Usability Evaluation of the South African National Accessibility Portal Interactive Voice Response System

Mardé Greeff
Meraka Institute (African Advanced Institute for Information and Communication Technology), CSIR, P.O. Box 395
Pretoria, South Africa, 0001
mgreeff@csir.co.za

Louis Coetzee
Meraka Institute (African Advanced Institute for Information and Communication Technology), CSIR, P.O. Box 395
Pretoria, South Africa, 0001
lcoetze1@csir.co.za

Martin Pistorius
Meraka Institute (African Advanced Institute for Information and Communication Technology), CSIR, P.O. Box 395
Pretoria, South Africa, 0001
mpistorius@csir.co.za

ABSTRACT
One of the most prominent problems that persons with disabilities face in South Africa, is access to relevant disability related information. To address this need the South African National Accessibility Portal (NAP Portal) was developed, that enable people with disabilities to easily get access to information. However, most people in South Africa do not have access to adequate Internet facilities. To overcome this obstacle, an Interactive Voice Response (IVR) engine was connected to the NAP Portal, which allows access to information through a telephony interface. The IVR engine and scripts guide the user through information categories on the portal to the desired information, which is then voiced out to the user. In this paper, we present the evaluation of the IVR system to determine how easy or difficult users experience the whole process of retrieving information via a telephone. A usability evaluation was performed on the current NAP IVR system. Furthermore, a heuristic evaluation was done on a new design of the NAP IVR system to determine whether the major problems, that were highlighted by an expert, are addressed in the new design. Inputs from both of these evaluations will be used to design the next version of the NAP IVR system.

Categories and Subject Descriptors
H.5.1 [**Information Interfaces and Presentation**]: User Interfaces—*Evaluation/methodology*

General Terms
Design, Human Factors

Keywords
IVR system, heuristic evaluation, usability evaluation

1. INTRODUCTION
According to Statistics South Africa, at least 5.9% of the people living in South Africa have one or more disability [1]. Access to services, relevant information and the ability to communicate effectively are a key need for persons with disabilities. The South African National Accessibility Portal (NAP) Initiative [2] is a research and development project aimed at addressing the marginalisation of persons with disabilities from the mainstream economy and society.

The NAP initiative promotes inclusivity for all. The NAP initiative consists of many different elements, including: research into affordable localised assistive technologies; accessible centers; sustainability models; and the initiative's accessible information-sharing portal (the so called NAP portal).

The focus of the NAP portal is on promoting inclusivity through research into accessible web interfaces and other modalities which can remove barriers. One modality that can remove barriers and enhance information dissemination, is the combination of voice and key presses using a standard telephone (cell or land-line based)– commonly known as an Interactive Voice Response (IVR) system. Telephones are becoming common place in all of the South African society, thus potentially becoming an important mechanism to promote inclusivity. In addition, the availability of open source telephony platforms allows for the much easier (and more cost effective) construction of services that utilise the telephone. It is unfortunate that the technical means to provide a service is not necessarily a guarantee that the service will be usable and accessible. For this reason, the NAP IVR service had to be evaluated to ensure appropriate usability.

In this paper our contribution is the following:

- We highlight how an interactive voice response system can be connected to a portal to enable information retrieval via the telephone.

- We present results from a heuristic evaluation of the IVR system that was performed by a person with a disability that works in the accessibility and usability domain.

- We discuss results from a usability evaluation of the IVR system performed by participants.

- We highlight issues that were identified by the participants that were not indicated by the expert as an issue or a problem.

- We present results from a heuristic evaluation of a new NAP IVR design, that was evaluated by a number of participants.

- We highlight issues that were identified by the expert and the participants in the usability evaluation, that are not addressed in the new NAP IVR design.

The rest of the paper's layout is as follows: Section 2 discusses relevant work. Section 3 highlights the NAP IVR System. The heuristic evaluation that was performed by an expert is highlighted in Section 4. Section 5 discusses the usability evaluation of the NAP IVR system and Section 6 highlights the heuristic evaluation of the new design of the NAP IVR system. Finally Section 7 discusses conclusions on the work presented in this paper.

2. BACKGROUND

Some work has been done to develop a "voice portal", i.e. a portal connected to an interactive voice response (IVR) system [14]. Some research has been done in using a voice portal for E-service delivery [8, 11] or on creating platforms to enable other people to develop a voice portal [13].

However, not much work has been done where the community contributes information to a portal that contains disability related information. The NAP portal consists of a vast amount of information. Some information that users might find useful is contact details of special needs schools in a specific province, information with regards to disability grants and information and contact details of providers of assistive devices. Possible information that the users will typically contribute to the portal is a new assistive device or an event that is of interest to the disability community. The vast amount of information on the portal leads to all kinds of difficulties with regards to the structuring of the information. This directly influences the menu structure of the portal (many possible categories and subcategories) and therefore the menu structure has to be adapted for the IVR system. Furthermore, since the community contributes information to the portal, simplicity of language or terms that are used in the portal cannot be controlled and guaranteed.

The next section discusses the NAP IVR system that enables users to retrieve information via a telephone.

3. IVR SYSTEM

The National Accessibility Portal is an accessible information sharing portal aimed to promote inclusivity in the South African disability sector [3, 4]. The NAP Portal has been designed and implemented to allow for community based contribution and sharing of relevant information. Typical interaction with, and the presentation of information is done through an accessible web interface [5]. Usability evaluations were performed to test the usability and accessibility of the NAP portal. The results of evaluations (refer to [9] for results of the first evaluation) were used as input for a new and improved interface design.
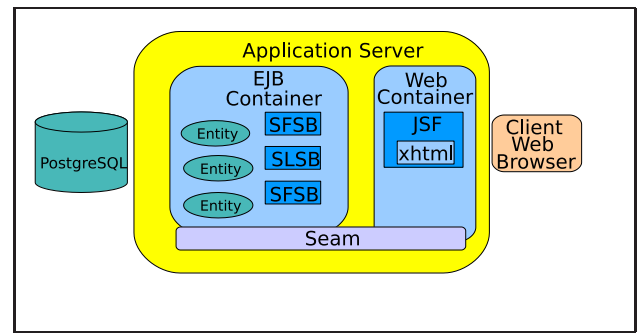

Figure 1: Technology stack

The NAP Portal was developed by the Intelligent Environment for Independent Living (IE4IL) group at the Meraka Insitute, using the technology stack as depicted in Figure 1. The main components are:

- An enterprise application server, which contains a web container and an Enterprise JavaBean container (EJB container).

- PostgreSQL as database. The database does not link into existing databases, but are custom-built.

- The NAP Portal application consisting of EJB 3.0 compliant components: Stateless Session Beans (SLSB), Stateful Session Beans (SFSB), Message-Driven Beans, and EJB 3.0 entities utilising a presentation technology known as JavaServer Faces, combined with a templating framework.

- These elements are glued together with JBoss Seam to constitute the NAP portal.

The telephony interface to the portal was built using an Asterisk [6] telephony platform hosting an instance of MobilED [10]. MobilED is the IVR engine running the various scripts guiding the user's actions. The NAP Portal publishes a web services interface allowing other applications to browse through the different information categories and to retrieve selected information items. MobilED utilises this functionality to retrieve and represent information as voiced text.

The IVR scripts lead the user and retrieve appropriate inputs from the user (through DTMF key presses) resulting in a web services call that retrieves information from the NAP Portal. The retrieved information is then voiced out through the Asterisk platform, along with additional command IVR prompts, thus allowing the user to continue navigating, retrieve other information or end the call.

The next section discusses an heuristic evaluation of the NAP IVR system that was performed by a person with a mobility impairment and limited use of his hands, that works in the accessibility and usability domain.

4. HEURISTIC EVALUATION BY EXPERT ON INITIAL SYSTEM

In this section we discuss the heuristic evaluation that was performed by an expert. He is a person with a mobility impairment (in a wheelchair) and limited use of his hands, and does research in the accessibility and usability domain. The data was collected through a questionnaire or checklist. The heuristic evaluation was not performed on the general ten usability heuristics [12]. The criteria were based on the Voice Interaction Evaluation Checklist [7] and modified accordingly. This was not a full scale heuristic evaluation, since the goal was to identify major issues that had to be corrected before a usability evaluation was done with users.

The criteria can be grouped into the following main categories: navigation; system functionality and user control of the system; language; system feedback; consistency; and error prevention and correction. More detail on the heuristics and the system's rating w.r.t. compliance, can be found in Tables 7 - 12. In all of the tables, the column "Compliance" indicates the rating by the expert.

In Table 7 the issues with regards to navigation are highlighted, and the system doesn't comply with the following criteria: phrases should be followed by the action, e.g. "To go to the main menu, press 4#"; menus are limited to 4 options (excluding the global options); and jargon, technical terms and acronyms that the user does not understand, should not be used. The problems with regards to functionality and control are explained in Table 8, with the main issue being that a user cannot interrupt the system at any time. Language issues are discussed in Table 9, and the system does not always comply to the following: sentences should be short; all words should be pronounced clearly; and assembled phrases should be clear and sound natural. Issues with regards to feedback are highlighted in Table 10, where the system does not always avoid the usage of long sentences, i.e. sentences that take longer than 5 seconds to voice out. Consistency issues are explained in Table 11, with the main problem indicated as the system's inconsistent use of keypad functions. Error prevention and correction problems are highlighted in Table 12 and the main issues under this category are: each prompt is not repeated if no action is taken; and error messages do not always describe the necessary action effectively.

In each of these Tables the column *Identified by Participants* indicates whether the participants also mentioned this issue or problem, while evaluating the system (refer to Section 5 where the participants' feedback is discussed). The column *Fixed in New Design* indicates whether this problem was addressed in the new design of the system (refer to Section 6, which highlights the heuristic evaluation of the new system design).

The following main issues were highlighted by the expert, with suggestions on how to eliminate the problems:

- The opening/welcoming prompt is only played once and the system doesn't inform the user what they can do to replay the available options. This can be a problem, especially since the system is using a synthetic voice and many users will first have to get use to the voice.
  Suggestion: Repeat the message if no selection is made after 5 seconds. If no user action is taken after 3 repetitions, the system should inform the user that the call will be ended and then end the call.

- There is no real consistency for the "repeat", "back" and "go to main menu" options, and these options are read last on the list. This will make it very difficult for the user to learn what to press to be able to do these actions, and the user would have to listen to the whole list of options before s/he knows what to press.
  Suggestion: Use the * ("star") to go back and the 0 ("zero") to go to main menu. Automatically replay the prompts after 5 seconds if no user input is received. If no user action is taken after 3 repetitions, the system should inform the user that the call will be ended and then end the call.

- With the exception of the welcoming prompt and menu, there are too many options per menu. This results in a cognitive overload on the user, making it difficult to remember all of the available options and their corresponding action and therefore the system will be extremely difficult to use.
  Suggestion: The system should say how many options are in the list, list a specific number (e.g. 3 items) and then tell the user to press # ("hash") to listen to the next 3 items in the list (e.g. "Press # to listen to the next 3 assistive devices categories").

- The voice quality may cause problems, since most users will not be use to listening to a synthetic voice.
  Suggestion: If the voice cannot be changed in the short to medium term, the "Press 3# (3 "hash") to hang up" message should be changed to something that is clearer when listening to the synthetic voice, e.g. "Press 3# to end the call". Even though the expert is use to synthetic speech, he still had to listen 3 times before he could understand that the message is "Press 3# to hang up".

The next section discusses the usability evaluation of the initial NAP IVR design by participants.

5. USABILITY EVALUATION ON INITIAL SYSTEM

Usability testing was used for the usability and accessibility evaluation of the NAP Interactive Voice Response (IVR) system. The aim of the evaluation was to assess the usability and accessibility of retrieving information on the NAP portal via the telephone. This will enable people without adequate internet facilities to access information that is available on the NAP portal. During the evaluation the participants had to perform a number of pre-determined tasks that are representative of the typical envisioned usage of the system. The data was collected within a task-based situation through interviews, during which questionnaires were answered by the participants, and observation.

This section describes the results obtained from the usability and accessibility evaluation of the NAP IVR system. It highlights the recruitment process that was followed to get

Table 1: Demographic profile of the participants

Criteria	Participant					
	A	**B**	**C**	**D**	**E**	**F**
Gender	Female	Female	Female	Male	Male	Male
Age	27	29	–	52	41	36
First Language	Tshivenda	Sepedi	Setswana	Isixhosa	Afrikaans or English	English
Disability	None	Mobility impairment (in wheelchair)	None	Visual impairment (wears glasses)	Visual impairment (Blind); Mobility impairment (limited use of hands)	None

participants for the evaluation and discusses the evaluation process that was followed. It provides information about the participants' demographic profile and discusses the results that were obtained from the evaluation.

5.1 Recruitment Process

We sent out a request for volunteers via E-mail to staff of the Meraka Insitute and then contacted the people who volunteered to assist us with the evaluation. When someone was identified as a possible volunteer, we contacted them either via phone or E-mail and asked them specific demographical questions. According to these questions the participants were selected for the evaluation.

The demographic profile of the participants can be seen in Section 5.3.

5.2 Evaluation Process

Before the participant evaluated the system, a briefing or discussion took place. During this discussion the whole process was explained to the participant, as well as the intended use of the results. After the explanation the participant had the option whether to sign the form of consent. Only once the participant gave his/her consent, the evaluation of the system took place.

It is extremely important that a process is followed to ensure ethical practice. Usability testing must adhere to an established moral and professional guideline, since it involves people. We followed guidelines provided by the Human Sciences Research Council (HSRC) [1].

The evaluation of the NAP IVR system was done at the Meraka Institute. The participant's interactions with the system were observed and video-recorded for later analysis. The participants were also asked questions with regards to their experience while using the system.

The tasks that the participants had to complete were finding information about the latest events, a talking thermometer, the Orlando stadium and signing to your child.

5.3 Demographic Profile

The demographic profile of the participants can be seen in Table 1. Half of the participants were male and half female.

[1] http://aspintra.csir.co.za/corporate/docs/CSIR_Good_Research_Guide.pdf

All of the participants have a different first language and the participants' age varied from 27 to 52 years. All participants have a high level of literacy. When we evaluate the next version of the NAP IVR system, we will select participants with varied literacy levels.

5.4 Evaluation Results

In this section we discuss general observations that were made while the participants used the system and the most important issues of concern that were highlighted by the participants.

5.4.1 General Observations

The following general observations were made while the participants used the system:

- Participants searched under events or news for the 2010 World Cup – we observed that the term *recreation* is not commonly understood.

- Recovering from errors were extremely difficult – there is no standard number that the user can press to go back to main menu or previous menu.

- Many times, e.g. when reading a list of events, the system doesn't just give the name of the events – it provides a summary. This is very irritating if the list contains a few elements and will be even worse when the list is long. It should only read the event name and provide the information after selection. Otherwise it takes extremely long before the user can select to go back to the main menu or even to go through the list to be able to make a selection.

- The pace of the voice is not consistent and not effective. At times it is very slow and other times it is too fast and doesn't pause after commas or a full stop (end of sentence).

- The pronunciation of words are sometimes so bad that you cannot understand what is being said. Even in the main menu, you have to listen a few times to understand that one option is to *hang up*.

5.4.2 User Feedback

The participants identified three aspects of the system that should be improved, namely the voice, menu navigation and the provided information.

Table 2: Participants' response to the question: "How do you feel after using the telephony service of the NAP portal?"

Response	Participant					
	A	**B**	**C**	**D**	**E**	**F**
Answer	Very frustrated	Very frustrated	Very frustrated	Somewhat frustrated	Somewhat frustrated	Somewhat frustrated
Reason	"The voice, it doesn't get tired of talking; it doesn't pause for a comma or full stop. Record my voice."	"The voice is not clear, sentences are too long – lose concentration."	"Couldn't use own tricks to use the system."	"The voice is unnatural, menus are too long, have to remember a lot of stuff, very autonomous."	"Struggling to understand the speech, very slow, standard options vary, cannot navigate the text that you are listening to, cannot search for information, speaks too much."	"Could not hear clearly what the information is. Cannot navigate when I want to. Cannot always remember what to press, message is too long – cannot remember the number."

Voice

All participants felt that the voice was unsympathetic, inhuman and unclear. The speed of the voice is also not consistent – at times the voice speaks very slow (e.g. when reading a telephone number) and at other times the voice speaks too fast with no pause after commas and end of sentences.

Menu Navigation

The participants identified the following problems with regards to menu navigation:

- The main menu doesn't provide an option to listen again. This forced participants to hang up and redial in order to listen to the main menu again.

- Many participants had to listen a few times to understand that one option of the main menu is "Hang up". "Recent events" is also not very clear.

- When a list of options are read, only the title should be given and not the title and a summary. This takes a lot of time and leads to high levels of frustration.

- The list of options on many menus are too long. This is time consuming and by the time that the user reaches the end of the list, s/he forgot the options that are available. Many participants then also wanted to go back to the main menu, but by accident selected the wrong number (due to a lack of memory) and then ended up selecting the repeat option. Then they had to listen to the whole list again, unless they could remember the number to go back to the main menu.

- One participant mentioned that it will be good if you can navigate through the items in the list – there should be a key that allows a user to skip to the next item in the list or to skip to a previous item in the list.

- There are no global options to return to the main menu or a previous menu. This forces participants to listen through the whole list of options before they can go back to another menu. This leads to high levels of frustration.

- Too much information is given when reading a list of options . When the system says "Press 2# ("2 hash") to listen to information on ...", the user cannot remember the number that s/he should select any more by the time that the sentence is finished. It is also irritating to keep hearing "Press x# ("x hash") to listen to information on..." in stead of just saying "Select the number according to the information that you want to listen to. Press 1# ("1 hash") for assistive devices, 2# ("2 hash") for recent events", etc.

Information

The system provides too much information when listing the possible options in a menu, e.g. when a list of events are given, only the event should be given and not the name of the event and a summary. Many participants also didn't understand the term *recreation* – this can occur frequently in future with users whose first language is not English.

Tables 2 – 5 highlight snippets of the participants' response to questions that were asked after they used the NAP IVR system:

- Table 2 indicates the participants' response to the following question: "How do you feel after using the telephony service of the NAP portal? " The possible answers are: "Very satisfied, Satisfied, Neither satisfied nor frustrated, Somewhat frustrated and Very frustrated".

- Table 3 highlights the participants' response to the following open question: "What one thing would you want to change about the telephony service?"

- Table 4 indicates the participants' response to the following open question: "What did you like the most about the telephony system?"

- Table 5 presents general comments that the participants made about the system.

Table 3: Participants' response to question: "What one thing would you want to change about the telephony service?"

Response	Participant					
	A	**B**	**C**	**D**	**E**	**F**
Answer	Voice and pace of voice – voice messes up everything	Voice	For certain situations it is good to have a manual to assist people in community centres to help others (complimentary tool)	Synthetic voice	Menu navigation	Possibility to return to menu at any time (global option). Possibility to skip options in a loop.

Table 4: Participants' response to question: "What did you like the most about the telephony system?"

Response	Participant					
	A	**B**	**C**	**D**	**E**	**F**
Answer	"I can access NAP at home when I have no access to Internet."	"Nothing at all."	"Hearing that there is a lot of information – but I cannot hear what information."	"Technology – the fact that you can access information using a telephone."	"The availability of the service."	"That there is much information and it is available."

Table 5: Participants' general comments about the telephone system

Response	Participant					
	A	**B**	**C**	**D**	**E**	**F**
Answer	"Can you access opinion poll/survey/ other services via telephone? If I use the IVR system at home, how do I give feedback? Via voice message or an operator?"	"Summarise the information. Try to get a clearer voice or a lady's voice. Why must you press # after the number and not just the number?"	"It is really a good initiative, but would like to test it on a mobile phone. In rural areas more people use mobile phones than landlines. How will it influence the battery life if you have to go back and forth through various options and menus?"	"I believe that the system will be useful if it is re-designed – I can see its importance if it could work well."	"For a first try it works quite well. A few small things can really improve the usability. There is a big need for the service – many people with disabilities are scared to use a computer. If the synthesizer is so bad for English, which synthesizers are going to be used for the other South African languages? "	"Menu structure should be improved as stated above. The voice should be more human. Improving menu navigation."

The participants' responses are reflected in the issues highlighted in this section. In Tables 7 - 12 (refer to Section 4) the column *Identified by Participants* indicates whether the participants also mentioned the specific issue or problem, while evaluating the system. The issues that were indicated by the expert as not being a problem, but that have been highlighted by participants as being a problem, are indicated in blue. From the participants' responses in these tables the importance of the voice becomes very clear. Many participants were completely put off by the synthetic voice and got really frustrated when they couldn't understand what the voice said.

Table 6: Demographic profile of the participants

Criteria	Participant						
	A	**B**	**C**	**D**	**E**	**F**	**G**
Gender	Male	Male	Female	Female	Female	Female	Female
First Language	Afrikaans	Ndebele	–	English	Afrikaans	Afrikaans	Afrikaans
Disability	None	None	None	None	None	None	None

It is interesting to note that the following issues were highlighted by participants as being a problem, but were not indicated by the expert:

- The system does not provide a clear way to return to the starting point of the menu – even though the option is there to go back to the previous or main menu, the participants got frustrated to listen through the whole list before hearing what number to press to go back.

- The phrases are not as short and concise as possible – the expert evaluated here only the menu options and did not take into account the cases where both the heading and a summary were read when you select a specific topic; the participants got very irritated when there were a list of possible information and every time the heading and summary is read.

- All necessary functionality is available without leaving the system – the participants struggled to understand the voice and couldn't find any possibility on the main menu to repeat the possible options; expert are used to a synthetic voice and therefore didn't require a repeat option at the main menu.

6. EVALUATION OF NEW DESIGN

This section discusses the heuristic evaluation of a new design for the NAP IVR system by participants. The data was collected through a questionnaire or checklist. The heuristic evaluation was not performed on the general ten usability heuristics [12]. The criteria was the same as specified in Section 4, namely based on the Voice Interaction Evaluation Checklist [7] and modified accordingly. The new design was not evaluated by experts, but by participants that represent typical users of the system. This was done to ensure that the feedback that is collected, represent how typical users feel about the system, and not only the viewpoint of a few experts. A small percentage of the particpants do have experience developing IVR systems or experience w.r.t usability and accessibility of systems. However, typical users of the system will not be use to IVR systems, have a low literacy level and English is not typically their first language.

6.1 New Design

A new design was developed for the NAP IVR system by the usability team (part of the IE4IL group), based on the heuristic evaluation by an expert (refer to Section 4) and usability guidelines. This prototype was heuristically evaluated by a number of participants. Recruitment of the participants and the evaluation process took place in the same manner as described in Sections 5.1 and 5.2. The heuristic evaluation is described in more detail below.

6.2 Heuristic Evaluation by Users

This section discusses the heuristic evaluation that was performed by a number of participants. It highlights the demographic profile of the participants and the results that were obtained from the evaluation.

6.2.1 Demographic Profile

The demographic profile of the participants can be seen in Table 6. Two participants were male and five female, and all participants have a high level of literacy. When we evaluate the next version of the NAP IVR system, we will select participants with varied literacy levels.

6.2.2 Evaluation Results

This section discusses the feedback from the participants that heuristically evaluated the new design of the NAP IVR system.

The participants highlighted the following issues that should be addressed:

- Some jargon or acronyms are still used in the system that will not always be understood by a user, e.g. role-players, empowerment, stadia, Rap (Research advisory panel) and SASL (South African Sign Language). When "NAP" is said for the first time, the system should say: "the National Accessibility Portal" and only thereafter use the abbreviation.

- The language is not always simple, clear and easy to understand, e.g. it is not clear what to expect under certain headings e.g. "Communication" and "Disability Related Information".

- In the mock-up of the new design the error messages were not clearly indicated. This makes it difficult to evaluate that functionality of the system.

- There is no indication or reminder of the menu level. This makes it difficult for the user to know his/her location within the system.

- The system does not always provide adequate feedback to the user, e.g. it does not always indicate what has been pressed or what has been selected.

- The system is not descriptive enough with regards to the system's purpose – the introduction message should also state the purpose of the system or there should be a menu option in the main menu to find out more about the system and it's purpose.

- The main menu does not have an option to exit the system. We cannot assume that users will know to hang-up when done.

- It will be very useful to have a keyword search e.g. if a user says a word, the system repeats the word and then searches for that keyword in the portal for relevant information. Without a search it can be very difficult to find specific information, especially information that is at deeper levels of the information structure.

In Tables 7 - 12 (refer to Section 4) the column *Addressed in New Design* indicates whether the issues that were indicated by the expert as a problem (refer to Section 4) were addressed in the new design of the NAP IVR system. The issues that were indicated by the expert as being a problem, but that have not been addressed in the new design, are indicated in red.

It is interesting to note that the following problems were not addressed in the new design:

- Current location is not clearly stated at beginning of each prompt.

- Menu structure is not simple, with no unnecessary levels/steps.

- Most commonly used tasks/functions are listed first.

- Jargon, technical terms and acronyms that user may not understand, are used.

- Language is not simple and clear.

- Error messages were not indicated in the new design.

Taking the above into consideration, more atttention should be given to the menu structure, including a mechanism to indicate where the user currently is within the structure, language and the error messages.

7. CONCLUSION

In this paper we presented how an interactive voice response system can be connected to a portal to enable information retrieval via the telephone. We discussed results from a heuristic evaluation of the IVR system that was performed by an expert and results from a usability evaluation of the IVR system performed by participants. We also highlighted issues that were identified by the participants that were not indicated by the expert as an issue or a problem.

Results from a heuristic evaluation of a new NAP IVR design were presented and issues that were identified by the expert and the participants in the usability evaluation, that are not addressed in the new NAP IVR design, were highlighted.

From the participants' responses in the usability evaluation the importance of the voice became very clear. Many participants were completely put off by the synthetic voice and got really frustrated when they couldn't understand what the voice said. Furthermore, after heuristically evaluating the new design of the NAP IVR system it was highlighted that more atttention should be given to the menu structure, including a mechanism to indicate where the user currently is within the structure, language and the error messages.

The results of the heuristic evaluation by an expert, the usability evaluation of the current IVR system, as well as

the heuristic evaluation of the new design, will be used to develop the next version of the NAP IVR System.

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Table 7: Heuristic evaluation of navigation

Criteria	Compliance			Identified by Participants	Addressed in New Design
	Always	**Sometimes**	**Never**		
Current location clearly stated at beginning of each prompt		X		Yes	**No**
Clear way to return to starting point of main menu	X			**Yes**	Yes
Phrases are as short and concise as possible	X			**Yes**	Yes
Menu structure is simple, with no unnecessary levels/steps		X		Yes	**No**
Corresponds to numbers on telephone keypad, not letters	X			–	–
Phrases function followed by action (e.g. "To go to menu, press...")			X	Yes	Yes
Ascending numerical order with no gaps in numbering	X			–	–
Most commonly used tasks/functions are listed first		X		Yes	**No**
Menus are limited to 4 options (excluding help, repeat, back or end call)			X	Yes	Yes
Jargon, technical terms and acronyms that user may not understand, are used			X	–	No

Table 8: Heuristic evaluation of the system functionality and user control of the system

Criteria	Compliance			Identified by Participants	Addressed in New Design
	Always	**Sometimes**	**Never**		
All functions are clearly defined	X			–	–
All necessary functionality is available without leaving the system	X			**Yes**	Yes
User can interrupt at any time		X		Yes	Yes
System supports user's workflow	X			–	–

Table 9: Heuristic evaluation of language

Criteria	Compliance			Identified by Participants	Addressed in New Design
	Always	**Sometimes**	**Never**		
Language is simple and clear	X			**Yes**	**No**
Sentences are short		X		Yes	Yes
All words are pronounced clearly		X		Yes	–
Alternative options are clearly delineated by pauses	X			–	–
Assembled phrases are clear and sound natural		X		Yes	–
Instructions are clearly identifiable	X			**Yes**	Yes

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Table 10: Heuristic evaluation of system feedback

Criteria	Compliance			Identified by Participants	Addressed in New Design
	Always	**Sometimes**	**Never**		
It is clear what is happening	X			–	–
Appropriate use of pauses to convey structure	X			–	–
Avoidance of long sentences (not longer than approximately. 5 seconds)		X		Yes	Yes
Confirmation of the user's choices	X			–	–

Table 11: Heuristic evaluation of consistency

Criteria	Compliance			Identified by Participants	Addressed in New Design
	Always	**Sometimes**	**Never**		
Only one word or term is used to describe any item	X			–	–
Menu option titles match the items to which they refer to	X			–	–
Each activity/action is phrased in the same manner	X			–	–
Keypad functions are used consistently throughout the system		X		Yes	Yes
Invalid entries and timeouts are handled in the same way at each menu level	X			–	–
Voice quality, including pitch and volume, is consistent throughout the system	X			Yes	–
A single voice is used throughout the system	X			–	

Table 12: Heuristic evaluation of error prevention and correction

Criteria	Compliance			Identified by Participants	Addressed in New Design
	Always	**Sometimes**	**Never**		
Each prompt is automatically repeated at least once if no action is taken			X	Yes	Yes
No-match events provide the user with an informative prompt, e.g. "invalid option", followed by repeating the available options to the user	X			–	–
Error message describe the necessary action effectively		X		Yes	**No**
Error messages are in simple language and easily understandable	X			–	–
Error messages provide a clear exit point with no dead ends	X			–	–