

# The Importance of Colour Guided Navigation

**A Qualitative Study on the Use of Colour as a Tool of Communication and Navigation in Video Games**

By: William Pellas and Sandra Thenstedt

Supervisor: Mikolaj Dymek  
Södertörns University | Department of Natural Sciences, Technology and Environmental Studies  
Bachelor's thesis, 15 credits  
Media technology | Spring semester 2020



# Vikten av färgstyrd navigering

**En kvalitativ studie om användningen av färg som ett kommunikationsredskap och navigation inom spel**

## **Abstract**

Colour coding is seen in various forms throughout different types of media and in real life. This study focuses on what effect colour coded visuals can have on a player in a video game, using lights and environments deliberately coloured in a specific way to gain the players attention. Results suggest that colour coding aids the player in understanding where to go in the game and what something means. Participants expressing their ability to traverse levels in the game with ease thanks to their understanding of what a colour may imply. The participants selected for the test have varied in skill, age and gender to avoid any form of bias. Further prevention of bias was done through the between-subjects method where the subjects always started on a random level.

**Keywords:** Colour coding, guidance, stimulated recall, video games, navigation

## **Abstrakt**

Färgkodning ses i olika former inom media och verkliga livet. Denna studie fokuserar på vad för effekt färgkodade visuella element kan ha på en spelare i ett videospel, med hjälp av ljus och miljö i ett videospel med avsiktlig färgkodning för att vägleda spelaren och fånga dennes uppmärksamhet. Resultaten föreslår att färgkodning hjälper spelaren att förstå vart de ska gå i datorspelet, samt vad något betyder. Deltagare anser att deras förmåga att ta sig igenom spelets nivåer var enkelt tack vare deras förståelse av vad en färg kan antyda. Deltagarna valda för studien varierade i förmåga, ålder och kön för att förhindra någon form av partiskhet. Vidare förebyggande av partiskhet gjordes via mellan-deltagare metoden, där deltagare startade på en slumpad nivå.

**Nyckelord:** Färgkodning, vägledning, stimulated recall, videospel, navigering

# Table of Contents

<b>Introduction</b>	<b>3</b>
Background	4
Related Research	5
The Relevance of Colour	5
Colour Used as Navigation and Interaction	6
Colour and Shapes in Relation to Emotional Dimensions	6
<b>Research Question / Purpose</b>	<b>9</b>
<b>Methods</b>	<b>9</b>
Introduction	10
Data Collection	11
Participants	11
The Game, 'Escape!'	11
Play Sessions	13
Interviews	14
Data Handling	14
Data Analysis	15
Phase 1: Getting Familiar with the Data	15
Phase 2: Data Coding	16
Phase 3. Searching for Themes	16
Phase 4. Reviewing the Potential Themes	17
Phase 5. Defining and Naming the Themes	17
Phase 6. Producing the Report	18
<b>Results</b>	<b>19</b>
Relevancy of Colour and Design as Guidance	19
Communication through Colour and Shape	21
<b>Discussion</b>	<b>25</b>
Different Visual Aspects	25
Completion and Failure	26
Limitations and Future Studies	26
<b>Conclusion</b>	<b>28</b>
A Tool for Navigation	28
Different Visual Elements	28
<b>References</b>	<b>29</b>
<b>Appendixes</b>	<b>32</b>
Interview Questions	32

# Introduction

## Background

Coding through colour in video games means using different colours to lead the player towards various things or using colours to evoke emotion (Plass et al., 2014, pp.130-131). If a difference in colour is used consistently, the player may start to relate colours to something intended by developers, such as repeated use of warm colours. An example being strong variants of red to evoke positive emotions from players (Plass et al., 2014, p.132). For example *Portal 2* (Valve Corporation, 2011) uses the colours blue and orange on different in-game objects to hint players towards what is interactable for the player and not interactable. The levels are primarily grey in *Portal 2* with some parts of them being white, the white being an indicator for where a portal can be placed with the games signature Portal Gun. The Portal Gun is used to place down two portals, portals that are connected to each other that enables the player to travel between point A and point B instantaneously (Foroughi et al., 2016, pp. 60-61).

Colour coding is not limited to video games and can be seen in other mediums and real-life examples, such as the colours in traffic signs and traffic lights.

Apart from being used strictly for game-objects (also known as *props*), it can also be used through means of showing the player the way through the level to progress. In the *Tomb Raider* (Crystal Dynamics, 2013) franchise, obstacles that the protagonist Lara Croft can ascend physically are marked with some form of visual guidance to show that there is something that the player can do with that specific part of the level. The typical guidance used is white paint that covers parts of the traversable obstacle, consistently showing the player that it is possible to get somewhere by traversing the obstacle.

## **Related Research**

Research relevant to this study was gathered with the intent to answer questions and further knowledge regarding the importance of colour, the usage and the varying methods of guidance through colour.

## **The Relevance of Colour**

The visual sense is the most developed one of human evolution and *gamers*(people that play games regularly) interaction happens mainly through visual stimulus (Zammitto, 2005, p.1). The visual sense is known to interact with the other senses creating illusion such as feeling warmth from the colour red or cold from blue (Garber and Hyatt, 2003, p.313).

Schell (2008, p. 136) states that there is a world wide idea what meanings different colours have. According to Hart (2013, p. 99) the idea of light colours as happy colours is one of them. In other media such as comics, cartoons and filmography, the importance of colour is just as prominent as it is in video games (Block, 2008, ch.6). McCloud tells of how colour impacts the way a person perceives the medium and how certain colours and combinations of colour become symbolic to a characteristic as the reader, or in this case, the player, is repeatedly met with the same colour for specific entities, creating a pattern for the person to recognize. (1994, pp.188-189) An example used is the colour seen in the suits of *Batman* (DC Comics, 1939) and *Superman* (DC Comics, 1938). The suits became an identity for the characters and when comic books later became filled with colour, their appearance became truly symbolic (McCloud, 1994, p.189). The ability colour has in affecting a players response is critical in this study as the game created for it makes use of information found in previous related studies regarding the effects of colour. In research done by Wolfson and Case (2000), a study was made comparing the response players had while playing a game depending on the colour that the background was filled with. The colours used were blue and red, where blue was perceived as a colour that allowed players to continue to improve throughout the game, whereas red was

considered more arousing and made the player more erratic (Wolfson & Case, 2000, pp.188-190). Their findings in what colour impacts the player in which way was taken into account for the creation of the games environment in the game used in this study.

### **Colour Used as Navigation and Interaction**

Mäklin and Lindblad (2015, p. 7) in their study used colours with the purpose of letting their participants get a sense of direction, perspective, depth, scale and importance. Mäklin and Lindblad (2015, p. 20) used highly saturated colours to guide their participants through the game. According to Plass et al. (2014, p.130) research has found that warm and saturated colours increase pleasure. They also state there is research showing cold colours can not evoke the same great feeling of arousal as warm and saturated colours. Zammitto (2005, p. 4) confirms the use of saturated colours as a good way to attract interest amongst players since saturated colours are associated with fun, whilst unsaturated colours is often associated with sadness. Zammitto (2005, p. 6) also states that a game experience gets more immersive when the developers have a conscious use of colours.

According to Schell (2008, pp. 176-177) the visual differences in colour of the same enemy will have the players conclude that the enemies are functionally different too. If not, they will probably get confused and disappointed. This further proves the importance of knowledge in usage of colour and saturation when developing games.

### **Colour and Shapes in Relation to Emotional Dimensions**

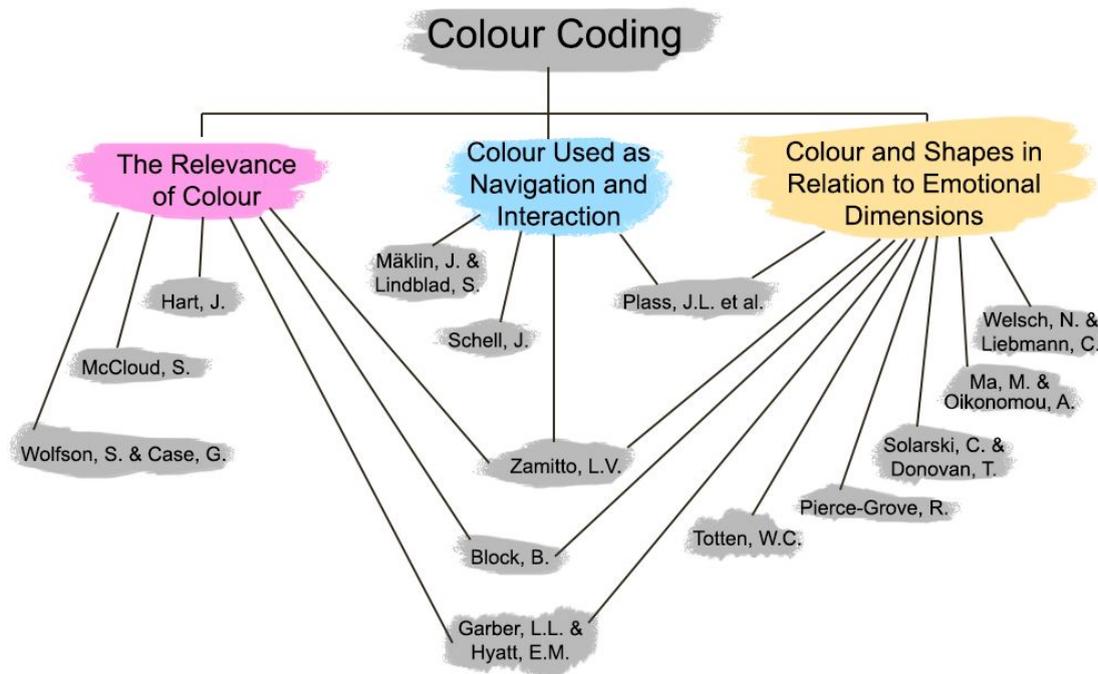
Garber and Hyatt (2003, p.313) describe colours as a *compelling visual cue* (a means to direct the player in a certain direction) which can be used with the purpose of communicating meaning, identity or novelty of an idea or an object. Through the use of colours, it is also possible to increase and reduce some emotions (Zammitto, 2005, p.1). Solarski (2012, p. 224) writes about how colour can communicate emotions, however the symbolism of colours may differ between cultures. As an example of this Garber and Hyatt (2003, s. 316) mention how white is often seen as the colour of

death in many asian countries, whereas in the west black is associated with death. Another example is the common use of green in the flags of Islamic countries, where they often associate the colour green with trees and meadows which symbolizes paradise (Welsch & Liebmann, 2003, p.22). However video games seem to follow a worldwide language when it comes to communication with colour and symbols. This can be seen in games played worldwide, such as World of Warcraft (Blizzard Entertainment, 2004), Final Fantasy XIV (Square Enix, 2013), Star Wars: The Old Republic (BioWare Austin, 2011), where certain colours communicate the same things, such as enemy characters being outlined with a red colour and non-enemies being outlined with a blue colour. In her text, Zammitto (2005, p.9) presents another example from the game *Baldur's Gate* (Bioware, 1998) which supports the above mentioned example. In *Baldur's Gate*, when you mark a character, a circle appears under the chosen character. The colour of this circle will reveal whether the character is hostile (red), friendly (green) or neutral (blue).

Totten (2014, p. 176) mentions how colours in many games are a tool for communication and states the reason behind it to be that colours carry emotional or metaphorical associations. In games items related to health are often green or red, which can relate to growth or blood. The same way blue is often associated with *mana* (a type of fantasy resource used to restrict the usage of magic in fiction, often blue) and/or magic in games (Totten, 2014, p. 178). Like Solarski and Totten, Block (2008, p.2) mention that moods and emotions are communicated with visual components. Solarski (2012, p.226) presents a relevant example about the game *Journey* (Thatgamecompany, 2012), explaining how the developers use complementary colours in the character and the background to evoke specific emotions with the player. Pierce-Grove (2014, pp.469-470) deems games to be something more than an interactive artform, asserting that they impact the player emotionally and affect and trigger human senses. According to him (2014, p.470), the visual presentation in games is a big factor in how the game is experienced.

Colour and shape design can be used in tandem with other non-graphical aspects as a means to show the player what something means or is (Ma, 2017, pp.13-14), an example being a hazardous ground element such as red lava, the graphical aspect making it clear to the player that the ground is dangerous.

Plass et al. (2014, p.128) made a study in which they researched design factors and how they could evoke positive emotions. Plass et al. (2014, p.139) state that usage of both colour and shape in games results in improved comprehension. They conclude that their participants felt more motivated when material was presented in colour and not just as black and white. The participants also found it less difficult to understand the material when presented in colour (Plass et al., 2014, p.137).



**Figure 1.** Literature map describing the correlations between the literature studied for the literature review. Made according to the guidelines presented by Creswell (2014, chapter 2).

## Research Question / Purpose

Studies covering the effects on the player with the use of colour coding is inadequate, which is why this topic was chosen to study further. With data collected from this study the aim is to be able to answer if colour coding aids in guidance in a level by a big amount or if it is overlooked by players, to see whether or not colour coding has much importance in a game and if it is the sole source of guidance. Based on related research found on this subject the thesis of this study is that colour coding in games is a helpful tool for the player to navigate a level.

*“How does colour coded guidance affect the ability of a player to traverse the game levels?”*

This question will be answered using the following subqueries:

- *What motivates a player to choose their respective path when faced with colour coded navigation?*
- *What motivates a player to choose their respective path when met with choices that lack colour coding?*

# Methods

## Introduction

Twelve participants were asked to play through two levels, six of them starting with a greyscale level and six starting with a level in colour. Participants were allowed to play the levels until completion or for a maximum of fifteen minutes per level, then as suggested by Pitkänen (2015, p.122) took part in a stimulated recall interview directly after their play session to share their thoughts about their playthrough and to answer questions. The participants were divided randomly into the two respective levels, this was done to force the between-subjects method to prevent bias (Young, Cole & Sutherland, 2012, p.186). Age groups varied and so did previous amounts of video game experience. Everything done was recorded and kept throughout the study period, though all participants remained anonymous. Anomalies in gameplay and points of interests were noted down by the interviewers using the recorded in-game footage from the playthroughs, allowing themes to be found by cross-referencing what participants did in their sessions. These sections of the footage were used in tandem with the stimulated recall interview where interviewers asked what the participants were thinking when they did specific things. Participants were encouraged to say what they were thinking when they were doing things in their playthrough, using a so-called think-aloud protocol which aided in understanding the behaviour when re-watching the participants playthrough.

Braun and Clarke (2012, p.61) suggests that themes should be thoroughly searched for and narrowed down from many themes to just a few. Three main themes were found in the research following completion of the thematic analysis six steps, showing a usable result. All interviews were conducted in Swedish, though everything is translated to English in this paper in an author's translation.

## **Data Collection**

### **Participants**

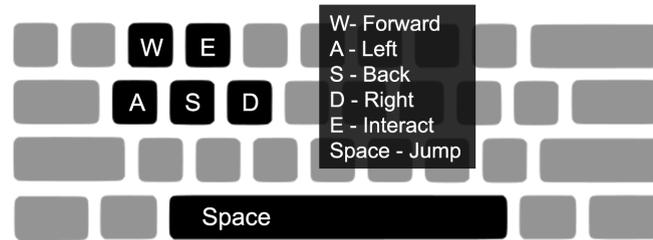
For this study no specific target group was used, instead a variety of people were more suitable as the game itself is not meant to be challenging and the research questions were not aimed at a specific group, however all participants will start on a random level as per the between-subjects method (Young, Cole & Sutherland, 2012, p.186). The aim is to see how efficient the guidance through colour coding can be and thus previous experience of games is not considered a requirement. Twelve volunteering participants were found by asking friends and relatives. Since the selection of participants includes relatives it was certain to create the desired variety in gaming experience for this study. The participants were between 21 and 64 years old and as desired, they have a clear variation of experience in terms of previous experience in computer games. Their identity remained anonymous throughout the entire study.

### **The Game, '*Escape!*'**

The object of this study is a game developed as a tool solely for the purpose of this study. When developing this game, the choice of colour usage was based on previous research. Garber and Hyatt (2003, p.313), Zammitto (2005, p.1) and Solarski (2012, p. 224) mention colour and shapes as a tool of communication. Previous research from Zammitto (2005, p.9) was used as support when deciding to use red as something bad or dangerous and blue as something neutral or friendly. The usage of the colours is consistent throughout the game - the blue pathway is always innocuous, and red always leads to something dangerous or to a dead end. This design choice is based upon Schells (2008, pp. 176-177) research saying that players will get confused when the visual differences in colour and functions change throughout the game. The specific colours were chosen based on what Wolfson and Case(2000, pp.188-190)

implied usage and contrast for red and blue.

The game is set in a warehouse environment and is to be played on a PC with a keyboard using the following controls typically used when playing computer games (see figure 2) and a computer mouse.



**Figure 2.** Keys used when playing the game

The game consists of two scenes/levels (see figure 3) where the first one was made with the intent to guide the player as much as possible, through level design navigation and colour coding based on previous research found covering the subject. The level also contains barrels marked with the symbol of nuclear waste. The use of colour and shape together can evoke feelings of recognition (McCloud's 1994, pp.188-189), possibly helping the player to navigate. These barrels are placed within the deadly areas as an extra indicator of danger through symbolism. The second level is coloured in greyscale but the layout is similar to that of the level in colour, each participant played both levels. Level one will be referred to as the level in colour and level two will be referred to as the level in greyscale (see figure 3).



**Figure 3.** Level one in colour (left) and level two in greyscale (right)

## **Play Sessions**

To be able to answer the research question play sessions were held with the participants followed by a stimulated recall interview. They were allowed to use a think aloud protocol, meaning that they were encouraged to share their thought process vocally whilst playing the game. This data was taken into account when analyzing playdata(in-game footage). Participants were first informed in how to control the playable character in the game and how the think aloud protocol and stimulated recall works. Nothing in regards to level completion nor difference between the two levels was given away to the participants.

The participants got to individually play both levels in the game. Which level they got to play first was random based on the between-subjects method, however it was an equal amount of participants starting with the first level as participants starting with the second level. This was done to prevent the end result from being dependent on the order the levels were played (Young, Cole & Sutherland, 2012, p.186). The participants played until done, which took roughly between four and 30 minutes depending on previous experience. A maximum time limit of fifteen minutes played per level was added beforehand to prevent the test from taking too long to complete, however it was not mentioned to the players to prevent time being a factor in their performance. Since not all of the participants are experienced players they were allowed a cheat sheet containing a description of the controls if desired.

The in-game screen and the face of the participant were recorded. The recordings of the participants' faces are important to capture their facial expressions during their play sessions. Using an open broadcaster software these two recordings were automatically synced and combined into one single video and audio recording for each play session, making the data easier to manage when starting the analyzing process.

## **Interviews**

Stimulated recall-interviews were individually held with all participants after the completion of their play session. In stimulated recall interviews you interview your participants while playing recorded footage or/and audio of their own actions and behaviour in certain situations (Dempsey, 2010, p. 352). Dempsey (2010, p. 365) made a study about using stimulated recall as a method and strongly recommend it to anyone “interested in the details of interaction“. Using this method could aid in understanding how participants reason while making choices and what signals they think is important (Dempsey, 2010, p. 365). Questions (see appendix 1) were asked referring to certain events in the recordings - so called semi-structured interviews (Pitkänen, 2015, p. 122). Recorded footage and audio of their own actions and behaviour in certain situations were played back along with related questions.

The interviews lasted for about 10-25 minutes and were recorded with an audio recorder. According to Cote and Raz (2015, p.106) it is beneficial to record your interviews since it is otherwise close to impossible to take notes that are detailed enough. All interviews were transcribed into text and translated through the authors translation since they were conducted in swedish with all participants being swedish. This was done to make sure answers were as detailed as possible, thus allowing the participants to answer in their native tongue.

## **Data Handling**

Collected data in the form of video footage and recorded interviews were stored in a Google Drive folder available only to the interviewers and authors of the study. Once the study was completed the data was removed. In the study, by changing all participants' names to encoded ones, they are all presented anonymously. They were also anonymized during the process of transcription by renaming them to “participant” followed by a number. For example “Participant #4”. Before each session the participants were informed about the data handling and their anonymity in

this study, which they had to agree to before being allowed to participate.

## **Data Analysis**

The collected data was analyzed using a thematic analysis method to see if any themes are evident in the two different levels used and what correlates to colour and what does not. Thematic analysis is a suitable method for stimulated recall interviews and is used to find patterns within data - themes (Pitkänen, 2015, p.123). Thematic analysis allows understanding of shared experiences and meanings within the data (Braun and Clarke, 2012, p.57). Data from the stimulated recall interviews along with data from the video and sound recordings were used to analyze the players expressions and study their behaviour to see if they understood that the suggested colour coding is something they should follow or not.

Once the phase of collecting data was completed, the process of transcribing the data started. Cote and Raz (2015, p.109) advocate to on beforehand make up a plan for how detailed the transcriptions should be. It was decided to include all pauses and sounds in the transcriptions, such as humming-sounds and laughs. It made the transcripts longer but it also made sure all possible data was collected and nothing that could be of importance for the study was lost.

When writing about thematic analysis as a method of analysis Braun and Clarke (2012, p.60) mention a six-phase approach. The same approach was used when analysing the collected data.

### **Phase 1: Getting Familiar with the Data**

The first phase is about getting familiar with the collected data which was done by the interviewers re-reading the transcripts several times as well as looking at the recorded material again. By watching and listening to the recorded material repeatedly, more data was found as a result of the think aloud protocol that was encouraged to the participants to follow during their play sessions.

According to Braun and Clarke (2012, p.61) the data should be read critically and analytically and you should dig deep and really think about what the data really means. One example could be: “Places that look a little hard to get up to, but are still possible to reach, usually tend to be more interesting” by Participant #1. When analyzing this quote from one of the participants it was possible to conclude that they had previous experience from computer games based on the confidence in what the referenced thing were and that it influenced the way they acted and navigated when playing the game.

### **Phase 2: Data Coding**

Data gathered from play sessions and interviews yielded results that were similar in a way that allows for assessments to be made based on each participants’ replies and feedback. There were multiple instances where a question received answers similar to a previous participants’ answer and identical in some cases. It was evident that the majority of participants were understanding the fundamentals of the game and what the goal was, however no participant was identical to another. The way this was coded was by highlighting lines of the transcribed interview, comparing how many times a participant would mention something that would seem repetitive, or form a pattern or a theme. An example of this would be different participants describing that the level was formed or shaped in a way that made them feel as if they were meant to go somewhere. Though multiple participants replied something related to this, it was rarely at the same point in the levels that they realised it. This was marked down and responses that shared similarities were gathered to form an understanding about the topic at large.

### **Phase 3. Searching for Themes**

Data gathered from play sessions and interviews shows themes in colour coding, suggestive level design, lights, symbolism, atmosphere, controllers, experience, age, visibility, shapes, death, progression, failure, completion, understanding, anger, accomplishment, confusion and trial and error.

The themes were found by analyzing and understanding each transcribed interview separately and only potential themes that occurred repeatedly were taken into consideration. It was not deemed to be a theme if something only occurred once and had to happen at least three times to be considered one.

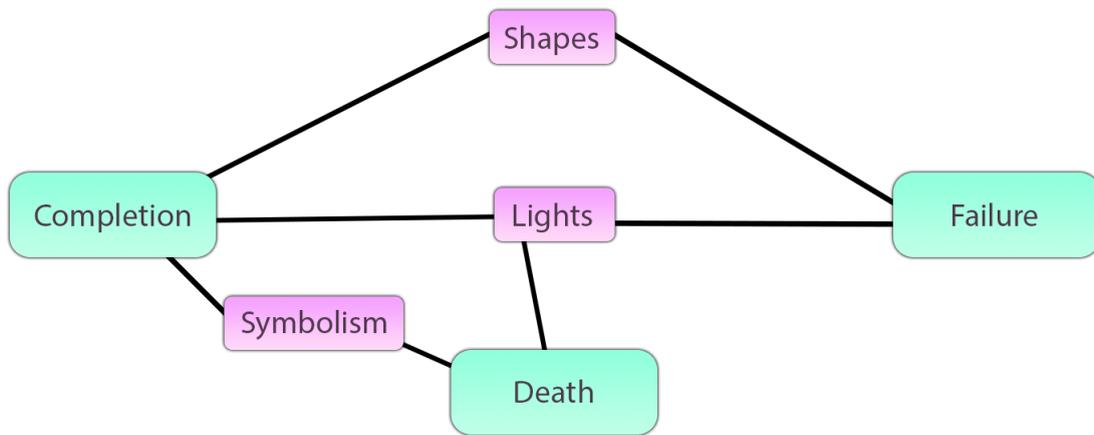
#### **Phase 4. Reviewing the Potential Themes**

According to Braun and Clarke (2012, p.65) this phase is about quality checking. In this phase all themes were double checked to the collected data to confirm whether the data works in relation to the chosen themes. When looking at the themes it was discussed whether or not their data sets were relevant for the research question and if this was enough data to support each theme. Braun and Clarke (2012, p.66) mention the importance of finding the most relevant and important elements of the data, which was something this study strives for.

#### **Phase 5. Defining and Naming the Themes**

- Lights
- Symbolism
- Shapes

When the themes were narrowed down enough to leave only three remaining, a thematic map was created (see figure 4) to illustrate how the themes relate to each other and what causes the themes.



**Figure 4.** Thematic map

Symbolism leads to completion and also death, but failure from symbolism was never expressed by any participant. Lights were observed to affect a player's ability to complete, fail and be the reason for their death in multiple instances. Lights are as described the colour-indicators structured throughout the levels. Shapes played a part in participants' completion and also their failure, objects being placed in suggestive ways and objects showing the player what something is, sometimes in tandem with symbolism. Symbolism refers to objects meant to mean something, a barrel with a symbol for toxic waste would indicate that the barrel contains something toxic as an example.

### **Phase 6. Producing the Report**

The final phase of the analysis is the writing of the report itself. However Braun and Clarke clarifies that this is not the phase that only begins at the end - it began with the writing of memos and notes (2012, p.69).

## Results

### Relevancy of Colour and Design as Guidance

Evidence that lights play a part in a players navigation was found from the thematic analysis, however not all participants mentioned anything about it. It was specifically mentioned that colour in some way was relevant to the participants decision-making throughout their playthrough (see table 1).

**Table 1.** Example of participants quotes about lights as a tool of guidance

Participant	Quote
Participant #3	<i>At first I just ran straight ahead and then I realized that you have to watch out. I started to connect that the red lights were stop lights and the blue lights were where to go. It took a while before I discovered it but then it went faster.</i>
Participant #7	<i>When the thought hit me that I could just follow the blue lights, it became easier to find the right path.</i>
Participant #9	<i>[...] Actually, I should have gone to the blue lights because so far all the lamps I have gone to have been blue except where I fell down and died. I think it was a red lamp there.</i>
Participant #12	<i>Hm... I probably thought I would just go the other way because I died over there at the red lights earlier...</i>

What was also apparent was the suggestive design and layout of the levels.

Participants mentioned that they thought parts of the level looked like it was designed in a way which led the player on, which is what in some cases made them choose certain directions. Participants mentioned the symbolism as a reason for at least one of their choices of direction (see table 2). The most commonly mentioned example was the placement of objects that formed an almost stair-like design which was said to

reveal the correct pathway. This was also clear when participants played level two (greyscale) and participants immediately started running straight forward. When participants were asked about their choice of direction, multiple answers were given saying they saw a big open area and wanted to explore it. Participants were then asked what they looked for when standing in the open area and the answers were that they looked for something that stood out from the rest of the environment. This would refer to symbols, lights or shapes. One example of this is the obstacle where you need to walk on boxes placed over the deadly white liquid on the floor (see table 2).

**Table 2.** Example of participants quote about deadly white liquid in level two

<b>Participant</b>	<b>Quote</b>
Participant #8	<i>I just wanted to see if there was anything that stood out and then there was something white on the floor that was really bright. It was much brighter than anything else.</i>

Examples of participants mentioning symbolism or shapes as guidance in table 3.

**Table 3.** Example of participants quotes about symbolism as a tool of guidance

<b>Participant</b>	<b>Quote</b>
Participant #1	<i>Those boxes are well placed there for you to understand that it is probably better to step on them than to walk on any crap on the ground.</i>
Participant #4	<i>It looked like a staircase, the drawers were placed in a way that gave it away. They seem to go in steps, then I saw the beam and the next beam so it became like ... From this perspective, you see a gangway, and that everything is created as a path.</i>

Participant #5 *I thought "now I have to get up" and there were some beams above and I thought there must be a reason why the beams are up there. The idea must be that I am supposed to walk on them.*

Participant #8 *[...] But when I came back I saw that the boxes were placed like you were supposed to jump on them so it was pretty obvious what I should do.*

---

### **Communication through Colour and Shape**

Almost all participants who mentioned colour as a tool to navigate the colour-guided level chose to avoid the areas lit by red lights and motivated the reason behind it saying they assumed red to be associated with danger. An example for this is an excerpt from the interview with participant #11 (Q=Questioner):

<b>P#11:</b>	[...] I always died in that sticky goo and it was red(lights) there. A bit like when you are driving a car.
<b>Q:</b>	You die of red in traffic?
<b>P#11:</b>	Yes, I mean... Kind of!
<b>Q:</b>	What was the blue then? There is no blue(lights) in traffic, is it...?
<b>P#11:</b>	No... No, I just thought it was the only thing that wasn't red, so I followed it.

Participants who assumed colours from lights to be relevant (in coloured level) mentioned that it was easier to understand that red meant that something was bad than it was for them to understand that blue was the correct way to go. The assumption of blue as something good or friendly was not mentioned as much. According to the participants' replies, this appears to be a result of the assumption of green being the colour to indicate positive things. Answers related to colour as guidance were the assumption that red lights were something bad (see table 4).

**Table 4.** Example of participants quotes about the assumption of red as something bad

<b>Participant</b>	<b>Quote</b>
Participant #7	<i>I know that red is usually associated with danger in games.</i>
Participant #8	<i>Yes, but I felt so stupid. [...] Where I jumped in and died there was a red lamp. It was kind of like a warning signal that I shouldn't go in there at all.</i>

Apart from colour as an indicator of where to go and not, symbols were mentioned by participants (see table 5).

**Table 5.** Example of participants quotes about symbolism in barrels

<b>Participant</b>	<b>Quote</b>
Participant #2	<i>There I saw the yellow barrels again, where it is clear with the mark on the yellow barrel. Assuming you know what it means, but I know it.</i>
Participant #1	<i>I see no such thing as 'danger' or that it would be nuclear waste or something that would hurt, so I was not prepared I would die there.</i>

It was also contradicted by other participants (see table 5) failing to acknowledge the symbolism used for the barrels. This indicates that using symbolism to show a player what something is will not always work and that it should be taken into consideration what type of symbolism is used. Although this could be based on player-experience, an introduction to what the symbol means could be done in a more advanced game.

Participants who thought of colour to be relevant in the colour-guided level tended to avoid red lights more often than they chose to follow blue lights. A pattern could be

seen during the data analysis process that participants who are also experienced players immediately identified red lights as something bad. The reason behind this behaviour could be the worldwide language of colour and symbols in video games, which both Zammito (2005, p.9) and Totten (2014, p. 176) mention in their texts. According to them the colour red in video games is something associated with danger and hostility, which is why this may have influenced the participants' way of navigating the level. The opposite pattern was seen with the non-gamer participants who did not necessarily think of red as something bad. Participants even mentioned they wanted red lamps to help guide them since red would stand out and be clearly visible (see table 6).

**Table 6.** Participants quote about a desire for something already existing

<b>Participant</b>	<b>Quote</b>
Participant #5	<i>It would have been good if there were any lights or something that indicates where I need to go, like a red light.</i>

This suggests that experience influences ability to perceive the environment in the game. Wolfson and Case idea that red acts as something erratic can be seen from participants behaviour, however the feedback of a desire for green opposed to blue suggests that blue is not as impactful as Wolfson and Case suggested (2000, pp.188-190). As observed from interviews, green was suggested to be used instead of blue (see table 7).

**Table 7.** Example of participants quotes about suggesting green over blue

<b>Participant</b>	<b>Quote</b>
Participant #8	<i>I might have understood earlier if the lamps were green instead, though.</i>
Participant #12	<i>[...]And the blue stuff, or was it green?</i>

When asked why they chose the path they did, participants sometimes remembered blue as green (see table 7). Wolfson and Case (2000, pp.188-190) were not necessarily wrong as participants were still able to navigate through the level using blue lights as a means of directional colour, though for future studies green lights would likely be more useful than blue lights for showing players the correct path. Colour does communicate to players, though choosing what colour should represent which element is important for future studies.

No variation could be observed through which level the participants started in, though it was apparent that the second level of their playthrough was somewhat easier to them regardless of which they played first. This is likely due to participants understanding how to play the game in the first level and familiarising themselves with the controllers, allowing for a better approach to the second level. Participants mention the difficulty being easier in their second level (see table 8).

**Table 8.** Example of participants quotes about suggesting green over blue

<b>Participant</b>	<b>Quote</b>
Participant #2	<i>A lot easier at the second level since I have already had my test-run so to speak, and to me it is not too obvious since I have not played games that much, so it takes a while to practice.</i>

This was common with participants that were not experienced in games and was a part of the older age group that started with the level in colour.

# Discussion

## Different Visual Aspects

Colour coding does not seem like a mandatory element in games in order to have the player understand which way to take. However it is a helpful tool. A number of aspects that seemed helpful for the participants were identified during this study (not specifically in this order):

- Placement of props in level
- Colour through lights
- Level design linearity
- Symbols

How the props were placed in the level was mentioned as helpful by participants. Participants mentioned the prop placement as something that led them on and somewhat revealed the path. Participants mentioned coloured lights and symbolism as something that affected their decisions, which could be seen as proof that Garber and Hyatts (2003, p.313) theory of colour as a *compelling visual cue* and a way to guide the player in a certain direction is accurate. Though none of the above listed aspects excludes the other, it is apparent that collectively visual elements assist players with navigation. Whether or not one of these visual elements specifically aid more or less is difficult to determine from a small sample size, however it is evident that they all play a part in what the players take into consideration when attempting to traverse a level.

The use of symbols in this study did not seem like an important visual cue for navigation, but it was identified. As mentioned, symbols can be used to show the player what something means or is (Ma, 2017, pp.13-14), however the use of symbols in this study were sometimes overlooked by participants. Participants mention of symbols as the reason behind why they avoided a certain area of the level was not evident enough to serve as a result. This may be related to previous experience confirming McCloud's (1994, pp.188-189) theory that repeated exposure to the same

colour and pattern will create a recognition, indicating that more playtime would be necessary. Participants mentioned that a symbol indicating “nuclear waste or something that would hurt” could have saved them from dying. When the participants were told there in fact were barrels marked with nuclear waste they blamed it on the level being too dark and that they could not see them. The answer suggests that McCloud’s theory (1994, pp.188-189) could be applied here as well. The answer also means that it is impossible to exclude that symbols could in fact have been of more importance when it comes to navigation if only the level would have been better lit up in order to make the barrels and its symbol clearly visible.

### **Completion and Failure**

Not all participants were able to complete both levels, though most managed to complete at least one of the two levels. In the cases where participants only completed one, it was always the greyscale level that was finished, implying that it was easier than the one in colour. Based on video footage, this is likely due to the final puzzle in the coloured level being too difficult for inexperienced players. The puzzle left most participants stuck for the remainder of their playtime and did not contribute anything to the primary research questions. This is not something that should be included in future research. Avoiding difficult gameplay and focus on navigation would be more important to the research question.

### **Limitations and Future Studies**

Though limited in scope, this study may serve as a foundation within the topic. As seen in the collection of related research, not much research has been done within the subject of colour as a guiding method. A future study may include more levels, with more visual indicators and a larger amount of participants. As this study was limited primarily by the amount of participants, results may vary with a larger group.

For future studies a few changes would be addressed, such as changing the blue colour of the lights to a green colour as feedback from participants showed that green would be a colour that could easier lead them to believe that it is something positive. The levels could be edited to have some actual gameplay elements in them to further force the player to seek visual elements, using puzzles with colour coding as an example though not making the levels harder in difficulty. The puzzles would be better suited if they challenged the participants mentally rather than forcing them to complete a puzzle based on character movement and control. The final puzzle of the coloured level caused many participants to get stuck and failed to get past it to see the final section of the level, which made the study lose valuable data from participants figuring out the last section.

Following the doubt on Wolfson and Case (2000, pp.188-190) thoughts on red complementing blue for video game directions, future studies should do extra research in which colour should be used as means of communication.

The time that participants had to complete each level may have been too short, as it was expressed in interviews that there was an inability to see anything that resembled directives. Participants argued that red lights would aid them in finding where they had to go, despite being on the level filled with colour. These problems were prominent with participants of the older age group (45 and up), thus this is thought to be related to inexperience in games.

This study opens up for future studies to further investigate the effects colour through lights, symbolism and shapes may have on how players navigate through a level. No conclusive evidence could be found to support whether or not colour coded lights, symbolism, shapes and suggestive placement of props exclusively aided players. This is however not a setback and should prove useful for future studies in the same topic, whereas they could benefit from having one level to test each visual element to understand if one element is more represented than another in the entire category of guidance through visual elements.



## **Conclusion**

### **A Tool for Navigation**

This research aimed to explore the importance of colour as a tool of navigation. Based on the data collected showing that all participants successfully managed to navigate in both levels despite one of the levels completely lacking colour as a tool of directional guidance, we can conclude that colour-coding is not a mandatory thing to assist the player with guidance. However it did prove to be a useful tool for players to navigate. The combination of colour-coded lights, symbolism and shapes proved to be what allows a player to understand which directions to take in the level, though not all elements were needed for a participant to complete the levels.

### **Different Visual Elements**

Participant data suggests that different elements from visual guidance aids and since the opinion of what actually aids them varies with every participant, the conclusion stands that visual guidance works in tandem together with a multitude of guiding elements. From this study alone it is impossible to say which element affects players the most as answers from interviews have varied, though it is evident that aiding factors do assist players regardless of player-experience. This answered the thesis of colour along with Plass et al. (2014, p.139) statement of both colour and shape being relevant, confirming the thesis of this study. Though the thesis is confirmed, other questions arose thanks to the data and feedback from interviews that confirm different colours could have been used to improve the study, despite related research implying otherwise. Colour and shape are not the only ways of guiding the player as symbolism has a part in it as well, being used as a means to make the player understand the direction in a natural way by understanding how a level or part of a level is designed in a way that deliberately invites the player to explore it, or to avoid it.

## References

- Bioware, 1998. *Baldur's Gate*. [video game], Los Angeles: Black Isle Studios
- Bioware, 2011. *Star Wars: The Old Republic*. [video game], San Francisco: LucasArts
- Blizzard Entertainment, 2004. *World of Warcraft*. [video game], Los Angeles: Blizzard Entertainment
- Block, B., 2008. *The Visual Story. Creating the Visual Structure of Film, TV, and Digital Media*. 2nd ed. Oxford: Elsevier Inc.
- Braun, V., & Clarke, V., 2012. Thematic analysis. In H. Cooper, P. M. Camic, D. L. Long, A. T. Panter, D. Rindskopf, & K. J. Sher (Eds.), *APA handbooks in psychology. APA handbook of research methods in psychology, Vol. 2. Research designs: Quantitative, qualitative, neuropsychological, and biological*, (pp. 57–71). Washington: American Psychological Association. DOI: 10.1037/13620-004
- Cote, A., & Raz, J., G., 2015. In depth interviews for games research. In: P. Lankoski och S. Björk, eds. *Game Research Methods*. Pittsburgh: ETC Press, pp.93–116.
- Creswell, J.W., 2014. *Research design: qualitative, quantitative, & mixed methods approaches*. 4th ed. Los Angeles: Sage.
- Crystal Dynamics, 2013. *Tomb Raider*. [video game], Tokyo: Square Enix
- Dempsey, N. P., 2010. Stimulated recall interviews in ethnography. *Qualitative Sociology* 33(3), pp.349–367. DOI=10.1007%2Fs11133-010-9157-x
- Foroughi, C.K., Serraino, C., Parasuraman, R. & Boehm-Davis, D.A., 2016. Can we create a measure of fluid intelligence using Puzzle Creator within Portal 2? *Intelligence*. 56. [online] DOI: 10.1016/j.intell.2016.02.011
- Garber, L.L. & Hyatt, E.M., 2003. Color as a tool for visual persuasion. In Scott, L. & Batra, R. (Eds.), *Persuasive imagery: A consumer response perspective*, (pp. 313-336). Mahwah: Lawrence Erlbaum Associates.
- Hart, J., 2013. *The Art of the Storyboard: A Filmmaker's Introduction*. 2nd ed. Oxford: Focal Press.
- Ma, M. & Oikonomou, A., 2017. *Serious Games and Edutainment Applications*

- Volume II*. Gewerbestrasse: Springer International Publishing.
- McCloud, S., 1994. *Understanding Comics: The Invisible Art*. New York: HarperCollins Publishers.
- Mäklin, J. & Lindblad, S., 2015. *Composition in Level Design*. [online] Available at: <<https://uu.diva-portal.org/smash/get/diva2:872686/FULLTEXT01.pdf>> [Accessed 11 November 2019]
- Pierce-Grove, R., 2014. Pressing Play: Digital Game Techniques and Interactive Art, *Games and Culture*, 9(6), pp. 468–479. DOI: 10.1177/1555412014549806.
- Pitkänen, J., 2015. Studying thoughts: Stimulated recall as a game research method. In: P. Lankoski och S. Björk, eds. *Game Research Methods*. Pittsburgh: ETC Press, pp.117–132.
- Plass, J.L. et al., 2014. Emotional design in multimedia learning: Effects of shape and color on affect and learning. *Learning and Instruction*, 29(C), pp.128–140. DOI: 10.1016/j.learninstruc.2013.02.006
- Schell, J., 2008. *The Art of Game Design: A Book of Lenses*. 2nd ed. Pittsburgh: CRC Press.
- Solarski, C. & Donovan, T., 2012. *Drawing basics and video game art: classic to cutting-edge art techniques for winning video game design*. New York: Watson-Guptill.
- Square Enix, 2013. *Final Fantasy XIV*. [video game], Tokyo: Square Enix
- Thatgamecompany, 2012. *Journey*. [video game], Tokyo: Sony Computer Entertainment
- Totten, W.C., 2014. *An Architectural Approach to Level Design*. Fairfax: CRC Press
- Valve Corporation, 2011. *Portal 2*. [video game], Washington: Valve Corporation
- Young, M., Cole, J. & Sutherland, S., 2012. Rich stimulus sampling for between-subjects designs improves model selection. *Behavior Research Methods* [online], 44(1), pp.176–188. DOI: 10.3758/s13428-011-0133-5
- Zammitto, L.V., 2005. The Expressions of Colours. *DiGRA Digital Library*. [online] Available at: <<http://www.digra.org/wp-content/uploads/digital-library/06278.05074.pdf>> [Accessed 11 November 2019]

Welsch, N. & Liebmann, C., 2003. *Farben*. Heidelberg-Berlin: Spektrum Akademischer Verlag.

Wolfson, S. & Case, G., 2000. The effects of sound and colour on responses to a computer game. *Interacting with Computers*, 13. [online] pp.183-192.  
DOI: 10.1016/S0953-5438(00)00037-0

# Appendixes

## Interview Questions

### Warm-up Questions

- How old are you?
- How often do you play videogames?
  - What type of games do you play?
- When did you play your first game?
  - How experienced are you with games? On a scale of 1-10?

### Questions based on time in recorded footage

- What was your thought here?
- What made you go here?
- Why did you choose this path(direction)?
- What do you think this meant? (Signs, guidance etc.)

### General Questions

- How successful were you in navigating the levels?
  - If short answer: Why?
- Where do you think the levels took place?
- Why did you choose the path you took?
- What were your challenges in the game?
- What did you feel was easy in the game?
- What do you think the game was about?
- What do you think the purpose of the game was?