ABSTRACT

Historically, real-time strategy video games, such as StarCraft (1999) and Command and Conquer (1995), were intended to be played on desktop or laptop computers, with interfaces that afford the user dozens of keys and key combinations, mouse gestures including clicking and dragging, and several mouse buttons to further complicate the interface while allowing customization and a wide range of possibilities to the user. On a mobile multi-touch platform, there are constraints of limited visual real estate, which is actually shared with the touch command interface. Though work has been done to port real-time strategy games to the mobile platform, to date, there has not been a significant effort to enhance the usability of these interfaces by removing redundancies and tailoring the game commands to these multi-touch devices.

The touch interface presents unique challenges as there are touches and gestures rather than buttons and key combinations. In this paper, we present a rapidly-prototyped user-centered design in a ten-week project of a real-time strategy user interface native for the iPad. As the user's experience is key in creating a robust and intuitive interface, we incorporate the user's feedback in several stages of the design and prototyping of the project. We show changes to the design of the user interface over several iterations and, finally, show a prototype of the user interface system using a game of our own design as a test platform. The contributions of this project are the multi-touch interface design, the ability to cancel orders, and the ability of the user to play the game using only one hand. Pilot studies confirm the speed, accuracy, effectiveness of the user interface using both two hands and one hand.

1. INTRODUCTION

On many mobile platforms, multiple compelling games and applications have sprung to life, but the user interface design still has not taken full advantage of the touch surface. In this project, redesign the real-time strategy (RTS) game menu interface to use several intuitive gestures to run natively on the Apple iPad. We theorize that the multi-touch surface of the iPad allows users to play RTS games more quickly and more accurately because gestures use more area and require less targeting precision than traditional buttons.

Current iPad RTS user interfaces are direct translations from their desktop counterparts, and do not take into account the unique requirements of the multi-touch user environment. Existing interfaces present the user with small buttons, or exhibit major design flaws such as the inability to cancel a selected function. This project's design draws on the experience of users who use play RTS games on iPad, and incorporates these users' comments into the design and implementation of the interface. The goal of this project is to implement a new and innovative touch-based interface to give the users a new way to experience RTS game play.

The benefits of using a multi-touch device over a desktop computer include portability, ergonomics, and the ability to use the device with only one hand. The user interface described in this paper investigates and celebrates one-handed device use.

2. AFFORDANCES

For the purposes of this demonstration, we defined the following affordances to the user.

- The player can open the build menu.
  Command: TOUCH & HOLD (main screen)

- The player can open the unit command menu.
  Command: TOUCH & HOLD (unit)

- The player can apply a build or unit command.
  Command: DRAG & RELEASE (command menu)
• The player can select a single unit or building. 
  Command: SINGLE-TAP (main screen)
• The player can select a group of units or buildings. 
  Command: LASSO or ONE-FINGER DRAG (main screen)
• The player can select all units of the same type. 
  Command: DOUBLE-TAP (unit)
• The player can scroll to a specified spot on the minimap, thus displaying the area surrounding the requested location on the map. 
  Command: SINGLE-TAP (minimap)
• The player can drag the screen to a specified spot on the mini-map, thus displaying the area surrounding the requested location on the map. 
  Command: TWO-FINGER DRAG (main screen)
• The player can place a building or unit on the map. 
  Command: DRAG (map mode)
• The player can assign unit(s) or buildings(s) to a control group. 
  Command: MEMORY (button)
• The player can assign or change a function of a unit. 
  Command: TAP & HOLD
• The player can build workers and offensive units. Workers are able to build, attack, gather, and move; offensive units can attack and move. 
  Command: SINGLE-TAP (menu mode)
• The player can place barracks and supply buildings. Barracks can build a unit, and can be set as a rally point. 
  Command: SINGLE-TAP (menu mode)
• The player can select units in each control group (CG). 
  Command: SINGLE-TAP (control group CG1–5)
• The player can toggle add or set for creating control groups. 
  Command: SINGLE-TAP (add/set toggle button)

3. EARLY PROTOTYPING

The iOS human interface usability guidelines proposed by Apple were our starting points in designing the system. In particular, our goal was to embrace the platform by making full use of the touch-screen interface, a detail ignored (in favor of ease of portability) by currently-available real-time strategy games.

The user’s work flow when interacting with the system on the iPad can be summarized with the storyboard shown in Figure 1.

Figure 2: Layout of the screen

Figure 2 shows the layout of the game screen. The features of this interface are as follows.

1. Minimap (can be tapped to see different areas of the map quickly).
2. Control Group Buttons (can be tapped to select a Control Group).
3. Unit Name and Statistics (visual aid of selected unit’s or building’s features).

4. Control Group Add/Set Buttons (this is a toggle-able function that allows the user to add units to a Control Group and set units as a Control Group. By default, it is toggled to add).

5. Resources and Supply Cap (visual aid of the user’s current resources and supplies).

The low-fidelity prototype shown in Figure 3 was created with paper cut-outs for the various parts of the menu, an iPad screen sized print-out, and various colored shapes for the representation of buildings and units. The menu system was designed based on interviews with seven users, most of whom were intermediate to expert RTS game players. We tested the prototype with five users. To interact with the prototype, the user would act as if it was a real touch interface, and use all gestures available on the iPad platform. Then, a group member would be responsible for updating the state of the prototype as the user progressed.

![Figure 3: Low-fidelity paper prototype](image)

4. HIGH-FIDELITY PROTOTYPING

The high-fidelity prototype was created in iOS developer suite for the iPad. A screen capture is shown in Figure 4. The sample game uses geometric shapes in the place of sprites to indicate buildings and units. The red triangle indicates an offensive unit; the blue circle is a worker; the grey pentagon is a supply building; and the yellow square is a barrack.

Heuristic evaluation showed minor to critical usability, playability, and mobility flaws in our design. In the coming weeks, we will be assessing these flaws and making necessary changes to our design to produce a polished product for user testing.

5. USER TESTING

The user interface will be tested with five to seven participants, all of whom have had extensive experience with real-time strategy games. The reason the users must be domain experts is because we wish to stress the importance of our novel user interface rather than the underlying game mechanic. The system will be compared against the iPad version of Command and Conquer (2010). A within-subjects design will ensure that participants have an equal grounds for comparison with a known system. The order in which participants see and play the games will be randomized to reduce participant bias. Qualitative and quantitative approaches will be used to glean the most information about the system given the small number of pilot participants, hence the inability to produce statistical significance to our quantitative measurements.

6. FUTURE WORK

Future work on this project includes making small performance-related changes and separating the user interface element from the game element and offering it as an optional add-on to current games.