Tampere University of Applied Sciences

How Colours Guide the Player in Video Games

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BACHELOR'S THESIS
May 2023

Bachelor's Degree Programme of Media and Arts
Interactive media

ABSTRACT

Tampereen ammattikorkeakoulu
Tampere University of Applied Sciences
Bachelor's Degree Programme in Media and Arts
Interactive Media

KAURANEN, AINO:
How Colours Guide the Player in Video Games

Bachelor's thesis 64 pages
May 2023

The goal of this thesis was to gather information on how colours can guide the player in video games. The two main aspects researched were emotional and navigational colour guiding. This thesis also included a summary of accessibility regarding colour-blindness.

The beginning of the thesis delved into the basics of colour theory for the sake of understanding basic terms and theories, and some cultural aspects of them. The theoretical part of this thesis covered emotional and storytelling ways of colour including research on colour-emotion relations. This emotion part included topics of mood, tension, colour-grading and colour scripts. Game-related theory discussed was in form of talks from game developers, literature, articles and research studies. In the theme of navigation, topics of affordances, cognitive mapping, and UI were discussed. Throughout the thesis a variety of examples from different games with different aesthetics were provided.

The conclusions were that while there exist few research data on the impact of colour on emotions in gaming environments, its influence is still notable. Especially cultural differences affect the meanings of colour in many ways. The topic of colour is vast, and to completely understand its nuances a designer must research many different fields of expertise. The compiled information in this thesis could be used as a basic guide for developers to make more profound colour choices in game development, and to hopefully find new perspectives to the importance of colour in many phases of the design process.

Key words: game design, colour, emotion, environmental design, level design

CONTENTS

ABBREVIATIONS AND TERMS

FPS	first person shooter
HUD	heads up display
IGDA	International Game Developers Association
indie	small independent group
MMO	massively multiplayer online game
RPG	role-playing game
UI	User Interface
UX	User Experience

1 INTRODUCTION

This thesis is a dive into the world of colours through theory and examples in the video game media. How colours emphasize our feelings and guide the experiences based on many psychological, cultural, historical or taught principles. It's not just about physical guiding through colour and light, but also about how we are affected emotionally by the choices of colours during gameplay.

The start is simple colour theory to easily understand some of the concepts and terms regarding colours. Including some psychology and cultural implications of colour concepts in our society. Then the thesis continues to colour and emotion in video games with themes of storytelling, colour-grading and colour scripts. Second part is about navigation with affordances and signifiers, mental maps, lighting and UI, without forgetting the subject of accessibility. With literature, articles and research, the thesis also includes examples from different game developers talking about their design processes in their game projects.

Different colour combinations and lighting settings evoke a variety of feelings, and we can use that to emphasize storytelling moments or to physically guide the player through environmental colour language. Many basic design principles are linked to colour in some ways. It is important to carefully plan colour relations and sometimes even break the norm for a greater effect. It is not only about having a clear, easy to follow colour palette, but also to subtly suggest things and move the experience towards the wanted goal.

2 ABOUT COLOURS

Colours are often taken for granted and our choices for them are not always fully analyzed. However, they affect our emotional experiences and choices we make more than just serving as surface level aesthetics. In personal life we make a lot of choices for colours based on our own preferences, but in design we must think about the messages we want to tell the audience. Subtle shifts in mood can be conveyed through a well thought colour palette, or a player can traverse a world seamlessly by giving them both conscious and subconscious cues through paths of light and colour. To talk about designing in a coherent way a designer needs to know some of the basic colour theory to easily understand some of the concepts and terms. The fundamentals are essential to be known for being able to discuss theories in a clear way.

Rules can sometimes be broken for an impactful effect, but to do so it is good to know them first. Sometimes those rules are what society has set to us. As an example, from art history, in 1860s in Paris some new revolutionary painters, including the well-known painter Claude Monet, were starting a new impressionistic painting movement. Impressionism drew from the idea of inspecting rapidly changing lighting conditions outside and so being able to be more aware of how subtly colour and light change. (Tate, n.d.) They saw colours of the light and shadow as complementary colours where shadows were rarely just black or grey. Back then they were critiqued as being completely mad because for reasons like “trees are not violet”. People even came up with a word for it: “violettomania”. (St. Clair 2017, 166-167) However, they knew that the future was changing: “But Manet went further, proclaiming, “I have finally discovered the true colour of the atmosphere. It is violet. Fresh air is violet. Three years from now the whole world will work in violet.” “(Ball 2009, 207).

Even though people don’t really get criticized for using “mad” colour combinations anymore there are still many trends that come and go in the world of colour that affect our decision making. Video game industry has often followed the trends of movies in things like colour grading. It’s important to know how much and what kind of emotional journey a designer wants the player to be set on.

2.1 Basics of colour theory

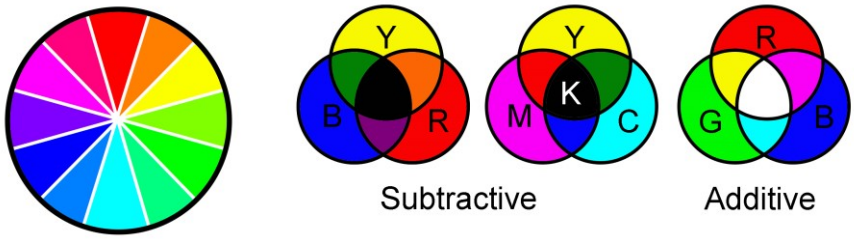
Scientific understanding of colours has a long and complicated history, and even the simple usage of colour hasn't always been so straightforward. For example, ancient Greeks thought colours were a range from black to white, or dark and light, with other colours in-between. Medieval scholars based their knowledge on this Greek literature for centuries. (Ball 2009, 15) It wasn't until the late 1600s when Isaac Newton came up with the discovery of a colour spectrum where black and white weren't colours at all anymore when we started getting towards the modern usage of colour palette. (Töyssy, Vartiainen, Viitanen 2007, 178) That is the basis for modern colour theory.

Even these days new discoveries are made in the world of colours. In 2009 researchers found a new blue pigment, called "YInMn Blue" (Davis-Marks 2021). Or some might have heard of "Vantablack", the black that absorbs 99,965% of light (Threewitt 2021). The world is ever changing in the subject of understanding and creating colours.

2.1.1 The colour wheel

There are a lot of different colour wheels in the world for different purposes. We are often used to seeing the classic traditional artist's pigment colour wheel (RYB), where the primary colours are red, yellow and blue. This is not able to produce the whole spectrum of colours and so RYB are not considered to be the true primaries. For that we have the other pigment colour wheel, CMYK, which means cyan, magenta and black, which has been used traditionally in printing media. Many painters these days use CMYK paints to come up with a wider spectrum of colour combinations than what the RYB ones offers (Picture 1). These two colour wheels are subtractive, meaning that when you combine all the colours they produce pure black in CMYK and something close to it in RYB (Picture 1). However, since RYB colours are not chromatically pure they don't produce a pure black like CMYK colours. Subtractive colour mixing is based on every added base colour absorbing more light and becoming darker. However, pigment colours are rarely optically pure without any black, grey, or white in them, like in case of RYB,

so no full black can be achieved. (Arnkil 2007, 74-78 & 84-85; Eckstut & Eckstut 2014, 18)

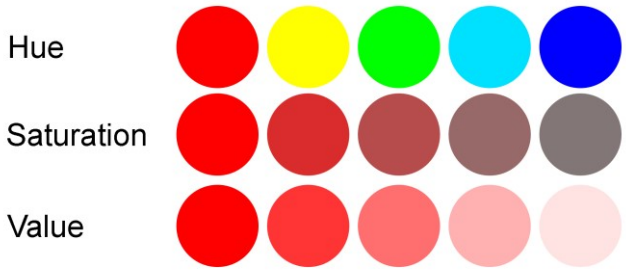


PICTURE 1. Colour wheel and mixing examples.

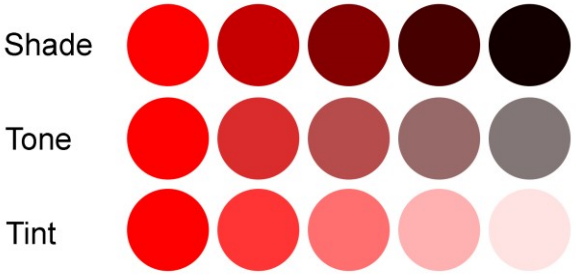
Subtractive palettes work with mixing pigments, but in the digital world we work with mixing light in additive way. The same cyan, magenta and yellow are still there, but are produced by mixing the light primaries which are red, green and blue (RBG). These colours when combined produce white because black would be the absence of light (Picture 1). (Arnkil 2007, 74-76 & 84-85; Eckstut & Eckstut 2014, 18)

2.1.2 Colour terms

When we talk about the properties of colour we can use terms like hue, saturation, value, tint, shade, tone and temperature. Depending on the context there are many different terms for the same thing. Hue is the pure base colour, position on the spectrum, like red, yellow or cyan (Picture 2). Saturation, also referred to as intensity of a colour or chroma, is about how pure the hue is with 0% saturation being black, white or grey. Value, also referred as luminance, is the lightness or brightness of a colour, from white (100%) to black (0%). (Töyssy et al. 2007, 178). For example, pure red is a high saturation colour, with dark red being lower in saturation. A tint of a colour means adding white to a pure hue making it lighter, while shade darkens the hue by adding black and tone adds grey (Picture 3).

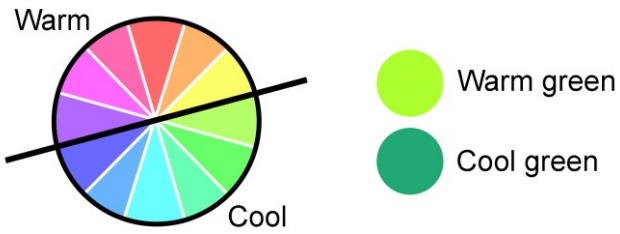


PICTURE 2. Visual representation of hue, saturation and value.



PICTURE 3. Visual representation of shade, tone and tint.

Colour temperature is mentioned in everyday life when talking about lighting conditions, like choosing a proper lightbulb for home. However, in art colour temperature in its simplest form means that blues and greens are considered cool colours whereas reds and yellows are warm colours (Picture 4). Warm colours are thought to remind of warmth and cosiness and cool colours bring feelings of peace and calm. (Canva n.d.)

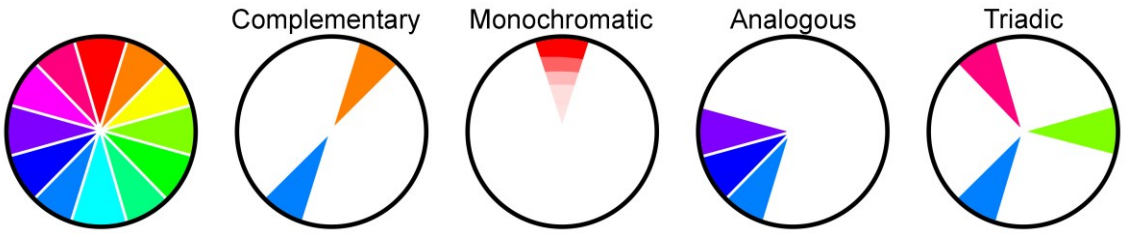


PICTURE 4. Warm and cool colours.

However, we need to remember that all primaries have their cool and warm properties. As an example, a green that's been mixed with yellow or orange is a warm green and a green mixed with blue or purple is a cool green. (Townsend 2017)

2.1.3 Colour harmonies

Colours that are traditionally thought to go well together are called a colour harmony. Multiple basis for these harmonies exists varying from geometry, physics, and mathematics. (Arnkil 2007,118) There are several ones, but few examples of most common ones are complementary, monochromatic, analogous, or triadic (Picture 5). These work as a good building point for a colour palette for any design and avoiding a one that is way too busy. These harmonies produce contrasts that are considered visually pleasing.

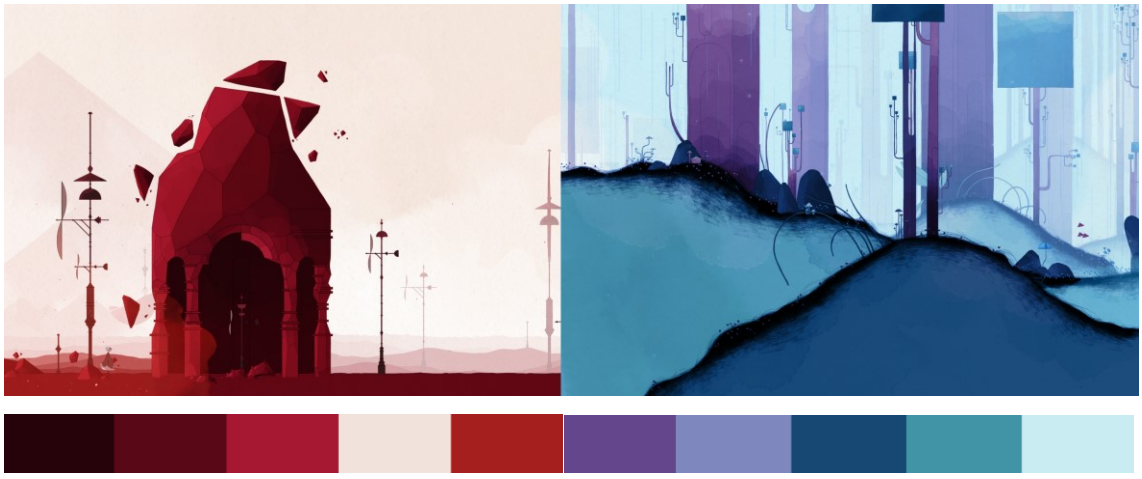


PICTURE 5. Four mentioned colour harmonies in CMYK colour wheel.

Using complementary colours (Picture 5; Picture 6) is one of the maybe simplest ways to highlight certain things and make them pop. Complementary colours are found on the opposite sides of the color wheel, like orange and blue. Like the name suggests they complement each other by their strong contrast and make each other appear more prominent. With this combination exists also the balance of warm and cold. We might easily find and example from many games where the overall map design is blueish in main color, maybe a building inside. And by bringing in some warm yellow and orange tones for example in a form of light peeking from windows we are already building a point of interest for a player.

PICTURE 6. Complementary colours in a game environment (Mirror's Edge Catalyst 2016).

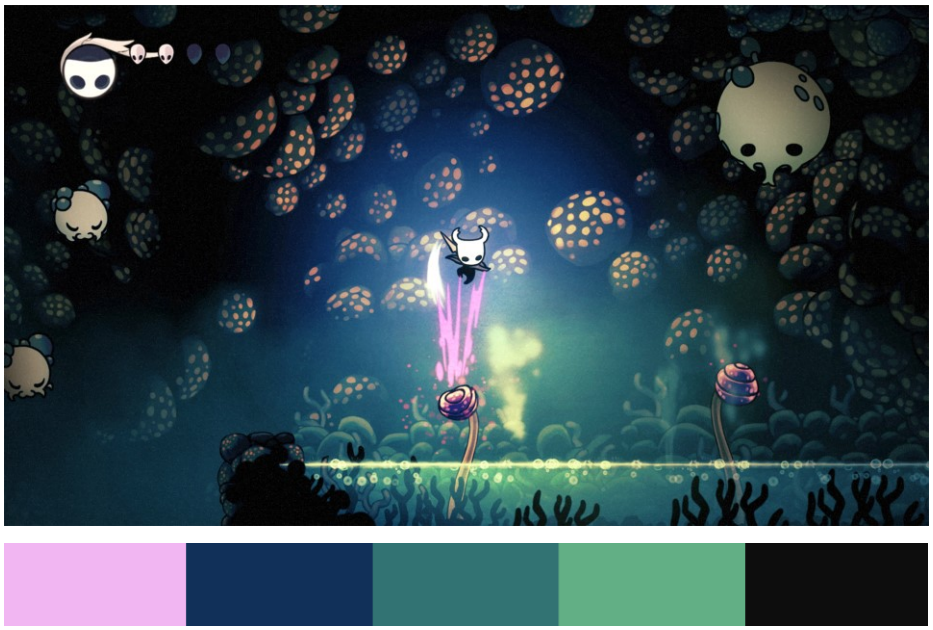
A monochromatic colour palette (Picture 5; Picture 7) is based on different shades, tones and tints of the one base colour. It's necessary to keep in mind to have enough contrast when using this palette. This colour palette is subtle and works to achieve a harmonious balance. When choosing a single colour as a base to work with it's important to know how it will resonate with the feeling and message that the designer wants to convey.



PICTURE 7. Examples of a monochromatic (left) and an analogous (right) colour palette in the same game (Gris 2018).

An analogous colour palette (Picture 5; Picture 7) is based on three colours side by side on the colour wheel. This is often used so one hue is the main colour and the rest are used less, as accents, to avoid being too overwhelming of a combination. It can be described to have less tension than other harmonies. (Kaushik 2021) With this palette it's also important to have enough contrast with the chosen colours.

A triadic palette (Picture 5; Picture 8) is three colours evenly spaced in the colour wheel. It works as a very contrast palette but with more options than a pure complementary colour pair. Balance of main colour versus rest as accents is very important with this palette since it can be easily perceived as very intense (Kaushik 2021).



PICTURE 8. A triadic palette in game design (Hollow Knight 2017).

There are also a lot of ready-made tools for playing around with colour harmonies and palettes. Some notable ones include Adobe Color and Canva. These can help to come up with ideas and easily test around different colour combinations. This thesis will include some colour palettes made in Adobe Color to see the used harmonies more easily in the chosen game pictures.

2.1.4 Emotional colour

A variety of things affect our perception and feeling of colours. When we look at different colours, we tie certain emotions and feeling to them. Impressionist painter Claude Monet created a series of The Rouen Cathedral in 1890s which includes over 30 pictures of the same cathedral in France during different times of year, day and light conditions (Picture 9). He was interested in how important lighting is to our perception of a subject. (Smee 2022)

PICTURE 9. A collage of 15 different versions of Monet's Rouen cathedral paintings.

These paintings convey beautifully the importance colour and lighting to tell stories and set up a certain mood. The oppressing, never structurally changing church goes through so many different feelings from one end of the spectrum to the other. From something soft and delicate to the feeling of impending doom. It's hard to scientifically measure these changes, but there is one for sure. These pieces can teach everyone about the importance of colour, even if they are not going for an impressionistic palette. There is an impact in the way even subtle changes can make a notable difference.

Baker-Miller Pink (Picture 10) is somewhat a notorious shade of pink that was found in 1979 to make people less aggressive by Professor Alexander G. Schauss. Reports were from “mixed to dramatic reductions” in perceived aggressive behaviour (Schauss 1985, 61).

PICTURE 10. Baker-Miller Pink.

It led to a boom in the usage of that particular shade of pink from prisons to locker rooms but these days the colour is very rare. There has been a lot of contradictory results in researching this pink shade after Schauss’ discovery. (St. Clair 2017, 114-115) This further proves the point of how subjective colour can be. Colour associations are also very strong. If a certain hue or shade starts getting associated with a certain environment, like a prison, it can change how people feel about it.

Personally, I have a very strong colour-related synaesthesia that affects my relationship with different colours at times in unexpected ways. Jamie Ward (2013, 50) describes synaesthesia as “One attribute of a stimulus (e.g., its sound, shape or meaning) may inevitably lead to the conscious experience of an additional attribute.” There are many examples of musicians such as Olivier Messiaen whose music was influenced by his perception of the colour of different musical keys (Ward 2013, 51). For me, when I see the colour of freshly cut grass, I taste salt in my mouth and a particular beautiful shade of orange feels like I have pieces of sand stuck between my teeth.

2.2 Culture and history

History and culture shape our perception of colour in many ways, often holding it back based on many religious beliefs. In 1666 Isaac Newton started experiments with sunlight using different prisms. Back then it was considered that pure white sunlight was a gift from God. And so, the way he was able to mix it and break it into different colours with a prism was considered blasphemous. (St. Clair 2017,

20) This and a simple act of mixing colour pigments was considered a taboo in Ancient Greece (around 300 CE). The scholars thought that mixed pigments are inferior to “pure” natural pigments and often referred to this as “losing virginity. (Ball 2007, 19) This fear of mixing colours started to finally get easier during the early Renaissance period.

For centuries colours have been used as symbols in religious and social rituals, such as weddings, funerals and rites of passage. Some examples are liturgic and family colours in different heraldic symbols. These are based on known rules that have been used to signify and strengthen religious or family-tied identities. These norms and traditions have made some colours to have symbolic meanings. (Arnkil 2007, 146) These have affected our perception of colours always and continue to do so. For example, St. Clair (2017, 111) explains how these days we associate pink to be a “girly” colour, whereas blue “is for boys”. Truthfully this hasn’t been a norm for very long and used to be quite the opposite. Blue was symbolic to the Virgin Mary and the men of power or soldiers were often clad in red. St. Clair writes that “In 1918 a trade publication affirmed that this was the “generally accepted rule” because pink was the “more decided and stronger color,” while blue was “more delicate and dainty.”

Early pigments were mostly restricted to very earthy tones with some exceptions, but the Industrial Revolution increased the amount available in quick succession. As different chemicals started to be manufactured, many different pigments were created as by-products of these processes. Some pigments were so rare and expensive that people who commissioned paintings had to buy them for their artists who couldn’t afford those themselves. (St. Clair 2018, 24-25) When colours started to have more significant roles in different cultures, they also became regulated. Colours started to signify different social classes from clothing to indoor furnishing. Earthy muted colours would signify lower class and more rich and saturated colours were for the high society. (St. Clair 2017, 33)

How we’ve talked about colours has also shaped our perception of them. Different languages have specific words for some shades of colours that English does not,

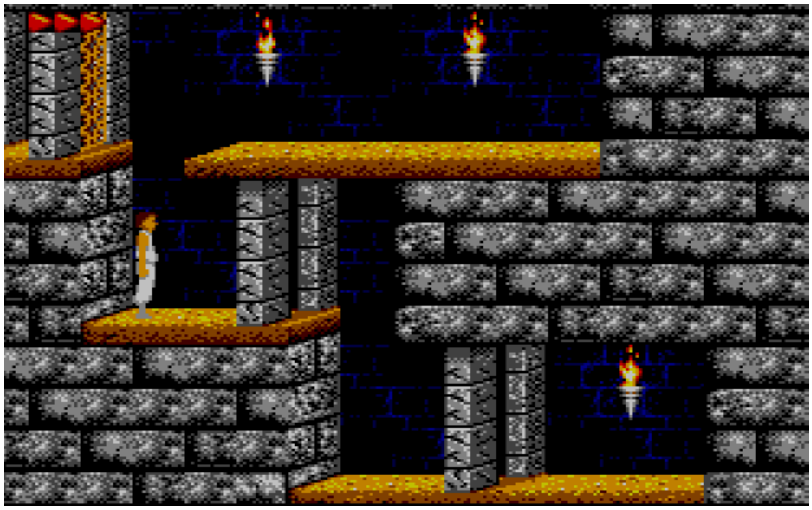
and some cultures divide the spectrums of colour differently from us. For example, Hanunóo, spoken by Malayo-Polynesian people in the Philippines, has four categories for colour, “dark”, “light”, “dry” and “fresh”. (Ball 2009, 15-16)

When using certain colours as symbols we must remember that these are not absolutes. These colours can have the opposite meaning depending on context and culture, or the form it is associated with (Arnkil 2007, 146). In the west black associates with things like grief and evil and white is goodness, enlightenment and purity. But if we inspect these colours in Eastern traditions, they have very different meanings. How wedding dress colour in western culture is white but in Chinese culture that is the colour of mourning. But just like in the west, in Japan it also symbolises the bride’s sexual purity. (St. Clair 2017, 42)

3 COLOUR AS EMOTION IN VIDEO GAMES

It could be said that the main function of colour in a video game is to make visual elements easily identifiable and ease the navigation process for the player. We play video games for many different reasons. Mostly to enjoy the gameplay or the story and to somehow feel relaxed or accomplished while progressing in the game's environment. Even if a player is not mainly interested in the visuals of a game a coherent colour palette with a purpose is a key element of any design.

Early games were restricted by technology in the amount and type of colours they could display, which is defined by the processor's bit depth. For example, depth like 1-bit is black and white, 2-bit is 4 colours, 3-bit is 8, 4-bit is 16 etc. 24-bits includes over 16,6 million colours and is considered the "true colour" requirement for realistic looking media, such as images. (PCMag, n.d.) First on-screen colour capabilities came around the 80s with console like Sega Master System. It had the ability to show 32 colours on screen, full palette being 64 (Copetti 2020). This continued to increase and in the early 1990s we got 256 colours with Super Nintendo (Copetti 2022). Later devices started to have technological and digital capabilities of millions of different colours. The simpler the era of the colour palette, the more different colours were used as identifiers for different enemies, or signifiers for items. When the palette and technology were restricted, means like palette swapping, dithering (Picture 11) or palette cycling were commonly used.



PICTURE 11. Example of dithering in Prince of Persia for Sega Master System (Prince of Persia 1992).

Cycling means switching colour mapping of a sprite to create for example, the effect of moving water. And dithering means creating gradient-like colour transitions to make it appear that there are more colours on the screen.

These days the bit depth exceeds the colours that the human eye can distinguish and with that comes the need for understanding the power of colours. With the right colour and lighting setup they can be used as pathways to guide the player to move forwards or hint at how some places can be accessible. For a smooth playing experience these guiding methods make players experience of traversing the maps fluid and don't require them to have much conscious thinking. In a simple example, a map design might be dark and moody and certain places there will be brighter in both colour and lighting to give people a centre of attention.

PICTURE 12. The game Journey guiding the player with complementary colours and environmental lights (Journey 2012).

Or it can be related to UI and how certain colour choices symbolize and signify certain things. A colour can tell the player which objects are interactable and which are part of the environment through things like different glows or certain colour coding. In Picture 12 the game has taught the player that the glowing pillar is something to interact with and progress to the next level. Of course, all these mentioned things can be used as a method to purposefully lead them to something quickly, or by removing these things the designer can also hide places for only the hardcore explorer player types to find.

This part onwards will mention GDC talks from different artists and developers. GDC, short from Game Developers Conference, is a yearly conference for different game developers where they give these talks about a specific topic of their interest. They vary from very niche topics to much broader ones, in categories of design, programming, business, art and more. (GDC 2023) These presentations are a great way to hear about industry topics right from the relevant people.

3.1 Studies about colour and emotion

Further on this thesis will talk about emotions, feelings and moods. Emotions are considered physiological, unconscious responses lasting short amounts of time. Feelings are conscious, physical and mental sensations based on our interpretation of emotions. They are often a mix of many emotions. Moods are made up from both emotions and feelings, frequently fluctuating. They can last longer than feelings or emotions. (McInnes, n.d.) There exist few clear studies on the correlations between emotions or feelings and colour which can draw clear conclusions. So many things affect these from personal experiences to cultural environments.

A study conducted by Joosten, Van Lankveld and Spronck (2010) points out that previous research of how colours affect players emotionally has been somewhat limited. According to them only few colours have been part of examination and the chosen games have been very simple. The third point was that “the adaptation of colours in order to influence emotions was considered to be outside the scope of the research”. Joosten et al. (2010) found out that in their experiment red evoked negative emotional responses, while yellow had positive ones. These emotional responses seemed the strongest with more inexperienced players.

In their 2015 study “How Color Properties Can Be Used to Elicit Emotions in Video Games” Geslin, Jégou and Beaudoin tested how brightness, hue, value, chroma and lightness affect the feelings of joy or sadness and confidence or fear. Except for hue their research implies that there is a correlation between these elements. The greater the colour saturation is, the greater the positive feelings

and the feeling of confidence. Less saturation correlates with feelings of sadness and fear. They also tested feelings of calm or excitement, but those results produced low correlations.

Another interesting study about linking a colour with a certain emotion was conducted in 2019 by Jonauskaite et al. about the association of yellow with joy and how physical environment affects that. They studied this colour-emotion link in geographical, climatological and seasonal ways. According to this study people who live further away from the equator or in more rainy climates have the strongest yellow/joy association, with Finland being at 87,7% and at the other end Egypt at 5,7%.

Later in 2020 Samy A. Azer raised some methodological concerns about the study of yellow by Jonauskaite et al. The first one was the big difference of participants from different countries, varying between 20-30 from some and over 300 from others. According to Azer (2020) this would not judge the cultural differences enough. The second point is that while the original authors did discuss the cultural and environmental changes, they didn't try to explain the results. For example, why the percentage is so low in Egypt and what cultural things affect that. Azer (2020) provides an insight through other examples how that colour has a negative impact in Egyptian culture. It includes sayings like when someone gives a "yellow-eyed look" it is used to express things like jealousy and envy. Azer (2020) summarizes the text by saying that the study is still important for further advancement of understanding the topic. But to properly analyse these kinds of results it would help to understand different culture's idiomatic expressions.

Studies seem to have certain similarities in how players feel about certain values, brightness etc. in games, but not so much on hue. This is influenced by the cultural differences how different hues are perceived. Using red as the western tradition for danger has very different connotations in the east where it can be the colour of prosperity. However, there seems to be a lot to be researched about this topic in the future.

3.2 Emotion and storytelling

Even categorizing emotions can have different ways and viewpoints regarding videogames. Frome (2007) suggests that video game related emotions should be put in two categories: game emotions and narrative emotions. Game emotions are related to competitiveness: feelings of loss, win, annoyance and success. These emotions can also be present when watching a game. Narrative emotions are about the characters, environment and events.

Frome (2007) also discusses artifact and ecological emotions. Artifact emotions are “emotions of aesthetic evaluation”. Ecological emotions happen when the player responds to something that is happening in a video game the same way they would in real life. A startled reaction out of fear after a jump scare in a game would be an ecological emotion of fear, but our reasoning system keeps us from running away. It can be good to remember the complexity of video games as an form of media and art and remember how the gameplay aspect affects them.

3.2.1 Setting the mood

People make first impressions of things they see in a matter of few seconds. This means that when the player first sees the start of a game, they have already made some kind of impression and have generated their first emotions. This is why a well formulated colour palette is an important part from the very first moments onwards. It instantly sets the mood and hopefully gives the player a sense of intrigue. Overton (2021, 16:20) discusses the importance of intentional colour in 3D lighting. She mentions in an example how a warm colour can be more appropriate for a certain mood, or a certain colour to make it feel silly or magical.

As an example of how mood has been taken well into consideration in game production is Firewatch (2016), a first-person mystery game set in rural Wyoming wilderness. The main character, Henry, lives in a fire lookout tower. The main way of communication for Henry is a handheld radio with another person, Delilah. In her GDC talk, the artist Jane Ng (2019) from the development team discusses some design choices they made for the game related to their emotional impact.

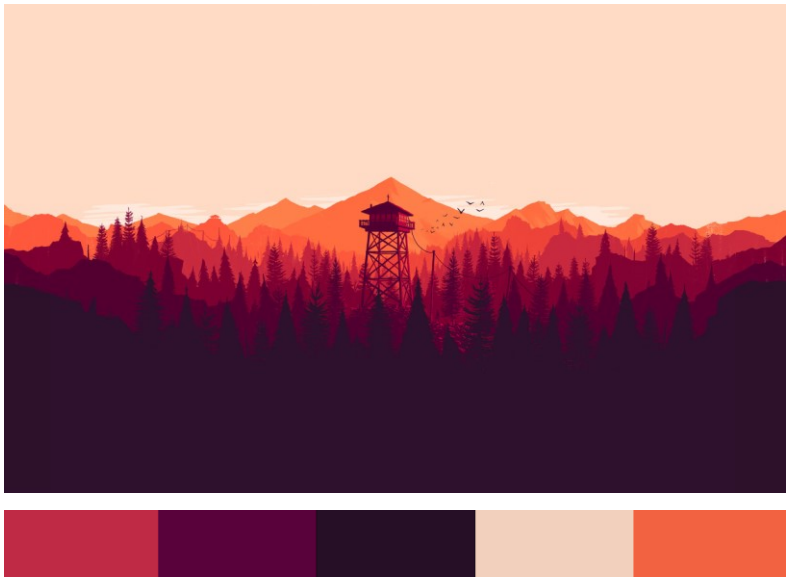
PICTURE 13. Screenshot from Firewatch (Firewatch 2016).

The art style of the game is heavily stylized, but they wanted the main character's story to feel real. In that case the environment had to be believable too (Picture 13). They wanted the player to feel connected to the main character's story. (Ng 2019, 4:40) In another GDC talk, Ally Overton (2021) of Spry Fox talks about some common visual problems in games. She mentions stylization and especially the problem of "too cute". Some of the elements of that are oversaturated colours or exaggerated proportions that don't always fit a game's wanted tone. (Overton 2021, 18:23) However, Firewatch threads this line well with the balance of saturation and proportions fitting the seriousness of the story.

Chris Remo (2021, 5:30) from the Firewatch development team mentions that their reasons for a first-person view was not only for the sense of intimacy, but budget reasons also, since rendering a full human character in third person would have been resource intensive. And this choice of point of view ended up highlighting the environmental art even more. He describes this art to be as much as in a character role as the human characters. Remo (2021) continues by saying: "It's an overwhelming and all-encompassing presence surrounding you, which suits a story about a man who's desperate to lose himself in a new environment away from his real life."

Ng continues with the importance of colours in the key art (Picture 14) of the game. (2019, 6:50) Each layer of colour gives a sense of great depth and distance

which fits the tone of a wilderness setting. The chosen colour palette evokes feelings of mystery. She also talks about how to translate that 2D key art into a 3D environment (Picture 15).



PICTURE 14. Key art of Firewatch (Ng 2014).

For that the colour of the sky was important to them since it's such a dominant element throughout the whole game. Not only for sky colours, but how it affects the whole lighting of the environment. They used a dynamic lighting solution that let them change colours on the fly and in specific points in the environment. (Ng 2019, 7:40-10:40) Besides the sun and sky changing colours the key element for getting that layered colour look was atmospheric fog (Ng 2019,12:05).

PICTURE 15. Screenshot from Firewatch (Firewatch 2016).

Ng (2019) puts the importance of colour in simple words, how they are not there just to look beautiful, but to set the right mood that the designer also recognizes. Since Firewatch is a narrative game at its core, they were very clear on what kind of moods they wanted each part of the game to have. Ng (2014) writes in their developer team blog about translating the concept art into the game and how it is about capturing the right feeling. It's not enough to pick the colours from the illustrations using the exact values. A designer must understand what the concept artist is trying to express as colours as their tool. The harmony between the art and what the player is feeling is important for them to get an immersive and realistic feeling experience (Ng 2019, 15:00).

Another example is from a game which narratively revolves around the main character's mental state, The Sea of Solitude (2019). It's an indie game where the colour palette is heavily affected by the emotional story. The game is about the main character's inner negative emotions that turn her into a monster and manifest to other creatures around her. In a GDC talk the CEO and Creative Director Cornelia Geppert talks about creating the game's visual language. Geppert (2019, 18:35) talks about how she wanted to give an overall sense of light-heartedness by choosing "holiday-like" colour palettes where the sun is shining and glowing rooftops give a feeling of sunny beaches (Picture 16).

PICTURE 16. Screenshot of Sea of Solitude (Sea of Solitude 2019).

They wanted to avoid surrounding the player with negativity from everywhere given the themes of the game. “As often as possible we put sunny weather part into the game to let the player relax before we push them into a tension again.”. The weather and so colour palette are connected to the main character’s mood. (Geppert 2019, 19:30)

In both game’s cases they showcase a good understanding of using colour harmonies. In Firewatch (Picture 14; Picture 15) an analogous harmony shines with a contrast of brightness. The intense oranges and yellows in the background pop thanks to the dark foreground. In Sea of Solitude (Picture 16) there are no dark shadows, but tone of the sunny feeling is conveyed through a well-balanced triadic palette. The contrast between the warm and cool toned colours works well in this composition.

3.2.2 Creating tension

Firewatch’s development team are not the only ones utilizing the meaning of the sky in environmental storytelling in games. Naughty Dog’s lead visual artist Keith Guerrette also talks about the importance of it, specifically in their game The Last of Us. It’s a story-heavy realism-styled apocalyptic survival horror game. He describes skies being often overlooked in design processes, but that they have a lot of power to change the visual portrayal of a game (2018, 1:20). The team recognized this power as a narrative tool very early in the process. As the time-of-day changes so does the directional light, highlights and form of the shadows. The whole shape of the environment and its composition ends up changing. Light has the power to change the material and the player’s perception of it. (Guerrette 2018, 2:30)

PICTURE 17. Concept art of The Last of Us (Concept art world n.d.).

He continues by saying how narratively the passing of time was very important to them, especially in the concept phase (2018, 4:00). Emphasis being on how the weather is a great tool for changing the tension in the environment and to foreshadow things to come or reflect on things of the past (2018, 5:00) (Picture 17). A looming storm cloud can be used to hint about future dangers, or a sun setting can bring the feeling of sadness when all the colours disappear one by one. A sunny day can bring comfort to the player. (2018, 8:30) (Picture 18) The complementary colour harmony of blues and oranges (Picture 17) adds to the tension of the concept art piece. In Picture 18 a bright yellow light brings a tinge of happiness to the otherwise calm monochromatic harmony.

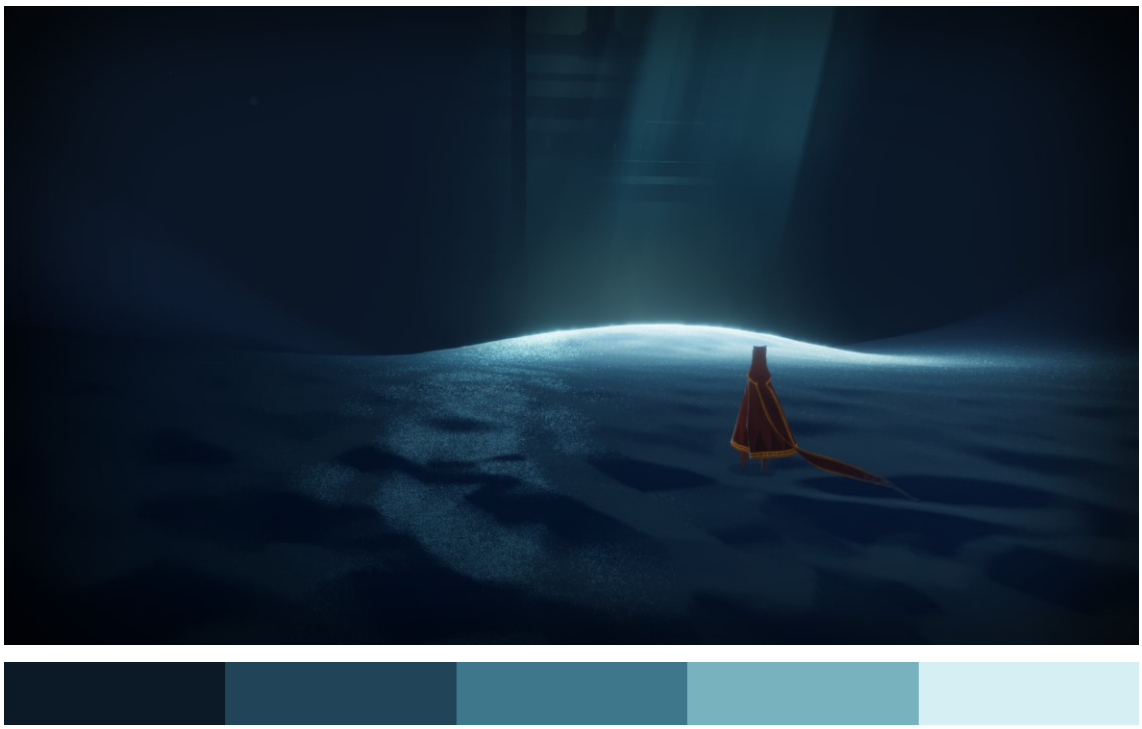
PICTURE 18. Concept art of The Last of Us (Sweeney n.d.).

Guerrette (2018, 6:10) continues by talking about the emotions of colour and how warm colours can have tones of energy and tension drawing the eye into them. Blue can be relaxing, cold and melancholic. In his opinion these basic colour theories are rarely applied to environments in production and skies are often overlooked in the design of visual experience for the players (2018, 6:40). The sky affects everything from tone to colour temperatures in a scene, including the narrative tone and leading the player's emotional experience. "The sky can be used as a tool to present to the player whatever tone or mood this character is supposed to be feeling, because we feel it too." (2018, 8:55).

The game Journey (2012) creates narrative tension with carefully curated colour palettes that also utilize the time of day in narrative ways. In this game the player controls a humanoid creature in simplistic environments starting from sandy deserts and continuing to explore the mysterious world in different colours.

PICTURE 19. Surfing down the sands in Journey (Journey 2012).

One notable sequence of scenes starts with the character surfing down huge hills of sand while the colour scheme shifts to strong oranges that feel like being hugged by that colour and sun itself (Picture 19). All while a rhythmic, upbeat music plays in the background. This surf lasts for a while, until the scene ends abruptly with the character falling into a dark blue hole in the ground. The stark contrast of the deep blues and silence hit hard after such vibrant and warm sequence (Picture 20).



PICTURE 20. Dark underground of Journey (Journey 2012).

This is beautifully foreshadowed by how before the fall the orange tones are joined by purples and together changing into evening tones. While keeping the feeling of warmth and comfort the notable ending of the day also symbolises the end of something else. The tone of the game isn't the same after this anymore. In both scenes the game uses a monochromatic colour palette. They work well in scenes that follow each other. The first (Picture 19) palette conveys a joyful feeling and then it rapidly changes to a more sombre scheme that feels reflective and ends up quieting the game's tone permanently (Picture 20).

A lot goes to crafting the wanted impact for the player. Whether it's a quick change in the whole composition and colour palette or something more subtle through the changing of the day. It's good to know that the meaningfulness of these choices is often considered very early in the design process.

3.3 Colour grading

Colour grading is traditionally the styling of the overall colour palette of the film footage or photography during post process. It allows the designer to convey a certain tone, unlike colour correction which is used to make content look realistic

(Adobe n.d.). In films a colourist will ensure that the wanted tone and emotion is properly conveyed through the right colour grading (MasterClass 2021). In games this is often achieved with the usage of different filters. Different game engines have different post-processing styles, many including colour grading options under different names. For example, Unity offers colour adjustments in tone, brightness, contrast, hue, saturation and luminosity among other options (Unity Manual n.d.).

In her GDC talk photographer and game developer Izzy Gramp (2022) talks about the importance of colour grading in games. Grading can be used to evoke certain feelings, like matching colour grading to an existing piece of media as a quote to them. The power of the technique lies in its subconscious effects. (Gramp 2022, 5:50) Colour grading doesn't have to be realistic, just consistent and based on a clear idea of what the designer wants to convey (Gramp 2022, 7:35). If the designer wants to go for a specific look from a specific time, they can research how the colour grading from that time looks like and replicate that. Sometimes grading is used to pass some regulations in certain countries, for example to change the colour of blood to remind us of something "less violent." Just like Monet's many versions of Rouen's cathedral (Picture 9, p.13) the emotional impact changes with the correct grading for each setting of a game.

Like the movie industry the world of games is also influenced by the fashion of its time. Many games and movies around the year 2010, had this shade of grey colour grading. These desaturated colours were used to give certain games a more realistic feeling, but often went overboard with the lack of colour. Resident Evil 5 (2009) has a notable green cast type of colour grading (Picture 21). When typing "Resident Evil 5 green filter" to Google search a lot of matches appear regarding the removal of that filter.

PICTURE 21. Green colour cast of Resident Evil 5 (Resident Evil 5 2009).

The sickly green filter can also feel appropriate to the game's tone. In the game the characters around the player have parasites inside them that burst out in different slimy formations. The green cast works as enhancing this ominous feeling. In movies one notable example is The Matrix (1999) where the filmmakers used a green colour grading during the simulation scenes to give the audience a certain sense of uneasiness (Elvy 2020). In Journey (2012) at a certain point in the game a green colour palette is being used to evoke similar emotions in the player (Picture 22).

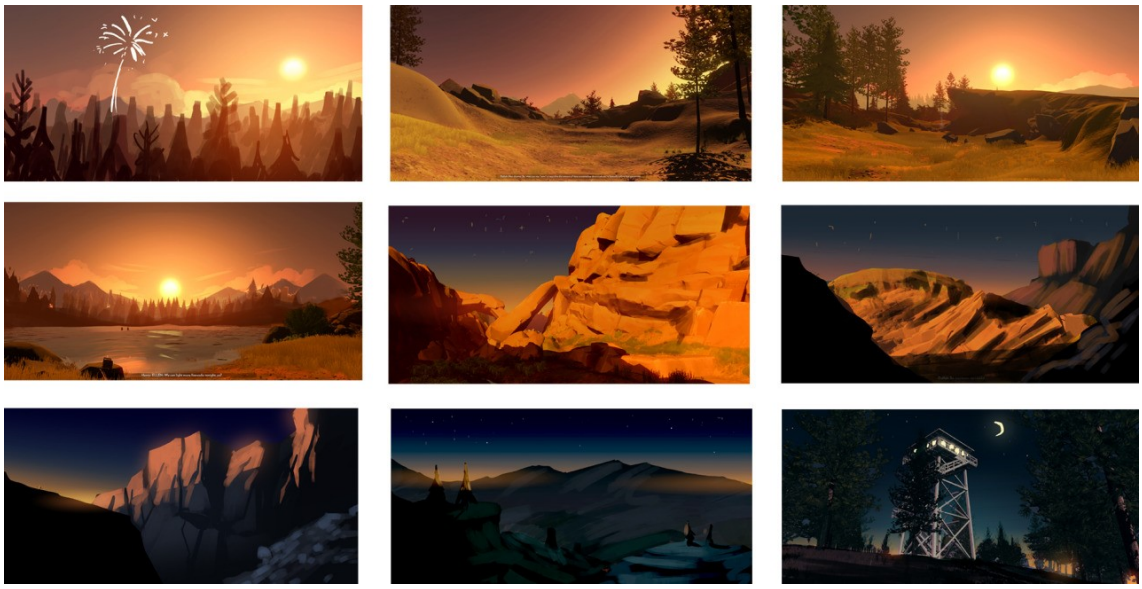
PICTURE 22. An oppressing green environment in Journey (Journey 2012).

The bluish green environment feels oppressing and almost suffocating, especially after the happy sunny sand areas in the game. The lighting is no more from the

sun outside, but cold and off-putting. The bright red of the player's character seems to also disappear in the depths of the green.

3.4 Colour scripts

Colour scripts are a pre-production technique often used in both video games and movies, especially animated movies, for mapping out colour, lighting and emotional moments. They are picture sequences used to illustrate the feeling and visual look like colour, composition and lighting of the final product before any assets get made (Williams 2020). Colour scripts can vary in style from very abstract colour blocks to finely detailed drawings.



PICTURE 23. Colour script of Firewatch (Ng 2014).

An example from game development colour scripts is from Firewatch (Picture 23). In their development blog Ng (2014) mentions a part their thought process regarding this: "Oh yeah—we should really have one, because we apparently all have different ideas of what DUSK means." In her GDC talk Ng (2019, 16:00) describes the colour scripts of the progression of their game. The team were doing these scripts early in production by picking important story locales and mapping out their colour palettes (Picture 23). Having a colour script helps with visual mapping of the player experience. It's good to be happy with it before art is fully produced since having to rework assets can be expensive.

In another example, Moon Studios art director Jeremy Gritton (2021, 8:00) talks about how during the production of their game “Ori and Will of the Wisps” one cinematic scene was changed from full night-time into night to morning transition (Picture 24). This was because the artists thought that full night scene would fall too flat visually.

PICTURE 24. Colour script for one scene of Ori and the Will of the Wisps (Gritton 2021, 8:55).

In the scene the main character creature flies on the back of his friend and the dark night turns into a morning. Gritton (2021) explains that the visuals now fit the character’s emotional journey as they get happier while the light gets brighter. Change of day to morning or evening has a lot of symbolic meanings for new beginnings or for an end of an era depending on the context.

The last example of a bit different colour palette is this colour progression chart for the game Journey (2012) (Picture 25). The chosen colours for each scene in the game follows the emotional progression of the story very carefully. Especially the first half has some in interesting colour harmony choices.

PICTURE 25. Colour progression in Journey (Art of Journey 2012, 69).

The smooth early game's orange monochromatic mysterious palette progresses to very cheerful complementary choices for a while, with pinks and greens. After that it transitions to the "orange hug" sequence (Picture 19) that ends up cutting the whole game in half both palette-wise and narrative tone-wise to continue with more cool sombre tones. In a way this picture and many of its level colour schemes are a reminder of Monet's Rouen paintings (Picture 9). The paintings are not telling any kind of story or trying to convey specific emotions, but both are works of intensified colour and light in nature. And they both are strongly emotional.

3.5 Content colour variation

A very easy and sometimes cheap way of prolonging the game experience and adding content to it is making colour variations. This has been used since the very early video games, mainly because of colour palette technological limitations. But a modern simplistic game can give the player a sense of more variety by changing for example the background colour between certain set of levels keeping the same graphics (Picture 26). Some games use map layouts that generate different colours and patterns to its worlds to keep them feeling fresher, so the player doesn't feel as the same environments repeat too often. These are

often used in games where the game world is quite big, so making everything unique wouldn't be realistic budget-wise.

PICTURE 26. Differently coloured procedurally generated biomes in Starbound (Starbound Official Wiki 2019).

If the game has a lot of icons, for example a huge variety of different items, changing the colour but keeping the same model or drawing adds more content in a cost-effective way (Picture 27). Colour might also work as an identifier for different types of items. More valuable types of items might be coloured in certain way, for example with a purple background or a glow.

PICTURE 27. Example of content variation in an inventory in Genshin Impact (Genshin Impact 2020).

As a developer it is good to know when to save resources and when to spend them. No player expects every asset to be always handcrafted as completely new if the game has a lot of them. However, a player base often has less patience

with bigger game companies who might release too many recolours of the same asset, for example skins that change a character’s appearance. These and other vanity items are often very wanted and recolours are frequently received with negativity. Developers must be careful when balancing on the line of what keeps the content fresh.

4 COLOUR IN NAVIGATION IN VIDEO GAMES

Leading players without breaking the immersion of the game is a challenging task. Colour and especially light is often used to aid players in navigating their gaming environments. Just like architecture, game environment must balance the elements of function and aesthetics, so the flow of the gameplay stays as the most important part (Byrne 2005, 241-242). Navigation, or wayfinding, is about being able to recognize the environments and created mental maps of them for later use.

Byrne (2005, 292) writes that in general players want to feel like they are in control making their own decisions, not being held by their hand. Guiding with hints and attracting attention, like subtle lighting will let them have that sense of freedom. Chung (2016, 17:45) compliments that thought with comparing real-life environments and their lack of a HUD or an UI. A player can feel respected when they can navigate the game environments like these real-life places without too much handholding from the designer.

Light is used to give points of interest to the player, as highlighting tool and to add visibility to the environment. Key lighting, which is used to highlight and frame key elements of the map, is often used as directional aid. Fill light is the overall light of the scene. (Byrne 2005, 262)

PICTURE 28. Anticipation and path lighting in Genshin Impact (Genshin Impact 2020).

Chung (2016, 11:50) talks about the importance of building anticipation for the player in level design. This is to give the player glimpses of areas they can or cannot reach. One common way to highlight these glimpses is through key light and colour to make them pop. Picture 28 shows a great example of building anticipation for the player by showing some easier and some harder to reach areas with mysterious unnatural-coloured highlights. This doesn't only draw the player's eye, but the strangeness of the light can add extra interest from story perspective.

PICTURE 29. Screenshot from Genshin Impact (Genshin Impact 2020).

A great example of a game where light and especially its different colourful properties is Genshin Impact (2020) a very popular open-world action RPG game. It is said to be becoming the most expensive game ever made, calculated to have around 500-million-dollar budget with a gross income of over 3 billion dollars per year (Landaverde 2022). The high budget is visible in the carefully crafted environments where both light, colour and compositions are very well thought out. It especially excels in the environmental lighting in both guiding and storytelling ways. For being an open-world game with vast lands to explore it manages to create very intimate story beats only through light, colour and composition. The key light and composition in Picture 29 create an almost painting-like sight from the doorway, highlighting a creature on the tree branch and guiding the eyes to a crack in the ground for further exploration.

PICTURE 30. A corridor in Genshin Impact (Genshin Impact 2020).

In Picture 30 there is a great sense of depth in the corridor in the middle. The misty blueness and leafless branches are almost eerie and not necessarily very inviting. The lights hanging from above bring a little more warmth and signify something living there or tending to this place. The sense of mystery and unsureness of the nature of this corridor is high, but at the same time its call to explore it is irresistible.

4.1 Affordances and signifiers

Affordance is a term in psychology, often used in design. The Cambridge dictionary explains it as “A use or purpose that a thing can have, that people notice as part of the way they see or experience it: In design, perceived affordance is important – that is, our implicit understanding of how to interact with an object”. In other words, it is about how an object makes it clear how it’s supposed to be used.

A video game must tell the player what they need to do. Hodent (2015, 11:50) explains the concept of how “form follows function” and the reaching of affordance, meaning of what the player sees is how it works. The less things the player must remember, the better. A designer can adjust forms in video games

to afford to the player how things are used. These affordances often come with a colour or light. Sometimes affordance is not enough, but the player needs signifiers to understand intractability. Identifiers give more information to the player of the interaction. When talking about affordances it often includes the theme of signifiers. An example of a cohesive and style-fitting use of signifiers is in the game The Last of Us (2013) (Picture 31). The game uses the colour yellow to signify not only interactable parts of the environment, but other things of importance, like landmarks.

PICTURE 31. Yellow signifying interactability in The Last of Us (IGN 2023).

Yellow is realistic, but noticeable enough as a contrast colour and the player often starts noticing this hue eventually as being a guide throughout the whole game. Use of these types of signifying colours can often be based on visual things in the real world and norms from video game history. The way red and green are associated with things like stop and go from traffic lights. Or how healing items are often colour coded as green.

Mirror's Edge (2008) series are notorious for their very "on the nose" guiding with bright red signifiers that pop out in stark contrast from the cool blue backgrounds. At first glance it might seem way too obvious, but the core of the gameplay is free running through the rooftops and cold corporate buildings. The player moves in such a speed that the navigational clues must be very clear to be able to make

fast decisions. Losing momentum and the free feeling of running because of constantly having to figure out where to go would be too frustrating.

PICTURE 32. Visual affordances and signifiers in Mirror's Edge Catalyst (Mirror's Edge Catalyst 2016).

The highlighted red effect on interactable elements (Picture 32) are called "runner's vision" and it can be turned off. If we were to remove those two red glowing elements the map design in the picture would still be very clear. The way the key light points to the reachable other side's platform, red pipes are contrasted against the dark blue background and the planks pointing as a jumping pad are enough to lead the player there. More experienced players might prefer to have the runner's vision turned off to feel more immersive.

Byrne (2005, 292-293) suggests that for navigation purposes a signifier for an open door could be a properly modelled door with a handle, when a closed door would simply be a texture of the surface of the door. However, Nisbet (2016, 5) points out that these visual cues could be more natural, since a resolution-based solution is not great for immersion. Naturally occurring blockades would be things such as a blocked or broken door. Colour-wise, if appropriate to the game's tone, it could be a change in the door's glow.

4.2 Visual clarity

Communicating clarity is a fundamental thing in level design. Overton (2021, 16:55) mentions the importance controlling the player's focus. Especially with a detailed background the value contrast balance of the background and the character is important. For variety's sake a high contrast player against a low contrast background can allow a high variety of different types of low contrast backgrounds.

Clarity is especially important in fast-paced action games, where the ambiguity that lasts for a split second can cost the player their life. If a player must spend time pinpointing figures from the background, they will struggle with both navigation and targeting. (Brown 2016, 18:55) An example of light and colour of this is from Geppert's (2019, 24:35) talk about Sea of Solitude (2019). The team experimented how dark they can make the game in some points (Picture 33). Geppert wanted to make it as dark and black as possible. However, they had problems with finding the right balance, so it doesn't become too hard to navigate while adjusting to different monitors. Some monitors would show the scene as completely black.

PICTURE 33. Dark scene in Sea of Solitude (Sea of Solitude 2019).

To help with this they added a subtle light source around the playable character to make it pop more from the background. They also made the background lighter than the foreground so the player would always see a silhouette of their character.

Some designers have developed a squint tool for their development process. Blurring a scene can help the designer to see better the broad image and not focus too much on the details. Using these techniques can help the developer to see if the foreground and background are visually distinctive enough from each other.

Final Fantasy XIV (2010) is an example of bringing visual and mechanical clarity through simple waymarks. The main gameplay fighting content, raiding, is done in groups of 8 players with different kinds of mechanics, like spreading or stacking. Players might need to spread apart because everyone gets an explosion around them, and they can't hit each other with said explosions. Or they might need to stack together to share and survive the incoming damage. Since 8 different people need to coordinate and strategize simultaneously the game allows them to place markers on the playing field. There are 8 different markers: numbers from 1 to 4 and letters from A to D. They are also brightly colour coded so that one number and one letter match in colour.

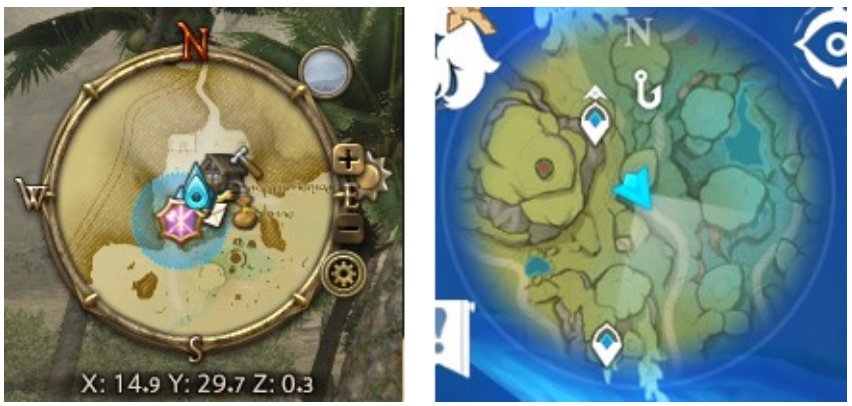
PICTURE 34. The available markers in FFXIV (FFXIV, 2010).

With these markers players can assign spots for different mechanics based on number, letter or colour. If the raid has mechanics that you have to do in pairs,

for example stack with one other player, they can be assigned to a colour marker pair. These markers are a very simple way of coordinating certain fights since many of them require split second decision making. Knowing the exact spot for the upcoming mechanic reduces mental and decision-making load and makes it easier to communicate non-verbally with other players.

4.3 Mental maps

In a GDC talk, designer Brendon Chung (2016, 1:10) talks about guiding players through level design. He mentions that one of his most helpful learning moments came from a lead level designer in a project he worked for. It was to take a level and remove minimaps, markers and UI. Suddenly pathways, lines of sight and lighting became so much more important. He found out that it forced the team to become more creative with design solutions to make the environments more intuitive, and to think if the world readable in a way that is it saying everything they want clearly and concisely. Game designer Nicolas Oueijan (2022) mentions that there exists a lot of scientific studies on how HUDs and minimaps (Picture 35) can easily be used as crutches in video game design. Playing with a dynamic minimap can cause long term atrophy of the player's ability to navigate and memorize their surroundings. It can be good to test the environments and levels without the aid of a HUD for example.



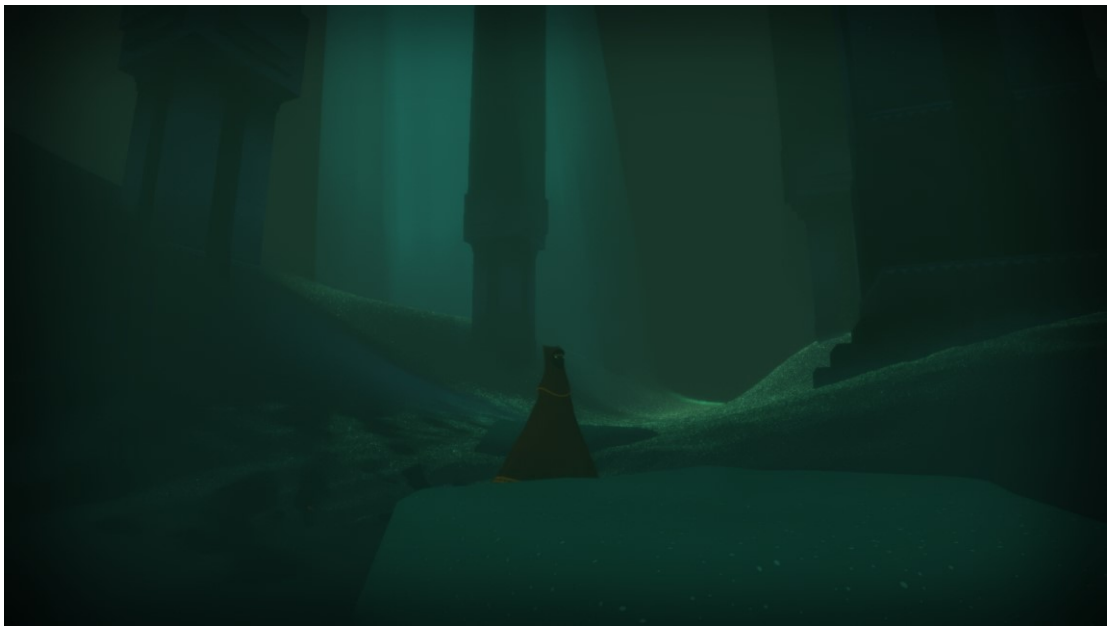
PICTURE 35. Two visually different minimaps, FFXIV (left) and Genshin Impact (right) (FFXIV 2010; Genshin Impact 2020).

A study conducted in 2017 by N. Khan and A. Rahman proposed a landmark-based verbal navigation system in urban game environments instead of a minimap. This was based on the needs of developing a guidance system that supports spatial navigation better than a traditional minimap. When it came to this spatial knowledge the landmark system was considered better. However, a classic minimap was better in terms of efficient navigation.

Oueijan (2022, 5:50) talks about cognitive mapping in video game design and how we use these types of maps every day in our lives. We get lost when our cognitive maps don't match with what we are seeing around us. These maps consist of paths, landmarks, districts, edges and nodes. These are common terms from architectural design, urban planning and many more.

4.3.1 Paths & landmarks

Paths are common in both video games and cognitive maps. They are good at catching lost players and guiding them to a wanted destination (Oueijan 2022, 7:00). Paths connect big areas together while controlling the flow of the environment. Visually these are often highlighted through colour, lighting and composition.



PICTURE 36. A path in Journey (Journey 2012).

In Picture 36 a path is formed through composition of architectural elements, the key light and the shining sand texture of the ground. There is also a slight change in colour temperature between the green lights making the shiny path look more inviting than the colder light behind it.

Placing paths doesn't however, automatically mean the players won't get lost. (Oueijan 2022, 9:15) Breadcrumbs are a great way to get the players back to correct paths if they are lost. They are visual, often some ways contrast from the rest of the environment (Picture 37).

PICTURE 37. Subtle visual breadcrumbs in Journey (Journey 2012).

Breadcrumbs are not only for lost players, but visual cues to show the player where they should go. They can be used for leading the player to their main goal, or to explore other areas. (Byrne 2005, 62)

Another part of cognitive mapping are landmarks, which are great at orienting players from a distance while being stationary (Oueijan 2022, 11:30). Colours and lighting can make them pop far from the distance or make them seem further away than they are. Journey (2012) has this huge singular element of a mountain with a beam of light that the player sees almost constantly in the background throughout the whole game (Picture 38). It sets both a physical and mental destination for the player right from the start.

PICTURE 38. Mountain landmark in Journey (Journey 2012).

4.3.2 Districts

Districts (Oueijan 2022, 13:05) are zones, like towns, industrial zones, harbours or nature areas. Using a squint test usually works to identify districts visually. Districts are areas with edges which the player enters and goes through. Oueijan (2022) compares districts to colour-by-number pieces which form one cohesive image through recognizable colours.

PICTURE 39. Districts and clustering in a map design (Genshin Impact 2020).

Regarding districts something called clustering is an important part of them (Picture 39). Groups of similar things are easier for the player to remember than a group that consists of randomized things. Clustering doesn't have to be only visual. (Oueijan 2022,14:25) They can be objectives, enemies or items, or usage of difficulty curves. Clustering together for example challenging mechanical encounters together can add tension to the game's plot. In Picture 39 from Genshin Impact (2020) the world map design uses clear districts and clustering in both structural and colour ways. A clear distinction between different terrains is made through colour giving each area a distinct look.

4.3.3 Edges

Edges (Oueijan 15:30) happen naturally in games in things like level transitions and boundaries or portals and ledges. They close one area off from another (McConnell 2016). Edges are vertical and linear, but not like paths. A player usually goes through or around them. It's good to be intentional in design with edges, since crossing an edge is a memorable act to the player (Picture 40).

PICTURE 40. A clear edge transition between two levels (Journey 2012).

According to Oueijan (2022, 16:55) designers tend to blur these edge lines, to make them less harsh. However, this vague nature of them can transfer to cognitive maps and will in result be worse at anchoring players. Edges of environments should also be visually clear enough. In Picture 40 Journey makes a clear visual for a level transition is through the contrast of colour and light, warm and cool.

PICTURE 41. Near an edge of a level transition in The First Tree (The First Tree 2017).

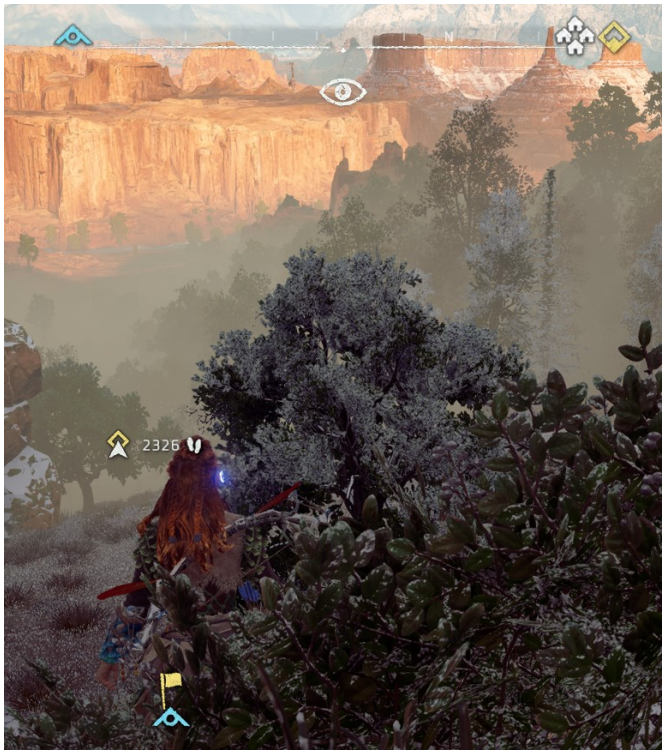
However, in Picture 41 the vast grassy land looks explorable and like a new beginning for an area, but taking few steps forward will transition the player to the next level. A clearer line with composition and lighting would better indicate the player of the end of the level.

4.4 UI & HUD

Nisbet (2016, 15) writes that regarding open-world games when they are built with tighter areas consisting of small districts visual navigation can be more effective. This would reduce the player's need for using UI elements as their main way of navigating through the game. Reducing the need for the UI would increase the level of participation from the player.

Not all game UI elements have much to do with colours, but some do, at least on the very basic level. Most navigational HUD elements are high in contrast since their main priority is to be as visually clear as possible. These rarely fit the immersion of the story narrative. Sci-fi games can sometimes make them more story-related if the gameplay is in first-person view and the markers appear on the character's technologically enhanced vision.

Nisbet (2016, 16) categorizes modern UI wayfinding into three categories: floating points, manually engaged dynamic directions and persistent dynamic directions. Floating points are markers on the environment, outside of the area of the HUD. Manually engaged dynamic directions are manually made to appear by the player. They might be stuck and press a button to show a ping to a current objective, or a breadcrumb trail to physically lead them through the environment to the right direction.



PICTURE 42. 3 types of UI wayfinding (Horizon Zero Dawn 2017).

The persistent dynamic directions are constantly showing the player an icon or another way towards the current goal. It can be an arrow on the HUD pointing towards the objective like a compass, or a constant trail of glowing breadcrumbs

for the player to follow. In the Picture 42 all 3 types of UI wayfinding are present. The floating point marker is in the middle of the screen with a square and an arrow. On the bottom the blue marker is pinged by the player to specifically show up on the screen, working as a manually engaged dynamic direction. On the top is a bar showing the current objective on yellow as a persistent direction.

Celia Hodent (2015, 37:00) mentions a “red overload problem” they had during a FPS game development where the game has a red team and a blue team. She talks about red being often overused to signify many things in video games. In UX testing they noticed that when the player is part of the red team there was a noticeable overload in red. A lot of the red feedback on the screen that required quick decision making were harder for the players to spot. Hodent (2015) also mentions that red and blue are very common team colours, but red teams are often in disadvantage. According to her statistic in Gears of War 3 (2011) the blue team had 5% better win rate than red team.

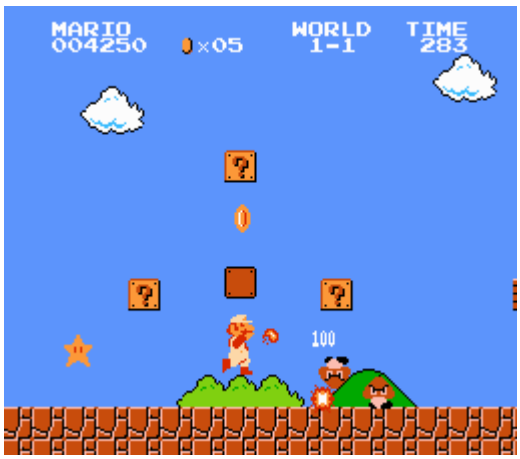
Battleborn (2016) was a game that didn’t live past 2021. Some of the many reasons for that have been said to be the poor UI design that took new players a long time to get used to. All stylized FPS games tend to get visually busy for some seconds during the thick of a fight, but the important elements on the player’s screen should still stay coherently visible. Introducing too many different elements that clash together visually are very distracting in a fast-paced decision-making environment (Picture 43).

PICTURE 43. Visual clutter in Battleborn (Gamer Design Snacks Wikia 2016).

Picture 43 captures an unfortunate timing from Battleborn (2016). The effectiveness of the visual information is basically wasted because of there being too much of it. Viewing the colour palette through Adobe Color these contrasts seem to be mainly hue-based so there are just colours from all the spectrums of light. The weird aerial perspective that turns further objects brown and pale green is one of the main distracting elements. The UI markers seem very dynamic in their shape language, like the blue and green bars on the left bottom corner. When information is presented in such active shapes it adds to the visual exhaustion. Battleborn might not have had a “red overload” problem but could’ve benefited from similar type of UI troubleshooting.

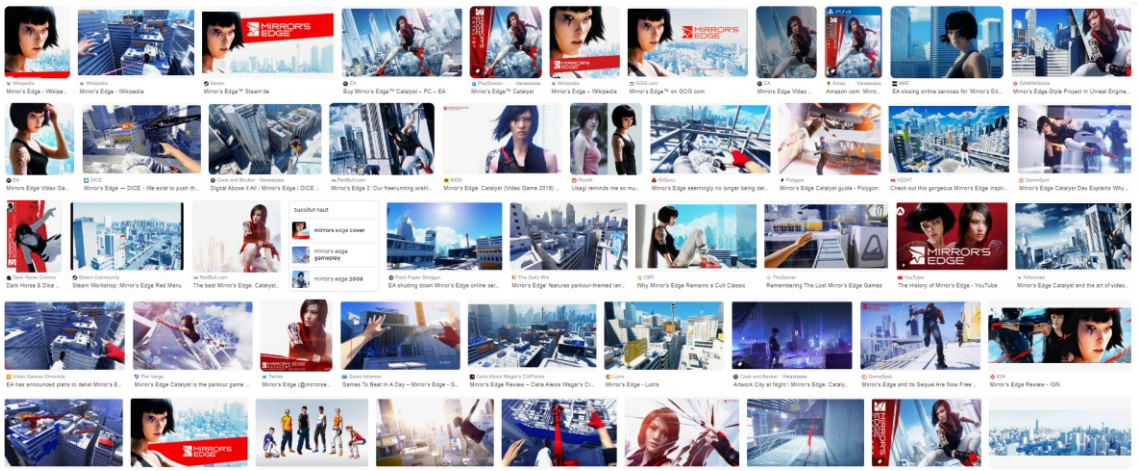
4.5 Brand identity

A certain colour palette is also an important part of the game brand’s identity. The colours tie it to a certain image of its genre and then go deeper to being able to be recognized from very small image clues. If we think about an early Super Mario Bros. game, we can instantly recognize it from its blocks and the certain shade of blue backgrounds even if we haven’t played it ourselves. The aesthetic of the game has become so iconic.



PICTURE 44. Screenshot from Super Mario Bros. (Super Mario Bros. 1985).

Another great example is Mirror's Edge (2009) franchise. Mirror's Edge and Mirror's Edge Catalyst's colour palette (Picture 44) is strikingly contrast with the iconic red signifiers and sci-fi tones of sunny white rooftops with blue shadows. It's easy to recognize from small image samples and few games use a similar palette.



Picture 45. First page of Google Images with the search word "Mirror's Edge".

An example from launching a game the developer of "The First Tree" David Wehle (2019) talks about the marketing of his game. Marketing through gif making in Reddit, a popular social media site, was hugely successful especially before the game's launch. He also posted on other sites, but the main point was to have visual content since that attracted the most views. He got millions of views on these colourful gifs of his game during the development of his game. This translated to other interest such as people also visiting his Steam game store page.

Pictures are powerful, especially in today's busy world where people's attention spans are often short and small games compete for attention during development. Having a coherent visual language and identifiable snippets of a game early in development can really catch people's eyes.

4.6 Accessibility

When talking about the importance of colour, we can't forget the fact that around 6-10% of men and 0,4-0,7% of women have some kind of colour-blindness (Gordon, 1). In a GDC seminar about colour-blindness (2019) associate development manager Douglas Pennant (19:00) lists colour-blindness issues are most common in video games, which include:

- team colours
- blending of UI, characters or environment
- colour matching puzzles
- a lot of UI information in colour.

Pennant (30:00) later discusses the key steps for supporting colour-blind players. The first one is to never only communicate with colour, and this is true for all design fields. For example, web design has its own very strict guidelines for accessibility which are strictly enforced: the Web Content Accessibility Guidelines. These guidelines are the product of many years of compiling guides for accessibility. The very basic guideline for the use of colour puts it this way: "Colour is not used as the only visual means of conveying information, indicating an action, prompting a response, or distinguishing a visual element" (WCAG 2022).

Another important standard practice is to understand the colour palette that's being used. There are many resources for palette creation that exclude all the colours that colour-blind people cannot see. Pennant continues to talk how it's important to identify which colour features are present in your game from team colours, item differences based on colours, light colours to text and more. (Pennant, 30:10-34:20) Picture 46 showcases some of colour blindness options that a FPS game Overwatch 2 (2022) offers. These include filters for different types of colour-blindness and being able to customize team colours.

PICTURE 46. Colour-blindness options in Overwatch 2 (Overwatch 2 2022).

It's important to figure out colour information categories by setting up colour presets and have them tested. For example, to have a preset colour for different factions. These presets allow designers to focus on the design process and worry less about the accessibility side of it themselves. There are also multiple simulator and preview tools for developers to use for previewing their assets through a colour-blindness lens. These tools will help to alleviate the workload in advance and in time these choices can become more intuitive for the designers. (Pennant 2019, 36:32) IGDA Game Accessibility special group (N.d.) warns about implementing colourblind filters in system level into games. This can result to many colours that don't need to be changed being affected by the filter and hurting the overall aesthetics and experience. Instead, giving the players a choice of choosing important colours themselves can provide a better outcome.

For feedback Pennant (2019, 52:45) mentions the importance of reaching out to colour-blind players and colleagues for their own input. Asking for community feedback is also important, since people will usually be thrilled to know that a developer is interested in these issues. It's also important that the accessibility options are made accessible and to be conscious about how many different people can be reached with a singular accessibility feature. Taking accessibility options seriously and adjusting for them can also help everyone, not only people with visual impairments, to have more visual clarity (Overton 2019, 15:00).

5 CONCLUSIONS

Colour has been an integral part of game design for decades now. The importance of its cohesive usage is well understood and is evolving all the time. Art and colour driven video game experiences seem to be developed more and more, with different storytelling styles. Colour is such a fundamental part of our lives and so we have developed so many perspectives to it.

A variety of techniques originally from filmmaking can be useful in game design. It's important to take colour into the design process, from early on, as a colour script or colour grading are part of the storytelling. When it comes to navigation it's not only about colour-coded signifiers, but the emphasis on good lighting design is a key for all kinds of game genres. If a designer wants their game to be as immersive as possible, subtle environmental guiding with light and colour can lessen the need for UI elements. Accessibility is also an important part of today's design culture and should be included in the processes from early on.

The goal with this thesis was to create a basic comprehensive guide of terms and techniques in emotional and navigational colour guidance. Video game design is a complex process but paying close attention to colours can really enhance the emotional journey for the player. Many properties of colour still evoke emotion, but it's not simply straightforward. After all, colours keep being a subjective experience. The cultural differences in meaning of colour are important and a designer shouldn't rely in their symbolism too much.

These examples of level design are very fundamental, and they don't all work for every type of game. However, this thesis can hopefully clarify some terms and concepts and provide a base for further individual research on the topics mentioned.

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