# Preliminary Evaluation of Three Eyes-Free Interfaces for Point-and-Click Computer Games

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## ABSTRACT
This paper presents a preliminary evaluation of the perceived entertainment value and ease of use of three eyes-free interfaces for point-and-click games. Interface 1 (I1) uses a web-like cyclical navigation system to change the focused interactive element. Interface 2 (I2) uses a sonar to help the user locate interactive elements with the mouse. Interface 3 (I3) interprets natural language commands typed in by the player. Results suggest that I2 adds more entertainment value and is appropriate for experienced players. Players find I1 is the easiest to use while I3 seems more adequate for users with little gaming experience.

## Categories and Subject Descriptors
H.5.2 [**Information Interfaces and Presentation**]: User Interfaces – *auditory (non-speech) feedback, graphical user interfaces (GUI), natural language, screen design*;

## General Terms
Design, Ergonomics, Human Factors.

## Keywords
Accessibility, audio 3D, eyes-free games.

## 1. INTRODUCTION
The use of computer and videogames is rising quickly, not only for leisure but also for serious purposes such as advertising, education or health. As a side effect, the demographics of people who play games are increasingly more heterogeneous in gender, age and gaming habits (e.g. casual gamers vs. hardcore gamers).

However, videogames can pose significant accessibility barriers for people with disabilities. As their importance grows, so does it their potential for becoming a source of digital divide. Although research on accessibility in games has grown in recent years [3, 4], how to design universally accessible games remains an unanswered question. Therefore, it is necessary to investigate new interfaces that improve the accessibility of games taking also into account the current diversity of gamers, as not all the interfaces are appropriate for all sorts of players.

The purpose of this study is to investigate accessible interfaces that deliver the best game experience to screen reader (i.e. blind) users with different gaming habits.

This study is part of a more ambitious project aiming to integrate these interfaces into the eAdventure game authoring tool [1]. This would help to increase the accessibility of games produced with eAdventure by cutting down development costs as developers could reuse accessible interfaces more easily. The focus in on point-and-click adventure games, although the studied interfaces and their results may be repurposed to suit other genres.

## 2. INTERFACES DEVELOPED
The three interfaces here presented use sound to convey information, combining text-to-speech with sound effects. However, each interface supports user input in a different way.

### 2.1 Cyclical navigation system (Interface 1)
With this interface, the interaction is similar to browsing the web using a screen reader. Available interactions in the scene are structured in a two-level focus cycle that can be navigated with left and right arrow keys. The first level contains the interactive elements on the scene (characters, objects, exits, etc.). The second level contains actions related to each element (e.g. talk to, grab, etc). To access the second level, the user hits the action key. To return to the first level, the user hits the cancel key. The specific keys for action and cancel can be customized.

### 2.2 Sonar (Interface 2)
The purpose of this interface is to guide the player in finding interactive elements with the mouse, instead of using the keyboard. Thus users can explore the game scenario independently and at their own pace without using vision. The scene can be examined through a 3D positional audio system. In this system, each interactive element is configured to emit a different sound [2]. Altering the intensity and pitch of the sound provides information about the position of the interactive element relative to the mouse cursor. The intensity of the sound increases inversely to the distance from the mouse cursor to the element. Pitch is used to provide information about the vertical position of the mouse pointer (high pitch denotes that it is near an element, while low pitch denotes that it is far from it).

### 2.3 Natural language commands (Interface 3)
With this interface interaction is articulated through short natural language commands that the user types. After the command is introduced, the system tries to interpret it and match it to one of the available interactions in the scene, using a regular grammar that defines the structure of supported commands and a thesaurus of synonymous based in a previous work [1]. The user receives


*ASSETS'12*, October 22–24, 2012, Boulder, Colorado, USA.
ACM 978-1-4503-1321-6/12/10.

audio feedback about the results of this matching and if it has succeeded, the interaction is triggered.

In contrast to interface 1, in this case the interactions available are not directly revealed to the user, but instead the player has to find them out by test-and-error of different commands. Nonetheless, the user can use some basic commands that are always available to get a textual description of the scene.

# 3. PRELIMINARY EVALUATION

## 3.1 Method and Settings

The three interfaces were evaluated by two screen reader (i.e. blind) users. They were asked to play three short games that were set up each with one of the interfaces. The users had different gaming habits: while user 1 was a casual gamer with little gaming experience, user 2 played games frequently.

The users completed the evaluation in independent sessions of 60 minutes, where two observers were present at all times. They were exposed to each game for about 10 min. After that, they rated two aspects of the interfaces using a 1-7 Likert scale:

a) Ease of use, defined as the ability of the interface to allow players to explore the game scenes, find interactive elements and trigger desired interactions with minimum effort.

b) Entertainment potential, defined as the ability of the interface to make the game interesting and appealing for the user.

Finally, they were asked to discuss with the observers which was the best overall interface for games in their opinion.

## 3.2 Games used

The games used had a similar design, with similar number of scenes (around 4), game mechanics and interactive elements (7-10), but a different story.

In each game the player was set out to solve a crime by inspecting the crime scene and surrounding areas while finding and collecting evidence. After interacting with elements in the scene new clues were unveiled. Some of them were deliberately designed to mislead the player, making the crime more difficult to solve to keep the player interested.

Each game started with a short explanation of the situation and basic instructions about the interaction and the interface.

## 3.3 Results and Discussion

### *3.3.1 Ease of Use*

Both users reported interface 1 (cyclical navigation system) as the "easiest" to use (see Table 1).

**Table 1. User rates for the ease of use of each interface**

| | User 1 | User 2 |
|---|---|---|
| Game 1 (cyclical navigation) | 7 | 7 |
| Game 2 (Sonar) | 5 | 6 |
| Game 3 (Natural language commands) | 3 | 5 |

This data is backed up by the analysis of the game completion times (Table 2), as game 1 took less time for both users regardless of their gaming habits.

These results reflect the fact that interface 1 is more familiar for screen reader users and all interactions can be reached within a minimum number of keystrokes.

**Table 2. Completion times for each game and user**

| | User 1 | User 2 |
|---|---|---|
| Game 1 (cyclical navigation) | 4.30 min | 3 min |
| Game 2 (Sonar) | 11 min | 8 min |
| Game 3 (Natural language commands) | 7 min | 6 min |

### *3.3.2 Entertainment*

Both users agreed in rating interface 2 (sonar) as the most fun (Table 3). Looking at the completion times, it is probably the most challenging - it took both users more than twice as much time to complete game 2 compared to game 1. The increased challenge can make the experience more engaging.

**Table 3. User rates for the entertainment value**

| | User 1 | User 2 |
|---|---|---|
| Game 1 (cyclical navigation) | 3 | 6 |
| Game 2 (Sonar) | 6 | 7 |
| Game 3 (Natural language commands) | 4 | 6 |

### *3.3.3 Overall evaluation*

Users disagreed on which interface provides the best overall experience. User 1, considered as "non gaming expert", preferred interface 3 (commands), while the "gaming expert" user preferred interface 2 (sonar). User 1 commented that interface 3 (natural language commands) was probably more adequate because it is more interactive and fun than interface 1 (web-like navigation) but easier to use than interface 2 (sonar). User 2 leaned towards interface 2 because it provided more challenge than any of the others. This suggests that users appreciated the potential of interface 2 (sonar) for games, but it may be appropriate only for experienced gamers seeking new experiences.

# 4. CONCLUSIONS AND FUTURE WORK

The results of the evaluation conducted are promising, but the small number of users (2) prevents extracting final conclusions. In the future it is necessary to conduct research with a higher number of screen reader users and with higher exposure times to the games.

# 5. ACKNOWLEDGMENTS

The Spanish Ministry of Science (TIN2010-21735-C02-02), the European Commission (519332-LLP-1-2011-1-PT-KA3-KA3NW, 519023-LLP-1-2011-1-UK-KA3-KA3MP, FP7-ICT-2009-5-258169), the Complutense University (GR35/10-A-921340) and the Regional Government of Madrid (eMadrid Network - S2009/TIC-1650) have partially supported this work.

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