Review of Gestalt 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 Gestalt Principles in computer games. Our hypothesis is that Gestalt Principles can be used in games to improve user engagement with the Graphical User Interface (GUI) and this in turn affects User Experience (UX). First, we define the key elements of the Gestalt, as they apply to graphic design. Then, we demonstrate how Gestalt Principles are used in computer games and discuss how this may affect consumer behaviour and GUI design for games.**

Keywords - computer games; GUI design; Gestalt principles; user interface; analysis.

I. INTRODUCTION

Consumer behaviour is associated with the study of consumers and their activities, associated with the purchase, use and disposal of goods and services. It is driven by how the consumer's emotions, attitudes and preferences affect buying behaviour. The Gestalt theory helps us to understand which visual elements are most effective in certain positions and how these cause behavioural changes in consumers, affecting primarily their perception and attention.

Developed in the early twentieth century by the German psychologists, Wertheimer, Koffka and Kohler [4], the concept of Gestalt Principles began with a psychological study into vision; what the eye or the gaze perceives and comprehends about what it **sees** [1]. The discovery was that the brain's natural tendency is to group smaller elements into a larger, more complete picture, to "find and create order" [2]. The overarching concept being that by reducing the sum of parts to a whole, we are producing an ultimate simplicity of form.

The application to graphic design is that in visual communication we can direct the user or viewer to comprehend patterns of association - to take in and process hierarchies of information more easily - and therefore create an order of importance which allows for direct and simple understanding [5].

Gestalt Principles are incorporated as part of the overall design process in computer games, to assist the designer of GUI to simplify what could be quite complex informational structures, and thus improve the overall user experience of gameplay, by providing logical and rational visual choices for player direction and selections.

The Gestalt Principles in design involve perceptions relating to space and form.

We observe those visual relationships are based on the principles of:

1. **Proximity**: space forms, or separates, groups
2. **Similarity**: similar elements will form a group
3. **Common fate**: change can occur as a group
4. **Figure/ground ambiguity**: negative or positive space can be used to manipulate the eye
5. **Closure or continuation**: of lines and structure – we close gaps in recognisable objects ourselves or are directed by repeated or continuous elements.

Graphic designers take advantage of these visual comprehension tendencies, employing design strategies to incorporate them, such as:

- reducing elements to **basic shapes.**
- using **positive and negative space**, both foreground and background.
- using **pattern** (or disruption of pattern).
- using '**the known**' to challenge the viewer to fill in missing information or identify shapes.
- utilising **grouping modes,** which include simplicity, similarity, proximity, closure, continuity, and symmetry.

Whilst analysis of Gestalt Principles as an element of graphic design for print and digital spaces are plentiful, investigations and evaluations for review or comparison into Gestalt Principles as a strategic approach for the unique, highly interactive nature of computer game GUI, were hard to come by, and have inspired this avenue of research.

In Section II, we look further into the graphic design techniques used to apply Gestalt Principles. Grouping modes represent the strategy we use to incorporate the Gestalt into our designs, and we will examine the use of these modes in several computer games in Section III. A general analysis of Gestalt Principles in our selected GUI examples (Section IV) and the conclusions drawn from this (Section V), finalize this paper.

II. GESTALT PRINCIPLES: WHAT WE KNOW

By grouping related elements into wholes, we target simplicity. This allows us to understand large tracts of data more easily. How we read a visual communication is

complex and involves appraisal of the visual hierarchy (setting an order of importance), including: viewing or reading patterns, such as in a 'Z' or 'F' pattern (Figure 1), graphic and typographic content, and narrative features [10].

GUI is the interactive element of computer 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" [7].
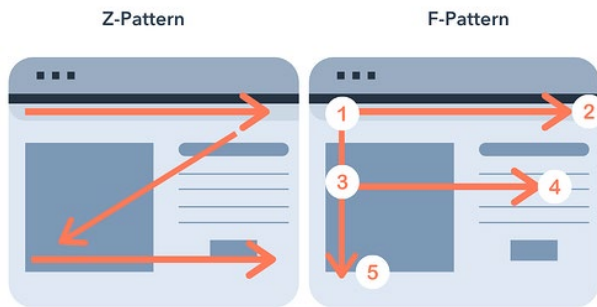

Figure 1.   Patterns of viewing [10]

The focus of graphic design in this setting is to design appropriately for the aesthetic and technical functions of the game design, as multiple user interface styles may be used within the one game. UI in games takes on different forms, such as **diegetic**, which involve elements that exist within the game world, or **non-diegetic**, referring to an on-screen UI element that is separate from the game world [11]. Other UI types are **Meta**, referring to elements which exist within the game world (and are used as a form of UI) and **Spatial**, which often appears as an element, or pop-up, appearing in the game but is not of the game world [7].

A. Reducing elements to **basic shapes**

Figure 2.   Example of basic shapes

In visual communication, we can reduce complex ideas into simple graphic representations (like Figure 2), by incorporating a type of 'visual shorthand', as in use of iconography and, more recently, 'emoji' [1].

Icons, like logos, are simple graphic devices that we infer with meaning, due to the associations we imply from the shapes used in construction of those elements. An example (Figure 3) shows male and female sides for the bathroom, and we understand (without any text to describe), which side is which based on shape alone.

Figure 3.   Icons for male/female bathrooms [23].

Development of icons is an oft-used design tool, to cater toward simplicity of communication, and is indeed a universal language which crosses dialect and cultural barrier, not unlike use of colour, which can have some universal associations such as the red, green, and yellow of stoplights [3]. In computer games, too, we use icons and basic shapes to designate functions of UI, such as in Tool Bars or Backpacks, where multiple actions may be stored in shaped unit blocks, with basic icons inside (see Figure 11).

B. Using positive and negative space

According to Lupton and Phillips, Contrast plays a key role in the separation of "figures (forms) from the space, color or patterns that surround them" [2]. Using overlapping elements to create ambiguity as to the positioning of fore and background, the meaning or narrative within the negative or positive space created reveals itself, as in the example movie poster for "Brave," by Pixar [12], in Figure 4. Here we can see both the figure of a girl with wild red hair on a black backdrop in the positive space or foreground, but also and a bear's head in the negative, or background. This is a clever way of incorporating two perspectives of the same narrative.

Figure 4.   Positive and negative space, "Brave" by Pixar poster [12].

C. Using pattern

Pattern can manifest as both a behavioral, and graphic, occurrence. Certain repetitions of graphic may also prompt patterns in behaviour, encouraging players to do the same action or sequence of actions repeatedly.

Patterns have power, both in terms of continuity and regularity of shape, but can also be dynamic. When a break in pattern occurs, a deliberate disruption of order is intended. Patterns can take many forms, as an aesthetic choice in a background, exampled by Figure 5 [15], or gameplay related, such as a pattern-based puzzle within a game (Figure 6) [21].

Figure 5.   Example of a literal Pattern in "Cozy Grove" by Spry Fox [15].

Figure 6.   Example of a puzzle Pattern in "Wolfenstein II:The New Colossus" by Bethedsa Softworks [21].

D. Using 'the known'

Links and associations with known shapes and ideas allow the designer to use clever visual tricks, and combinations of concepts, to pull together multiple meanings into singular graphics. As noted with the design of icons or logos, we can reduce complexity by relying on pre-conceived notions or visual memory.

In the logo for "The Good Avocado," Figure 7 [22], the designer has taken a universal symbol for good (an 'OK' hand gesture) and within the negative space created placed an 'avocado' shape. Because we know what an avocado looks like, our prior knowledge, we can make the appropriate association.

Figure 7.   "The Good Avocado" logo by TwoFromTwo [22]

E. Utilising grouping modes

As mentioned in Section I, the main grouping modes for Gestalt Principles are:

- Proximity
- Similarity
- Symmetry
- Simplicity
- Continuity
- Closure

The natural tendency of the mind to group and structure complex objects or even concepts back to simplicity, give us the ability to demonstrate these groupings easily in most design settings, including computer game UI. We will explore this in Section III.

III.   AN ANALYSIS OF GESTALT PRINCIPLES IN GAMES USING GROUPING MODES

How do Gestalt Principles affect the design of UI? It is worthwhile examining a small selection of games with different visual layouts to identify where these principles exist and how they are beneficial to design.

Modes of grouping are a useful way to address how Gestalt Principles interact with the user in a games format – and here we discuss where in the GUI of a game these principles can be clearly seen in action.

A. Proximity

Proximity is used as a design strategy, to position elements in such a way that they, due to their location in relation to other elements, become related – and thus are grouped together. Proximity is a tool used by designers to develop hierarchical forms, be they graphic or typographic.

This connected spatial relationship allows the viewer or user to identify where elements belong and direct the eye or "gaze" (Lupton, 2015), as seen in Fig8. Proximity is one of the most widely used Gestalt Principles in games, as the interactive nature of the medium makes it crucial to give swift and easy visual access to UI tools, and information, therefore the creation of relationships through Proximity assists with this. The limited screen area also dictates the placement and size of these elements, along with the genre and style of game.
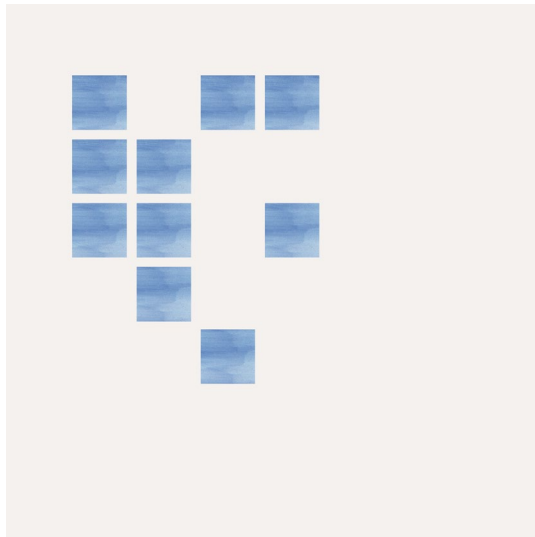
Figure 8.   Example of Proximity

In the example (given in Figure 9), from "A Total War Saga: Troy", by Creative Assembly Sofia (2020), we note the Skill Tree elements are all round, and the same size, but divided into five separate areas of Skill.

Figure 9.   Example of Proximity, "A Total War Saga: Troy" [17].

Proximity links the Skill sets, but also separates them - as the proximity distance is increased between sets but decreased between individual circles – to connect them together, along with their paths, and create specific groups.

With the box element encasing these shapes, we can clearly perceive a set of five different Skill Trees, related but separate.

B. Similarity

Our viewing patterns tend toward creating order, to organize concepts in a rational way, and group what we see. In this example (Figure 10), the similarity of the objects allows us to create two distinct groups (circles and squares). This, like Proximity, also plays to maintaining simplicity (another grouping mode) of form, and designers use this principle to link graphic representations.
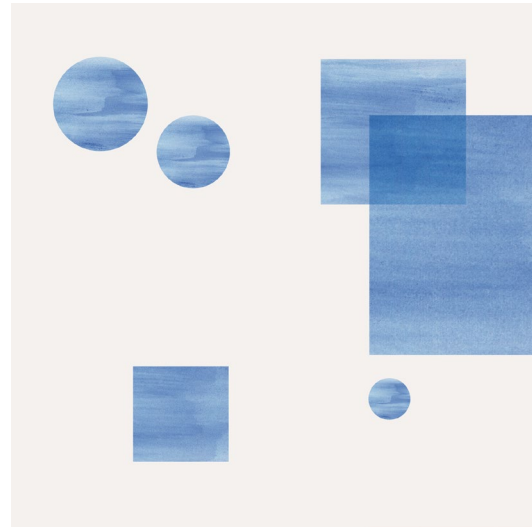

Figure 10. Example of Similarity

As this concept applies to game UI, we often see similar shapes repeated throughout to indicate specific information or apply hierarchy.

In the example from "Cozy Grove," (Figure 11) by Spry Fox, the small, rounded squares all contain icons related to collected objects, acquired skills or inventory in some way. Our eye recognizes these shapes as belonging to the content system of the game, as the same forms are repeated for like-structures relating to the character played (such as the Backpack, Weapons or Skills, Inventory, Chests).

Colour, here, also plays a part, indicating a specific informational hierarchy. This can be seen from the use of a pop colour (jade green), which draws the eye to the icons, encouraging us to click and reveal the objects within.
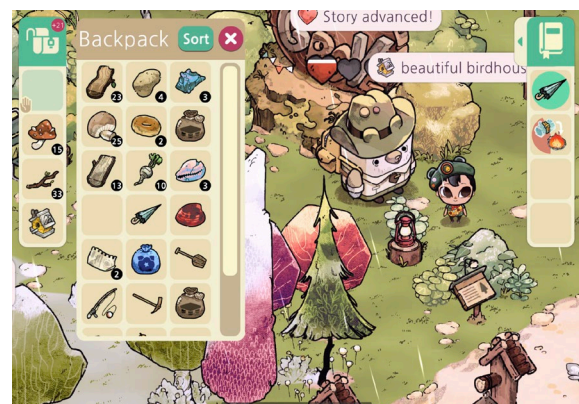

Figure 11. Example of Similarity from "Cozy Grove" by Spry Fox [15].

C. Symmetry

Creating balance in a design is often the function of Symmetry (see Figure 12). Symmetry gives rest to the eye and where asymmetry challenges and provides dynamic differentiation, symmetry balances with a certain neutrality.
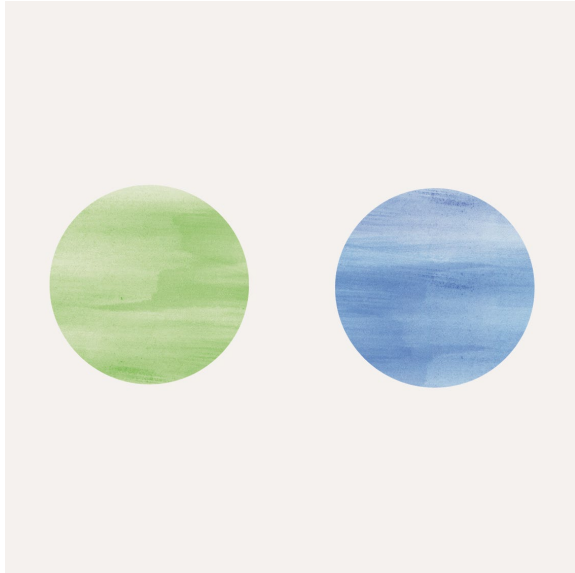

Figure 12. Example of Symmetry

Figure 13, the "Fortnite" UI, by Epic Games [18] shows a central character, with symmetrical UI elements of text and image on either side. Whilst content may vary, the space allowed - using a grid or column system - is clearly designed to show symmetry (and thus balance the visual).

Figure 13. Example of Symmetry from "Fortnite" by Epic Games [18].

D. Simplicity

The goal of creating a great game UI is to communicate all necessary information to the user or player in the clearest and simplest of terms, appropriately and in keeping with the mood and style of the game.

Simplicity of communication in a game UI, could be utilizing iconography to interpret specific information, such as in the following level map from "Anthem," (Figure 15) by Bioware [13] and as such, reducing elements to basic shapes (Figure 16).
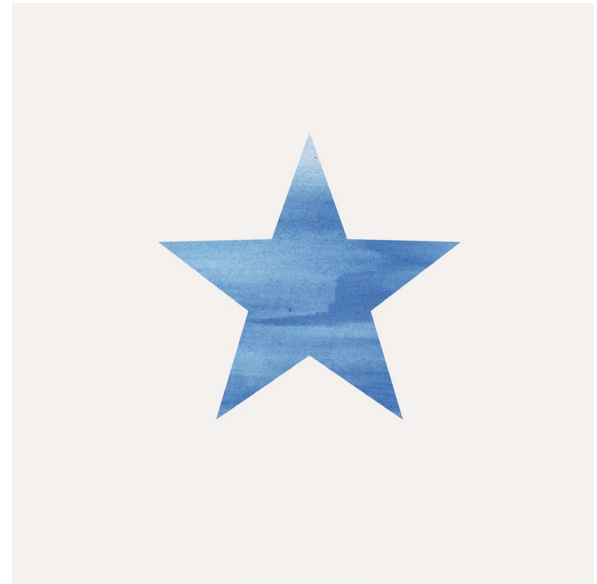

Figure 14. Example of Simplicity

Simplicity, in terms of use of space, is also a factor in UI design, keeping the playing area clear and tools accessible, as demonstrated in a padlock input execution (Figure 17), in "Firewatch", by Campo Santo [15]. Here we see an expanse of unencumbered screen space, drawing our attention to the minimalist design elements of simple linework icons and text. This serves to shift the eye of the player to the desired UI features and perceive immediately how they are to interact with them (use the 'up' or 'down' icons, to achieve the correct number combination).
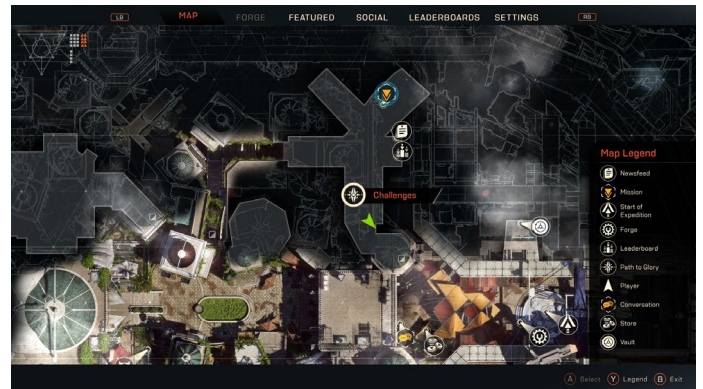

Figure 15. Example of Simplicity, iconography in a level map from "Anthem" by Bioware games [13].

Figure 16. Example of Simplicity, iconography in a map legend from "Anthem" by Bioware games [13].
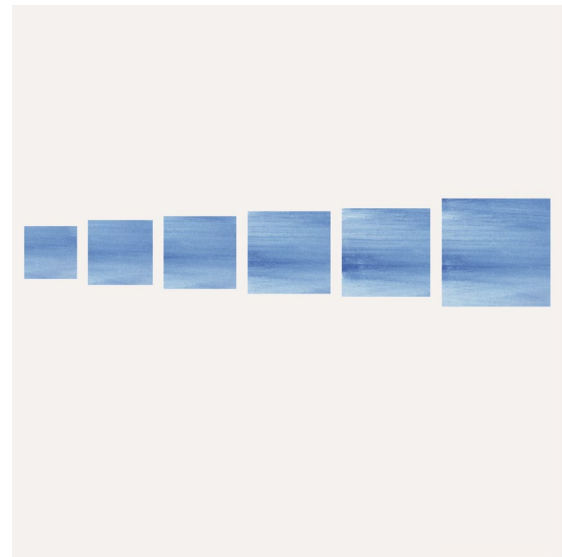

Figure 18. Example of Continuity

Graham also points to the nature of time as being relevant here, as a flow of information or communication based on visual elements shows a certain progression [4]. Figure 19 is an example of a continuous line, where the driver can follow a line of 'best fit' for the roads or tracks available [20].

Figure 17. Example of Simplicity, UI text and icon elements in "Firewatch" by Campo Santo [15].

Figure 19. Example of Continuity, showing a blue, continuous driving line (arrows) from "Forza Horizon 5", by Playground games [20].

E. Continuity

According to Graham [4], the eye looks for relationships, through the space between elements, thus "continuation occurs when the eye follows along a line, curve, or a sequence of shapes" as seen in Figure 18. A designer can facilitate this in several ways, from linework or animations to direct the gaze, or harnessing Proximity in tandem to bounce the eye from shape to shape, colour to colour.

F. Closure

The title screen from "Anthem," (Figure 20) by Bioware games [13] is a classic example of how the mind perceives Closure. We know the name of the game, and despite the elements placed in the way of our visual comprehension of the word, "Anthem," we are still able to complete the association. Our minds close the open letters (such as the A) and fill in the blanks of information we do not have (such as the incomplete M, E or H).

Figure 20. Example of Closure from "Anthem" logo, Bioware games [13].

Closure also comes to the fore in UI, where a sense of time or completion need to be visualized, a notable example of which is present in the loading icon for "Darksiders" (Figure 21) by Vigil/Gunfire Games [14]. The icon is circular in nature, a commonly used structure for time-based animations (as the progression can continue seamlessly in a circular device). We know, however, that this progression must end, or close, for us to move forward in the game, so our eye is anticipating this occurrence.
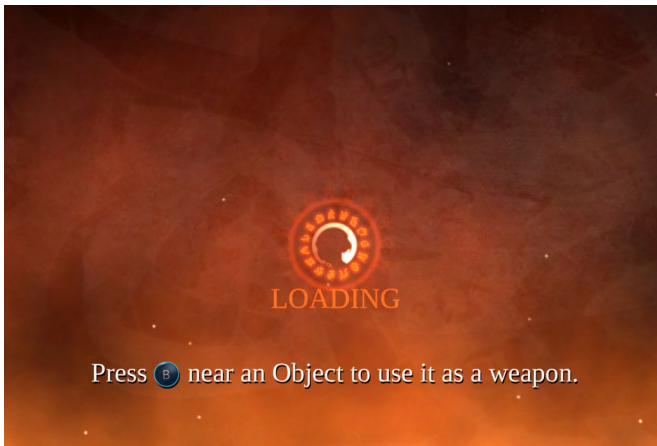

Figure 21. Example of Closure from "Darksiders" loading icon byVigil/Gunfire games [14].

A similar circular graphic animation, indicating loading time, can be seen in a game for mobile/tablet, "Animal Crossing: Pocket Camp" (Figure 22) by Nintendo [19]. The UI analysed also includes a download bar with a similar Closure-based principle – in this graphic we await the end of the download, and finalization of loading.
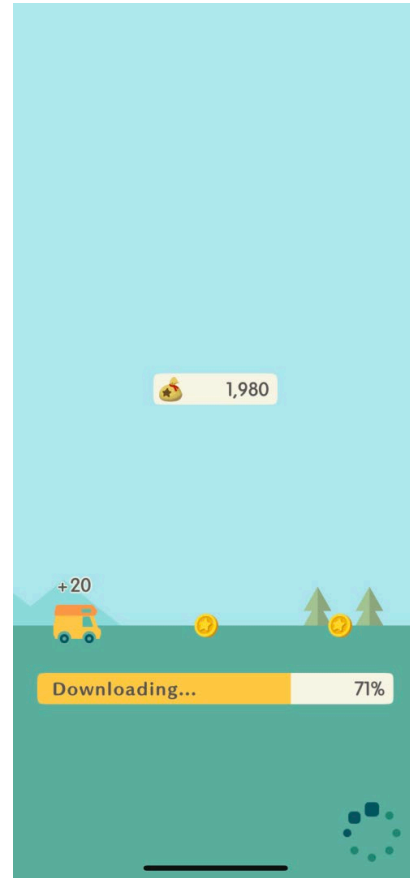

Figure 22. Example of Closure from "Animal Crossing: Pocket Camp" by ND Cube/Nintendo, download bar [19].

IV. ANALYSIS OF GESTALT PRINCIPLES AS UTILISED IN GAME UI

The UI of a computer game is an informational, directive and interactive action tool. Unlike the design for a logo or magazine spread, the utilitarian nature of such a digital, user-based design necessitates clear and swift communication of information, logical placements, and proximities – and thus the appropriateness of incorporating some aspects of Gestalt Principles in design (those which require deciphering or complicate the overall navigation) may be undesirable.

A. Underutlised Gestalt Principles in computer game GUI

1) Figure/Ground Ambiguity: We may see this principle used for in-game design (where heavy contrast may be needed, or in animations or graphic designs in the game environment), or utilised as a design device in marketing for games, but it could be argued that creating ambiguity is not a goal of UI design.

Dynamics, it could be argued, should give way to symmetry, legibility, and clarity and, in an overall sense, a more utilitarian design response which puts direct communication to the fore to enhance comprehension.

B. Review of Gestalt Principles in computer game GUI

Computer games are a media in which the principles of the Gestalt, as applied to GUI graphic design, can be easily observed. Indeed, the interactions required of the user demand we consider the visual perceptions, prior knowledge, and diverse ways of seeing of the player.

1) Proximity: Establishing relationships between elements is the goal of Proximity, and our analysis reflects this, with many games using this principle to link (or separate) graphic elements.

2) Similarity: This principle exists throughout game UI in general, as similarity is one of the key visual touchpoints for recognition and therefore response. If simplicity is the goal of an effective UI (to promote clarity and functionality), the use of shape and colour works to not only differentiate, but allow navigation through like objects as well.

3) Common fate: Elements regularly used in computer games such as directional menus or sub-menus demonstrate this principle by continually opening or tracking in the same direction and ending when the desired outcome is reached. Elements of Continuation also exist in this Gestalt Principle, as often a Continuous line will have sections repeating to the same end (Figure 19).

4) Figure/ground ambiguity: This principle applies less to GUI design than it does to the brand and marketing of games, such as in logo design, where mood and graphic creativity are necessary to attract attention and differentiate through contrasts and clever manipultion of forms. Elements containing or displaying overt ambiguities are less functional, and therefore could cause confusion in the UI space.

5) Closure or continuation: Closure, again, relates more to static logo designs traditionally, but could be seen to be used in any progress-related element which necessitates an end point, such as a progress bar or loading icon (Figure 22), as our eye naturally seeks to close or end sequences [8]. Continuation can be seen in linework, colour referencing and animations throughout UI spaces [4], sometimes even within gameplay, along with patterns or animated elements which loop or run parallel to the action (as in Figure 19).

V. CONCLUSION

Gestalt Principles have long been recognized around interactive media and User Experience (UX) [6], as being a product of psychological reaction to, and perception of, how a game functions or is designed [4]. This paper, however, has presented a brief analysis of how Gestalt Principles, as applied through the lens of graphic design in game GUI, are used within that sphere to influence and engage the user from a practical standpoint. This analysis suggests that Gestalt Principles are certainly a part of the overall UI design response, utilizing the knowledge gained through established "ways of seeing" [2] – from use of Simplicity to create clear and easily understood graphics in an inventory,

to Proximity to establish navigation routes through a complex talent or Skill Tree. UI design, and therefore the user or player at large, can benefit from the application and assessment of these basic principles.

The strength of the Gestalt theory lies in its ability to provide support to marketing and graphic design activities, by providing more engaging content that stimulates the user attention and perception [9]. In this paper, we have demonstrated how Gestalt principles are applied to GUIs in games. In future studies, we plan to investigate the relationships between Gestalt principles in game GUIs and the game's commercial success, by doing a market analysis.

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