Accessibility of Mobile Card Games

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Abstract. The article describes a study aimed at developing an interaction template for mobile card games for visually impaired gamers. First, accessibility features of existing mobile card games were analyzed. Then various types of actions in common card games were studied and classified to proper categories. Next a simplified layout was proposed in a simplified form of single card view. The interaction mode also was limited to six simple gestures. This approach was used in the sample game. Finally, the new approach was evaluated obtaining satisfactory results.

Keywords: Game accessibility · Mobile games · Card games · Visually impaired

1 Introduction

The mobile games markets currently include many items, and their number is still growing. One type of them is mobile games, which become popular because of their ease of being able to be played anywhere and anytime [10]. However, there are still not many mobile games developed for players with special needs, such as people with visual impairment. The accessibility that focuses on the ease access to all game contents should be one of the mandatory elements in every mobile game. Awareness of game developers about the need of game accessibility is still growing, and appropriate guides are being created. However, they are often too general and difficult to fit into the appropriate category of games.

This study focused on a gesture template suitable for interaction in mobile card games. As a result, when the visually impaired gamer launches any mobile card game first time, most gestures should be intuitive for him.

2 Background

Accessibility in games is defined as the ability to play a game despite limiting conditions, which can be temporary functional limitations or permanent disabilities – such as blindness, deafness or reduced mobility [15]. The accessibility

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development of mobile game is more difficult than in the case of regular computer applications [2]. Most computer games are not developed to be played by people with special needs [13], because they cannot access input sensors and graphical user interface in sufficient way [5].

A very important issue is the integration of assistive technology in the guidelines [14]. In the area of game accessibility very important role plays the Independent Game Developers Association (IGDA). IGDA includes the Special Interest Group on Game Accessibility with a passion for game accessibility. IGDA-GASIG recommends several guidelines that can be used as a reference for developing the accessibility of computer games [3]. Although, the recommendation is proposed for applications used by gamers with different kinds of impairment, in some cases, the guidelines cannot be applied properly [17]. Players who are blind often meet an incompatibility of screen readers and games when want to get access to information about elements of interaction. Even players with low vision need options for increasing the size or contrast of game elements [12,16].

Anticipating that awareness of the existence of players with special needs will be growing among mobile game developers, the set of design rules should be increased so that emerging applications meet specific accessibility expectations. Some guides present recommendations and accessibility guidelines focused specifically on the assessment and support for the development of accessible digital games. Other guidelines are dedicated to audio game developers, where attention is especially paid to the audio feedback interface [4,9]. Another research focuses on structuralization and organization of the main guidelines of accessibility for audio games in mobile platforms [1]. The development of alternative design can be conducted by using participatory design approach [11]. This approach is considered to be able to create interaction design which is appropriate with the participants wish [11]. However, this is not the best way to create general, universal accessibility templates. Some solutions show that it is enough to develop a good interaction engine and the game data can be taken from external files, as in the case of mobile gamebooks [8]. At present we can develop multimodal interfaces. The research [7] compared the effectiveness of using various control interfaces. This study presented that the best result obtained by gestures means that the implementation of other not so commonly used methods of interaction for mobile games may not be useful.

3 Methodology

The methodology followed in this study consisted of four phases: review of existed mobile card games, comparison of actions in card games, proposal of game layout and gesture-action pairing, and evaluation of the prototype accessible card game. The starting point of the work was the search and studying of papers concerning mobile game accessibility. This study also includes the investigation of the main accessibility guidelines for mobile games. Looking for fully accessible mobile card games in the most popular gaming stores, nothing was found. Therefore, it was decided to analyze the existing games for any elements of accessibility.
The research next stage consisted of card games analysis for types of actions. Then after the consultation of the individual who was visually impaired, the template of gesture-action pairing and gesture-action mode were proposed. In the last part of the study, we verified accessible card game implemented using proposed template of the interaction.

4 Review of Mobile Card Games

Mobile card games are quite a popular and large group of games available in the Google Play store. It would be impossible to test all of them. Therefore, the 15 most popular were selected for analysis: Kuku (G1), Macau (G2), Pig (G3), Oczko (G4), Bishop’s buttocks (G5), Pan (G6), Kemps (G7), Bluff (G8), War (G9), Thousand Schnapsen (G10), Durak (G11), Rummy (G12), Poker (G13), Blackjack (G14), Sixty-Six (G15). Next among them, two implementations of each type with the highest rating and number of downloads. Various aspects of accessibility were assessed for them. Solitaires were excluded for the analysis, because each of them requires placing a card on the table in a strictly defined place and quite complex operations related to changing their location during the game.

Table 1 summarizes all analyzed games and accessibility features. An ‘X’ has been placed next to each feature fulfilled. Analyzing the data contained in the table, it was found that most games do not meet even half of the verified attributes of availability. Some of them (G1, G3, G6, G15) do not have any features that facilitate playing for the disabled. The biggest surprise may be caused by the fact that the TalkBack - a screen reader dedicated by Google for the disabled, was not supported by any of the games. The most common facilities found in the tested games are: hints, audio messages and access to the rules of the game or tutorial.

Table 1. Accessibility features in mobile card games

| Feature                  | G1 | G2 | G3 | G4 | G5 | G6 | G7 | G8 | G9 | G10 | G11 | G12 | G13 | G14 | G15 |
|--------------------------|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|
| A. Custom. control       |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |
| B. Hints                 |    |    |    |    |    |    |    |    | x  |     |     |     |     |     |     |
| C. No small cards        |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |
| D. No small fonts        |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |
| E. Configurable colors   |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |
| F. Help/tutorial         |    | x  |    |    | x  |    |    |    |    |     |     |     |     |     |     |
| G. Voice messages        |    |    |    |    |    |    |    |    |    |     |     |     | x   |     |     |
| H. Audio messages        |    | x  |    |    |    |    |    |    |    |     |     |     | x   |     |     |
| I. Vibrations            |    | x  |    |    |    |    |    |    |    |     |     |     |     |     |     |
| J. Conf. diffic. level   |    |    |    |    |    |    |    |    |    |     |     |     |     | x   |     |

Development of the accessibility features is not a hard task. Features B, C, D, G, I, J are easy to implement and require only adequate awareness of the
developers about accessibility to be considered. Voice messages can be handled by Text-To-Speech mechanism if the application architecture does not support the TalkBack screen reader. Features E and F are related to the way of displaying cards on the hand and require a change of approach to the user’s interface and presenting the cards in a different form. Configurable game control (A) can be accomplished by using an intuitive control template that will be universal for all mobile card games.

5 Towards the Universal Layout and the Interaction Template

5.1 Game Layout

When developing the graphical interface, the game designer also determines how the control will take place. Usually, control in mobile games is done by precisely indicating the appropriate elements of the graphic interface, e.g. cards, on a touch screen of the device.

To eliminate this problem, the principle of displaying only one face card at the same time can be applied on the screen. Single Card View (SCV) is a great convenience for the visually impaired, especially - low vision people. Thus, all the actions that a player could make at a given moment would relate either to that particular card or to the entire game in general. This solution does not impose on the user a specific way to use the smartphone (horizontally or vertically). The consequence of this method of displaying is the need to reserve proper gestures for viewing cards on a hand. Left and right swipes can be selected, or alternatively, swipe only in one direction.

5.2 Card Game Analysis

The same set of games was analyzed in terms of actions performed: get a card, discard a card, returning a card to the opponent, etc. Each of them was played five times recording the type of performed actions. The summary is presented in the Table 2. All of identified actions can be simplified to Take and Discard type, or use both. The Other row covers information about additional actions related to special game rules.

|       | G1  | G2  | G3  | G4  | G5  | G6  | G7  | G8  | G9  | G10 | G11 | G12 | G13 | G14 | G15 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Take  | –   | 36% | 55% | 90% | –   | 22% | –   | 33% | –   | 38% | 41% | –   | 63% | 44% |     |
| Discard| –   | 60% | 45% | 90% | 78% | 90% | 67% | 75% | 55% | 20% | –   | –   | 55% |     |     |
| Transfer| 75% | –   | –   | –   | –   | 96% | –   | 4%  | –   | –   | –   | –   | –   | –   |     |
| Return | –   | –   | –   | –   | –   | –   | –   | –   | –   | –   | 39% | –   | –   | –   |     |
| Exchange| –   | –   | –   | –   | –   | –   | –   | –   | –   | –   | –   | –   | 27% | –   |     |
| Other  | 25% | 4%  | 10% | 50% | 4%  | 10% | 21% | 7%  | –   | 63% | 37% | 1%  |     |     |   |
The frequency of actions is important when designing the accessible game interface. It determines which moves should be assigned to easy-to-use keys, gestures, etc. After analysis, it was found that most card games have only a few actions. It is good information in the context of design the accessible mobile card games. In this case, the limited number of simple gestures available on the touchscreen will not be a barrier to the implementation of a new way of interaction.

5.3 Gesture-Action Pairing

Many mobile games use screen buttons. Unfortunately, blind gamers often cannot properly hold the device to be able to play the game by using that kind of interaction [6]. Thus, when designing a new interaction template, the following principles of associating gestures with actions were adopted: the set of gestures should be limited, most frequently actions should be associated with the simplest gestures performed anywhere on the screen. Other actions should be accessed in a special Question-Answer mode (QA mode). Hence, proposed interaction template uses only six gestures as follows:

- *swipe left* and *swipe right* navigate between cards on a hand,
- *swipe up* discards the current card,
- *swipe down* gets the card from the deck/dealer,
- *single tap* emits a message about current card,
- *double tap* turns on the QA mode.

The QA mode is a sequence of questions about additional actions. The following gestures are available in this mode:

- *swipe left* and *swipe right* navigate between questions,
- *single tap* equals the “YES” answer, then exits the QA mode immediately,
- *double tap* turns off the QA mode.

6 Evaluation

The proposed interaction template and layout have been implemented in a prototype game: *BlackJack* (Fig. 1). The game was created in a multiplayer mode including three predefined computer players. All gestures have been implemented using proposed approach. Only *swipe up* gesture was inactive due to the lack of appropriate action in the rules of the game. Maximum four (depending on the current situation in the game) questions were available in the QA mode for BlackJack game: Don’t you want more cards?, Do you double down?, Do you want to split cards?, and Do you want to insure? In order to speed up the game, gestures in the QA mode have stopped speaking current question and move control to the next one.

The introduced elements of the mobile application implement accessibility features. Configurable game control (A feature in the Table 1) has been replaced
Fig. 1. Accessible mobile Blackjack.

by a developed interaction template. The set of questions in the QA mode plays a role of hints (B), because the availability of the question depends on the current state of the game, cards on a hand, discarded table, etc. The SCV layout (C, D features) although is not customizable, it shows cards in natural contrast colors (E): black and red symbols on a white background. Moreover, next accessibility features have been implemented: the tutorial is immediately read at the star instead of splash screen (F), voice messages informs about current game state (G), confirmation of gesture detection is done by audio beep (H) and vibration (I). The configurable difficulty level (J) has been replaced by a bidding algorithm dynamically adaptable to the player level.

A group of 11 voluntaries participated in the study: 3 women and 8 men - in the age range 21–50. They play the game several times (30 min). Then they completed a short questionnaire with a 5-point Likert scale answers. The most interesting two of them gave satisfying results: *The method of interaction is intuitive* (M = 4.42, MSE = 0.67) and *Feedback is sufficient* (M = 4.58, MSE = 0.52).

7 Conclusions

The proposed approach of the game control, limits the number of available gestures to six types: swipes in four directions, taps and double taps. In a standard mode, swipes are associated with the basic card actions on the hand, while in QA
mode they are used to view optional actions in the game. A single tap works for information (as for screen readers) about the current card in the normal mode. Double tap is used to switch between modes. This approach and SCV layout should allow for the efficient implementation of many mobile card games.

However, some games that are placed in the card game genre involve a board, or cards are arranged on the table in a special way (as solitaires). In consequence a list of questions in the QA will be uselessly long. Therefore, another special interaction mode could be included to the template to enable navigation among the cards placed on the table. This issue is a topic of the future work.

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