

THE END OF DALTONISM AS AN OBSTRUCTION

**THIS BOOK MUST NOT BE
TURNED AROUND OR TURNED OVER.
IN ORDER TO UNDERSTAND THE CONTENT,
ONE MUST CHANGE THE PERSPECTIVE.**

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THE END OF DALTONISM AS AN OBSTRUCTION

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ABSTRACT

The phenomenon of daltonism was first researched in 1794 and although the symptoms of color-blindness have made it difficult to practice several professions, the diagnosis has probably not influenced any other profession as much as that of an artist. While 200 years ago artists struggled to cope with their color-blindness in connection with their art, contemporary artists seem to find ways to incorporate their visual color limitation in their artistic work. Through an in-depth analysis of the interplay between the artists handling of his color vision defect as well as the public's reception of daltonic art, this paper seeks to unveil the influence of color-blindness in art. By analyzing four case studies of daltonic artists, parallels and differences in overcoming this visual deficiency are studied in order to explore whether the artists achieved to overcome the obstacle of their limited visual perception. Consequently, *The End of Daltonism as an Obstruction* aims to identify how artworks created by color-blind artists are understood by people with a normal vision and the extent to which daltonic art has successfully integrated itself into art history.

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•• A	Arsham
H	Harbisson
M	Meryon
S	Sims
X	Normal

INTRODUCTION

The phenomenology of perception has over the past decades been subject to various psychological and philosophical studies. Carmelo Cali, an assistant professor at the University of Palermo specialized in the philosophy of cognitive science, recognizes the general perception as follows: “from the epistemological standpoint, perception is considered an independent mode of knowledge of the world at the environmental scale to which the subjects have access. Accordingly, the world is considered as the perceivable environment specified in the modes of sound, visual and tactual appearances and distinguished from the world as the object of research of the natural sciences.”¹ In accordance with Cali’s understanding of perception in general, the analyses conducted on the following pages focuses mainly on visual perception while partially touching the subject of an advanced form of acoustic perception.

When speaking of visual perception, we have to differ between sight and vision. Sight represents our sensory experience, namely “the physical attributes and performance of the many organic components involved in the visual system.”² Vision, however, refers to how our mind interprets the images perceived by the eyes. It is “a

¹ CALI, Carmelo, *Phenomenology of perception: theories and experimental evidence*, Leiden and Boston, Brill Rodopi, 2017, p. 1-2.

² AUTHOR UNKNOWN, “Eyecare, the difference between sight and vision”, smartvisionoptometry, (date unknown), <https://www.smartvisionoptometry.com.au/eyecare/eyesight-vs-vision/>, accessed July 2020.

thought process, which gives an understanding of what is seen, where it is and how to react to it. It combines information from many sensory systems and thus creates a perception of reality.”³

Through the pupil of our eyes, light is refracted and falls onto the retina at the back of our eyes. Through light-sensitive nerve endings and color cells the information of what is seen is transmitted as optic nerves to the brain. The brain then processes the image. Through this procedure, we are capable of distinguishing over 10 million color nuances.⁴ Which color we perceive, depends on the object and its properties as well as of the light source. Friedrich von Schiller already wrote about the paintings of Peter Paul Rubens in the 18th century: “I cannot shake off the thought that these colors are lying to me because they seem to be different depending on the way the light falls on them or whether the angle from which I see them is the one or the other.”⁵ When light hits the object, parts of the light are being absorbed, while some parts called “wavelengths”⁶ are being reflected. These are responsible for what colors our eyes perceive. But not only. Scientists have found that there are differences in color perception among people with complete visual functionality.⁷

With the awareness that even the visual perception of human beings without congenital defect creates differences in vision, how can we as viewers of the same ob-

KNOWING THAT THE PERCEPTION OF COLOR IS RELATIVE, HOW DO WE KNOW THAT OUR VISUAL PERCEPTION CORRESPONDS TO REALITY?

ject ever know that one perceives the color of the object in the same way? The answer is simple : we cannot. As Josef Albers writes in his book *Interaction of color* : “In visual perception a color is almost never seen as it really is – as it physically is.”⁸ Accordingly, he claims that “this fact makes color the most relative medium in art.”⁹ Knowing that the perception of color is relative, how do we know that our visual perception corresponds to reality? Knowing that other people see differently, what can be called reality? Is reality the one that corresponds to the perception of the majority of people or do we live in a world of visual parallel realities? How do people whose reality looks different reflect their reality?

People with severe color vision deficiency are called to be daltonic or color-blind. Research shows that 8% of men and 1% of women have a form of color impairment.¹⁰ From deuteranomaly, which is a red-green color-blindness, and the most common form, to tritanopia or achromatopsia, which is a complete color-blindness, and the rarest one. While the color-blindness type of deuteranomaly has as a consequence that green looks redder, protanomaly works the other way around and thus makes red look closer to green. Protanopia and deuteranopia cause the affected person to be unable to tell any difference between red and green whereas tritanomaly makes it difficult to differ between blue and green, as well as yellow and red. Tritanopia leads to the person affected not being able to differ between blue and green, purple

3 AUTHOR UNKNOWN, “Eyecare, the difference between sight and vision”, smartvisionoptometry, (date unknown), <https://www.smartvisionoptometry.com.au/eyecare/eyesight-vs-vision/>, accessed July 2020.

4 PANTON, Verner, “Notes on Color” (1997), in Musée des arts décoratifs et du design – Bordeaux, *Oh! Couleurs*, Bordeaux, Les éditions confluences, 2017, p. 199-214.

5 PANTON, Verner, “Notes on Color” (1997), in Musée des arts décoratifs et du design – Bordeaux, *Oh! Couleurs*, Bordeaux, Les éditions confluences, 2017, p. 211.

6 AUTHOR UNKNOWN, “Light: Electromagnetic waves, the electromagnetic spectrum and photons”, khanacademy, (date unknown), <https://www.khanacademy.org/science/ap-chemistry/electronic-structure-of-atoms-ap/bohr-model-hydrogen-ap/a/light-and-the-electromagnetic-spectrum>, accessed July 2020.

7 JURICEVIC, Igor, WEBSTER, Michael A., “Variations in normal color vision. V. Simulations of adaptation to natural color environments”, *Cambridge University Press*, December 2008, p.1.

8 ALBERS, Josef, *Interaction of Color*, New Haven and London, Yale University Press, 1963, p. 1.

9 ALBERS, Josef, *Interaction of Color*, New Haven and London, Yale University Press, 1963, p. 1.

10 BAILEY, Gretchyn, “Color Blindness: Types, Causes, Symptoms, Treatment”, *allaboutvision*, (2019), <https://www.allaboutvision.com/conditions/colordeficiency.htm>, accessed July 2020.

and red, as well as yellow and pink. Lastly, the rarest form of color-blindness, named achromatopsia, withholds the person from seeing any color, in a way that the world that reveals itself solely in black and white.¹¹ .₁

The first writings on the perception of color-blindness date from 1777 and were documented by Captain Joseph Huddart.¹² Huddart wrote about the perception of a shoemaker named Thomas Harris. Just like his brothers, Harris noticed that he couldn't distinguish colors red and green from each other. As a child he discovered that "when other children could observe cherries on a tree some pretended difference of color, he could only distinguish them from the leaves by their difference of size and shape."¹³ The first one to examine this visual deficiency was John Dalton. Through analyzations of his own color perception defect, he was able to understand that his vision differed from other people's visual perception. Dalton was able to contact Harris's brother who he sent a set of colored ribbons in order for him to describe their colors.¹⁴ Harris had described their colors the same way Dalton did. This made him conclude that "a considerable number of individuals might be found whose vision differed from that of the generality, but at the same time agreed with my own."¹⁵ .₁₆

Even though Dalton had developed an understanding of color-blindness in 1794, he was surprised that he had not encountered a female case to date : "it is remarkable that

WHAT IS THE EXTENT TO WHICH COLOR-BLINDNESS CAN BE DEFINED AS A FALSIFIED PERCEPTION AT ALL?

his discoveries, "I was always of opinion, though I might not often mention it, that several colors were injudiciously named. The term pink, in reference to the flower of that name, seemed proper enough; but when the term red was substituted for pink, I thought it highly improper; it should have been blue, in my apprehension, as pink and blue appear to me highly allied; whilst pink and red to me have scarcely any relation."

¹⁷ DALTON, John, "Extraordinary facts relating to the vision of colors: with observations", *Memoirs of the Literary and Philosophical Society of Manchester*, vol. 5, 1798, p. 40.

¹⁸ AUTHOR UNKNOWN, "Exemple d'hérédité lié au sexe: le daltonisme chez l'homme", *La Science et la vie*, 1939, p. 472.

¹⁹ BAILEY, Gretchyn, "Color Blindness: Types, Causes, Symptoms, Treatment", *allaboutvision*, (2019), <https://www.allaboutvision.com/conditions/colordeficiency.htm>, accessed July 2020.

I have not heard of one female subject to this peculiarity."¹⁷ The reason why Dalton might not have encountered any female case is that, while for women, to be daltonic, both parents have to be colorblind, for men only one parent has to have a daltonic vision.¹⁸ .₂ Dalton attributed the reason for his different color perception to a slightly tinted liquid in his eyes. It was only after his death that it turned out that this was a false assumption. Other researchers found the reason for the deficient color to lie in the concept of the cones on the retina.¹⁹ Although Dalton's assumption about the reason of his color-blindness was wrong, his initial researches have led to lively discussions on visual color impairment. Thus, in recognition of his pioneering work people have been talking about daltonism ever since.

An impairment of the visual color perception can play a role in many areas of life. A particularly interesting question, however, is to understand how a restriction with regard to the perception of colors affects people whose visual perception is elementary to their professional activity. One could assume that the functionality of visual perception is for few people as elementary as it is for the artist. Being active in a profession that is based on perception, how does a false or distorted perception of our surroundings influence the practice of art? What is the extent to which color-blindness can be defined as a falsified perception at all? And, in what way has this influential factor changed the way art is created and perceived?

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¹¹ AUTHOR UNKNOWN, "Types of Colour Blindness", *colourblindawareness*, (date unknown), <https://www.colourblindawareness.org/colour-blindness/types-of-colour-blindness/>, accessed July 2020.

¹² HUDDART, Joseph, "An account of persons who could not distinguish color", *Philosophical transactions of the Royal Society of London*, vol. 67, 1777, p. 260.

¹³ HUDDART, Joseph, "An account of persons who could not distinguish color", *Philosophical transactions of the Royal Society of London*, vol. 67, 1777, p. 260.

¹⁴ MARMOR, Michael F., "John Dalton: The Recognition of Color Deficiency", in MARMOR, Michael F., ALBERT, Daniel M., *Foundations of Ophthalmology*, Switzerland, Springer, 2017, p. 23-34.

¹⁵ DALTON, John, "Extraordinary facts relating to the vision of colors: with observations", *Memoirs of the Literary and Philosophical Society of Manchester*, vol. 5, 1798, p. 28-45.

¹⁶ Note : In a publication from 1798 Dalton wrote about

ved by the public?

There are several artists in the history of art for which there were indications that they were color-blind. Posthumously, however, it is difficult to prove the artists' color-blindness and therefore, in retrospect, one can only speculate about the state of perception of certain artists. The artist Baccio Bandinelli (1488-1560), is a fitting example of an artist who has been speculated about being color-blind, as people said that he hired other artists in the 1500s to teach him how to use colors. Before that, his pictures were said to be of low quality and his handling of color was faulty.²⁰

Another case was the Irish artist Paul Henry (1876-1953), who was expected to be also color-blind but never made his deficiency public.²¹ Henry was told to have asked his wife to mix the colors for him. After Henry was divorced and remarried, it was said that the use of his colors, possibly due to the departure of his first wife, had changed as well.²² Because both women were independent artists, they may have been able to implement their personal color expression in his pictures, since Henry was already a well-known artist at the time, whose pictures were nationally recognized at the end of his life and later internationally shown.²³ Regardless of how he painted with colors, the question that arises is why an artist would create a piece of work in a spectrum he/she cannot really see himself? The case of the American artist Paulanship

20 MARMOR, Michael F., "Bandinelli era daltonico?", in HEIKAMP, Detlef, STROZZI, Beatrice P., *Baccio Bandinelli: Scultore e Maestro*, Florence, Giunti Editore, 2014, p. 498.

21 FLEGG, Eleanor, "Treasures, wedded to a life of color.", independent, (2018), <https://www.independent.ie/life/home-garden/treasures-wedded-to-a-life-of-colour-36987306.html>, accessed July 2020.

22 FLEGG, Eleanor, "Treasures, wedded to a life of color.", independent, (2018), <https://www.independent.ie/life/home-garden/treasures-wedded-to-a-life-of-colour-36987306.html>, accessed July 2020.

23 LAVERY, Brian, "From Irish Art Hero to Cliché and Back to Favor", nytimes, (2013), <https://www.nytimes.com/2003/03/06/arts/from-irish-art-hero-to-cliche-and-back-to-favor.html>, accessed October 2020.

(1885-1965), who gave up painting after becoming aware of his color-blindness and turned to the art of sculpting, is one example of many daltonic artists, who decided to continue working with an art technique that did not necessarily involve the use of colors.²⁴ According to statistics led by the ophthalmologist Wolfgang Münchow in 1978, 17 out of 31 color-blind artists have turned away from painting and decided on a different medium.²⁵

Given the multitude of color-blind artists that existed so far, the analyzation of four different case studies offers the possibility to investigate how the working process of daltonic artists has changed in such a way that their color-blind deficiency is no longer seen as an obstacle in the creation of their art. The artists were chosen based upon their form of daltonism, their differing ways of handling their deficiency, as well as the diversity of art mediums they used within their artistic work.

The artists' case studies that were selected for the analyses conducted on the following pages are Charles Meryon, Meghan Sims, Daniel Arsham and Neil Harbisson. While the Frenchman Charles Meryon lived from 1821 to 1868, all the other artists are still alive, with Meghan Sims, from Ontario and Daniel Arsham, from Ohio, both being born in 1980 and Neil Harbisson from Spain, being born in 1984. For Charles Meryon it is not exactly proven which form of daltonism he had, but according to experiences he described in letters he wrote at the time

24 MARMOR, Michael F., RAVIN, James G., *The eye of the artist*, Philadelphia, Mosby, 1997.

25 LANTHONY, Philippe, "Daltonism in Painting", *Color Research and Application*, vol. 26, 2001, p. 13.

Note: Author had no access to the original source: MÜNCHOW, Wolfgang, "Color vision deficiencies in painting", in MARRÉ, M., MARRÉ, E., MIERDEL, P., *Regional Symposium of the International Research Group on Colour Vision Deficiencies*, Dresden, September 1978, (no pagination).

14 **“COLOR DOES NOT EXIST IN AND OF ITSELF. IT IS PERCEPTIBLE ONLY IN LIGHT, WHICH REVEALS IT IN THE MOMENT BUT DESTROYS IT OVER TIME. COLOR IS INTRACTABLE, VARYING DEPENDING ON ITS QUANTITY, THE SUBSTANCE THAT BEARS IT AND THE EYE THAT PERCEIVES IT.”**

and how he used colors in existing paintings, he is expected to have suffered from a form of protanopia²⁶ or deuteranopia²⁷. This form of daltonism is the same form which was diagnosed for Arsham. Sims and Harbisson however, both have the rarest form of daltonism, meaning that they suffer from achromatopsia and thus they see everything in greyscales.

By taking these four cases as a basis, the following work within this thesis aims to reveal how color-blindness affects the creation of artistic work, the instruments artists use to deal with their color impairment, and the extent to which appearance and acceptance of color-blindness has changed from the past to the present. Constance Rubini, director of the Musée des arts décoratifs et du design de Bordeaux, has succeeded very well in describing how people with a limited perception system subjectively perceive colors by saying that : “Color does not exist in and of itself. It is perceptible only in light, which reveals it in the moment but destroys it over time. Color is intractable, varying depending on its quantity, the substance that bears it and the eye that perceives it.”²⁸

²⁶ Note : Red-green color-blindness.

²⁷ Note : Green blindness.

²⁸ RUBINI, Constance, “Color is everywhere Color does not exist”, in Musée des arts décoratifs et du design – Bordeaux, Oh! Couleurs, Bordeaux, Les éditions confluences, 2017, p. 22.

1/ THE INFLUENCE OF DALTONISM ON THE ARTISTIC CREATIVE BEHAVIOR

When one speaks of a visual deficiency in relation to an artistic work in which visual perception is fundamental, one can assume that this visual deficiency affects the way the artist works in one form or another.

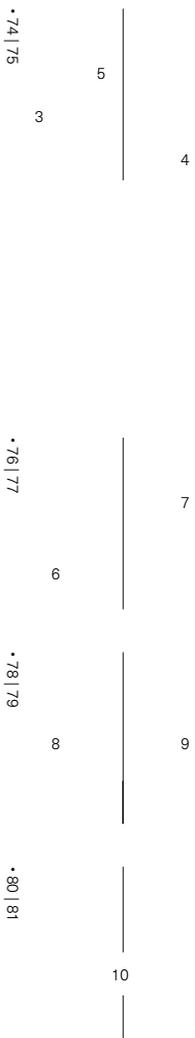
1/1/ THE ARTISTIC CHOICES

The four artists analyzed show fundamental differences, both in the choice of their artistic medium and in relation to the thematic expression of their art.

Meghan Sims’ various creative periods as well as the different approaches she tested to deal with her color-blindness, give an indication that Sims is constantly questioning and self-reflecting her visual perception in her artistic work. Thus, her work represents her visual perception of the world, that she tries to communicate to the public. “Although my works often appear to be surreal or even abstract, they are usually literal representations of my subject matter, which demonstrates my visual field to those with normal eyesight.”²⁹ As Meghan Sims is not only color-blind but also extremely sensitive to light, she prefers to paint night settings when light is the dar-

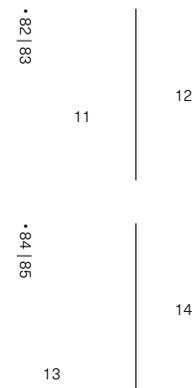
²⁹ AUTOR UNKNOWN, “Meghan Sims”, achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

16 "WHERE OTHERS SEE LIFE IN DETAIL AND COLORS, I AM LIMITED TO LIGHT, SHADES AND SHAPES."



kest. However, even if it hurts her to paint under strong light, she is of the opinion that when painting under conditions like these, her personal perception is represented best. Accordingly, paintings like *Courtland at David* (2010)^{.3}, *Victoria Park Trees* (2010)^{.4} or *Breithaupt Pines* (2010)^{.5} are representations of her vision at daylight. In these paintings, it is clearly visible how the dark shapes are practically engulfed by the blinding brightness. Interestingly, her night paintings seem to be more recognizable for the public, as she is able to include details that get lost when she paints by daylight. "Where others see life in detail and colors, I am limited to light, shades and shapes."³⁰ Paintings that underline this argumentation are her almost monochromatic artworks like *Queen at Courtland* (2012)^{.6}, *David Street at Night* (2011)^{.7}, *King at Queen* (2012)^{.8} or *Night Life* (2009)^{.9}, which visualize her more pronounced perception of detail in the absence of strong light. Until 2016 Sims had not used colors in any of her artworks and limited her color palette to grey tones as she distrusted colors in general. Accordingly, Sims argues : "I didn't see color, so I didn't use it. I had no interest."³¹

In contrast to Meghan Sims, who focuses primarily on painting, Daniel Arsham is a multidisciplinary artist, whose work focuses predominantly on structures and surfaces. In most of his art he avoids the use of colors because he prefers to work in black and white. Artworks such as *Baseball Pile* (2014)^{.10}, *Moon Globe Black* (2016)



30 AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

31 AGGERHOLM, Barbara, "Meghan Sims, a Kitchener artist who is colour blind, makes the most of her unique vision", therecord, (2019), <https://www.therecord.com/news/waterloo-region/2019/03/05/meghan-sims-a-kitchener-artist-who-is-colour-blind-makes-the-most-of-her-unique-vision.html>, accessed July 2020.

32 KINNEY, Bunny, "Daniel Arsham's Future Relic", nowness, (2018), <https://www.nowness.com/story/future-relic-daniel-arsham-juliette-lewis>, accessed July 2020.

33 Note : A person whose physical abilities are extended beyond normal human limitations by mechanical elements built into the body.

.¹¹ and *Televisions* (2015)^{.12} are only a few of many examples that visualize this systematic exclusion of color. This way of working without colors gives him the opportunity to perceive his art in the same way as the viewer. In 2016, however, Arsham began to add color to his work for the first time. Through the use of differing materials like volcanic ash, sand or selenite, his work revolves around the subject of fictitious artifacts that he creates and refers to as "future relics"³² of the present. Furthermore, the targeted selection of his objects, which through their digitization mostly shaped the end of the 20th century, allow Arsham to develop an interplay between the present, the future and the past.

Neil Harbisson who initially had no sense of color at all, as he sees the world in scales of grey, has gained the perception of sensing color through sound. Through a wavelength sensible antenna implanted into his head, Harbisson is able to hear the sound of colors and ever since calls himself a *Cyborg*³³.^{.13} While Meryon, Sims and Arsham have realized, respectively, physical forms of art, Harbisson focuses not only on art creation, but feels the act of creating a new sense through a "new organ"³⁴ as art in itself. "Cyborg art will eventually be seen as an art and I see the creation of senses and the creation of new body parts, the design of your perception of reality as an art movement, where art no longer needs to express itself through the traditional senses, but through new senses."³⁵ Additionally, Harbisson uses this new sense

THE ART OF DESIGNING NEW SENSES BY CREATING NEW ORGANS, AND THE ART OF “MERGING WITH THEM”

to show people what he is able to do with his antenna. Therefore, he creates paintings of people and people's voices, as their voices have frequencies that he relates to colors. He calls his resulting art “sonochromatic”³⁶. An example of a sonochromatic painting Harbisson created is the visualization of Beethoven's *Für Elise* (no date).

¹⁴ While Harbisson positions himself as a cyborg artist who expresses himself through the art of designing new senses by creating new organs, and the art of “merging with them”³⁷, the pieces resulting from his work can be seen as art itself. Consequently, in the case of Harbisson one should speak of two different forms of art, firstly the creation and adaption to his new sense, secondly the art which is created by the artist through the new sense he has gained. As a result, by permanently integrating this new sense in order to compensate for his lacking color perception, his limited visual perception has unintentionally become the constant thematic center of his art.

By comparing the contemporary artistic works of Sims, Arsham and Harbisson with the artworks of Charles Meryon, who was active in a different artistic period, it can be conceived that while Meryon specialized predominantly on black and white etchings, the other three artists all integrated some traces of color in their artworks. In the course of work of Meryon it is noticeable that even if he used colors at the beginning, around 1849 he changed to the medium of etching as this transition gave him the possibility to work predominantly with greyscales

³⁴ IYENGAR, Radhika, “This is the future, says world's first cyborg Neil Harbisson”, *livemint*, (2018), <https://www.livemint.com/Companies/TDIMfjB21T-P5eSB5kR0UtM/This-is-the-future-says-worlds-first-cyborg-Neil-Harbisson.html>, accessed July 2020.

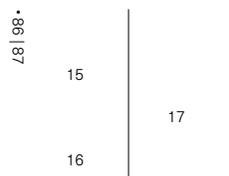
³⁵ HSGUNISTGALLEN, “Neil Harbisson on being a Cyborg”, *youtube*, (2017), https://www.youtube.com/watch?v=C_OnYqx3ynA&list=WL&index=9&t=0s, accessed July 2020.

³⁶ Note : The sonochromatic music scale is a microtonal and logarithmic scale with 360 notes in an octave, each note corresponds to a specific degree of the color wheel.

³⁷ DESIGN INDABA, “Cyborg artists, Neil Harbisson and Moon Ribas, on physically merging oneself with technology”, *youtube*, (2019), <https://www.youtube.com/watch?v=U-tGk65wyYs&list=WL&index=11&t=0s>, accessed August 2020.

and thus to hide his limited visual perception of colors.

In contrast to Sims' work topics of vision and reduced perception, as well as Harbisson's thematic subject of cyborgnatic perception, Meryon's thematic of his etchings had nothing to do with the human visual perception. Instead he depicted mostly Parisian landscapes with an incredible attention to detail. Thus, Gustave Geffroy, a French journalist, art critic, and historian, wrote about Meryon's style of work : “[...] by the sure signs of the habitation, by the concerned expression of the stone faces, by the old age of the dwellings open to space and time, he suggested, because he was a visionary of hidden things, a humanity endlessly living its temporary life in a setting that seems eternal. This absent humanity, our eyes guess it, our mind evokes it.”³⁸ He was very fond of Paris and showed a great affection for depicting views of the cityscape, that would change due to rebuilds and captured these in his work. “What also gives these unprecedented works their immobile character of eternity is that the present in it is the setting of the past.”³⁹ If you have a look for instance at artworks such as *L'Abside de Notre-Dame de Paris* ,¹⁵ painted by Meryon in 1854, Gustave Geffroy is undoubtedly right. Meryon managed to develop a feeling of eternity in his engravings, even though the city was constantly changing. Nevertheless, the decision not to make the poor eyesight the subject of his art was certainly not only a decision to do justice to the artistic themes of the time, but also a decision that



³⁸ GEFFROY, Gustave, *Charles Meryon*, Paris, H. Floury Éditeur, 1926, p. 184.

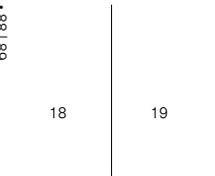
Note : Original quotation translated by the author. “[...] par les signes certains de l'habitation, par l'expression soucieuse des visages de pierre, par la vieillesse des logis ouverts sur l'espace et le temps, il a suggéré, parce qu'il était un visionnaire des choses cachées, une humanité vivant sans cesse sa vie temporaire dans un décor qui semble éternel. Cette humanité absente, nos yeux la devinent, notre esprit l'évoque.”

³⁹ GEFFROY, Gustave, *Charles Meryon*, Paris, H. Floury Éditeur, 1926, p. 184.

Note : Original quotation translated by the author. “Ce qui donne aussi à ces œuvres sans pareilles leur caractère immobile d'éternité, c'est que le présent y est le décor du passé.”

allowed him to suppress his color-blindness as far as possible.

In contrast to Meryon, Sims and Harbisson treat their color-blindness thematically in their art. Compared to paintings like *Courtland at David* (2010), *Victoria Park Trees* (2010) or *Breithaupt Pines* (2010), which represent Sims' perception during daylight, the painting *Night Town 2* (2009) .₁₆ depicts her perception at night which is generally richer in detail. Harbisson for his part has, based on the hue and light he detects through his antenna on human skin, developed a color wheel which he calls *The Human Colour Wheel* (2009) .₁₇ Arsham only deals with his daltonism indirectly in art and addresses it in rare cases on a thematic level. Ironically, in his series *Static Mythologies* Arsham has created relics using volcanic ash and rose quartz in combination with pink selenite. These relics depict a book on color-blindness, which include a typical color-blindness Ishihara⁴⁰ test plate in the form of Arsham's Studio Logo on the cover. ._{18 & 19} However, he never tried to hide his color-blindness. In contrast, for Meryon who was looking for ways to elude from his daltonism in order to be able to keep working as an artist, the selection of his artistic subject focus allowed him to cover up his color-blindness also in a thematic sense. Through the interaction of his choice of medium and the implementation of his subject, Meryon succeeded in circumventing his color-blindness and suppressing it in his art.



40 Note : The Ishihara test, is a color-blind test, named after the Japanese ophthalmologist who invented the colored plates. Each plate consists of a circle with colored dots including a composition forming the shape of a number, with a different color. People with a normal color vision don't have any problems to recognize the numbers, while they are hard to detect, or invisible to people with a red-green color deficiency.

1/2/ THE ARTIST'S PERCEPTION OF DALTONISM

"THIS COLOR DEFECT OF WHICH I SPEAK IS SUCH THAT I OFTEN PREFER BEAUTIFUL BLACK PRINTS, IN WHICH ONE CAN SEE THE GRADATION OF SHADING, TO THE MORE VIVID EFFECTS OF PAINTING."

While some of the artists analyzed in this thesis only became aware of their visual limitations in the course of their artistic work, others were aware of the visual obstacle very early on. This recognition leads to the question : How do artists perceive their own color-blindness? Do artists take their color-blindness as a physical impairment? Is daltonism perceived as an obstacle by an artist? Is it possible to determine whether daltonism has formed the artists in their artistic approach or even prescribed their artistic expression in one way or another?

Even though Meryon's hopes were high to work with colors when he first started as an artist, he later preferred the exclusion of colors in his artistic works.⁴¹ After serving the French navy, Meryon decided to study arts. In the early 1840s he started working with sepia, but quickly moved on to watercolor, as he wrote to his father to have stopped the use of sepia to begin watercolor. In the letters he wrote to his father he claimed that this change would allow him various other possibilities.⁴² It can be assumed that he noticed his differing visual perception even if he was not aware of it at first. In writings Meryon sent to his father in 1846, he mentioned his color-blindness : "This color defect of which I speak is such that I often prefer beautiful black prints, in which one can see the gradation of shading, to the more vivid effects of painting."⁴³ Al-

41 RAVIN, James, ANDERSON, Nancy, LANTHONY, Philippe, "An Artist with a Color Vision Defect: Charles Meryon", *Survey of Ophthalmology*, vol. 39, 1995, p. 403-408.
Note : Author had no access to the original source: LEE, Sidney, Dictionary of National Biography, 1894.
42 DROST, Wolfgang, "Documents Nouveaux sur l'Oeuvre et la Vie de Charles Meryon", *Gazette des Beaux-Arts*, vol. 63, 1964, p. 63-230.
43 RAVIN, James, ANDERSON, Nancy, LANTHONY, Philippe, "An Artist with a Color Vision Defect: Charles Meryon", *Survey of Ophthalmology*, vol. 39, 1995, p. 405.
Note : Author had no access to the original source: LEE, Sidney, Dictionary of National Biography, 1894.

though Meryon has written about his color-blindness to his father, he has never spoken about it in public. At a later stage in Meryon's work process, he even wrote about the reason why he had resisted to the artform of colored paintings : "Because, as I believe I told you, I certainly have an organizational defect in my sight which causes certain colors, very different for everyone, to be confused by me. It is rather singular, but it is very true, and you can imagine that it was only to my great regret that I became certain of this defect."⁴⁴ This statement indicates that Meryon's color-blindness represented a limitation in the exercise of his artistic work. However, even though he was aware of his congenital defect, he was convinced to continue creating art. While his initial intention was the painting of themes using colors, Meryon felt that he did have to abandon color in order to continue as an artist. Meryon's limitations in his art seemed to be a solution to further his personal artistic execution, but this decision led, among other things, to the fact that he gradually developed a feeling of having been abandoned by the society on an artistic level.⁴⁵ Accordingly, in letters to his friend Edouard Foley, Meryon regularly wrote in a plaintive manner : "Some, tempted by gain, adopt an easy path that succeeds them, and end up blinded by their works, speaking only with disdain of the just criticism that their manner raises; others, more conscientious, but quick to delude themselves, soon recognize their inferiority [...]."⁴⁶ This personal development swung high until he eventually destroyed some of his own brass plates to keep them

44 GEFFROY, Gustave, *Charles Meryon*, Paris, H. Floury Éditeur, 1926, p. 30.

Note : Original quotation translated by the author. "Parce que, comme je crois vous l'avoir dit, j'ai bien certainement dans la vue un défaut d'organisation qui fait que certaines couleurs, bien différentes pour tout le monde, se confondent chez moi. C'est assez singulier, mais c'est très vrai, et vous concevez que ce n'est qu'à mon bien grand regret que j'ai acquis la certitude de ce défaut."

45 JOUVE, Pierre-Jean, *Le quartier de Meryon I*, La Nef, September 1945, p. 5.

46 MERYON, Charles, *Letter to E. Foley*, Paris, 20 May 1849. Note : Original quotation translated by the author. "Les uns, que tente le gain, adoptent une voie facile qui leur réussit, et finissent par s'aveugler sur leurs œuvres, ne parlant qu'avec dédain des justes critiques que soulève leur manière ; les autres, plus consciencieux, mais prompts à s'illusionner, reconnaissent bientôt leur infériorité ; [...]."

"I SORT OF KEPT THE DOOR SHUT THERE, BECAUSE IT WAS SOMETHING OUT OF MY REACH AND I FELT THAT I DIDN'T NEED TO UNDERSTAND IT."

47 JOUVE, Pierre-Jean, *Le quartier de Meryon II*, La Nef, October 1945, p. 68.

48 AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

49 AGGERHOLM, Barbara, "Meghan Sims, a Kitchener artist who is colour blind, makes the most of her unique vision", *therecord*, (2019), <https://www.therecord.com/news/waterloo-region/2019/03/05/meghan-sims-a-kitchener-artist-who-is-colour-blind-makes-the-most-of-her-unique-vision.html>, accessed July 2020.

50 SHARKEY, Jackie, "Colourblind artist Meghan Sims paints with full palette for first time with fascinating results", *cbc*, (2016), <https://www.cbc.ca/news/canada/kitchener-waterloo/kitchener-artist-meghan-sims-colourblind-1.3811847>, accessed July 2020.

from becoming part of the art industry.⁴⁷

Although Meghan Sims and Neil Harbisson have the same form of color-blindness, their visual perception is still different. Achromats normally experience a strong sensitivity to light, which makes it hard for them to be able to perceive their surroundings normally during daytime. While this is exactly the form of achromatopsia Sims experiences, Harbisson is lacking color perception without being sensible to light.

At a younger age Meghan Sims, just like many other people with a color perception deficiency, felt the need to hide her visual impairment.⁴⁸ Accordingly, in school she was bullied for having to wear light blocking glasses and coloring things in a different way than other children.⁴⁹ Against this background, it can be assumed that these circumstances led Meghan Sims to avoid the use of colors as an artist for a long time. Until 2016 Sims categorically excluded colors from her artistic approach : "I sort of kept the door shut there, because it was something out of my reach and I felt that I didn't need to understand it."⁵⁰ It is only recently that she started integrating colors in her artworks.

For Daniel Arsham, who in the beginning of his career worked mainly in black and white, his color reductive perception was never really an obstacle in his artwork. He claimed that his work is not necessarily dependent

24 **“OFTEN WHEN I’M LOOKING AT MATERIALS, I’M SELECTING THEM FOR PROPERTIES OTHER THAN COLOR [...] SO I SELECT THE COLOR INADVERTENTLY THROUGH THE SELECTION OF THE MATERIAL.”**

nor related to his color-blindness, as his choice of colors within his work always relied on the materialistic choices he made. “Often when I’m looking at materials, I’m selecting them for properties other than color [...] so I select the color inadvertently through the selection of the material.”⁵¹ Even though Arsham perceives his daltonism as a deficiency, for him it never really was an obstruction. “I knew that I was color-blind all my life, it’s not something that was pointed out to me on many occasions nor something that I even thought about being part of my work.”⁵² His blindness raised questions for him, regarding the difference in perception compared to other people, but it was never a strong hindrance in his artistic work.

Similar to Daniel Arsham, for Neil Harbisson the fact to not be able to see colors never really consisted in a physical problem. He is even of the opinion that being totally color-blind has its benefits. “To me, black and white vision has advantages. We see better at night. We see distances better than people that see color, and we also identify shapes more easily. So, to me, greyscale vision was an advantage.”⁵³ However, Harbisson felt that living in a colorful world that is grey to you affects you in a social way. A color-coded world where a minority of people are color-blind and only few of them suffer total color-blindness has the capability to make you feel excluded. “Being colorblind was always an advantage in many ways. The only issue I felt with color was that I felt socially excluded

51 CARPENTER, Kim, “Playing with Perception: A Conversation with Daniel Arsham”, sculpture, (2014), https://www.sculpture.org/documents/scmag14/dec_14/fullfeature.shtml, accessed August 2020.

52 COMPLEX HUSTLE, “How Daniel Arsham’s Experimental Art Attracted Collaborations with Pharrell, Adidas and Usher”, youtube, (2017), <https://www.youtube.com/watch?v=YwURKXWz2h0&list=WL&index=16&t=0s>, accessed August 2020.

53 SISLEY, Dominique, “Why this artist got an antenna implanted in his skull”, dazeddigital, (2016), <https://www.dazeddigital.com/arts-andculture/article/31102/1/why-this-artist-got-an-antenna-implanted-in-his-skull>, accessed August 2020.

“I HAVE NEVER SEEN COLOR, I DON’T KNOW WHAT BLUE OR RED MEAN VISUALLY, BUT I GREW UP IN A WORLD WHERE COLOR EXISTS.”

54 SISLEY, Dominique, “Why this artist got an antenna implanted in his skull”, dazeddigital, (2016), <https://www.dazeddigital.com/arts-andculture/article/31102/1/why-this-artist-got-an-antenna-implanted-in-his-skull>, accessed August 2020.

55 AUTHOR UNKNOWN, “Neil Harbisson Interview – Part 2: Hearing Colors”, munsell, (date unknown), <https://munsell.com/color-blog/neil-harbisson-hearing-colors/>, accessed August 2020.

56 D&AD CREATIVE ADVERTISING, “Design and Digital, Neil Harbisson – D&AD Presidents’s Lecture”, youtube, (2015), <https://www.youtube.com/watch?v=2l-HPpyRZujM&list=WL&index=28&t=0s>, accessed August 2020.

57 SISLEY, Dominique, “Why this artist got an antenna implanted in his skull”, dazeddigital, (2016), <https://www.dazeddigital.com/arts-andculture/article/31102/1/why-this-artist-got-an-antenna-implanted-in-his-skull>, accessed August 2020.

because color is used socially. I felt that I was missing out on something social, but I never felt like I was missing out something physical.”⁵⁴ Nonetheless, not having any comprehension of colors didn’t stop Harbisson from studying music and visual arts. In course he was allowed to create paintings in black and white and managed to develop an understanding of how people without a visual deficiency perceive colors. While he studied the theory of colors, Harbisson felt like studying a religion as the color effects were invisible to him and people seemed to attach something more than physical to it.⁵⁵ Thus it seems to be only natural that a certain curiosity evolved from what he wasn’t able to perceive. “I have never seen color, I don’t know what blue or red mean visually, but I grew up in a world where color exists.”⁵⁶

It is evident that all three contemporary artists question themselves how their perception differs from the perception of normal-vision people. Although the color-blindness affects the artists differently in their creative process, it certainly affects them all on a personal level. It is conceivable that there is a connection between this personal affection and the psychology of someone concerned. As Harbisson expresses, a color-blind artist like him is well aware that in his profession he is constantly surrounded by colors that he cannot really perceive himself.⁵⁷ It seems only normal that a daltonic artist aims to understand what he is visually missing. However, a color-blind artist will never develop a real visual understand-

“THE RELATION OF WHAT WE SEE AND WHAT WE KNOW IS NEVER SETTLED.”

ding of what normal sighted people see, and the reverse is also applicable. Someone with a normal vision can never see the world through the eyes of the color-blind artist. This being the case, one can assume that we live in a world of visual parallel realities. Similar to the description of the writer John Berger regarding the context of our visual perception : “The relation of what we see and what we know is never settled.”⁵⁸ For instance, when Sims is standing in front of her colored paintings she can neither truly perceive the colors of her paintings nor develop a visual understanding of these colors. Or the other way around, a person with a normal vision can put himself in the situation of working like a color-blind person with a restriction of shades, but will never be able to visually experience the other person’s view. In his book, Berger explains that René Magritte, who related to images and the descriptive words of paintings, spoke of an ever-present gap which he called “The Key of Dreams”⁵⁹. A very beautiful expression that can be used to describe the space that allows both sides to interpret what they are unable to perceive themselves.

1/3/ CONQUERING THE VISUAL DEFICIENCY

By comparing the different means the artists use to carry out their artistic activities despite their color-blindness, it can be observed that the personal approaches of the artists differ one from another. While some of them found

58 BERGER, John, *Ways of Seeing*, Great Britain, Penguin Books, 2008, p. 7.
59 BERGER, John, *Ways of Seeing*, Great Britain, Penguin Books, 2008, p. 7.

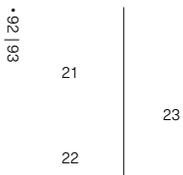
tools to work with, others found coding systems to overcome their visual hindrance in their art.

Of all the colored paintings that Meryon had done prior to the etchings, only one remains. The artwork *Ghost ship* (before 1840, exact date unknown) illustrates with which ideology Meryon started painting. This painting shows the selection of yellow and blue tones which is typical for deuteranopic color-blind artists.⁶⁰ For color-blind artists with this form of daltonism, these are the colors they perceive best.⁶⁰ However, Meryon did not succeed to attract the interest of the audience with his color paintings. *Ghost ship* seems like a remnant of a failed attempt to gain a foothold as a daltonic artist trying to paint colors, because from this point on, Meryon realized that his deficiency would not allow him to work with colors and thus he decided to circumvent his color-blindness in his art. The change of the medium and the change from color to black and white etchings gave Meryon the possibility to suppress his color visual impairment in his art. At the same time, this way of dealing with his visual deficiency seemed for Meryon to be the only escape to continue the practice of his art and to be recognized by the public. Thus, compared to the other artists analyzed in this thesis, Meryon is the only artist who changed to a medium where his deficiency could not be noticed by the public and, we can assume, that thereby he circumvented his visual limitations in his artworks.

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60 RAVIN, James, ANDERSON, Nancy, LANTHONY, Philippe, “An Artist with a Color Vision Defect: Charles Meryon”, *Survey of Ophthalmology*, vol. 39, 1995, p. 405.

28 **"I DON'T KNOW WHAT ANY OF THE COLORS ARE, REALLY, I'M SEEING A GRADIENT OF LIGHT WHEN I LOOK AT THE COLOR ON THE TUBE. I NUMBER THEM ACCORDING TO THE AMOUNT OF LIGHT I SEE."**



61 AGGERHOLM, Barbara, "Meghan Sims, a Kitchener artist who is colour blind, makes the most of her unique vision", therecord, (2019), <https://www.therecord.com/news/waterloo-region/2019/03/05/meghan-sims-a-kitchener-artist-who-is-colour-blind-makes-the-most-of-her-unique-vision.html>, accessed July 2020.

62 SIMS, "Meghan Sims "Do You See What I See"", vimeo, (2015), <https://vimeo.com/143038849>, viewed August 2020.

63 AUTOR UNKNOWN, "Meghan Sims - Visual Artist", megansimsartist, (date unknown), <https://www.megansimsartist.ca/pages/biography>, accessed July 2020.

Even though Meghan Sims will never be able to experience colors the way normal-vision people do, she felt the need to at least understand what she is not able to perceive. In that sense, she developed a system which helped her to code the greyscales she sees with the corresponding colors normal-vision people see, linking them to the tubes she uses for painting. "I don't know what any of the colors are, really, I'm seeing a gradient of light when I look at the color on the tube. I number them according to the amount of light I see."⁶¹ This method allowed her to constitute a scheme for mixing colors together in order to get the desired shade she aims to paint. "I've learned about color by comparison, and memorization. I will learn a certain shade of grey, of a granny smith apple, and from that point on, that will be to my best ability, be apple green."⁶² Although her red tinted glasses or lenses, which she wears daily, allow her to perceive more details, she uses photography as a support to gain time when analyzing lighted surfaces.⁶³ This way of working has become an important part of her artistic process, as she uses it to capture moments very precisely during daylight. These moments she can then visually analyze under different conditions such as in a darker room, allowing her to perceive a wider spectrum of details than in the direct daylight. ⁶² She matches the tones of grey in the images taken with what she has learned related to the system she developed for her own color comprehension. ²³ By combining photography with her approach to understand what colors mean to normal-vision peop-

le, Sims was able to develop a comprehension for color perception, although she will never be able to actually see these colors. "Red I attribute things like danger, blue expresses a sadness, or loneliness, yellow I'm not sure about, I don't really understand yellow."⁶⁴

HOW IS IT POSSIBLE THAT PEOPLE WITH AN ACHROMATIC PERCEPTION DEVELOP AN IDENTICAL CONCEPTION OF COLORS AND THEIR EFFECTS AS PEOPLE WITH A NORMAL VISION?

64 SIMS, "Meghan Sims "Do You See What I See", vimeo, (2015), <https://vimeo.com/143038849>, viewed August 2020.

65 JIN, Joy, "Colors and Emotions: How Different Colors Affect Perception and Mood", looka, (2019), <https://looka.com/blog/colors-and-emotions/>, accessed September 2020.

In modern color psychology, color associations are described in a way that is very similar to Sims' color interpretation. While red is a signal color that is effectively associated with danger, a lot of people associate blue with a certain calmness but also sadness.⁶⁵ This leads to the question of how it is possible that people with an achromatic perception develop an identical conception of colors and their effects as people with a normal vision. In this context, the question arises whether Sims associations are shaped by modern color psychology or whether the eventual confrontation with color psychology unconsciously influence her own color interpretation. Or could it be possible that even with a total absence of colors, a certain effect is transferred that comes close to the general color effect? A possible explanation for this observation, however, could also be that the way we use color in everyday life, aiming to cause the strongest possible color signaling, such as red for a stop sign, carried over to Sims' interpretation of color. Consequently, it is conceivable that the color perception of normal-vision people blended with her color perception over time. However, no matter how Sims developed a sense for color effects, she seems to use her understanding of these

in her pictures. This observation is particularly evident in her series *Solitary nature with Midnight Moonlight 2* (2012).²⁴ in which the light in the forest appears in a deep blue, as well as, in the piece *Watered down coffee* (2016)²⁵ in which a man walks in solitude past a fountain.

Daniel Arsham's approach to deal with his color-blindness as an artist was in the beginning similar to Meryon's approach. However, while Meryon chose to forego colors in order to hide his deficiency, the reason why Arsham initially did not use paints in his creative work was rather due to the lack of interest in colors. "As an artist, within my work, I didn't think about the lack of color as being even part of my practice. Perhaps I was more drawn to them because I knew that in their lack of color, I was able to see them the way that everyone else would see them."⁶⁶ Over time however, Arsham's curiosity to understand what he visually missed in relation to colors, was awakened by the treatment of an ophthalmologist. This has led him to try *EnChroma* glasses, which widen his color spectrum.⁶⁷ Nonetheless, the glasses Arsham tried present no permanent solution for his color-blindness, as they can rather be seen as an artificial correction, refracting light in a way that he is able to see a broader spectrum of colors. Arsham claims that he could not guess to what extent his color-blindness affected him until he tried these glasses.⁶⁸ Even though wearing the glasses for the first time felt magical to him, Arsham developed another feeling over the next few months of full-time usage. Ac-

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66 Yi, Hannah, "What it's like for an artist to suddenly see color", qz, (2017), <https://qz.com/quartz/1116230/daniel-arsham-a-colorblind-artists-work-changed-with-his-new-glasses/>, accessed August 2020.

67 SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECIia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

68 SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECIia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

ordingly, he had the impression of living in an oversaturated game. "There were consequences that I had not anticipated, almost like color-fatigue."⁶⁹ As it is the case for many color-blind people, Arsham's visual perception, shows its strength in the perception of structures and forms. As the colors are less emphasized and fewer colors are visible in a way that the eye focuses predominantly on constructs detached from colors. "When I'm looking at just architecture and things that I enjoy sort of spending time with, I'm distracted by all of the other [...] I look much more at the structure of the space rather than the nuances of color in it."⁷⁰ In the course of his work as an artist, Arsham has reduced the regular wearing of his glasses in order to get back to how he saw the world initially without glasses. From then on, he decided to wear them only for artistic purposes in order to objectify his view on color in his work. "I use them within the studio to see what everyone else is seeing, and then I am able to take them off once I've selected the palette."⁷¹ The effect the glasses had on Arsham's art had translated into his work through the use of vibrant colors instead of staying with the material's color only. "It's not to say I will continue making all of my work in these vibrant hues, it's just that it has expanded the potential."⁷² Therefore, a clear shift of color usage is noticeable in the artwork Arsham created from 2016 onwards. His work *Lunar Garden* (2017-2019)^{26 & 27} from the series *Static Mythologies*, which he had created under different forms over the past few years, perfectly show his use of pink colored sand in combinati-

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69 SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECIia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

70 SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECIia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

71 BATTERSBY, Matilda, "Blind artists and a unique vision: The visually impaired artists using tech to see things differently", independent, (2016), <https://www.independent.co.uk/arts-entertainment/art/features/blind-artists-and-a-unique-vision-the-visually-impaired-artists-using-tech-to-see-things-differently-a7311916.html>, accessed August 2020.

72 QUARTZ, "Colorblind artist sees colors with new glasses", youtube, (2017), <https://www.youtube.com/watch?v=MA7OV3HxcOw&list=WL&index=14&t=96s>, accessed August 2020.

32 "I WANTED TO SENSE COLOR, AND IT DIDN'T NEED TO BE VISIBLE THROUGH THE EYES."

on with white sand. Although his interest in forms which are shaped by light could always been felt, a few years ago prior to these installations, it was unthinkable that Arsham would integrate colors with such intensity.

Neil Harbisson, who does not perceive his color-blindness as a physical hindrance, expresses the wish to know how colors really affect someone : "I wanted to sense color, and it didn't need to be visible through the eyes."⁷³ Out of pure curiosity he experimented new ways of sensing colors while he was studying arts. "Even if I don't see color it is impossible for me to ignore that color exists. [...] I didn't feel the need, but I felt the curiosity to get to know what colors are."⁷⁴ In order to distinguish different colors from each other, Harbisson created and implanted an antenna into his head, which allows him to perceive colors as sound through the transposition of light frequencies to vibrations. He sees his antenna as a new part of his body that allows him to extend his senses beyond human sight.⁷⁵ The artist explains that while the adaptation of his body and brain to his new antenna took him two months, it took him three years to understand his new sense and to identify the visual spectrum and sounds the colors represented.⁷⁶ However, Harbisson claims that over time wearing such an antenna has become subliminal like any other sense of our body.⁷⁷ Further, he disagrees that his perception of color has become synesthetic as he is of the opinion that he didn't have any perception of colors prior to his implantation. Interestingly, Harbisson explains

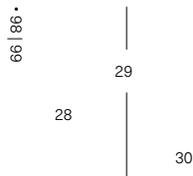
73 THE FEED SBS, "Neil Harbisson: Eyeborg", youtube, (2014), https://www.youtube.com/watch?v=Ts_-XVPQOG-M&list=WL&index=13&t=0s, accessed August 2020.

74 ROCKET CAST, "Neil Harbisson Interview Trailer-park 2015", youtube, (2015), <https://www.youtube.com/watch?v=jTJcYm9uAo&list=WL&index=5&t=0s>, accessed August 2020.

75 DONAHUE, Michelle Z., "How a Colour-Blind Artist Became the World's First Cyborg", nationalgeographic, (2017), <https://www.nationalgeographic.com/news/2017/04/worlds-first-cyborg-human-evolution-science/>, accessed August 2020.

76 HSGUNISTGALLEN, "Neil Harbisson on being a Cyborg", youtube, (2017), https://www.youtube.com/watch?v=C_OnYqx3ynA&list=WL&index=9&t=0s, accessed July 2020.

77 HSGUNISTGALLEN, "Neil Harbisson on being a Cyborg", youtube, (2017), https://www.youtube.com/watch?v=C_OnYqx3ynA&list=WL&index=9&t=0s, accessed July 2020.



78 ESSEC BUSINESS SCHOOL, "Hearing colors: my life experience as a cyborg, by Neil Harbisson, iMagination Week 2016", youtube, (2016), <https://www.youtube.com/watch?v=SYB3nnvX-3g&list=WL&index=6&t=0s>, accessed July 2020.

79 SISLEY, Dominique, "Why this artist got an antenna implanted in his skull", dazeddigital, (2016), <https://www.dazeddigital.com/arts-andculture/article/31102/1/why-this-artist-got-an-antenna-implanted-in-his-skull>, accessed August 2020.

80 LIVEMEDIA, "Neil Harbisson, The Renaissance of Human", youtube, (2018), <https://www.youtube.com/watch?v=sENJ4aUyWJY&list=WL&index=7&t=0s>, accessed August 2020.

81 DESIGN INDABA, "Cyborg artists, Neil Harbisson and Moon Ribas, on physically merging oneself with technology", youtube, (2019), <https://www.youtube.com/watch?v=U-tGk65wyYs&list=WL&index=11&t=0s>, accessed August 2020.

that even if he can hear colors now through bone conduction, he would not compare hearing colors to hearing conventional sounds.⁷⁸ While synesthesia represents the union of two or more senses, he rather regards his case as the creation of a new sense.⁷⁹ In connection to his new organ, Harbisson would not speak of artificial intelligence (AI) but rather of an artificial sense (AS). Accordingly, he perceives his reality not as a virtual reality (VR) nor as an artificial reality (AR) but rather as a revealed reality which he usually calls "RR"⁸⁰. Harbisson does not perceive the utilization of his antenna as a technology because it has become something that he uses unconsciously : "The difference between using or wearing technology is that if you merge with technology, you don't feel you are using technology, while if you use it as a tool, you are conscious that you're using it."⁸¹ Consequently, the implantation of the antenna allowed him to sense colors and therefore was his solution to be able to start working creatively. Since the implantation Harbisson has created works of art which are based on the relationship between color and sound. He started to produce sound portraits of well-known people by analyzing their face with his antenna and combining what he perceives into micro tone cords. ^{28 & 29 & 30} As Harbisson got accustomed to perceiving colors through hearing sounds, his brain began to use the process of recirculation to associate colors with the sounds he hears. "I had this secondary effect, that normal sounds started to become color. I heard the telephone tone, and it felt green, because it sounded just like

the color green.”⁸² Harbisson then applied this principle to his artistic works and began to paint vinyl records in the colors that he perceived through the dominant tones in the music. In this way, he started converting speeches into colors and created color associations for cities through the main tones he heard when visiting these.

While the other artists were already artistically active and were looking for ways to deal with their daltonism, Harbisson started to deepen his artistic activity due to his color-blindness. In connection with Harbisson’s method of dealing with his daltonism, one could speak of a prosthesis that enables him to implement previously impracticable skills through designing his perception of reality. For Harbisson, even though being daltonic, gaining this new sense was the ultimate solution to not be blind to color anymore.

1/4/ TRANSFORMATION OF DALTONISM AS A HINDRANCE

In regard to the solutions used by the different artists to deal with their color-blindness the question arises whether color-blindness consists a mental challenge for artists that are creatively active? Or in other words, has there been a transformation in working with the visual impediment that has allowed the artists concerned to no longer consider their deficiency as an obstacle?

⁸² TED, “Neil Harbisson: I listen to color”, youtube, (2012), <https://www.youtube.com/watch?v=ygRNoieAnzi&list=WL&index=20&t=0s>, accessed August 2020.

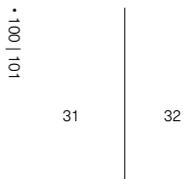
⁸³ MERYON, Charles, *Letter to F. Braquemond*, Charenton, 21 Mars 1867. Note : Original quotation translated by the author. “[...] (celui) qui n’a pas dès le jeune âge hanté les mêmes écoles”.

⁸⁴ GEFROY, Gustave, *Charles Meryon*, Paris, H. Floury Éditeur, 1926, p.4. Note : Original quotation translated by the author. “[Meryon] était un fou, probablement né fou ou prédestiné à le devenir, candidat à la folie, comme les médecins aliénistes étiquettent ce genre de sujets.”

⁸⁵ AUTOR UNKNOWN, “Questions juridiques”, *Mercur de France*, 1 mars 1930, p. 422.

Charles Meryon who had been looking for a long time to find ways to deal with his color-blindness, could find neither happiness nor contentment in the course of his artistic life. Accordingly, he later wrote to a friend that he felt that he had not attended the same art schools as the great masters.⁸³ A thought that seems to have influenced him throughout his entire creative process. Gustave Geffroy described Meryon in a biography as follows : “[Meryon] was a madman, probably born mad or predestined to become mad, a candidate for madness, as alienist physicians label these kinds of subjects.”⁸⁴ At the age of only 37, Meryon began showing signs of mental illness which gradually worsened over time. His later mental state caused him to destroy his prints by crossing them out in situations of complete madness.⁸⁵ Nonetheless, the exact nature of Meryon’s madness remains obscure. Further, having had a demented mother, who died at a young age, and a father who only played a minor role in his life certainly did not contribute to his well-being. After Meryon left the Navy, he dedicated his whole life to art, but one could assume that the constant pressure he put on himself in order to meet artistic requirements worsened the situation. Thus, one can suppose that Meryon’s color-blindness presented an ever-present obstacle to him. Therefore, it cannot be excluded that if Meryon had succeeded to implement his artistic expression in color or expand his capabilities, his life might have taken a turn in a way that he might have been artistically successful.

"I OFFER THE AUDIENCE A METAPHYSICAL EXPERIENCE BY SUGGESTING THAT WHAT THEY ARE VIEWING TRANSCENDS A TWO-DIMENSIONAL IMAGE; IT IS AN INVITATION TO VIEW THE WORLD THROUGH THE EYES OF AN ACHROMAT."



86 AGGERHOLM, Barbara, "Meghan Sims, a Kitchener artist who is colour blind, makes the most of her unique vision", therecord, (2019), <https://www.therecord.com/news/waterloo-region/2019/03/05/meghan-sims-a-kitchener-artist-who-is-colour-blind-makes-the-most-of-her-unique-vision.html>, accessed July 2020.

87 AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

Although Meghan Sims used to be self-conscious about her distorted perception of colors, as an artist it took her a while to accept and to adapt to her exceptional situation. "Anyone with a disability has been raised to see a disability and that they're ,less than' in some way and that does a number on you. Being afraid of color was only natural. I was comparing myself to people who use color."⁸⁶ In art Sims has found a catalysator that gives her the possibility to deal frankly with her color-blindness. "Through my creativity I have been able to openly express my difference and the way my eyes see."⁸⁷ From this statement follows that she does not perceive her art as a hindrance anymore but rather strives to stimulate discussions about differences in perception. By raising awareness about visual color disabilities, Sims succeeds in showing people with normal visions how color-blind people see, as well as integrating color-blind people into society and art. Via her paintings, which she creates almost solely in black and white (e.g. *City Silhouettes* series), .³¹ & ³² Sims aims to let the public experience her personal form of sight with their own eyes. "I offer the audience a metaphysical experience by suggesting that what they are viewing transcends a two-dimensional image; it is an invitation to view the world through the eyes of an achromat."⁸⁸ Her art allows Sims to share her disappointment about her lack of visual color perception with others, not only through the connections she makes with other achromats, but also with the viewer of her art. Hereby she constructs an opportunity to share her point of view and to create

"THE WAY WE SEE THINGS IS AFFECTED BY WHAT WE KNOW OR WHAT WE BELIEVE. [...] WE NEVER LOOK AT JUST ONE THING; WE ARE ALWAYS LOOKING AT THE RELATION BETWEEN THINGS AND OURSELVES."



88 AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

89 AUTOR UNKNOWN, "Meghan Sims - Visual Artist", meghansimsartist, (date unknown), <https://www.meghansimsartist.ca/pages/biography>, accessed July 2020.

a unique understanding that is often not present prior to viewing her work. Sims is of the opinion that art represents a universal communicator and a form of social connection from which a healing and growth process can occur.⁸⁹ This procedure has helped her to accept her visual deficiency and to overcome it in regard to the application of colors in her own art.

Besides using her paintings to sensitize people to her visual deficiency, Sims also creates colored artworks with her color identification system. When looking at Sims' colored work as a viewer without prior knowledge about her non-existent color recognition one does not necessarily notice that she is completely color blind. Her work *Legacy Greens* (2010) .³³ illustrates that she is using colors in a way that is amazingly similar to our reality. At this point we can raise the question of why an artist would create a piece of work in a spectrum he cannot purely perceive himself? It can be assumed that the answer to this question lies in psychology again. As Sims explained, she constantly compares herself with other people who integrate colors in their work. Therefore, it is comprehensible that the thought of having a limited visual perception creates a feeling of exclusion from those who have a normal vision. John Berger's reflections about how humans perceive things can be applied to Sims' perception of other people's color sight : "The way we see things is affected by what we know or what we believe. [...] We never look at just one thing; we are always looking at the relati-

on between things and ourselves.”⁹⁰ To a certain extent Sims tries to adapt her artistic view in her paintings to the view of normal-vision individuals. There seems to be an urge to do justice to the opposing parallel realism. Maybe Sims sees it in a certain form as a norm and tries to prove herself her affiliation through best possible adaptation. It can be assumed that the consciousness of a daltonic person having a physical deficiency, even though not optically visible (from the perspective of someone else), can nevertheless develop into an order of a psychological deficiency. In relation to artistic creation, one has to ask oneself whether the goal must be the striving for exact representation of color visual normality, or whether a reinterpretation of the color use of color-blind artists can be all the more interesting.

Through the experience of the glasses, Arsham feels more confident in the use of color within his artworks, although he openly admits that he is unsure about the interplay of multiple ones : “Every work has a single color, it’s not a rainbow of color within that, I’m not quite sure or confident yet or know truly, how different colors within that spectrum react to each-other and how I feel in my work about that.”⁹¹ Arsham’s visual alteration caused him to value his initial perception in a way he didn’t before. “When you are diagnosed with some deficiency, it’s seen negative right? And this is how I interpreted it throughout my life and really up into the point that I’ve received these lenses. It took me a while to kind of realize that the gift

90 BERGER, John, *Ways of Seeing*, Great Britain, Penguin Books, 2008, p. 8-9.
 91 OUR CHOICES, “DANIEL ARSHAM – The Angle Of Repose”, youtube, (2017), <https://www.youtube.com/watch?v=L4QpmIV7opk>, accessed August 2020.

WHEN TALKING ABOUT VISUAL PARALLEL WORLDS, THE QUESTION SHOULD BE ALLOWED WHETHER GLASSES OPEN UP A NEW ARTIFICIALLY CREATED VISUAL PARALLEL WORLD.

actually was not having color vision in the first place. In many ways that may have formed who I am, what I am interested in and what I make.”⁹² By experiencing this visual change, Arsham learned to appreciate the way he saw things before, as he became aware that he will never be capable to see things the way people without a visual color deficit do. He is comforted in this thought that he sees the world with his own eyes, which he feels to be just as valuable.⁹³ Furthermore, for Arsham the question arises whether the color spectrum he sees through his glasses actually corresponds to the color spectrum normal-vision people see. In this context the artist states the following : “Even though I may be able to identify a wider range of color with these lenses, there’s still an open question as to whether I’m seeing what you see, or what other people see, and that opens up a larger question about objectivity and color.”⁹⁴ When talking about visual parallel worlds, the question should be allowed whether glasses open up a new artificially created visual parallel world. This could be a world in which effects are visible to both, color-blind and normal-vision individuals, even though both sides perceive this same world differently. Still no one will ever be able to see how the other side perceives, a reasoning that even Arsham took some time to understand.

In contrast to Daniel Arsham, Neil Harbisson is not able to directly see colors, but due to his new technology he is able to perceive them through a new perceptual sense.

92 SEMAINE, “Daniel Arsham, Color-blind artist: In Full Color”, youtube, (2016), <https://www.youtube.com/watch?v=ZCsECIia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.
 93 YI, Hannah, “What it’s like for an artist to suddenly see color”, qz, (2017), <https://qz.com/quartz/1116230/daniel-arsham-a-colorblind-artists-work-changed-with-his-new-glasses/>, accessed August 2020.
 94 YI, Hannah, “What it’s like for an artist to suddenly see color”, qz, (2017), <https://qz.com/quartz/1116230/daniel-arsham-a-colorblind-artists-work-changed-with-his-new-glasses/>, accessed August 2020.

“KNOWLEDGE COMES FROM OUR SENSES, SO IF WE EXTENT OUR SENSES, WE WILL CONSEQUENTLY EXTENT OUR KNOWLEDGE.”

95 HARBISSON, Neil, "Cosmic Senses", in HARBISSON, Neil, *A Collection of Essays*, 2017, no pagination.

96 AUTHOR UNKNOWN, "Design Yourself", cyborg-foundation, (date unknown), <https://www.cyborgfoundation.com>, accessed August 2020.

97 Note: The different types of relationships between technology and organisms.

98 DESIGN INDABA, "Cyborg artists, Neil Harbisson and Moon Ribas, on physically merging oneself with technology", youtube, (2019), <https://www.youtube.com/watch?v=U-tGk65wyYs&list=WL&index=11&t=0s>, accessed August 2020.

99 TED, "Neil Harbisson: I listen to color", youtube, (2012), <https://www.youtube.com/watch?v=ygRN0ieAnzi&list=WL&index=20&t=0s>, accessed August 2020.

Even though Harbisson's daltonism consisted in a personal obstruction for the artist, his transformation has allowed him to develop a new awareness of colors, and has thus helped him to develop his personal identity.⁹⁵ This way of merging with technology allowing the artist to reconnect with nature as Cyborgism^{96, 97} is possible through technology, and simultaneously derived from a natural phenomenon. Accordingly, Harbisson's perception of hearing through bone conduction was initially inspired by the hearing process of dolphins.⁹⁸ Harbisson is of the opinion that cyborg art is not limited to his current application and he strives to invent other senses which could further extend his perception : "Knowledge comes from our senses, so if we extent our senses, we will consequently extent our knowledge."⁹⁹ Additional transformations will allow him to expand his perception of his surrounding and thus will ultimately lead to an extension of his art as well as the creation of new forms of art. Harbisson succeeded not only in creating his own form of perception, which allowed him to overcome his color-blindness, but also in developing his own form of art which is ultimately an emergence from this change. Consequently, Harbisson does not reduce the creation of art to the use of human organs confined to our species but also allows the idea that technology can enable people to perceive and understand art differently. "[Cyborg art] is the art of building your own senses, the art of creating your own body part and then the art of expressing yourself through your senses. [...] I'm doing it through the

sound of color and the color of sound, but many other people are doing it though other senses."¹⁰⁰ Accordingly, Harbisson's handling of his color blindness has led to a situation in which not only the artist himself has changed his perception of colors, but which has also led to a new point in which the perception and acceptance of color-blind artists was sustainably changed. Therefore, we can suppose that in Harbisson's case daltonism, as a medicalized vision of color, has led to an extension of the senses, while influencing the artist in a way that it influences the perception of art in return.

100 ROCKET CAST, "Neil Harbisson Interview Trailer-park 2015", youtube, (2015), <https://www.youtube.com/watch?v=jTJcYm9uAo&list=WL&index=5&t=0s>, accessed August 2020.

2/ THE PUBLIC'S PERCEPTION OF DALTONIC ART

In art, the artist's intention is generally directly linked to the viewer's conception. This raises the question of how a viewer perceives a work of art created by an artist with a distorted visual perception. Are there any major differences in understanding daltonic art compared to understanding art created by artists with normal color perception?

2/1/ THE PUBLIC'S PERCEPTION ANALYZED

While the artist himself can never see the color of his work that is recognizable for people with normal color perception, the converse also applies. Thus, people who look with an unbiased vision at an artwork created by a daltonic artist will never see the work through the eyes of the artist. However, this does not preclude the viewers from developing their own point of view on the artwork based on what is visible to them.

The art critic Louis Vauxcelles wrote in 1923 : "Meryon is known only to the elite, and the public ignores his work as well as his name."¹⁰¹ This statement has proven to be correct over time, as it were primarily well-known writers

¹⁰¹ VAUXCELLES, Louis, "La Semaine Artistique", *L'Ère nouvelle*, October 1923, (no pagination).
Note : Original quotation translated by the author.
"Puisque vous connaissez M. Meryon, dites-lui que ses splendides eaux-fortes m'ont ébloui sans la couleur, rien qu'avec l'ombre et la lumière, le clair-obscur tout seul et livré à lui-même : [...]".

¹⁰² GEFFROY, Gustave, *Charles Meryon*, Paris, H. Floury Editeur, 1926.

¹⁰³ WRIGHT, Harold J.L., "Three Master Etchers: Rembrandt, Meryon, Whistler. Lecture II. The Etchings of Charles Meryon (1821-1862)", *Journal of the Royal Society of Arts*, vol. 78, n° 4060, September 1930, p. 1084.

¹⁰⁴ KOSPOTH, B. J., "Meryon, The Etcher Of Old Paris", *The Chicago Tribune and the Daily News*, April 1927, p. 5.

¹⁰⁵ GEFFROY, Gustave, *Charles Meryon*, Paris, H. Floury Editeur, 1926, p. 130.

Note : Original quotation translated by the author.
"Puisque vous connaissez M. Meryon, dites-lui que ses splendides eaux-fortes m'ont ébloui sans la couleur, rien qu'avec l'ombre et la lumière, le clair-obscur tout seul et livré à lui-même : [...]".

¹⁰⁶ FROLLO, Jean, "Vernissage", *Le Petit Parisien*, May 1883, (no pagination).

¹⁰⁷ GEFFROY, Gustave, *Charles Meryon*, Paris, H. Floury Editeur, 1926.

such as Charles Baudelaire and Victor Hugo who were interested in Meryon's artwork.¹⁰² The public, however, seemed to have a different perception and was more and more bored by Meryon's outdated painting technique.¹⁰³ Baudelaire, in contrast, who was taken with Meryon's art showed interest in accompanying his etchings with sonnets. This proposition was, however, rejected by Meryon who was at that time already marked by his mental illness.¹⁰⁴ Whereas his oil-paintings such as his watercolor work hardly aroused interest from the audience, his strength in working with contrasts in his etchings did not remain hidden among art enthusiasts. Victor Hugo wrote in a letter to Baudelaire, "Since you know Mr. Meryon, tell him that his splendid etchings dazzled me without color, only with shadow and light, the chiaroscuro alone left to itself : [...]".¹⁰⁵ However, as mentioned earlier, people from the elite showed keen interest in Meryon's art, whereas the public was rather disinterested. This made it difficult for the artist to sell his art, therefore he had to sell his etchings for 1 franc per work or even 50 centimes a print and thus lived in constant poverty.¹⁰⁶ This went so far that when Meryon asked *La Chalcographie du Louvre* to buy the brass Meryon had engraved, they refrained.¹⁰⁷ From this it can be deduced that the public, at least in Meryon's lifetime, was not willing to do without colorful works of art and therefore expected artists to offer works that fulfilled this exact request.

Nearly 200 years later, this demand seems to partially

have changed and the reaction of the audience to art-work from contemporary artists seems to differ fundamentally from the feedback Meryon received back in the days.

Meghan Sims, who was mainly painting for herself until 2006, was discovered by a local gallery owner from her hometown and encouraged to present her works of art to the public. This life-changing experience opened Sims the door to the art world, as from then on, she was able to exhibit her works in galleries.¹⁰⁸ The reactions of art enthusiasts to Sims exhibitions range from recognition to respect. At first glance, they question whether Sim's way of dealing with colors is possible, despite complete color-blindness; they will quickly find an answer when looking at her work. Through the confrontation of their own perception with Sims' irrefragable will to deal with her color-blindness and to display colors as detailed as possible, viewers often show great respect. Further, with her constant ambition to try to implement something that she found difficult to grasp and understand at first, Sims emits sign of courage and perseverance.

While there is a great interest in what Daniel Arsham will show before each exhibition, the interest was particularly high after the artist experienced his *EnChroma* glasses. Although art enthusiasts were hoping that Arsham was not getting too distracted by color, they were curious how this mental, emotional and artistic experience affected

108 AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

his work.¹⁰⁹ Nevertheless, Arsham knows that every work he exhibits is first criticized until the viewer of his art has become accustomed : „I'm quite sure that the reaction will be of "I prefer the art in black and white", and this has been true for every single body of work that I've shown. The audience typically prefers the body of work that I've shown just before that until that body of work becomes what I'm known for and then on to the next."¹¹⁰ As Cecilia Dean, co-founder of *Visionaire*¹¹¹ responded to Arsham's first colorful exhibition in 2017 at *Gallerie Perrotin* in New York called *Circa 2345* : "I think it's also a great way of expressing what people think of as a deficiency are actually your strengths. [...] You talk about correcting your color-blindness, but clearly it didn't need correcting."¹¹² Additionally, the American film producer Jane Rosenthal, praises the work from the same exhibition as following : "Seeing Daniels work in color [...] and knowing how he's tried to just overcome his color-blindness, the depth of color in all of this work is extraordinary."¹¹³ Although viewers had to get used to discover colors in Arsham's art, his first colored exhibition caused great admiration.¹¹⁴ However, above all, the awareness that a color-blind artist dares to approach colors seemed particularly spectacular for the viewers of Arsham's art.

The reactions to the art of Arsham and Sims are more homogeneous than the reactions to Harbisson's art, which lead to a certain controversy among the viewers. The reactions vary, when it comes to the acceptance of

109 SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECia1Ck&-list=WL&index=24&t=1341s>, accessed August 2020.

110 SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECia1Ck&-list=WL&index=24&t=1341s>, accessed August 2020.

111 Note : A multi-media art and fashion company.

112 WEISS, Zachary, "Watch Colourblind Artist Daniel Arsham's Quest to See in Color", observer, (2016), <https://observer.com/2016/09/watch-colorblind-artist-daniel-arshams-quest-to-see-color/>, accessed August 2020.

113 SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECia1Ck&-list=WL&index=24&t=1341s>, accessed August 2020.

114 SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECia1Ck&-list=WL&index=24&t=1341s>, accessed August 2020.

46 **“PEOPLE THINK THAT WHEN WE ARE MERGING WITH TECHNOLOGY, WE BECOME LESS HUMAN, AND BECOMING LESS HUMAN IS BAD. I DON'T THINK TO BECOME LESS HUMAN IS BAD.”**

cyborgism, which is, according to Harbisson an art form of itself. The skepticism that arises from the public is not only due to the connection between the technology and the human body, but also due to the fear that art could, in the future, develop into an undesirable direction which could be ethically questionable. Harbisson, however, represents a different point of view : “People think that when we are merging with technology, we become less human, and becoming less human is bad. I don’t think to become less human is bad.”¹¹⁵ Nevertheless, in public life some people react to his newly acquired organ with confusion. They cannot associate his antenna with any direct function because the object appears strange to them. Harbisson himself has got used to his implant for a long time and thus he no longer sees any difference between an implant and an organ : “Only people remind me that I have an antenna.”¹¹⁶ Although his physical and mental adaptation to his antenna was no great challenge for him, he saw the actual challenge in the social effects : “What really changed is, I had to get used to social reaction.”¹¹⁷ Accordingly, Harbisson sees his antenna almost as an interesting social experiment by examining how the audience perceives unknown technology.¹¹⁸

Even if the enthusiasm to cyborgism is divided among people, the reactions are relatively homogeneous, when Harbisson shows people what he is capable of doing and how his antenna enlarges his ability of perceiving colors. Here again, like it is the case for Meghan Sims, people

¹¹⁵ DESIGN INDABA, “Cyborg artists, Neil Harbisson and Moon Ribas, on physically merging oneself with technology”, youtube, (2019), <https://www.youtube.com/watch?v=U-tGk65wyYs&list=WL&index=11&t=0s>, accessed August 2020.

¹¹⁶ FREETHINK, “The Cyborg Artist Who Hears Color”, youtube, (2020), https://www.youtube.com/watch?v=an_Qc0Q1MHE&list=WL&index=17&t=6s, accessed August 2020.

¹¹⁷ FREETHINK, “The Cyborg Artist Who Hears Color”, youtube, (2020), https://www.youtube.com/watch?v=an_Qc0Q1MHE&list=WL&index=17&t=6s, accessed August 2020.

¹¹⁸ FREETHINK, “The Cyborg Artist Who Hears Color”, youtube, (2020), https://www.youtube.com/watch?v=an_Qc0Q1MHE&list=WL&index=17&t=6s, accessed August 2020.

first develop a form of disbelief develops first, which then quickly turns into astonishment.

2/2/ THE RELEVANCE OF PRIOR KNOWLEDGE

IN WHAT WAY DOES THE KNOWLEDGE OF AN OBSERVER REGARDING THE DALTONISM OF THE ARTIST HAVE AN INFLUENCE ON THE PERCEPTION OF A DALTONIC WORK OF ART?

In what way does the knowledge of an observer regarding the daltonism of the artist have an influence on the perception of a daltonic work of art? Do viewers need to be aware about the artist’s color-blindness in order to understand the work and must a color-blind artist publicly reveal his deficit in order to make his art receptive? When looking for answers to these questions, it is important to keep in mind that the viewer’s knowledge about the limited visual perception of an artist could lead to a distorted objectivity and a prejudgment about the artist’s artistic skills. Accordingly, the view is widely held that in order to simply perceive an artwork from a daltonic artist, one does not need to have foreground knowledge about the artist’s color-blindness. This may, however, be different if a viewer wants to develop a deeper understanding about the artwork and the circumstances under which it was created. This reasoning whether their art has to be understood in connection with their disease inevitably leads us to the essential question in art : Does art have to be understood? As the answer to this question (if there is one) could fill the pages of a separate paper, the underlying thesis aims to refer solely to art as a form of ex-

pression that can be both understood or interpreted. But for some artists, their color-blindness plays an essential role in their art. Therefore, as a viewer in cases like these, one would have to know about the daltonic visuality in order to comprehend the total work of art in relation to the artistic context.

With regard to artworks by Daniel Arsham, whose art revolves primarily around the subject of futuristic artifacts, an understanding of his color-blindness does not seem to be a prerequisite for being able to follow his artistic intentions. When Arsham used colors, they always played a secondary role in his work and were mainly tied to the choice of the material processed. For a long time Arsham did not assign a major artistic role to the colors. For that reason, it would certainly be wrong to influence the viewer's interpretation of the works by pointing out Arsham's color blindness. As Arsham himself did not give the colors in his works much value prior to his experience with his glasses, viewers would possibly attach a higher significance to colors than he does. Even if he has used more colors in his works due to the knowledge he gained through his glasses, art enthusiasts do not need to know that he is color-blind in order to interpret or to understand his artworks. This contemplation is mainly explained by the fact that Arsham's intentions in his work, namely the disruption of people's reference for a recognizable object, take place detached from the colors used.¹¹⁹

In contrast to Arsham, Meghan Sims deals with her total

color-blindness not only on a creative but also on a thematic level. Therefore, for a viewer to understand both the creation process of her work as well as her artistic statements, it seems to be elementary to be informed about Sims' daltonism. However, it needs to be mentioned that from a visual point of view with regard to the processing of colors and the detail of the images, Sims' impairment is hardly noticeable. By comparing Sims' black and white works with her colored works one can say that, without any knowledge about her visual condition, it is certainly easier to interpret the work that is proceeded in black and white. In terms of content, these images are easier to understand because they realistically depict her visual limits. In order to be able to read her colored works, however, prior knowledge about her daltonism seems to be crucial for the viewing process of the audience. This is the case because here it is not only about what is visually depicted, but it is about Sim's attempt to live up to our colored vision. In her colored paintings, Sims manages to use colors in a way, that makes her color-blindness hard to notice for someone who is not aware of her deficiency. Sims tends to confuse greens and reds, such as blues and oranges, as these colors are complementary colors and have a very similar visual greyscale for Sims, but other than that, no major differences are visible regarding her color choice, in comparison with her photographed view. For this reason, it also seems to be important for Meghan Sims herself to provide the viewer with a certain point of reference, as at exhibitions she often hangs the original

¹¹⁹ CARPENTER, Kim, "Playing with Perception: A Conversation with Daniel Arsham", sculpture, (2014), https://www.sculpture.org/documents/scmag14/dec_14/fullfeature.shtml, accessed August 2020.

photo next to the finished work for comparison. .³⁴ Regarding the above-mentioned idea of visual parallel worlds, it is interesting to analyze which parallels arise here. While the viewer with normal vision can define the photo as their own visual parallel, neither the painted picture nor the photography is a real representation for Sims, as she cannot perceive either of them in real colors.

Harbisson's sonochromatic artworks have to be understood in context of his new sensory perception. Merely exhibiting Harbisson's art without conveying the process of creation, makes his colored records appear as simple records and his colored images (e.g. *Für Elise* (no date)) as simple color squares instead of a musical composition. A viewer's exploration of Harbisson's artworks through simple visual perception and without prior knowledge about his visual impairment would put the proceeded colors in the center. A comparison of colors among different creations as well as a comparison of different creations themselves would be a logical approach to analyze Harbisson's art. However, for the artist it was never just about simple comparisons of colors and color combinations. Harbisson's main interests lies in the relationship between color and sound as well as the process of hearing colors and visualizing sound. Due to the fact that Harbisson has no visual understanding of colors he was never able to develop a feeling of how colors harmonize or discord together. His color perception is purely acoustic. For this reason, without any knowledge of his

color-blindness, one would reduce Harbisson's art to the simple color composition. Prior information about Harbisson's color-blindness enables the viewer to develop an awareness for the designed sense and an understanding of how a totally color-blind artist can develop a perception of something that is invisible to him. Thus, this information provides access to Harbisson's artistic intentions, which one would miss without prior knowledge. Moreover, besides that reasoning, it also enables the viewer to understand how art is currently being redefined and in which direction it could possibly develop in relation to the boundaries that art has long since broken down.

To conclude, for Sims and Harbisson, it seems elementary that the viewer perceives their artworks in the context of its artistic aura. For Meryon's art, on the other hand, prior knowledge does not appear to be necessary in order to be able to interpret the works and understand them holistically. Due to the fact that Meryon worked in black and white and his thematic representations are not related to his visual impairment, his daltonism is not the central subject of his art. Therefore, an understanding of the targeted selection of Meryon's art can be developed without a context to his color-blindness.

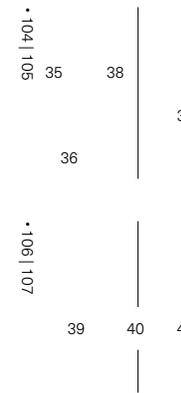
“THE ORDER OF COLOR, BOTH PRACTICALLY AND CONCEPTUALLY, IS A MIRROR OF ITS TIME”

2/3/ A CHANGE IN UNDERSTANDING THE ARTS

While daltonic artists in former times felt that they had to adapt to art forms where color was not a central part of their work, daltonic artists nowadays often integrate color into their creative process. From this observation and due to the fact that since the 19th century artists have used color more for the impression it can translate rather than using color for its figurative qualities, one could assume that the importance of colors in art has changed over the last decades. However, to be able to draw a historical comparison and to analyze how the viewer’s perception of daltonic art has changed, it is important to bring the comparison into temporal context.

In this context, the art historian Alexandra Loske is of the opinion that : “The order of color, both practically and conceptually, is a mirror of its time”.¹²⁰ The understanding of colors has changed over in the past centuries mainly on the basis of research by scientists. The English Scientist Isaac Newton was among the first to analyze the relationship between light and color. His initial experiments led him to the discovery of the visible spectrum of light, which he published in his book *Opticks* in 1704.¹²¹ Newton’s color theory was followed by a number of other theoretical approaches of scientists and artists who all tried to explain colors in relation to each other. Interestingly, the significance of color seems to have changed around this time. Against this background, Alexandra

120 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019, p. 7.
121 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.



122 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019, p.13.
123 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.
124 Note : Entomology is the scientific study of insects.
125 RAVIN, James, ANDERSON, Nancy, LANTHONY, Philippe, “An Artist with a Color Vision Defect: Charles Meryon”, *Survey of Ophthalmology*, vol. 39, 1995, p. 405.
126 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.

Loske argues : “For centuries it had been considered inferior in the hierarchy of the elements of art. By the end of the eighteenth century, however, color had become a standard element in aesthetic discourse, teaching and academic publications, although *colore* had not quite achieved the same status as *disegno* [line drawing].”¹²² The first printed color circle was published in 1708 in the *Traité de la peinture en miniature* by the artist Claude Boutet.¹²³ Color theories, color wheels and Nomenclatures of scientists, artists, chemists and entomologists¹²⁴ like Moses Harris .³⁷, Johan Wolfgang von Goethe .³⁸, Abraham Gottlob Werner .^{39 & 40 & 41} or Eugène Chevreul, followed, which have all shaped our understanding of color throughout the centuries. When analyzing Meryon’s art, one notices that he started to paint in oil in the 1840s before moving on to his first engraving *La sainte face* in 1849. From his creative period during which he painted in oil, only the colorful painting *Ghost ship* from the 1840s remains. The picturesque capturing of ship scenes was thematically related to Meryon’s experiences as a member of the French Navy.¹²⁵

In relation to aesthetic ideas of beauty and the “sublime”, multiple artists and philosophers expressed their understanding of color. Accordingly, the writer and philosopher Edmund Burke wrote a chapter on “Colour considered as productive of the sublime” in his work *A Philosophical Inquiry Into the Origin of Our Ideas of the Sublime and Beautiful* in 1757.¹²⁶ Alexandra Loske took this phenome-

non as a basis for further analyses and explains: "While beauty was a standard that could be identified, measured and even created, the concept of the sublime described a more elusive reaction; an impression of grandeur, awe and fear. It encompassed things that were both fascinating and threatening, impressive and untamable, for example vast mountain ranges, storms and darkness."¹²⁷ In this context, the Englishman William Turner produced the work *Steamship in Snowstorm* .⁴² in 1842, almost at the same time as Meryon painted his last remaining colored work *Ghost Ship* .⁴³ In his paintings, William Turner has literally set the color matter in motion. He painted his own experience of the storm after he had admired the spectacle for several hours tied to a mast.¹²⁸ The works of these artists were shaped by their atmosphere and mood, brought about by light in interaction with the color expression.¹²⁹ An expression that artists mastered perfectly in a much more pronounced way than Meryon ever did.

While Turner's work is characterized by a depth and variety of colors which allows him to depict the feeling of the storm very concisely, Meryon's painting seems to be dominated by a distinct yellow-blue color tinge. This tinge is observable in the sky, the sea, as well as in the reproduction of the ship. Although Meryon's choice of perspective is quite successful, the color selection does not seem to reflect the impact of the storm. The clouds which appear lilac, together with the yellowish tinge create the impres-

127 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019, p.30.

128 HAHNE, Robert, KLIMA, Sigrid, PARTSCH, Susanne, RACHOW, Gerlinde, REZAC, Susanne, MAYER, Stefan, SOCKERL, Thomas, *Kammerlohr Epochen der Kunst, Von der Renaissance bis zum Jugendstil*, München, Oldenbourg Schulbuchverlag, 2015.

129 HAHNE, Robert, KLIMA, Sigrid, PARTSCH, Susanne, RACHOW, Gerlinde, REZAC, Susanne, MAYER, Stefan, SOCKERL, Thomas, *Kammerlohr Epochen der Kunst, Von der Renaissance bis zum Jugendstil*, München, Oldenbourg Schulbuchverlag, 2015.

130 HAHNE, Robert, KLIMA, Sigrid, PARTSCH, Susanne, RACHOW, Gerlinde, REZAC, Susanne, MAYER, Stefan, SOCKERL, Thomas, *Kammerlohr Epochen der Kunst, Von der Renaissance bis zum Jugendstil*, München, Oldenbourg Schulbuchverlag, 2015.

131 BITTERER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, *Kammerlohr Epochen der Kunst, Von der Moderne zu aktuellen Tendenzen*, München, Oldenbourg Schulbuchverlag, 2013.

132 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019, p. 90.

133 BITTERER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, *Kammerlohr Epochen der Kunst, Von der Moderne zu aktuellen Tendenzen*, München, Oldenbourg Schulbuchverlag, 2013.

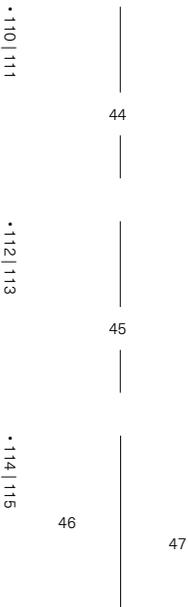
134 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.

sion of a sunset and not of a sea storm. An effect that certainly could not have matched Meryon's intention. Consequently, one could claim that Meryon was in a way defeated by color.

Turner and Meryon can be attributed to the romantic era of their respective country. For Turner, color in relation to light became the subject of his art, which made him an influencer of impressionism.¹³⁰ Unlike other artists who focused primarily on the form of objects, impressionists, attempted to capture fleeting sensory impressions using light and color. Through their way of working they increasingly abandoned the literary themes that museums and academies in particular cultivated. With the further development of art the neo-impressionists were especially interested in the newly researched scientific principles of optics and color.¹³¹ Their work often grounded in research that dealt with Eugène Chevreul's theory of colors, a chemist who studied the interaction of colors and who is known today as "the most important and influential European color theorist of the later nineteenth century"¹³².¹³³ Chevreul was the first to realize that color combinations had different effects on our visual perception. Based on this insight he has created his laws of simultaneous contrast which, as no other theories, have later influenced several people from creative industries.¹³⁴ Instead of concentrating on colorants and materiality Chevreul focused purely on the human color perception. In 1839, he published his main findings in his work *De la loi du contraste*

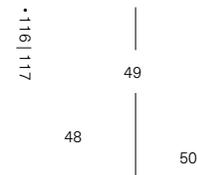
simultané des couleurs (*The laws of simultaneous contrast of color*).¹³⁵ In further publications he explored the effect of colors in relation to different backgrounds .⁴⁴ by partly painting by hand in combination with the relatively new form of lithography printing. In his atlas of *Cercles Chromatiques* from 1839 Chevreul studied the development of colors from complete brightness to almost complete darkness. .⁴⁵ This atlas, that was reprinted multiple times, represents the most sophisticated ever printed publications on color due to its numerous different tints.¹³⁶ “A masterpiece of color-printing in the later nineteenth century”.¹³⁷

Around the same time as the achievements of Chevreul in color theory, art in the nineteenth century had developed in such a way that it had become more and more an expression of artistic personality. Consequently, this expression has therefore primarily influenced how an artist is appreciated and perceived by viewers. This artistic approach was mainly shaped by the three pioneers of modernism, Cézanne, Gauguin and Van Gogh.¹³⁸ Against the background of this paper, it makes sense above all to highlight the approaches of Paul Gauguin and Vincent Van Gogh as they added a subjective symbolism to colors, which was later adopted by Franz Marc in expressionism. As a formative example from 1894 Gauguin can be cited, who worked in his creation *Mahana no atua* .⁴⁶ with the color pink in order to represent the sandy soil. Such implementations can also be seen in artworks like *Rou-*



135 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.
 136 Note : The atlas was printed with a total of 14'420 tints.
 137 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019, p. 96.
 138 BITTERER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, *Kammerlohr Epochen der Kunst, Von der Moderne zu aktuellen Tendenzen*, München, Oldenbourg Schulbuchverlag, 2013.

ANY HISTORICAL DEVELOPMENT IN THE HISTORY OF ART HAS THEREFORE HAD AN INFLUENCE ON COLOR, HOW IT IS USED, BUT ALSO HOW IT IS PERCEIVED BY THE VIEWER.



139 BITTERER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, *Kammerlohr Epochen der Kunst, Von der Moderne zu aktuellen Tendenzen*, München, Oldenbourg Schulbuchverlag, 2013.
 140 BITTERER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, *Kammerlohr Epochen der Kunst, Von der Moderne zu aktuellen Tendenzen*, München, Oldenbourg Schulbuchverlag, 2013.
 141 BITTERER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, *Kammerlohr Epochen der Kunst, Von der Moderne zu aktuellen Tendenzen*, München, Oldenbourg Schulbuchverlag, 2013.

te avec cyprès et ciel étoilé (1890) .⁴⁷ from Vincent Van Gogh, who resorted to fire-like colors to paint the fields as well as to yellow and blue tones to represent the pasture. Similar art tendencies developed a short time later with the abstract expressionists in America, caused by the social ruptures in World War II and the profound renewals that followed.¹³⁹ The trend in color field painting in which color stood above form for good, is particularly noteworthy here.¹⁴⁰ In the context of this movement the artists mainly focused on the effect of the color as an artistic tool. The magically charged atmosphere emanating from paintings like those by Mark Rothko or Barnett Newman was created solely by the colors themselves.¹⁴¹ Since then, these influences have shaped our understanding of color and even caused it to change over time. Any historical development in the history of art has therefore had an influence on color, how it is used, but also how it is perceived by the viewer. As a result, we have developed a broader understanding for colors that is not only bound to objects but also integrated in figurative representations. Consequently, the viewers have accepted the representation of color detached from the object. This effect can be observed for instance in the paintings *Gaukel Green* (2016) .⁴⁸ and *Multicultural texter* (2016) .⁴⁹ from Meghan Sims. In both paintings the artist used a green tone for the figures and their skin tones. However, this is probably an unconscious color decision as Sims often confuses the grey values of orange and green because they appear very similar to her. Nevertheless, here, the

• 118 119	51	52
• 120 121	53	
• 122 123	54	55

viewer accepts the artist's color decision and regards the color usage as an aesthetic choice. The same is the case for the selected grey tones of the woman's skin color in the painting *Wrong Way* (2016).⁵⁰ In the same vein, another example would be the work *Lunar Cycle* from 2017 of Daniel Arsham in which the shadows of the moon are represented in a strong blue tone.⁵¹

Differences in our understanding of color have evolved, but not only as one would wrongly assume, through influences in art and science. Developments in the fields of technology and printing have contributed to the fact that we were always offered new possibilities in terms of color use and color perception. This has consequently led to new artistic possibilities due to an extended connection between colors and art. Specifically, technological developments in art have made it possible to create new forms of reproduction, which was among others illustrated by Thomas E. Griffiths' book *The Technique of Colour Printing by Lithography* 1940.¹⁴² ⁵² Such pigment and print developments made it possible to overtake manual hand-coloring, as Abraham Gottlob Werner had done in 1814, in order to be able to print Color Identification Systems, such as the *Munsell Color System* ⁵³ in 1915 or the *Villalobos Colour Atlas* ⁵⁴ in 1947 as well as the well-known *Pantone Matching System* in 1963.¹⁴³ ⁵⁵

In addition to new forms of reproduction, however, photography also developed as a medium that was able to

142 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.
143 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019

assert itself more and more in art. Although the first color photography was shown in 1861 by James Clerk Maxwell, it was not until the 1970s that color photography became popular in art.¹⁴⁴ The use of technology for artistic creations was henceforth an integral part of art.

It is therefore not surprising that several decades later an artist like Harbisson turned to technology to further develop his understanding of colors. Even though Harbisson claims to not actually hear color but to rather feel color (as his new sense works through bone conduction), various forms of perceiving colors, other than through our visual perception, have already been subject of artworks from different artists such as Wassily Kandinsky or Robert and Sonia Delauney. Although they investigated the synesthetic aspects of color and music, while Harbisson differentiates his color perception from synesthetic perception, the works of these artists, to a certain extent, already affected the audience. Therefore, Harbisson's color perception alone is not shocking. What makes people feel insecure about Harbisson's use of his implant is the ethical aspect regarding the merging connection between humanity and technology. However, this question would thematically open a bottomless pit, which would go beyond the scope of the topics dealt with in this study.

Summarizing, it can therefore be assumed that due to the previously mentioned influences of research carried out by artists and scientists on the basis of color analy-

144 SCHWENDENER, Martha, "Tracking the Rise of Color on Film", *nytimes*, (2010), <https://www.nytimes.com/2010/08/08/nyregion/08artsnj.html>, accessed September 2010.

sis, but also due the artistic context of the last two centuries as well as the technological advancements, it can be concluded that the social requirements of color in art have changed. Impacts like these brought about a greater value for color in art worldwide. Consequently, this has led to a further understanding of the artist's handling of color and suggests that the acceptance the public side, regarding daltonic art, had steadily increased.

2/4/ HINDRANCE OR VIRTUE

Various professions such as the navy and aviation have been inaccessible to daltonists since the discovery of color-blindness.¹⁴⁵ In art industry this diagnosis is not so devastating and therefore many artists have tried to live and work with the diagnosis or to circumvent it. This paper has in the previous paragraphs shown which instruments artists use to deal with their color-blindness as well as how artworks from color-blind artists are received by the public. One question, however, remains unanswered: Is color-blindness an obstacle or a driver to artistic success?

Many artists would certainly agree that the success of their art in a certain aspect can be measured by the acknowledgement and appreciation of the public, although these forms of recognition are subjective. Another aspect that cannot be ignored is the emotional value of a

145 FAVRE, Antoine, *Prognostic du Daltonisme*, Lyon, Imprimerie du salut public, 1886.

work of art for an artist. Thus, considering this variety of different factors on which the success of art can be determined, it is not presumptuous to claim that there are several views on the evaluation of success in art. While one artist might place a higher value on the monetary valuation of his artworks, another one might prefer the interpersonal and emotional assets related to his creations. Accordingly, although there exists no straightforward formula to measure artistic success uniformly, it is not impossible to investigate how the four artists analyzed in this paper define the success of their art and to what extent the works created by these daltonic artists can be considered successful.

“[T]HE PUBLIC IS NOT VERY RECEPTIVE TO WORK OF THIS KIND, OF WHICH THE USEFULNESS, HOWEVER, I DO NOT THINK CAN BE DOUBTED.”

With regard to the artistic work of Charles Meryon, it is well-known that the public interest and appreciation towards his creations was very limited during his lifetime. The artist, who due to his color-blindness increasingly devoted himself to engraving, has repeatedly mentioned in letters how much he would like to see his work recognized by a large audience : “[T]he public is not very receptive to work of this kind, of which the usefulness, however, I do not think can be doubted.”¹⁴⁶ Accordingly, it seems that the artist's personal artistic success is mainly based on the appreciation and recognition of his viewers. His personal satisfaction could also not be changed by the fact that, in contrast to the grand public, famous art enthusiasts and scholars tended to appreciate his creations: “Meryon is known only to the elite, and the public ignores

146 GEFFROY, Gustave, *Charles Meryon*, Paris, H. Floury Editeur, 1926, p. 78.

his work as well as his name.”¹⁴⁷ Although Meryon equated the lack of public recognition with failure, the artist had not given up working : “In the arts as everywhere, perseverance is essential, one should not be discouraged from failure.”¹⁴⁸ Since it is conceivable that the monetary value of art is generally related to the appreciation and exaltation of the audience that is willing to pay, it is not surprising that Meryon was only able to sell his art at low prices during his lifetime.¹⁴⁹ This realization filled Meryon more and more with bitterness and led him to criticize the development of art in which the price and not the profound sense of an artwork turned out to be the central measure of success.¹⁵⁰ Consequently, confronted by the lack of recognition at both inclination and financial level, the artist had increasingly fallen into a mental deep that made him think he was an unsuccessful artist as, due to his color-blindness, he could not give the public what they expect from art : “In the present moment, I’m not very happy, I’m pretty much on the ropes; but I still have a good enough philosophical background to put myself above all these little miseries that may not be eternal. I find consolation in my work.”¹⁵¹ Although Meryon did not receive the recognition he desired during his lifetime and even if he himself occasionally considered his art as unsuccessful¹⁵², it can still be said that Meryon goes down in history as a pioneer who struggled with daltonism at a time when daltonism was a rarely discussed subject. Compared to the other artists analyzed in this paper, who live in an age where they can use antennas,

147 VAUXCELLES, Louis, “La Semaine Artistique”, *L’Ère nouvelle*, October 1923, (no pagination).

Note : Original quotation translated by the author. “Puisque vous connaissez M. Meryon, dites-lui que ses splendides eaux-fortes m’ont ébloui sans la couleur, rien qu’avec l’ombre et la lumière, le clair-obscur tout seul et livré à lui-même : [...]”.

148 GEFFROY, Gustave, *Charles Meryon*, Paris, H. Flourey Éditeur, 1926, p. 24. Note : Original quotation translated by the author. “Dans les arts comme partout, la persévérance est de rigueur, il ne faut pas se rebuter de l’insuccès.”

149 FROLLO, Jean, “Vernissage”, *Le Petit Parisien*, May 1883, (no pagination).

150 GEFFROY, Gustave, *Charles Meryon*, Paris, H. Flourey Éditeur, 1926.

151 GEFFROY, Gustave, *Charles Meryon*, Paris, H. Flourey Éditeur, 1926, p. 36. Note : Original quotation translated by the author.

“Dans le moment présent, je ne suis pas très heureux, je ralingue passablement ; mais j’ai encore un assez bon fond de philosophie pour me mettre au-dessus de toutes ces petites misères qui peuvent ne pas être éternelles. Je trouve de la consolation dans mon travail. Je me dis que si je n’avais pas quitté la marine, je serais probablement encore moins heureux.”

152 GEFFROY, Gustave, *Charles Meryon*, Paris, H. Flourey Éditeur, 1926, p. 78.

glasses and rely on open exchanges with like-minded people, Meryon was left to his own and could only adapt his art completely to his visual impediment. The fact that this led him to devote himself to engraving rather than the colorful painting, which was most popular that time, does not necessarily mean that he was an unsuccessful artist, but perhaps that society at this time was not prepared to appreciate his form of art. This argumentation finds support in the fact that, in retrospect, art historians such as Harold J. L. Wright nevertheless valued Meryon’s works as unique : „By the intensity of his vision, and scarcely less by the completeness of his performance, he goes down to later ages in association with Rembrandt and Dürer. Doubtless there are limitations to the things he saw and felt. His great plates are few in number — his whole work comprised only a hundred and two etchings — but how unique are his best, how arresting, how certain, how unforgettable! As Wedmore says : „Of the vast field of art Meryon tilled but a corner. But with what result!”¹⁵³

In comparison to Charles Meryon, who did not personally experience success during his lifetime, the three contemporary artists Sims, Arsham, and Harbisson seem to have a certain success with their art already during their lifetime. While Meryon did not face his illness directly and tried to avoid it by changing the medium of art, the other three have concretely dealt with their visual impairment and tried to find instruments that enable them to

153 WRIGHT, Harold J.L., “Three Mater Etchers: Rembrandt, Meryon, Whistler: Lecture II. The Etchings of Charles Meryon (1821-1862)”, *Journal of the Royal Society of Arts*, vol. 78, n° 4060, September 1930, p. 1084.

recognize and reproduce colors in the best possible way. Through this approach, which has certainly been facilitated by the technological progress of today, Sims and Arsham were able to overcome their visual deficiency. By integrating their color-blindness into their art rather than bypassing it, they have been able to develop and shape an unmistakable new art style that is difficult to imitate. Aware of the complexity of colors but eager to implement them in a way it is hardly noticeable to the public that she is totally color-blind, Sims has managed to deal with her deficit and to establish her art in the art world. Through practice and dedication as well as the development of a processing method that gives her an understanding of the colors she cannot actually see, Sims has succeeded in overcoming her color-blindness. She has managed to transform the deficiency into her strength and created and inimitable artistic value in her art.

Daniel Arsham, who was already internationally recognized for his art that he exhibited all around the world, was not afraid to openly identify as color-blind.¹⁵⁴ The artist, who has never seen his daltonism as a real barrier but rather as a challenge to discover things he could not perceive before, has learned how to use his handicap to stand out from the crowd and can be considered a unique artist.¹⁵⁵ His coming-out as a daltonic artist did not harm Arsham's success. On the contrary, when he used colors in his works for the first time, this aroused additional interest among viewers. People were curious

¹⁵⁴ AUTHOR UNKNOWN, "Daniel Arsham biography", ocula, (date unknown), <https://ocula.com/artists/daniel-arsham/>, accessed September 2020.

¹⁵⁵ SEMAINE, "Daniel Arsham Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECia1Ck&-list=WL&index=24&t=1341s>, accessed August 2020.

¹⁵⁶ SEMAINE, "Daniel Arsham Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECia1Ck&-list=WL&index=24&t=1341s>, accessed August 2020.

¹⁵⁷ SEMAINE, "Daniel Arsham Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECia1Ck&-list=WL&index=24&t=1341s>, accessed August 2020.

¹⁵⁸ AUTHOR UNKNOWN, "Neil Harbisson", saatchiart, (date unknown), <https://www.saatchiart.com/neilharbisson>, accessed September 2020.

about how he handles colors and perceives different objects so that they could explore his art from a new angle.¹⁵⁶ Thereby, he has not disappointed the viewers of his art. His art is seen by many as a successful attempt to "overcome his color-blindness" as film producer Jane Rosenthal explains. In reference she describes Arsham's application of his colors through the use of his glasses to have an extraordinary depth.¹⁵⁷ Further, it is not presumptuous to say that Arsham can also be called successful on a personal level, since, through his curiosity in colors and the experience of the glasses, he has succeeded in transforming an initial deficit into a personal appreciation a stand-alone feature.

The recognition of Neil Harbisson's art can be seen in the fact that his works have been exhibited in various places around the world, such as the 54th Venice Biennale or various other recognized galleries and museums.¹⁵⁸ His extravagant appearance, which also includes his antenna, his open approach to his daltonism as well as his unique method of perceiving color through sound, have helped Harbisson to become well known in the art world. However, the artist is not only known for his unique new sense, but his work also meets with great recognition and enthusiasm among art enthusiasts. Harbisson's success comes primarily from the fact that he has developed a unique artistic expression with which he further expands the notion of color in relation to sound in art. He has succeeded in expanding his limited color perception and de-

veloping an art form from it, for which he is the only artist who is able to carry it out. His unique artistic expression enables him to be invited to talks in order to bring his art closer to people. Despite initial skepticism his art impresses people every day. Furthermore, Harbisson's curiosity and his optical aberration have led him to strive for new perceptual possibilities and to further develop cyborgism as well as new body organs to create new senses and with it, new art.

CONCLUSION

This paper pursued the core objective, based on the case studies of four specific artists, to analyze the extent to which color-blind artists are affected by their visual impairment, how their approaches to face this visual deficiency differ between each other, as well as how daltonism itself is recognized in the art world. The investigated case studies reveal that the handling of daltonism in art seems to have changed over time on a personal artistic level as well as on a public awareness level. Even if color-blindness is not visible to outsiders, this visual deficiency seems to affect the personal subconsciousness of artists. The approach of contemporary artists to deal with color-blindness is in comparison to the approach of Meryon fundamentally different. Nowadays, artists have the opportunity to use tools (e.g. coding system, glasses, antenna) that enable them to expand their visual perception and actively address the problem of visual impairment by learning how to properly apply colors and how they affect normal-vision people. Thus today, artists can artistically explore differences in perception and therefore seek to create, despite their visual limitations, new ways of processing colors which result in unprecedented forms of art. Previously, however, during Meryon's lifetime, these tools were not accessible and artists had

to find other ways to deal with their color-blindness. This led Meryon to avoid the use of color in his work whenever necessary and to turn to engraving in order to avoid working with colors.

Besides the different methods the artists have developed to deal with their color-blindness, there further arises the question of what daltonism does to artists on a psychological level. As previously discussed, one can assume that daltonic artists live in parallel visual worlds in which they can never be sure that what they see corresponds to what the public sees and vice versa. Thus, even though Meghan Sims has unquestionably developed an impressive coding system which allows her to accurately process colors, the question also arises in her case : Why an artist would create a piece of work in a spectrum they can't really see. By analyzing this question psychologically it was shown that one can assume that Sims strives for artistic recognition by painting the colors in her paintings as close as possible to the reality of the underlying photos. The fact that Sims measures her artistic talent by how the public perceives her work shows that personally she has not fully accepted her daltonism yet. In this way, the use of color in a figurative sense could be much more desirable for Sims and would offer her space for her own color interpretation and expressiveness. Nevertheless, the achievements that Sims has made as a color-blind artist are still remarkable.

WHEN RECEIVING PREVIOUSLY UNKNOWN INFORMATION ABOUT SOMETHING THAT SEEMS OUT OF OUR REACH, WE NURTURE OUR CURIOSITY FOR MORE.

Arsham and Harbisson have both shown a pronounced curiosity about the colors which they can, due to their visual impairment, only perceive distorted. This behavior is not unusual because people often develop a curiosity for things they cannot understand at first sight. When receiving previously unknown information about something that seems out of our reach, we nurture our curiosity for more. The human species constantly tries to extend its comprehension and knowledge of the unknown. However, the tools developed or used on the basis of this curiosity are not a universal remedy for every daltonic artist. As previously shown in the case of Daniel Arsham, this artist used his tool (e.g. glasses) only for a temporary period and, as a result, he now prefers to stick to his unaltered perception of things. Accordingly, Cecilia Dean explained about Arsham's change of perception : "To be color-blind and then to be given color, there's probably a double edge saw, it's not necessarily a gift. Not everyone wants another person's reality."¹⁵⁹ The case of Arsham shows that not every physical change has to be permanent but can lead to new views which influence how one comprehends and perceives daltonism itself. Thus, his personal experience has brought rather a psychological change (e.g. the preference to keep his personal, distorted view of things) rather than an optical one, which can be just as valuable.

Even if over the past decades color-blindness in art has become more and more receivable, the question arises whether the processing of colors by a daltonic artist is

¹⁵⁹ SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECIia1Ck&-list=WL&index=24&t=1341s>, accessed August 2020.

THE PERSONAL COMMITMENT TO OVERCOME THIS VISUAL HINDRANCE CREATES NEW FORMS OF ART AND UNPRECEDENTED EXPRESSIONS OF CREATIVITY.

bound to limits. Although the answer is probably yes, people should be aware that these limits are constantly being pushed back due to technological progress and the personal dedication of color-blind artists. The personal commitment to overcome this visual hindrance creates new forms of art and unprecedented expressions of creativity. All three contemporary artists analyzed in this paper, have developed solutions which enable them to adapt to their visual impairment and to be successful in today's art world. Although Sarah Former, Arsham's ophthalmologist commented that even if the brain is not made for major alterations of perception,¹⁶⁰ Harbisson, through the implantation of his antenna, has created a new sense. His case is proof that while science and technology constantly develop, color impaired individuals are also able to surpass their physical impairments. Accordingly, in Sims' and Arsham's case, technology has also made a major contribution and plays a pivotal role regarding how daltonic artists nowadays deal with colors. The use of photography or the reference to spectrum-widening glasses was unthinkable 200 years ago. Thus, if one looks at the evolution of the handling of daltonism in art, one can relate to Maya Angelou's citation, which even though was meant figuratively, it still applies to the subject of color-blindness in art : "We are only as blind as we want to be."¹⁶¹ In this sense the cases of Sims, Arsham and Harbisson are proof of how artists managed to continue their artistic work despite severe color-blindness. These artists have unique visions, which do not only allow

¹⁶⁰ SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZCsECIia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

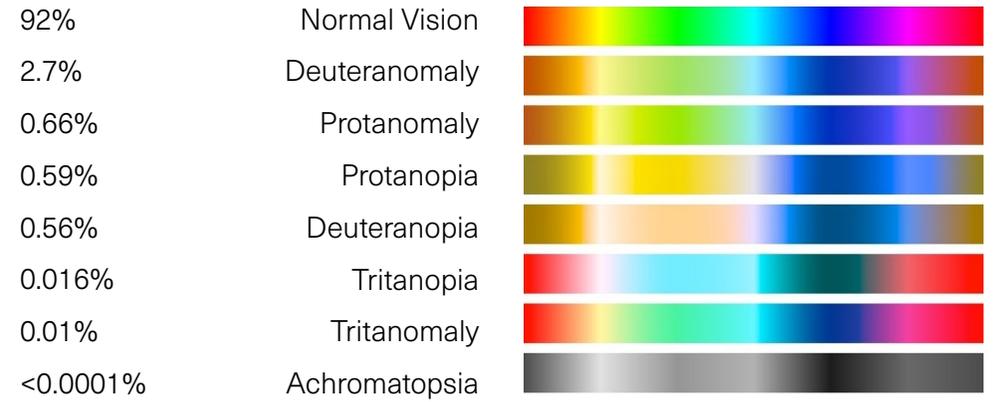
¹⁶¹ AUTHOR UNKNOWN, "Maya Angelou Unforgettable Quotes You Should Know", pmcaonline, (2020), <https://www.pmcaonline.org/maya-angelou-unforgettable-quotes-you-should-know/>, accessed September 2020.

us to understand what they see, but also to make people see something beyond their own vision that might present them a new visual and thematical perspective. Their approaches tempt the viewers to question their own perception and rethink their preconceptions and understanding of daltonism in general. Further, they were able to help color-blindness gain a new position in art. Thus, the artists' confrontation with their daltonism in art has led to a change in the consciousness (in regards to daltonism) of both themselves and the viewers. Therefore, the analysis carried out remove any remaining doubts that the contemporary artists, in contrast to Meryon, have managed to formulate strategies to overcome their deficient color perception and even to transform it into an artistic strength, or as the researcher and ophthalmologist Maureen Neitz had expressed in 1997, that color-deficient people have learned to survive in a world surrounded by people who see what they cannot.¹⁶²

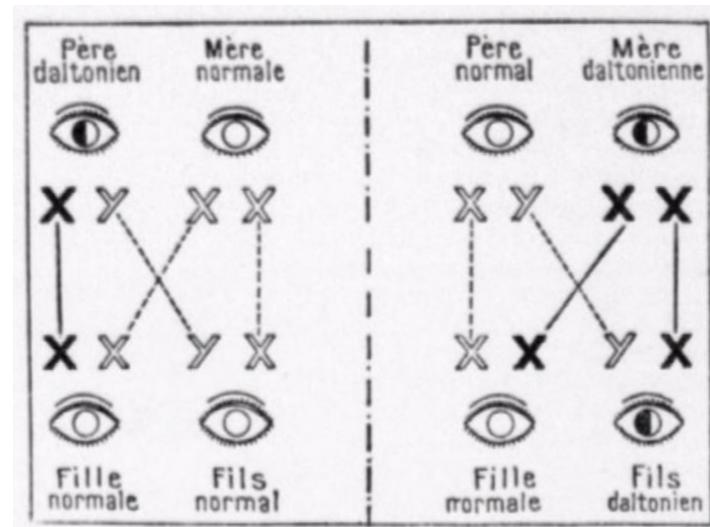
COLOR-DEFICIENT PEOPLE HAVE LEARNED TO SURVIVE IN A WORLD SURROUNDED BY PEOPLE WHO SEE WHAT THEY CANNOT.

¹⁶² LANTHONY, Philippe, MARMOR, Michael F., "The Dilemma of Color Deficiency and Art", *Survey of Ophthalmology*, vol. 45, n° 5, April 2001, p. 409. Note: Author had no access to the original source: NEITZ, Maureen, Society and colorblindness, in 14th Biennial Eye Research Symposium, Research to prevent blindness, 1997.

IMAGES



• 1 Daltonism chart : Normal color vision in comparison with the different forms of daltonism.



• 2 Visualisation of the sex-related inheritance of color blindness.



• 3 SIMS, Meghan, *Courtland at David*, 2010, oil on canvas, 25 cm x 20 cm, place of conservation unknown.



• 5 SIMS, Meghan, *Breithaupt Pines*, 2010, oil on canvas, 76 cm x 61 cm, place of conservation unknown.



• 4 SIMS, Meghan, *Victoria Park Trees*, 2010, oil on canvas, 91 cm x 66 cm, place of conservation unknown.

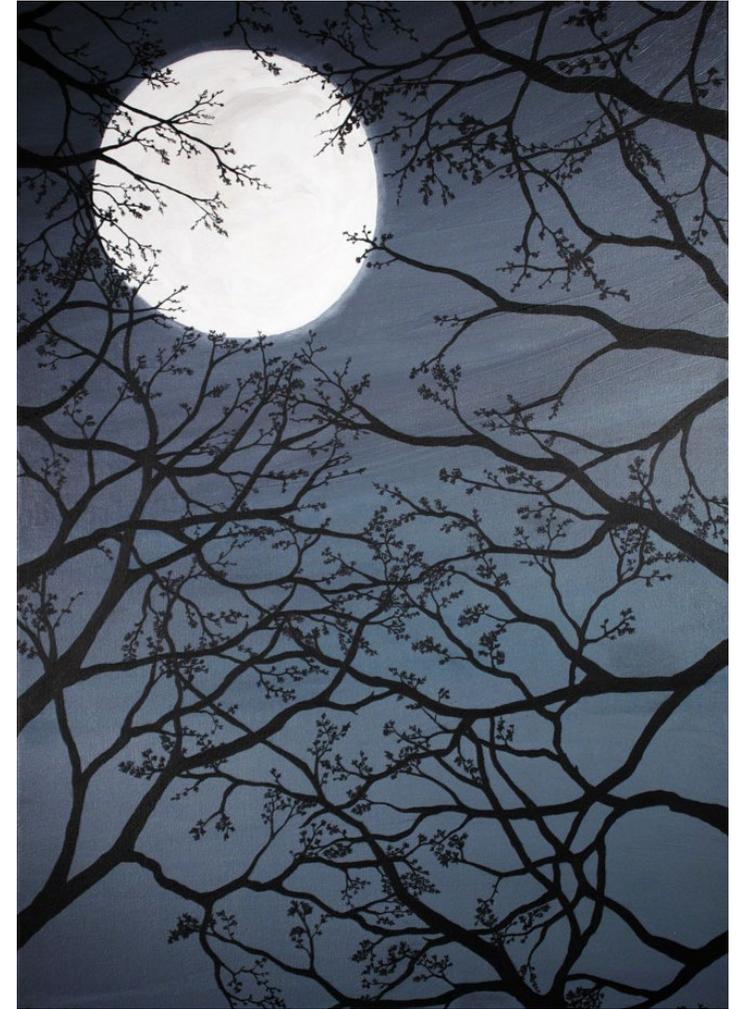


• 7 SIMS, Meghan, *David Street at Night*, 2011, acrylic on canvas, 30 cm x 23 cm, place of conservation unknown.

• 6 SIMS, Meghan, *Queen at Courtland*, 2012, acrylic on canvas, 51 cm x 41 cm, place of conservation unknown.



• 8 SIMS, Meghan, *King at Queen*, 2012, acrylic on canvas, 30 cm x 25 cm, place of conservation unknown.



• 9 SIMS, Meghan, *Night Life*, 2009, acrylic on canvas, 91 cm x 61 cm, place of conservation unknown.



• 10 ARSHAM, Daniel, *Baseball Pile*, 2010, selenite, size unknown, place of conservation unknown.



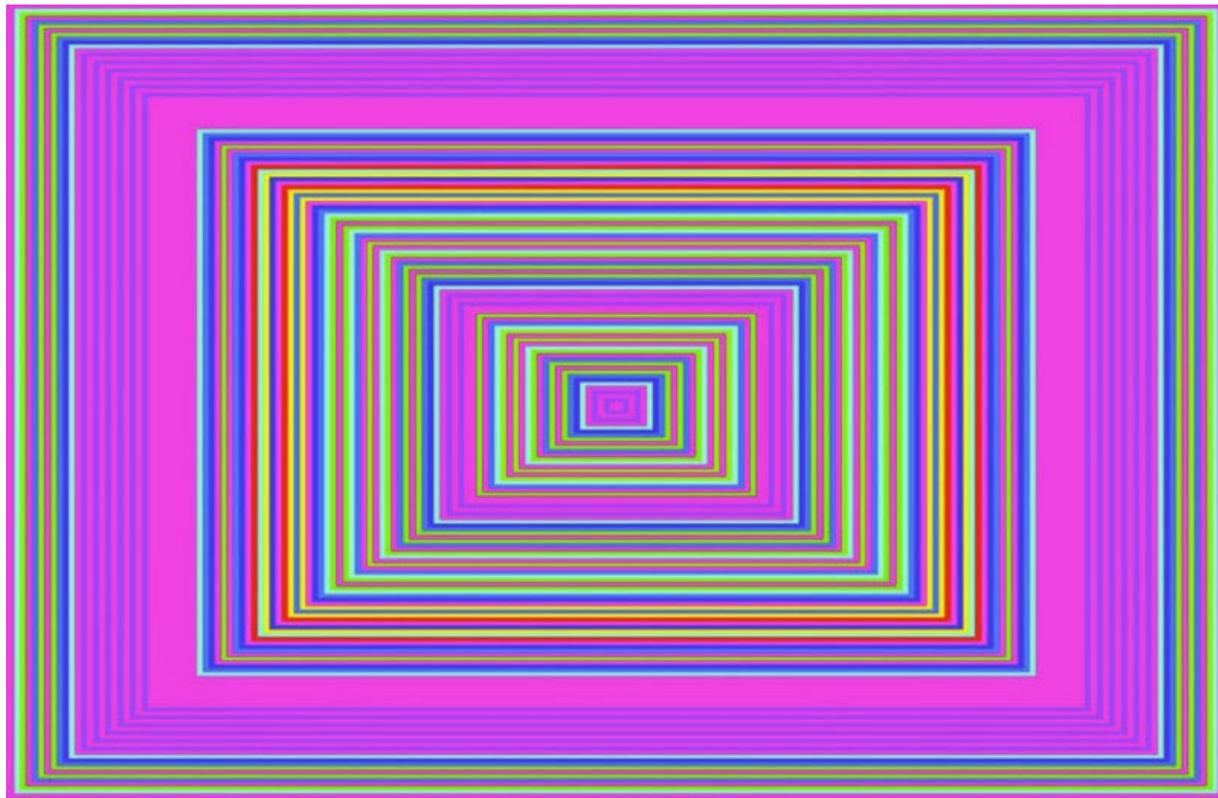
• 11 ARSHAM, Daniel, *Moon Globe Black*, 2016, material unknown, size unknown, place of conservation unknown.



• 12 ARSHAM, Daniel, *Televisions*, 2015, selenite (left) glacial rock, crushed marble, shattered glass and hydrostone (right), 24 cm x 35 cm x 25 cm (size of one television), place of conservation unknown.



• 13 Profile view of Neil Harbisson with his antenna implant.



• 14 HARBISSON, Neil, *Für Elise*, date unknown, medium unknown, size unknown, place of conservation unknown.



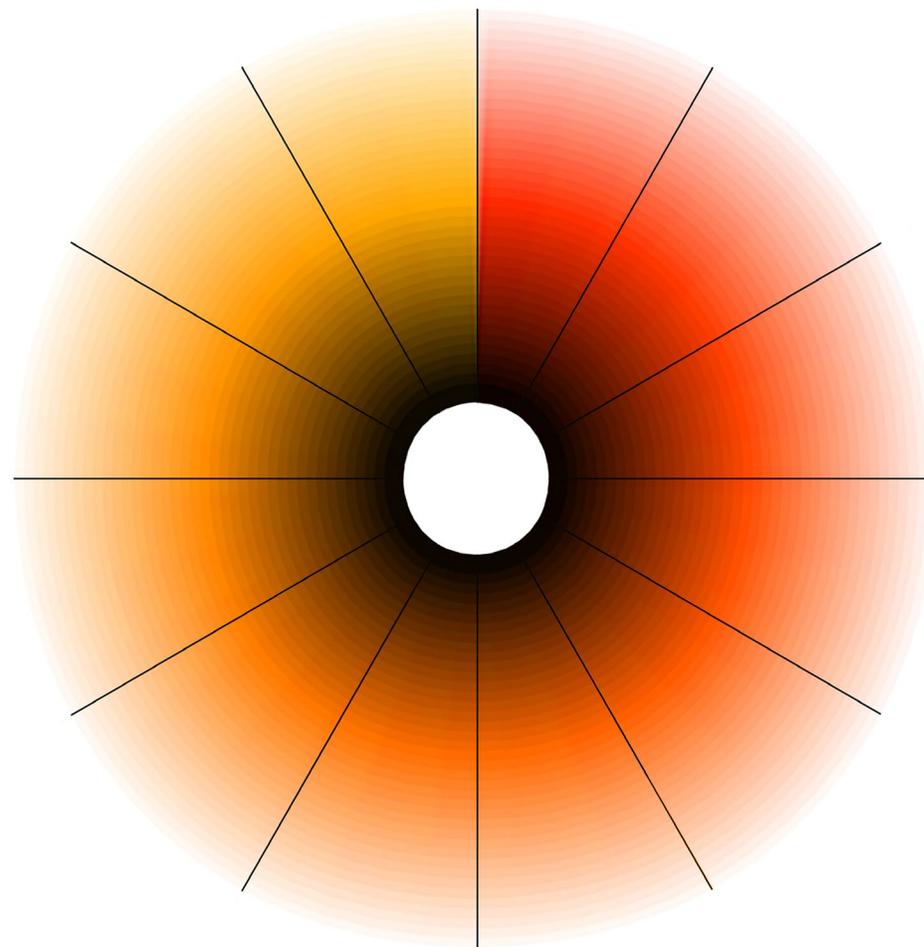
• 15 MERYON, Charles, *L'Abside de Notre-Dame de Paris*, 1854, etching and drypoint printed in black ink on laid paper, 16.5 cm x 29.8 cm, National Gallery of Art, Washington, D.C.



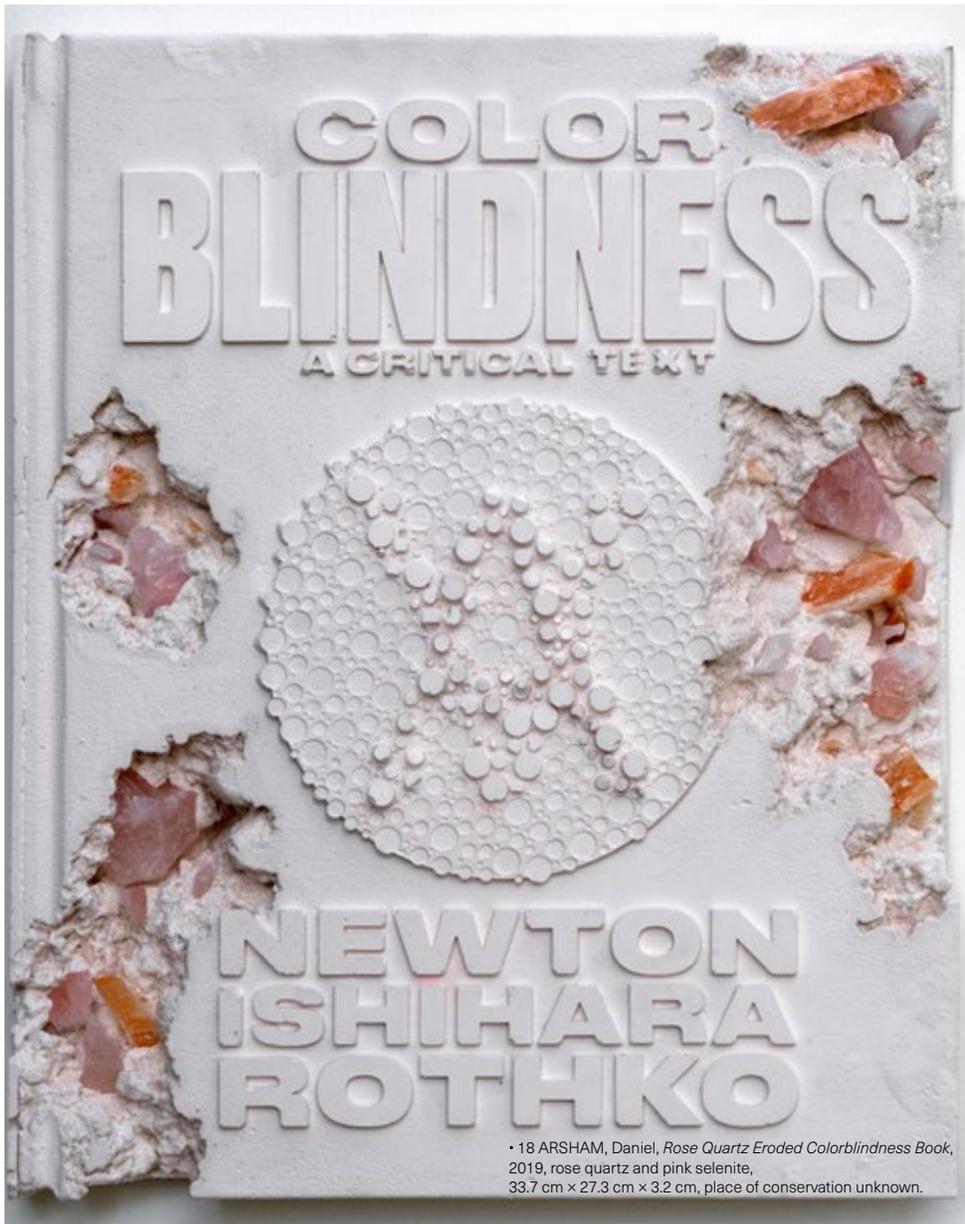
• 16 SIMS, Meghan, *Night Town 2*, 2009, acrylic on canvas, 91 cm x 61 cm, place of conservation unknown.

THE HUMAN COLOUR WHEEL

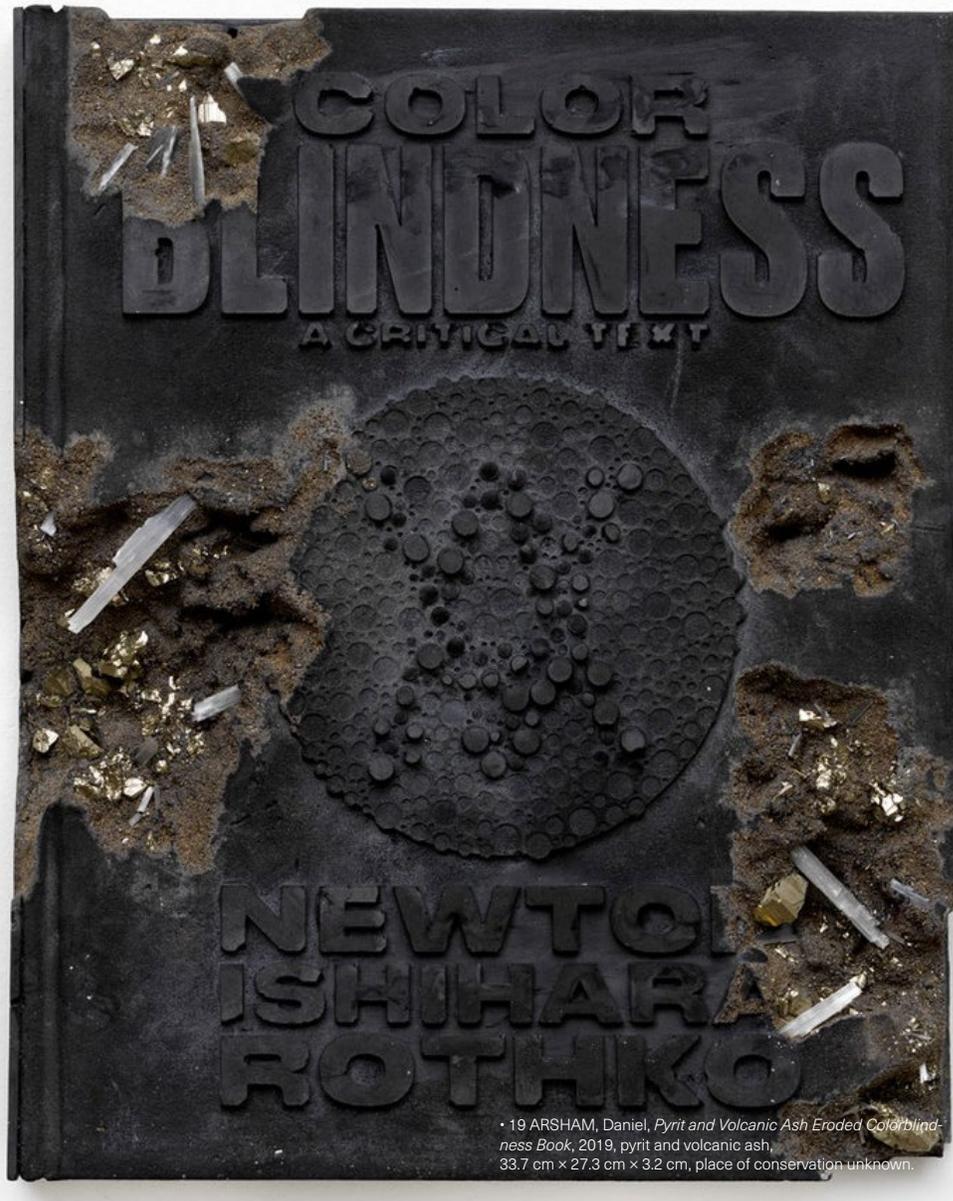
Colour wheel based on the hue and light detected on human skins.



(Neil Harbisson 2009)



• 18 ARSHAM, Daniel, *Rose Quartz Eroded Colorblindness Book*, 2019, rose quartz and pink selenite, 33.7 cm x 27.3 cm x 3.2 cm, place of conservation unknown.



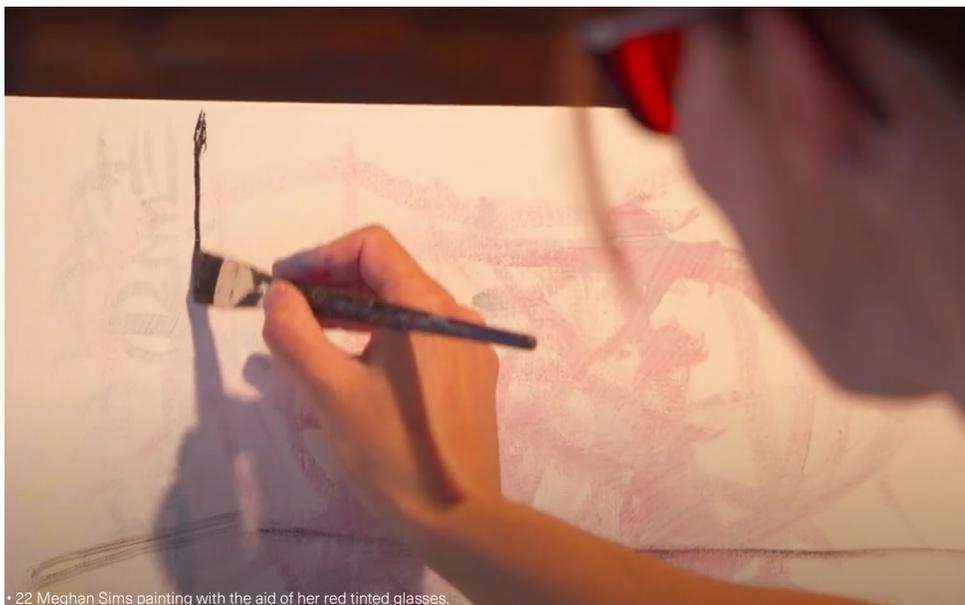
• 19 ARSHAM, Daniel, *Pyrite and Volcanic Ash Eroded Colorblindness Book*, 2019, pyrite and volcanic ash, 33.7 cm x 27.3 cm x 3.2 cm, place of conservation unknown.



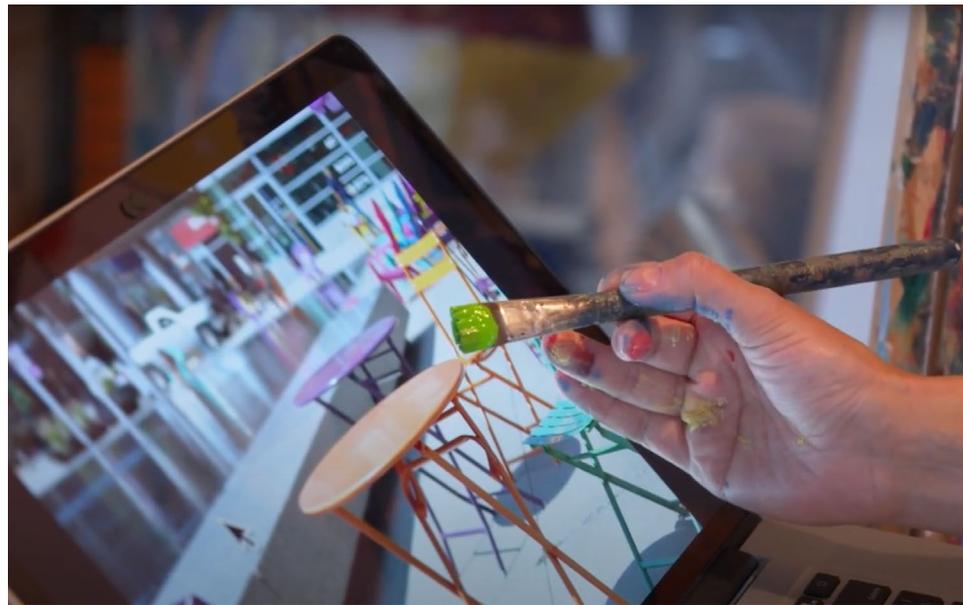
• 20 MERYON, Charles, *Ghost Ship*, date unknown, oil pastel on paper, size unknown, Musée du Louvre.



• 21 Meghan Sims' coded paint tubes.



• 22 Meghan Sims painting with the aid of her red tinted glasses.



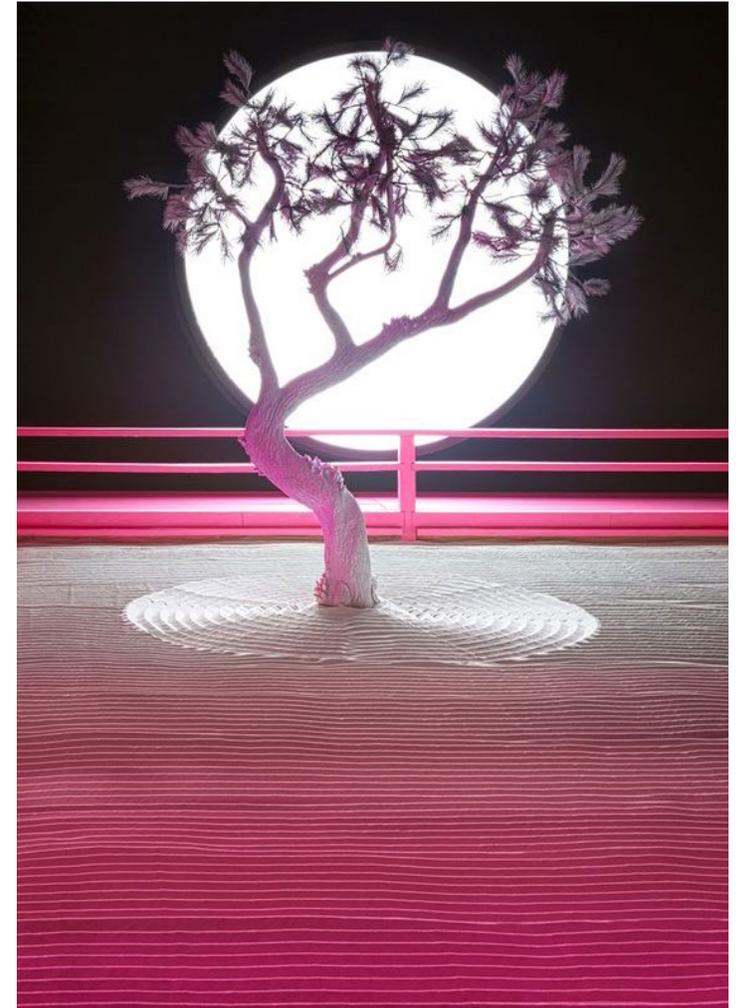
• 23 Meghan Sims comparing the color of paint with the colors of a photo she took.



• 24 SIMS, Meghan, *Midnight Moonlight 2*, 2012, oil on canvas, 86 cm x 71 cm, place of conservation unknown.



• 25 SIMS, Meghan, *Watered Down Coffee*, 2016, oil on canvas, 61 cm x 61 cm, place of conservation unknown.



• 26 ARSHAM, Daniel, *Lunar Garden*, 2017, white and colored sand, size unknown, temporary exhibition at the gallery at Cadillac House New York.

• 27 ARSHAM, Daniel, *Lunar Garden*, 2017, white and colored sand, size unknown, temporary exhibition at the gallery at Cadillac House New York.

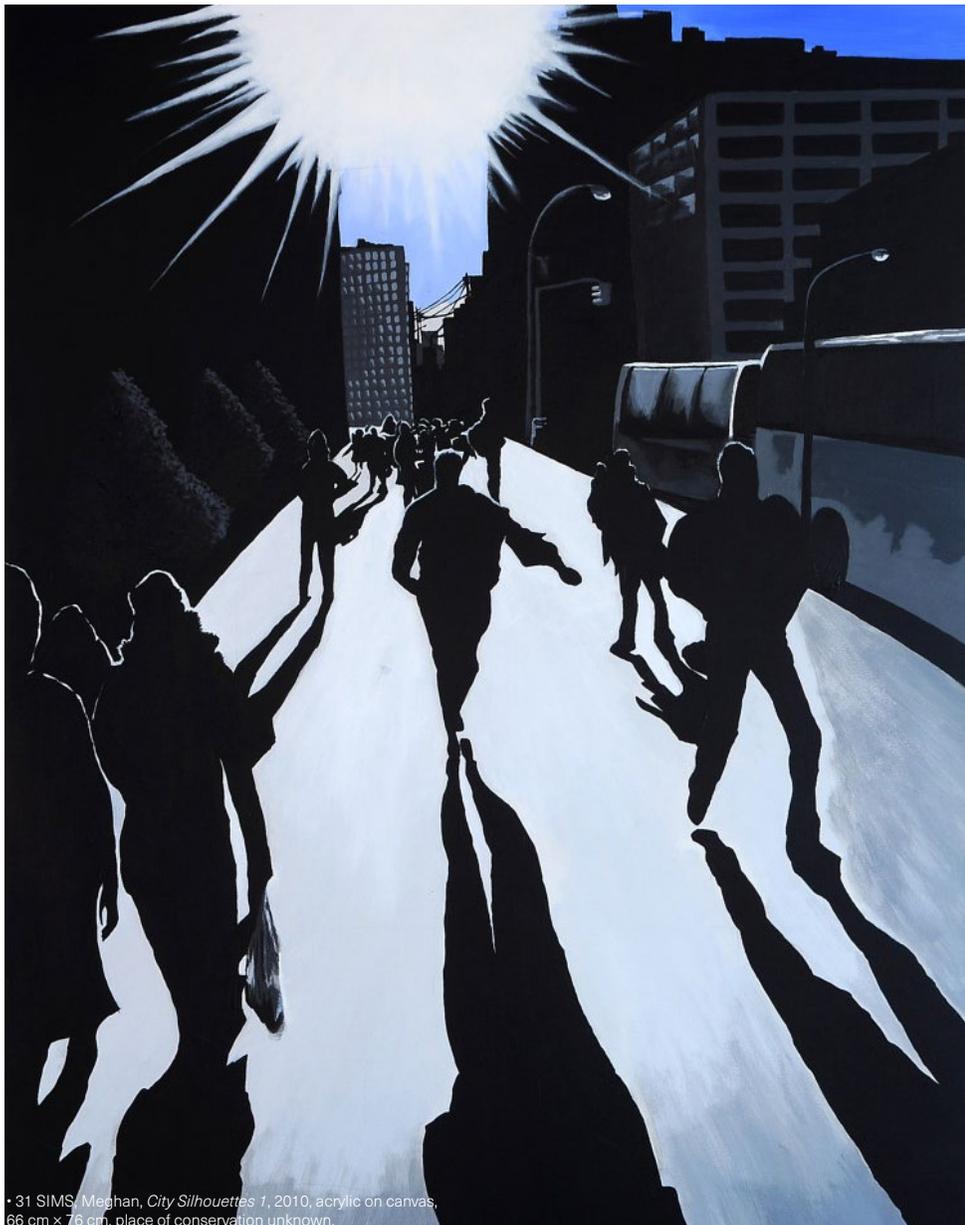


• 29 Neil Harbisson doing a sound portrait of Judi Dench.

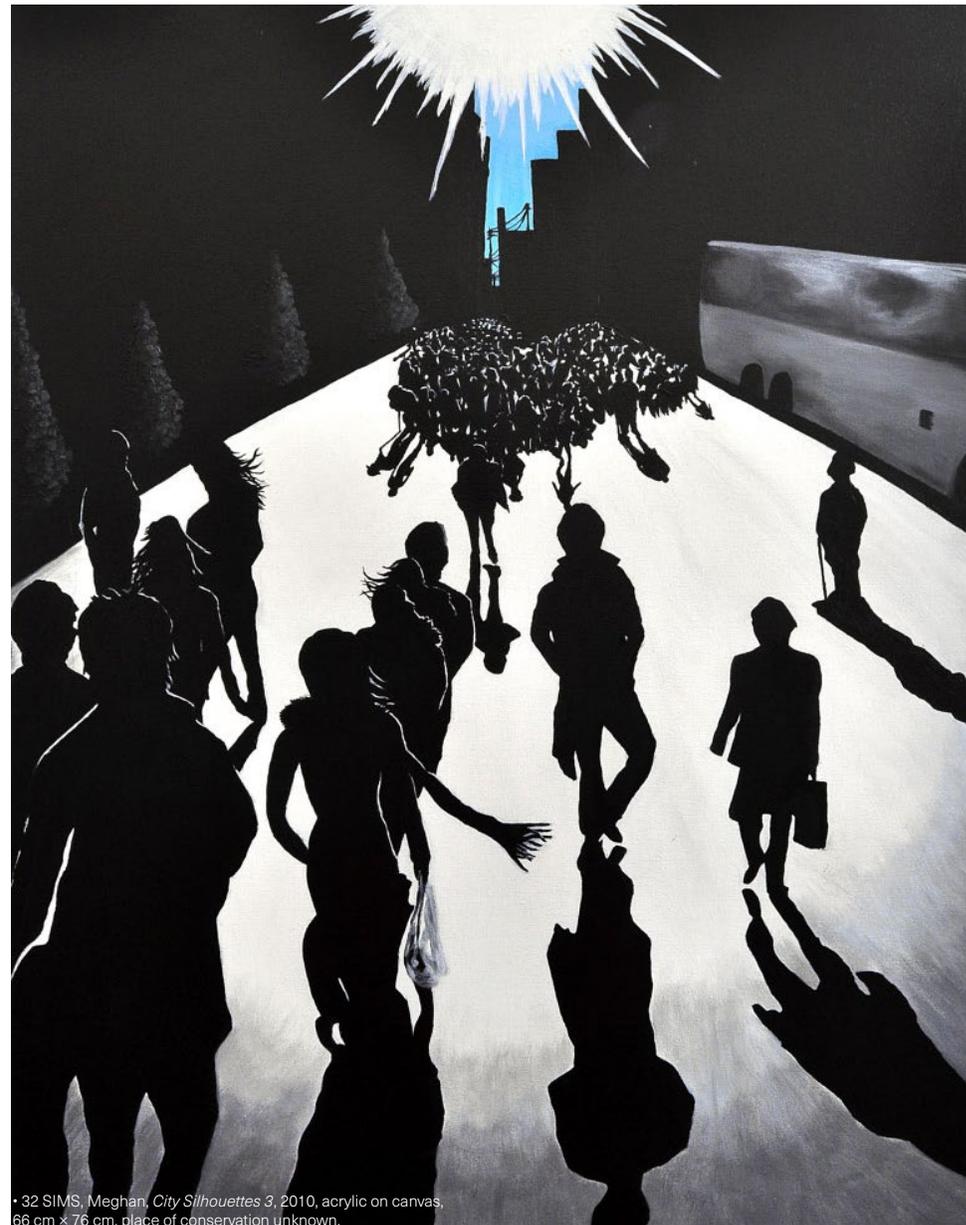


• 28 Neil Harbisson doing a sound portrait of Philip Glass.

• 30 Neil Harbisson doing a sound portrait of James Cameron.



• 31 SIMS, Meghan, *City Silhouettes 1*, 2010, acrylic on canvas, 66 cm x 76 cm, place of conservation unknown.



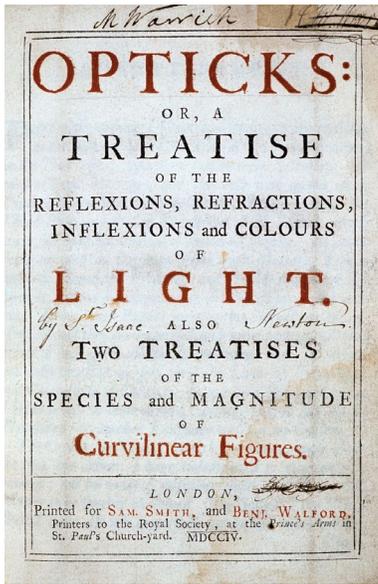
• 32 SIMS, Meghan, *City Silhouettes 3*, 2010, acrylic on canvas, 66 cm x 76 cm, place of conservation unknown.



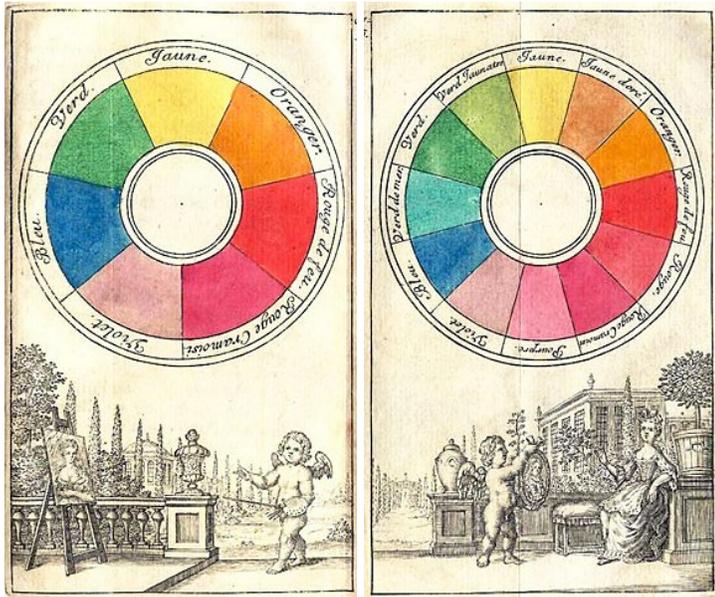
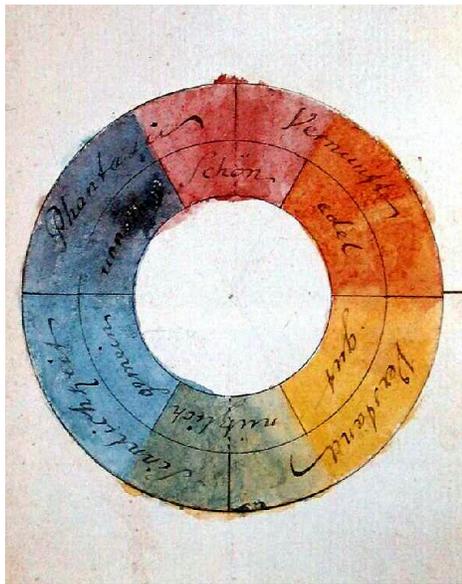
• 33 SIMS, Meghan, *Legacy Greens*, 2010, oil on canvas, 61 cm x 61 cm, place of conservation unknown.

• 34 Meghan Sims' art exhibited with the photography of the scene next to it.



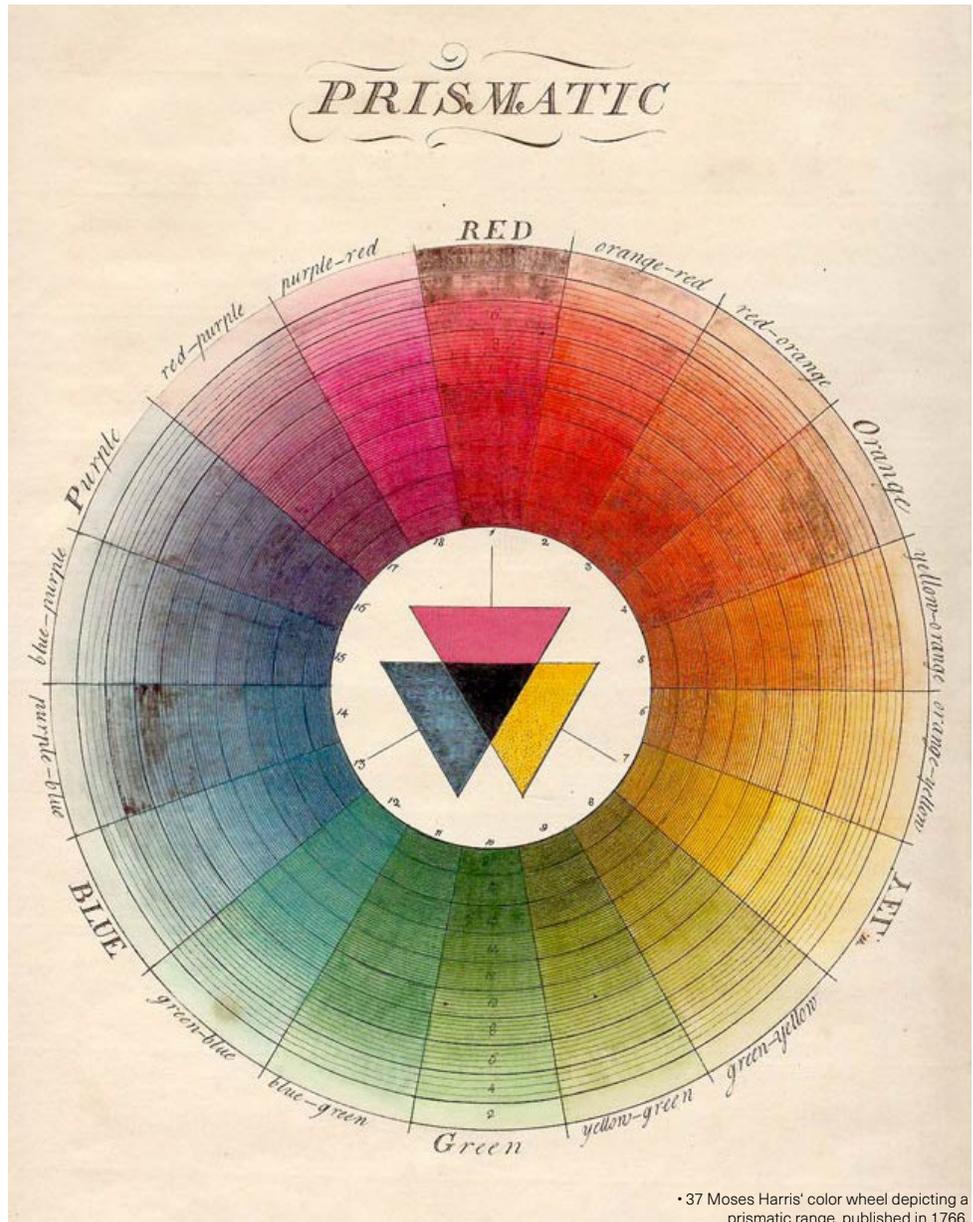


• 35 Isaac Newton's Book Opticks on the visual colors of light, published in 1704.



• 38 Johann Wolfgang von Goethe's color wheel from 1809.

• 36 Color wheels by Claude Boutet published in 1708.



• 37 Moses Harris' color wheel depicting a prismatic range, published in 1766.

BLUES

No.	Names	Colours	ANIMAL	VEGETABLE	MINERAL
24	Scotch Blue		Throat of Blue Titmouse.	Stamina of Single Purple Anemone.	Blue Copper Ore.
25	Prussian Blue		Beauty Spot on wing of Mallard Drake.	Stamina of Bluish Purple Anemone.	Blue Copper Ore
26	Indigo Blue				Blue Copper Ore.
27	China Blue		Rhynchites Nitens	Back Parts of Gentian Flower.	Blue Copper Ore from Chessy.
28	Azure Blue.		Breast of Emerald-crested Manakin.	Grape Hyacinth. Gentian.	Blue Copper Ore.
29	Ultra marine Blue.		Upper Side of the Wings of small blue Heath Butterfly.	Borage.	Azure Stone or Lapis Lazuli.
30	Flax-flower Blue.		Light Parts of the Margin of the Wings of Devil's Butterfly.	Flax flower.	Blue Copper Ore
31	Berlin Blue.		Wing Feathers of Jay.	Hepatica.	Blue Sapphire.
32	Verditer Blue				Lenticular Ore.
33	Greenish Blue			Great Fennel Flower.	Turquoise. Fluor Spar.
34	Greyish Blue.		Back of blue Titmouse	Small Fennel Flower.	Iron Earth.

• 39 Extract of Abraham Gottlob Werner's *Werner's Nomenclature* from 1821.

RED.

Nº	Names.	Colours.	ANIMAL.	VEGETABLE.	MINERAL.
82	Tile Red.		Breast of the Cock Bullfinch.	Shrubby Pimpernel.	Porcelain Jasper.
83	Hyacinth Red.		Red Spots of the Legless Apterous Fly.	Red on the golden Renette Apple.	Hyacinth.
84	Scarlet Red.		Scarlet Ibis or Curlew. Mark on Head of Red Grouse.	Large red Oriental Poppy. Red Parts of red and black Indian Pass.	Light red Cinnabar.
85	Vermillion Red.		Red Coral.	Love Apple.	Cinnabar.
86	Aurora Red.		Vent coverts of Pied Wood-Pecker.	Red on the Naked Apple.	Red Orpiment.
87	Arterial Blood Red.		Head of the Cock Gold-finch.	Corn Poppy. Cherry.	
88	Flesh Red.		Human Skin.	Larkspur.	Heavy Spar. Limestone.
89	Rose Red.			Common Garden Rose.	Figure Stone.
90	Peach Blossom Red.			Peach Blossom.	Red Cobalt Ore.

• 40 Extract of Abraham Gottlob Werner's *Werner's Nomenclature* from 1821.

YELLOWS.

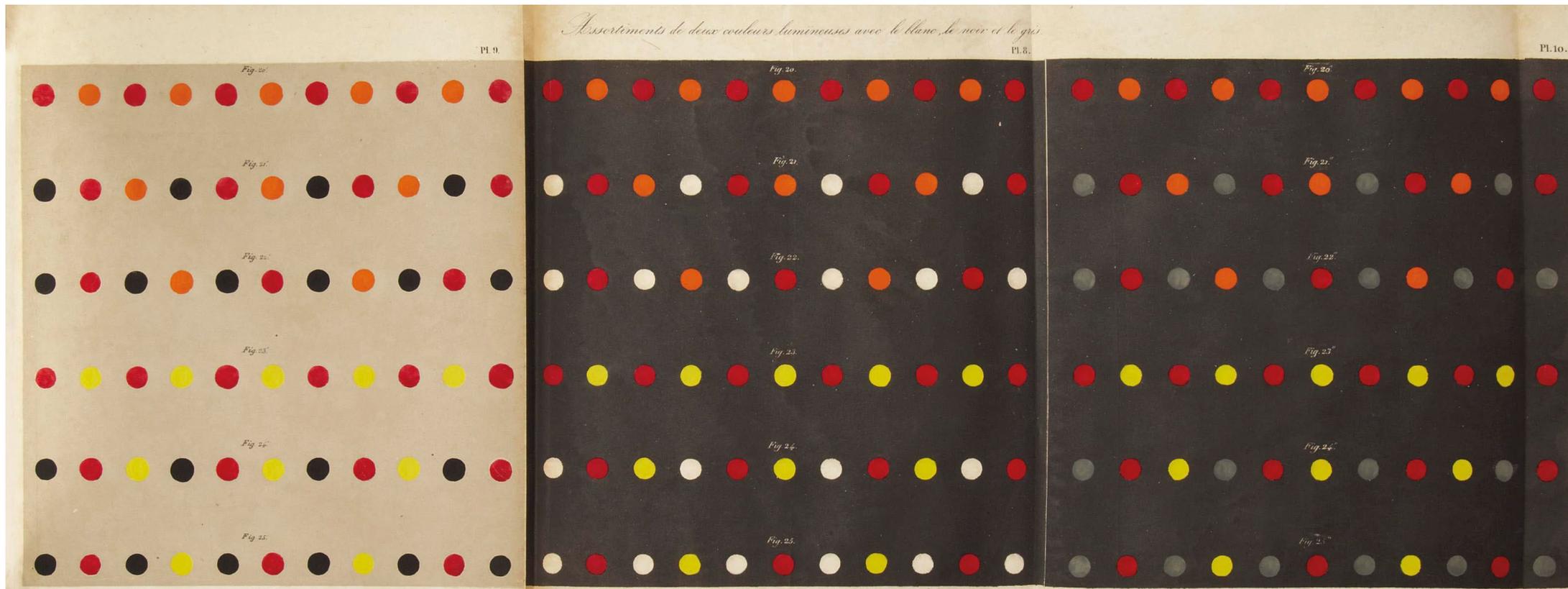
No.	Names	Colours	ANIMAL	VEGETABLE	MINERAL
62	Sulphur Yellow.		Yellow Parts of large Dragon Fly.	Various Coloured Snap dragon.	Sulphur
63	Primrose Yellow.		Pale Canary Bird.	Wild Primrose	Pale coloured Sulphur.
64	Wax Yellow.		Larva of Larva Water Beetle.	Greenish Parts of Nymphed Apple.	Semi Opal.
65	Lemon Yellow.		Large Wasp or Hornet.	Shrubby Goldlocks.	Yellow Orpiment.
66	Gamboge Yellow.		Wings of Goldfinch. Canary Bird.	Yellow Jasmine.	High coloured Sulphur.
67	King's Yellow.		Head of Golden Pheasant.	Yellow Tulip. Cinquefoil.	
68	Saffron Yellow.		Tail Coverts of Golden Pheasant.	Anthers of Saffron Crocus.	

• 41 Extract of Abraham Gottlob Werner's *Werner's Nomenclature* from 1821.



• 43 MERYON, Charles, *Ghost Ship*, date unknown, oil pastel on paper, size unknown, Musée du Louvre.

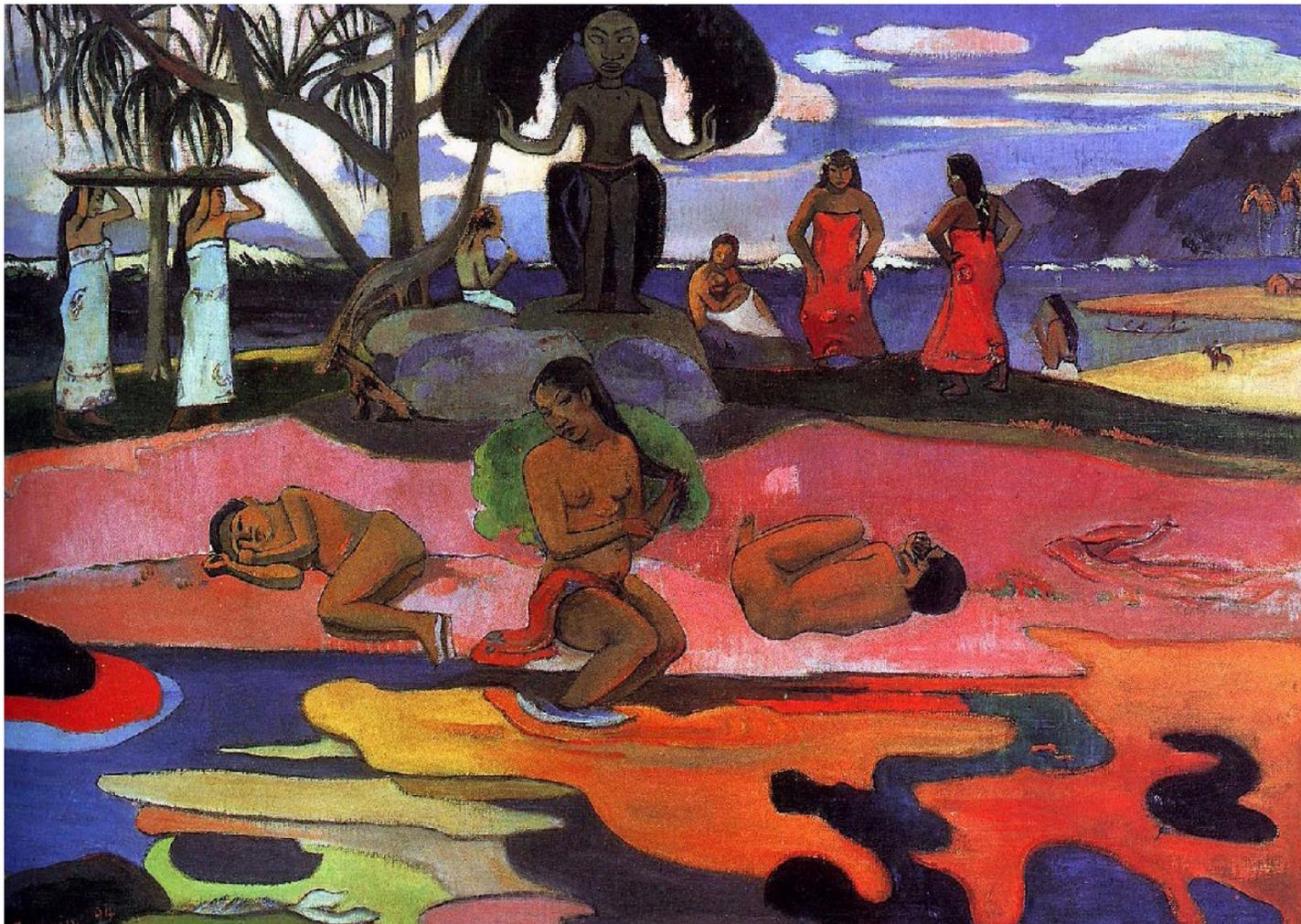
• 42 TURNER, William, *Steamship in Snowstorm*, 1842, oil on canvas, 41 cm x 122 cm, J. Paul Getty Museum.



• 44 One of Chevreul's color plates comparing colors on different backgrounds. From the publication *De la loi du contraste simultané des couleurs* from 1839.



• 45 Chevreul's 12 graded *Cercles chromatiques* published the first time in 1839.



• 46 GAUGUIN, Paul, *Mahana no atua*, 1894, oil on canvas, 91 cm x 68 cm, Art Institute of Chicago.



• 47 VAN GOGH, Vincent, *Route avec cyprès et ciel étoilé*, 1890, oil on canvas, 92 cm x 73 cm, Kröller-Müller Museum.



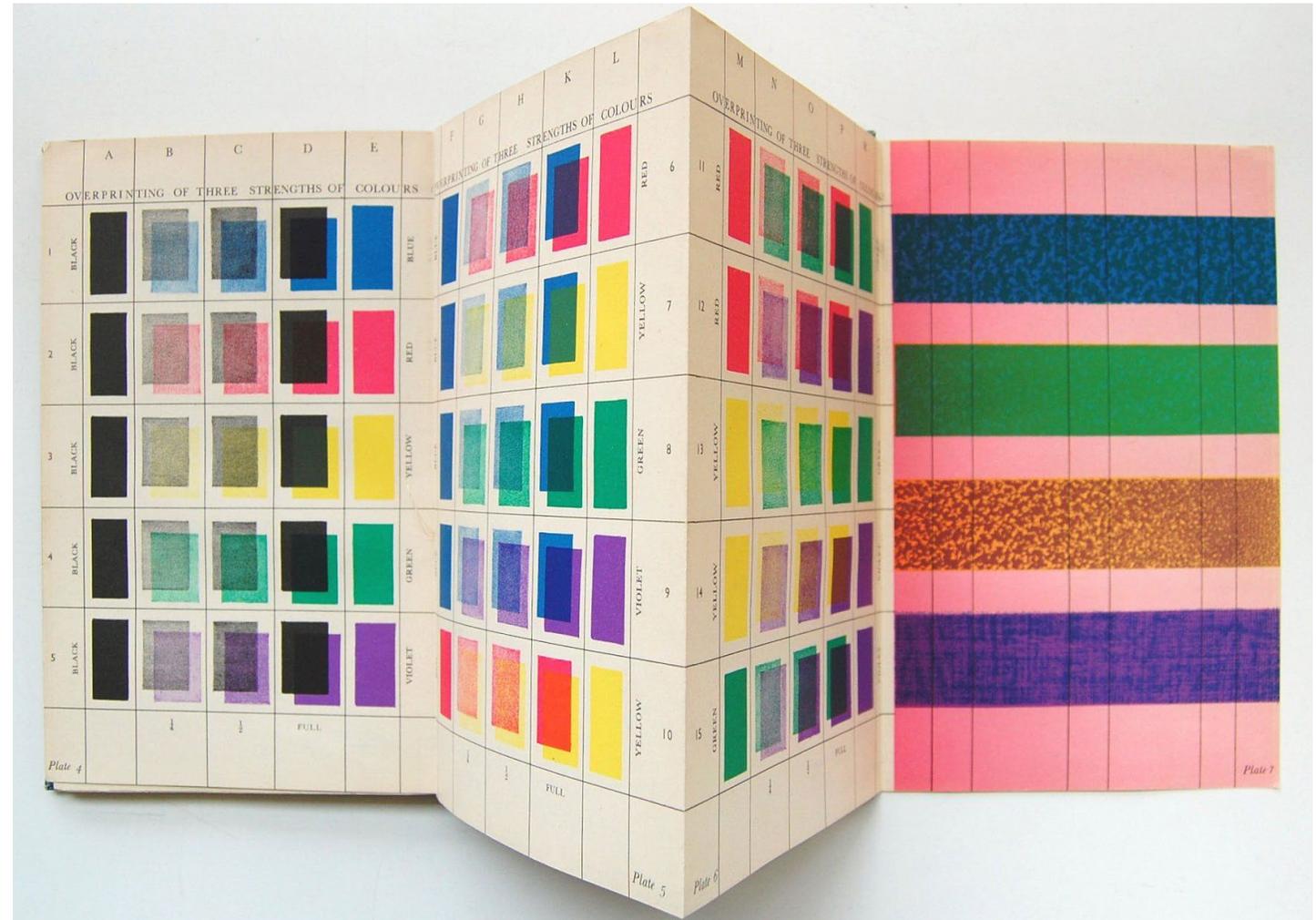
• 48 SIMS, Meghan, *Gaukel Green*, 2016, oil on canvas, 61 cm x 61 cm, place of conservation unknown.



• 49 SIMS, Meghan, *Multicultural Texter*, 2016, oil on canvas, 76 cm x 61 cm, place of conservation unknown.



• 50 SIMS, Meghan, *Wrong Way*, 2016, oil on canvas, 76 cm x 61 cm, place of conservation unknown.



• 51 ARSHAM, Moon Phases I, 2017, material unknown, 162.6 x 162.6 x 36.8 cm, place of conservation unknown.

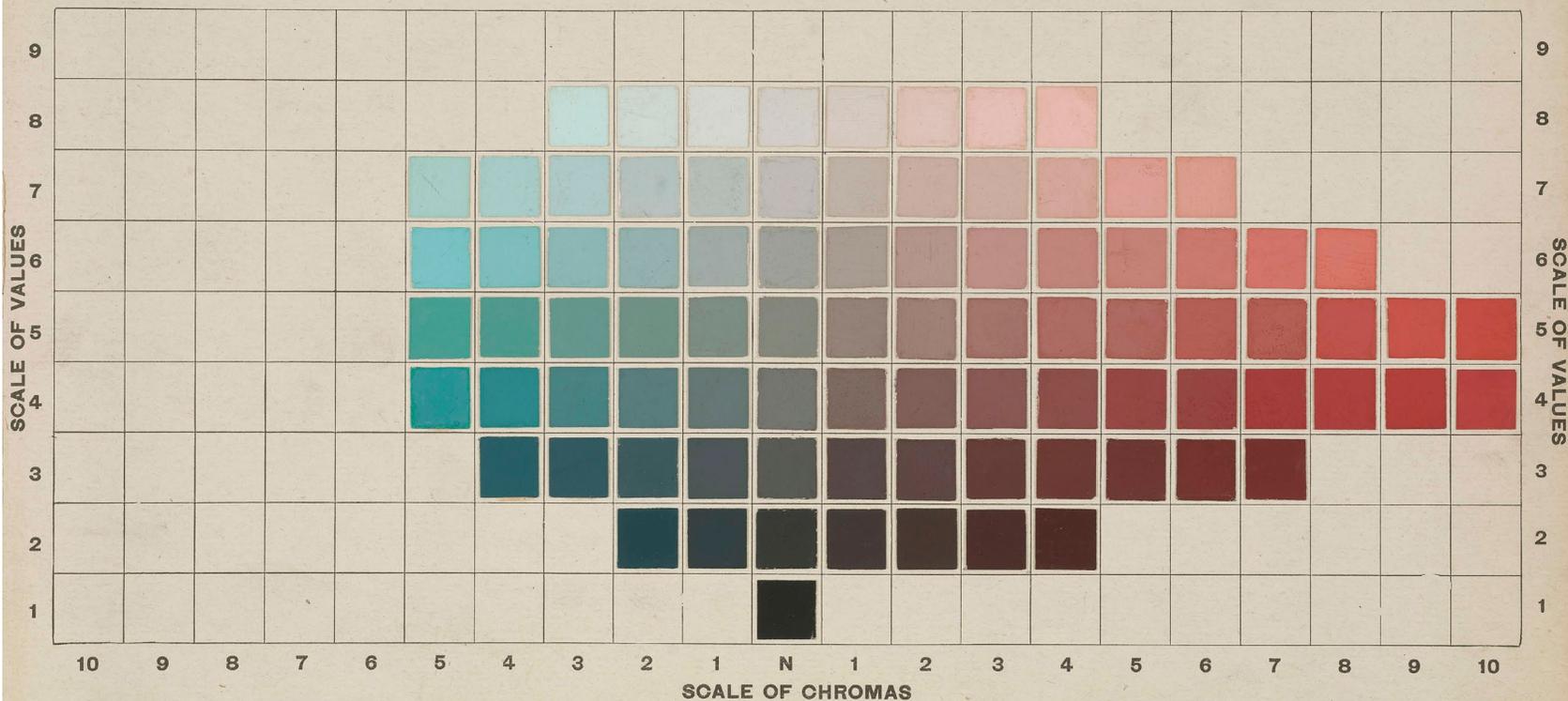
• 52 Thomas E. Griffitts' book *The Technique of Colour Printing by Lithography* from 1940.

MUNSELL COLOR SYSTEM

ATLAS
—OF—
COLOR CHARTS.

COPYRIGHT BY A. H. MUNSELL, 1907-1915.
PATENTED JUNE 26, 1906.

CHART
R



RED AND BLUE-GREEN CHART.

This chart presents a vertical plane passed through the axis of the color solid and bearing the complementary hues, red and blue-green. This pair of opposite hues is shown in regular measured scales from black to white, and from greyness to the strongest color made in stable pigment.

VALUES of red and blue-green range vertically from black (0) to white (10). CHROMAS or strengths of color range horizontally from neutral gray to the maximum (10).

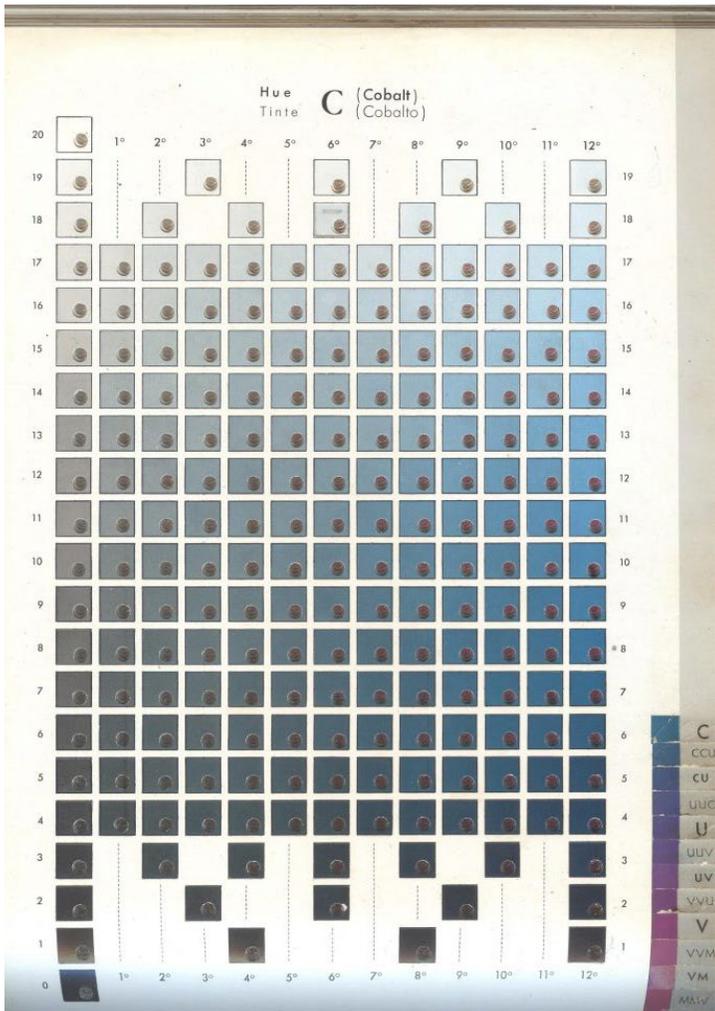
Each step in these color scales bears an appropriate symbol describing its light and its strength. Thus $R_{1\frac{1}{2}}$ is vermilion, the standard red of the system, which exhibits 100% of chromatic strength and reflects 40% of the incident light. Its opposite $BG_{\frac{1}{2}}$ reflects the same percentage of light but only 50% of chroma. To balance this pair the areas must be inversely as the chroma, i. e., since

blue-green is but half as strong as vermilion red, twice as much is required for a balance. Attention to these measures leads to pleasing combinations.

Any chosen steps of red and blue-green upon this chart may be balanced by noting their symbols: thus light blue-green ($BG_{\frac{3}{2}}$) balances dark red ($R_{\frac{3}{2}}$) when the areas are inversely as the product of the symbols viz:-six parts of light blue-green and twenty-four parts of dark red.

Chapters III and IV of the handbook, "A Color notation," describe these balances and their combinations with other hues. The symbol on each color step is its NAME, a measure of its light and strength by which it is to be memorized, written and reproduced.

AVOID DUST, HANDLING AND EXPOSURE TO STRONG LIGHT.



• 54 Extract of the *Villalobos Colour Atlas* published by Cándido Villalobos-Domínguez and his son in 1947.



• 55 *Pantone Matching System* from 1963.

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COLOPHON

THE END OF DALTONISM
AS AN OBSTRUCTION

Master Thesis

Rachel Hoffmann

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This book can be read from both sides, with the reader taking in the color perspective of a person with a normal color vision or the daltonic vision of the artist case studies from the thesis. The daltonic perspective is an anticipation of representation and does not represent the artist's real view. As this thesis explains, a real imitation of a view is impossible, as we cannot fully know what another person's color vision looks like.

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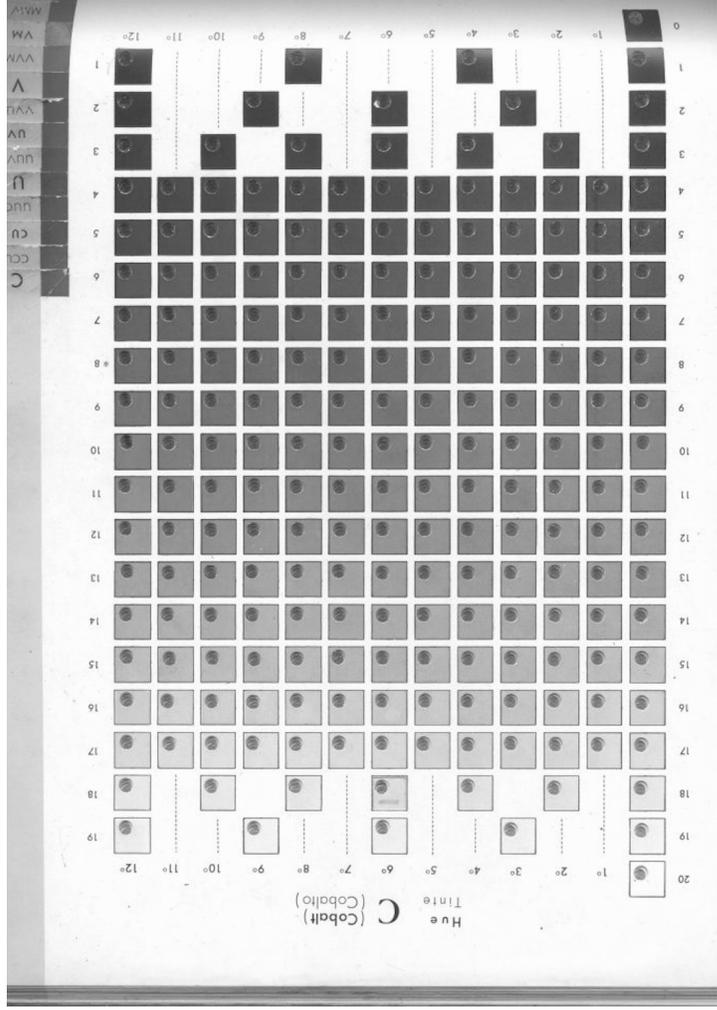
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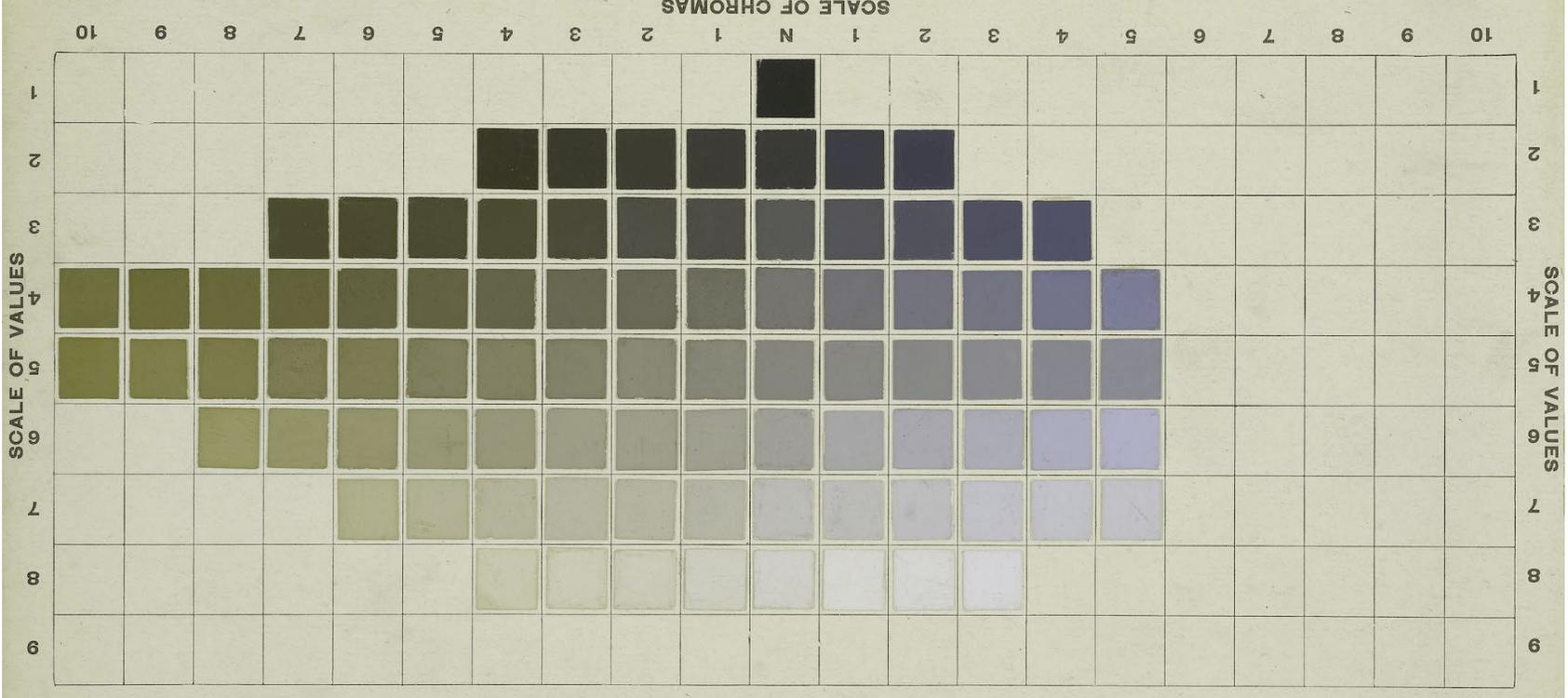
• 64 Extract of the Villalobos Colour Atlas published by Cándido Villalobos-Domínguez and his son in 1947.

• 55 Pantone Matching System from 1963.

ATLAS

—OF—
COLOR CHARTS.

COPYRIGHT BY A. H. MUNSELL, 1907-1915.
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RED AND BLUE-GREEN CHART.

This chart presents a vertical plane passed through the axis of the color solid and bearing the complementary hues, red and blue-green. This pair of opposite hues is shown in regular measured scales from black to white, and from greyness to the strong, at color made in stable pigment.

VALUES of red and blue-green range vertically from black (0) to white (10). CHROMAS or strengths of color range horizontally from neutral gray to the maximum (10).

Each step in these color scales bears an appropriate symbol describing its light and its strength. Thus R₁ is vermilion, the standard red of the system, which exhibits 100% of chromatic strength and reflects 40% of the incident light. Its opposite B₁ reflects the same percentage of light but only 50% of chroma. To balance this pair the areas must be inversely as the chroma, i. e., since

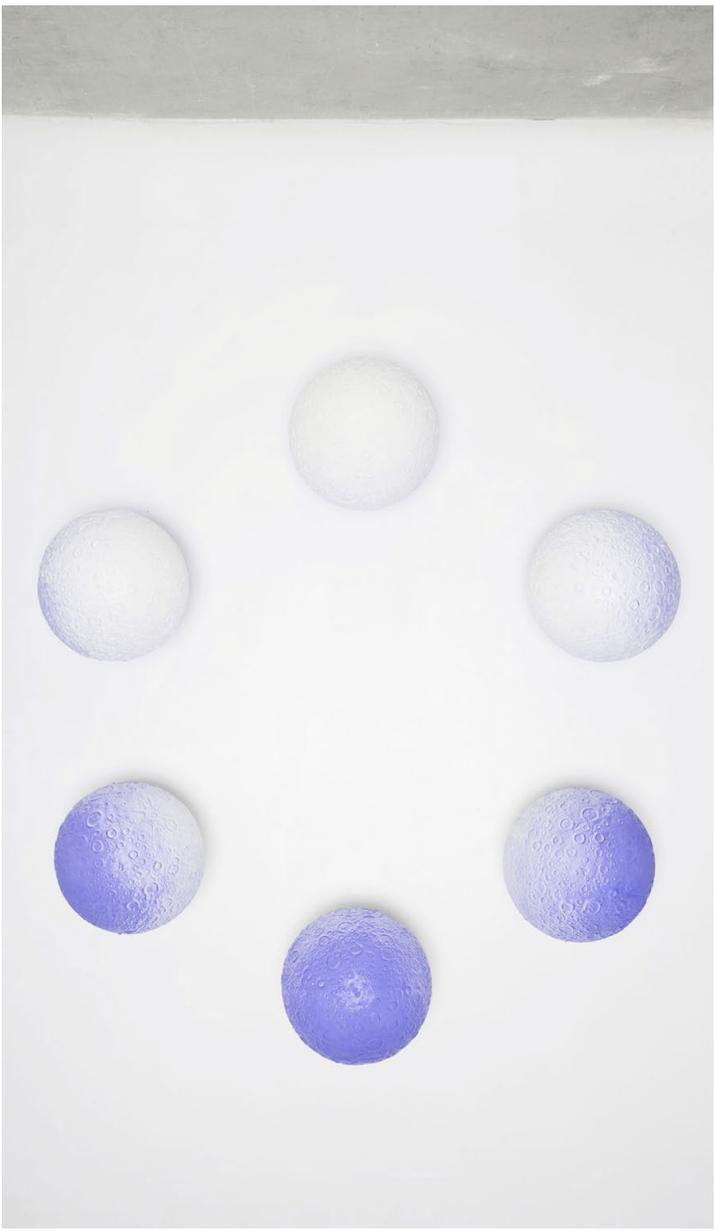
blue-green is but half as strong as vermilion red, twice as much is required for a balance. Attention to these measures leads to pleasing combinations.

Any chosen steps of red and blue-green upon this chart may be balanced by noting their symbols; thus light blue-green (B₃) balances dark red (R₃) when the areas are inversely as the product of the symbols viz: six parts of light blue-green and twenty-four parts of dark red.

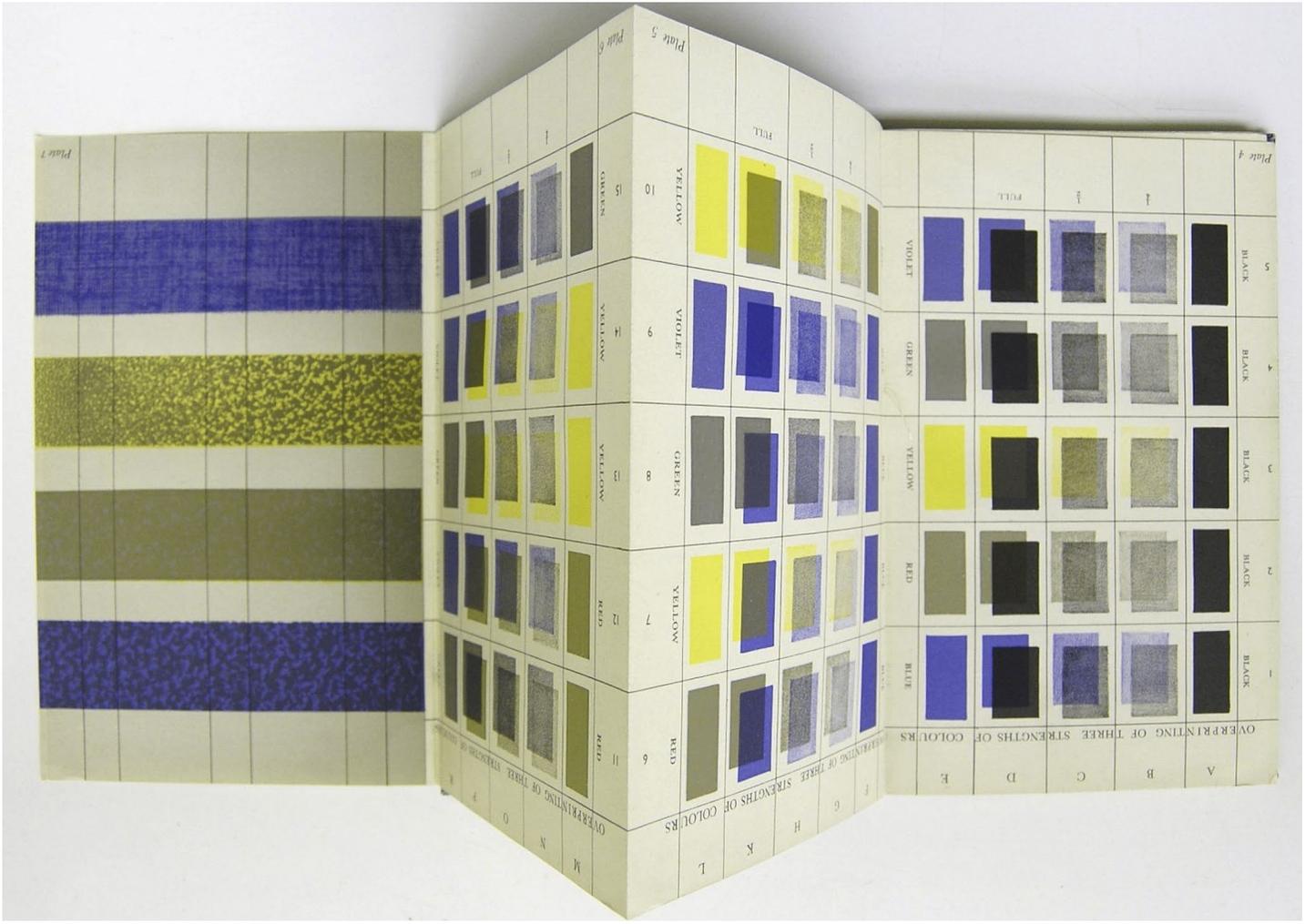
Chapters III and IV of the handbook, "A Color notation," describe these balances and their combinations with other hues. The symbol on each color step is its NAME, a measure of its light and strength by which it is to be memorized, written and reproduced.

AVOID DUST, HANDLING AND EXPOSURE TO STRONG LIGHT.

CHART
R



• 51 ARSHAM, Moon Phases I, 2017, material unknown, 162.6 × 36.8 cm, place of conservation unknown.



• 52 Thomas E. Griggs' book *The Technique of Colour Printing by Lithography* from 1940.



• 48 SIMS, Meghan,
Gaukel Green, 2016,
oil on canvas, 61 cm x 61 cm,
place of conservation
unknown.



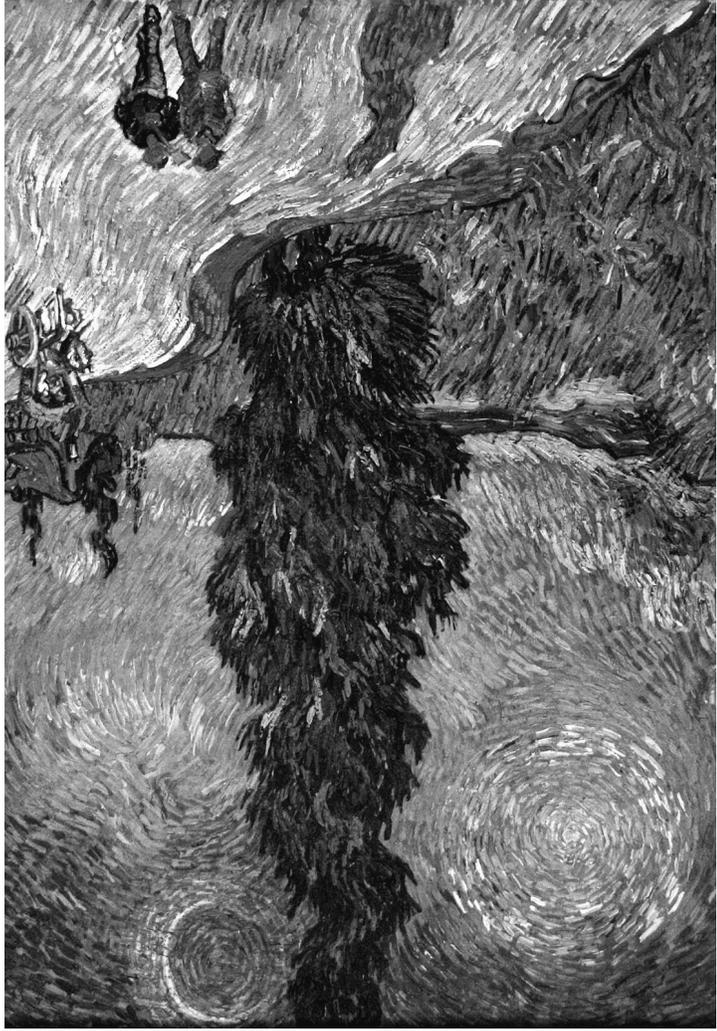
• 49 SIMS, Meghan, *Multicultural Texter*, 2016, oil on canvas,
76 cm x 61 cm, place of conservation unknown.



• 50 SIMS, Meghan, *Wrong Way*, 2016, oil on canvas,
76 cm x 61 cm, place of conservation unknown.



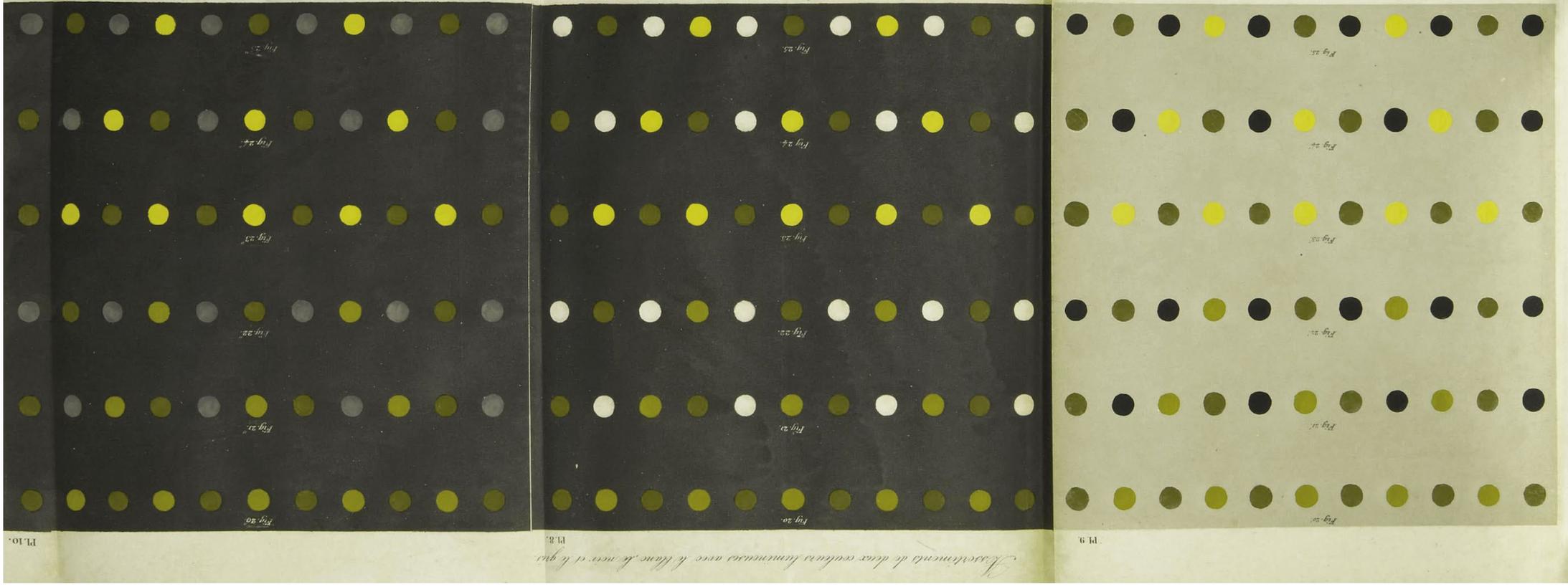
• 46 GAUGUIN, Paul, *Mahana no atua*, 1894, oil on canvas, 91 cm x 68 cm, Art Institute of Chicago.



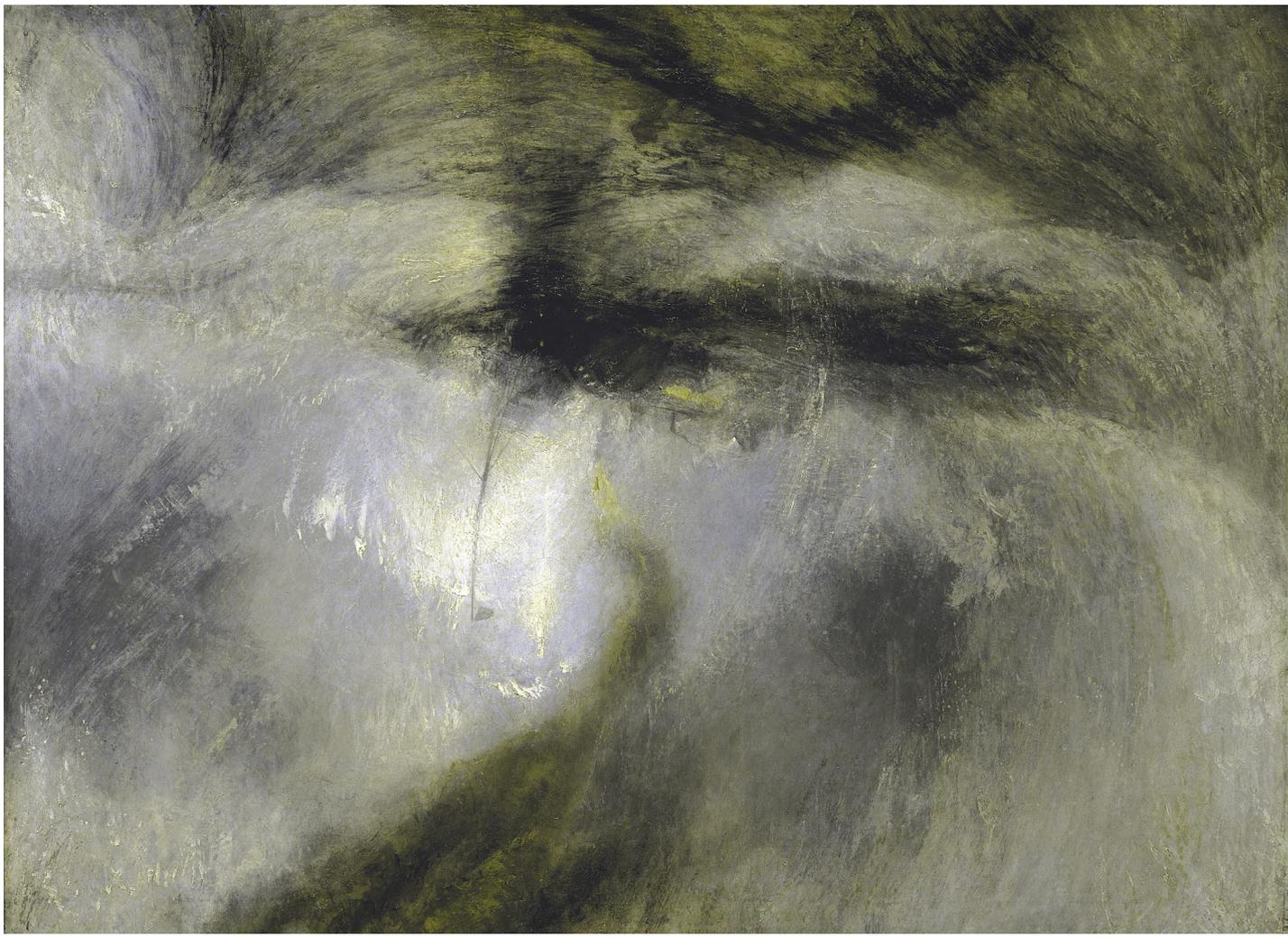
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• 45 Chevreul's 12 graded *Cercles chromatiques* published the first time in 1839.





• 44 One of Chevreul's color plates comparing colors on different backgrounds. From the publication *De la loi du contraste simultané des couleurs* from 1839.



• 42 TURNER, William, *Steamship in Snowstorm*, 1842, oil on canvas, 41 cm x 122 cm, J. Paul Getty Museum.



• 43 MERYON, Charles, *Ghost Ship*, date unknown, oil pastel on paper, size unknown, Musée du Louvre.

BLUES

No.	Names	ANIMAL	VEGETABLE	MINERAL
24	Scarlet Blue	Throat of Blue Titmouse.	Stamina of Single Maple & Menzies.	Blue Copper Ore.
25	Prussian Blue	Beamy Spot on Wing of Mallard Drake.	Stamina of Bluish Purple Anemone.	Blue Copper Ore
26	Indigo Blue			Blue Copper Ore.
27	China Blue	Rhinoceros & Venus	Back Parts of Gentian Flower.	Blue Copper Ore from Chessy.
28	Azure Blue.	Breast of Emerald-crested Manakin.	Grape Hyacinth.	Blue Copper Ore.
29	Ultra marine Blue.	Upper Side of the Wings of small blue Heath Butterfly.	Borage.	Azure Stone or Lapis Lazuli.
30	Flax-blue Flower.	Light Parts of the Margin of the Wings of Dew's Butterfly.	Flax flower.	Blue Copper Ore
31	Berlin Blue.	Wing Feathers of Jay.	Hepatica.	Blue Sapphire.
32	Verditer Blue			Lenticular Ore.
33	Greenish Blue	Great Fennel Turquoise.	Great Fennel Flower.	
34	Emerald Blue.	Back of blue Titmouse	Small Fennel Flower.	Iron Earth.

• 39 Extract of Abraham Gottlob Werner's Nomenclature from 1821.

RED.

No.	Names.	ANIMAL.	VEGETABLE.	MINERAL.
82	Tile Red.	Breast of the Cock Bullfinch.	Shrubby Popperet.	Porcelain Jasper.
83	Hyacinth Red.	Red Spots of the Lagoon Apharus Fly.	Rennetle Apple.	Hyacinth.
84	Scarlet Red.	Scarlet Tits or Curlew. Mark on Head of Red grouse.	Large red Oriental Poppy. Red Peas. Indian Peas.	Light red Cinnabar.
85	Vermilion Red.	Red Coral.	Love Apple.	Cinnabar.
86	Aurora Red.	Vent covers of Red Wood Pecker.	Naked Apple.	Red Opuntia.
87	Arterial Red.	Head of the Cock Goldfinch.	Corn Poppy.	Cherry.
88	Peach Red.	Human Skin.	Larkspur.	Heavy Spar. Limestone.
89	Rose Red.		Common Garden Rose.	Figure Stone.
90	Peach Blossom Red.		Peach Blossom.	Red Cobalt Ore.

• 40 Extract of Abraham Gottlob Werner's Nomenclature from 1821.

YELLOWS.

No.	Names.	ANIMAL	VEGETABLE	MINERAL.
62	Sulphur Yellow.	Yellow Parts of large Dragon Fly.	Various coloured Snap dragon.	Sulphur
63	Periwinkle Yellow.	Pale Canary Bird.	Wild Pyrose.	Yellow coloured Sulphur.
64	Race Yellow.	Laeva of large Water Beetle.	Marigold. Apple.	Greenish Part of Scum Opal.
65	Lemon Yellow.	Large Wasp or Hornet.	Shrubby Goldlocks.	Yellow Opuntia.
66	Gamboge Yellow.	Wings of Goldfinch. Canary Bird.	Yellow Jasmine.	High coloured Sulphur.
67	Kings Yellow.	Head of Golden Pheasant.	Yellow Yolk.	Canary Yolk.
68	Saffron Yellow.	Tail Feathers of Golden Antelope or Indian Crocus.		

• 41 Extract of Abraham Gottlob Werner's Nomenclature from 1821.



• 33 SIMS, Meghan, *Legacy Greens*, 2010, oil on canvas, 61 cm x 61 cm, place of conservation unknown.



• 34 Meghan Sims' art exhibited with the photography of the scene next to it.



• 31 SIMS, Meghan, *City Silhouettes 1*, 2010, acrylic on canvas, 66 cm x 76 cm, place of conservation unknown.



• 32 SIMS, Meghan, *City Silhouettes 3*, 2010, acrylic on canvas, 66 cm x 76 cm, place of conservation unknown.



• 29 Neil Harbisson doing a sound portrait of Judi Dench.



• 28 Neil Harbisson doing a sound portrait of Phillip Glass.

• 30 Neil Harbisson doing a sound portrait of James Cameron.





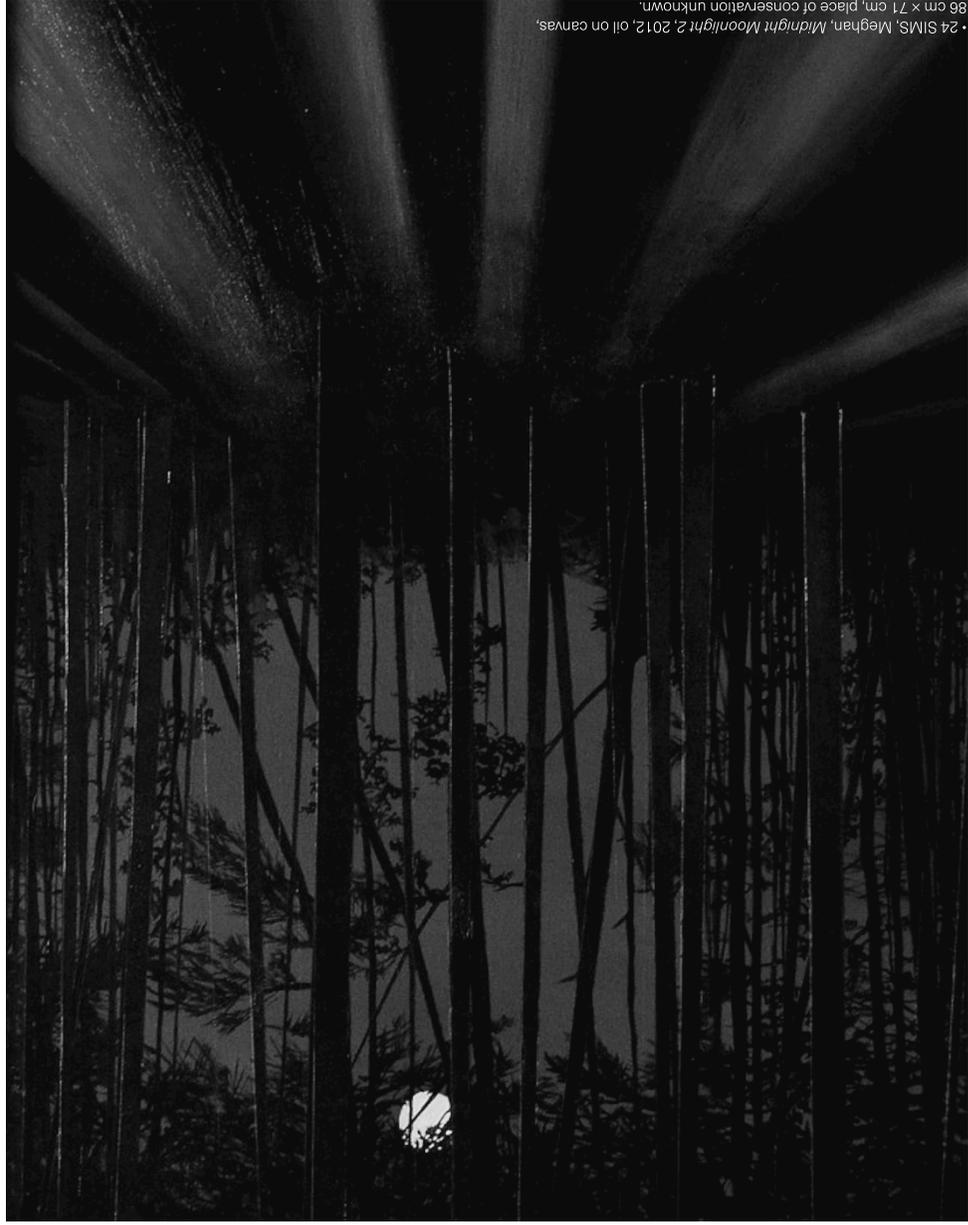
• 26 ARSHAM, Daniel, *Lunar Garden*, 2017, white and colored sand, size unknown, temporary exhibition at the gallery at Cadillac House New York.



• 27 ARSHAM, Daniel, *Lunar Garden*, 2017, white and colored sand, size unknown, temporary exhibition at the gallery at Cadillac House New York.



• 25 SIMS, Meghan, *Watered Down Coffee*, 2016, oil on canvas, 61 cm x 61 cm, place of conservation unknown.



• 24 SIMS, Meghan, *Midnight Moonlight 2*, 2012, oil on canvas, 86 cm x 71 cm, place of conservation unknown.



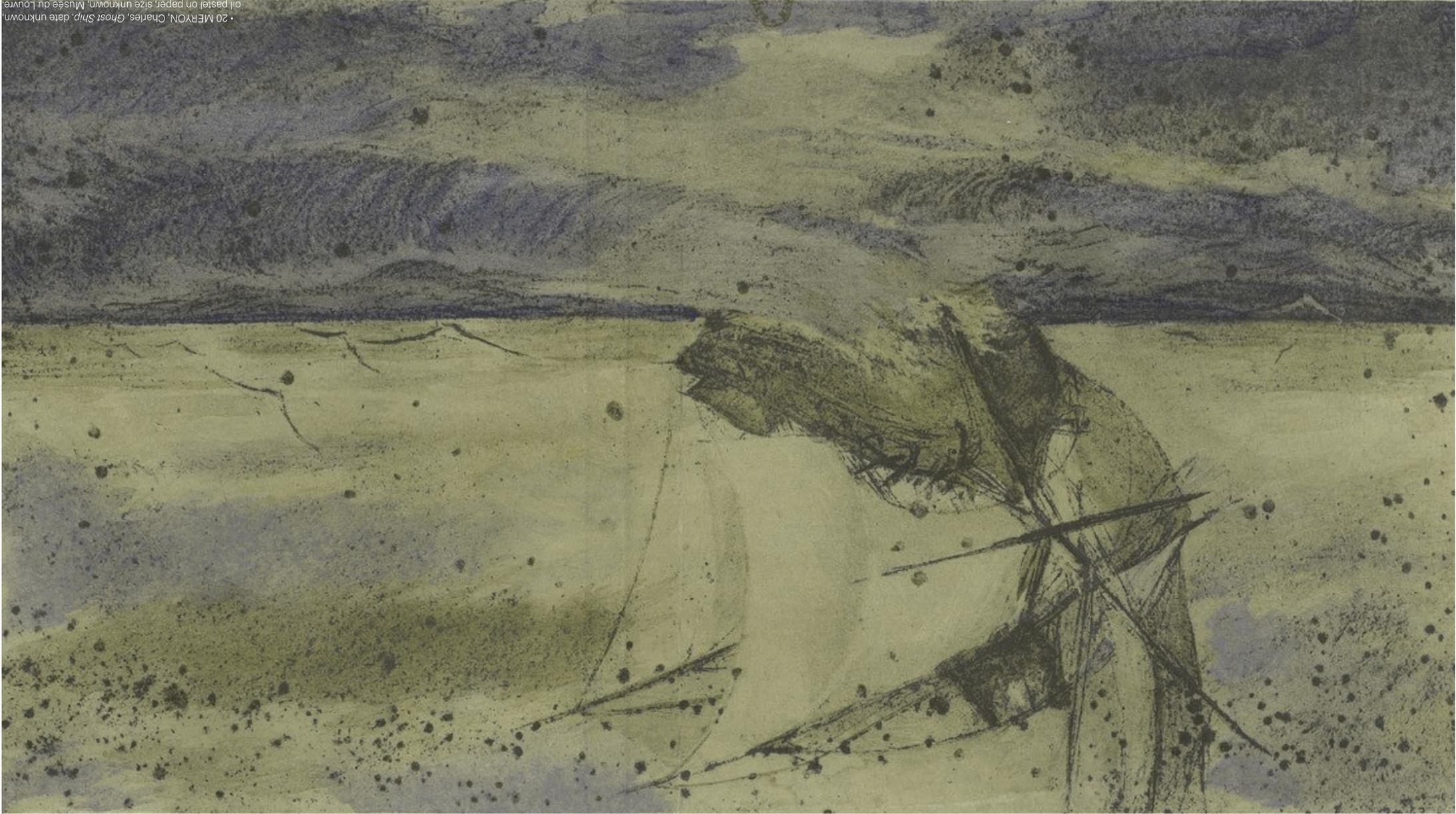
• 21 Meghan Sims' coded paint tubes.



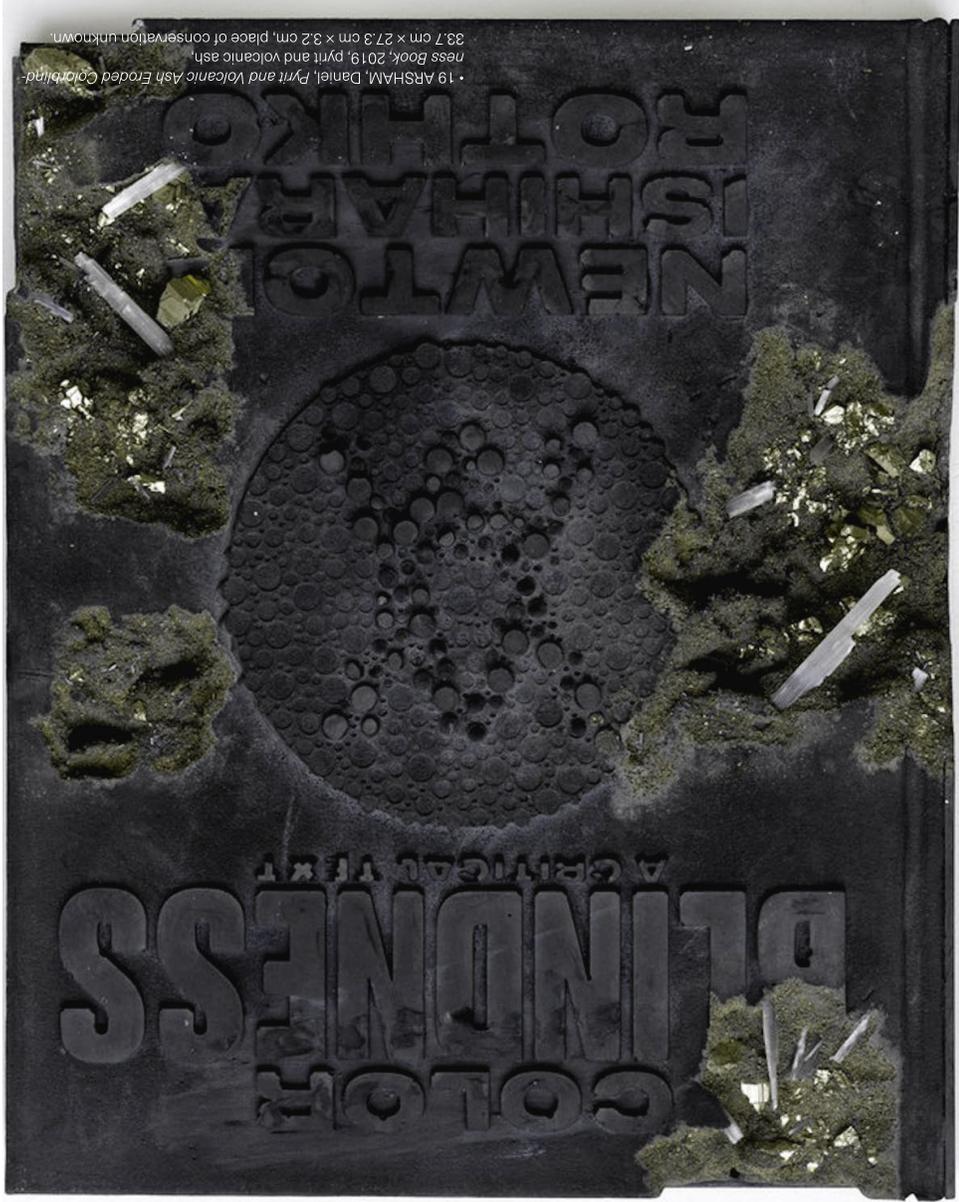
• 22 Meghan Sims painting with the aid of her red tinted glasses.



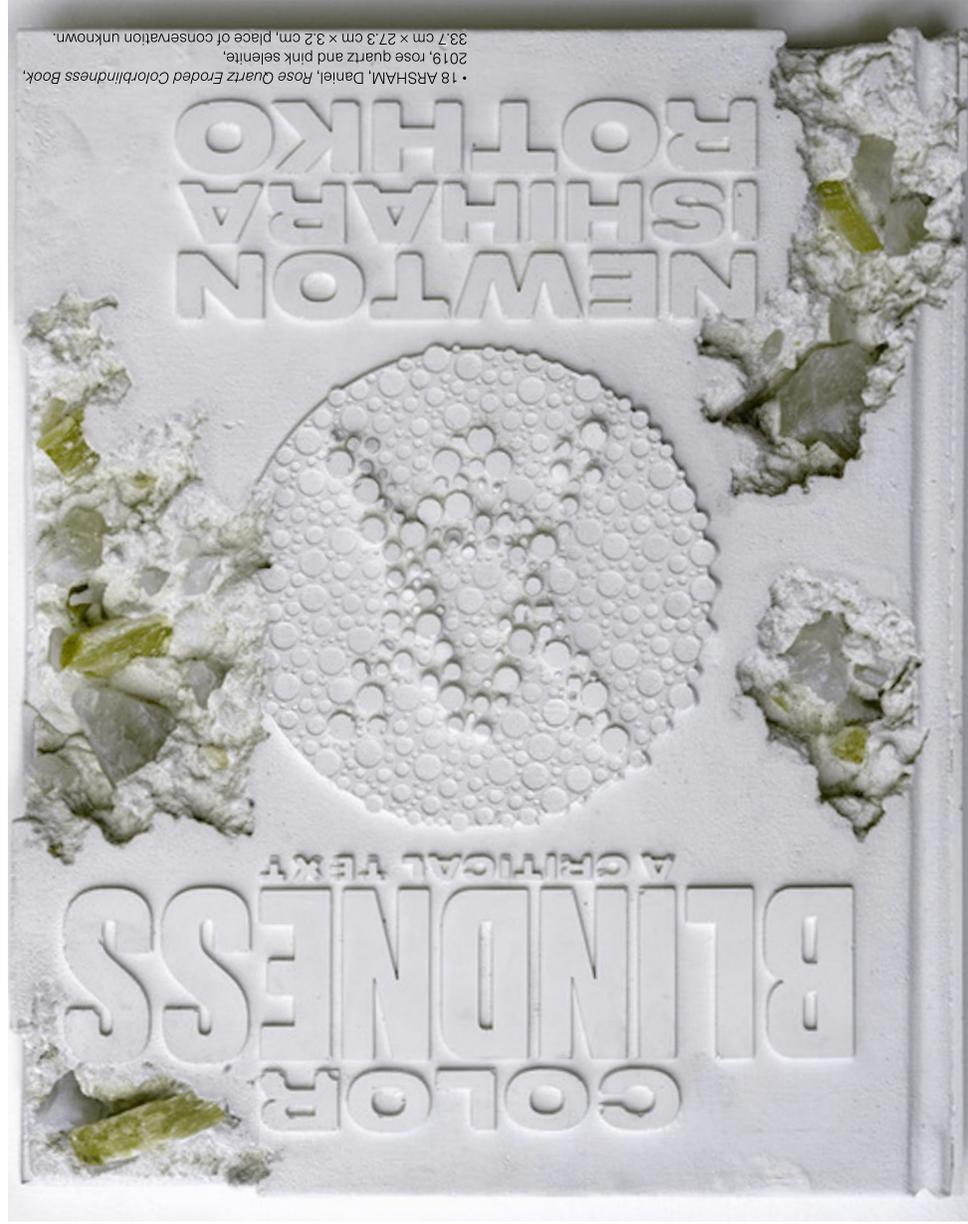
• 23 Meghan Sims comparing the color of paint with the colors of a photo she took.



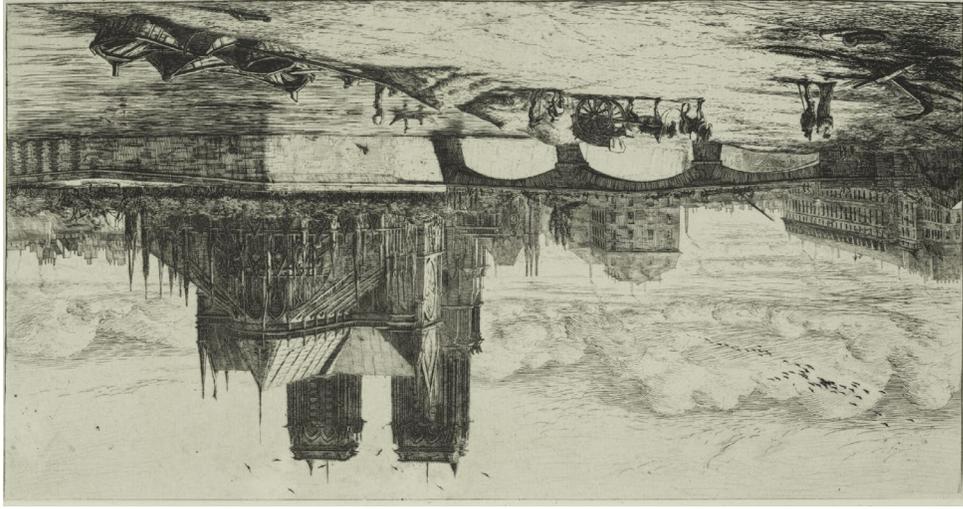
• 20 MERZON, Charles, *Ghost Ship*, date unknown, oil pastel on paper, size unknown, Musée du Louvre.



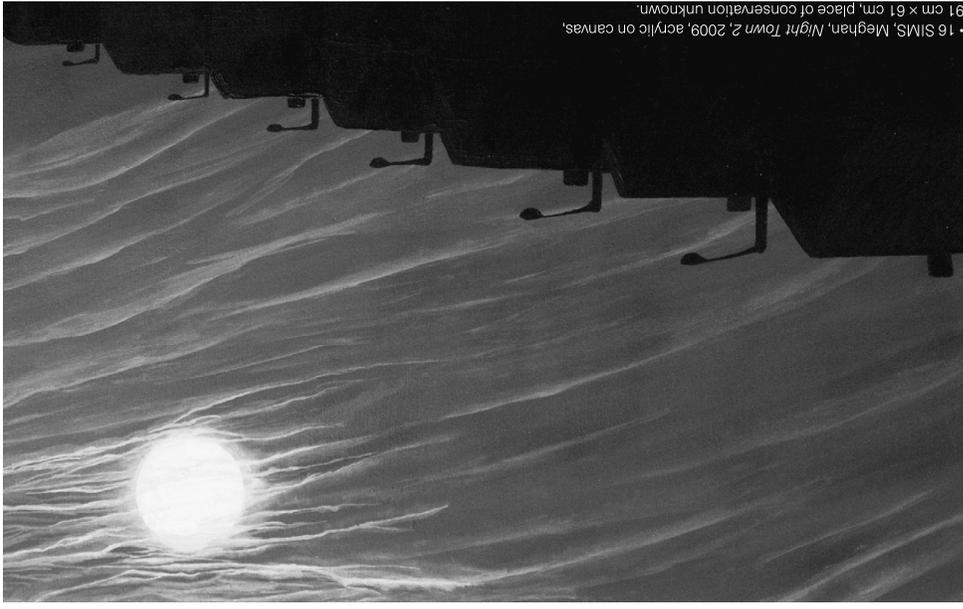
• 19 ARSHAM, Daniel, *Pyrit and Volcanic Ash Eroded Colorblindness Book*, 2019, pyrit and volcanic ash, 38.7 cm x 27.3 cm x 3.2 cm, place of conservation unknown.



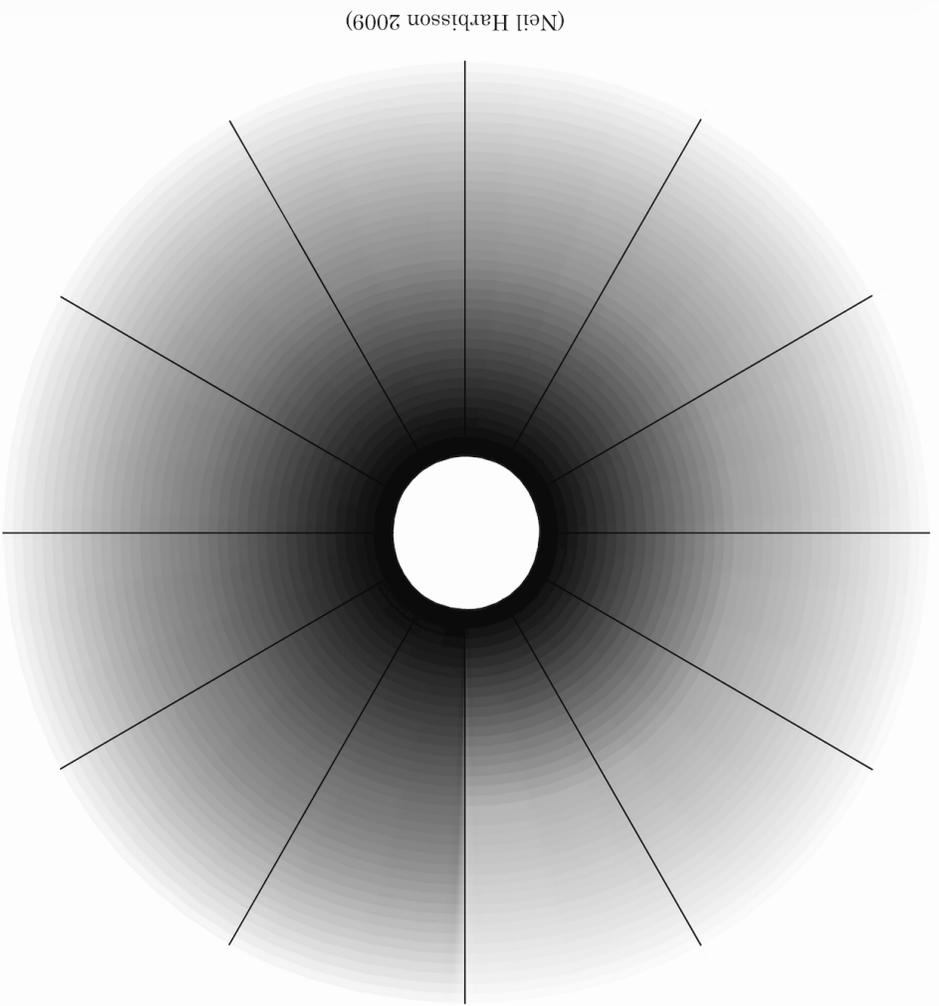
• 18 ARSHAM, Daniel, *Rose Quartz Eroded Colorblindness Book*, 2019, rose quartz and pink selenite, 38.7 cm x 27.3 cm x 3.2 cm, place of conservation unknown.



• 15 MERYON, Charles, *L'Abside de Notre-Dame de Paris*, 1854, etching and drypoint printed in black ink on laid paper, 16.5 cm x 29.8 cm, National Gallery of Art, Washington, D.C.



• 16 SIMS, Meghan, *Night Town 2*, 2009, acrylic on canvas, 91 cm x 61 cm, place of conservation unknown.

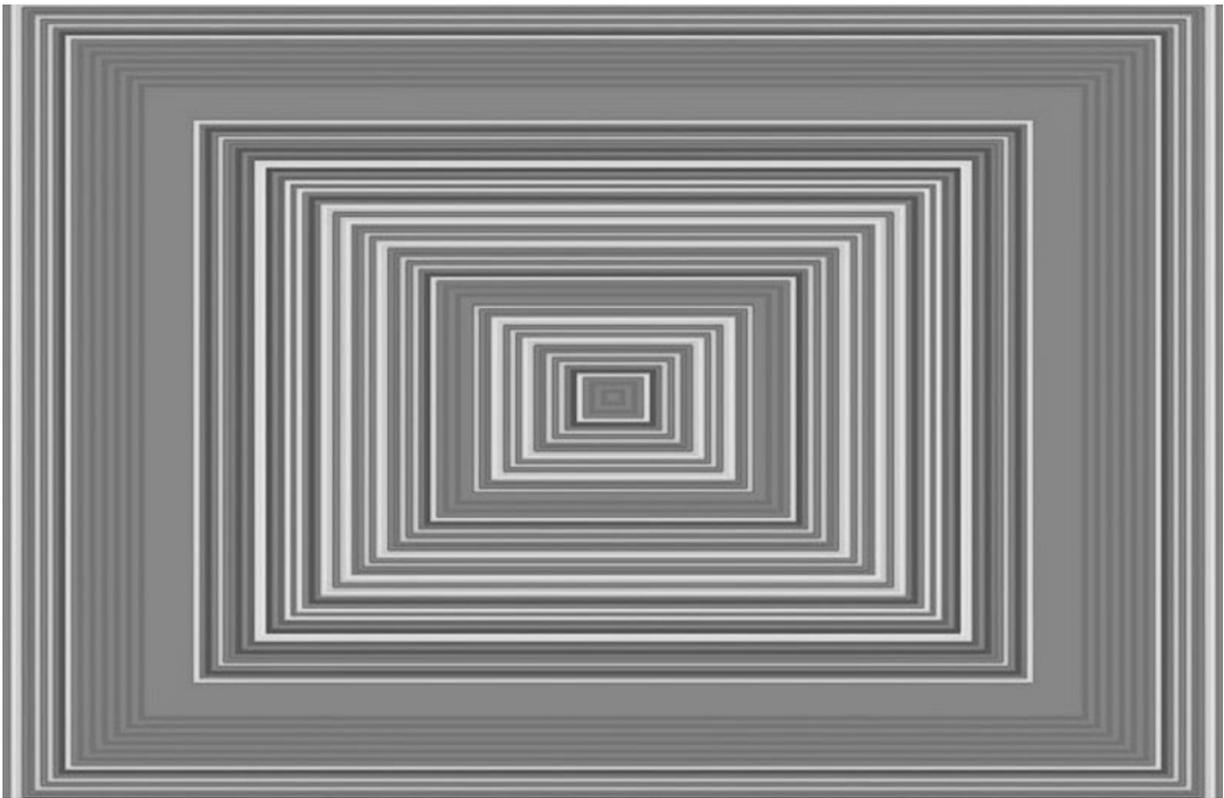


THE HUMAN COLOUR WHEEL
 Colour wheel based on the hue and light detected on human skins.

(Neil Harbisson 2009)



• 13 Profile view of Neil Harbisson with his antenna implant.



• 14 HARRIBSON, Neil, *Für Elise*, date unknown, medium unknown, size unknown, place of conservation unknown.



• 11 ARSHAM, Daniel, *Moon Globe Black*, 2016, material unknown, size unknown, place of conservation unknown.



• 12 ARSHAM, Daniel, *Televisions*, 2015, selenite (left) glacial rock, crushed marble, shattered glass and hydrostone (right), 24 cm x 35 cm x 25 cm (size of one television), place of conservation unknown.

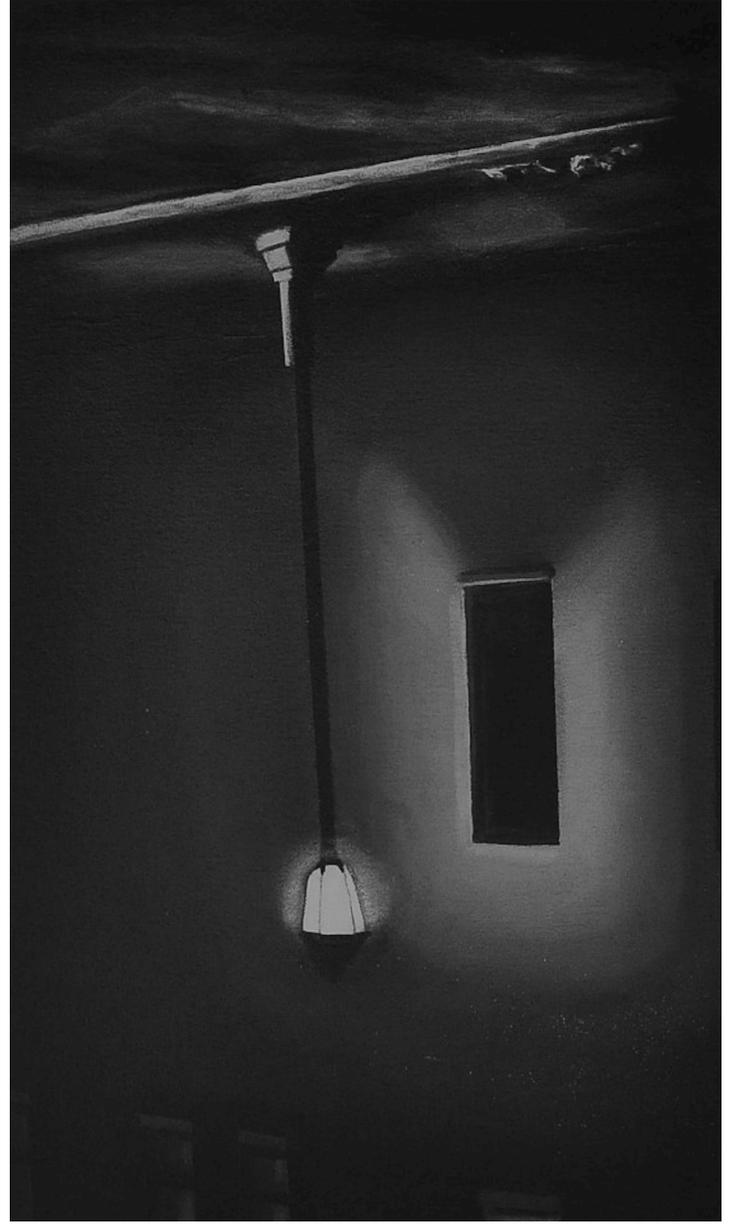


• 10 ARSHAM, Daniel, *Baseball Pile*, 2010, selenite, size unknown, place of conservation unknown.

• 9 SIMS, Meghan, *Night Life*, 2009, acrylic on canvas, 91 cm x 61 cm, place of conservation unknown.



• 8 SIMS, Meghan, *King at Queen*, 2012, acrylic on canvas, 30 cm x 25 cm, place of conservation unknown.





• 7 SIMS, Meghan, *David Street at Night*, 2011, acrylic on canvas, 30 cm x 23 cm, place of conservation unknown.

• 6 SIMS, Meghan, *Queen at Courtland*, 2012, acrylic on canvas, 51 cm x 41 cm, place of conservation unknown.



• 3 SIMS, Meghan, *Courtland at David*, 2010, oil on canvas, 25 cm x 20 cm, place of conservation unknown.



• 5 SIMS, Meghan, *Breithaupt Pines*, 2010, oil on canvas, 76 cm x 61 cm, place of conservation unknown.

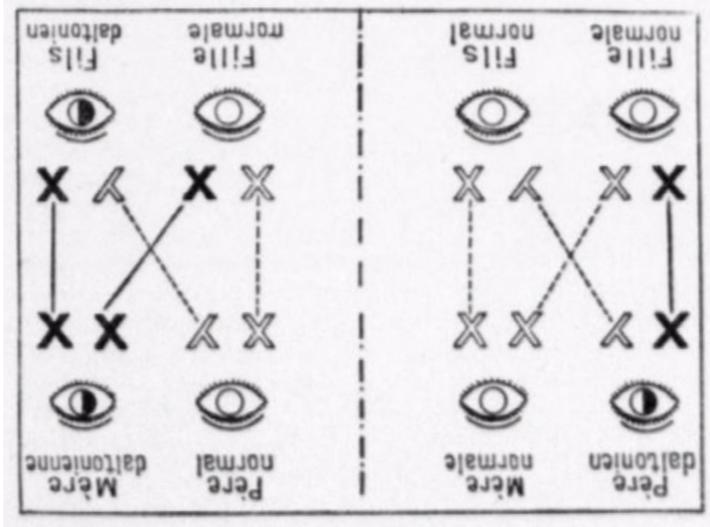
• 4 SIMS, Meghan, *Victoria Park Trees*, 2010, oil on canvas, 91 cm x 66 cm, place of conservation unknown.



IMAGES

	Normal Vision	92%
	Deuteranomaly	2.7%
	Protanomaly	0.66%
	Protanopia	0.59%
	Deuteranopia	0.56%
	Tritanopia	0.016%
	Tritanomaly	0.01%
	Achromatopsia	<0.0001%

• 1 Daltonism chart: Normal color vision in comparison with the different forms of daltonism.



• 2 Visualisation of the sex-related inheritance of color blindness.

us to understand what they see, but also to make people see something beyond their own vision that might present them a new visual and thematic perspective.

Their approaches tempt the viewers to question their own perception and rethink their preconceptions and understanding of daltonism in general. Further, they were able to help color-blindness gain a new position in art. Thus, the artists' confrontation with their daltonism in art has led to a change in the consciousness (in regards to daltonism) of both themselves and the viewers. Therefore, the analysis carried out remove any remaining doubts that the contemporary artists, in contrast to Meryon, have managed to formulate strategies to overcome their deficient color perception and even to transform it into an artistic strength, or as the researcher and ophthalmologist Maureen Neitz had expressed in 1997, that color-deficient people have learned to survive in a world surrounded by people who see what they cannot.¹⁶²

COLOR-DEFICIENT PEOPLE HAVE LEARNED TO SURVIVE IN A WORLD SURROUNDED BY PEOPLE WHO SEE WHAT THEY CANNOT.

¹⁶² LANTHONY, Philippe, MARMÖR, Michael F., "The Dilemma of Color Deficiency and Art", *Survey of Ophthalmology*, vol. 45, n° 5, April 2001, p. 409. Note: Author had no access to the original source: NETZ, Maureen, Society and colorblindness, in 14th Biennial Eye Research Symposium, Research to prevent blindness, 1997.

bound to limits. Although the answer is probably yes, people should be aware that these limits are constantly being pushed back due to technological progress and the personal dedication of color-blind artists. The personal commitment to overcome this visual hindrance creates new forms of art and unprecedented expressions of creativity. All three contemporary artists analyzed in this paper, have developed solutions which enable them to adapt to their visual impairment and to be successful in today's art world. Although Sarah Former, Arsham's ophthalmologist commented that even if the brain is not made for major alterations of perception,¹⁶⁰ Harbisson, through the implantation of his antenna, has created a new sense. His case is proof that while science and technology constantly develop, color impaired individuals are also able to surpass their physical impairments. Accordingly, in Sims' and Arsham's case, technology has also made a major contribution and plays a pivotal role regarding how daltonic artists nowadays deal with colors. The use of photography or the reference to spectrum-wide-nining glasses was unthinkable 200 years ago. Thus, if one looks at the evolution of the handling of daltonism in art, one can relate to Maya Angelou's citation, which even though was meant figuratively, it still applies to the subject of color-blindness in art : "We are only as blind as we want to be."¹⁶¹ In this sense the cases of Sims, Arsham and Harbisson are proof of how artists managed to continue their artistic work despite severe color-blindness. These artists have unique visions, which do not only allow

THE PERSONAL COMMITMENT TO OVERCOME THIS VISUAL HINDRANCE CREATES NEW FORMS OF ART AND UNPRECEDENTED EXPRESSIONS OF CREATIVITY.

¹⁶⁰ SEMAINE, "Daniel Arsham, Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=Z0sCEl1a1Ck&list=WL&index=24&t=1341s>, accessed August 2020.
¹⁶¹ AUTHOR UNKNOWN, "Maya Angelou Unforgettable Quotes You Should Know", pmeanonline.org, <https://www.pmeanonline.org/maya-angelou-unforgettable-quotes-you-should-know/>, accessed September 2020.

Arsham and Harbisson have both shown a pronounced curiosity about the colors which they can, due to their visual impairment, only perceive distorted. This behavior is not unusual because people often develop a curiosity for things they cannot understand at first sight. When receiving previously unknown information about something that seems out of our reach, we nurture our curiosity for more. The human species constantly tries to extend its comprehension and knowledge of the unknown. However, the tools developed or used on the basis of this curiosity are not a universal remedy for every daltonic artist. As previously shown in the case of Daniel Arsham, this artist used his tool (e.g. glasses) only for a temporary period and, as a result, he now prefers to stick to his unaltered perception of things. Accordingly, Cecilia Dean explained about Arsham's change of perception: "To be color-blind and then to be given color, there's probably a double edge saw, it's not necessarily a gift. Not everyone wants another person's reality."¹⁵⁹ The case of Arsham shows that not every physical change has to be permanent but can lead to new views which influence how one comprehends and perceives daltonism itself. Thus, his personal experience has brought rather a psychological change (e.g. the preference to keep his personal, distorted view of things) rather than an optical one, which can be just as valuable.

Even if over the past decades color-blindness in art has become more and more receivable, the question arises whether the processing of colors by a daltonic artist is

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159 SEMAINE, "Daniel
Arsham, Color-blind artist: In
Full Color", youtube, (2016),
https://www.youtube.com/
watch?v=Z0sECiia1K&
list=WL&index=24&t=1341s,
accessed August 2020.

to find other ways to deal with their color-blindness. This led Myron to avoid the use of color in his work whenever necessary and to turn to engraving in order to avoid working with colors.

Besides the different methods the artists have developed to deal with their color-blindness, there further arises the question of what daltonism does to artists on a psychological level. As previously discussed, one can assume that daltonic artists live in parallel visual worlds in which they can never be sure that what they see corresponds to what the public sees and vice versa. Thus, even though Meghan Sims has unquestionably developed an impressive coding system which allows her to accurately process colors, the question also arises in her case: Why an artist would create a piece of work in a spectrum they can't really see. By analyzing this question psychological-ly it was shown that one can assume that Sims strives for artistic recognition by painting the colors in her paintings as close as possible to the reality of the underlying photos. The fact that Sims measures her artistic talent by how the public perceives her work shows that personally she has not fully accepted her daltonism yet. In this way, the use of color in a figurative sense could be much more desirable for Sims and would offer her space for her own color interpretation and expressiveness. Nevertheless, the achievements that Sims has made as a color-blind artist are still remarkable.

veloping an art form from it, for which he is the only artist who is able to carry it out. His unique artistic expression enables him to be invited to talks in order to bring his art closer to people. Despite initial skepticism his art impresses people every day. Furthermore, Harbisson's curiosity and his optical aberration have led him to strive for new perceptual possibilities and to further develop cyborgism as well as new body organs to create new senses and with it, new art.

CONCLUSION

This paper pursued the core objective, based on the case studies of four specific artists, to analyze the extent to which color-blind artists are affected by their visual impairment, how their approaches to face this visual deficiency differ between each other, as well as how daltonism itself is recognized in the art world. The investigated case studies reveal that the handling of daltonism in art seems to have changed over time on a personal artistic level as well as on a public awareness level. Even if color-blindness is not visible to outsiders, this visual deficiency seems to affect the personal subconsciousness of artists. The approach of contemporary artists to deal with color-blindness is in comparison to the approach of Merzon fundamentally different. Nowadays, artists have the opportunity to use tools (e.g. coding system, glasses, antenna) that enable them to expand their visual perception and actively address the problem of visual impairment by learning how to properly apply colors and how they affect normal-vision people. Thus today, artists can artistically explore differences in perception and therefore seek to create, despite their visual limitations, new ways of processing colors which result in unprecedented forms of art. Previously, however, during Merzon's lifetime, these tools were not accessible and artists had

about how he handles colors and perceives different objects so that they could explore his art from a new angle.¹⁵⁶ Thereby, he has not disappointed the viewers of his art. His art is seen by many as a successful attempt to "overcome his color-blindness" as film producer Jane Rosenthal explains. In reference she describes Arsham's application of his colors through the use of his glasses to have an extraordinary depth.¹⁵⁷ Further, it is not presumptuous to say that Arsham can also be called successful on a personal level, since, through his curiosity in colors and the experience of the glasses, he has succeeded in transforming an initial deficit into a personal appreciation a stand-alone feature.

The recognition of Neil Harbisson's art can be seen in the fact that his works have been exhibited in various places around the world, such as the 54th Venice Biennale or various other recognized galleries and museums.¹⁵⁸ His extravagant appearance, which also includes his antennae, his open approach to his daltonism as well as his unique method of perceiving color through sound, have helped Harbisson to become well known in the art world. However, the artist is not only known for his unique new sense, but his work also meets with great recognition and enthusiasm among art enthusiasts. Harbisson's success comes primarily from the fact that he has developed a unique artistic expression with which he further expands the notion of color in relation to sound in art. He has succeeded in expanding his limited color perception and de-

¹⁵⁶ SEMAINE, "Daniel Arsham Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZsEClia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

¹⁵⁷ SEMAINE, "Daniel Arsham Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZsEClia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

¹⁵⁸ AUTHOR UNKNOWN, "Neil Harbisson", [saatchiart.com/neilharbisson](https://www.saatchiart.com/neilharbisson), (date unknown), <https://www.saatchiart.com/neilharbisson>, accessed September 2020.

recognize and reproduce colors in the best possible way. Through this approach, which has certainly been facilitated by the technological progress of today, Sims and Arsham were able to overcome their visual deficiency. By integrating their color-blindness into their art rather than bypassing it, they have been able to develop and shape an unmistakable new art style that is difficult to imitate. Aware of the complexity of colors but eager to implement them in a way it is hardly noticeable to the public that she is totally color-blind, Sims has managed to deal with her deficit and to establish her art in the art world. Through practice and dedication as well as the development of a processing method that gives her an understanding of the colors she cannot actually see, Sims has succeeded in overcoming her color-blindness. She has managed to transform the deficiency into her strength and created and imitable artistic value in her art.

Daniel Arsham, who was already internationally recognized for his art that he exhibited all around the world, was not afraid to openly identify as color-blind.¹⁵⁴ The artist, who has never seen his daltonism as a real barrier but rather as a challenge to discover things he could not perceive before, has learned how to use his handicap to stand out from the crowd and can be considered a unique artist.¹⁵⁵ His coming-out as a daltonic artist did not harm Arsham's success. On the contrary, when he used colors in his works for the first time, this aroused additional interest among viewers. People were curious

¹⁵⁴ AUTHOR UNKNOWN, "Daniel Arsham biography", <https://ocula.com/artists/daniel-arsham/>, accessed September 2020.

¹⁵⁵ SEMAINE, "Daniel Arsham Color-blind artist: In Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZsEClia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

glasses and rely on open exchanges with like-minded people, Meryon was left to his own and could only adapt his art completely to his visual impediment. The fact that this led him to devote himself to engraving rather than the colorful painting, which was most popular that time, does not necessarily mean that he was an unsuccessful artist, but perhaps that society at this time was not prepared to appreciate his form of art. This argumentation finds support in the fact that, in retrospect, art historians such as Harold J. L. Wright nevertheless valued Meryon's works as unique : "By the intensity of his vision, and scarcely less by the completeness of his performance, he goes down to later ages in association with Rembrandt and Dürer. Doubtless there are limitations to the things he saw and felt. His great plates are few in number — his whole work comprised only a hundred and two etchings — but how unique are his best, how arresting, how certain, how unforgettable! As Wedmore says : "Of the vast field of art Meryon tilled but a corner. But with what result!"¹⁵³

In comparison to Charles Meryon, who did not personally experience success during his lifetime, the three contemporary artists Sims, Arsham, and Harbisson seem to have a certain success with their art already during their lifetime. While Meryon did not face his illness directly and tried to avoid it by changing the medium of art, the other three have concretely dealt with their visual impairment and tried to find instruments that enable them to

J.L., "Three Master Etchers: Rembrandt, Meryon, Whistler: Lecture II. The Etchings of Charles Meryon (1821-1862)", *Journal of the Royal Society of Arts*, vol. 78, n° 4060, September 1930, p. 1084.

his work as well as his name."¹⁴⁷ Although Meryon equaled from failure:¹⁴⁸ "Since it is conceivable that the monetary value of art is generally related to the appreciation and exaltation of the audience that is willing to pay, it is not surprising that Meryon was only able to sell his art at low prices during his lifetime."¹⁴⁹ This realization filled Meryon more and more with bitterness and led him to criticize the development of art in which the price and not the profound sense of an artwork turned out to be the central measure of success.¹⁵⁰ Consequently, confronted by the lack of recognition at both inclination and financial level, the artist had increasingly fallen into a mental deep that made him think he was an unsuccessful artist as, due to his color-blindness, he could not give the public what they expect from art : "In the present moment, I'm not very happy, I'm pretty much on the ropes; but I still have a good enough philosophical background to put myself above all these little miseries that may not be eternal. I find consolation in my work."¹⁵¹ Although Meryon did not receive the recognition he desired during his lifetime and even if he himself occasionally considered his art as unsuccessful¹⁵², it can still be said that Meryon goes down in history as a pioneer who struggled with daltonism at a time when daltonism was a rarely discussed subject. Compared to the other artists analyzed in this paper, who live in an age where they can use antennas,

147 VAUXCELLES, Louis,

"La Semaine Artistique",

L'ère nouvelle, October 1923,

(no pagination),

translated by the author.

"Puisque vous connaissez

M. Meryon, dites-lui que ses

splendides eaux-fortes mont

ébloui sans la couleur, n'en

qu'avec l'ombre et la lumière,

le clair-obscur tout seul et

livré à lui-même : [...]".

148 GEFROY, Gustave,

Charles Meryon, Paris, H.

Flouy Éditeur, 1926, p. 24.

Note : Original quotation

"Dans les arts comme

partout, la persévérance est

de rigueur, il ne faut pas se

rebûter de l'insuccès."

149 FROLLO, Jean, "Vermis-

sage", *Le Petit Parisien*, May

1883, (no pagination).

150 GEFROY, Gustave,

Charles Meryon, Paris, H.

Flouy Éditeur, 1926,

mais j'ai encore un assez bon

fond de philosophie pour me

mettre au-dessus de toutes

ces petites misères qui peu-

vent ne pas être éternelles. Je

serais probablement encore

moins heureux".

152 GEFROY, Gustave,

Charles Meryon, Paris, H.

Flouy Éditeur, 1926, p. 78.

work of art for an artist. Thus, considering this variety of different factors on which the success of art can be determined, it is not presumptuous to claim that there are several views on the evaluation of success in art. While one artist might place a higher value on the monetary valuation of his artworks, another one might prefer the interpersonal and emotional assets related to his creations. Accordingly, although there exists no straightforward formula to measure artistic success uniformly, it is not impossible to investigate how the four artists analyzed in this paper define the success of their art and to what extent the works created by these daltonic artists can be considered successful.

With regard to the artistic work of Charles Meryon, it is well-known that the public interest and appreciation towards his creations was very limited during his lifetime. The artist, who due to his color-blindness increasingly devoted himself to engraving, has repeatedly mentioned in letters how much he would like to see his work recognized by a large audience : "[T]he public is not very receptive to work of this kind, of which the usefulness, however, I do not think can be doubted."¹⁴⁶ Accordingly, it seems that the artist's personal artistic success is mainly based on the appreciation and recognition of his viewers. His personal satisfaction could also not be changed by the fact that, in contrast to the grand public, famous art enthusiasts and scholars tended to appreciate his creations: "Meryon is known only to the elite, and the public ignores

**"THE PUBLIC IS
NOT VERY
RECEPTIVE TO
WORK OF THIS
KIND, OF WHICH
THE USEFUL-
NESS, HOWEVER,
I DO NOT THINK
CAN BE
DOUBTED."**

Charles Meryon, Paris, H.
Flouvy Editeur, 1926, p. 78.
146 GEFROY, Gustave.

sis, but also due the artistic context of the last two centuries as well as the technological advancements, it can be concluded that the social requirements of color in art have changed. Impacts like these brought about a greater value for color in art worldwide. Consequently, this has led to a further understanding of the artist's handling of color and suggests that the acceptance the public side, regarding daltonic art, had steadily increased.

2/4/ HINDRANCE OR VIRTUE

Various professions such as the navy and aviation have been inaccessible to daltonists since the discovery of color-blindness.¹⁴⁵ In art industry this diagnosis is not so devastating and therefore many artists have tried to live and work with the diagnosis or to circumvent it. This paper has in the previous paragraphs shown which instruments artists use to deal with their color-blindness as well as how artworks from color-blind artists are received by the public. One question, however, remains unanswered: Is color-blindness an obstacle or a driver to artistic success?

Many artists would certainly agree that the success of their art in a certain aspect can be measured by the acknowledgedgement and appreciation of the public, although these forms of recognition are subjective. Another aspect that cannot be ignored is the emotional value of a

assert itself more and more in art. Although the first color photograph was shown in 1861 by James Clerk Maxwell, it was not until the 1970s that color photography became popular in art.¹⁴⁴ The use of technology for artistic creations was henceforth an integral part of art.

It is therefore not surprising that several decades later an artist like Harbisson turned to technology to further develop his understanding of colors. Even though Harbisson claims to not actually hear color but to rather feel color (as his new sense works through bone conduction), various forms of perceiving colors, other than through our visual perception, have already been subject of artworks from different artists such as Wassily Kandinsky or Robert and Sonia Delaunay. Although they investigated the synesthetic aspects of color and music, while Harbisson differentiates his color perception from synesthetic perception, the works of these artists, to a certain extent, already affected the audience. Therefore, Harbisson's color perception alone is not shocking. What makes people feel insecure about Harbisson's use of his implant is the ethical aspect regarding the merging connection between humanity and technology. However, this question would thematically open a bottomless pit, which would go beyond the scope of the topics dealt with in this study.

Summarizing, it can therefore be assumed that due to the previously mentioned influences of research carried out by artists and scientists on the basis of color analy-

¹⁴⁴ SCHWENDENER, Martha, "Tracking the Rise of Color on Film", *nytimes*, (2010), <https://www.nytimes.com/2010/08/08/nyreg-on/Bartsnj.html>, accessed September 2010.

viewer accepts the artist's color decision and regards the color usage as an aesthetic choice. The same is the case for the selected grey tones of the woman's skin color in the painting *Wrong Way* (2016).⁵⁰ In the same vein, another example would be the work *Lunar Cycle* from 2017 of Daniel Arsham in which the shadows of the moon are represented in a strong blue tone.⁵¹

Differences in our understanding of color have evolved, but not only as one would wrongly assume, through influences in art and science. Developments in the fields of technology and printing have contributed to the fact that we were always offered new possibilities in terms of color use and color perception. This has consequently led to new artistic possibilities due to an extended connection between colors and art. Specifically, technological developments in art have made it possible to create new forms of reproduction, which was among others illustrated by Thomas E. Grift's book *The Technique of Colour Printing by Lithography* 1940.⁵² Such pigment and print developments made it possible to overtake manual hand-coloring, as Abraham Gottlob Werner had done in 1814, in order to be able to print Color Identification Systems, such as the *Munsell Color System*.⁵³ In 1915 or the *Villalobos Colour Atlas*.⁵⁴ In 1947 as well as the well-known *Pantone Matching System* in 1963.⁵⁵

In addition to new forms of reproduction, however, photography also developed as a medium that was able to

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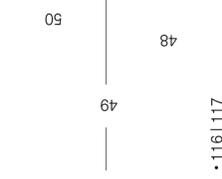
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Van Vincent Van Gogh, who resorted to fire-like colors to paint the fields as well as to yellow and blue tones to represent the pasture. Similar art tendencies developed a short time later with the abstract expressionists in America, caused by the social ruptures in World War II and the profound renews that followed.¹³⁹ The trend in color field painting in which color stood above form for good, is particularly noteworthy here.¹⁴⁰ In the context of this movement the artists mainly focused on the effect of the color as an artistic tool. The magically charged atmosphere emanating from paintings like those by Mark Rothko or Barnett Newman was created solely by the colors themselves.¹⁴¹ Since then, these influences have shaped our understanding of color and even caused it to change over time. Any historical development in the history of art has therefore had an influence on color, how it is used, but also how it is perceived by the viewer. As a result, we have developed a broader understanding for colors that is not only bound to objects but also integrated in figurative representations. Consequently, the viewers have accepted the representation of color detached from the object. This effect can be observed for instance in the paintings *Gaukel Green* (2016) .⁴⁸ and *Multicultural texter* (2016) .⁴⁹ from Meghan Sims. In both paintings the artist used a green tone for the figures and their skin tones. However, this is probably an unconscious color decision as Sims often confuses the grey values of orange and green because they appear very similar to her. Nevertheless, here, the

ANY HISTORICAL DEVELOPMENT IN THE HISTORY OF ART HAS THEREFORE HAD AN INFLUENCE ON COLOR, HOW IT IS USED, BUT ALSO HOW IT IS PERCEIVED BY THE VIEWER.



139 HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, Kammerlohr Epochen der Kunst, München, Oidenburg Schulbuchverlag, 2013.

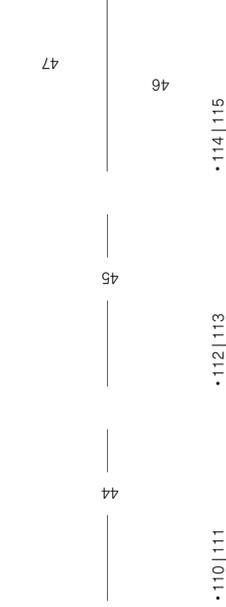
140 BITTNER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, Kammerlohr Epochen der Kunst, München, Oidenburg Schulbuchverlag, 2013.

141 BITTNER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, Kammerlohr Epochen der Kunst, München, Oidenburg Schulbuchverlag, 2013.

57 they appear very similar to her. Nevertheless, here, the

simultane des couleurs (The laws of simultaneous contrast of color).¹³⁵ In further publications he explored the effect of colors in relation to different backgrounds .⁴⁴ by partly painting by hand in combination with the relatively new form of lithography printing. In his atlas of *Cercles Chromatiques* from 1839 Chevreul studied the development of colors from complete brightness to almost complete darkness. .⁴⁵ This atlas, that was reprinted multiple times, represents the most sophisticated ever printed publications on color due to its numerous different tints.¹³⁶ "A masterpiece of color-printing in the later nineteenth century".¹³⁷

Around the same time as the achievements of Chevreul in color theory, art in the nineteenth century had developed in such a way that it had become more and more an expression of artistic personality. Consequently, this expression has therefore primarily influenced how an artist is appreciated and perceived by viewers. This artistic approach was mainly shaped by the three pioneers of modernism, Cézanne, Gauguin and Van Gogh.¹³⁸ Against the background of this paper, it makes sense above all to highlight the approaches of Paul Gauguin and Vincent Van Gogh as they added a subjective symbolism to colors, which was later adopted by Franz Marc in expressionism. As a formative example from 1894 Gauguin can be cited, who worked in his creation *Mahana no atua* .⁴⁶ with the color pink in order to represent the sandy soil. Such implementations can also be seen in artworks like *Rou-*



135 LOSKE, Alexandra, *Color: A Visual History*, United Kingdom, ILEX, 2019.

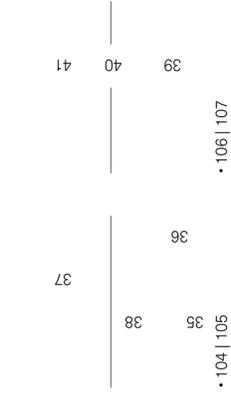
136 Note : The atlas was printed with a total of 14,420 tints.

137 LOSKE, Alexandra, *Color: A Visual History*, United Kingdom, ILEX, 2019, p. 96.

138 BITTNER, Maja, HAHNE, Robert, LEHNER, Günther, MAYER, Stefan, RACHOW, Gerlinde, REZAC, Susanne, WEBER, Felix, Kammerlohr Epochen der Kunst, München, Oidenburg Schulbuchverlag, 2013.

Loske argues : "For centuries it had been considered inferior in the hierarchy of the elements of art. By the end of the eighteenth century, however, color had become a standard element in aesthetic discourse, teaching and academic publications, although *couleur* had not quite achieved the same status as *disegno* [line drawing]."122 The first printed color circle was published in 1708 in the *Traité de la peinture en miniature* by the artist Claude Boutet.¹²³36 Color theories, color wheels and Nomenclatures of scientists, artists, chemists and entomologists¹²⁴ like Moses Harris.³⁷137 Johan Wolfgang von Goethe.³⁸138 Abraham Gottlob Werner.^{39 & 40 & 41} or Eugène Chevreul, followed, which have all shaped our understanding of color throughout the centuries. When analyzing Meryon's art, one notices that he started to paint in oil in the 1840s before moving on to his first engraving *La sainte face* in 1849. From his creative period during which he painted in oil, only the colorful painting *Ghost ship* from the 1840s remains. The picturesque capturing of ship scenes was thematically related to Meryon's experiences as a member of the French Navy.¹²⁵

In relation to aesthetic ideas of beauty and the "sublime", multiple artists and philosophers expressed their understanding of color. Accordingly, the writer and philosopher Edmund Burke wrote a chapter on "Colour considered as productive of the sublime" in his work *A Philosophical Inquiry Into the Origin of Our Ideas of the Sublime and Beautiful* in 1757.¹²⁶126 Alexandra Loske took this phenomenon



122 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019, p.13.
123 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.
124 Note : Entomology is the scientific study of insects.
125 RAVIN, James, ANDERSON, Nancy, LAN-THONY, Philippe, "An Artist with a Color Vision Defect: Charles Meryon", *Survey of Ophthalmology*, vol. 39, 1995, p. 405.
126 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.

2/3/ A CHANGE IN UNDERSTANDING THE ARTS

While daltonic artists in former times felt that they had to adapt to art forms where color was not a central part of their work, daltonic artists nowadays often integrate color into their creative process. From this observation and due to the fact that since the 19th century artists have used color more for the impression it can translate rather than using color for its figurative qualities, one could assume that the importance of colors in art has changed over the last decades. However, to be able to draw a historical comparison and to analyze how the viewer's perception of daltonic art has changed, it is important to bring the comparison into temporal context.

In this context, the art historian Alexandra Loske is of the opinion that : "The order of color, both practically and conceptually, is a mirror of its time".¹²⁰120 The understanding of colors has changed over in the past centuries mainly on the basis of research by scientists. The English Scientist Isaac Newton was among the first to analyze the relationship between light and color. His initial experiments led him to the discovery of the visible spectrum of light, which he published in his book *Opticks* in 1704.¹²¹35 Newton's color theory was followed by a number of other theoretical approaches of scientists and artists who all tried to explain colors in relation to each other. Interestingly, the significance of color seems to have changed around this time. Against this background, Alexandra

"THE ORDER OF COLOR, BOTH PRACTICALLY AND CONCEPTUALLY, IS A MIRROR OF ITS TIME"

120 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019, p. 7.
121 LOSKE, Alexandra, *Color A Visual History*, United Kingdom, ILEX, 2019.

color-blindness, one would reduce Harbisson's art to the simple color composition. Prior information about Harbisson's color-blindness enables the viewer to develop an awareness for the designed sense and an understanding of how a totally color-blind artist can develop a perception of something that is invisible to him. Thus, this information provides access to Harbisson's artistic intentions, which one would miss without prior knowledge. Moreover, besides that reasoning, it also enables the viewer to understand how art is currently being refined and in which direction it could possibly develop in relation to the boundaries that art has long since broken down.

To conclude, for Sims and Harbisson, it seems elementary that the viewer perceives their artworks in the context of its artistic aura. For Merz's art, on the other hand, prior knowledge does not appear to be necessary in order to be able to interpret the works and understand them holistically. Due to the fact that Merz worked in black and white and his thematic representations are not related to his visual impairment, his daltonism is not the central subject of his art. Therefore, an understanding of the targeted selection of Merz's art can be developed without a context to his color-blindness.

photo next to the finished work for comparison.³⁴ Regarding the above-mentioned idea of visual parallel worlds, it is interesting to analyze which parallels arise here. While the viewer with normal vision can define the photo as their own visual parallel, neither the painted picture nor the photography is a real representation for Sims, as she cannot perceive either of them in real colors.

Harbisson's sonochromatic artworks have to be understood in context of his new sensory perception. Merely exhibiting Harbisson's art without conveying the process of creation, makes his colored records appear as simple records and his colored images (e.g. *Für Elise* (no date)) as simple color squares instead of a musical composition. A viewer's exploration of Harbisson's artworks through simple visual perception and without prior knowledge about his visual impairment would put the proceeded colors in the center. A comparison of colors among different creations as well as a comparison of different creations themselves would be a logical approach to analyze Harbisson's art. However, for the artist it was never just about simple comparisons of colors and color combinations. Harbisson's main interests lies in the relationship between color and sound as well as the process of hearing colors and visualizing sound. Due to the fact that Harbisson has no visual understanding of colors he was never able to develop a feeling of how colors harmonize or discord together. His color perception is purely acoustic. For this reason, without any knowledge of his

color-blindness not only on a creative but also on a thematic level. Therefore, for a viewer to understand both the creation process of her work as well as her artistic statements, it seems to be elementary to be informed about Sims' daltonism. However, it needs to be mentioned that from a visual point of view with regard to the processing of colors and the detail of the images, Sims' impairment is hardly noticeable. By comparing Sims' black and white works with her colored works one can say that, without any knowledge about her visual condition, it is certainly easier to interpret the work that is proceeded in black and white. In terms of content, these images are easier to understand because they realistically depict her visual limits. In order to be able to read her colored works, however, prior knowledge about her daltonism seems to be crucial for the viewing process of the audience. This is the case because here it is not only about what is visually depicted, but it is about Sims' attempt to live up to our colored vision. In her colored paintings, Sims manages to use colors in a way, that makes her color-blindness hard to notice for someone who is not aware of her deficiency. Sims tends to confuse greens and reds, such as blues and oranges, as these colors are complementary colors and have a very similar visual greyscale for Sims, but other than that, no major differences are visible regarding her color choice, in comparison with her photographed view.

For this reason, it also seems to be important for Meghan Sims herself to provide the viewer with a certain point of reference, as at exhibitions she often hangs the original

pression that can be both understood or interpreted. But for some artists, their color-blindness plays an essential role in their art. Therefore, as a viewer in cases like these, one would have to know about the daltonic visually in order to comprehend the total work of art in relation to the artistic context.

With regard to artworks by Daniel Arsham, whose art revolves primarily around the subject of futuristic artifacts, an understanding of his color-blindness does not seem to be a prerequisite for being able to follow his artistic intentions. When Arsham used colors, they always played a secondary role in his work and were mainly tied to the choice of the material processed. For a long time Arsham did not assign a major artistic role to the colors. For that reason, it would certainly be wrong to influence the viewer's interpretation of the works by pointing out Arsham's color blindness. As Arsham himself did not give the colors in his works much value prior to his experience with his glasses, viewers would possibly attach a higher significance to colors than he does. Even if he has used more colors in his works due to the knowledge he gained through his glasses, art enthusiasts do not need to know that he is color-blind in order to interpret or to understand his artworks. This contemplation is mainly explained by the fact that Arsham's intentions in his work, namely the disruption of people's reference for a recognizable object, take place detached from the colors used.¹¹⁹

In contrast to Arsham, Meghan Sims deals with her total

¹¹⁹ CARPENTER, Kim, "Playing with Perception: A Conversation with Daniel Arsham", sculpture, (2014), https://www.sculpture.org/documents/scmag14/dec_14/fullfeature.shtml, accessed August 2020.

first develop a form of disbelief develops first, which then quickly turns into astonishment.

2/2/ THE RELEVANCE OF PRIOR KNOWLEDGE

In what way does the knowledge of an observer regarding the daltonism of the artist have an influence on the perception of a daltonic work of art? Do viewers need to be aware about the artist's color-blindness in order to understand the work and must a color-blind artist publicly reveal his deficit in order to make his art receptive? When looking for answers to these questions, it is important to keep in mind that the viewer's knowledge about the limited visual perception of an artist could lead to a distorted objectivity and a prejudgment about the artist's artistic skills. Accordingly, the view is widely held that in order to simply perceive an artwork from a daltonic artist, one does not need to have foreground knowledge about the artist's color-blindness. This may, however, be different if a viewer wants to develop a deeper understanding about the artwork and the circumstances under which it was created. This reasoning whether their art has to be understood in connection with their disease inevitably leads us to the essential question in art : Does art have to be understood? As the answer to this question (if there is one) could fill the pages of a separate paper, the underlying thesis aims to refer solely to art as a form of ex-

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cyborgism, which is, according to Harbisson an art form of itself. The skepticism that arises from the public is not only due to the connection between the technology and the human body, but also due to the fear that art could, in the future, develop into an undesirable direction which could be ethically questionable. Harbisson, however, represents a different point of view : "People think that when we are merging with technology, we become less human, and becoming less human is bad. I don't think to become less human is bad."¹¹⁵ Nevertheless, in public life some people react to his newly acquired organ with confusion. They cannot associate his antenna with any direct function because the object appears strange to them. Harbisson himself has got used to his implant for a long time and thus he no longer sees any difference between an implant and an organ : "Only people remind me that I have an antenna."¹¹⁶ Although his physical and mental adaptation to his antenna was no great challenge for him, he saw the actual challenge in the social effects : "What really changed is, I had to get used to social reac-

tion."¹¹⁷ Accordingly, Harbisson sees his antenna almost as an interesting social experiment by examining how the audience perceives unknown technology.¹¹⁸

Even if the enthusiasm to cyborgism is divided among people, the reactions are relatively homogeneous, when Harbisson shows people what he is capable of doing and how his antenna enlarges his ability of perceiving colors. Here again, like it is the case for Meghan Sims, people

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THINK TO BECOME
LESS HUMAN IS
BAD."**

115 DESIGN INDABA, "Cyborg artists, Neil Harbisson and Moon Ribas, on physically merging oneself with technology", youtube, (2019), <https://www.youtube.com/watch?v=U-Gk65wYs&list=WL&index=17&t=0s>, accessed August 2020.
116 FREETHINK, "The Cyborg Artist Who Hears Color", youtube, (2020), https://www.youtube.com/watch?v=an_Qc0Q1MH&list=WL&index=17&t=6s, accessed August 2020.
117 FREETHINK, "The Cyborg Artist Who Hears Color", youtube, (2020), https://www.youtube.com/watch?v=an_Qc0Q1MH&list=WL&index=17&t=6s, accessed August 2020.
118 FREETHINK, "The Cyborg Artist Who Hears Color", youtube, (2020), https://www.youtube.com/watch?v=an_Qc0Q1MH&list=WL&index=17&t=6s, accessed August 2020.

his work.¹⁰⁹ Nevertheless, Arsham knows that every work he exhibits is first criticized until the viewer of his art has become accustomed : "I'm quite sure that the reaction will be of "I prefer the art in black and white", and this has been true for every single body of work that I've shown. The audience typically prefers the body of work that I've shown just before that until that body of work becomes what I'm known for and then on to the next."¹¹⁰ As Cecilia Dean, co-founder of *Visionaire*¹¹¹ responded to Arsham's first colorful exhibition in 2017 at *Gallerie Perrotin* in New York called *Circa 2345* : "I think it's also a great way of expressing what people think of as a deficiency are actually your strengths. [...] You talk about correcting your color-blindness, but clearly it didn't need correcting."¹¹² Additionally, the American film producer Jane Rosenthal, praises the work from the same exhibition as following : "Seeing Daniels work in color [...] and knowing how he's tried to just overcome his color-blindness, the depth of color in all of this work is extraordinary."¹¹³ Although viewers had to get used to discover colors in Arsham's art, his first colored exhibition caused great admiration.¹¹⁴ However, above all, the awareness that a color-blind artist dares to approach colors seemed particularly spectacular for the viewers of Arsham's art.

¹⁰⁹ SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), https://www.youtube.com/watch?v=ZcSEClia1CK&-list=WL&index=24&t=1341s, accessed August 2020.

¹¹⁰ SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), https://www.youtube.com/watch?v=ZcSEClia1CK&-list=WL&index=24&t=1341s, accessed August 2020.

¹¹¹ Note : A multi-media art and fashion company.

¹¹² WEISS, Zaehary, "Watch Colourblind Artist Daniel Arsham's Quest to See in Color", observer, (2016), <https://observer.com/2016/09/watch-colorblind-artist-daniel-arshams-quest-to-see-color/>, accessed August 2020.

¹¹³ Note : A multi-media art and fashion company.

¹¹⁴ SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), https://www.youtube.com/watch?v=ZcSEClia1CK&-list=WL&index=24&t=1341s, accessed August 2020.

¹⁰⁹ SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), https://www.youtube.com/watch?v=ZcSEClia1CK&-list=WL&index=24&t=1341s, accessed August 2020.

¹¹⁰ SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), https://www.youtube.com/watch?v=ZcSEClia1CK&-list=WL&index=24&t=1341s, accessed August 2020.

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¹¹² WEISS, Zaehary, "Watch Colourblind Artist Daniel Arsham's Quest to See in Color", observer, (2016), <https://observer.com/2016/09/watch-colorblind-artist-daniel-arshams-quest-to-see-color/>, accessed August 2020.

¹¹³ Note : A multi-media art and fashion company.

¹¹⁴ SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), https://www.youtube.com/watch?v=ZcSEClia1CK&-list=WL&index=24&t=1341s, accessed August 2020.

have changed and the reaction of the audience to artwork from contemporary artists seems to differ fundamentally from the feedback Myron received back in the days.

Meghan Sims, who was mainly painting for herself until 2006, was discovered by a local gallery owner from her hometown and encouraged to present her works of art to the public. This life-changing experience opened Sims to exhibit her works in galleries.¹⁰⁸ The reactions of art enthusiasts to Sims exhibitions range from recognition to respect. At first glance, they question whether Sims' way of dealing with colors is possible, despite complete color-blindness; they will quickly find an answer when looking at her work. Through the confrontation of their own perception with Sims' irrepensible will to deal with her color-blindness and to display colors as detailed as possible, viewers often show great respect. Further, with her constant ambition to try to implement something that she found difficult to grasp and understand at first, Sims emits sign of courage and perseverance.

While there is a great interest in what Daniel Arsham will show before each exhibition, the interest was particularly high after the artist experienced his *EnChroma* glasses. Although art enthusiasts were hoping that Arsham was not getting too distracted by color, they were curious how this mental, emotional and artistic experience affected

such as Charles Baudelaire and Victor Hugo who were interested in Meryon's artwork.¹⁰² The public, however, seemed to have a different perception and was more and more bored by Meryon's outdated painting technique.¹⁰³ Baudelaire, in contrast, who was taken with Meryon's art showed interest in accompanying his etchings with sonnets. This proposition was, however, rejected by Meryon who was at that time already marked by his mental illness.¹⁰⁴ Whereas his oil-paintings such as his watercolor work hardly aroused interest from the audience, his strength in working with contrasts in his etchings did not remain hidden among art enthusiasts. Victor Hugo wrote in a letter to Baudelaire, "Since you know Mr. Meryon, tell him that his splendid etchings dazzled me without color, only with shadow and light, the chiaroscuro alone left to itself : [...]".¹⁰⁵ However, as mentioned earlier, people from the elite showed keen interest in Meryon's art, whereas the public was rather disinterested. This made it difficult for the artist to sell his art, therefore he had to sell his etchings for 1 franc per work or even 50 centimes a print and thus lived in constant poverty.¹⁰⁶ This went so far that when Meryon asked *La Chalcographie du Louvre* to buy the brass Meryon had engraved, they refrained.¹⁰⁷ From this it can be deduced that the public, at least in Meryon's lifetime, was not willing to do without colorful works of art and therefore expected artists to offer works that fulfilled this exact request.

Nearly 200 years later, this demand seems to partially

¹⁰² GEFROY, Gustave,

Charles Meryon, Paris, H.

Floury Editeur, 1926.

103 WRIGHT, Harold

J.L., "Three Master Etchers:

Rembrandt, Meryon, Whistler:

Lecture II. The Etchings of

Charles Meryon (1821-1862),"

Journal of the Royal Society of

Arts, vol. 78, n° 4060, Septem-

ber 1930, p. 1084.

¹⁰⁴ KOSPOTH, B. J.,

"Meryon, The Etcher Old

Paris", *The Chicago Tribune*

and the *Daily News*, April

1927, p. 5.

¹⁰⁵ GEFROY, Gustave,

Charles Meryon, Paris, H.

Floury Editeur, 1926, p. 130.

Note : Original quotation

translated by the author.

"Puisse vous connaissez

M. Meryon, dites-lui que ses

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ébloui sans la couleur, rien

qu'avec l'ombre et la lumière,

le clair-obscur tout seul et

livré à lui-même : [...]".

¹⁰⁶ FROLLO, Jean, "Vernis-

sage", *Le Petit Parisien*, May

1883, (no pagination).

¹⁰⁷ GEFROY, Gustave,

Charles Meryon, Paris, H.

Floury Editeur, 1926.

2/ THE PUBLIC'S PERCEPTION OF DALTONIC ART

In art, the artist's intention is generally directly linked to the viewer's conception. This raises the question of how a viewer perceives a work of art created by an artist with a distorted visual perception. Are there any major differences in understanding daltonic art compared to understanding art created by artists with normal color perception?

2/1/ THE PUBLIC'S PERCEPTION ANALYZED

While the artist himself can never see the color of his work that is recognizable for people with normal color perception, the converse also applies. Thus, people who look with an unbiased vision at an artwork created by a daltonic artist will never see the work through the eyes of the artist. However, this does not preclude the viewers from developing their own point of view on the artwork based on what is visible to them.

The art critic Louis Vauxcelles wrote in 1923 : "Meryon is known only to the elite, and the public ignores his work as well as his name."¹⁰¹ This statement has proven to be correct over time, as it were primarily well-known writers

¹⁰¹ VAUXCELLES, Louis, "La Semaine Artistique", *L'Ére nouvelle*, October 1923, (no pagination).
Note : Original quotation translated by the author.
"Puisse vous connaissez M. Meryon, dites-lui que ses splendides eaux-fortes m'ont ébloui sans la couleur, rien qu'avec l'ombre et la lumière, le clair-obscur tout seul et livré à lui-même : [...]".

“KNOWLEDGE COMES FROM OUR SENSES, SO IF WE EXTEND OUR SENSES, WE WILL CONSEQUENTLY EXTEND OUR KNOWLEDGE.”

95 HARBISSON, Neil. “Cosmic Senses”, in HARBISSON, Neil, *A Collection of Essays*, 2017, no pagination. 96 AUTHOR UNKNOWN. “Design Yourself”, cyborg-foundation, (date unknown), <https://www.cyborgfoundation.com>, accessed August 2020. 97 Note : The different types of relationships between technology and organisms. borg artists, Neil Harbisson and Moon Ribas, on physically merging oneself with technology”, youtube, (2019). <https://www.youtube.com/watch?v=U-Gk65wVt8&list=WL&index=11&t=0s>, accessed August 2020. 99 TED, “Neil Harbisson: I listen to color”, youtube, (2012), <https://www.youtube.com/watch?v=ygRN0eA-nzI&list=WL&index=20&t=0s>, accessed August 2020.

Even though Harbisson's daltonism consisted in a personal obstruction for the artist, his transformation has allowed him to develop a new awareness of colors, and has thus helped him to develop his personal identity.⁹⁵ This way of merging with technology allowing the artist to reconnect with nature as Cyborgism^{96, 97} is possible through technology, and simultaneously derived from a natural phenomenon. Accordingly, Harbisson's perception of hearing through bone conduction was initially inspired by the hearing process of dolphins.⁹⁸ Harbisson is of the opinion that cyborg art is not limited to his current application and he strives to invent other senses which could further extend his perception : “Knowledge comes from our senses, so if we extend our senses, we will consequently extend our knowledge.”⁹⁹ Additional transformations will allow him to expand his perception of his surrounding and thus will ultimately lead to an extension of his art as well as the creation of new forms of art. Harbisson succeeded not only in creating his own form of perception, which allowed him to overcome his color-blindness, but also in developing his own form of art which is ultimately an emergence from this change. Consequently, Harbisson does not reduce the creation of art to the use of human organs confined to our species but also allows the idea that technology can enable people to perceive and understand art differently. “[Cyborg art] is the art of building your own senses, the art of creating your own body part and then the art of expressing yourself through your senses. [...] I'm doing it through the

sound of color and the color of sound, but many other people are doing it though other senses.”¹⁰⁰ Accordingly, Harbisson's handling of his color blindness has led to a situation in which not only the artist himself has changed his perception of colors, but which has also led to a new point in which the perception and acceptance of color-blind artists was sustainably changed. Therefore, we can suppose that in Harbisson's case daltonism, as a medicalized vision of color, has led to an extension of the senses, while influencing the artist in a way that it influences the perception of art in return.

100 ROCKET CAST, “Neil Harbisson Interview Trailer park 2015”, youtube, (2015), <https://www.youtube.com/watch?v=J1cTm9uA0&list=WL&index=5&t=0s>, accessed August 2020.

actually was not having color vision in the first place. In many ways that may have formed who I am, what I am interested in and what I make.⁹² By experiencing this visual change, Arsham learned to appreciate the way he saw things before, as he became aware that he will never be capable to see things the way people without a visual color deficit do. He is comforted in this thought that he sees the world with his own eyes, which he feels to be just as valuable.⁹³ Furthermore, for Arsham the question arises whether the color spectrum he sees through his glasses actually corresponds to the color spectrum normal-vision people see. In this context the artist states the following : "Even though I may be able to identify a wider range of color with these lenses, there's still an open question as to whether I'm seeing what you see, or what other people see, and that opens up a larger question about objectivity and color."⁹⁴ When talking about visual parallel worlds, the question should be allowed whether glasses open up a new artificially created visual parallel world. This could be a world in which effects are visible to both, color-blind and normal-vision individuals, even though both sides perceive this same world differently. Still no one will ever be able to see how the other side perceives, a reasoning that even Arsham took some time to understand.

WHEN TALKING ABOUT VISUAL PARALLEL WORLDS, THE QUESTION SHOULD BE ALLOWED WHETHER GLASSES OPEN UP A NEW ARTIFICIALLY CREATED VISUAL PARALLEL WORLD.

Arsham, Color-blind artist: In Full Color", youtube, (2018), <https://www.youtube.com/watch?v=ZcSCiia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.
93 Yl, Hannah, "What it's like for an artist to suddenly see color", qz, (2017), <https://qz.com/quartz/1116230/daniel-arsham-a-colorblind-artists-work-changed-with-his-new-glasses/>, accessed August 2020.
94 Yl, Hannah, "What it's like for an artist to suddenly see color", qz, (2017), <https://qz.com/quartz/1116230/daniel-arsham-a-colorblind-artists-work-changed-with-his-new-glasses/>, accessed August 2020.

on between things and ourselves."⁹⁵ To a certain extent Sims tries to adapt her artistic view in her paintings to the view of normal-vision individuals. There seems to be an urge to do justice to the opposing parallel realism. Maybe Sims sees it in a certain form as a norm and tries to prove herself her affiliation through best possible adaptation. It can be assumed that the consciousness of a daltonic person having a physical deficiency, even though not optically visible (from the perspective of someone else), can nevertheless develop into an order of a psychological deficiency. In relation to artistic creation, one has to ask oneself whether the goal must be the striving for exact representation of color visual normality, or whether a reinterpretation of the color use of color-blind artists can be all the more interesting.

Through the experience of the glasses, Arsham feels more confident in the use of color within his artworks, although he openly admits that he is unsure about the interplay of multiple ones : "Every work has a single color, it's not a rainbow of color within that, I'm not quite sure or confident yet or know truly, how different colors within that spectrum react to each-other and how I feel in my work about that."⁹¹ Arsham's visual alteration caused him to value his initial perception in a way he didn't before. "When you are diagnosed with some deficiency, it's seen negative right? And this is how I interpreted it throughout my life and really up into the point that I've received these lenses. It took me a while to kind of realize that the gift

a unique understanding that is often not present prior to viewing her work. Sims is of the opinion that art represents a universal communicator and a form of social connection from which a healing and growth process can occur.⁸⁹ This procedure has helped her to accept her visual deficiency and to overcome it in regard to the application of colors in her own art.

Besides using her paintings to sensitize people to her visual deficiency, Sims also creates colored artworks with her color identification system. When looking at Sims' colored work as a viewer without prior knowledge about her non-existent color recognition one does not necessarily notice that she is completely color blind. Her work Legacy Greens (2010).³³ illustrates that she is using colors in a way that is amazingly similar to our reality. At this point we can raise the question of why an artist would create a piece of work in a spectrum he cannot purely perceive himself? It can be assumed that the answer to this question lies in psychology again. As Sims explained, she constantly compares herself with other people who integrate colors in their work. Therefore, it is comprehensible that the thought of having a limited visual perception creates a feeling of exclusion from those who have a normal vision. John Berger's reflections about how humans perceive things can be applied to Sims' perception of other people's color sight: "The way we see things is affected by what we know or what we believe. [...] We never look at just one thing; we are always looking at the rela-

"THE WAY WE SEE THINGS IS AFFECTED BY WHAT WE KNOW OR WHAT WE BELIEVE [...] WE NEVER LOOK AT JUST ONE THING; WE ARE ALWAYS LOOKING AT THE RELATION BETWEEN THINGS AND OURSELVES."

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⁸⁸ AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

⁸⁹ AUTOR UNKNOWN, "Meghan Sims - Visual Artist", megahansimsartist, (date unknown), <https://www.megahansimsartist.ca/pages/biography>, accessed July 2020.

Although Meghan Sims used to be self-conscious about her distorted perception of colors, as an artist it took her a while to accept and to adapt to her exceptional situation. "Anyone with a disability has been raised to see a disability and that they're 'less than' in some way and that does a number on you. Being afraid of color was only natural. I was comparing myself to people who use color."⁸⁶ In art Sims has found a catalyst that gives her the possibility to deal frankly with her color-blindness. "Through my creative activity I have been able to openly express my difference and the way my eyes see."⁸⁷ From this statement follows that she does not perceive her art as a hindrance anymore but rather strives to stimulate discussions about differences in perception. By raising awareness about visual color disabilities, Sims succeeds in showing people with normal visions how color-blind people see, as well as integrating color-blind people into society and art. Via her paintings, which she creates almost solely in black and white (e.g. *City Silhouettes* series),^{31 & 32} Sims aims to let the public experience her personal form of sight with their own eyes. "I offer the audience a metaphysical experience by suggesting that what they are viewing transcends a two-dimensional image; it is an invitation to view the world through the eyes of an achromat."⁸⁸ Her art allows Sims to share her disappointment about her lack of visual color perception with others, not only through the connections she makes with other achromats, but also with the viewer of her art. Hereby she constructs an opportunity to share her point of view and to create

"I OFFER THE AUDIENCE A METAPHYSICAL EXPERIENCE BY SUGGESTING THAT WHAT THEY ARE VIEWING TRANSCENDS A TWO-DIMENSIONAL IMAGE; IT IS AN INVITATION TO VIEW THE WORLD THROUGH THE EYES OF AN ACHROMAT."

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⁸⁶ AGGERHOLM, Barbara, "Meghan Sims, a Kitchener artist who is colour blind, makes the most of her unique vision", therecord, (2019), <https://www.therecord.com/news/waterloo-region/2019/03/05/meghan-sims-a-kitchener-artist-who-is-colour-blind-makes-the-most-of-her-unique-views-the-most-of-her-unique-views.html>, accessed July 2020.

⁸⁷ AUTOR UNKNOWN, opsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

⁸⁸ AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

the color green."⁸² Harbisson then applied this principle to his artistic works and began to paint vinyl records in the colors that he perceived through the dominant tones in the music. In this way, he started converting speeches into colors and created color associations for cities through the main tones he heard when visiting these.

While the other artists were already artistically active and were looking for ways to deal with their daltonism, Harbisson started to deepen his artistic activity due to his color-blindness. In connection with Harbisson's method of dealing with his daltonism, one could speak of a prosthetic that enables him to implement previously impracticable skills through designing his perception of reality. For Harbisson, even though being daltonic, gaining this new sense was the ultimate solution to not be blind to color anymore.

1/4/ TRANSFORMATION OF DALTONISM AS A HINDRANCE

In regard to the solutions used by the different artists to deal with their color-blindness the question arises whether color-blindness consists a mental challenge for artists that are creatively active? Or in other words, has there been a transformation in working with the visual impediment that has allowed the artists concerned to no longer consider their deficiency as an obstacle?

Charles Meryon who had been looking for a long time to find ways to deal with his color-blindness, could find neither happiness nor contentment in the course of his artistic life. Accordingly, he later wrote to a friend that he felt that he had not attended the same art schools as the great masters.⁸³ A thought that seems to have influenced him throughout his entire creative process. Gustave Geoffroy described Meryon in a biography as follows: "[Meryon] was a madman, probably born mad or predestined to become mad, a candidate for madness, as alienist physicians label these kinds of subjects."⁸⁴ At the age of only 37, Meryon began showing signs of mental illness which gradually worsened over time. His later mental state caused him to destroy his prints by crossing them out in situations of complete madness.⁸⁵ Nonetheless, the exact nature of Meryon's madness remains obscure. Further, having had a demented mother, who died at a young age, and a father who only played a minor role in his life certainly did not contribute to his well-being. After Meryon left the Navy, he dedicated his whole life to art, but one could assume that the constant pressure he put on himself in order to meet artistic requirements worsened the situation. Thus, one can suppose that Meryon's color-blindness presented an ever-present obstacle to him. Therefore, it cannot be excluded that if Meryon had succeeded to implement his artistic expression in color or expand his capabilities, his life might have taken a turn in a way that he might have been artistically successful.

83 MERYON, Charles, *Letter to F. Bracquemond*, Charenton, 21 Mars 1867. Note: Original quotation translated by the author. "[...] (celui) qui n'a pas des le jeune âge hante les mêmes écoles".
84 GEFROY, Gustave, *Charles Meryon*, Paris, H. Floury Editeur, 1926, p.4. Note: Original quotation translated by the author. "[...] [Meryon] était un fou, probablement né fou ou prédestiné à le devenir, candidat à la folie, comme les médecins aliénistes étiquettent ce genre de sujets".
85 AUTOR UNKNOWN, "Questions juridiques", *Mercure de France*, 1 mars 1930, p. 422.

that even if he can hear colors now through bone conduction, he would not compare hearing colors to hearing conventional sounds.⁷⁸ While synesthesia represents the union of two or more senses, he rather regards his case as the creation of a new sense.⁷⁹ In connection to his new organ, Harbisson would not speak of artificial intelligence (AI) but rather of an artificial sense (AS). Accordingly, he perceives his reality not as a virtual reality (VR) nor as an artificial reality (AR) but rather as a revealed reality which he usually calls "RR".⁸⁰ Harbisson does not perceive the utilization of his antenna as a technology because it has become something that he uses unconsciously: "The difference between using or wearing technology is that if you merge with technology, you don't feel you are using technology, while if you use it as a tool, you are conscious that you're using it."⁸¹ Consequently, the implantation of the antenna allowed him to sense colors and therefore was his solution to be able to start working creatively. Since the implantation Harbisson has created works of art which are based on the relationship between color and sound. He started to produce sound portraits of well-known people by analyzing their face with his antenna and combining what he perceives into micro tone cords.^{28 & 29 & 30} As Harbisson got accustomed to perceiving colors through hearing sounds, his brain began to use the process of recirculation to associate colors with the sounds he hears. "I had this secondary effect, that normal sounds started to become color. I heard the telephone tone, and it felt green, because it sounded just like

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78 ESSCE BUSINESS SCHOOL, "Hearing colors: my life experience as a cyborg, by Neil Harbisson, *Magination Week 2016*", youtube, (2016), <https://www.youtube.com/watch?v=SB3nrvK-3gg&list=WL&index=6&t=0s>, accessed July 2020.

79 SISELEY, Dominique, "Why this artist got an antenna implanted in his skull", *dazeddigital*, (2016), <https://www.dazeddigital.com/arts-and-culture/article/31102/1/why-this-artist-got-an-antenna-implanted-in-his-skull>, accessed August 2020.

80 LIVEMEDIA, "Neil Harbisson, The Renaissance of Human", youtube, (2018), <https://www.youtube.com/watch?v=SEJH4UjVYf8&list=WL&index=7&t=0s>, accessed August 2020.

81 DESIGN INDABA, "Cyborg artists, Neil Harbisson and Moon Ribas, on physically merging oneself with technology", youtube, (2019), <https://www.youtube.com/watch?v=U-Gk65wyYs&list=WL&index=11&t=0s>, accessed August 2020.

accessed August 2020.

on with white sand. Although his interest in forms which are shaped by light could always been felt, a few years ago prior to these installations, it was unthinkable that Arsham would integrate colors with such intensity.

Neil Harbisson, who does not perceive his color-blindness as a physical hindrance, expresses the wish to know how colors really affect someone: "I wanted to sense color, and it didn't need to be visible through the eyes."⁷³ Out of pure curiosity he experimented new ways of seeing colors while he was studying arts. "Even if I don't see color it is impossible for me to ignore that color exists. [...] I didn't feel the need, but I felt the curiosity to get to know what colors are."⁷⁴ In order to distinguish different colors from each other, Harbisson created and implanted an antenna into his head, which allows him to perceive colors as sound through the transposition of light frequencies to vibrations. He sees his antenna as a new part of his body that allows him to extend his senses beyond human sight.⁷⁵ The artist explains that while the adaptation of his body and brain to his new antenna took him two months, it took him three years to understand his new sense and to identify the visual spectrum and sounds the colors represented.⁷⁶ However, Harbisson claims that over time wearing such an antenna has become subliminal like any other sense of our body.⁷⁷ Further, he disagrees that his perception of color has become synesthetic as he is of the opinion that he didn't have any perception of colors prior to his implantation. Interestingly, Harbisson explains

"I WANTED TO SENSE COLOR, AND IT DIDN'T NEED TO BE VISIBLE THROUGH THE EYES."

73 THE FEED SBS, "Neil Harbisson: Eyeborg", youtube, (2014), <https://www.youtube.com/watch?v=Ts-XVPOG-M&list=WL&index=13&t=0s>, accessed August 2020.

74 ROCKET CAST, "Neil Harbisson interview Trailer park 2015", youtube, (2015), <https://www.youtube.com/watch?v=T1cYm9uA&list=WL&index=5&t=0s>, accessed August 2020.

75 DONAHUE, Michelle, "Artist Became the World's First Cyborg", *nationalgeographic*, (2017), <http://www.nationalgeographic.com/news/2017/04/worlds-first-cyborg-human-evolution-science/>, accessed August 2020.

76 HSGUNSTIGALLEN, "Neil Harbisson on being a Cyborg", youtube, (2017), <https://www.youtube.com/watch?v=C-OnYqx3ymA&list=WL&index=9&t=0s>, accessed July 2020.

77 HSGUNSTIGALLEN, "Neil Harbisson on being a Cyborg", youtube, (2017), <https://www.youtube.com/watch?v=C-OnYqx3ymA&list=WL&index=9&t=0s>, accessed July 2020.

cordingly, he had the impression of living in an oversaturated game. "There were consequences that I had not anticipated, almost like color-fatigue."⁶⁹ As it is the case for many color-blind people, Arsham's visual perception, shows its strength in the perception of structures and forms. As the colors are less emphasized and fewer colors are visible in a way that the eye focuses predominantly on constructs detached from colors. "When I'm looking at just architecture and things that I enjoy sort of spending time with, I'm distracted by all of the other [...] look much more at the structure of the space rather than the nuances of color in it."⁷⁰ In the course of his work as an artist, Arsham has reduced the regular wearing of his glasses in order to get back to how he saw the world initially without glasses. From then on, he decided to wear them only for artistic purposes in order to objectify his view on color in his work. "I use them within the studio to see what everyone else is seeing, and then I am able to take them off once I've selected the palette."⁷¹ The effect the glasses had on Arsham's art had translated into his work through the use of vibrant colors instead of staying with the material's color only. "It's not to say I will continue making all of my work in these vibrant hues, it's just that it has expanded the potential."⁷² Therefore, a clear shift of color usage is noticeable in the artwork Arsham created from 2016 onwards. His work *Lunar Garden* (2017-2019) & ²⁷ from the series *Static Mythologies*, which he had created under different forms over the past few years, perfectly show his use of pink colored sand in combinati-

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69 SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZcSEClia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

70 SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZcSEClia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

71 BATTERSBY, Matilda, "Blind artists and a unique vision: The visually impaired artists using tech to see things differently", independent.co.uk/arts-entertainment, (2016), <https://www.independent.co.uk/arts-entertainment/art/features/blind-artists-and-a-unique-vision-the-visually-impaired-artists-using-tech-to-see-things-differently-1341916.html>, accessed August 2020.

72 QUARTZ, "Colorblind artist sees color with new glasses", youtube, (2017), <https://www.youtube.com/watch?v=MA7OV3HkCW&list=WL&index=14&t=96s>, accessed August 2020.

in her pictures. This observation is particularly evident in her series *Solitary nature with Midnight Moonlight 2* (2012),²⁴ in which the light in the forest appears in a deep blue, as well as, in the piece *Watered down coffee* (2016) in which a man walks in solitude past a fountain.²⁵

Daniel Arsham's approach to deal with his color-blindness as an artist was in the beginning similar to Meryon's approach. However, while Meryon chose to forego colors in order to hide his deficiency, the reason why Arsham initially did not use paints in his creative work was rather due to the lack of interest in colors. "As an artist, within my work, I didn't think about the lack of color as being even part of my practice. Perhaps I was more drawn to them because I knew that in their lack of color, I was able to see them the way that everyone else would see them."⁶⁶ Over time however, Arsham's curiosity to understand what he visually missed in relation to colors, was awakened by the treatment of an ophthalmologist. This has led him to try *Enchroma* glasses, which widen his color spectrum.⁶⁷ Nonetheless, the glasses Arsham tried present no permanent solution for his color-blindness, as they can rather be seen as an artificial correction, refracting light in a way that he is able to see a broader spectrum of colors. Arsham claims that he could not guess to what extent his color-blindness affected him until he tried these glasses.⁶⁸ Even though wearing the glasses for the first time felt magical to him, Arsham developed another feeling over the next few months of full-time usage. Ac-

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66 Yi, Hannah, "What it's like for an artist to suddenly see color", qz, (2017), <https://qz.com/quartz/1116230/daniel-arsham-a-colorblind-artist-work-changed-with-his-new-glasses/>, accessed August 2020.

67 SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZcSEClia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

68 SEMAINE, "Daniel Arsham, Color-blind artist: in Full Color", youtube, (2016), <https://www.youtube.com/watch?v=ZcSEClia1Ck&list=WL&index=24&t=1341s>, accessed August 2020.

"I DON'T KNOW WHAT ANY OF THE COLORS ARE, REALLY, I'M SEEING A GRADIENT OF LIGHT WHEN I LOOK AT THE COLOR ON THE TUBE. I HELPED HER TO CODE THE GREYSCALES SHE SEES WITH THE CORRESPONDING COLORS NORMAL-VISION PEOPLE SEE, LINKING THEM TO THE TUBES SHE USES FOR PAINTING. "I DON'T KNOW WHAT ANY OF THE COLORS ARE, REALLY, I'M SEEING A GRADIENT OF LIGHT WHEN I LOOK AT THE COLOR ON THE TUBE. I HELPED HER TO CODE THE DESIRED SHADE SHE AIMS TO PAINT. I'VE LEARNED ABOUT COLOR BY COMPARISON, AND MEMORIZATION. I WILL LEARN A CERTAIN SHADE OF GREY, OF A GRANNY SMITH APPLE, AND FROM THAT POINT ON, THAT WILL BE TO MY BEST ABILITY, BE APPLE GREEN."⁶² Although her red tinted glasses or lenses, which she wears daily, allow her to perceive more details, she uses photography as a support to gain in time when analyzing lighted surfaces.⁶³ This way of working has become an important part of her artistic process, as she uses it to capture moments very precisely during daylight. These moments she can then visually analyze under different conditions such as in a darker room, allowing her to perceive a wider spectrum of details than in the direct daylight.²² She matches the tones of grey in the images taken with what she has learned related to the system she developed for her own color comprehension.²³ By combining photography with her approach to understand what colors mean to normal-vision peop-

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61 AGGERHOLM, Barbara, "Meghan Sims, a Kitchener artist who is colour blind, makes the most of her unique vision", www.therecord.com/news/waterloo-region/2019/03/05/meghan-sims-a-kitchener-artist-who-is-colour-blind-makes-the-most-of-her-unique-vision.html, accessed July 2020.

62 SIMS, "Meghan Sims "Do You See What I See"", vimeo.com/143038849, viewed August 2020.

63 AUTON UNKNOWN, "Meghan Sims - Visual Artist", <https://www.meghansimsartist.ca/pages/biography>, accessed July 2020.

le, Sims was able to develop a comprehension for color perception, although she will never be able to actually see these colors. "Red I attribute things like danger, blue expresses a sadness, or loneliness, yellow I'm not sure about, I don't really understand yellow."⁶⁴

In modern color psychology, color associations are described in a way that is very similar to Sims' color interpretation. While red is a signal color that is effectively associated with danger, a lot of people associate blue with a certain calmness but also sadness.⁶⁵ This leads to the question of how it is possible that people with an achromatic perception develop an identical conception of colors and their effects as people with a normal vision. In this context, the question arises whether Sims' associations are shaped by modern color psychology or observation, however, could also be that the way we use color in everyday life, aiming to cause the strongest possible color signaling, such as red for a stop sign, carried over to Sims' interpretation of color. Consequently, it is conceivable that the color perception of normal-vision people blended with her color perception over time. However, no matter how Sims developed a sense for color effects, she seems to use her understanding of these

HOW IS IT POSSIBLE THAT PEOPLE WITH AN ACHROMATIC PERCEPTION DEVELOP AN IDENTICAL CONCEPTION OF COLORS AND THEIR EFFECTS AS PEOPLE WITH A NORMAL VISION?

64 SIMS, "Meghan Sims "Do You See What I See"", vimeo.com/143038849, viewed August 2020.

65 JIN, Joy, "Colors and Emotions: How Different Colors Affect Perception and Mood", <https://looka.com/blog/colors-and-emotions/>, accessed September 2020.

ding of what normal sighted people see, and the reverse is also applicable. Someone with a normal vision can never see the world through the eyes of the color-blind artist. This being the case, one can assume that we live in a world of visual parallel realities. Similar to the description of the writer John Berger regarding the context of our visual perception : "The relation of what we see and what we know is never settled."⁵⁸ For instance, when Sims is standing in front of her colored paintings she can neither truly perceive the colors of her paintings nor develop a visual understanding of these colors. Or the other way around, a person with a normal vision can put himself in the situation of working like a color-blind person with a restriction of shades, but will never be able to visually experience the other person's view. In his book, Berger explains that René Magritte, who related to images and the descriptive words of paintings, spoke of an ever-present gap which he called "The Key of Dreams"⁵⁹. A very beautiful expression that can be used to describe the space that allows both sides to interpret what they are unable to perceive themselves.

1/3/ CONQUERING THE VISUAL DEFICIENCY

By comparing the different means the artists use to carry out their artistic activities despite their color-blindness, it can be observed that the personal approaches of the artists differ one from another. While some of them found

"THE RELATION OF WHAT WE SEE AND WHAT WE KNOW IS NEVER SETTLED."

58 BERGER, John, *Ways of Seeing*, Great Britain, Penguin Books, 2008, p. 7.
59 BERGER, John, *Ways of Seeing*, Great Britain, Penguin Books, 2008, p. 7.

tools to work with, others found coding systems to overcome their visual hindrance in their art.

Of all the colored paintings that Meryon had done prior to the etchings, only one remains. The artwork *Ghost ship* (before 1840, exact date unknown) illustrates with which ideology Meryon started painting. This painting shows the selection of yellow and blue tones which is typical for deuteranopic color-blind artists.⁶⁰ For color-blind artists with this form of daltonism, these are the colors they perceive best.⁶⁰ However, Meryon did not succeed to attract the interest of the audience with his color paintings. *Ghost ship* seems like a remnant of a failed attempt to gain a foothold as a daltonic artist trying to paint colors, because from this point on, Meryon realized that his deficiency would not allow him to work with colors and thus he decided to circumvent his color-blindness in his art. The change of the medium and the change from color to black and white etchings gave Meryon the possibility to suppress his color visual impairment in his art. At the same time, this way of dealing with his visual deficiency seemed for Meryon to be the only escape to continue the practice of his art and to be recognized by the public. Thus, compared to the other artists analyzed in this thesis, Meryon is the only artist who changed to a medium where his deficiency could not be noticed by the public and, we can assume, that thereby he circumvented his visual limitations in his artworks.

60 RAVIN, James, ANDERSON, Nancy, LANTHONY, Philippe, "An Artist with a Color Vision Defect: Charles Meryon", *Survey of Ophthalmology*, vol. 39, 1995, p. 405.

nor related to his color-blindness, as his choice of colors within his work always relied on the materialistic choices he made. "Often when I'm looking at materials, I'm selecting them for properties other than color [...] so I select the color inadvertently through the selection of the material."⁵¹ Even though Arsham perceives his daltonism as a deficiency, for him it never really was an obstructive on. "I knew that I was color-blind all my life, it's not something that was pointed out to me on many occasions nor something that I even thought about being part of my work."⁵² His blindness raised questions for him, regarding the difference in perception compared to other people, but it was never a strong hindrance in his artistic work.

Similar to Daniel Arsham, for Neil Harbisson the fact to not be able to see colors never really consisted in a physical problem. He is even of the opinion that being totally color-blind has its benefits. "To me, black and white vision has advantages. We see better at night. We see differences better than people that see color, and we also identify shapes more easily. So, to me, greyscale vision was an advantage."⁵³ However, Harbisson felt that living in a colorful world that is grey to you affects you in a social way. A color-coded world where a minority of people are color-blind and only few of them suffer total color-blindness has the capability to make you feel excluded. "Being colorblind was always an advantage in many ways. The only issue I felt with color was that I felt socially excluded

"OFTEN WHEN I'M LOOKING AT MATERIALS, I'M SELECTING THEM FOR PROPERTIES OTHER THAN COLOR [...] SO I SELECT THE COLOR INADVERTENTLY THROUGH THE SELECTION OF THE MATERIAL."

"51 CARPENTER, Kim. "Playing with Perception: A Conversation with Daniel Arsham", sculpture, (2014), https://www.sculpture.org/documents/somag14/dec_14/fullfeature.shtml, accessed August 2020.

"52 DANIEL ARSHAM'S EXPERIMENTAL ART ATTRACTED COLLABORATIONS WITH PHARRELL, ADIDAS AND USHER", youtube, (2017), <https://www.youtube.com/watch?v=YURKXWZ2t0&list=WL&index=16&t=0s>, accessed August 2020.

"53 SISELEY, Dominique. "How Daniel Arsham's Experimentation with Color Affects You in a Social Way", youtube, (2015), <https://www.youtube.com/watch?v=2l-HfpyRZUjM&list=WL&index=28&t=0s>, accessed August 2020.

because color is used socially. I felt that I was missing out on something social, but I never felt like I was missing out on something physical."⁵⁴ Nonetheless, not having any comprehension of colors didn't stop Harbisson from studying music and visual arts. In course he was allowed to create paintings in black and white and managed to develop an understanding of how people without a visual deficiency perceive colors. While he studied the theory of colors, Harbisson felt like studying a religion as the color effects were invisible to him and people seemed to attach something more than physical to it.⁵⁵ Thus it seems to be only natural that a certain curiosity evolved from what he wasn't able to perceive. "I have never seen color, I don't know what blue or red mean visually, but I grew up in a world where color exists."⁵⁶

It is evident that all three contemporary artists question themselves how their perception differs from the perception of normal-vision people. Although the color-blindness affects the artists differently in their creative process, it certainly affects them all on a personal level. It is conceivable that there is a connection between this personal affection and the psychology of someone concerned. As Harbisson expresses, a color-blind artist like him is well aware that in his profession he is constantly surrounded by colors that he cannot really perceive himself.⁵⁷ It seems only normal that a daltonic artist aims to understand what he is visually missing. However, a color-blind artist will never develop a real visual understanding

"I HAVE NEVER SEEN COLOR, I DON'T KNOW WHAT BLUE OR RED MEAN VISUALLY, BUT I GREW UP IN A WORLD WHERE COLOR EXISTS."

"54 SISELEY, Dominique. "Why this artist got an artificial eye implanted in his skull", accessed August 2020.

"55 AUTHOR UNKNOWN. "Neil Harbisson Interview - Part 2: Hearing Colors", <http://munsel.com/color-blog/>, accessed August 2020.

"56 D&AD CREATIVE ADVERTISING. "Design and Digital, Neil Harbisson - D&AD Presidents' Lecture", (2015), <https://www.youtube.com/watch?v=2l-HfpyRZUjM&list=WL&index=28&t=0s>, accessed August 2020.

"57 SISELEY, Dominique. "Why this artist got an artificial eye implanted in his skull", accessed August 2020.

44 GEFROY, Gustave, *Charles Meryon*, Paris, H. Floury Éditeur, 1926, p. 30. Note : Original quotation translated by the author. "Parce que, comme je crois certainement dans la vie vous l'avoir dit, j'ai bien un défaut d'organisation qui fait que certaines couleurs, bien différentes pour tout le monde, se confondent chez moi. C'est assez singulier, mais c'est très vrai, et vous mon bien grand regret que j'ai acquis la certitude de ce défaut."

45 JUVÉ, Pierre-Jean, *Le quartier de Meryon / La Nef*, September 1945, p. 5.

46 MERYON, Charles, *Letter to E. Foley*, Paris, 20 May 1849. Note : Original quotation translated by the author. "Les uns, que tente le gain, adoptent une voie facile qui leur réussit, et finissent par s'aveugler sur leurs dévances, ne parlant qu'avac dédain des justes critiques que soulève leur manière ; les autres, plus consciencieux, mais prompts à s'illusionner, reconnaissent bientôt leur infériorité : [...]".

though Meryon has written about his color-blindness to his father, he has never spoken about it in public. At a later stage in Meryon's work process, he even wrote about the reason why he had resisted to the artform of colored paintings : "Because, as I believe I told you, I certainly have an organizational defect in my sight which causes certain colors, very different for everyone, to be confused by me. It is rather singular, but it is very true, and you can imagine that it was only to my great regret that I became certain of this defect."⁴⁴ This statement indicates that Meryon's color-blindness represented a limitation in the exercise of his artistic work. However, even though he was aware of his congenital defect, he was convinced to continue creating art. While his initial intention was the painting of themes using colors, Meryon felt that he did have to abandon color in order to continue as an artist. Meryon's limitations in his art seemed to be a solution to further his personal artistic execution, but this decision led, among other things, to the fact that he gradually developed a feeling of having been abandoned by the society on an artistic level.⁴⁵ Accordingly, in letters to his friend Edouard Foley, Meryon regularly wrote in a plaintive manner : "Some, tempted by gain, adopt an easy path that succeeds them, and end up blinded by their works, speaking only with disdain of the just criticism that their gain, adopted une voie facile et finissent par s'aveugler sur leurs dévances, ne parlant qu'avac dédain des justes critiques que soulève leur manière ; les autres, plus consciencieux, mais prompts à s'illusionner, reconnaissent bientôt leur infériorité : [...]".⁴⁶ This personal development swung high until he eventually destroyed some of his own brass plates to keep them

from becoming part of the art industry.⁴⁷

Although Meghan Sims and Neil Harbisson have the same form of color-blindness, their visual perception is still different. Achromats normally experience a strong sensitivity to light, which makes it hard for them to be able to perceive their surroundings normally during daytime. While this is exactly the form of achromatopsia Sims experiences, Harbisson is lacking color perception without being sensible to light.

At a younger age Meghan Sims, just like many other people with a color perception deficiency, felt the need to hide her visual impairment.⁴⁸ Accordingly, in school she was bullied for having to wear light blocking glasses and coloring things in a different way than other children.⁴⁹ Against this background, it can be assumed that these circumstances led Meghan Sims to avoid the use of colors as an artist for a long time. Until 2016 Sims categorically excluded colors from her artistic approach : "I sort of kept the door shut there, because it was something out of my reach and I felt that I didn't need to understand it."⁵⁰ It is only recently that she started integrating colors in her artworks.

For Daniel Arsham, who in the beginning of his career worked mainly in black and white, his color reductive perception was never really an obstacle in his artwork. He claimed that his work is not necessarily dependent

"I SORT OF
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OF MY REACH
AND I FELT THAT I
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UNDERSTAND IT"

47 JUVÉ, Pierre-Jean, *Le quartier de Meryon II, La Nef*, October 1945, p. 68.

48 AUTOR UNKNOWN, "Meghan Sims", *achromatopsia*, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

49 AGGERHOLM, Barbara, "Meghan Sims, a Kitchener artist who colour blind, makes the most of her unique vision", www.therecord.com/news/waterloo-region/2019/03/05/meghan-sims-a-kitchener-artist-who-is-colour-blind-makes-the-most-of-her-unique-vision.html, accessed July 2020.

50 SHARKEY, Jackie, "Colourblind artist Meghan Sims paints with full palette for first time with fascinating results", *cbc*, (2018), <https://www.cbc.ca/news/canada/kitchener-waterloo/kitchener-artist-meghan-sims-colourblind-1.3811847>, accessed July 2020.

40 Note: The Ishihara test, is a color-blind test, named after the Japanese ophthalmologist who invented the colored plates. Each plate consists of a circle with colored dots including a composition forming the shape of a number, with a different color. People with a normal color vision don't have any problems to recognize the numbers, while they are hard to detect, or invisible to people with a red-green color deficiency.

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allowed him to suppress his color-blindness as far as possible.

In contrast to Meryon, Sims and Harbisson treat their color-blindness thematically in their art. Compared to paintings like *Courtyard at David* (2010), *Victoria Park Trees* (2010) or *Breithaupt Pines* (2010), which represent Sims' perception during daylight, the painting *Night Town 2* (2009)¹⁶ depicts her perception at night which is generally richer in detail. Harbisson for his part has, based on the hue and light he detects through his antenna on human skin, developed a color wheel which he calls *The Human Colour Wheel* (2009)¹⁷. Arsham only deals with his daltonism indirectly in art and addresses it in rare cases on a thematic level. Ironically, in his series *Static Mythologies* Arsham has created relics using volcanic ash and rose quartz in combination with pink selenite. These relics depict a book on color-blindness, which include a typical color-blindness Ishihara⁴⁰ test plate in the form of Arsham's Studio Logo on the cover.¹⁸ ¹⁹ However, he never tried to hide his color-blindness. In contrast, for Meryon who was looking for ways to elude from his daltonism in order to be able to keep working as an artist, the selection of his artistic subject focus allowed him to cover up his color-blindness also in a thematic sense. Through the interaction of his choice of medium and the implementation of his subject, Meryon succeeded in circumventing his color-blindness and suppressing it in his art.

"THIS COLOR DEFECT OF WHICH I SPEAK IS SUCH THAT I OFTEN PREFER BEAUTIFUL BLACK PRINTS, IN WHICH ONE CAN SEE THE GRADATION OF SHADING, TO THE MORE VIVID EFFECTS OF PAINTING."

41 RAVIN, James, ANDERSON, Nancy, LANTHONY, Philippe, "An Artist with a Color Vision Defect: Charles Meryon", *Survey of Ophthalmology*, vol. 39, 1995, p. 403-408. Note: Author had no access to the original source. LEE, Sidney, Dictionary of National Biography, 1894. 42 DROST, Wolfgang, "Documents Nouveaux sur l'Oeuvre et la Vie de Charles Meryon", *Gazette des Beaux-Arts*, vol. 63, 1964, p. 63-230. 43 RAVIN, James, ANDERSON, Nancy, LANTHONY, Philippe, "An Artist with a Color Vision Defect: Charles Meryon", *Survey of Ophthalmology*, vol. 39, 1995, p. 405. Note: Author had no access to the original source. LEE, Sidney, Dictionary of National Biography, 1894.

1/2/ THE ARTIST'S PERCEPTION OF DALTONISM

While some of the artists analyzed in this thesis only became aware of their visual limitations in the course of their artistic work, others were aware of the visual obstacle very early on. This recognition leads to the question: How do artists perceive their own color-blindness? Do artists take their color-blindness as a physical impairment? Is daltonism perceived as an obstacle by an artist? Is it possible to determine whether daltonism has formed the artists in their artistic approach or even prescribed their artistic expression in one way or another?

Even though Meryon's hopes were high to work with colors when he first started as an artist, he later preferred the exclusion of colors in his artistic works.⁴¹ After serving the French navy, Meryon decided to study arts. In the early 1840s he started working with sepia, but quickly moved on to watercolor, as he wrote to his father to have stopped the use of sepia to begin watercolor. In the letters he wrote to his father he claimed that this change would allow him various other possibilities.⁴² It can be assumed that he noticed his differing visual perception even if he was not aware of it at first. In writings Meryon sent to his father in 1846, he mentioned his color-blindness: "This color defect of which I speak is such that I often prefer beautiful black prints, in which one can see the gradation of shading, to the more vivid effects of painting."⁴³ Al-

THE ART OF DESIGNING NEW SENSES BY CREATING NEW ORGANS, AND THE ART OF "MERGING WITH THEM"

34 IYENGAR, Radhika, "This is the future, says world's first cyborg Neil Harbisson", <https://www.livemint.com/Companies/TDMMFB21T-Companies/TDMMFB21T-P565B5KROUM/Tthis-is-the-future-says-worlds-first-cyborg-Neil-Harbisson.html>, accessed July 2020. 35 SGGUNISTGALLEN, "Neil Harbisson on being a cyborg", https://www.youtube.com/watch?v=C_OnYqX3yNk&list=WL&index=9&t=0s, accessed July 2020. 36 Note: The sonochromatic music scale is a microtonal and logarithmic scale with 360 notes in an octave, each note corresponds to a specific degree of the color wheel. 37 DESIGN INDABA, "Cyborg artists, Neil Harbisson and Moon Ribas, on physically merging oneself with technology", <https://www.youtube.com/watch?v=U-Gk65wYs&list=WL&index=11&t=0s>, accessed August 2020.

To show people what he is able to do with his antenna. Therefore, he creates paintings of people and people's voices, as their voices have frequencies that he relates to colors. He calls his resulting art "sonochromatic"³⁶. An example of a sonochromatic painting Harbisson created is the visualization of Beethoven's *Fur Elise* (no date).¹⁴ While Harbisson positions himself as a cyborg artist who expresses himself through the art of designing new senses by creating new organs, and the art of "merging with them"³⁷, the pieces resulting from his work can be seen as art itself. Consequently, in the case of Harbisson one should speak of two different forms of art, firstly the creation and adaptation to his new sense, secondly the art which is created by the artist through the new sense he has gained. As a result, by permanently integrating this new sense in order to compensate for his lacking color perception, his limited visual perception has unintentionally become the constant thematic center of his art. By comparing the contemporary artistic works of Sims, Arsham and Harbisson with the artworks of Charles Meryon, who was active in a different artistic period, it can be conceived that while Meryon specialized predominantly on black and white etchings, the other three artists all integrated some traces of color in their artworks. In the course of work of Meryon it is noticeable that even if he used colors at the beginning, around 1849 he changed to the medium of etching as this transition gave him the possibility to work predominantly with greyscale

and thus to hide his limited visual perception of colors.

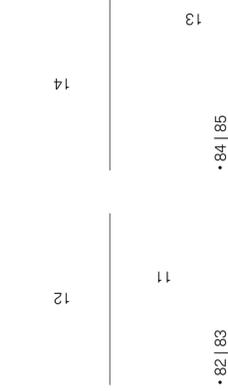
In contrast to Sims' work topics of vision and reduced perception, as well as Harbisson's thematic subject of cyborgnatic perception, Meryon's thematic of his etchings had nothing to do with the human visual perception. Instead he depicted mostly Parisian landscapes with an incredible attention to detail. Thus, Gustave Geoffroy, a French journalist, art critic, and historian, wrote about Meryon's style of work: "[...] by the sure signs of the habitation, by the concerned expression of the stone faces, by the old age of the dwellings open to space and time, he suggested, because he was a visionary of hidden things, a humanity endlessly living its temporary life in a setting that seems eternal. This absent humanity, our eyes guess it, our mind evokes it."³⁸ He was very fond of Paris and showed a great affection for depicting views of the cityscape, that would change due to rebuilds and captured these in his work. "What also gives these unprecedented works their immobile character of eternity is that the present in it is the setting of the past."³⁹ If you have a look for instance at artworks such as *L'Abside de Notre-Dame de Paris*,¹⁵ painted by Meryon in 1854, Gustave Geoffroy is undoubtedly right. Meryon managed to develop a feeling of eternity in his engravings, even though the city was constantly changing. Nevertheless, the decision not to make the poor eyesight the subject of his art was certainly not only a decision to do justice to the artistic themes of the time, but also a decision that

38 GEFROY, Gustave, *Charles Meryon*, Paris, H. Floury Editeur, 1926, p. 184. Note: Original quotation translated by the author. "[...] par les signes certains de l'habitation, par l'expression soucieuse des visages de pierre, par la veillesse des logis ouverts sur l'espace et le temps, il a suggéré, parce qu'il était un visionnaire des choses cachées, une humanité vivante sans cesse sa vie temporaire dans un décor qui semble éternel. Cette humanité absente, nos yeux la devinent, notre esprit févoque." 39 GEFROY, Gustave, *Charles Meryon*, Paris, H. Floury Editeur, 1926, p. 184. Note: Original quotation translated by the author. "[...] le présent y est le décor du passé."



Neil Harbisson who initially had no sense of color at all, as he sees the world in scales of grey, has gained the perception of sensing color through sound. Through a wavelength sensible antenna implanted into his head, Harbisson is able to hear the sound of colors and ever since calls himself a *Cyborg*.¹³ While Meryon, Sims and Arsham have realized, respectively, physical forms of art, Harbisson focuses not only on art creation, but feels the act of creating a new sense through a "new organ"³⁴ as art in itself. "Cyborg art will eventually be seen as an art and I see the creation of senses and the creation of new body parts, the design of your perception of reality as an art movement, where art no longer needs to express itself through the traditional senses, but through new senses."³⁵ Additionally, Harbisson uses this new sense

and *Televisions* (2015).¹² are only a few of many examples that visualize this systematic exclusion of color. This way of working without colors gives him the opportunity to perceive his art in the same way as the viewer. In 2016, however, Arsham began to add color to his work for the first time. Through the use of differing materials like volcanic ash, sand or selenite, his work revolves around the subject of fictitious artifacts that he creates and refers to as "future relics"³² of the present. Furthermore, the targeted selection of his objects, which through their digitization mostly shaped the end of the 20th century, allow Arsham to develop an interplay between the present, the future and the past.

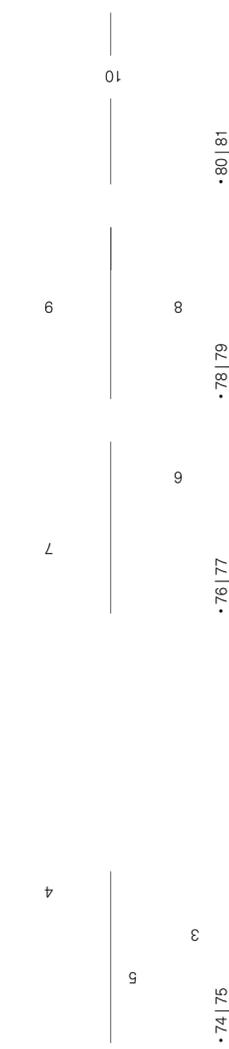


³⁰ AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://www.achromatopsia.squarepace.com/meghan-sims-artist/>, accessed July 2020.
³¹ AGGERHOLM, Barbara, "Meghan Sims, a Kitchener artist who is colour blind, makes the most of her unique vision", <https://therecord.com/news/waterloo-region/2019/03/05/meghan-sims-a-kitchener-artist-who-is-colour-blind-makes-the-most-of-her-unique-vision.html>, accessed July 2020.
³² KINNEY, Bunny, "Daniel Arsham's Future Relic", <https://www.nowness.com/story/future-relic-daniel-arsham-juliette-lie-wis>, accessed July 2020.
³³ Note : A person whose physical abilities are extended beyond normal human limitations by mechanical elements built into the body.

kest. However, even if it hurts her to paint under strong light, she is of the opinion that when painting under conditions like these, her personal perception is represented best. Accordingly, paintings like *Courtyard at David* (2010),³ *Victoria Park Trees* (2010),⁴ or *Breithaupt Pines* (2010),⁵ are representations of her vision at daylight. In these paintings, it is clearly visible how the dark shapes are practically engulfed by the blinding brightness. Interestingly, her night paintings seem to be more recognizable for the public, as she is able to include details that get lost when she paints by daylight. "Where others see life in detail and colors, I am limited to light, shades and shapes."³⁰ Paintings that underline this argumentation are her almost monochromatic artworks like *Queen at Courtyard* (2012),⁶ *David Street at Night* (2011),⁷ *King at Queen* (2012),⁸ or *Night Life* (2009),⁹ which visualize her more pronounced perception of detail in the absence of strong light. Until 2016 Sims had not used colors in any of her artworks and limited her color palette to grey tones as she trusted colors in general. Accordingly, Sims argues : "I didn't see color, so I didn't use it. I had no interest."³¹

In contrast to Meghan Sims, who focuses primarily on painting, Daniel Arsham is a multidisciplinary artist, whose work focuses predominantly on structures and surfaces. In most of his art he avoids the use of colors because he prefers to work in black and white. Artworks such as *Baseball Pile* (2014),¹⁰ *Moon Globe Black* (2016)

"WHERE OTHERS
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LORS, I AM
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SHAPES."



"COLOR DOES NOT EXIST IN AND OF ITSELF. IT IS PERCEPTIBLE ONLY IN LIGHT, WHICH REVEALS IT IN THE MOMENT BUT DESTROYS IT OVER TIME. COLOR IS INTRAC-TABLE, VARYING DEPENDING ON ITS QUANTITY, THE SUBSTANCE THAT BEARS IT AND THE EYE THAT PERCEIVES IT."

26 Note : Red-green color-blindness
27 Note : Green blindness.
28 RUBINI, Constance, "Color is everywhere Color does not exist", in Musée des arts décoratifs et du design – Bordeaux, Œil Couleurs, Bordeaux, Les éditions confluentes, 2017, p. 22.

and how he used colors in existing paintings, he is expected to have suffered from a form of protanopia²⁶ or deuteranopia²⁷. This form of daltonism is the same form which was diagnosed for Arsham. Sims and Harbisson however, both have the rarest form of daltonism, meaning that they suffer from achromatopsia and thus they see everything in greyscales.

By taking these four cases as a basis, the following work within this thesis aims to reveal how color-blindness affects the creation of artistic work, the instruments artists use to deal with their color impairment, and the extent to which appearance and acceptance of color-blindness has changed from the past to the present. Constance Rubin, director of the Musée des arts décoratifs et du design de Bordeaux, has succeeded very well in describing how people with a limited perception system subjectively perceive colors by saying that : "Color does not exist in and of itself. It is perceptible only in light, which reveals it in the moment but destroys it over time. Color is intractable, varying depending on its quantity, the substance that bears it and the eye that perceives it."²⁸

1 / THE INFLUENCE OF DALTONISM ON THE ARTISTIC CREATIVE BEHAVIOR

1/1/ THE ARTISTIC CHOICES

When one speaks of a visual deficiency in relation to an artistic work in which visual perception is fundamental, one can assume that this visual deficiency affects the way the artist works in one form or another.

1/1/ THE ARTISTIC CHOICES

The four artists analyzed show fundamental differences, both in the choice of their artistic medium and in relation to the thematic expression of their art.

Meghan Sims' various creative periods as well as the different approaches she tested to deal with her color-blindness, give an indication that Sims is constantly questioning and self-reflecting her visual perception in her artistic work. Thus, her work represents her visual perception of the world, that she tries to communicate to the public. "Although my works often appear to be surreal or even abstract, they are usually literal representations of my subject matter, which demonstrates my visual field to those with normal eyesight."²⁹ As Meghan Sims is not only color-blind but also extremely sensitive to light, she prefers to paint night settings when light is the dar-

29 AUTOR UNKNOWN, "Meghan Sims", achromatopsia, (date unknown), <http://achromatopsia.squarespace.com/meghan-sims-artist/>, accessed July 2020.

(1885-1965), who gave up painting after becoming aware of his color-blindness and turned to the art of sculpting, is one example of many daltonic artists, who decided to continue working with an art technique that did not necessarily involve the use of colors.²⁴ According to statistics led by the ophthalmologist Wolfgang Munchow in 1978, 17 out of 31 color-blind artists have turned away from painting and decided on a different medium.²⁵

Given the multitude of color-blind artists that existed so far, the analyzation of four different case studies offers the possibility to investigate how the working process of daltonic artists has changed in such a way that their color-blind deficiency is no longer seen as an obstacle in the creation of their art. The artists were chosen based upon their form of daltonism, their differing ways of handling their deficiency, as well as the diversity of art mediums they used within their artistic work.

The artists' case studies that were selected for the analyses conducted on the following pages are Charles Myron, Meghan Sims, Daniel Arsham and Neil Harbison. While the Frenchman Charles Myron lived from 1821 to 1868, all the other artists are still alive, with Meghan Sims, from Ontario and Daniel Arsham, from Ohio, both being born in 1980 and Neil Harbisson from Spain, being born in 1984. For Charles Myron it is not exactly proven which form of daltonism he had, but according to experiences he described in letters he wrote at the time

²⁴ MARJOR, Michael F., RAVIN, James G., *The eye of the artist*, Philadelphia, Mosby, 1997.

²⁵ LANTHONY, Philippe, "Daltonism in Painting", *Color Research and Application*, vol. 26, 2001, p. 13.

Note: Author had no access to the original source. MUN-CHOW, Wolfgang, "Color vision deficiencies in painting", in MARRE, M., MARRE, E., MIERDEL, P.,

International Symposium of the on Colour Vision Deficiencies, Dresden, September 1978. (no pagination)

ved by the public?

There are several artists in the history of art for which there were indications that they were color-blind. Posthumously, however, it is difficult to prove the artists' color-blindness and therefore, in retrospect, one can only speculate about the state of perception of certain artists. The artist Baccio Bandinelli (1488-1560), is a fitting example of an artist who has been speculated about being color-blind, as people said that he hired other artists in the 1500s to teach him how to use colors. Before that, his pictures were said to be of low quality and his handling of color was faulty.²⁰

Another case was the Irish artist Paul Henry (1876-1953), who was expected to be also color-blind but never made his deficiency public.²¹ Henry was told to have asked his wife to mix the colors for him. After Henry was divorced and remarried, it was said that the use of his colors, possibly due to the departure of his first wife, had changed as well.²² Because both women were independent artists, they may have been able to implement their personal color expression in his pictures, since Henry was already a well-known artist at the time, whose pictures were nationally recognized at the end of his life and later internationally shown.²³ Regardless of how he painted with colors, the question that arises is why an artist would create a piece of work in a spectrum he/she cannot really see himself? The case of the American artist Paul Manship

²⁰ MARJOR, Michael F., HEIKAMP, Detlef, STROZZI, Beatrice P., *Baccio Bandinelli: Sculture e Maestri*, Florence, Giunti Editore, 2014, p. 498.

²¹ FLEGG, Eleanor, "Treasures, wedded to a life of color", independent, (2018), <https://www.independent.ie/life/home-garden/treasures-wedded-to-a-life-of-colour-36987306.html>, accessed July 2020.

²² FLEGG, Eleanor, "Treasures, wedded to a life of color", independent, (2018), <https://www.independent.ie/life/home-garden/treasures-wedded-to-a-life-of-colour-36987306.html>, accessed July 2020.

²³ LAVERY, Brian, "From Irish Art Hero to Cliché and Back to Favor", nytimes.com/2003/03/06/arts/from-irish-art-hero-to-cliche-and-back-to-favor.html, accessed October 2020.

I have not heard of one female subject to this peculiar-ty."¹⁷ The reason why Dalton might not have encountered any female case is that, while for women, to be daltonic, both parents have to be colorblind, for men only one parent has to have a daltonic vision.^{18, 2} Dalton attributed the reason for his different color perception to a slightly tinted liquid in his eyes. It was only after his death that it turned out that this was a false assumption. Other researchers found the reason for the deficient color to lie in the concept of the cones on the retina.¹⁹ Although Dalton's assumption about the reason of his color-blindness was wrong, his initial researches have led to lively discussions on visual color impairment. Thus, in recognition of his pioneering work people have been talking about daltonism ever since.

An impairment of the visual color perception can play a role in many areas of life. A particularly interesting question, however, is to understand how a restriction with regard to the perception of colors affects people whose visual perception is elementary to their professional activities. One could assume that the functionality of visual perception is for few people as elementary as it is for the artist. Being active in a profession that is based on perception, how does a false or distorted perception of our surroundings influence the practice of art? What is the extent to which color-blindness can be defined as a falsified perception at all? And, in what way has this influential factor changed the way art is created and perceived?

WHAT IS THE EXTENT TO WHICH COLOR-BLINDNESS CAN BE DEFINED AS A FALSIFIED PERCEPTION AT ALL?

his discovers, "I was always of opinion, though I might not often mention it, that several colors were injudiciously named. The term pink, in reference to the flower of that name, seemed proper enough; but when the term red was substituted for pink, I thought it highly improper; it should have been blue, in blue appear to me highly allied; whilst pink and red to me have scarcely any relation."¹⁷ DALTON, John. "Extraordinary facts relating to the vision of colors, with observations," *Memoirs of the Literary and Philosophical Society of Manchester*, vol. 5, 1798, p. 40.

¹⁸ AUTHOR UNKNOWN, "Color Blindness: Types, Causes, Symptoms, Treatment", *allaboutvision.com*, <https://www.allaboutvision.com/allaboutvision>, (2019), <https://www.allaboutvision.com/condition/colorblindness/>, accessed July 2020.

and red, as well as yellow and pink. Lastly, the rarest form of color-blindness, named achromatopsia, withholds the person from seeing any color, in a way that the world that reveals itself solely in black and white.^{11, 1}

The first writings on the perception of color-blindness date from 1777 and were documented by Captain Joseph Huddart.¹² Huddart wrote about the perception of a shoemaker named Thomas Harris. Just like his brothers, Harris noticed that he couldn't distinguish colors red and green from each other. As a child he discovered that "when other children could observe cherries on a tree some pretended difference of color, he could only distinguish them from the leaves by their difference of size and shape."¹³ The first one to examine this visual deficiency was John Dalton. Through analyses of his own color perception defect, he was able to understand that his vision differed from other people's visual perception. Dalton was able to contact Harris's brother who he sent a set of colored ribbons in order for him to describe their colors.¹⁴ Harris had described their colors the same way Dalton did. This made him conclude that "a considerable number of individuals might be found whose vision differed from that of the generally, but at the same time agreed with my own."^{15, 16}

Even though Dalton had developed an understanding of color-blindness in 1794, he was surprised that he had not encountered a female case to date : "it is remarkable that

¹¹ AUTHOR UNKNOWN, "Types of Colour Blindness", <https://www.colourblindawareness.org/colourblindness/types-of-colour-blindness/>, accessed July 2020.

¹² HUDDART, Joseph, "An account of persons who could not distinguish color", *Philosophical transactions of the Royal Society of London*, vol. 67, 1777, p. 260.

¹³ HUDDART, Joseph, "An account of persons who could not distinguish color", *Philosophical transactions of the Royal Society of London*, vol. 67, 1777, p. 260.

¹⁴ MARJOR, Michael F., "John Dalton: The Recognition of Color Deficiency", in MARJOR, Michael F., ALBERT, Daniel M., *Foundations of Ophthalmology*, Switzland, Springer, 2017, p. 23-34.

¹⁵ DALTON, John, "Extraordinary facts relating to the vision of colors, with observations", *Memoirs of the Literary and Philosophical Society of Manchester*, vol. 5, 1798, p. 28-45.

¹⁶ Note : In a publication from 1798 Dalton wrote about

ject ever know that one perceives the color of the object in the same way? The answer is simple : we cannot. As Josef Albers writes in his book *Interaction of color* : "In visual perception a color is almost never seen as it really is – as it physically is."⁸ Accordingly, he claims that "this fact makes color the most relative medium in art."⁹

Knowing that the perception of color is relative, how do we know that our visual perception corresponds to reality? Knowing that other people see differently, what can be called reality? Is reality the one that corresponds to the perception of the majority of people or do we live in a world of visual parallel realities? How do people whose reality looks different reflect their reality?

People with severe color vision deficiency are called to be daltonic or color-blind. Research shows that 8% of men and 1% of women have a form of color impairment.¹⁰ From deuteranomaly, which is a red-green color-blindness, and the most common form, to tritanopia or achromatopsia, which is a complete color-blindness, and the rarest one. While the color-blindness type of deuteranomaly has as a consequence that green looks redder, protanomaly works the other way around and thus makes red look closer to green. Protanopia and deuteranopia cause the affected person to be unable to tell any difference between red and green whereas tritanomaly makes it difficult to differ between blue and green, as well as yellow and red. Tritanopia leads to the person affected not being able to differ between blue and green, purple

KNOWING THAT THE PERCEPTION OF COLOR IS RELATIVE, HOW DO WE KNOW THAT OUR VISUAL PERCEPTION CORRESPONDS TO REALITY?

8 ALBERS, Josef, *Interact-
on of Color*, New Haven and
London, Yale University Press,
1963, p. 1.
9 ALBERS, Josef, *Interact-
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10 BAILEY, Garethyn, "Color
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thought process, which gives an understanding of what is seen, where it is and how to react to it. It combines information from many sensory systems and thus creates a perception of reality."³

Through the pupil of our eyes, light is refracted and falls onto the retina at the back of our eyes. Through light-sensitive nerve endings and color cells the information of what is seen is transmitted as optic nerves to the brain. The brain then processes the image. Through this procedure, we are capable of distinguishing over 10 million colors or nuances.⁴ Which color we perceive, depends on the object and its properties as well as of the light source. Friedrich von Schiller already wrote about the paintings of Peter Paul Rubens in the 18th century : "I cannot shake off the thought that these colors are lying to me because they seem to be different depending on the way the light falls on them or whether the angle from which I see them is the one or the other."⁵ When light hits the object, parts of the light are being absorbed, while some parts called "wavelengths"⁶ are being reflected. These are responsible for what colors our eyes perceive. But not only, Scientists have found that there are differences in color perception among people with complete visual functionality.⁷

With the awareness that even the visual perception of human beings without congenital defect creates differences in vision, how can we as viewers of the same ob-

3 AUTHOR UNKNOWN, "Eycare, the difference between sight and vision", <https://www.smartvisionoptometry.com/auycare/eyesight-vs-vision/>, accessed July 2020.
4 PANTON, Verer, "Notes on Color" (1997), in Musée des arts décoratifs et du design – Bordeaux, *Oh! Couleur*, Les éditions confluentes, 2017, p. 211.
5 "Light: Electromagnetic waves, the electromagnetic spectrum and photons", <https://www.khanacademy/a/date>
6 AUTHOR UNKNOWN, "Bohr-model-hydrogen-ap/structure-of-atoms-ap/ap-chemistry/electronic-khanacademyorg/science/unknown)", <https://www.khanacademy.org/science/ap-chemistry/electronic-structure-of-atoms-ap/bohr-model-hydrogen-ap/light-and-the-electromagnetic-spectrum>, accessed July 2020.
7 JURICEVIC, Igor, WEBS-TER, Michael A., "Variations in normal color vision", *Cambridge University Press*, December 2008, p. 1.

•• A	Arsham
H	Harisson
M	Merion
S	Sims
X	Normal

INTRODUCTION

The phenomenology of perception has over the past decades been subject to various psychological and philosophical studies. Carmelo Calli, an assistant professor at the University of Palermo specialized in the philosophy of cognitive science, recognizes the general perception as follows: "from the epistemological standpoint, perception is considered an independent mode of knowledge of the world at the environmental scale to which the subjects have access. Accordingly, the world is considered as the perceivable environment specified in the modes of sound, visual and tactual appearances and distinctions-hed from the world as the object of research of the natural sciences."¹ In accordance with Calli's understanding of perception in general, the analyses conducted on the following pages focuses mainly on visual perception while partially touching the subject of an advanced form of acoustic perception.

When speaking of visual perception, we have to differ between sight and vision. Sight represents our sensory experience, namely "the physical attributes and performance of the many organic components involved in the visual system."² Vision, however, refers to how our mind interprets the images perceived by the eyes. It is "a

¹ CALLI, Carmelo, *Phenomenology of perception: theories and experimental evidence*, Leiden and Boston, Brill Rodopi, 2017, p. 1-2.
² AUTHOR UNKNOWN, "Eyecare, the difference between sight and vision", smartvisionoptometry.com, (date unknown), <https://www.smartvisionoptometry.com.au/eyecare/eyesignht-vs-vision/>, accessed July 2020.

ABSTRACT

The phenomenon of daltonism was first researched in 1794 and although the symptoms of color-blindness have made it difficult to practice several professions, the diagnosis has probably not influenced any other profession as much as that of an artist. While 200 years ago artists struggled to cope with their color-blindness in connection with their art, contemporary artists seem to find ways to incorporate their visual color limitation in their artistic work. Through an in-depth analysis of the interplay between the artists handling of his color vision defect as well as the public's reception of daltonic art, this paper seeks to unveil the influence of color-blindness in art. By analyzing four case studies of daltonic artists, parallels and differences in overcoming this visual deficiency are studied in order to explore whether the artists achieved to overcome the obstacle of their limited visual perception. Consequently, *The End of Daltonism as an Obstruction* aims to identify how artworks created by color-blind artists are understood by people with a normal vision and the extent to which daltonic art has successfully integrated itself into art history.

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THE END OF DALTONISM AS AN OBSTRUCTION

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THE END OF DALTONISM AS AN OBSTRUCTION

THIS BOOK MUST NOT BE
TURNED AROUND OR TURNED OVER.
IN ORDER TO UNDERSTAND THE CONTENT,
ONE MUST CHANGE THE PERSPECTIVE.

