HCI/GUI Design Applied for Adaptable Context-Aware Mobile Game

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ABSTRACT

This paper is about the design aspects applied to the *StreetDroids* Project, a context-aware mobile game developed for the Android Platform. It was the result of a one year project (2009/2010) combined between the applied science universities: Hochschule Bremen and Hochshcule Bremerhaven; immersed in the Digital Media Master Program[1], in Bremen, Germany.

The *StreetDroids* is an open mobile game where the users/players can contribute to its expansion by an available web-editor, being able also to apply the created missions on different games scenarios, taking place in the real environment, following the concept of pervasive gaming or real world mission games.

In this research paper it is discussed some aspects related to the design of the user interface of the game, and the found solutions for designing for small screen, which can be applied for future cases.

Author Keywords

Mobile entertainment, storytelling and location based gaming; context-aware app; design; mobile art.

ACM Classification Keywords

D.2.2 [Design Tools and Techniques]: User Interfaces.

I.2.1 [Applications and Expert Systems]: Games.

General Terms

Design.

INTRODUCTION

Recent advances in computer hardware have culminated in the so-called mobile smartphones. Such devices are nowadays an essential aspect of everyday-life for most of the world's population, with applications that range from simple communication applications like *texting* to highly specialized professional support, such as in the health care domain. In the *Streetdroids* project the ever-expanding use of mobile smart phones gaming industry was explored. The result was the development of a context-aware mobile game for the Android platform.

The *StreetDroids*' game follows the concept of a "Treasure Hunter" game, with missions, maps and puzzles (items). Every mission has its own personalized map, and a map has several puzzles to be solved interacting with the real environment. Once solved one puzzle, a collectable item is received, open the way for the next one. The navigation also counts with an interactive map and compass.

But the differential about the original treasure hunter concept is the contribution aspect, making it also an open game where the users/players could contribute to its expansion by a web-editor[2], where the users are able to create their own missions, taking place in the real environment, following the concept of pervasive gaming or real world mission games. The user just needs to register on the web-editor, and start to create their own map and avatars, uploading pictures, information and modeling the available puzzles.

In this research paper it is discussed the aspects related to the design of the user interface for the game, and the challenges for designing on small screen of mobile devices. The found solutions can be used as a guideline for aesthetics design development, where the concepts of HCI/GUI were taken in consideration.

1 - DESIGN CONSIDERATIONS FOR SMALL SCREENS

The interactive features present on smart phones, such as the touch interfaces found in increasingly affordable devices, give developers the opportunity to explore vast new possibilities. By using new technologies and devices (like the T-Mobile G1 Android[3]), new features are being developed, like context and location-awareness – one of the *StreetDroids* characteristics - which can be used to make

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[1]   http://www.digitale-medien-bremen.de/en/study/master/master-program.html

[2]   Used to be available at http://www.StreetDroids.com/ [Accessed: 02-17-2011]. Nowadays, this URL is not available.

[3]   The T-Mobile G1 was the chosen Android mobile device for the *StreetDroids*' Project.[13]

games that are more connected to the real world and to the community around the user. [6]

The used approach to develop the design interface was based on "*design, usability and interaction are recognized as the core issues in HCI*" [4]. Furthermore, to work on small mobile screens is a challenging task. In order to enhance the interaction, studies on HCI and GUI were considered at the development process. For instance, the elements of the initial screen followed one of the principles of GUI design. According to Galitz [3], "*the array of alternatives available to the user is what is presented on the screen or what may be retrieved through what is presented on the screen - nothing less, nothing more*". From this principle, only what the user needs to know about the application and the available options should be presented on the screen, affecting how the design is developed.

Ronchi [10] pointed that a well-developed interaction design could serve as bridge to fill the gap between man and machine, enhancing the interaction between them. However, there are no easy rules to define which solution is the best when displaying content on the screen. Attention must be paid to aspects like intuitive usability, easy navigation, clear information, nice layout, harmonious colors and internationalization, also respecting the values of HCI/GUI in a well-developed perspective. That is the base of the design concepts for the *StreetDroids*' project.

StreetDroids was developed for Google's Android platform and, as mentioned, targets devices with 480x320 pixels screens. One of the features of the platform is the possibility of using the screen in a vertical or horizontal position. Some applications developed for Android can be used in both positions, which demands a flexible and adaptive design. That represents a change in the design paradigm since it is no longer possible to design for a single static position and view. It also makes it harder to predict patterns of user behavior because all the content might change according to the device's position. Taking this design challenge into consideration and looking for a solution that can clarify the structure of the game, the project fixed the vertical position for the game format. That choice considered also the most common position for handling a mobile phone.

It was necessary to keep in mind that the design for mobile requires special attention about the use and optimization for the small space available, where the choice of the displayed information is crucial for the navigation and performance. "*Designing for a mobile application is really quite a bit different than for desktop software. Limitations of the device itself, including screen real estate and user input methods, force us to make different choices*." [7]

Another issue around screen usability is the visualization of elements and possibilities of navigation, where a minimum height and width should be considered. The displayed elements cannot be too small, considering that some users may have visual deficiencies. Also, the projected game has an outdoors context, which means that the lightness of the environment may interfere with the visualization as well. "*For small-screen interfaces, human factors designers face the challenge of displaying all the information they want to present, while making sure that what they present is not too small to be seen by the user.*" [6]

These considerations were crucial for the design development of the mobile game. It is clear that the game could not be developed only by taking concepts of design of desktop applications and shrinking to a 320 x 480 pixels screen. It was sought to treat the mobile screen as an independent media, respecting its size limitations and exploring every pixel available in a user-friendly way.

The touch-screen feature is another factor that should be considered for screen design optimization, where the player uses fingers instead of a mouse or joystick. Fingers are less accurate and demand a larger area if compared to a pointer mouse. [15]

1.1 - Design Concept for the Game

Albert Einstein once suggested to "*make everything as simple as possible, but not simpler*" [Einstein apud 6]. Evidently he was not referring to design for mobile screens, but this axiom can be perfectly applied for it. An intuitive and attractive user interface is usually a familiar user interface. [14]


Figure 1: Initial screen with the main menu and logo.

Taking into consideration the aesthetics and functional aspects, the game starts with an iconographic main menu, where the user can access the main features and information about the game, such as Play Game, Language, Quit, Settings, Info/About and Help. The Figure 1 shows a screen-shot of the main menu, where the icons are followed by the message: "*Please select one of the buttons*". The

logo of the game appears on top and disappears on the other screens when it is not needed, opening space for other elements.

Some research on the appropriate symbols to use for the icons was made, in order to get the proper metaphor for each action, maintaining the visual consistency for each icon group. The idea was to use the most well-known concept for those actions and metaphors, allowing a meaningful interpretation even in a multicultural environment. Also, the research went further and also it was considered the way in which players interact and navigate with the game using their fingers on the touch-screen: *"User interface designs for touch screens must carefully consider the size of and spacing between touch-activated buttons and icons so that the user's inputs will be accurate. (…) People performed best when it was equal to or bigger than 40*40 pixels."* [11]

This rule about the size of buttons was observed. The navigation menu in the bottom of the screen was directly influenced for this touch-screen factor, where the available buttons followed the minimum height of 46 pixels, with width changing from 99 to 56 pixels, according to the game scenario, as shown at Figure 2.
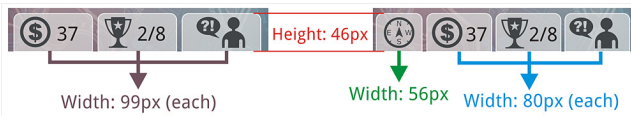
Figure 2: Bottom Menus used on Game, during a Puzzle and Map, respectively.

1.2 – Game Interface
Optimization of space, simplicity, metaphorical icons and symbols, and direct navigation were the key elements that guided the development of the game interface. *"A metaphor provides an analogy to concepts already familiar to the user, from which the user can deduce the system's use and behavior"* [5]

The metaphorical elements were not exclusive for the navigation buttons, but also applied to the entire interface, including background, Non-Player-Character (NPC) and action feedback during the game. One example is how the NPC "talks" to the player using the metaphor of comics' bubbles (balloons), as shown in Figure 3.

More than just offering functionality, it is necessary to coordinate the graphic elements in order to provide a compatible and comprehensive visual rhetoric. In this way, the use of familiar elements helps to enhance the comprehension of the situation by the player. In this example, it is clear that the text displayed on comics' bubbles mean that the NPC is talking directly to the player.

Scrollbars were avoided in the developed design. In some situations, however, they proved necessary, being

introduced with a "fade out" effect. *"To create a better mobile experience, follow these guidelines: - Simplify everything. Use clear, short, simple words for links, buttons, and menus"* [2]. It is important to point that one of the fundamental ideas of space optimization is that all required information should be displayed at the screen whenever possible.

Figure 3: NPC offering help to the user, for solving a puzzle during the game adventure.

1.3 - Navigation Design and Immediate Feedback
The use of icons and visual feedback can support the player to become aware of actions and follow consequences. *"You can improve the flow of your application by helping your user more quickly ascertain the meaning of your controls"* [7]. One way to enhance the controlling aspect is using immediate feedback on the navigation. This feedback can be done by image, text and symbols, as shown in Figure 3 and 4.
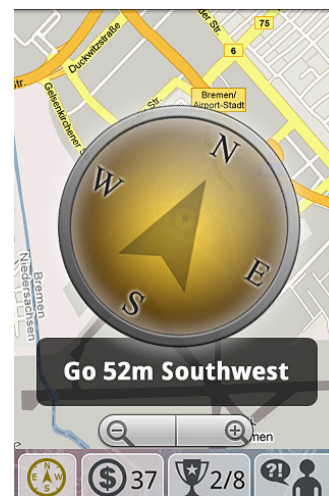
Figures 4: map during the navigation toward the next puzzle, and accessing the compass (with feedback)

CONCLUSION

Planning a good interface design for mobile screen is not just a matter of providing colorful buttons and fancy graphics. For a game development, *"a well-designed product based on a team effort with a simple, user-friendly interface developed within a reasonable time frame will be successful"* [8]. That was one of the guidelines used to support the learning process during the *StreetDroids* design development. It was not a "trial and error" process, as commonly can be observed in game development. Each aspect was deeply analyzed based on the theoretical frameworks and translated for each specific case.

In that context, *ergonomics*, and *internationalization* are important keys for the design development in this project. The use of icons and symbols is one of the research areas whose results were reflected in the solutions for the user interface. In a "visual era", as the world is now experimenting, GUI allied with HCI are more than just important fields of research. They can define the success or the failure of a project. If the final product does not hold the users' attention, you will lose them.

To conclude the design overview, a general evaluation of the product showed that the design aspects of *StreetDroids* received a positive approval by the consulted users. This indicates that the used approach to design development resulted in an attractive product. It is possible to believe that this is a reflection of two main aspects of the used approach, the choices made in consonant with theoretical foundations and the observation of a meaningful, coherent and well implemented aesthetic language.

An important issue regarding future work on the design interface is the adaptation for different screen resolutions. The Android platform is available for devices with several different screen resolutions [12], with different aspect ratios. It is not enough to simply scale the game to different resolutions, it is needed to adapt for different space proportions.

If the game is to be used by several kinds of users, it is important to consider the age factor. Discount-age applications have been developed [1], together with some criteria for the product interface design, such as simple and minimalist start menu and large icons and fonts. [9]

Another issue for future implementations is the translation of the game, towards the internalization of the *StreetDroids*. To this end, it is necessary to use only simple instances of English text, whenever possible. *"Simple English text will be easier and less expensive to translate"* [3]. As a recommendation, German should be the first European choice (after English) [idem] and, in this context, *StreetDroids* was placed in a positive environment.

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