iPhone App Usability Report

Student Number 16078150

The app *Aircraft Wars* is a highly usable iPhone app designed for iOS using the Swift language. The design is responsive and does adapt to different screen sizes. The app is currently not optimised for use on iPad, since it was not part of the requirements, although it is possible to play it on any platform that supports iOS, thanks to using the screen dimensions as variables to adapt the position of the aircraft and possible missile spawning points instead of hard-coding the values (See Issue 3: Game difficulty problems).
The game is focused on military aircrafts and scenarios given the attraction of the public towards these kinds of games, especially among teenagers, foreseeably the target audience for the game[1][2]. It also features several animations (such as aircraft engines, explosions and missile afterburners) and different aircraft models, making the game more desirable to play, as suggested by *L. Medina*[3], who states that animations and personalization are a key factor to the involvement of the players.

Major issues in development

While the app is considered by the developer to be an overall success, there were some issues that are worth mentioning for a better understanding of the challenges faced during the creation of the app.

Issue 1: Plane boundaries

While the aircraft movement is constrained to only be sideways, right to left or left to right instead of freely moving around the screen, boundaries were introduced to constrain the aircraft movement so that when it reached the edge of the screen, it would not be allowed to keep moving slightly out of the screen. This was useful at the beginning, since the app was only being tested on larger screen iPhone models, such as iPhone 7 Plus. However, when testing the app on smaller iPhones or greater levels of difficulty (See Issue 3: Game difficulty problems), the game offered some certainly unfair scenarios where the player was forced to crash into one or more missiles due to this movement constraint. This feature was finally removed and is not present in the final release of the project.

Issue 2: Collision detection

Initially, the game did not have collisions implemented, and these were the last major feature to be added to the game. The tutorials for the Mobile Computing module covered multiple kinds of collisions but didn't cover one that was desirable for the kind of game that was being developed, where instead of objects bouncing off each other or performing similar actions, the collision would trigger a function that could then update scores, armor, while keeping the game in play, to allow *Onslaught* mode to be implemented.
To address this issue, the developer created a collision function from scratch called `func detectCollision(missile: UIImageView)`. This is a recursive function called for

[1] Lenoir, T., 2000. All but war is simulation: The military-entertainment complex. Configurations, 8(3), pp.289-335.
[2] "The Next Generation 1996 Lexicon A to Z". Next Generation. No. 15. Imagine Media. March 1996. pp. 28–42. "Action game - A game characterized by simple action and response gameplay. ... the defining characteristic is that enemies and obstacles are overcome by 'physical' means, rather than involved intellectual problem solving."
[3] Leclerc Medina, S.I., 2012. Exploring the relevance of visual aesthetics on educational videogames.

every missile right after being launched that would track whether said missile intercepted with the aircraft in any moment of the gravity animation. Its recursiveness also prevented the function from being triggered more than once by the same missile. This function also handles the moment when the missile exits the screen to update the scoreboard, as well as updating the armor left on the airplane if it is hit.

Issue 3: Game difficulty problems

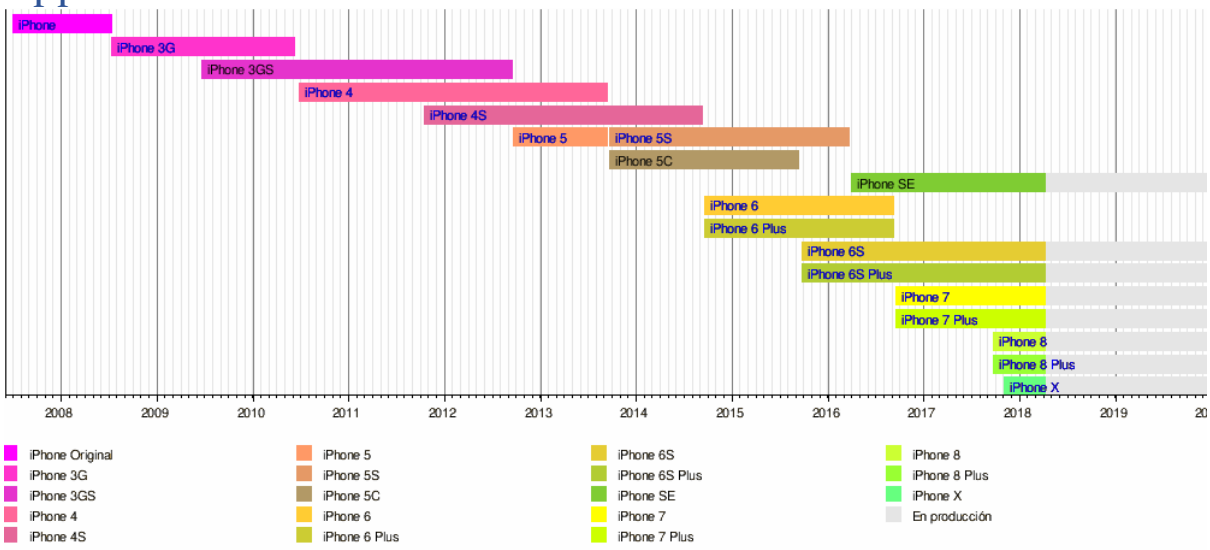
This was the main issue while developing the app and it still exists for certain iOS devices such as iPads or some of the oldest iPhones. While the game is entirely playable in devices of any screen size and shape, these issues become significant when the game is played in devices other than the mainly supported ones nowadays – this is iPhone 6S, 7, 8 and X and the respective *Plus* versions[4] (See Appendix 1. iPhone models timeline). Their resolution and screen size are significantly larger (more than 1" difference) than some of the older devices and iPhone SE[5], which may negatively influence playability, since the game has been optimised mostly for newer models. This causes an apparent imbalance while playing the game in older devices, making the game a lot more challenging on them, especially on the hardest levels, since the number of missiles spawned is the same, but the screen is significantly narrower (See Future balance changes). This was also the cause for the side boundaries to be removed, as mentioned on Issue 1: Plane boundaries, because they made the game less enjoyable in older devices, creating frustrating situations for these players.
This issue also occurs on iPads inversely, making the game a lot easier since the screen is significantly wider.

Future balance changes

As discussed on Issue 3: Game difficulty problems, the only major issue that still persists in the game is the imbalance across different devices. The first solution thought was to make the size of the objects (e.g. missiles and aircraft) relative to the screen size. This was not implemented because it made the objects appear overly distorted as shown on Appendix 2. Missile shape distortion. However, a feasible solution to this problem would be to spawn a different number of missiles for the same level depending on the device the game is being played on. A player on iPad would have significantly more missiles spawned for the *Hard* level than for instance someone playing on an iPhone SE.

[4] Apple Inc. (2004-2016). Press Release Library. Last revised 6th of April 2016.
[5] Alexis Fruhinsholz. (2010-03-08). Apple iPhone product line comparison. Available at: http://socialcompare.com/en/comparison/apple-iphone-product-line-comparison. Last revised 11th of April 2018.

Appendix 1. iPhone models timeline



Appendix 2. Missile shape distortion

Missile as shown on taller but narrower screens (e.g. older iPhones)

Missile as shown on wider screen (e.g. iPads)