Review of Core Graphic Design Principles Used in Computer Games

An Evaluation of Graphical User Interface Design

Christy Martin, Michael Cooper

Visual Communication Studio + Consultancy

Queensland,

Australia

e-mail: voxelandpixel@gmail.com

Manolya Kavakli

AIE Institute

33 Mountain St, Ultimo

Sydney, Australia

e-mail: manolya.kavakli@aieinstitute.edu.au

Abstract—**Our goal in this paper is to review the use of core graphic design principles in computer games. We believe that the architecture of great Graphical User Interface (GUI) design is built upon a solid foundation of core graphic design principles. First, we define core principles used in graphic design, such as the grid, hierarchy, scale, balance, and framing. Then, we analyse the examples of core graphic design principles in computer games. Our findings state that there is evidence of all being utilised, despite the disparity in game genre.**

Keywords- computer games; GUI design; graphic design principles; user interface; evaluation.

I. INTRODUCTION

Our current technologies for visual communication (through print, digital, environment and increasingly virtual/interactive means) all fall back on an established set of basic design principles to consider when approaching a design, across these platforms [1][2]. New technologies are expanding considerations needed for graphic design layout, with screen sizing and touch capabilities also impacting possibilities in design. There are opinion articles about best user interfaces as seen in games [3][4] and what the medium is capable of delivering on, however no reviews about how basic graphic design principles are used in interface design.

The core principles of graphic design have remained approximately the same from modernist-era developments, having proven their efficacy over time. We have a basic framework for graphic design, developed and expanded upon since the International Typographic Style (ITS) emerged in the 1960's, to assist us in organising and understanding the digital era challenges we now face as designers, in a fast-moving and ever-more technical world. Our potential toolkit for executing graphic design grows, as we experiment with new technologies, and engage with new ideas and social/political constructs.

Design principles prove to offer a great foundational architecture for visual communicators to build their designs, with huge scope for further discussion and development of graphic design concepts within the bounds of the two, three or even fourth dimensional spaces we interact with today.

Graphic design serves as the bridge between the game software and the player. Graphic designers design the different User Interfaces (UI) the player interacts with. The menus, icons, navigation bars, data, and in-game displays must be organized with the user utmost in mind, and simple to understand. They must accommodate users from different backgrounds and cultures by applying universal design principles to communicate in the most efficient way possible.

The rest of this paper is organized as follows. Section II describes the core graphic design principles. Section III demonstrates the use of core graphic design principles in computer games. Section IV addresses the analysis of underutilized elements of graphic design in contemporary computer games. Section V draws an evaluation with respect to the GUI design and lessons learnt from the analysis. The acknowledgement and conclusions close the article.

II. CORE GRAPHIC DESIGN PRINCIPLES

The architecture of great graphic design is built upon a strong foundation of core graphic design principles that most designers begin with [2]:

- the grid
- hierarchy
- scale
- balance (symmetry and asymmetry)
- framing

These five principles give structure to layout, to allow the designer to then experiment with other elements of form, for instance: colour, line, pattern, texture, and layers.

A. The Grid

A grid could be seen as the "bones" of a design layout - a series of columns with margins, to place text and image within – the organization of content. A grid allows the designer to align content vertically and horizontally across multiple pages of layout. Column width and depth can either be set as a strict adherence or varied to the designer's specifications, making this structural element work hard throughout the design (thus giving flow and balance and allowing great control over hierarchy).

From this foundation, the designer may choose to break out of the grid boundaries, to enhance the impact of the work; with Gestalt principles, asymmetry, contrast, and scale contributing to this dynamism.

B. Hierarchy

When we speak of hierarchy as a graphic design term, we are insinuating an order of importance in the reading of information, the visual hierarchy of design. Creating a hierarchy of visuals aims to clearly convey a message, a goal achieved using a range of concepts defined as the Basic Design Principles. Sources might list slightly different versions of the "Principles of Graphic Design", such as in [5]. The terminology used might be different, but the fundamental concepts are the same.

The gaze concept draws on psychological studies to determine the way we take in valuable information – how we process what we see, what we look for in (for instance) a piece of design work. Our viewing patterns tend toward creating order to conceptualise, rationalise and group what we see; a factor further explored in Gestalt principles. We are looking for things which stand out to guide us visually: differentiation.

The message or information - the communication in design - is often the order of text content, creating typographic hierarchy to clearly, as Ellen Lupton [5] states, "add difference methodically" and create visual "signals of difference, signals of separation".

In layout, defining and differentiating content, such as heading, sub-heading, body text and caption can be achieved by adjusting the character of the text, using combinations of:

- size and scale (drama/dynamism)
- weight (bold, medium, light, italic)
- colour (emotion, tone)
- spacing (flow and pause between text)
- case (all capitals, all lowercase)
- character (typeface selection).

Hierarchy provides order and direction to structure. Our eye naturally gravitates to differentiations, spatially and typographically, so with appropriate design we can communicate an order of importance in our messaging and lead a user's eye around a page or screen.

Typographic hierarchy is particularly important to communication as the ability to clearly read and understand where information begins, and ends, gives the reader comfortable flow (with visual pauses and punctuations) when absorbing the text.

Hierarchy also makes life easier for the designer, as we can set our particular "styles" for typography, line spacing and kerning at the beginning of the design process, and in layout software programs like InDesign, apply them across the board.

C. Scale

Scale gives dimension to design. Designers use contrast in scale to draw the eye, for impact and added drama. Scale of text or image on the page can assist with hierarchy. Appropriate scale for text sets a comfortable reading size, or makes a headline stand out. In design, we see two types of scale:

1. **Objective scale:** how large something is (in reality, or the scaled down actuality of the real thing).

2. **Subjective scale:** how big we think something is (our impression; in relation to other things).

Similar sized graphics in a design can lead to flatness, or monotony, therefore adding variation through scale creates movement and flow.

D. Balance (symmetry and asymmetry)

A graphic designer will often play with the shapes and text in their design piece until a tenuous balance, or flow, develops. The resulting rhythm and balance, contribute to the overall feel of a piece of design. The goal of both symmetrical and asymmetrical design principles is to engender a sense of harmony and balance to a piece - a stability of form and flow.

Whilst symmetry harnesses the power of harmony and simplicity, asymmetry challenges the eye with form which may appear random, however placement of elements is deliberate, to add interest and movement. Symmetry through simplicity of form gives us strong, clear messaging. Asymmetry through a harmonious balance guides us through the communication, promoting interaction.

E. Framing

Framing concentrates focus within the design space. The edges of the page, screen or object form a natural barrier. Framing for images through cropping is a subtle skill; the challenge being to identify and choose an appropriate section, angle, and subject. Margins on layouts also provide a framing opportunity. The placement or orientation of design elements on a page become dictated by the grid, with text, image and illustration layered across these lines, but all have an end-point – the edge of the page, or an internal shape.

Framing "creates the conditions for understanding an image or object", according to Lupton & Phillips [2, pp.116). Content within a frame becomes our focus, the frame or border itself a tool of visual acuity.

All graphic design is contained in a frame of reference, be it a device screen, a book jacket, magazine spread or package. The way a graphic designer chooses to use the frame is where creativity surfaces - sometimes what is left out of the frame can be as important as what remains inside.

III. USE OF GRAPHIC DESIGN PRINCIPLES IN GAMES

The GUI is the arrangement of visual components that act as a means of communication between the user and various aspects of the game code, for example, in-game interactivity, information displays, narrative, and settings. A graphic designer designs the user interface (UI) of a game. A single game often has multiple user interfaces; thus, the designer decides the placement of all these visual elements and typography to create not only a pleasing aesthetic, but also to avoid restricting gameplay. There are a few studies published using design principles to enhance engagement in therapy-based video games [22] and cloud games [23].

UI in games takes on different forms (Figure 1), such as **diegetic** (elements that exist within the game world), or **non-diegetic** (an on-screen UI element that is separate from the game world) [7]. These two approaches can markedly affect the way the graphic design appears in the game, but the core

design principles in creating it will remain similar. Other UI types are **Meta** (elements which exist within the game world and are used as a form of UI) and **Spatial** (an element or pop-up which appears in the game but is not of the game world).

Figure 1.   Table of GUI types and uses [7].

In this paper, we will examine the 5 Core Graphic Design Principles of Grid, Hierarchy, Scale, Balance and Framing as they apply to recent game titles with a range of GUI styles.

A.   The Grid

There is an acceptable level of valuable screen 'real estate' used for UI, which allows it to be visible and playable, but not overtly intrusive. Perspective and view (keeping it clear) are of utmost importance.

Use of a grid to develop the staging for a game's UI can depend on the style of game (the difference between a console game and a mobile game, for example, may include the screen size and shape, style of game, and simplicity of controls).

GUI for diegetic games operates on a slightly different basis to those which present UI as a screen overlay. Diegetic UI will often be gridded out, with the same hierarchical principles, but when they appear onscreen diverge; the viewpoint of the player affects how the UI appears (dependent on the element in question and camera view being used, the grid is skewed.).

The non-diegetic grid remains flat and neat, arranged around the screen (a 'Head's Up Display' or 'HUD'), or popping up as a layered sub-screen when required, with ease of use and clarity the goal.

Appropriate design of UI grid systems will give the user a sense of space - that all elements in the layout have the right amount of proximity. In this example from first-person shooter (FPS) "Destiny 2" (Bungie Games), we see use of grid systems to position inventory UI onscreen, in squares with strict alignments, hanging from and ending at a specified point (Figure 2).

Diegetic UI, such as in the action-adventure, third-person shooter "Tom Clancy's The Division 2" (Ubisoft), require the same build structures but appears onscreen quite differently, often from the perspective of the character (Figure 3). The information and icons are in columns, with necessary alignment and structure. The player views them as

'built in' to the world, in this case as a projection from the character's watch.

Figure 2.   Example of grid elements in non-diegetic UI ("Destiny2", Bungie Games) [8].

"Tom Clancy's The Division 2" gives us a good example of a UI where the character is looking at an 'in-world' object and interacting with it. We can clearly see that it is set within a grid structure, with all the alignments and boxes neatly arrayed.
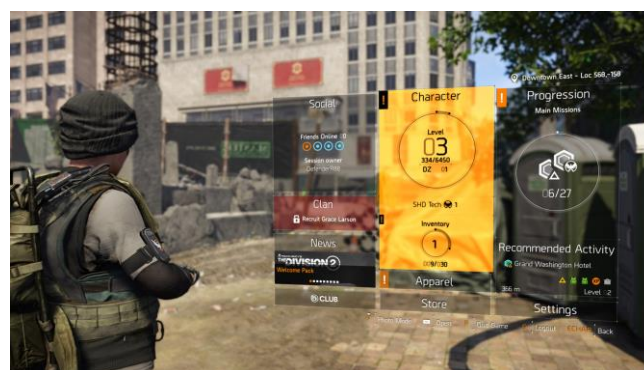

Figure 3.   Example of grid elements in diegetic UI ("Tom Clancy's The Division 2", Ubisoft) [9].

B.   Hierarchy

Hierarchy exists in all facets of games, from typography to the visual dominance of imagery. There is example of visual and typographic hierarchy observed in this UI for "Destiny 2" (Figure 4).

With value on simplicity, one sans serif typeface remains used (almost) exclusively throughout the game, with importance indicated by variances in weight, size/scale, case and spacing. In this example the headline and sub-heading are in all uppercase with alternate weights, whilst the body text is sentence or lowercase and much smaller. This typographic strategy produces a harmonious and clean result, which is easy to read and understand.

The large visual element of the 'Pariah' gun draws our attention to its features, thus also demonstrating visual hierarchy through placement and scale of image.

Figure 4.   Typographic hierarchy ("Destiny2", Bungie Games) [10].

C.   Scale

Applying appropriate scale to UI is not only extremely important to prevent information from impeding the view, but also to create a UI which is legible and easily operated.

The examples from non-diegetic racing game, "Forza Horizon 5" (Playground Games) in Figure 5 and Figure 6, we demonstrate how effective use of scale through differentiation of image and text is utilised as a graphic device; to create visual hierarchy and draw attention dynamically to the information of most import. In Fig.5 the '1000' text stands out as the dominant lead-in graphic, through its comparatively large scale on the screen. In Fig.6 the use of a large car image becomes the directive element, The eye looped back across the screen to the 'Start Race Event' box by its size and positioning.
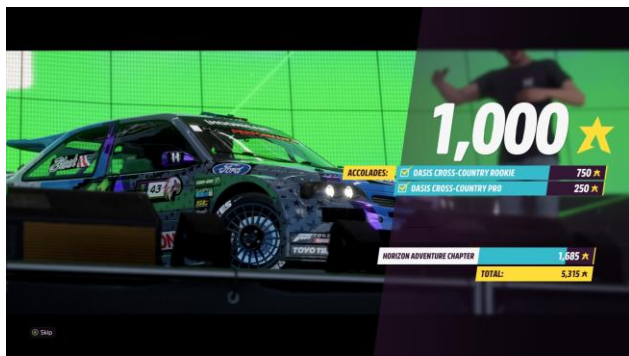

Figure 5.   Example of scale ("Forza Horizon 5", Playground Games) [11].

D.   Balance (Symmetry and Asymmetry)

An isometric puzzler game, Monument Valley (Ustwo) is renowned for its zen-like qualities, benefitting from a sensitive use of colour. In this game, as seen in Figure 7 and Figure 8, the symmetry applied to each screen – with harmony achieved by the isometric structure – enhances this balance by use of a minimalist UI. The peaceful nature of the game visuals due in large part to the graphic design principles applied.
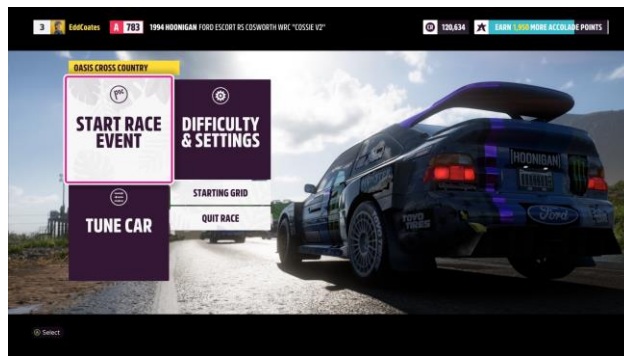

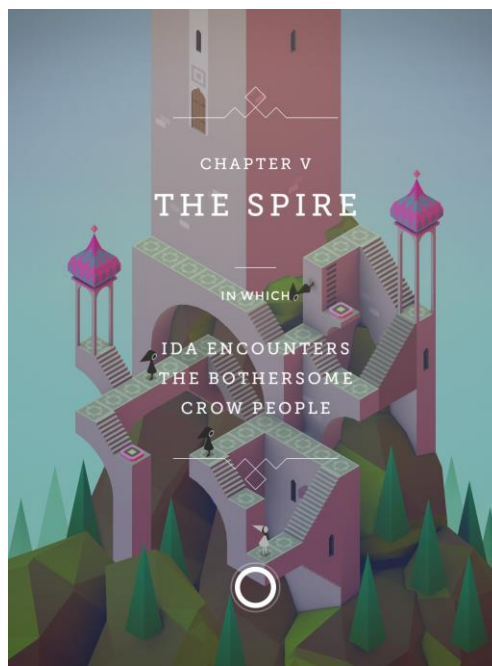Figure 6.   Example of scale ("Forza Horizon 5", Playground Games) [12].

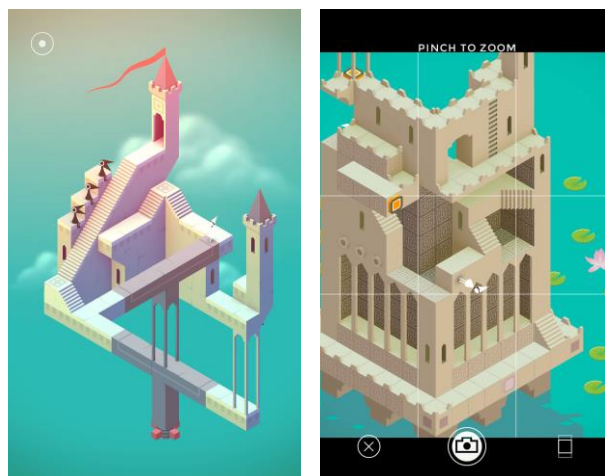Figure 7.   Symmetrical balance ("Monument Valley", Ustwo) [13].

Figure 8.   Example of symmetrical balance of visual and UI tools ("Monument Valley", Ustwo) [14][15].

Similarly balanced but in a different genre, adventure game "Firewatch" (Campo Santo), as seen in Figure 9 and Figure 10, demonstrates a minimalist, light, and airy non-diegetic UI HUD with plenty of space surrounding text elements, centred text boxes for speech, and use of diegetic UI pieces throughout the gameplay, The elements appear to pivot in the middle of screen, as the player opens a map (Figure 10), or uses a compass, for example.

Figure 9.   Symmetrical balance ("Firewatch", Campo Santo) [16].

Figure 10. Symmetrical balance ("Firewatch", Campo Santo) [17].

The perspective of the player is of foremost importance to the balance and symmetrical nature of the visuals here, and this has affected the design choices for a harmonious UI.

E.   Framing

In this example of framing (Figure 11), from isometric dungeon crawler "Hades" (Supergiant Games), we see clever use of a dark, shadowy vignette to draw attention inwards from the edge of the screen, toward the speech box pop-up (also inset in a framed box). This device facilitates discussions with the Gods, however actual frames also appear as a regular element throughout the gameplay to hold information and communications (Figure 12) and direct the eye.

Figure 11. Example of framing ("Hades", Supergiant Games) [18].

Figure 12. Example of framing ("Hades", Supergiant Games) [19].

IV.   THE ANALYSIS OF UNDERUTILIZED ELEMENTS OF GRAPHIC DESIGN IN COMPUTER GAMES

Aspects of graphic design in games are utilised well and often. Colour, for example, works with significant effect to make differentiations and highlight important touchpoints in most games. Gestalt Principles, and affordances, are also widely used and critical to how players both view the action and the UI elements, thus experiencing a game [1]. However, there are certain elements of graphic design which are either harder to incorporate onscreen or potentially overlooked.

A.   Dynamic Contrast / Asymmetry

Few games include a truly dynamic UI. "Persona" (by P-Studio, Atlus) is a stand-out example of this, where the UI's highly graphic, contrast-heavy, and animated shapes flow with the player and give an extremely stylised, attention-seeking and rule-breaking [3] game experience (see Figure 13 and Figure 14). This game remains one of few to embrace a sense of order-in-chaos through asymmetry, contrast in colour and dynamic animation.

B.   Typographic Knowledge

How to use typographic hierarchy effectively is a design principle which can be tricky on digital surfaces, and games are no exception. Selecting the correct and most appropriate typeface, for example, can have major influence on the result from a UI perspective. A font which does not "match" the character or 'feel' of the game, or is not clear enough in its communication, and legibility (particularly when sized down

to UI level), can slightly lift the player out of a sense of immersion, or at worst actively inhibit the player from understanding what they need to do.

Figure 13. Asymmetry and contrast ("Persona" P-Studio, Atlus) [20].

Figure 14. Asymmetry and contrast ("Persona" P-Studio, Atlus) [21].

C. Simplicity & Clarity

Simplicity references the 'less is more' principle that most designers ascribe to – that simple is, in fact, hard to do well. Computer games, from in-game facets to UI and marketing material, trend toward a very narrative and/or illustrative style to the design work – which can be necessary, but also requires restraint in execution. With the importance of screen real-estate and the goal of player immersion HUD UI elements are typically simple and non-intrusive. With a simple and intuitive game design a game UI can in fact be almost non-existent. Games, such as Limbo and Inside (Playdead) uses no HUD and all UI elements are limited to small spatial tool tips to show interactivity.

V. EVALUATION OF GRAPHICAL USER INTERFACES IN GAMES

Game GUI performs a vital role in the User Experience (UX). This basic analysis into graphic design principles examines whether these core elements present from a communication perspective – simply posing the question, "do the core design principles exist in this game?" Analysis of successful use is still subjective in nature – games with very aesthetic and fundamentally elegant UI may fail to address ergonomic or experience concerns from a technical perspective (do the UI elements work well in placement for console, for example, or does the UI work well across all screen types and sizes?). Addressing graphic concerns still go a long way to developing a great UI design. What we can determine from the application of the 5 core design principles in the analysis performed in this paper is all 5 graphic design principles are used to some extent in analysed games.

As a work of design, games are no different to any frame of reference which seeks to communicate using text and image. Successful visual communication occurs with the excellent execution of design basics. As per the conclusions drawn below, we believe that the games we examined all used the core graphic design principles (Section II), despite varying genre and platform.

1) Grid: All games analysed showed evidence of columns, boxes and alignment, and consistency of placement, which implies the use of a grid system. Some UI set-ups appeared to be more complex than others, requiring a grid which was at once structured and flexible. This speaks to the genre of each game. For example, where "Monument Valley" (designed as a mobile app) is by necessity very simple, touchscreen orientated and reliant on user intuition rather than an expansive UI, "Destiny 2" (designed for PC and console) has a long narrative arc, involving many and varied elements (such as a curved diegetic HUD hinting that its projected on the players helmet visor and non-diagetic UI screens, icons and tools and meta pop-up layers).

2) Hierarchy: All games analysed used some form of typographic element, with associated hierarchial features, to pass on information to the player - be they complex as 'Destiny 2' or 'Forza Horizon 5', or more simple in their communications like 'Firewatch' or 'Monument Valley'. Visually, hierarchy was also achieved through use of colour, layering and transparency, to make certain UI features stand out as the player required.

3) Scale: Knowing appropriate scale to use for digital outputs is crucial to a working UI. If button scale is too large, or text too small, the usability and balance of design is thrown out. All the games analysed in this paper displayed variance, but addressed issues of scale appropriately. Some used scale to bring hierarchy to their UI designs whilst others were more dependent on visual contrasts and scale to lead the player.

4) Balance: Some of our analysed games, such as 'Firewatch' and 'Monument Valley' were clearly quite symmetrical in structure, with centred elements and space around the action onscreen. This applied to their UI as well, which appeared simple and easy to identify. Deliberate asymmetry was harder to find, beyond stand-out examples, such as "Persona 5" which straddled the line between chaos and order. Asymmetry for balance in all games was present to a small degree, but in terms of the UI elements edged much closer to favouring symmetrical and harmonious, easy to navigate results.

5)   Framing: All games analysed adapt to a frame of some kind (and have a margin to work within, where no information will cross). Some, like "Hades", use the more literal version of the concept to put containers around UI elements. All of the games analysed used boxes for information and/or imagery in their UI executions at some point, and many (like "Forza Horizon 5") dynamically cropped imagery in their UI screens to help lead the eye.

VI.   CONCLUSION

Graphic design principles, applied appropriately and with consistency and forethought, can increase positive user experiences with game UI and assist in the clear communication of information critical to gameplay. In an analysis of 5 core design principles as they apply to a range of computer games, there is evidence of all being utilised, despite the disparity in game genre (be it isometric, first-person shooter, action-adventure, racing or Zen puzzler). The complexity of game structure and choice of UI style often dictates to what extent the graphic design principles play a role. This paper presents an analysis into graphic design principles to examine whether the core elements present from a communication perspective. In future studies, we plan to conduct a set of user studies to measure user experience and test the players' immersion in gameplay to investigate whether the UI elements work well in placement for console and across all screen types and sizes.

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