Less is more.

Exploring Optimal User Interface Layouts for Achieving Cognitive Flow in Action Games

Jack Benjamin Griffiths

AINT354 Design for Entertainment
Systems
griff@backyardgiant.co.uk
www.backyardgiant.co.uk

ABSTRACT

A GUI (Graphical User Interface) plays a large part in communicating key information to the user of any system. This study analyses a variety of design principles used to create user-friendly interfaces, specifically within the genre of action video games. It will explore the use of cognitive flow in User Interface design and how, when achieved, it can affect player engagement.

Keywords

User Interface, User Experience, Action games, Combat Simulation , Affective Design, Heads-up Display, Human-Computer Interaction, Cognitive Flow

1. INTRODUCTION

When it comes to video game UIs (User Interfaces), the developers only get one chance to make a first impression. For companies, it can be a deciding factor; if your game's UI is deemed terrible, it can drive customers away from your product and towards your competitors. This is very rarely a problem for large franchises, as a bad game UI has very rarely tarnished the reputation of its predecessors. However, it remains a challenge for small development teams who are new to the industry.

The visuals of user interfaces within games can be split into two subsections: GUI (Graphical User Interface) and HUD (Heads-up Display).The GUI refers to the methods and interfaces through which a user interacts with your game, like inventory screens and a main menu (Quintans, 2013). The HUD, however, defines the non-interactive display area where players can see their character's vital statistics such as: current health,armor level, ammo count and more (Wilson, 2006)

Many GUI and HUD standards have arisen in creating immersive interfaces for action games, and developers must not deviate too far from these standards of layout, colouring and fonts in order to achieve a player-friendly user interface. This paper will aim to explore those standards being used within the industry, and how they have led to creating successful HCIs (Human-Computer Interactions). It will also derive conclusions about optimal HUD and GUI layouts, taking into account the psychology of achieving cognitive flow during gameplay.

2. FIELD

2.1 User Interfaces

A Graphical User Interface serves as the method of linking human and computer interactions, a space where a user will interact with a system to complete tasks. Being a large driving force of UX (User Experience), it is key that a GUI allows for users to easily and quickly view data and tools through accessible text,links,buttons and images.

Over the past few decades, video games have been refined by graphical enhancements, increased processor speed of video game systems and other technological advancements. As a result, GUIs have been evolving to adapt to the increasing complexity of video games (Poh, 2013).

2.2 Cognitive Flow

M. Csikszentmihalyi writes about the psychology behind cognitive flow. Flow is defined as a euphoric state of concentration and involvement, often claimed to be one of the most enjoyable and valuable experiences one can have.

Csikszentmihalyi outlined four characteristics of tasks that drive an equilibrium between skill and difficulty (See Figure 1.), thus increasing the probability of Flow states. Tasks must: Have concrete goals with manageable rules, demand actions to achieve goals that fit within the person's capabilities, have clear and timely feedback on performance and goal accomplishment, and diminish extraneous distraction, thus facilitating concentration (Csikszentmihalyi, 1992).
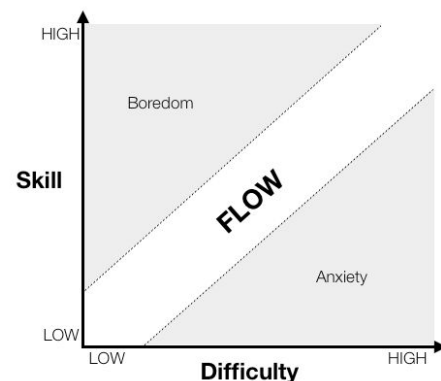

Figure 1: Flow boredom, and anxiety as they relate to task difficulty and user skill level. (Baron, 2012)

While in 'flow state', people experience: extreme focus, a sense of active control, a loss of self awareness, distortion of the experience of time and the experience of the task being the only necessary justification for continuing it (Baron, 2012). Designing a game experience that motivates players to

experience Cognitive Flow can dramatically increase player engagement.

This paper will introduce cognitive flow as a key design principle to consider when creating user interfaces, and how key players in the industry have achieved optimal flow through their HUD and GUI layouts.

3.   KEYPLAYERS

Many large-budget games have done a lot of usability testing while developing their user interfaces, and hence have become great examples of how to achieve flow-state through intuitive UI. For this reason, this paper will focus majoritively on these larger titles, and will explore one indie title as an example of how a smaller development team might function in this sector.

3.1   Star Wars Battlefront II [2017]

Star Wars Battlefront II is an action shooter video game based on the Star Wars film franchise. It was developed by EA DICE, in collaboration with Criterion Games and Motive Studios, and published by Electronic Arts. EA DICE are known for Battlefield, one of the largest franchises in FPS (First Person Shooter) video gaming. (DICE, 2018)

3.1.1   Graphical User Interface

The main menu in SWB2 (Star Wars Battlefront II) exhibits clean, bold areas in which players can see featured events, challenges and rewards (See Figure 2). Comparable to the 'Live Tiles' introduced to Windows 8 back in 2012. The menu options are clearly visible in the upper-left corner of the screen; emulating the layout popularised by Apple's 'Lisa' operating system, which is now standard in all modern software. (Dernbach, 2007).
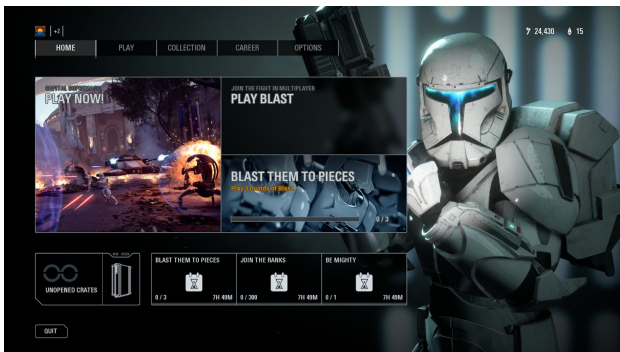

Figure 2 : Screenshot of the Main Menu from Star Wars Battlefront II [2017]

Anna Wikstrom, a UX Designer at DICE during this game's development, shared a wireframe layout of the Main Menu. (See Figure 3). This displays that the featured/promoted content is given center stage, while gameplay statistics remain in the upper right corner. This favours the game's multiplayer-based focus, which will continue to keep player engagement high.

The wireframe also shows that GUI font stylisation doesn't necessarily come from the gameplay content, but instead the designer should take a much more functional viewpoint. Each tile is given an objective, and below, the button function. For example, the largest tile's objective is "Capital Supremacy" and the function says "Play Now". This level of simplicity reduces the sensory and informational clutter on the screen, hence the gamer's ability to find and evaluate important information is greatly improved. This, like many other UI design principles, aligns with characteristic 4 of cognitive flow: *'Diminish*

extraneous   distraction,   thus   facilitating   concentration.' (Csikszentmihalyi, 1992)
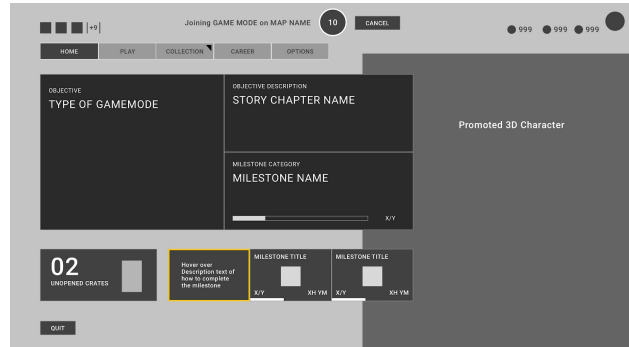

Figure 3 : A wireframe layout of the Main Menu from Star Wars Battlefront II [2017](Wikström, 2017)

3.1.2   Heads-Up Display

The game features a mode called Starfighter Assault, where players control hero ships, fighters,bombers and interceptors as two teams "engage in multi-stage, objective based space battles" (Osborn, 2017), This will be the gamemode primarily referenced in this paper, due to the fact that it is the most unique HUD layout when compared to the other key players.

This instance takes inspiration specifically from Military Aircraft applications of HUDs. While remaining minimalistic, it implements a variety of weapons system displays such as: target designation indication (places a cue over the in-air target) , weapon seeker (shows where a seeker or sensor is pointing) and weapon status (includes type and number of weapons selected) (Federal Aviation Administration, 2007).

The combination of enemy targeting, speed indicators and weapon reload displays gives the player a quick reference of critical information while in combat. Unconventionally, the players speed and health are displayed in the middle of the screen, stylised to blend in with the crosshair. This reduces the distance the player has to look from where they're aiming to where their health is displayed. This breaks the standard of similar titles, where this information is displayed in the bottom corners.

Figure 4 : Heads-Up Display during the Starfighter Assault Gamemode in Star Wars Battlefront II [2017]

There is a balance to be reached between replicating realistic military HUDs and creating a simplistic but enjoyable experience for the average player. SWBF2 has gone for a

minimalistic approach that allows players to feel as if they're skillfully performing tasks, with as few as possible.

3.2   Borderlands : Game Of The Year Edition [2019]

Borderlands is an up to four co-op players FPS (First Person Shooter), which features frantic combat and random weapon generation. It also features RPG elements and hence, has an inventory management and quest system. It was developed by Gearbox Software and published by 2K Games in 2009. Borderlands features four original playable characters, each with skill trees and preferred weapons. The game features a heavy loot-and-shoot persuasion, with over seventeen million different weapons available to the player. (Gearbox Software, 2016)

In 2019, Gearbox released Borderlands : GOTY (Game Of The Year Edition). This was a remaster of the 2009 original, adding the ability to play the game in 4K, along with various User Interface improvements.

3.2.1   Graphical User Interface

Borderlands is not known for its unfavourable Main Menu, but instead it's inventory management that aids players in understanding each and every item in its ground breaking weapons system (Bomb, 2009).

The Inventory takes inspiration from classic RPGs, having a list on the left with all items in the inventory, and then a differently formatted equipped item menu on the right. (See Figure 5) Each weapon, when selected, is highlighted in bright yellow, contrasting to the blue background. When inspecting an item, the statistics of the weapon appear in the upper right, and simple arrow indicators display whether it's stats are higher or lower than the currently equipped weapon. This layout allows players to quickly see newly looted weapons, due to its left-aligned critical information and right-aligned inventory management. In English, and most european languages, words are read left-to-right, which means the left side of the screen is typically where players look first (Bringhurst, 2013).

Figure 5 : Screenshot of the inventory from Borderlands GOTY [2019] (Rodriguez, 2019)

The above layout is an enhanced version of the original. The sleek and intuitive design uses large icons to prevent misclicking and misplacing of items (See Figure 5). This leads to an overall pleasing inventory management experience, which can be easy to use both when in intense combat, and when looking to spend a bit longer inspecting the inventory. (Rodriguez, 2019)

The displacement of critical from extraneous statistics reduces the amount of information a player needs to process during gameplay. This positively affects goal comprehension, and ultimately improves flow (Baron, 2012).

3.2.2   Heads-Up Display

The HUD in Borderlands resembles that of many of its competitors. RPG games tend to feature a health and map display, as well as some sort of weapon counter; in this case, ammo. The information is displayed in the bottom corners (See Figure 6) , so during combat, the player knows exactly where critical values are displayed.

Figure 6 : Screenshot of the Heads-Up Display during gameplay from Borderlands GOTY [2019] (Rodriguez, 2019)

In order to achieve full immersion, it becomes necessary to reduce the amount of HUD elements visible. They have become something that, for the vast majority of players, has little to no impact on gameplay. Call of Duty 2 provides a good example of this. Although the game does feature some elaborate Heads-Up Display elements, it become notable for one thing: completely removing the visible health meter. Instead, health was indicated through contextual elements, such as blood appearing on the screen and the sounds of intense heartbeating. This made the experience of losing health a much more intense moment for the player, helping them realise how quickly they may need to make it to cover (Wilson, 2006).

4.   Hyper Light Drifter [2016]

Hyper Light Drifter is a 2D action role-playing game developed by Heart Machine. The game pays homage to 8-bit and 16-bit games, and is considered *"a combination of The Legend of Zelda: A Link to the Past and Diablo"* by its lead developer, Alex Preston (Preston, 2016).

This paper will explore this game as an example of an indie developers approach to user interface. With lower budgets and smaller teams, user interface can easily be regarded as a lower priority compared to other elements of game development; however, usually the more simplistic interfaces yield a better user experience.

4.1   Heads-Up Display

The Heads-Up Display in Hyper Light Drifter remains simplistic while stylised. The bright neon aesthetic is carried in every element, from energy bar to the weapon icons (See Figure 7). The colour choices stand out against the background, to allow the player to easily see what their inventory contains.

Figure 7 : Screenshot of Hyper Light Drifter Gameplay
(SYH, 2016)

These choices allow the player to quickly view their critical information, while staying consistent with the overall aesthetic of the game. Interestingly, there is a story to Hyper Light Drifter, however it is only ever conveyed through images and cut scenes, there is no NPC dialogue. This means there was little need for localisation, as this design is visually universal (SYH, 2016).

Although Heart Machine's stylistic decisions led to a cohesive art style, the choice to go 8/16-bit with all icons often leads to confusion with inventory management, as some icons look too similar to others. This confuses the player while they're trying to complete tasks, and during moments of intense gameplay, can negatively affect flow.

4.2 Summary

Each of the examples this paper explores have had varying methods of achieving a fully player-friendly UI. Keeping a balance between simplicity of tasks and information provided is a constant challenge for developers, and keeping a consistent art style can sometimes lead to a less than enjoyable user experience.

Table 1. Table showing Strengths and Weaknesses between the user interfaces of 3 games.

Title	Positives	Negatives
Star Wars Battlefront 2	● Minimalist design is stylistic and approachable. ● Adequate HUD for enjoyable space combat.	● Leaves experienced players wanting more information on the HUD.
Borderlands : Game Of The Year Edition	● Large buttons and Gun icons allows for hot-swapping of weapons during intense combat. ● Easily understood icons to aid in weapon comparison.	● Lacking in contextual references to health, ammo and map. ● Over cluttered HUD
Hyper Light Drifter	● Bright Neon aesthetic immerses players in game world. ● Absence of words leads to quick localisation.	● Art Style doesn't translate well in certain UI elements.

4.3 USP

In Star Wars Battlefront II [2017], the UX designers have adopted a massively minimalistic style, putting featured content front and centre of the screen. This favours well to the online multiplayer-based title, as players are always able to see the latest gamemode on their home screen. The menu layout replicates the traditional layout of software, meaning it feels more comfortable to a new user. The Heads-up Display aids the player subtly in combat, while giving all of the critical information within the centre of the screen, and less important information in the corners. This aids in task progression, leading to good cognitive flow.

Borderlands : Game Of The Year Edition [2019] takes influence both from it's 2009 original, and the sequels that came between them. It's use of weapon icons and various indicators to aid players in comparing their weapons mid-combat creates an enjoyable experience that doesn't break the flow of gameplay. It's HUD displays all key information quickly on the screen, and being as the game contains RPG elements, having loot notifications, a map and various quest notifications is essential to gameplay.

In Hyper Light Drifter, the bright neon aesthetic carries through all of the user interface, leading to a cohesive experience. The absence of any text allows for easy localisation, making the game more accessible to more people. The simplistic health and ammo bars allow players to quickly see how they're doing in combat, which positively affects goal comprehension, leading to greater cognitive flow. It is a brilliant example of how the most simple user interface can keep a player immersed. However, it's 8-bit and 16-bit art style sometimes doesn't work in its favour, and players could easily get confused between the smaller icons in the game.

Each of the games analysed were catering to slightly different genres while developing their UI, however the most successful user experience was from Star Wars Battlefront II. This is because of its accessibility to both new and old players. Enemy targeting, health and speed being easily understandable to a new player, and easily mastered by a more experienced player.

4.4 Approach

It is clear from the given examples that UX designers reference already existing interfaces when looking to make a new one. Star Wars Battlefront II replicates the menu formatting from the original Apple Lisa OS (Operating System) (Dernbach, 2007), and Borderlands uses the fact that European Languages start reading from the left as a basis for it's inventory system layout. It is clear that the approach to good user interface design stems from already existing theories and layouts. Designers that tend to challenge these standards go

against observed human psyche, and ultimately lead users into bad cognitive flow.

From the games discussed, it is clear that Heads-Up Display layouts vary substantially based on a game's functionality and art style. Star Wars had a very functional HUD, heavily inspired by realistic military combat displays. This led the player into a fully immersive experience. Hyper Light Drifter created immersion through a fully cohesive art style, sticking to the sometimes limiting 8-bit and 16-bit styles.

The approach a designer takes must remain minimal while also displaying critical game information, and must always simplify tasks in order to achieve cognitive flow.

5. CONCLUSIONS

Cognitive flow must remain the principle goal for user interface designers. Easy task comprehension remains the key to creating an enjoyable experience in a menu system, and adopting currently standard UI layouts can increase the players ability to comprehend new environments. Using standards such as upper-left menu alignment, clean and approachable fonts and colour schemes, and large easily-clickable buttons are essential to optimal user experience.

In action games, a Heads-Up Display must remain as minimalistic as possible, using contextual elements such as blood splatter on the screen and on-gun ammo displays as a way of reducing the amount of time the player has to look away from where they're aiming. A simplistic HUD creates a cinematic-quality experience, aiding in storyline and overall identification with the player's character. A HUD can differ greatly based on the sub-genre of a game. However, Star Wars Battlefront II [2017] has made it clear that health bars are expected where blood splatter isn't possible

It can be concluded that larger-budget games have the ability to usability test their systems through many iterations, and hence, usually serve as good examples of approachable user interfaces. Minimalism with bright contrasting colours allows for easy viewing, and also follows current trends in interface design.

Further research into this subject could start to reflect on affective computing. Acknowledgment 1 contains information on how affective design can influence user interfaces, and it includes some great usability testing on it's theories. Affective computing is the study of systems that react to a users emotions, and can hence change on-screen elements to suit. This could be studied for its application in GUI and HUD design, possibly aiding in achieved cognitive flow through increasing/decreasing skill perception of tasks. (See Acknowledgment 2). For example, automatically making a user interface simpler if the user is becoming frustrated by it.

Further research could also be done into the design of varying interfaces. Acknowledgement 3 serves as a source of many different papers on the design of a pleasurable experience, and goes deeper into a variety of different interfaces and how they can be designed to improve UX.

6. ACKNOWLEDGEMENTS

7. REFERENCES

Baron, S. (2012) *Cognitive Flow: The Psychology of Great Game Design*. Available at: https://www.gamasutra.com/view/feature/166972/cognitive_flow_the_psychology_of_.php (Accessed: 13 October 2019).

Bomb, G. (2009) *Borderlands (Game) - Giant Bomb*, Giant Bomb. Available at: https://www.giantbomb.com/borderlands/3030-20487/ (Accessed: 14 October 2019).

Bringhurst, R. (2013) *The Elements of Typographic Style*. Hartley & Marks Publishers.

Csikszentmihalyi, M. (1992) *Flow: The Psychology of Happiness*. Rider, 1992, p. 43,71.

Dernbach, C. (2007) *Apple Lisa - Mac History*, Mac History. Mac History. Available at: https://www.mac-history.net/apple-history-2/apple-lisa/2007-10-12/apple-lisa (Accessed: 13 October 2019).

DICE (2018) *Games - DICE*, DICE. Available at: https://www.dice.se/games/ (Accessed: 13 October 2019).

Federal Aviation Administration (2007) *Title 14 of the Code of Federal Regulations*, Federal Aviation Administration. Available at: http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgFAR.nsf/MainFrame?OpenFrameSet (Accessed: 13 October 2019).

Gearbox Software (2016) *Borderlands*, Gearbox Software. Gearbox Software. Available at: https://www.gearboxsoftware.com/game/borderlands/ (Accessed: 14 October 2019).

Osborn, A. (2017) *Star Wars Battlefront 2 Multiplayer Maps and Modes Revealed - IGN*. IGN. Available at: https://uk.ign.com/articles/2017/09/26/star-wars-battlefront-2-multiplayer-maps-and-modes-revealed

(Accessed: 13 October 2019).

Poh, M. (2013) *Evolution of Video Games User Interfaces - Hongkiat, Hongkiat*. Available at: https://www.hongkiat.com/blog/video-games-ui-evolution/ (Accessed: 13 October 2019).

Preston, A. (2016) *Hyper Light Drifter — Heart Machine, Heart Machine*. Available at: https://heartmachine.com/hyper-light (Accessed: 14 October 2019).

Quintans, D. (2013) *Game UI By Example: A Crash Course in the Good and the Bad, Game Development Envato Tuts+*. Available at: https://gamedevelopment.tutsplus.com/tutorials/game-ui-by-example-a-crash-course-in-the-good-and-the-bad--gamedev-3943 (Accessed: 13 October 2019).

Rodriguez, J. (2019) *Borderlands: GOTY Technical Review - Back In Business | PC Invasion, PC Invasion*. Available at: https://www.pcinvasion.com/borderlands-goty-technical-review/ (Accessed: 14 October 2019).

SYH (2016) *UI Breakdown: Hyper Light Drifter, Medium*. The Space Ape Games Experience. Available at: https://medium.com/the-space-ape-games-experience/hyper-light-drifter-ui-breakdown-c2d9cfe0a192 (Accessed: 14 October 2019).

Wikström, A. (2017) *Anna Wikström - Battlefront II*. Available at: https://annawikstrom.com/starwars.html (Accessed: 13 October 2019).

Wilson, G. (2006) *Off With Their HUDs!: Rethinking the Heads-Up Display in Console Game Design*. Available at: https://www.gamasutra.com/view/feature/130948/off_with_their_huds_rethinking_.php (Accessed: 14 October 2019).