336.

Alexander, C.: 1979, *The Timeless Way of Building*, Oxford University Press.

Czaja S.: 1996, Interface Design for Older Adults, *in* A. F. Ozok and G. Salvendy (eds), *Advances in Applied Ergonomics*, 262 – 266.

Morris J.: 1994, User Interface Design for Older Adults, *Interacting with Computers*, **6** (4), 373 – 393.

Office of National Statistics: 2008, *Mid-2000 UK Population estimates*, [online] http://www.statistics.gov.uk/CCI/nugget.asp?ID=6 (last accessed 4.1.2008)).

Tidwell, J.: 2002, *UI Patterns and Techniques*, [online] http://time-tripper.com/uipatterns/about-patterns.html (last accessed 4.1.2008).

Van Welie, M..: 2002, *Interaction Design Patterns*, [online] http://www.welie.com (last accessed 4.1.2008).

Zajicek, M.: 2004, Successful and available: interface design exemplars for older adults, *in* Zajicek, M. and Edwards (eds), *A Special Issue 'Universal Usability Revisited'*, *Interacting with Computers*, **16** (3), 411 – 430.

Zajicek, M., and Morrissey, W.: 2001, Speech output for older visually impaired adults, *in* Blandford A., Vanderdonckt L,. Grat P (eds), *Interaction without frontiers*, Joint Proceedings of HCI 2002 and IHM 2001, pp. 503 – 513.