TECHNISCHE HOCHSCHULE
OSTWESTFALEN-LIPPE
UNIVERSITY OF
APPLIED SCIENCES
AND ARTS

Bachelor Thesis (B.A. Media Production)
Psychology of Colors and Facial Expressions
with Application on a CG short clip:
The [Im]mortal Man

Bachelorarbeit (B.A. Medienproduktion)
German Title: “Psychologie von Farben und
Mimik mit Anwendung auf einen CG Kurzclip:
The [Im]mortal Man (ENG)”

Paulina. A. Steinert

MEDIENPRODUKTION

CC BY 4.0

Bachelor Thesis (B.A. Media Production)
Psychology of Colors and Facial Expressions
with Application on a CG short clip: The [Im]mortal Man

(German Title: “Psychologie von Farben und Mimik mit Anwendung auf einen CG Kurzclip: The [Im]mortal Man (ENG)”

Submitted by
Paulina A. Steinert

Supervised and Examined by
1st examinator: Prof. Dipl.-Ing. Rico Dober
2nd examinator: Celia Kaspar

Submission Date
18.04.2022 / SS2022

Technische Hochschule OWL

(University of Applied Sciences Ostwestfalen-Lippe, Germany)

MOTIVATION

Colors always have been fascinating to me. Since my early stages as an artist, I have always paid close attention to the most efficient utilisation of these elements. During my time as a student at the TH OWL (“Technische Hochschule OWL” / University of Applied Sciences and Arts in OWL”), I devoted my study towards the field of analogue and digital pictorial worlds. This included subjects such as computer graphics and visual effects, but also dramaturgy, media history, and design. When I thought about producing an animated computer graphics clip, I wanted to approach this with unconventional methods. Thus, creating a protagonist who communicates through abstract facial expressions and colors — a challenging concept which I wanted to pursue.

ABSTRACT

Nature is known for being rich in color. Throughout evolution, humankind’s brains have learned to respond to selected colors in multiple ways by assigning meanings to them. Since colors have an impact on our perception of the world, they can be artificially integrated into the media world in order to trigger thought processes. The media world utilises them as powerful tools to create impressions. This study aims to determine the natural and artificial occurrence of different hues in wildlife and their use in character/environment design. This thesis’ practical part uses the gathered information and integrates it actively into the short clip’s character design in relation to its non vocal communication.

The methods of choice for the research were literature, studies, films, online articles, and analyses that addressed the topics of color psychology and non-verbal/vocal communication. The results suggest that an even wider range of color palettes can be implemented into media to create more advanced stunning motion pictures, although there already are very stereotypical schemes that can be relied on but should not.

TABLE OF CONTENTS

1 | INTRODUCTION

Colors are omnipresent and without light we wouldn't be able to see them. Fortunately we are not just able to perceive their beauty on the visible light spectrum, but can additionally separate them into primary, secondary, and tertiary types of hues. Nevertheless, it is not just about the aesthetic aspects. Throughout centuries both humankind and wildlife have learned to read the signals that those elements convey. In fact, colors do not only steer our gaze but can also affect the way we feel. Which is why nowadays they find use as powerful tools in our creative world. Furthermore, they can serve as beautiful instruments to visualise ideas, signs, symbols, thoughts or even stories. A wise man once said: "A thousand words leave not the same deep impression as does a single deed" (Henrik Ibsen, 20th century). After his death, this saying was repetitively reinvented by Arthur Brisbane, Fred R. Barnard and copious magazines until it eventually became one of the globally most known metaphors through use in journalism and advertising:

"One Picture is Worth a Thousand Words"

- San Antonio Light's Pictorial Magazine, 1918

Although this quote is very much true, we also realise that it takes more than colors to make a picture. There is another vital and irreplaceable component that cannot be missed out on: *actions*. Humanity has depended on non-verbal communication since the early stages of our time. As time progressed, we have learned different methods to collectively communicate with one another through body language, symbols, and colors. Surprisingly enough, we have not only connected to the color coding language throughout our evolution, but also to learned to distinguish primitive emotions: happiness, sadness, anger or anxiety. Both elements have become universal to our repertoire as humans and can be identified by anyone, regardless of their cultural or ethnic background, gender-identity or age. As a result, cultural trademarks established themselves over the course of history and became part of former ancient civilizations.

Research topic This bachelor thesis illustrates the magic of color coding, mimics and gesturing, and their importance for moving pictures as one piece. It explores and involves their different yet very universal meanings in the world of nature, marketing and more importantly: character / environment design. Last but not least, this paper will hopefully extend the horizon of other creatives and dare them to implement different approaches of coloration into their own work.

2 | THEORETICAL FOUNDATIONS

2.1. Color Psychology

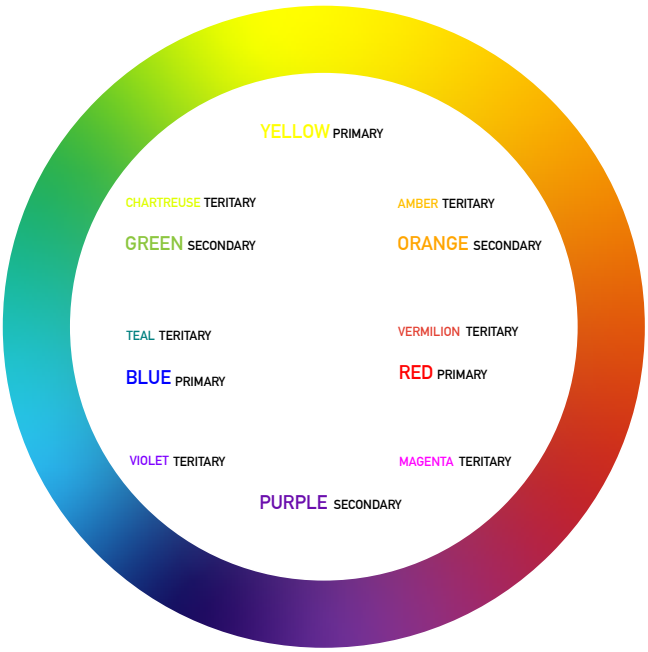


Fig. 1: Primary, Secondary, Tertiary Colors
(Based on Johannes Itten's + Isaac Newton's Color Theories)

COLORS can be separated into three different categories:

- Primary c. (Red, yellow, blue)
- Secondary c.(Orange, green, violet/purple)
- Tertiary c. (Amber, vermilion, magenta, violet, teal, chartreuse)

Colors aren't just colors - they are powerful tools that impact our modern daily lives even more than we might expect. They alter our alpha brain waves and feed our subconsciousness with important sensory information.[1] Every color on the spectrum can, if applied purposefully and correctly, be used as a powerful tool to trigger a psychological process and steer our emotions, behaviour and the decisions we make.[2] But why does that happen? In this chapter, I'm going to explain the signals and meanings of colors in nature and how these can be applied in our modern media branch…

---

1 Gerl, Ellen J.: The Causes and Consequences of Color Vision (02.10.2008), [online] https://evolution-outreach.biomedcentral.com/articles/10.1007/s12052-008-0088-x [Accessed: 14.02.2022]

2 Pivirotto, Nicole (2021), Color, Form and Magic: Use the power of aesthetics for creative and magical work, San Francisco (CA): Chronicle Books LLC.

An excursion to the *Wild Colors Exhibition* at the Field Museum in Chicago helped me to gain a better perspective on the significance of color effects, their natural impact on brain processing, and identify color language in nature's environment. The exhibition addressed all primary and secondary hues located in nature.

Fig. 2: Granular Poison Frog
(Source: Wild Colors Exhibition)

NATURE'S RED belongs to the three primary colors and has the longest wavelength (≈600-780 nm) with the lowest frequency (4.29 Hz) on the visible light spectrum. This makes it stand out more than contrary cooler tones.[3,4] Depending on the intensity of its vibrancy, its dominance gains our immediate reaction and attracts our interest.[5] The brighter it appears, the more noticeable and alarming it becomes. It is a passionate color which can also be deadly. Why do we associate red warning signs and symbols with danger? Red is not only an eye catching color, but also naturally occurs in our own bodies. To be more exact: the substance to which we refer to as *blood* pumps through our own veins. Thus, red is one of the culturally most established colors since the beginning of time. We simultaneously connect blood with pain because naturally pain needs to be induced to cause bleeding.[5] Therefore, from an evolutionary perspective our subconsciousness learned to code our blood's color as a warning symbol. It finds multiple usage in areas that need urgent attention or caution (even though yellow is more commonly used in areas that demand caution).

In the case of the granular poison frog, red does not only signalise danger, but is also accompanied by the black on its stomach. As the Wild Color Exhibition demonstrates, "aposematism" is the opposite of camouflage and is meant to signalise predators to stay away from their potentially deadly prey. [7] The same theory can be also applied to pepper types on the Scoville scale, as well as the Black Widow spider.

---

3 Wäger, Markus (2017). *Das ABC der Farben.* Bonn, Germany: Rheinwerk Design, pg. 147-149.

4 Butcher, G. / NASA. (2016). *Tour of Electromagnetic Spectrum*. 3rd ed [ebook] pg.18. Available at: https://smd-prod.s3.amazonaws.com/science-pink/s3fs-public/atoms/files/Tour-of-the-EMS-TAGGED-v7_0.pdf [Accessed: 14.02.2022]

5 *Wild Colors* (2022). [Exhibition]. Field Museum of Natural History (Field Museum), Chicago, USA. 22.10.2021 till 08.01.2023

6 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, p. 22-23.

7 Wikipedia Contributors (2022). *Aposematism*. [online] Wikipedia. Available at: https://en.wikipedia.org/wiki/Aposematism [Accessed: 28.02.2022]

Combinations of colors and different shades on the greyscale can theoretically indicate a subject's "attitude" (safe versus deadly) if nature didn't program them to lure prey through an oxymoron color scheme. For this reason, aposematism also finds additional practice in today's modern character design (however, this topic won't be discussed until we reach the chapter of "Colors in Character and Environment Design").

RED IN HISTORY AND MEDIA Throughout human history, aggressors and warriors have used colors to both establish dominance and demonstrate their values. A perfect example for this statement are the ancient Spartan warriors who were well-known for their brute oligarchy; a system based on military, honor, wealth, and royalty, whereas the Athenians primarily believed in democracy and philosophical education. Both city-states owned powerful armies, however, Sparta added more pressure on physical training.[8] Red belonged to their color scheme and is still heavily used nowadays in modern sports and the movie branch to signalise aggression, strength and speed (e.g. Ferrari, Formula 1, Chicago Bulls and various franchised movie characters whom I'll talk about).

But we do not only connect red to blood, sports, and war. There has been another important tool which is deeply linked to our ancestors survival: fire. Fire's color is red and even in our modern life we still partly depend on this tool for warmth and cooking. As Markus Wäger mentioned in his book "Das ABC der Farbe", it has been proven through studies that test subjects perceived red spaces to be warmer than they actually were.[9] From a psychological perspective in relation to food, it is also known to be the most commonly and effectively used color in the food industry due to its subconsciously energising and stimulating properties (e.g. Kentucky Fried Chicken, McDonald's, Wendy's, Coca Cola, Pizza Hut, Burger King,…).[10]

Red also finds use in areas that require caution. Wherever we find a red sign it usually asks for our attention.

---

8 Hasa (2019). *What is the Difference Between Athens and Sparta.* [online] Pediaa. Available at: https://pediaa.com/what-is-the-difference-between-athens-and-sparta/ [Accessed: 28.02.2022]

9 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 147.

10 Howell, Ashley Anastasia (2016). *Understanding Color Psychology for Restaurants & Brands*. [online] Medium. Available at: https://medium.com/@ashley_howell/understanding-colour-psychology-for-restaurants-brands-dbb7ffbcecae [Accessed: 28.02.2022]

Fig. 3: Clownfish
(Source: Wild Colors Exhibition)

NATURE'S ORANGE is a secondary color that in this unique case simultaneously shares similarly positive attributes to its neighboured colors (see **RED** and **YELLOW**). Due to its closeness to red, it had not been paid much attention to until the 16th century because it was considered a shade of red. Therefore, up until the medieval times there was not even a term to describe orange. Its wavelength of ≈585-600 nm is significantly shorter in comparison to the one of red, yet longer than yellow's.[11]

A relatively neutrally bright hue of orange can be interpreted as very refreshing, fun, joyful, and energetic. It can also capture the attention of the viewer to slow down and focus on it at the same time since it is a highlighting element.[12] In nature's environment it most commonly occurs in foods such as oranges, mangoes, and persimmons, but can be also part of some animals patterns; such as lizards to flash attention.[13] Due to this particular reason, it is used as a signal color in areas that require caution (e.g. taxiway areas at airports, construction sites, correctional facilities). In case of tigers orange, it is used to fool their color blind prey and make their foe blend flawlessly into its environment.[15]

ORANGE IN MEDIA... In the advertisement world it can be often seen in the foods, cosmetics, and the sports industry to achieve various types of psychological effects. One of America's most known coffee shops, Dunkin' Donuts, uses a primarily orange, pink, and brown color scheme to underline the sweetness and casualness of its pastries and beverages. This way it is seen as more appealing by the average consumer.[16] Due to orange's childlike energy and positive connotations it can be also strongly assumed that brands such as Fanta try to target a younger audience with their bubbly and sizzling soda, which can be also associated with oranges and thus freshness …

---

11 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 150.

12 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, p. 24-25.

13 *Wild Colors* (2022). [Exhibition]. Field Museum of Natural History (Field Museum), Chicago, USA. 22.10.2021 till 08.01.2023

14 Wäger. *Das ABC der Farbe.* pg. 150.

15 *Netflix Series: Life in Colour with David Attenborough* (2021). Directed by A. Geiger. [online streaming]. United Kingdom. BBC One.

16 The J.M. Smucker Company. Dunkin' Donuts. [online] Dunkin Donuts. Available at: https://www.dunkinathome.com/ [Accessed: 28.02.2022]

Fig. 4: Yellow Sprinkled Butterflies
(Source: Wild Colors Exhibition)

NATURE'S YELLOW is a beautiful, cheerful and happy color, but moreover also the brightest hue of all. Since yellow conveys the shortest wavelength (≈575-585 nm) on the visible light spectrum, it is barely recognisable on white but even more noticeable if it is placed next to darker shades or black. In addition, it is located between green and orange on the color spectrum. When bright, it can neither be categorised as cold nor warm. Due to this reason, its pureness can be easily corrupted by other tones which can quickly lead to a more pleasant or unpleasant perception. For example, if contaminated with a darker shade it will rather be associated with traits that we connect to green or brown or be even perceived as cheap.[17,18] However, if a warm tone gets added it can quickly become a shade of orange. Due to this fragility, it is extremely important to work with a suitable brightness.

Nature decorated insects such as bees, wasps and butterflies with concise yellow-and-dark/black patterns to fend off predators (another example of *aposematism*).[19] Nevertheless, the deadliness cannot be generally assumed based on their colorisation. Not all creatures are poisonous but some are deadly, indeed. The blue-ringed octopus's yellow skin bears blue rings which can be flashed iridescently if it fears harm from a potential predator. Although it is very uncommon to get bitten, a bite can quickly result in death. [20] One can claim that yellow's carriers seem not approachable, but yellow on its own does not promote immediate harm. It is a smart but sensitive color which with the right provocation can lead to trouble. That is why it can be simultaneously associated with intellect as well. [21]

Fig. 5: Blue-Ringed Octopus
(Source: Wild Colors Exhibition)

17 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 151-153.

18 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, pg. 26-27.

13 *Wild Colors* (2022). [Exhibition]. Field Museum of Natural History (Field Museum), Chicago, USA. 22.10.2021 till 08.01.2023

20 Spencer, Erin (2017). *The Blue-Ringed Octopus: Small but Deadly.* [online] Ocean Conservancy. Available at: https://oceanconservancy.org/blog/2017/03/13/the-blue-ringed-octopus-small-but-deadly/ [Accessed: 28.02.2022]

21 Pivirotto, *Color, Form and Magic*, 26.

But why do we then connect so many positive traits to yellow despite its negative connotations in nature? Yellow is regarded to be the color of the sun, which in turn we connect to life, energy, summer, illumination and warmth. In addition to that, it is also associated with one of world's most desired precious metals: Gold. Throughout history gold has been a sign of wealth and can also be connected to sophistication and optimism. [22]

YELLOW IN MEDIA can be observed from two different perspectives with a very sharp contrast. Firstly, if we take all previously discussed points into account and address its serious attributes, we realize very quickly that this color is commonly used to ask for caution in public traffic and areas that require imminent attention. Especially in combination with black, it serves the purpose of asking for caution even more than orange (e.g. police tapes, warning vests, bus and train stations,…). It has become a major design component of insurances and public services like HUK-Coburg, ADAC, Shell, DHL and the Deutsche Post. [23]

However, there is also a beautifully sunny side to this color due to its cheerful associations. Since yellow is very bright and easily spottable, the global fast food chain "McDonald's" has used it to its advantage. McDonald's famously arched "M" logo can be spotted from a far distance on any highway. Aside from that, their most popular kids menu known as the "Happy Meal" is packed in a red box with a yellow letter "M" and and a big smile on it. [24]

---

22 Velarde, Orana (2019). *Color Psychology in Marketing: The Ultimate Guide.* [online] visme. Available at: https://visme.co/blog/color-psychology-in-marketing-the-ultimate-guide/ [Accessed: 03.03.2022]

23 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 151-153.

24 McDonald's (2022). [online] McDonald's Website. Available at: https://www.mcdonalds.com/us/en-us.html [Accessed: 03.03.2022]

Fig. 6: Nature's Green(s)
(Source: Wild Colors Exhibit)

NATURE'S GREEN(S) can be primitively differentiated into two different types of hues. It is also another primary color. From a generalised point of view, green obtains a wavelength that ranges from ≈510-575 nm as a collective color, however one can distinguish between light green and (dark-) green which range between ≈540-575 nm (light green) and ≈510-540 nm ((dark-) green) in the center of the visible light spectrum.[25, 26]

While Markus Wäger is referring to light green as "yellow green" (dt. "Gelbgrün") in his book about the ABC of Color (original title in dt.: "Das ABC der Farbe") I disagree with this term because it does not capture light green as an isolated color from my point of perspective. As previously discussed on page 10, yellow's integrity can be very easily influenced by different brightnesses of hues due to its short wavelength and thus results in distorted connotations.

Generally, green is the most commonly occurring color in our environment, hence it has always been connected the most to nature. When humanity thinks of green, it immediately associates it with vegetation, fresh relaxing air, balance, growth, the cycle of life, and serenity.[27] Herbs have been used for centuries because of their healing abilities. Mother Nature's creations such as forests and jungles are our main oxygen suppliers and vital for life which is why we associate it with health. However, as any other color it also conveys negative associations. It is stigmatised as the color of envy. Green, followed by purple, is one out of two colors that we connect to poison, unpleasantry, radioactivity and the "unknown".[28] But where do those beliefs stem from? When Madame Currie discovered radium in 1898, she found out that the radioactive object had a green glow. In addition to that Scheele's Green (1775), a highly toxic and dangerous pigment that contains cupric hydrogen arsenite, was used in paint.[29, 30]

---

25 *Wild Colors* (2022). [Exhibition]. Field Museum of Natural History (Field Museum), Chicago, USA. 22.10.2021 till 08.01.2023

26 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 154-156

27 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, pg. 28-29.

28 Wäger, Markus (2017). *Das ABC der Farbe,* 156.

29 Harvey, Alisa (2020). *Why do we associate purple and green with poison?.* [online] How It Works. Available at: https://www.howitworksdaily.com/why-do-we-associate-purple-and-green-with-poison/ [Accessed: 05.03.2022]

30 Wikipedia Contributors (2022). *Scheele's Green*. [online] Wikipedia. Available at: https://en.wikipedia.org/wiki/Scheele%27s_Green [Accessed: 05.03.2022]

GREEN IN MEDIA Companies that offer services in the gastronomic field have recognised the positive consumer-connotation of green to nature. They learned to turn this color into a major component of their corporate design in order to display their environmentally friendly values or use of organic goods.[31] A perfect example for this incorporation is the Starbucks' Coffee Company's corporate design which conquers the coffee chain market with its famously green mermaid logo. Starbucks Company proudly offers a deeper look into its brand colors which can be seen in the illustration to the right.[32]

Fig. 7: Starbucks' Main Brand Colors (Source: Starbucks Coffee Company Website)

Shake Shack is another example for a (light-) green and white corporate design. Although the company sells fast food, its concept is about partaking in the US Animal Welfare Policy which includes responsible ingredient sourcing from reliable business partners and supporting charitable purposes.[33] Nevertheless, the same color scheme can also be observed at most local organic stores regardless of their popularity, size or cosmetic brands that want to represent similar values. Unfortunately, many big-name companies also "greenwash" their image. Greenwashing is a marketing strategy that uses an artificial concept to look environmentally friendly on a surface level.[34] As it can be seen in the case of greenwashing, colors and design can also serve as strongly manipulative tools.

Aside from that, green finds most commonly use in areas that need to indicate "Yes" while red usually signalises a clear "No!". This phenomenon can be observed globally in traffic light designs. Although minor differences exist, most international traffic light systems use a green, yellow/orange, and red scheme which makes them universal.[35] Due to its connection to nature green is also perceived as the color of wisdom and science, followed by blue.

---

31 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, pg. 29.

32 Starbucks Coffee Company (2020). Starbucks Creative Expression. [online] Starbucks. Available at: https://creative.starbucks.com/color/ [Accessed: 04.03.2022]

33 Shake Shack (2020): Stand for Something Good. [online] Shake Shack Website. Available at: https://shakeshack.com/stand-for-something-good [Accessed: 04.03.2022]

34 Klaehn, Marie (2021). *Greenwashing – gezielte Täuschung der Verbraucher*innen?.* [online] PRIO 1. Available at: https://prio1-klima.net/blog/2021/greenwashing-gezielte-taeuschung-der-verbraucherinnen/ [05.03.2022]

35 Symonds, Dr. Paul (2022). Traffic Lights Design and Standards Worldwide. [online] Wayfinding. Available at: https://www.travelwayfinding.com/traffic-lights-design/ [Accessed at: 05.03.2022]

Fig. 8: Bright Hue of Blue
(Source: Wild Colors Exhibition)

NATURE'S BLUE is the last primary color. It is the neighbour of purple and has a shorter wavelength than red (between ≈450-495 nm).[36] Therefore, it has a much higher frequency and appears to be more luminous than red. Just like green, it plays a huge part of our world's makeup. When we think of blue we think of the ocean, sky and night, however, these are the only common examples. Generally blue occurs only very rarely in nature which makes it even more fascinating. Most amphibians, insects and reptiles that appear blue at first sight are only conditionally blue since in some cases their skin color is not the result of a chemical pigmentation.

It may originate from structural coloration which means that their body surfaces interfere with the visible light and reflect only certain hues of light.[37] In some cases chemical pigments and structural colors can work together (e.g. reptiles). This makes it a perfect example of how different mixtures of pigments work together and can alter our impression.[38] Structural coloration looks nearly iridescent in contrast to the less vibrant pigment coloration as it can be seen in the example on the right.

Fig. 9: Structural Coloration (above)
vs. Pigmentation (below)
(Source: Wild Colors Exhibition)

Unlike red, blue is perceived as more calming, cooling and trustworthy. It is also associated with clean water that we need for survival, hence it can be also perceived as clean and fresh followed by white. On the other hand green, yellow, brown or red drinking water is generally biased as undrinkable. On the one hand it carries plenty of positive attributes. On the other hand just like in case of any other hues, some of us associate negative traits to it such as sadness, depression and forced dependability. [39, 40]

---

36 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 162-165.

37 Weisberger, Mindy (2021). *Why is the color blue so rare in nature?*. [online] Live Science. Available at: https://www.livescience.com/why-blue-rare-in-nature.html [Accessed: 07.03.2022]

38 *Wild Colors* (2022). [Exhibition]. Field Museum of Natural History (Field Museum), Chicago, USA. 22.10.2021 till 08.01.2023

39 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, pg. 31.

40 Wäger, Markus (2017). *Das ABC der Farbe,* 162-165.

Since blue can be categorised as mostly neutral, it does not cause any significant changes in our emotional perception. As a result, it is found to be the least activating hue of all. This is why it is seen as more serious in contrast to its playful and complimentary partner orange. Nevertheless, according to a study performed by Phillip N. Cohan in 2011, blue was the most preferred color among nearly ≈2000 children and parents which turns it into the most widely accepted color of all.[41]

BLUE IN HISTORY AND MEDIA From a historical perspective, blue established itself between the 16th and 19th century as the color of piety among high ranking royalties (see gemstones such as London blue sapphires, topazes or medieval gowns). This originates from its association with heaven (enlightenment and godliness).[42] It is also used to describe people of royal ancestry by referring to them as "blue-blooded". It is not for nothing that we often refer to a dark and vivid blue as "royal blue". In contrast to its counter partner red (used by communistic systems and dictatorships), the addressed element has also reigned as the color of democracy throughout the course of human existence.

As a widely accepted and mostly neutral color, it is thought of as the information carrier; hence it mostly occurs in the technology sector. Consumers seek reliability, trust and stability as brands want the best for their reputation. Therefore, it finds use in the corporate identity of banks (IBM, Chase, American Express, Visa, Paypal), insurances (Blue Cross Blue Shield Association), and intelligent technology heavy companies (Intel, Twitter, Dell, Hewlett Packard (HP), Facebook/Meta).[43]

---

41 Cohen, Philip N. (2012). *Children's Gender and Parents' Color Preferences*. [online] Springer Science+Business Media, LLC 2012. Available at: https://www.terpconnect.umd.edu/~pnc/ASB2013.pdf [Accessed: 07.03.2022]

42 Google Arts & Culture Contributors (Year). *The Color of Royals.* [online] Google Arts & Culture. Available at: https://artsandculture.google.com/usergallery/the-color-of-royals/2wKyQ40ioxf3IQ [Accessed: 08.03.2022]

43 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 161.

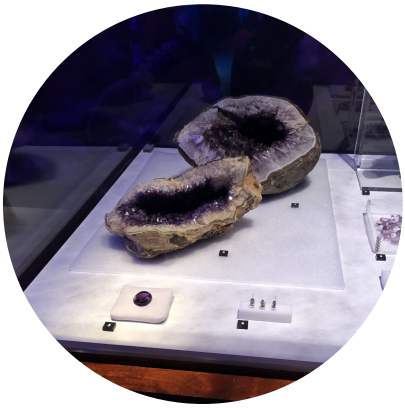


Fig. 10: Purple Crystals
(Source: Wild Colors Exhibition)

PURPLE / VIOLET is considered to be the most mysterious, honorable, creative, and luxurious hue of all. It overlaps with dark blue/violet-blue shades (≈460-470 nm) and sits at the ≈380-460nm mark of the spectrum which makes it the color with the shortest wavelength.[44] Although it is a perfect mixture between red and blue, it is not seen as a gender neutral and almost twice as popular among women according to Philip N. Cohan's study about *"Children's Gender and Parents' Color Preferences" (2012)*.[45]

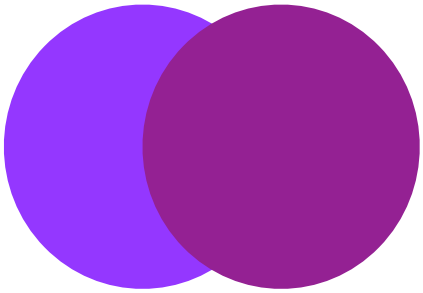


Fig. 11: Cool Purple vs. Warm Purple

From a neutral perspective, it is a combination of red and blue. A ratio of a dominating blue and submissive red tone will be less straining on the eye of the beholder than a ratio of a submissive blue and dominant red.[46] Both colors can be interpreted differently and lead to uncertainty about their interpretation. While the cool purple looks more artificial and might be especially associated with digital colors, a warm purple leans more heavily towards nature. Different tones of magenta will look more natural to the recipient because they can be found easier in nature (e.g. grapes, amethyst quartz crystals, birds, sea animals, and especially flowers (in lighter tones)).[47] As Markus Wäger describes in his book, magenta, pink, purple, and other hues that can be found on the short purple spectrum are hard to be defined due to their flowing borders.[48]

PURPLE IN HISTORY AND MEDIA Pure purple is even rarer to find in nature than blue. Due to this reason it has become the color of royalty, alongside blue. The use of purple by humankind dates back to the 15th century BCE (engl. "Before Current Era"). It took extensive …

---

44 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 167.

45 Cohen, Philip N. (2012). *Children's Gender and Parents' Color Preferences*. [online] Springer Science+ Business Media, LLC 2012. Available at: https://www.terpconnect.umd.edu/~pnc/ASB2013.pdf [Accessed: 07.03.2022]

46 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, pg. 33.

47 *Wild Colors* (2022). [Exhibition]. Field Museum of Natural History (Field Museum), Chicago, USA. 22.10.2021 till 08.01.2023

48 Wäger, Markus (2017). *Das ABC der Farbe,* pg. 168.

amounts of resources (e.g. purple snails) and lots of labor to gain about 30 grams of what we refer to as "Tyrian-/Imperial Purple". Due to this reason it became a very costly and luxurious object which made it comparable to gold. Ironically enough, both yellow/gold and purple are complimentary colors which have often accompanied each other in clothing through the course of history within the walls of Roman Catholicism and witchcraft.[49] Followed by green, purple is the only other hue that is associated with poison due to its rare occurrence in nature and connection to witchcraft. It often has had to be artificially replicated, hence it appears to be a synthetic element to humanity. Nowadays, the addressed hue is still deeply connected to luxury and spirituality. Since it is seen as the color of creativity, many make-up brands such as Urban Decay and other cosmetics brands primarily target women with their purple brand identity.[50]

However, it is also trying to escape the stigma of feminism which is not easy. In addition, more and more organisations try to approach their cooperate design with what could be described as a "*combined coloration*" approach. Charitable organisations such as the Lupus Foundation of America use purple to reflect the attributes of both red (for strength and motivation) and blue (for calmness) in their branding.[51] Moreover, intelligent technology and streaming companies like Yahoo!, Syfy and Twitch dare to implement it as their major component with a similar intent. Otherwise, purple is only sparingly used in the media and marketing branch.

Fig. 12: Lupus Awareness Graphic (Source: Client Commission)

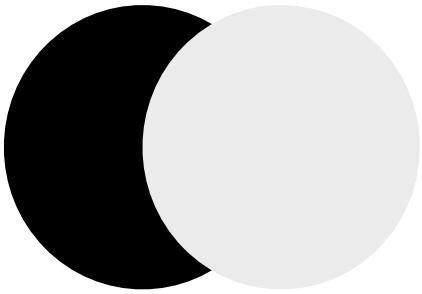
ULTRAVIOLET belongs to the mysteries of nature. It cannot be naturally seen by the human eye without technological help, hence its purpose is only conditionally understood. Nonetheless, just because the human eye cannot sense it does not mean that other species cannot. In other words, certain animal pigments evolved into the ultraviolet spectrum in order to send signals, from warnings to possible mates, to their own kind.

---

49 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, pg. 33.

50 Velarde, Orana (2019). *Color Psychology in Marketing: The Ultimate Guide.* [online] visme. Available at: https://visme.co/blog/color-psychology-in-marketing-the-ultimate-guide/ [Accessed: 09.03.2022]

51 Lupus Foundation of America Contributors (2022). Raise Awareness of Lupus. [online] Lupus Foundation of America Website. Available at: https://www.lupus.org/heartland/raise-awareness-of-lupus [Accessed: 09.03.2022]



BLACK AND WHITE can be categorised as colors, but are technically shades. While white is the result of all colors on the visible light spectrum combined (additive), black is the result of subtractive color mixing. As a result, both of them are not a direct part of the colors on the visible light spectrum. They are rather the combination or absence of light.

Fig. 13: Black and White

As a reflective shade, white makes spaces and objects appear wider than they are. Due to its association with cleanliness, it occurs in environments that require high visibility and sterility, such as hospitals. It can be perceived as neutral depending on the hue and shade (white / off-white), however, it generally serves little purpose and is less impactful than the primary, secondary, and tertiary colors. One could claim, that white represents a blank space that could use splatters of paint.

Black is an absorptive color. It makes spaces appear smaller. Like white, it is also associated with nothingness at the same time. Nonetheless, it finds more use due to its association with elegance and seriousness (for instance in the case of black tie events). It established itself within specific ancient cultural circles as a symbol of mourning and death, while others viewed it as protection from evilness. [52, 53]

Black and white find lots of use in minimalistic designs but can serve as even more powerful instruments in the character and environment development due to their association with innocence and darkness.

---

52 Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC, pg. 15.

53 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 174-176.

TABLE OF COLOR EFFECTS

COLOR	EMOTIONS / MEANINGS		PROPERTIES	BRANCH
RED	• Anger • Passion • Courage • Strength • Pain	• Warning • Danger • Attraction	• Stimulating and activating • Attention seeking and appealing	• Sports industry • Food industry • (Street-) signs
ORANGE	• Energetic • Refreshing • Confident • Fun / Friendly	• Creative	• Steering interest • Attention seeking and appealing	• Food industry • Toys industry • (Street-) signs
YELLOW	• Happy • Cowardice • Intellect	• Caution • Happiness	• Gaining attention	• Sports industry • Food industry • (Street-) signs
GREEN	• Rejuvenating • Relaxing • Balancing • Healthy • Nature	• Luck • Progress • Wealth • Growth • Poison / Greed	• Relax • Balance • Encourage	• Environment • Health care • Food industry • Banking • Education
BLUE	• Loyalty / Trust • Calmness • Honor • Progress • Logic / Wisdom	• Stability • Accountability • Sadness	• Gaining trust • Calm down • Create feeling of structure	• Technology • Banking • (Street-) signs
PURPLE	• Mysterious • Spirituality • Imagination	• Poisonous • Luxury • Nobility	• Gaining reputation	• Religion • Witchcraft • Charitable organisations

Fig. 14: Table of Color Effects
(Based on previous research)

To illustrate a detailed overview of our discoveries, I created a table chart which includes all important categories of colors (based on the visible color spectrum). All data included in the above graphic demonstrates how different types of hues can impact our emotions in contrast to the set individual signal coding. Additionally, their most common occurrence in our modern media world is listed on the right side. The named guidance is based on my research and also vouched for by information about color theory that was provided to me in Media Design and -Technology lectures between 2014 and 2017 at the Gottlieb-Daimler-Schule 1 in Sindelfingen, Germany.

2.2.1. Colors in Character Design

We have discussed the significance of colors in the previous introductory chapter about “Color Psychology”. This helped us to understand the significance of the addressed topic. Color schemes for both characters and the environment are deliberately chosen by artists to steer our subconsciousness and perception. They can make a character match its environment accordingly, help with the display of its values or personality, and change throughout the development of the hero’s journey. What’s more, an extended version of the color wheel from the previous subchapter will assist with demonstrating the validity of this statement. It illustrates an assigned range of well-known protagonists / antagonists that can be easily recognised by most of the average media consumers who have grown up during the Era of Walt Disney/Pixar, Marvel and DC.

RED AND BLUE HUES have become very common practice to be added alongside gold and white elements to heroes clothing. Why is this? Heroic characters are mostly expected to be strong, loyal, brave/courageous, and passionate. Due to this, red is the color that is used to represent those values. In addition, blue symbolises loyalty, stability/balance, confidence, and logic. That is why characters such as Marvel Universe’s Captain America, Captain Marvel, Dr. Strange, Spider-Man, and DC’s Superman follow this color scheme. However, just like in nature, certain color schemes can also be used to deceit the eye of the consumer. A good example for this is Homelander (“The Boys”, 2019 - today). While this character is meant to be as protective as DC’s Superman, he is increasingly developing selfish and harmful tendencies throughout the storyline. The same development can be also observed in Spider-Man 3 (2007) where Peter Parker’s suit turns black as he increasingly becomes nefarious.

As a result, we can generally assume that the darker the color contrasts are, the worse the character’s attitude can be. Due to red’s connotations to death, pain, and blood it can be used to display negative traits in antagonists (e.g. Red Skull, Marvel). A great example of this is Deadpool (dark red, black, white). Although Deadpool is the product of his environment, he is also very self-centred and mainly follows his own plans. Thus, he is not a standard villain and also cannot be categorised as a hero. In contrast to Marvel and DC, Disney has developed the tendency of using red for its villains since red is also a color that indicates danger.[54]

---

54 McGuire, Sara (2017). *What Disney Villains Can Tell Us About Color Psychology [Infographic]*. [online] Venngage. Available at: https://venngage.com/blog/disney-villains/ [Accessed: 11.03.2022]

GREEN AND EARTHY Characters that lean closer to nature can display a color scheme that the recipient associates with nature, therefore green and earthy tones find more dominance. For instance, Marvel's Hulk who turns into a large muscular creature is designed to be green. In this case, green symbolises his background as a scientist and exposure to radioactivity which turned him into the superhero (and occasional villain) named Hulk. Green was also used for DC's Joker who was turned into an antagonist by falling into a chemical substance. In addition to these, Marvel's Loki dons primarily green clothes. In his case, this might be due to the connection to magic and witchcraft.

PURPLE / VIOLET finds the most use in the design of villains in different franchises (Marvel, DC and Disney). In movies it is very often associated with poison, creativity and magic, thus DC's Joker, Marvel's Thanos, Disney's Ursula and Yzma wear primarily the color purple. Yet, it is also used for characters with positive attributes. Disney's Aladdin is one of the few examples for the use of purple for a protagonist.

YELLOW AND ORANGE are considered happy and fun colors, thus they can be easily found in young, naive, kindhearted, and simultaneously adventurous characters (such as Vaiana/Moana and Nemo). However, yellow should not be mistaken with gold in this case. While a combination of yellow and orange can be perceived as a playful, gold is meant to appear as the more noble and serious counter partner. Golden elements tend to be found in many heroes clothes to signalise intellect, honor, and nobility like in the case of Aquaman (DC, 2018) where Arthur fights for his throne against his brother, the Ocean Master.

WHITE AND BLACK show the highest contrast. They can both indicate a protagonist's/antagonist's/neutral's attitude.[51] While white is perceived to be more of an innocent shade, black tends to be connected to viciousness and darkness. Thus, it can be found in the design of antagonists such as Venom (Marvel), Red Skull (Captain America, Marvel), Dr. Octopus (Spider-Man, Marvel), and Ursula (The Little Mermaid, Disney). [55]

The detailed table chart on the following page demonstrates an overview of the primary and secondary color schemes of an exemplary range of protagonists, antagonists and neutral ones.

---

55 McGuire, Sara (2017). *What Disney Villains Can Tell Us About Color Psychology [Infographic]*. [online] Venngage. Available at: https://venngage.com/blog/disney-villains/ [Accessed: 11.03.2022]

Color Distribution in Protagonists and Antagonists

(Based on Marvel, DC and Disney/Pixar Characters)

	RED	ORANGE	YELLOW	GREEN	BLUE	PURPLE	Black	White
1	Captain America (M)	Nemo (D)	Aquaman (DC)	Aquaman (DC)	Captain America (M)	Joker (Batman, DC)	Venom (M)	EVE (Wall-E, D)
2	Captain Marvel (M)	Moana (D)	Wolverine (X-Men, M)	Joker (DC)	Captain Marvel (M)	Ursula (Arielle, D)	Black Widow (M)	Black Widow (M)
3	Spider Man (M)	Hercules (D)	Hercules (D)	Hulk (Marvel)	Spider Man (M)	Aladdin (D)	Black Panther (M)	Starlight (The Boys)
4	Homelander (The Boys)	Shere Khan (The Jungle Book, D)	Wall-E	Peter Pan (Disney)	Homelander (The Boys)	Thanos (Avengers Endgame, M)	Thanos (Avengers Endgame, M)	101 Dailmatians (D)
5	Deadpool (M)		Loki (Thor, Marvel)	Loki (Thor, Marvel)	John Smith (Pocahontas, D)	Randall Boggs (Monster Inc., D)	Deadpool (M)	
6	Iron Man (M)		Iron Man (M)	Mike Glotzkowski (Monster Inc., D)	Stitch (Lilo & Stitch, D)	Yzma (The Emperor, D)	Ursula (Arielle, D)	
7	Dr. Strange (M)		Belle (Beauty and The Beast, D)	Jimmy Sulley (Monster Inc., D)	Dr. Strange (M)	Green Goblin (Spider-Man, M)	Dr. Octopus (Spider-Man, M)	
8	Red Skull (Captain America, M)		Mrs. Potts (Beauty and The Beast, D)	Green Goblin (Spider-Man, M)	Hades (Hercules, D)	Mrs. Potts (Beauty and The Beast, D)	Red Skull (Captain America, M)	Mrs. Potts (Beauty and The Beast, D)
9	Ultron (Avengers, M)		Starlight (The Boys)	Green Lantern (DC)	Elsa (Frozen, D)		Ultron (Avengers, M)	
10	Carnage (Venom, M)				CInderella (D)		Batman (DC)	
11	Captain Hook (Peter Pan, D)				A-Train (The Boys)		Black Noir (The Boys)	
12	Arielle (D)			Arielle (D)	Beast (Beauty and The Beast,D)		Billy Butcher (The Boys)	
13	Henry J. Waternoose (Monster Inc., D)						Henry J. Waternoose (D)	
14	Mystique (X-Men, M)				Mystique (X-Men, M)		Ocean Master (Aquaman, M)	
15	Ant Man (M)						Ant Man (M)	
16	Juggernaut (M)							
17	Magneto (X-Men, M)							
20	Stormfront (The Boys)						Stormfront (The Boys)	
P	7	3	8	5	8	2	4	5
A	8	1		2	3	6	8	
N	3		1	2	2		3	

* Fig. 15: Table of Common Protagonists and Antagonists (Based on Marvel, DC and Disney/Pixar Characters)
M = Marvel Universe Movies, D = Disney Movies, P= Protagonist, A=Antagonists, N=Neutral.
All sampled characters listed above belong to the Marvel, DC and Disney Universe. Some examples overlap due to mixed color patterns. Characters from same named movies are only listed with their franchise.
The distribution is based on the subjects dominance of the primary and secondary elements.

The bar chart below compares the occurrence of primary and secondary (“accent”) colors in the character design of both protagonists and antagonists (as well as neutral characters) within the franchises of Marvel, DC, and Disney/Pixar. It is based on the listed characters from the table on page 22 and therefore is only a limited analysis that does not cover the full extent of all fandoms.

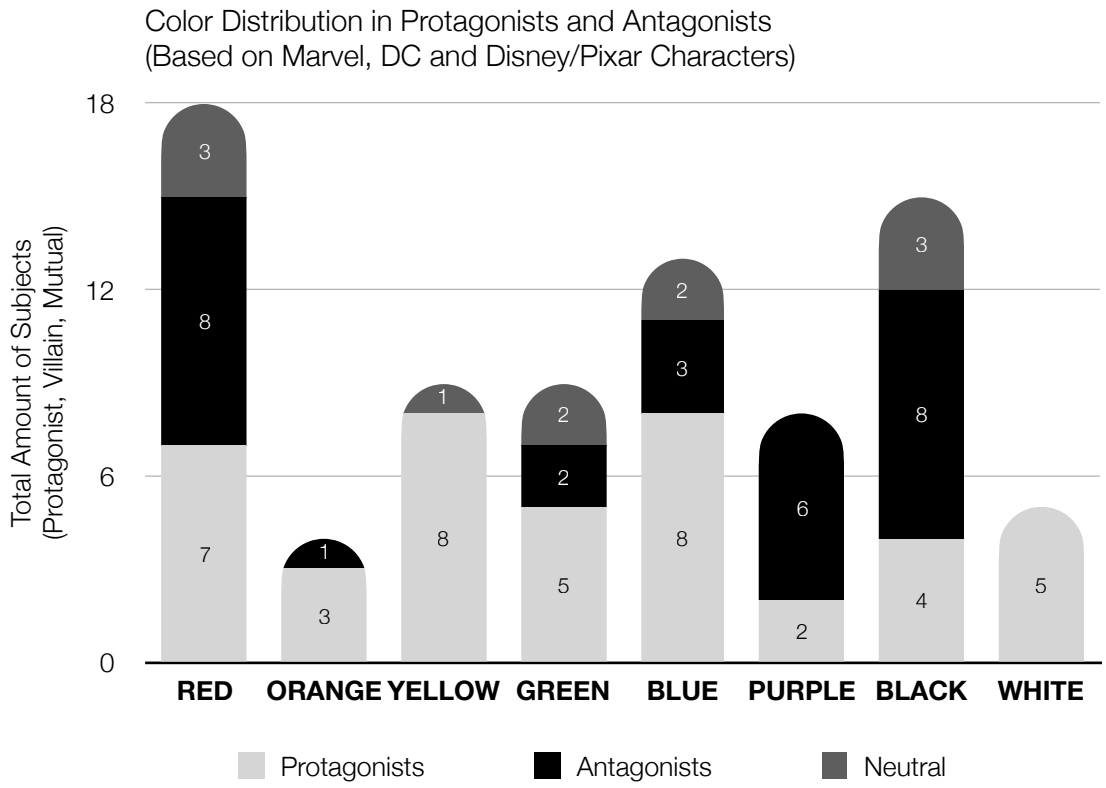


Fig. 16: Color Distribution in Protagonists and Antagonists
(Based on Marvel, DC and Disney Characters)

As the bar chart shows, protagonists are more likely to represent a wider range of colors in comparison to antagonists. Although red is evenly distributed between all three categories of archetypes, it occurs more often in combination with blue for protagonist characters, whereas a combination of red and black seems more likely to be used for villains. Another color that displays similar tendencies is green because of its positive and negative associations. Orange, yellow and white are the only colors that make the positive use outweigh. Purple outweighs with its tendency to be used for villains. Neutral characters are characters that display both good and bad traits/attributes and can be found almost all over the spectrum.

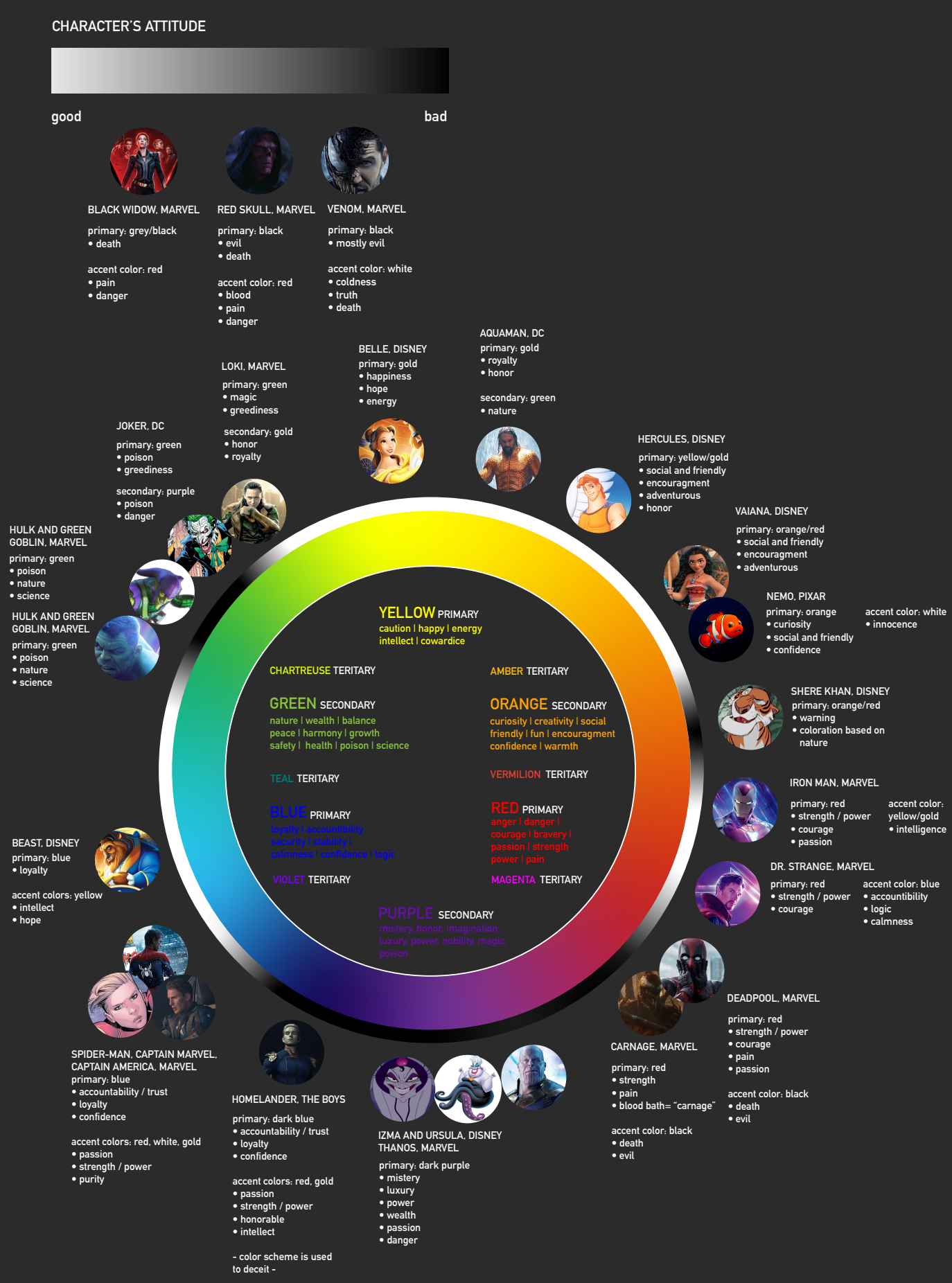


Fig. 17: Color Distribution in Protagonists, Antagonists and Neutral Characters (Based on previous research, Source: see "II List of Illustrations")

2.2.2. Colors in Character and Environment Design

In contrast to the color design of archetypes, setting a color scheme for an environment can prove itself to be more difficult. While a character's color scheme will rarely morph in its look throughout its hero journey, its environment is more likely to be constantly subjected to changes. The way colors can be used in surroundings can alter our perception and help to create a more suitable space experience for a viewer in regard to the narrative. The environment design in motion pictures and animated movies can alter dramatically. Motion picture films are more likely to include superficial characters in super realistic environments. However, animated movies have to be completely set up from scratch and thus allows more room for creativity. For this reason, *Spider-Man: Into the Spider-Verse* (2018) is the movie of choice for the environment color analysis. *Spider-Man: Into the Spider-Verse* uses a color scheme that strongly resembles the theoretical principles of color design rules with a twist. Unlike many other movies, it displays a very unique visual style that is close to its concept art and comics, therefore most of its textures were painted by hand.

Fig. 18: Disassociation / Anxiety (Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

To mimic the printing press comic book style, the production team of the animated movie integrated a CMYK (cyan, magenta, yellow, key (black)) offset instead of a motion blur. [56,57] This offset is lightly visible throughout the entire movie and has a significant impact on its color palette. During the beginning stages of his transformation, Miles Morales is experiencing waves of anxiety and disassociation. Those said sequences (≈00:16:30-00:16:50) are heavily accompanied by the CYMK colors.[58]

---

56 Chevat, Zev (2018). *Spider-Man: Into the Spider-Verse's unique art style meant 'making five movies'.* [online] Polygon. Available at: https://www.polygon.com/2018/12/11/18136056/spider-man-into-the-spider-verse-movie-art-animation-style-visual-effects [Accessed: 22.03.2022]

57 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 280

58 *Spider-Man: Into the Spider-Verse* (2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman. [film]. Sony Pictures Releasing. United States. Available at: https://www.netflix.com/title/81002747 [Accessed: 25.03.2022]

Spider-Man: Into the Spider-Verse uses different styles and color palettes for its protagonists:

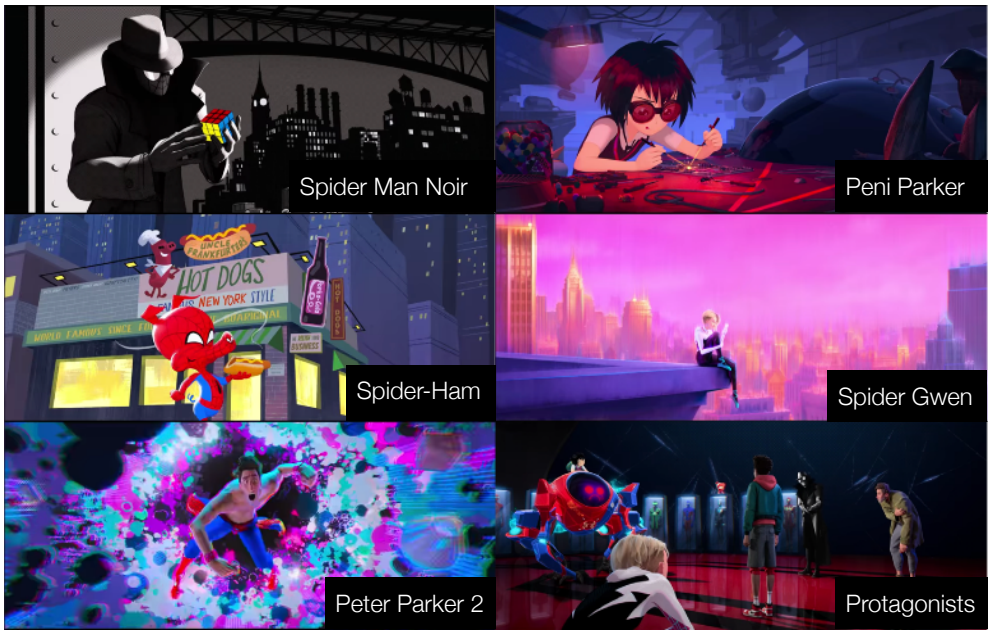
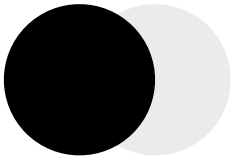
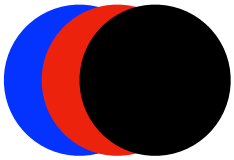


Fig. 19: Into the Spider-Verse Protagonists
(Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

All six [protagonist] Spider-People come from parallel universes, thus each character from an alternate environment matches its own archetype journey and style.



Spider-Man Noir comes from a 50s themed black and white world, where he himself is not colored in. His color palette is style-driven, however, since black is the color of mystery and elegance, it compliments his attributes.



Peni Parker comes from an anime-like universe. As a result, she speaks Japanese and looks strongly like a manga/anime character. She and her companion follow the color palette of a Japanese-style anime video game. Red and blue form a warm/cold-contrast, but are also the traditional colors of most heroes (red for strength, blue for loyalty). Peni was bitten by a black and red spider, thus it can be assumed that her outfit's color is influenced by this. [59, 60]

---

59 Chevat, Zev (2018). *Spider-Man: Into the Spider-Verse's unique art style meant 'making five movies'.* [online] Polygon. Available at: https://www.polygon.com/2018/12/11/18136056/spider-man-into-the-spider-verse-movie-art-animation-style-visual-effects [Accessed: 22.03.2022]

60 *Spider-Man: Into the Spider-Verse* (2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman [film]. Sony Pictures Releasing. United States. Available at: https://www.netflix.com/title/81002747 [Accessed: 25.03.2022]

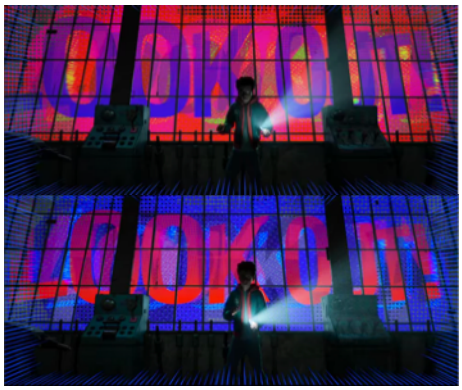
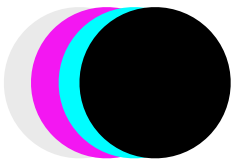


Fig. 20: Red for Danger
(Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

Spider-Ham is cartoon themed; accompanied by an outlined and more abstract coloration but follows the scheme of the normal Peter and Peni Parker. As a result Peter Parker 2, Peni Parker, and Spider-Ham share the same hues but different visual styles. This also roots in the fact that *Into the Spider-Verse* is aiming to stick to its comic roots.[60] A lot of comics that were produced during the *silver age of comics* were printed with primary colors. The heroes and villains stuck to uncomplicated ink choices.[61]

Although red is used as a signal color for "LOOK OUT!", it is part of Miles Morales' and Spider-Man's senses reacting to one another. It is appealing Miles to be alarmed, however, it is also the main color of his universe's main Spider-Man (Peter Parker), hence it conveys a double meaning (≈00:20:00- 00:20:35). Therefore, it can be generally assumed that the environment's color palettes additionally align with the characters designs.



Spider Gwen's color palette consists of white, black, purple/magenta, and neon-blue/cyan. These shades are the least common for a hero's outfit, thus it is difficult to fully interpret their meaning. Black and white both stand out for elegance and cleanness, though, purple (color of mystery and feminity) is less likely to represent protagonists (see "Color Distribution in Protagonists and Antagonists" on page 23). Her character design strongly derogates from the other spider-people's. Followed by Peni Parker, she is the only female protagonist in the entire movie. This makes her stand out more. Furthermore, purple/magenta and black are dominating hues in Gwen's environment, hence it can be assumed that it is part of her camouflage. [62, 63]

---

61 McLachlan, Brian; Hanson, Aaron (2016). Superhero Color Theory, Part I: The Primary Heroes. [online] Comics Alliance. Available at: https://comicsalliance.com/superhero-color-theory-primary-heroes/ [Accessed: 25.03.2022]

62 Chevat, Zev (2018). *Spider-Man: Into the Spider-Verse's unique art style meant 'making five movies'.* [online] Polygon. Available at: https://www.polygon.com/2018/12/11/18136056/spider-man-into-the-spider-verse-movie-art-animation-style-visual-effects [Accessed: 22.03.2022]

63 *Spider-Man: Into the Spider-Verse* (2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman [film]. Sony Pictures Releasing. United States. Available at: https://www.netflix.com/title/81002747 [Accessed: 25.03.2022]

Miles Morales' and Spider Gwen's suits have the availability to convey a more modern approach to the original spider-suits. Both protagonists are a younger generation of than predecessors. Although Miles starts out with wearing a classic red and blue Spider-Man suit, he later on designs his own black and red one. It resembles the coloration of the black widow spider. In addition to that, Morales has a strong tendency of living a nocturnal lifestyle while he battles his own demons after his uncle's death. Due to those reasons, it can be assumed that those are also valuable factors in the decision of the coloration of the suit. It is important to note that this is a rare case of a protagonist with a mainly black and red color palette.

Fig. 21: Miles Morales
(Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

Spider-Man: Into the Spider-Verse uses typical colors for its antagonists:

Fig. 22: Radioactive Alchemax Spider 42
(Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

While Miles Morales is spending time with his uncle, he is bitten by a radioactive spider. The spider's cephalothorax, abdomen, and eyes are mainly colored a dark shade of green. Additionally, purple and red patterns decorate those body parts. The darkness and the selection of hues suggest a negative connotation due to these hues being associated with poison, radioactivity, and danger. Its legs are colored both red and black, which once more, are hues that convey negative proneness. The neon-colored tips of its legs shine in a bright cyan color, making the spider shine in the darkness. It can be strongly assumed, that in this case the emission is used to support its connection with radioactivity. There is a total of 6 antagonists who are partaking in *Spider-Man: Into the Spider-Verse: Prowler, Doc Ock, Kingpin, Green Goblin, Tombstone, Scorpion, [and the Spider]*. All of them are very characteristically colored: purple, green, black, grey, and brown.[64]

64 *Spider-Man: Into the Spider-Verse* (2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman [film]. Sony Pictures Releasing. United States. [Accessed: 25.03.2022]

Fig. 23: Antagonist “Prowler” (Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

Miles’ uncle, who is one of the antagonists in the movie, follows a primary black and purple color palette. It is a standard choice for a villain’s design, as demonstrated by the “*Color Distribution in Protagonists and Antagonists*” on page 22. The movie’s atmosphere corresponds to “Prowler’s” appearance and range from a warm to cool purple tone. (≈00:28:04- 00:29:02).

Fig. 24: Antagonist “Doc Ock” and “Green Goblin” (Source: Spider-Man: Into the Spider-Verse)

A similar observation can be also made in the scenes that involve “Doc Ock” (≈01:29:07) and the “Green Goblin”(≈00:20:34-00:21:30). As scientists, their color palettes are mainly ranging from a very light to dark green (due to green’s connection to radioactivity and science).

Fig. 26: Antagonists “Tombstone” and “Scorpio" (Source: Spider-Man: Into the Spider-Verse)

Tombstone strongly resembles Frankenstein. He was born as albino and his skin became bulletproof after exposure to chemicals — this is why his skin consists of a light grey, unhealthy tone. Like in Kingpin’s case, his clothing primarily consists of dark shades of grey and black, which is supporting the attitude theory. [65] Scorpio’s color palette is primarily brown with green accents that seem to root from their associations from nature to science. [66]

---

65 Marvel (2022). *Lonnie Thompson Lincoln Tombstone.* [online] Marvel Website. Available at: https://www.marvel.com/characters/tombstone [25.03.2022]

66 *Spider-Man: Into the Spider-Verse* (2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman [film]. Sony Pictures Releasing. United States. Available at: https://www.netflix.com/title/81002747 [Accessed: 25.03.2022]

Spider-Man: Into the Spider-Verse experiments a lot with color contrasts [67, 68] :

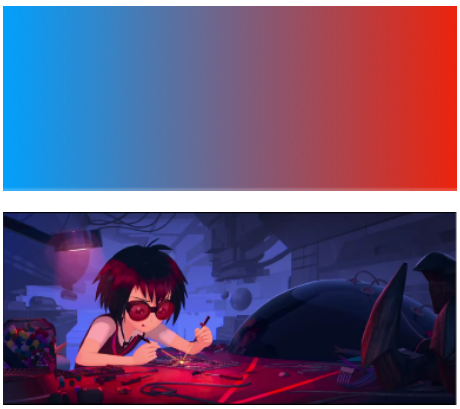


Fig. 27: Cold/Warm-Contrast (Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

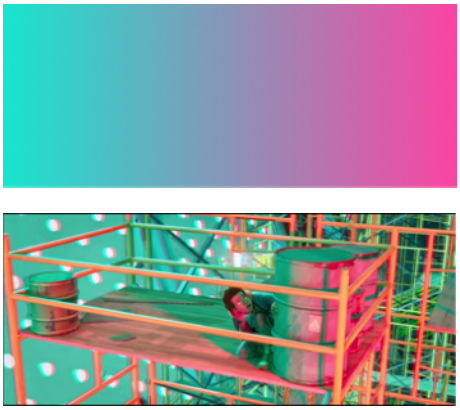


Fig. 28: Complimentary Contrast (Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

Fig. 29: Complimentary Triad Contrast (Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

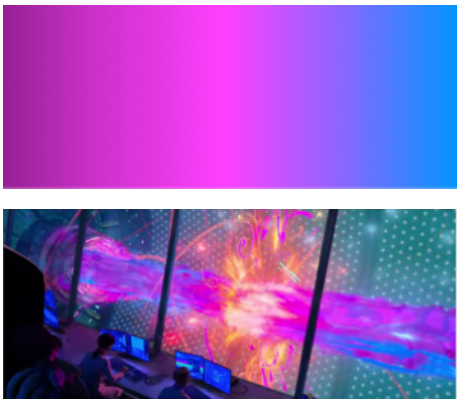


Fig. 30: Complimentary Triad Contrast (Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

67 *Spider-Man: Into the Spider-Verse* (2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman [film]. Sony Pictures Releasing. United States. Available at: https://www.netflix.com/title/81002747 [Accessed: 25.03.2022]

68 Wäger, Markus (2017). *Das ABC der Farbe.* Bonn, Germany: Rheinwerk Design, pg. 252-287

Spider-Man: Into the Spider-Verse uses colors to visualise mood settings:

Fig. 31: Blue (Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

A dark shade of blue is used to simulate sadness and the calm evening/late night hours in Miles Morales environment, especially after Peter Parker's death in Miles' dimension. While red and blue are again part of Peter Parker Spider-Man's color palette, a dark shade of blue is associated with sadness and depression. During that sequence, Miles is hitting one of his lowest points on his hero journey (≈00:34:21-00:35:34).

During the final fight against "Kingpin", the entire atmosphere turns into a spectrum of red > purple and black. It is a fight to the death. Both red and black are colors that are associated with pain, blood, death and pain, while purple is a common color for antagonists. No other sequences use this color palette to such an extent (01:37:25-01:40:08).

Fig. 32: Red and Black for Danger (Source: Spider-Man: Into the Spider-Verse)

Fig. 33: Alchemax Facility (Source: Spider-Man: Into the Spider-Verse)

[The enemy's] Alchemax's Facility is mainly colored a light grey, however, zones that demand caution are themed in a classic neon. This includes both Alchemax, but also the underground tunnel at the beginning of the movie (≈00:19:25 -00:20:00).[69]

69 *Spider-Man: Into the Spider-Verse* (2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman [film]. Sony Pictures Releasing. United States. Available at: https://www.netflix.com/title/81002747 [Accessed: 25.03.2022]

Fig. 34: Bright-Blue
(Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

During his battle against Kingpin, Miles finally unlocks and learns to use his Spider-Man powers which shine in a bright blue/cyan. Just like in the case of the other more outstanding protagonists and antagonists, these accent colors take over the environment design (≈01:40:13-01:40:56).

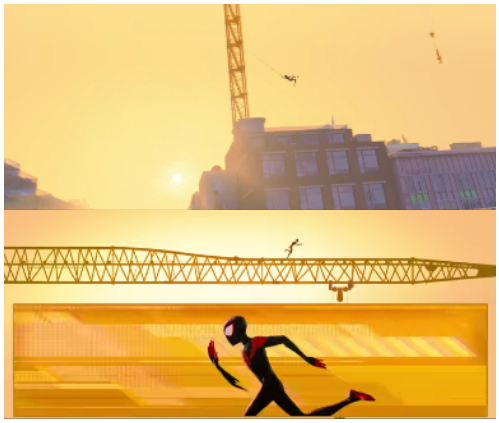


Fig. 35: Yellow
(Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

After the final boss fight, a warm tint of yellow makes a rare appearance. Since it is the color of happiness, hope, and energy, it is well-placed at the end of the movie (≈01:44:00). [70]

70 *Spider-Man: Into the Spider-Verse* (2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman [film]. Sony Pictures Releasing. United States. Available at: https://www.netflix.com/title/81002747 [Accessed: 25.03.2022]

2.3 Psychology of Facial Expressions and Gesturing

Since its first significant evolutionary steps, humanity has found various methods to converse. We live in a world where approximately about seven thousand languages are spoken, hence it was believed for a very long time that vocal expression was the highest form of communication.[71] Although this assumption sounds plausible, it was proven to be incorrect by various psychologists in the past 70 years. Languages are highly complex and only spoken within the circles of selected parts of society, thus it is naïve to assume that these constrained ways of interaction have always prevailed. Spoken language developed itself through an increase of our ancestors brain sizes, but it is the non verbal language that has truly left an everlasting impression on us. According to studies performed in the 50s by the behavioural psychologist Albert Mehrabian, the encryption of a message depended up to 55% on non verbal language, whereas vocalism took up 38% and verbalism only 7%. This is where the 7-38-55-rule originates from.[72] Although body language plays such a significant factor in our communication, it had not yet been properly studied until the 60s due to the belief that vocal communication was our most important medium.[73] It is partly inherited and partly conditioned, however, it has mostly established itself as an universal catalogue.

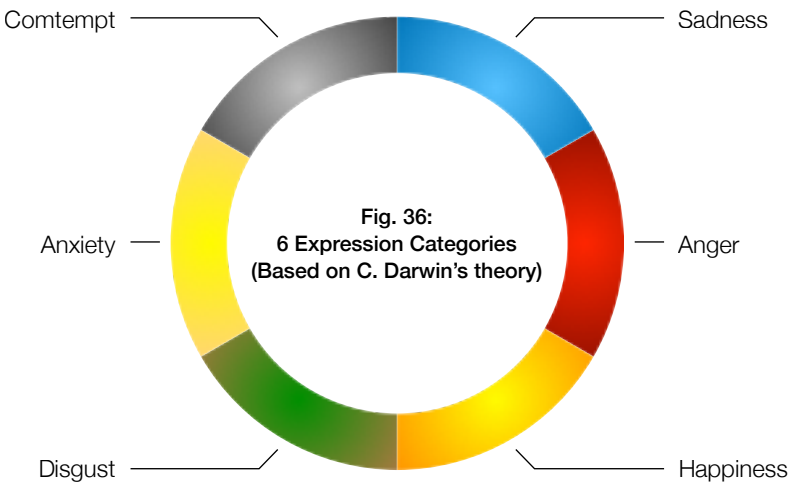


Fig. 36:
6 Expression Categories
(Based on C. Darwin's theory)

71 Pauli, Maren (2019). *How Many Languages Are There In The World?*. [online] +Babbel MAGAZINE Website. Available at: https://www.babbel.com/en/magazine/how-many-languages-are-there-in-the-world and https://www.ethnologue.com/guides/how-many-languages [Accessed: 15.03.2022]

72 Michael, Jon (2020). *Strong Nonverbal Skills Matter Now More Than Ever In This "New Normal".* [online] Forbes Website. Available at: https://www.forbes.com/sites/forbescoachescouncil/2020/08/24/strong-nonverbal-skills-matter-now-more-than-ever-in-this-new-normal/?sh=74c3402c5c61 [Accessed: 15.03.2022]

73 Pease, Barbara and Allan (2006). *The Definitive Book of Body Language*. [online] New York Times. Available at: https://www.nytimes.com/2006/09/24/books/chapters/0924-1st-peas.html [Accessed: 15.03.2022]

Dr. David Matsumoto from San Francisco State University analysed the facial movements of participants of the Paralympic Games using FACS (engl. “Facial Action Coding System”). His focus lied on blind athletes who were visually impaired from their birth because of their neutrality to their environment (=no outside factors that could have taught them any non verbal expressions).[74] Surprisingly, their faces reacted the same way as any non visually impaired person’s would have.

Fig. 37: Duchenne’s experiments (Source: Mécanisme de la Physionomie Humaine, 1862)

Charles Darwin addressed the same issue in his work about *The Expression of the Emotions in Man and Animals* in 1872. He collaborated for his experiments with the French neurologist and psychologist Guillaume Duchenne who tried to achieve an array of plates of authentic emotional mimics by electro-stimulating facial muscles. Later, Darwin reduced those to a small number of discrete emotions through an extended blind experiment. Participants of his blind study overwhelmingly agreed over the depiction of the core emotions which lead to the conclusion that only a distinct array of them was identifiable by the subjects (happiness/joy, sadness, surprise, anger, fearfulness/anxiousness, disgust). The emotions that were reviewed as vague were regarded as inconclusive to his study.[75] Based on the idea of Darwin’s *Expression of the Emotions in Man and Animals*, Adam Anderson (Cornell University) executed a study that suggests most facial expressions might have been promoted by environmental factors before they became parts of social signal language. Anderson’s study explored the adaptation of eye movements in relation to the anticipation and reaction to emotions. As a result, a direct relation between visual encoding and emotions was found. This link was especially affected by fear, disgust, and anxiety.[76] It cannot be excluded that further emotions such as happiness, sadness, or surprise also might have arose from similar circumstantial stimuli. These selected emotions are the same universal emotions that Darwin and many other scientists agreed on to

---

74 Body Language Decoded Documentary (2017). Directed by Geoff D’Eon. [online streaming] Amazon Prime. Canada, United States. CBC Nature. Available at: https://www.amazon.com/Body-Language-Decoded-Geoff-DEon/dp/B07P5VHB5R [Accessed: 15.03.2022]

75 Jabr, Ferris (2010). *The evolution of emotion: Charles Darwin's little-known psychology experiment.* [online] Scientific American. Available at: https://blogs.scientificamerican.com/observations/the-evolution-of-emotion-charles-darwins-little-known-psychology-experiment/ [Accessed: 19.03.2022]

76 Bosnia, Ted (2014). *Study: Facial expressions evolved from optical needs*. [online] Cornell Chronicles. Available: https://news.cornell.edu/stories/2014/03/study-facial-expressions-evolved-optical-needs [19.03.2022]

be universal regardless of one's culture background. It is important to note that any other facial expressions might be altered by cultural factors. However, it is difficult to calculate the amount of recognisable core expressions as many studies vary in total. Nowadays, there are at least 7 recognised basic emotions/expressions which can be extended by combinations of the categories. Non verbal communication is a perfect example of how verbalism and vocalism are not needed to transport a message. Humanity reacts universally to most non spoken gestures. When it comes to body language, the lateral body sway and ones posture can give away the intention of a human right away, hence why the marketing and security branches increasingly rely on reading and understanding the way we communicate non verbally. The more genuine the gestures appear to the brain, the more they are perceived as trustworthy and reliable. This ensured humankind's survival. [77]

Fig. 37A: Robot
(Source: Lost in Space, Netflix)

Since the thesis' practical part relies on a minimalistic choreography of facial expressions and body-language in combination with colors for minimal to non-vocal/verbal communication, it was important to point out their significance to the readers of this paper. Although these elements seem insignificant at first sight, they are capable to convey lots of information together. These principles can be applied in a more modern approach, like in the case of *Robot* (Netflix series "Lost in Space", 2018-2021)[78] or this project's protagonist *[Im]mortal Man*. Both characters use interfaces and combinations of different hues and abstract graphics to communicate. While Robot uses colored particles to display its emotions (blue for friendly, red for hostility and caution [79]), the [Im]mortal Man relies on primitive emotes that closely resemble the facial expressions of a human.

---

77 Body Language Decoded Documentary (2017). Directed by Geoff D'Eon. [online streaming] Amazon Prime. Canada, United States. CBC Nature. Available at: https://www.amazon.com/Body-Language-Decoded-Geoff-DEon/dp/B07P5VHB5R [Accessed: 15.03.2022]

78 *Lost in Space* (2018). Created by Irwin Allen [online streaming]. Netflix. United States. Available at: https://www.netflix.com/title/80104198 [Accessed: 03.04.2022]

79 Brown, Bryce E. (2021). *The Robots Of Lost In Space Explained | Lost In Space Seasons 3 Explained.* [online] YouTube. Available at: https://www.youtube.com/watch?v=xhlvrP2rSag [Accessed: 03.03.2022]

3 | PROJECT DEVELOPMENT

The primary goal of my bachelor thesis' practical part is to base a thoroughly planned CG short clip on my theoretical research about color psychology, mimics and gesturing (see Chapter "Theoretical Foundations") in order to illustrate a story with only little verbal communication.

3.1 Project Planning

TIME TABLE	
WEEK 1	• Research for visual conception, illustration and lookdev • Registration for B.A. Media Production examination Milestone: W1 - Finished concept, registration for examination
WEEK 2+	• Creation of the 3D Character • Animations Milestone: W2+ - 3D Character
WEEK 3+	• Creation of the 3D environment Milestone: W3+ - 3D Environment
WEEK 4	• Creation of the simulations Milestone: W4 - Export/import of vdb into the 3D scene
WEEK 5	• Merging of all files into a single one Milestone: W5 - Finished setup of the CG scene
WEEK 6+	• Demo/test workbench rendering Milestone: W6 - Tests und corrections of the shots
WEEK 7+	• Final rendering, edit/cut and compositing Milestone: W7 - Rendering und Compositing des fertigen Shots
WEEK 8+	• Finalisation of the project's documentation Milestone: W8 - documentation
WEEK 9	• Finished project and documentation • Preparations for examination Milestone: W9 - finished project

3.2. Synopsis

"The [Im]mortal Man" is an ironic short clip that involves a seemingly immortal character. The quirky protagonist participates in a program for people with special powers/abilities that exploits each player's weaknesses and uses them against them. In his case, it is his gambling addiction. When he enters a dark hall, he is still captivated by a pair of electric handcuffs that prevent him from moving freely. However, he then notices the gambling slot machine in front of him which makes him want to free himself. At first he struggles, but then he is able to free himself. He obviously fails to resist partaking in the game. As a result, he agrees to the terms of the game and tries his luck of hitting the "7,7,7 JACKPOT" combination; although a failed attempt will result in the elimination of the player. He gets lucky and his attempt is successful, but the machine starts to malfunction and he ends up with a combination of "7,7, lemon". A timer starts to count and as soon as it hits barely the 1-second-mark, the Immortal Man gets electrocuted.

Fig. 38: Eevee Engine Render
(Source: Short clip "The [Im]mortal Man")

3.3 Design and Implementation

In order to gather, structure, and illustrate my ideas, two separate mood boards were created to develop the lore of this assignment's practical part. The story of this project was heavily inspired by franchises such as the Marvel and DC Comics, as well as Altered Carbon (2018-2020), Pixels (2015), Squid Game (2021), Umbrella Academy (2019-today) and Money Heist (2017-today). Deadpool's (Marvel) personality was a major inspiring factor for the character development of the short clip's protagonist.

Fig. 39: Character development moodboard and inspirations
(Source: Multiple, listed on page 63)

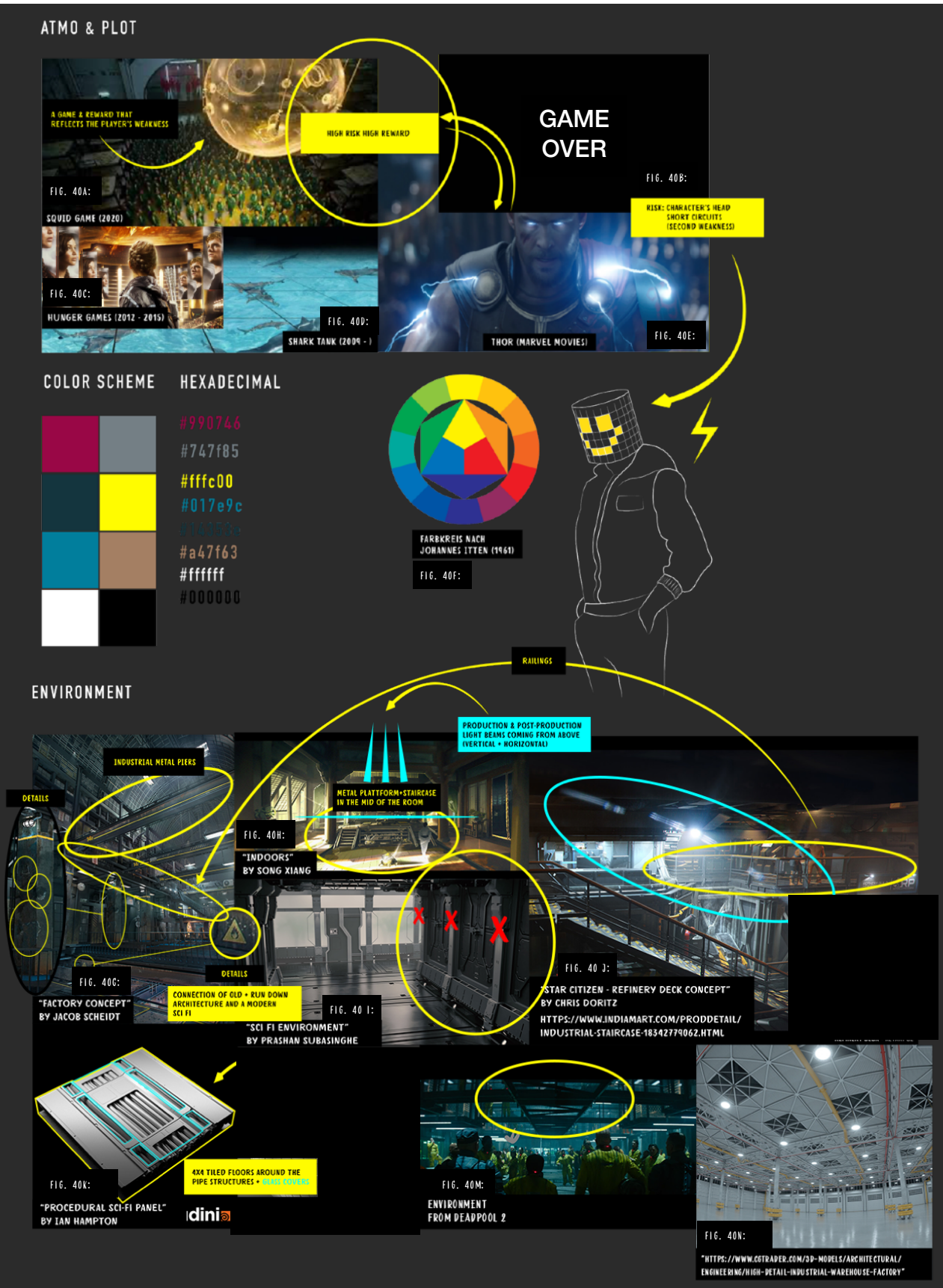


Fig. 40: Environment Development Moodboard and Inspirations (Source: Multiple, listed on page 64)

3.3.1 Character Look Development

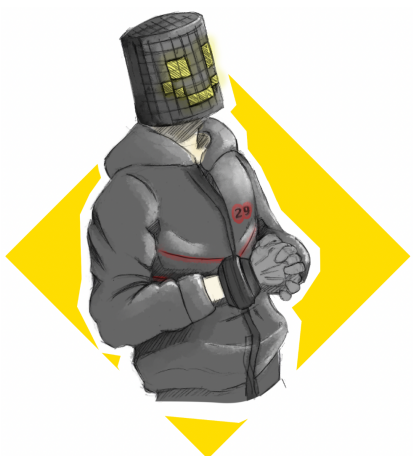


Fig. 41: Concept Art
(Source: “The [Im]mortal Man” Character Bible)

The Immortal Man is meant to convey both good and bad traits. Since we discussed on page 21 that the darkness of a character’s physical attributes can show its attitude, a shade of grey turned out to be the best option. It was important to stick to simplicity due to the protagonist being one of many participants who wear similar suits and should not stand out too much through its clothing. In order to show the character’s gambling addiction and greediness for money, a green color scheme could have been added, but his weaknesses were not meant to be directly visible, hence green is not part of the main color scheme.

Secondly, the character’s head is a cylindric interface that helps him to express basic facial emotions. The inspiration for the interface came from seeing the large interfaces called “Crown Fountain” at Chicago’s Millennium Park. A table on page 42 illustrates all used mimics and color scheme combinations. The hues for the displayed emotions were deliberately chosen based on their psychological effects to support the interpretation and readability of the mimics. The protagonist’s neutral facial expression is a yellow smile due to the reason that yellow is mostly associated with happiness, while sadness is associated with blue. Anger and fear are expressed with both yellow and red.*

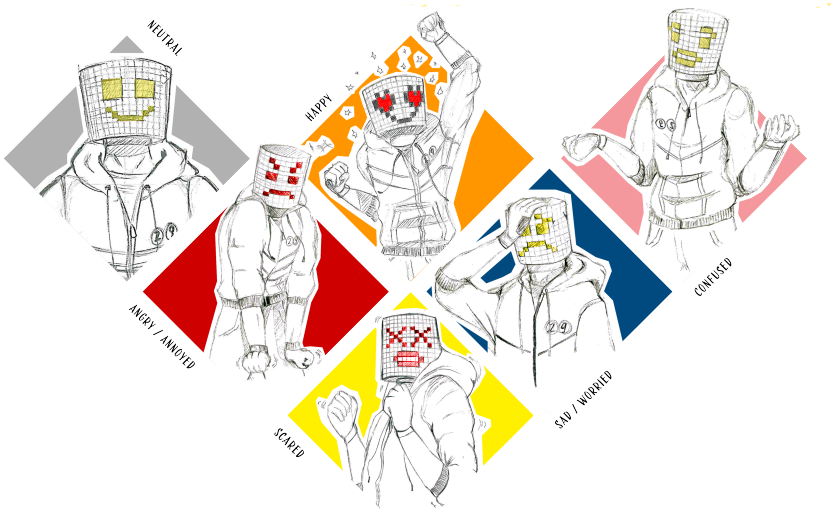


Fig. 42: Concept Art of the (Im)mortal Man
(Source: “The [Im]mortal Man” Character Bible)

* the concept art and final short clip show minor differences

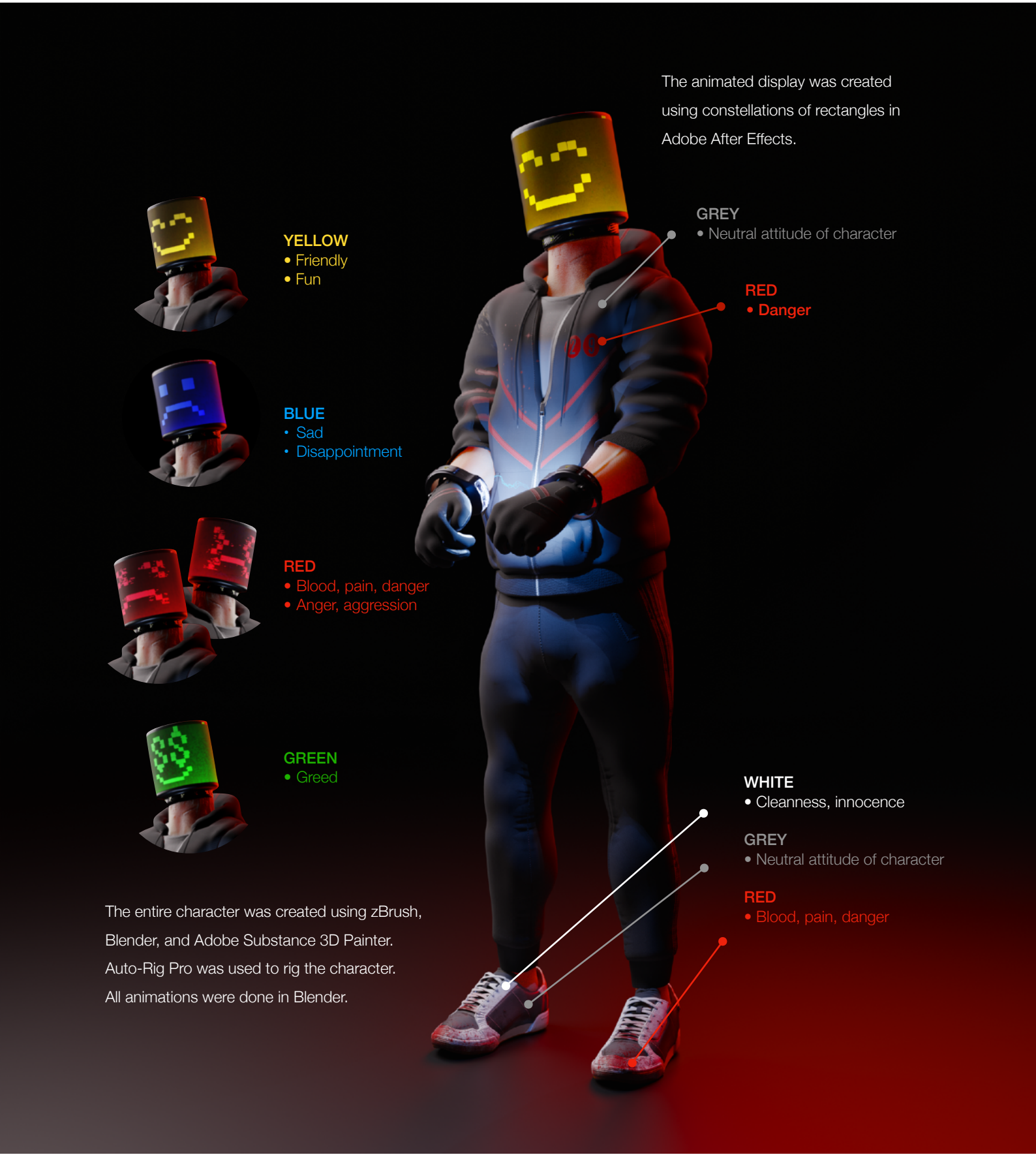
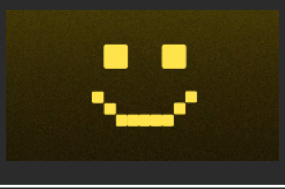
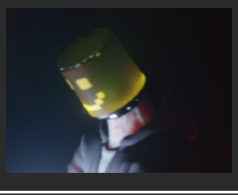
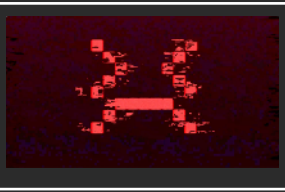
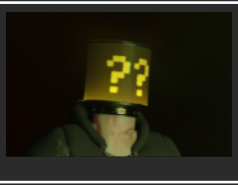
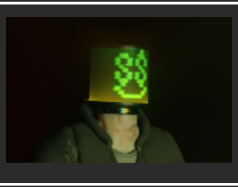
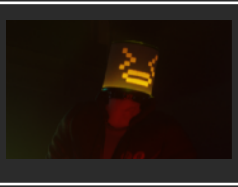
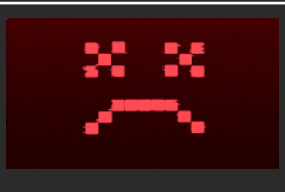
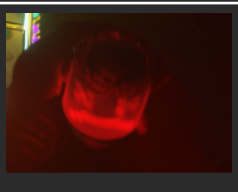


Fig. 43: Color Psychology Render of the (Im)mortal Man
(Source: “The [Im]mortal Man”)

TABLE OF COLORS AND FACIAL EXPRESSIONS

EMOTION	**COLOR ASSOCIATION**	**EXPRESSION** VISUALIZED IN AE*	**SHORT CLIP** VISUALIZED IN BLENDER	**TIMECODE** SHORT CLIP
Neutral	Yellow			
Sad / Disappointed	Blue			
Angry	Red			
Neutral / Happy	Yellow			
Curious	Yellow			
Money	Green			
Neutral / Happy	Yellow			
Worried	Yellow			
Scared	Red			

* AE = Adobe After Effects

Fig. 44: Table of Colors and Facial Expressions
(Source: Spider-Man: Into the Spider-Verse, Marvel & Sony Entertainment)

3.3.2 Environment Look Development

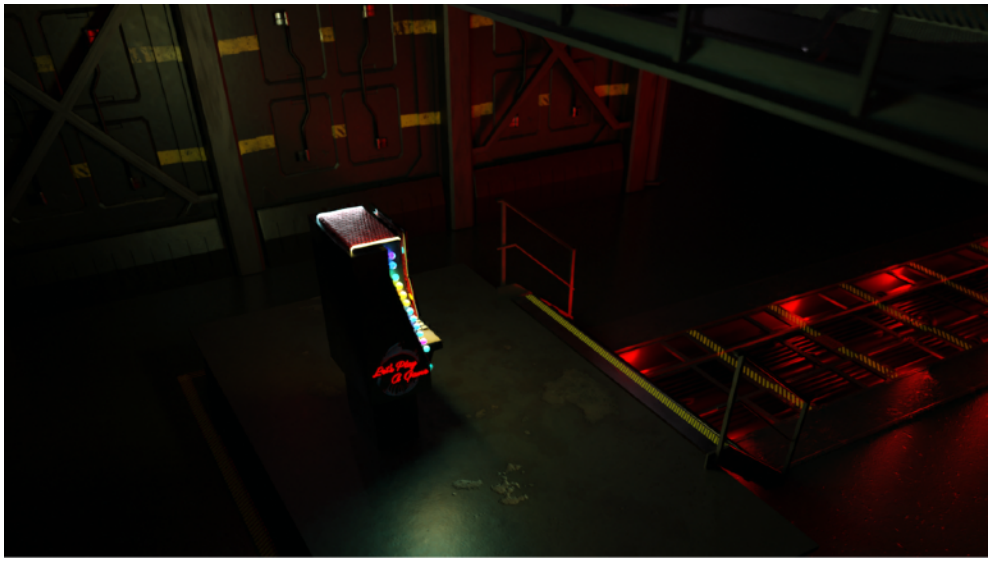


Fig. 45: Environment Render
(Source: “The [Im]mortal Man” Clip)

The topic of aposematism has a significant influence on the environment’s design. As a result, the color schemes for the overall design were deliberately chosen based on the information that has been collected during the development stages of this production. Therefore, putting the scene into a dark indoors area worked out in the project’s favour. Overall, it allowed me to gain more control over the mood setting since no more outside factors such as an HDRI or other hues would interfere with the steering effect of the color scheme.

Fig. 46: Use of Colors
(Source: “The [Im]mortal Man” Clip)

The darkness of the room mimics the color black and is accompanied by red floor lighting and camera sensors which are part of most of the environment’s assets (nearly all textures were done using Adobe Substance 3D Painter). From a psychological perspective, a combination of red, yellow, and green elements appeared to be most effective in order to create an unsettling scene. Red, and yellow on dark, are used to signalise danger. The yellow lights (long slim cylinders and area lighting) morph with the darkness and blue tinted lights into an unappetising poison-green, which results in a complimentary contrast (see also on page 45).

It was important to create a simple, and straight forward, yet leading scene. The rainbow themed light bulbs make the Jackpot slot machine look relatively interesting in contrast to the unpleasant environment. However, the slot machine still had to match the (scene's) uncanniness.

Fig. 47: Colorful Gradient Light Bulbs (Source: "The [Im]mortal Man" Clip)

The light bulbs shader required a randomised color ramp with a rainbow-colored gradient. The principle BSDF shader did not require a base color in this case. Instead, the object info (randomiser) and color ramp nodes were directly linked with the emission input. Since it is glass bulbs, the roughness needed to be lowered for the glossy finish.

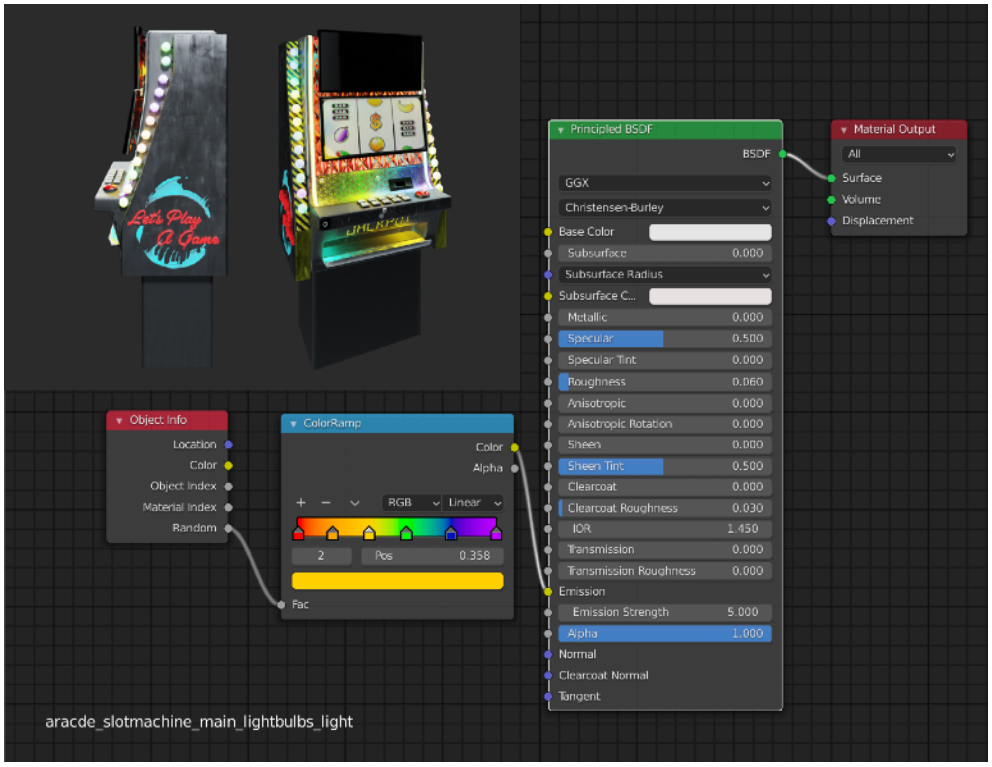


Fig. 48: Light Bulbs Material Shader (Source: "The [Im]mortal Man" Clip)

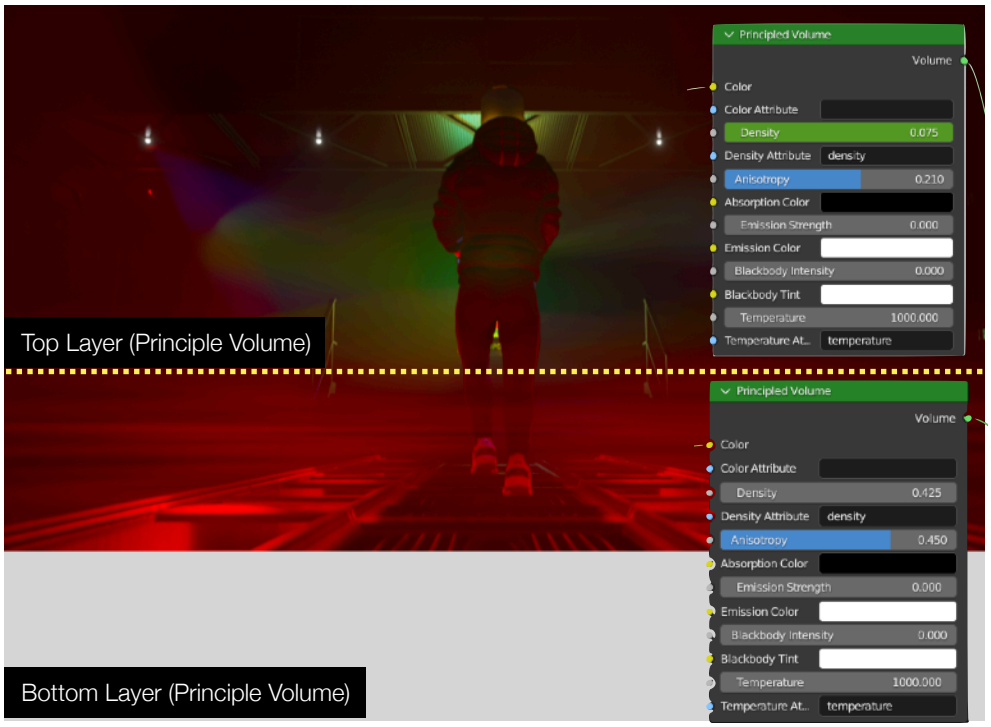


Fig. 49: Two Principle Volume Shaders (Different Density Levels)
(Source: “The [Im]mortal Man” Clip)

The mist in the 3D room scene was made using two differently sized cubes (a top and bottom layer) with two volume scatter shaders of different densities (volume scatter shaders allow to manipulate the scatteration of light within a volume [79]). To make it look less like fog and more like mist, the bottom layer was assigned a higher density (density=0.425, anisotropy=0.450) while the top layer’s one was adjusted to be thinner (density=0.075, anisotropy=0.210). It was important to still maintain a clear vision, while creating a mysterious atmosphere. In addition to that, the mist in the scene makes it easier for the character to stand out more, and blends the lights in relation to the background.

Both the bloom effect and volume scatter, were used to spread the lighting in the scene, thus the clamping (max. light contribution, min. light noise) required to be ramped up to 5.000 to reduce the light noise. Otherwise all point lights would puncture every object independently of their subsurface scatter value.

80 Blender Documentation Team. Blender 3.1 Manual. [online] Blender organisation website. Available at: https://docs.blender.org/manual/en/latest/render/shader_nodes/shader/volume_scatter.html [03.04.2022]

Fig. 50: With Volume Scatter vs. Without Volume Scatter
(Source: “The [Im]mortal Man” Clip)

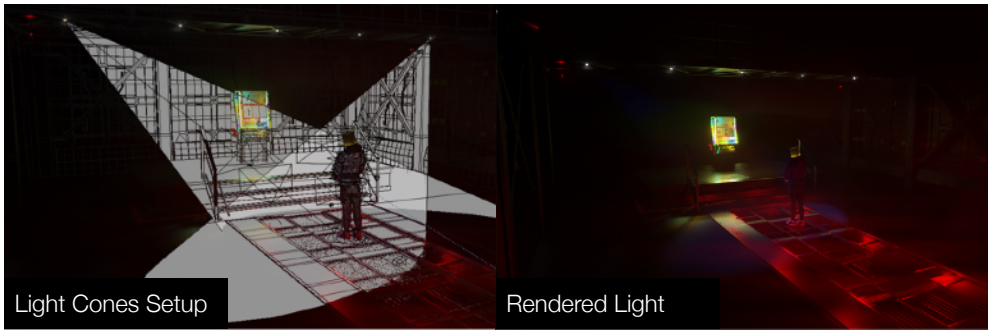


Fig. 51: Lighting Setup in Relation to Volume Scatter
(Source: “The [Im]mortal Man” Clip)

3.3.3 Animations and Simulations

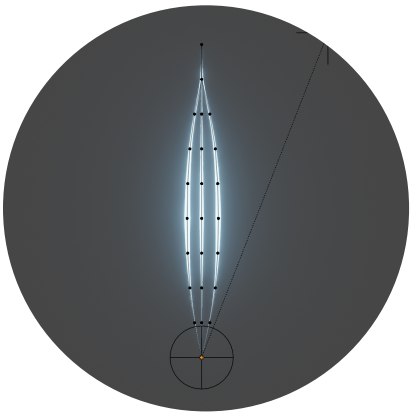


Fig. 52: Bolt without Displacement
(Source: “The [Im]mortal Man” Clip)

Fig. 53: Bolt with Displacement
(Source: “The [Im]mortal Man” Clip)

The creation of the lightning bolts was a very straight-forward process. Firstly, a primitive geometry was created by extruding a vertex to form a line and then subdividing the line between both vertices times 8. In the following step, a subdivision modifier filled in the larger spaces of the line with more vertices to make the geometry more deformable and easier to skew.

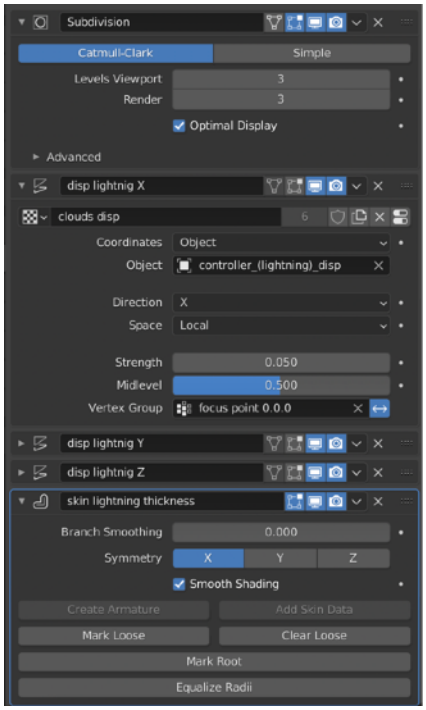


Fig. 54: Lighting Bolt Modifiers
(Source: “The [Im]mortal Man” Clip)

Additionally, three displacement modifiers with individual strength values between 0.05 and 0.1 were added to randomise the object’s vertices into all three directions of the X,Y,Z-coordinate system. Also, a cloud texture (values: size of 0.04, depth of 3 and nabla of 0.03) gave the lightning bolt a nosier appearance.

All displacement modifiers are parented to a controller (empty object > plain axis > controller_(lightning)_disp)) and its movements within the coordinate system, thus whenever the controller is moved along the X,Y and Z-axis it results in a movement of all vertices which in conclusion simulates a jitter.

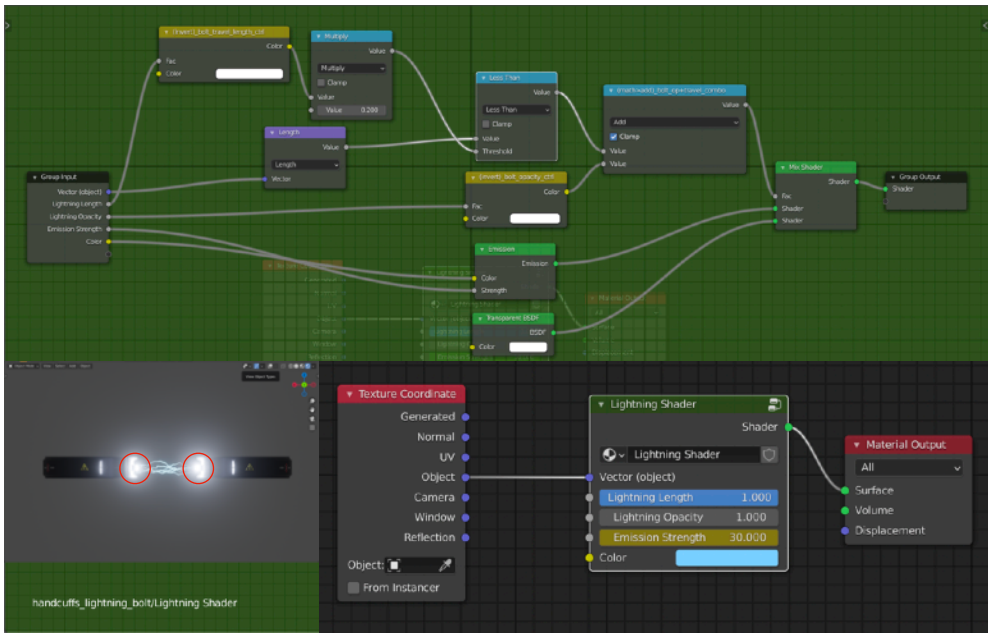


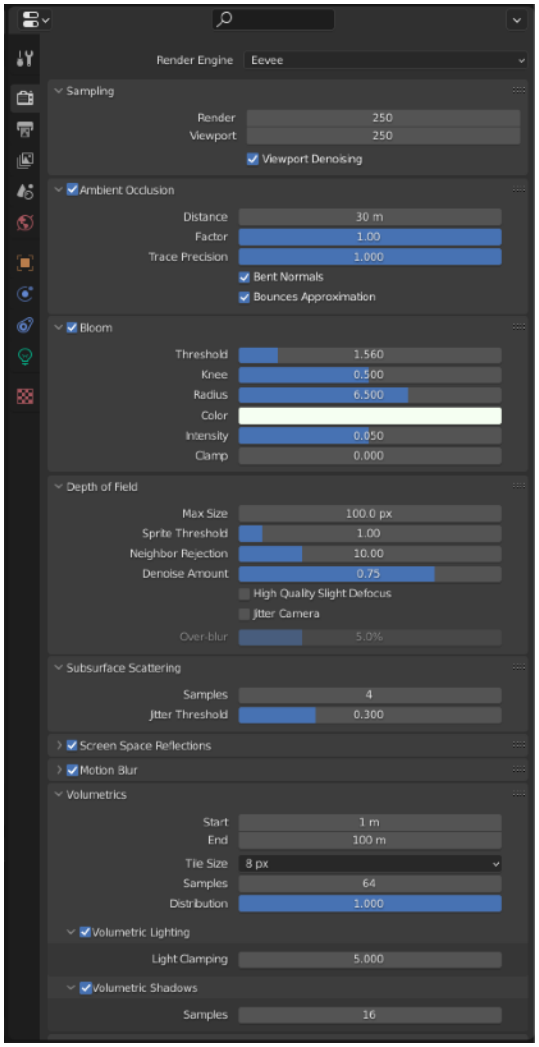
Fig. 55: Lightning/Bolt Material/Shader Node System
(Source: “The [Im]mortal Man” Clip)

A grouped network with a vector and also multiple math and invert nodes was set up in order to control the length, opacity and the intensity of the shader to simplify the simulation process of the illuminated lightning bolt’s flickering. Aside from that, two point lights were aligned along the end points of each lightning.

Houdini’s pyro solver was used to create the smoke simulation sequence (100 frames) between 00:00:53 and 00:00:57 (short circuit scene) and then imported into Blender as a OpenVDB file. The simulation was moved onto a different pass, separately rendered and integrated in the post production process (see page 52).

Fig. 56: Houdini’s VDB Smoke
(Source: “The [Im]mortal Man” Clip)

3.3.4 Render & Camera Settings



The short clip was rendered using Blender's real-time rendering engine "Eevee" with enabled ambient occlusion, bloom, screen space reflections, motion blur and volumetric lighting/shadows.

Although Blender's "Cycle" engine was meant to be the render engine of choice, the built of the scene proved itself to be too heavy for it. It lead to various technical problems, which are addressed on page 55. In contrast to that, the render sampling could be kept low in the scene's dark environment. Cycle's would have needed a much higher amount of samples and a more sophisticated lighting setup for the same results. In addition to that, this would have come at the cost of a significantly higher render time.

Furthermore, eevee proved itself to be more useful for the workflow in regard to the lighting effects, mist and general look development.

Fig. 57: Eevee Render Settings
(Source: "The [Im]mortal Man" Clip)

All cameras were marked on the timeline in order to allow a seamless switch between the cameras whenever the timeline was played. It made the coordination of each camera easier and fluent in relation to the animations.

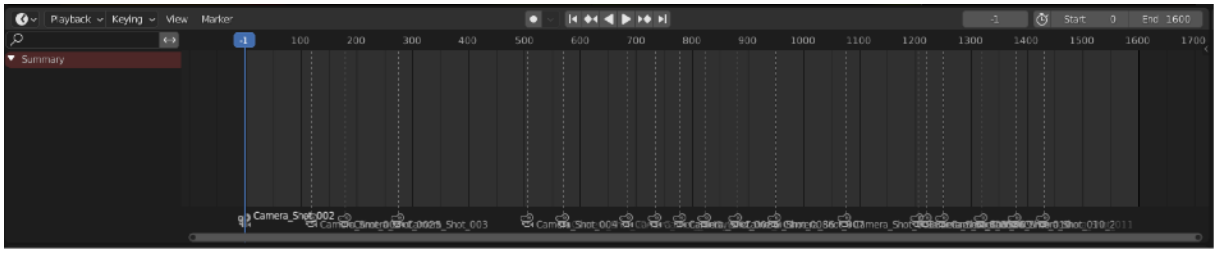


Fig. 58: Timeline Camera Markers
(Source: "The [Im]mortal Man" Clip)

LIST OF CAMERA SETTINGS		
CAMERA	**F***	**FRAME RANGE**
Camera_shot_002	28mm	0-119
Camera_shot_0025	35 mm	180-275
Camera_shot_003	28 mm	120-506
Camera_shot_004	28 mm	507-569
Camera_shot_0041	16-35 mm	570-684
Camera_shot_0045	28 mm	685-734
Camera_shot_005	28 mm	735-824
Camera_shot_006	28 mm	825-949
Camera_shot_007	28 mm	950-1075
Camera_shot_008	28 mm	1075-1250
Camera_shot_0085	28 mm	1205-1249
Camera_shot_0086	35 mm	879- 1249
Camera_shot_009	28 mm	1250-1320
Camera_shot_010	28 mm	1320-1430
Camera_shot_010_2	28 mm	1380-1550
Camera_shot_011	28 mm	1430-1550

* All cameras were queued in an chronological order and keyframe-marked on the timeline to automise the rendering process
* F = Focal Length

3.5 Post Production

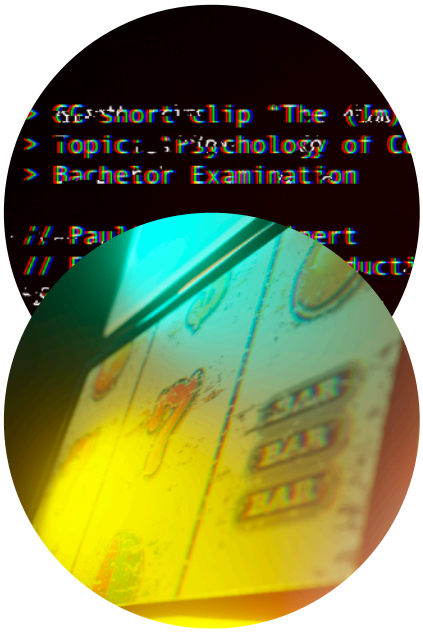


Fig. 59: AE “VR Digital Glitch” Filter
(Source: “The [Im]mortal Man” Clip)

The software of choice for the post production process was Adobe After Effects 2022 instead of Nuke, since no extreme amount of layers was necessary to be worked on.

Adobe AE “VR Digital Glitch” filter was applied to the (Im)mortal Man’s display, scene, and in the short clip’s post production to match the glitchy theme. Due to this reason it was prioritised over all other filters and effects in the hierarchy (on the adjustment layer).

The horizontal field of view setting was halved from 360,0 to 180,0 for a wider distortion. To animate quick glitches in the video material, the master amplitude was set to strike only within short frame sections (between 5 to 8 frames).

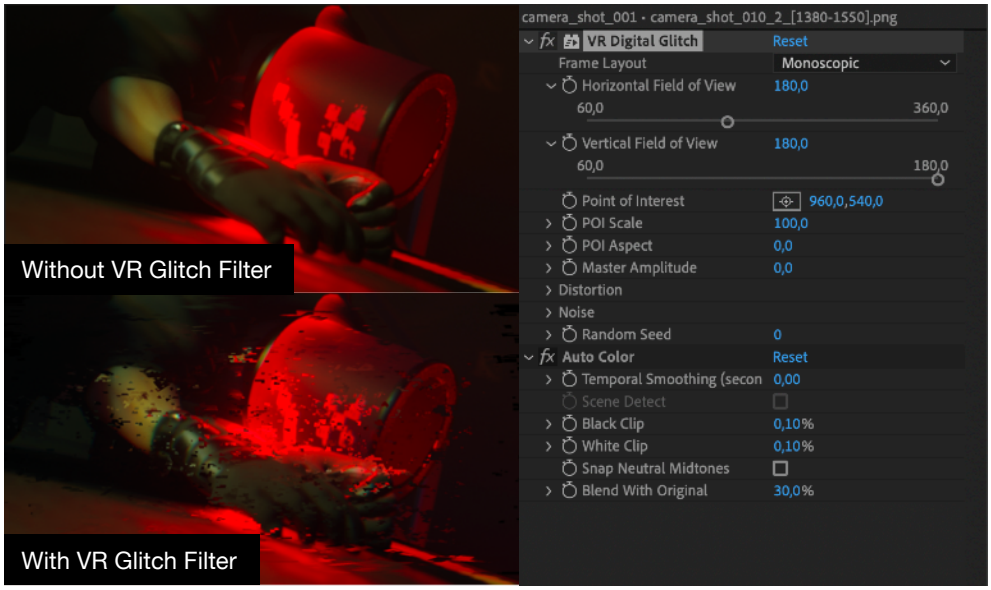


Fig. 60: AE “VR Digital Glitch” Filter Comparison
(Source: “The [Im]mortal Man” Clip)

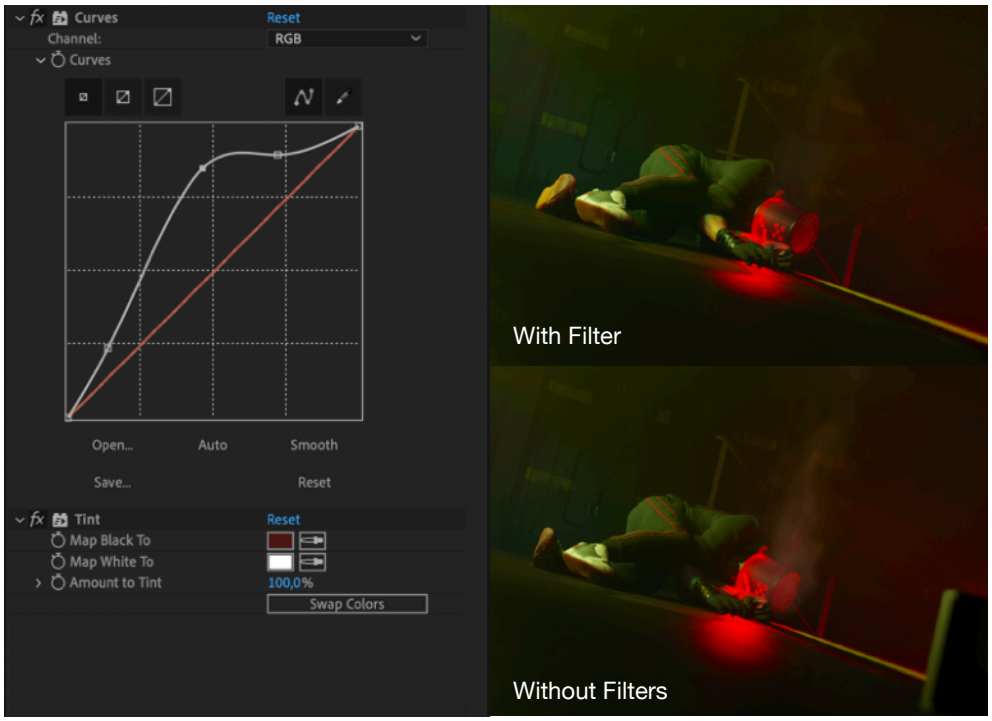


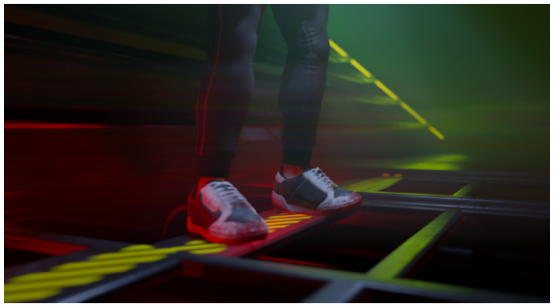
Fig. 61: AE Filters Comparison
(Source: “The [Im]mortal Man” Clip)

The layer (.png) of the smoke simulation sequence was set to an opacity of 75% and needed to be tinted in order to blend into the scene. In addition to that, the curves modifier enhanced the contrasted visibility of the footage. The smoke simulation takes place between 0:00:53 and 0:00:57. A time stretch modifier remapped its duration to 125%. This sequence was then duplicated to extend the smoke cloud.

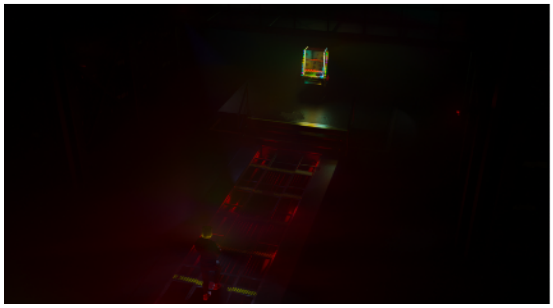
All sound effects that were used for the short clip originate from Adobe Audition’s Sound Library. The soundtrack (“More Human than Human”) that is part of the short clip, was created by Karl Casey @ White Bat Audio and runs under a CC BY 3.0 license.

3.4. Stills

STILLS

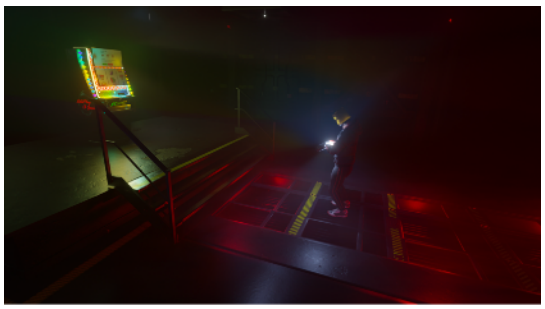


Camera_shot_001



Camera_shot_0025

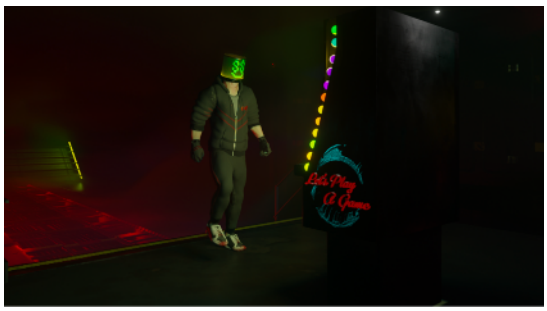
Camera_shot_003



Camera_shot_004

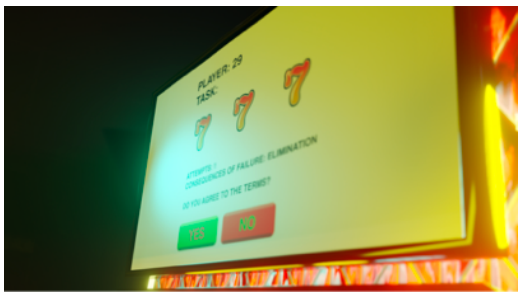
Camera_shot_0041

Camera_shot_0045

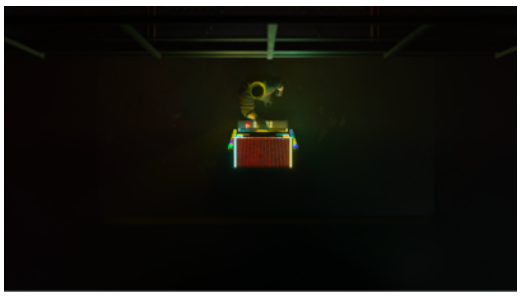


Camera_shot_005

Camera_shot_006



Camera_shot_0055



Camera_shot_007

Camera_shot_008

Camera_shot_0086

Camera_shot_0085

Camera_shot_009

Camera_shot_010_2

Camera_shot_010_2

Camera_shot_011

3.4 Challenges, Issues and Solutions

Rendering Issues

CUDA (GPU = graphics card) and RAM issues forced a swap of the render engine of choice. The load of polygons paired with the involvement of various simulations, such as the lightning and smoke, animations and also high resolution of textures caused an overload beyond the available threshold of 32 GB of RAM. A combination of the named factors from above would have significantly slowed down the rendering time even if I attempted to optimise the 3D scene and would have caused the software to crash. Due to those reasons, a switch to Eevee turned out to be inevitable.

Design

From the beginning till the end of the production, I wasn't entirely certain about how I wanted to attempt the visualisation of the protagonist's head which consists of an interface. My original brain storming included shape keys and node graphs for the different facial expressions, however, at the end an animated image sequence file (H.264/.mp4) seemed to be easiest to integrate.

4 | CONCLUSION

On final note, this thesis is aimed to clarify the importance of color psychology and non-verbal language in storytelling. It shows the conventional and unconventional approaches of these elements and the countless possibilities of their integration in the media world. Based on the information and analysis that was gathered during the research process, it can be concluded that understanding how to utilise these fundamentals can prove itself to be a very important factor for strong visually based narratives. Relying on the gold standard can be extremely limiting though. The most common colors that dominate our concepts are the primary (red, yellow, blue) and secondary (green, orange, purple) ones. However, the research that this thesis reviews exemplifies new insights that deviate from the instinctually traditional view on color pallets; specifically the character and environment color analysis of Spider-Man: Into the Spider-Verse. The animated film demonstrates how refreshing a more complex and extended color palette can be. Additionally, this was also exhibited by my inspection of the occurrence of color dominance in protagonists and antagonists, which tends to to follow stereotypical patterns (rooting in the Silver Age of Comics).

To support my thesis, I produced an animated short clip that is based on this research. Although a complimentary contrast of red and green hues was used for the environment design of “The [Im]mortal Man”, I wish I would have implemented more advanced color contrasts. Nonetheless, the simplicity of the protagonist’s interfaced head in relation to his comparably complex body language demonstrates how efficient a combination of non-verbal communication and colors can actually work together.

I BIBLIOGRAPHY

Gerl, Ellen J. (2008). *The Causes and Consequences of Color Vision* (02.10.2008), [online] https://evolution-out reach.biomedcentral.com/articles/10.1007/s12052-008-0088-x [Accessed: 14.02.2022]

Pivirotto, Nicole (2021). *Color, Form and Magic: Use the power of aesthetics for creative and magical work*, San Francisco (CA): Chronicle Books LLC.

Wäger, Markus (2017). *Das ABC der Farben.* Bonn, Germany: Rheinwerk Design.

Butcher, G. / NASA. (2016). *Tour of Electromagnetic Spectrum*. 3rd ed [ebook] pg.18. Available at: https:// smd-prod.s3.amazonaws.com/science-pink/s3fs-public/atoms/files/Tour-of-the-EMS-TAGGED-v7_0.pdf [Accessed: 14.02.2022]

Wild Colors (2022). [Exhibition]. Field Museum of Natural History (Field Museum), Chicago, USA. 22.10.2021 till 08.01.2023

Wikipedia Contributors (2022). *Aposematism*. [online] Wikipedia. Available at: https:// en.wikipedia.org/wiki/ Aposematism [Accessed: 28.02.2022]

Hasa (2019). *What is the Difference Between Athens and Sparta.* [online] Pediaa. Available at: https:// pediaa.com/what-is-the-difference-between-athens-and-sparta/ [Accessed: 28.02.2022]

Howell, Ashley A. (2016). Understanding Color Psychology for Restaurants & Brands. [online] Medium. Available at: https://medium.com/@ashley_howell/understanding-colour-psychology-for- restaurants-brands-dbb7ffbcecae [Accessed: 28.02.2022]

Netflix Series: *Life in Colour with David Attenborough* (2021). Directed by A. Geiger. [online streaming]. United Kingdom. BBC One.

The J.M. Smucker Company. *Dunkin' Donuts.* [online] Dunkin Donuts Website. Available at: https://www. dunkinathome.com/ [Accessed: 28.02.2022]

Spencer, Erin (2017). *The Blue-Ringed Octopus: Small but Deadly.* [online] Ocean Conservancy. Available at: https://oceanconservancy.org/blog/2017/03/13/the-blue-ringed-octopus-small-but-deadly/ [Accessed: 28.02.2022]

Velarde, Orana (2019). *Color Psychology in Marketing: The Ultimate Guide.* [online] visme. Available at: https://visme.co/blog/color-psychology-in-marketing-the-ultimate-guide/ [Accessed: 03.03.2022]

McDonald's (2022). [online] McDonald's Website. Available at: https://www.mcdonalds.com/us/en-us.html [Accessed: 03.03.2022]

Harvey, Alisa (2020). *Why do we associate purple and green with poison?*. [online] How It Works. Available at: https://www.howitworksdaily.com/why-do-we-associate-purple-and-green-with-poison/ [Accessed: 05.03.2022]

Wikipedia Contributors (2022). *Scheele's Green.* [online] Wikipedia. Available at: https://en.wikipedia.org/ wiki/Scheele%27s_Green [Accessed: 05.03.2022]

Starbucks Coffee Company (2020). *Starbucks Creative Expression.* [online] Starbucks. Available at: https://creative.starbucks.com/color/ [Accessed: 04.03.2022]

Shake Shack (2020). *Stand for Something Good.* [online] Shake Shack Website. Available at: https://shakeshack.com/stand-for-something-good [Accessed: 04.03.2022]

Klaehn, Marie (2021). *Greenwashing – gezielte Täuschung der Verbraucher*innen?.* [online] PRIO 1. Available at: https://prio1-klima.net/blog/2021/greenwashing-gezielte-taeuschung-der-verbraucherinnen/ [05.03.2022]

Symonds, Dr. Paul (2022). *Traffic Lights Design and Standards Worldwide.* [online] Wayfinding. Available at: https://www.travelwayfinding.com/traffic-lights-design/ [Accessed at: 05.03.2022]

Weisberger, Mindy (2021). *Why is the color blue so rare in nature?*. [online] Live Science. Available at: https://www.livescience.com/why-blue-rare-in-nature.html [Accessed: 07.03.2022]

Cohen, Philip N. (2012). *Children's Gender and Parents' Color Preferences.* [online] Springer Science+ Business Media, LLC 2012. Available at: https://www.terpconnect.umd.edu/~pnc/ASB2013.pdf [Accessed: 07.03.2022]

Google Arts & Culture Contributors (Year). *The Color of Royals.* [online] Google Arts & Culture. Available at: https://artsandculture.google.com/usergallery/the-color-of-royals/2wKyQ40ioxf3lQ [Accessed: 08.03.2022]

Lupus Foundation of America Contributors (2022). *Raise Awareness of Lupus.* [online] Lupus Foundation of America Website. Available at: https://www.lupus.org/heartland/raise-awareness-of-lupus [Accessed: 09.03.2022]

McGuire, Sara (2017). *What Disney Villains Can Tell Us About Color Psychology [Infographic]*. [online] Venngage. Available at: https://venngage.com/blog/disney-villains/ [Accessed: 11.03.2022]

Chevat, Zev (2018). *Spider-Man: Into the Spider-Verse's unique art style meant 'making five movies'.* [online] Polygon. Available at: https://www.polygon.com/2018/12/11/18136056/spider-man-into-the-spider-verse-movie-art-animation-style-visual-effects [Accessed: 22.03.2022]

Spider-Man: Into the Spider-Verse *(*2018). Directed by Bob Persichetti, Peter Ramsey, Rodney Rothman. [Film]. Sony Pictures Releasing. United States.

McLachlan, Brian; Hanson, Aaron (2016). *Superhero Color Theory, Part I: The Primary Heroes.* [online] Comics Alliance. Available at: https://comicsalliance.com/superhero-color-theory-primary-heroes/ [Accessed: 25.03.2022]

Marvel (2022). *Lonnie Thompson Lincoln Tombstone*. [online] Marvel Website. Available at: https://www.marvel.com/characters/tombstone [25.03.2022]

Pauli, Maren (2019). *How Many Languages Are There In The World?.* [online] +Babbel MAGAZINE Website. Available at: https://www.babbel.com/en/magazine/how-many-languages-are-there-in-the-world and https://www.ethnologue.com/guides/how-many-languages [Accessed: 15.03.2022]

Michael, Jon (2020). *Strong Nonverbal Skills Matter Now More Than Ever In This "New Normal".* [online] Forbes Website. Available at: https://www.forbes.com/sites/forbescoachescouncil/2020/08/24/strong-nonverbal-skills-matter-now-more-than-ever-in-this-new-normal/?sh=74c3402c5c61 [Accessed: 15.03.2022]

Pease, Barbara and Allan (2006). *The Definitive Book of Body Language.* [online] New York Times. Available at: https://www.nytimes.com/2006/09/24/books/chapters/0924-1st-peas.html [Accessed: 15.03.2022]

Body Language Decoded Documentary (2017). Directed by Geoff D'Eon. [online streaming] Amazon Prime. Canada, United States. CBC Nature. Available at: https://www.amazon.com/Body-Language-Decoded-Geoff-DEon/dp/B07P5VHB5R [Accessed: 15.03.2022]

Jabr, Ferris (2010). *The evolution of emotion: Charles Darwin's little-known psychology experiment.* [online] Scientific American. Available at: https://blogs.scientificamerican.com/observations/the-evolution-of-emotion-charles-darwins-little-known-psychology-experiment/ [Accessed: 19.03.2022]

Bosnia, Ted (2014). *Study: Facial expressions evolved from optical needs.* [online] Cornell Chronicles. Available: https://news.cornell.edu/stories/2014/03/study-facial-expressions-evolved-optical-needs [Accessed: 19.03.2022]

Lost in Space (2018). Created by Irwin Allen [online streaming]. Netflix. United States. Available at: https://www.netflix.com/title/80104198 [Accessed: 03.04.2022]

Brown, Bryce E. (2021). *The Robots Of Lost In Space Explained | Lost In Space Seasons 3 Explained.* [online] YouTube. Available at: https://www.youtube.com/watch?v=xhIvrP2rSag [Accessed: 03.03.2022]

Blender Documentation Team (2014). Blender 3.1 Manual. [online] Blender organisation website. Available at: https://docs.blender.org/manual/en/latest/render/shader_nodes/shader/volume_scatter.html [Accessed: 03.04.2022]

Music: "More Human than Human" - Karl Casey @ White Bat Audio (CC BY 3.0 license)

II LIST OF ILLUSTRATIONS

Captain Marvel, Marvel. Available at:
https://www.marvel.com/characters/captain-marvel-carol-danvers/in-comics

Captain America, Marvel. Available at:
https://www.marvel.com/characters/captain-america-steve-rogers/on-screen

Beast, Disney. Available at:
https://disneyprincess.fandom.com/wiki/Beauty_and_the_Beast_(film)

Hulk, Marvel. Available at: https://www.marvel.com/characters/hulk-bruce-banner

Green Goblin, Marvel. Available at:
https://marvel.fandom.com/wiki/Norman_Osborn_(Earth-TRN765)

Joker, DC. Available at: https://www.dccomics.com/characters/joker

Loki, Marvel. Available at: https://marvel-filme.fandom.com/de/wiki/Loki_Laufeyson

Venom, Marvel. Available at: *https://www.imdb.com/title/tt1270797/*

Red Skull, Marvel. Available at: https://marvel-filme.fandom.com/de/wiki/Red_Skull

Black Widow, Marvel. Available at: https://www.marvel.com/movies/black-widow

[Accessed: 11.03.2022]

Fig. 18-35, pg. 25-32 :
Spider-Man: Into the Spider-Verse (2018). [screenshot].
Sony Pictures Releasing, United States. Available at: https://www.netflix.com/title/81002747 [Accessed: 25.03.2022]

Fig. 36, pg. 33: Steinert, Paulina A. (2022). *6 Expression Categories* (Based on C. Darwin's theory about *The Expression of the Emotions in Man and Animals in 1872*)

Fig. 37, pg. 34: Mécanisme de la Physionomie Humaine (1862). *Duchenne's Experiments* [photograph]. Wikipedia. Available at: https://de.wikipedia.org/wiki/Guillaume-Benjamin_Duchenne#/media/Datei:Duchenne-FacialExpressions.jpg [Accessed: 04.03.2022]

Fig. 39G & Fig. 39I:: *Juggernaut, Deadpool 2, Marvel* (2018). [image].
Available at: https://www.youtube.com/watch?v=Dl368rVhh3w
https://www.kindpng.com/imgv/ihmRixo_juggernaut-fox-rt-tr-juggernaut-deadpool-2-png/

Fig. 39H: *Adidas Continental 80 Shoe*. [photograph].
Available at: https://www.adidas.de/continental-80-schuh/G27706.html

Fig. 39J: Steinert, Paulina A. (2022). *Crown Fountain Interface* [photograph].
Crown Fountain, Millennium Park Chicago.

Fig. 39K: *Assassination Classroom.* Available at:
https://assassination-classroom.fandom.com/de/wiki/Assassination_Classroom_(Anime)

Fig. 40, pg. 39: Environment Moodboards

Steinert, Paulina A. (2022). *Environment Development Moodboard and Inspirations.* The Immortal Man Short Clip. Germany.
All used images are available at:

Fig. 40A: *Squid Game* (2021). [image].
Available at: https://www.forbes.com/sites/paultassi/2021/09/29/how-much-is-squid-games-45-billion-won-prize-in-dollars/?sh=1a90d2322033

Fig. 40B: Steinert, Paulina A. *Game Over* (2021). [graphic].

Fig. 40C: *Hunger Games* (2012-2015). [image].
Available at: https://www.joyn.de/filme/die-tribute-von-panem-the-hunger-games

Fig. 40D: *Sharktank* (2009 -). [image].
Available at: https://www.downtowndc.org/event/shark-tank-casting-call/sharktank/

Fig. 40E: *Thor, Marvel.* [image]. Available at: https://www.heute.at/s/-thor-ragnarok-marvels-bester-film-seit-iron-man--41863256

Fig. 40F: *Johannes Itten [*1961]. [graphic].
Available at: https://de.wikipedia.org/wiki/Farbkreis

Fig. 40G: Scheidt, Jakob. *Factory Concept* (2020). [rendered image].
Available at: https://3dtotal.com/galleries/crynh/factory-concept

All 3D textures were created with Substance 3D Painter with the exception of:

- MetalStainlessSteelBrushedSwirls002_1K
- MetalAluminumPerforatedHoles001_1K

(https://www.poliigon.com/ (CC0 license))

III STATUTORY DECLERATION

I herewith declare that I have composed the present thesis myself and without use of any other than the cited sources and aids. Sentences or parts of sentences quoted literally are marked as such; other references with regard to the statement and scope are indicated by full details of the publications concerned. Furthermore I declare that the submitted copies of the present thesis and the version submitted on a data carrier are/will be consistent with each other in contents.

Detmold, 06.04.2022

Place, Date

Signature (Paulina A. Steinert)

III EIDESSTAATLICHE ERKLÄRUNG

Ich versichere hiermit, dass ich die vorliegende Arbeit selbständig und ohne Benutzung anderer als der angegebenen Quellen und Hilfsmittel verfasst habe. Wörtlich übernommene Sätze oder Satzteile sind als Zitat belegt, andere Anlehnungen, hinsichtlich Aussage und Umfang, unter Quellenangabe kenntlich gemacht. Die Arbeit hat in gleicher oder ähnlicher Form noch keiner Prüfungsbehörde vorgelegen und ist nicht veröffentlicht.Zudem versichere ich, dass die von mir abgegebenen Versionen der vorliegenden Arbeit mit der abgegebenen elektronischen Version inhaltlich übereinstimmen wird.

Detmold, 06.04.2022

Ort, Datum

Unterschrift (Paulina A. Steinert)