Reusable Game Interfaces for People with Disabilities

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ABSTRACT

Computer games are a very popular media today, spanning across multiple aspects of life, not only leisure but also health or education. But despite their importance their current level of accessibility is still low. One of the causes is that accessibility has an additional cost and effort for developers that is in many cases unaffordable. As a way to facilitate developers' job, this work proposes the creation of specialized tools to deal with accessibility. The hypothesis defined was that it was possible to produce tools that could reduce the input needed to adapt the games for people with special needs but achieving a good level of usability, resulting in a reduction of the cost and effort required. As game development tools and approaches are heterogeneous and diverse, two case studies were set up targeting two different platforms: a high level PC game authoring tool, and a low-level Android game programming framework. Several games were developed using the tools developed, and their usability was tested. Initial results depict that high usability levels can be achieved with a minimum additional input from the game author.

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*;

Keywords

Accessibility, audio 3D, eyes-free games.

1. BACKGROUND AND MOTIVATION

Computer and video games have became a very popular kind of media, being part of modern culture. Besides, current uses of games have escaped the boundaries of leisure, as they are being applied to improve education [4], for advertising or health [1].

But games can be a significant source of digital divide, as their current level of accessibility is low, with a small number of titles coping with the needs of people with disabilities [6, 7]. The improvement of accessibility in games should be a priority to prevent the exclusion of a broad sector of our population from the ever-growing number of activities related to digital games.

The poor level of accessibility is not motivated by a single cause. Nevertheless, one of the most important is that improving game accessibility has a cost for developers, not only in economic investment but also in time and effort. From a technical perspective, accessibility increases the development time as new modules have to be created, such as in-game screen readers or speech input processing units. Moreover, from a design perspective accessibility demands dealing with alternative interaction paradigms or adapting parts of the content. Game developers live under great pressure as they are immersed in a highly competitive and risky industry where the production of each title requires huge investments. From this perspective, accessibility is unlikely to get to the top on their priority list.

Hence one of the approaches to improve the accessibility of games is to make dealing with accessibility easier for developers. If the cost of introducing accessibility is low in economic terms, but especially in effort and time needed, the chances of accessibility would raise substantially.

Tools to support developers should be created, not to be distributed as independent products, but integrated into the development environments developers use every day (e.g. Unity or Eclipse). Thus impact achieved would be maximum.

Ideally, tools provided for developers should automate design and implementation tasks related to accessibility. For example, having alternative interaction modules that can be configured for players with different abilities and integrated into the games with minimum effort would be a valuable asset for developers.

But to get to that point it is necessary to reach a higher level of abstraction and generalization of current game accessibility design guidelines [3, 7]. A growing body of research is exploring how to make games more accessible [6], but solutions proposed are usually focused on particular examples and they do not scale easily to fit other titles. It is necessary to conduct research that, building upon recent breakthroughs and successful stories on game accessibility, comes up with accessible interfaces that are general enough to be reused for different games but specific enough to be implemented into mainstream game creation tools.

An additional challenge comes from the diversity of environments and tools used by game developers, such as high-level authoring tools for creating levels or scenarios, where visual interfaces predominate, or low-level programming environments and libraries where code is the key. For example, tools like Unity or Eclipse can be used for game development, but they have very different characteristics.

The goal of the work presented was to investigate accessible interfaces that could be integrated into game development tools of different kind. First, several configurable interfaces were developed for a serious games authoring tool with a very high level of abstraction. Second, a low level programming library was developed for accessible mobile games.

2. HIGH-LEVEL APPROACH: A SERIOUS GAMES AUTHORING TOOL

The first approach was centered on the eAdventure game authoring tool [5, 8]. This tool is oriented to educators so they can create their own educational games. The tool interface is simple, with a high level of abstraction as programming is completely hidden from the end user. The strategy used in eAdventure to

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reduce the complexity of the tool is to narrow the type of games that can be produced to a limited number of genres. As opposed to more complex tools, like Unity, which allows development of a wide range of games, eAdventure allows development of only 2D, single player, adventure games.

Besides, many aspects of the games are preconfigured, although the user can perform some tweaks. This is the case of the interaction. By default, interaction is point-and-click, and these are the controls used:

- Mouse movements to explore the scene. When an interactive element is found, visual feedback is provided (the mouse pointer changes and a brief text is displayed).
- Mouse left button clicks: trigger interactions with some elements or makes the player's character move to the given location.
- Mouse right button clicks over interactive elements: display a contextual menu with available actions, if more than one.

Three alternative interaction modules that overrode the default point-and-click interaction were developed for eAdventure. These modules targeted three profiles of players: 1) screen reader users (i.e. blind), 2) players with limited vision that use high contrast settings, and 3) players with motor impairments in hands that use voice recognition software. Configuration of the interfaces produced was straightforward as game authors only needed to introduce a few parameters and some additional content as alternative descriptions. The eAdventure accessibility module, using these settings, was able to generate the interfaces required automatically for the game being produced.

These interfaces were evaluated by creating a serious game: "My first day at work". The goal of the game was to facilitate access to the labour market for people with disabilities. The game and its accessible interfaces were evaluated by 15 people with different motor, visual, and cognitive disabilities. In this study two parameters were analyzed for each of the interfaces: usability and enjoyment. Participants played the game for an hour and the sessions were video recorded for post analysis. The videos are currently being examined to complete the study. However, through a preliminary analysis two main findings can be outlined. First, most of the participants were able to complete the game without additional support from researchers, which is an indicator of high usability levels. Second, it seems that enjoyment experienced by participants vary depending on their gaming habits and experience, as participants who played digital games more frequently found the interfaces less appealing.

This suggested that the game experience was different for users with a similar disability but different experience with digital games. Nonetheless, it is unclear if this issue is caused by the interfaces used or by other factors, such as the game story or mechanics. To further explore this aspect, a second case study was conducted. This study targeted profiles of players sharing a common disability but with different gaming experience. The disability profile selected was screen reader users. Three interfaces were developed. The first one allowed interaction through short text commands. The second interface was similar to Web interaction, allowing users to browse through the elements and GUI controls with the arrow keys and use an action key (e.g. Enter) to trigger interactions. The last interface was the most innovative, being a 3D sonar that helped users in locating the elements with the mouse. These interfaces were evaluated by a limited number of users. Initial results seem to confirm the initial hypothesis, as users with higher gaming experience preferred the most challenging interface (the sonar) while novice users preferred the text commands interface.

The main limitation of all the interfaces developed for eAdventure is that they were designed for a specific type of game and could only be used within the eAdventure platform. A similar approach could be applied to other tools, whereas it is inapplicable to games where interaction is a key part of the game experience.

3. LOW-LEVEL APPROACH: ANDROID FRAMEWORK FOR ACCESSIBLE GAMES

As a second approach, a framework was developed to facilitate development of 2D accessible games for screen reader users in mobile devices. Android was chosen as application platform, as at the time of the start of the project it was a less accessible platform than its competitor, iOS. The outcome was a number of libraries and classes that could be integrated into Android game development projects. This framework is available for download from its Google Code repository [2].

Using this framework, four accessible games were produced. Three of them are available at Google Play. Currently the usability and accessibility of the games is being evaluated with end-users.

Compared to approach 1, this solution allows for developing games of different types, as adopting a low level strategy adds flexibility and scalability. While in approach 1 only point-and-click adventure games could be created, with this approach a minesweeper, a point-and-shoot game, a snake-like game and an interactive fiction game were developed. Besides, this approach is less platform dependent, as it could be reused in any Android project while interfaces developed in approach 1 could only be used within the eAdventure authoring tool. However, the cost of producing games in approach 2 was higher as the setup of the interfaces required coding, which is a significant drawback.

4. REFERENCES

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