HACETTEPE UNIVERSITY
FINE ARTS INSTITUTE

Department of Ceramics

RESEARCH OF TRANSLUCENT PORCELAIN AND ITS USE IN LIGHTING DESIGN

Anita KOCSMAR

Master's Thesis

Ankara, 2022

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IŞIK GEÇİRGEN PORSELEN ARAŞTIRMASI VE AYDINLATMA TASARIMINDA KULLANIMI

Danışman: Prof. Adile Feyza ÖZGÜNDOĞDU

Yazar: Anita KOCSMAR

ÖZ

Bu tez porselen-ışık geçirgenlik ilişkisi ve metal tuzlarının aydınlatma tasarımında sunabileceği fırsatlar hakkında yazılmaktadır. Araştırma, porselenin tarihçesi, aydınlatma tasarımıyla bağlantısı ve metal tuzlarının kullanım olanaklarının anlatıldığı, ardından tasarımın arkasındaki fikir, test pişirimlerinin ve nihai ürünün yapımının belgelendiği üç bölümden oluşmaktadır. Amaç, suda çözünür metal tuzları hakkında daha önce yapılan araştırmaları takip ederek, ışık geçirgen porselen ile ilgili olarak aydınlatma tasarımında yer alabilecek olası bir tekniği incelemektir. Bu sanat araştırması, halihazırda var olan bir malzemenin yeni bir kullanımını bulma olanağına sahiptir.

Anahtar sözcükler: Porselen, ışık geçirgenlik, aydınlatma tasarımı, lamba, metal tuzları.

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RESEARCH OF TRANSLUCENT PORCELAIN AND ITS USE IN LIGHTING DESIGN

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ABSTRACT

This thesis is about the porcelain-translucency relationship and the opportunities that metal salts can present in lighting design. The research exists of three chapters in which the history of porcelain, its connection to lighting design, and the possibilities of using metal salts are described, followed by the reasoning of the design and the documentation of the test firings, and the making of the final product. The goal is to examine a possible technique that could be involved in lighting design in relation to translucent porcelain, by following previous researches about water-soluble metal salts. This art research has the possibility to find a new usage of an already existing material.

Keywords: Porcelain, translucency, lighting design, lamp, metal salts.

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INTRODUCTION

Porcelain is most famous for its whiteness, beautiful sound, and capability of translucency, but when it's mentioned, the first thing that might come to people's mind is a set of china rather than any other porcelain object. The use of porcelain in creating luminaires has been known because of its translucency but it is quite rare to see the colored state of porcelain in use or if it is used, it is not translucent. In functional lighting such as a pendant in the living room, or a wall light in a corridor, white, uncolored porcelain is a logical and elegant choice, but to create something new or different, colored porcelain could be a pick.

While the possibilities of coloring porcelain with metal salts had been examined before, little research focuses on the possibilities of the use of these colorants with translucent porcelain and even lesser in lighting design. This research will be discovering the potential of metal salt colorants and their artistic values in ceramic and lighting design. The metal salt research part will be done by taking examples of Arne Åse's book, *Watercolor on Porcelain* (1988), as well as of Oya Aşan's thesis *Light-Material Relationship and Use of Porcelain as an Art Material* (2011) and previous researches of Prof. Adile Feyza Özgündoğdu (2006) and others. Åse's book is not only an example for water soluble metal salts and their application, but it is an example for art research as well, which is the idea of this thesis.

To quote Gunnar Danbolt on art research:

> "Art research is the application of new materials in an aesthetic connection, and the development of new techniques, new tools, and new aesthetic ways and means. Further characteristics are the application of already more or less familiar techniques, tools, and methods in new combinations, and the ability to develop new kinds of works of art that function aesthetically." (Åse, 1989, p. 16.)

After explaining the brief history of porcelain, its connection to lighting design and the coloring method in the first chapter, the second chapter of the thesis will describe the idea behind the design and the process of the creation of the 'luminaire' from porcelain. The third chapter will consist of tests, such as test firings to achieve translucency, color tests to keep the achieved translucency and to find the color palette that will be applied to the final piece, and the preparation of the final pieces with metal salts. The goal is to find the best way to color porcelain with attaining the translucency, and to apply it in artistic use to create aesthetically functioning light sculptures.

1. CHAPTER: PORCELAIN, LIGHT AND COLOR

In the first chapter porcelain is introduced to the reader. Its origins, historical importance, its travel from the East to the West. Following that, the potential of ceramics and moreover the use of porcelain in lighting design is presented with examples of different ceramic artists and designers. Next, water-soluble colorants are introduced, as a possible material to be used with translucent porcelain in lighting design.

1.1. History of Porcelain

Porcelain has been described in many ways since its discovery. When searching for the definition of porcelain it is inevitable to come across some poetic descriptions or technical definitions, which shows the status of porcelain perfectly. While it has been an art form since Ancient China, it has also been a mystery of chemistry for the 17th Century Europe. Jack Doherty describes porcelain as "the most difficult and capricious of ceramic materials". When he asked many porcelain makers 'what is porcelain?', the main key words were as follows: "purity, fineness, translucency, whiteness, strength, hardness, and durability when fired" (2002, p. 7). Porcelain is also referred to as white gold because of its delicacy and durability, and in 17th century Europe was a sign of socio-economic status. Most pieces were created to be admired and not be used in everyday life.

Porcelain was first discovered in China, but not from one day to another or by a fortunate accident, it was developed over several thousands of years. First ceramic works and technologies that led to the development of porcelain can be traced back to the Shang Dynasty (17th-11th centuries BC). Shang wares were made of clay containing kaolin and were fired no higher than 1200℃. While there is little evidence of white ware technology until the Tang dynasty (AD618-906) it is suggested that were the kiln technology more developed and higher firing temperatures attainable, Shang wares could have been translucent and fully vitrified too. White wares in the Tang dynasty were referred to as "vessels of clay as transparent as glass". It was only in the Song dynasty (AD960-1279) that porcelain makers mastered the material and technique. It was during the Yuan (AD1279-1368) and Ming (AD1368-1644) dynasty that the town of Jingdezhen became the most important center of porcelain production, thanks to its geographical location. It was positioned near to inland waterways and raw material deposits, also due to the shrinking agricultural work ready workforce was available for employment (Wardell, 2020).

Figure 1. A selection of Ming Dynasty (1368-1644 CE) blue-and-white porcelain (ca. 1465-1487 CE) https://bit.ly/3d81UOJ

Figure 2. A Ming Dynasty porcelain bowl decorated with dragons chasing pearls (ca. 1368-1644 CE) https://bit.ly/3RwhYsx

Many changes and innovations happened in the decorative art in the Yuan dynasty. This period can be also connected to the popularity of underglaze cobalt blue decorations, for which the cobalt was probably imported from the Middle East. This decoration was applied to fine white porcelain and quickly became the most popular amongst Chinese ceramics, being exported to the Middle East and to Southeast Asia. The following Ming dynasty and its almost 300 years were a period of creative activity in China. The huge demand for porcelain made Jingdezhen the source of the world's porcelain. The blue and white (Figure 1), and red and white (Figure 2) style reached its peak during this period. The technique of over glaze enamels was developed during the late 15th Century.

Figure 3. A bottle made from the white porcelain manufactured during the Joseon dynasty of Korea (ca. 1392-1910 CE) https://bit.ly/3DjitSA

Figure 4. Sakaida Kakiemon XV (b. 1968), Octagonal lidded bowl, created in 2016 (Kakiemon, 2016) https://bit.ly/3xdD6eP

Korea was the second country after China to produce porcelain. Ceramics from China were imported to Korea from the 3rd Century AD and these pieces were used as models by Korean potters. With the use of these ceramics, they accepted the Chinese ceramic culture and technology, to help further their own progress. By the 12th century, they started making Korean porcelain, and by the 15th century they had their truly distinctive white porcelain (Figure 3) (Doherty, 2002, p. 13). It was in the 15th century that Korea suffered defeat by the hand of Japan and the porcelain industry collapsed. It is said that a Korean potter was taken prisoner to share his knowledge of porcelain making. He discovered a porcelain stone in Arita region and production began. Although Japan gathered their knowledge from China and Korea, a Japanese potter, Sakaida Kakiemon developed a typical Japanese style (Figure 4), which had influenced several European factories too, such as Worcester, Derby, and Meissen (Wardell, 2020).

Figure 5. Pot à sucre Hébert (part of a tray and tea service) (1755-1756) https://bit.ly/3eIZcQj

Porcelain was imported from China to Europe from the 17th century. While there were many unsuccessful experiments throughout Europe (Italy, France, Britain) in the 16th century, it wasn't until Johann Friedrich Böttger (1682-1719) that the secrets of true porcelain were discovered. The German alchemist was taken prisoner by Augustus II the Strong, King of Poland to produce porcelain, and with the help of Ehenfried Walter von Tschirnhausen German scientist and mathematician managed to create a high temperature red stoneware (red porcelain) and with the discovery of a white burning clay they were able to create porcelain. In 1710 the Meissen porcelain factory was established and started production under the patronage of Augustus II the Strong. (Doherty, 2002, pp. 9-15). In France, kaolin was only discovered in 1768, before that their factories were producing pieces with soft-paste porcelain. Factories in and around Paris, such as St Cloud and Chantilly were producing Kakiemon-inspired wares. The Vincennes factory, opened in 1740 was an important landmark in the porcelain production in France because they had been granted the rights to produce porcelain in the style of Saxony, with its rich flower and bird motif decoration, however these pieces were still produced with soft-paste (Figure 5). With the start of the European factories porcelain slowly became a part of people's lives (Wardell, 2020). Today porcelain is not a status symbol but a material that people buy and use with adoration.

1.2. Lighting Design

Light has a huge role in our lives and interior lighting is one field that became more and more important with the years passing. “Light, the basis for all vision, is an element of our lives that we take for granted.” (Gansland and Hofmann, 1992, p. 43). While in old times people arranged their days around the moving of the Sun and spent most of their times outdoors, in the 21st Century people tend to spend most of their times indoors. With the discovery of electricity and the invention of lightbulbs in the 19th century, it became possible to have the same quality of light in buildings as the Sun. Artificial lighting and lighting design creates an important segment of architecture today. The designing of every space requires knowledge of light, natural and artificial alike. Lighting is the provision of the necessary level of illumination for a function to be seen, and in cases where the illumination of daylight is not enough, the lighting made by consuming energy, artificial lighting must be used. (Bal, 2005, p. 75).

Figure 6. Woven Light and Porcelain (O’Rorke, n.d.) https://bit.ly/3QDW7hE

In the late 19th Century, the production of lamps was more focused on the practicality rather than the aesthetics. The invention of LED technology brought a great change in lighting design. This new technology let the designers to leave the ‘normal’ shape of a lamp and start creating unusual forms, shapes, and arrangements (Figure 6).

Interior lighting today has more function than only bringing light. Luminaires around a building can change our perception of the size of a room, it can hide unwanted corners, or it can give a different atmosphere to a place. Without maybe realizing it but one of the first thing that catches someone's eyes when entering a space is the lighting: the amount, the color, the direction of it. Luminaires' sole purpose in not only to bring light anymore. With the knowledge of artificial lighting's physiological, psychological, and aesthetic effects it is possible to create the desired atmosphere in offices, restaurants, and homes (Öztank, N. and Halıcıoğlu, F.H., 2009, p. 1).

Because of the blooming of lighting design, many new materials were introduced to the production, giving way to creativity. And while porcelain now can be easily replaced with frosted glass, Plexiglas, and other artificial materials, to quote Emma Lacey, ceramic objects could "transcend the fast moving home-ware trends and remain loved and relevant over extended time" (2009, p. 87). The latest design trends also show a returning desire for more natural, raw materials, such as ceramic, leather, bamboo, etc.

1.2.1. Ceramics and Lighting Design

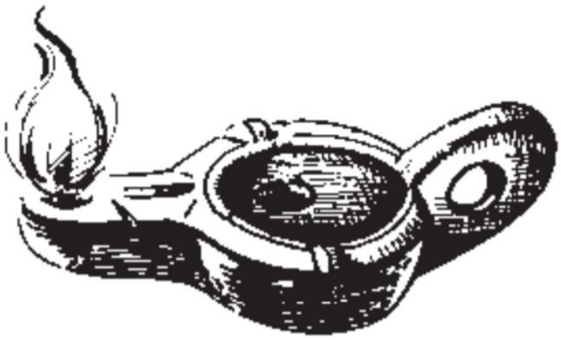

Figure 7. Greek oil lamp, a mass item in the ancient world (Ganslandt, R., and Hofmann, H., 1992, p. 13)

The relation between clay and light can be led back to thousands of years ago, when people were just getting to know how to control fire for their own benefits. The first clay lamps can be dated back 3ooo years, with their simple open form and floating wick. In the development of clay light over the years the shape has changed for reasons of practicality and the fuel varied according to location and natural resources (Figure 7). From the middle of the 15th century new materials were introduced to the candle industry, such as beeswax, paraffin, and kerosene, pushing clay lights with wicks to the background. Gas lighting was introduced in the 18th Century and by the late 19th Century electricity became the main fuel of lighting. This change kicked off the lighting industry as we know it today and gave a new part to ceramics in the future of lighting. (O'Rorke, 2010, pp. 7-10).

Figure 8. Mima Table Lamp (Sin, n.d.)
https://bit.ly/3exeEyD

Figure 9. Rolling Hills (Sin, n.d.)
https://bit.ly/3qwrb8l

Leaving the kitchen, ceramic objects are now present all around our homes in the form of tiles, decorative objects, and lighting. One of the trends of the last years in lighting design is sculptural ceramic lamps. These objects are very commonly created by artists and ceramicists who are drawn to create something not just aesthetical but functional too. This idea of creating useful ceramics that live beyond the kitchen and dining table is what inspires Virginia Sin for example, the creator of SIN (Orlow, 2018). Her ceramic table lamps are not just functional, but they carry artistic value within them. Each of the lamps were inspired by mountains where the light bulb represents the position of the sun (Figure 8) (Figure 9).

Figure 10. Ascension (Bromley, F. and Bromley, D., 2014) https://bit.ly/3RK3XaY

When talking about ceramics in lighting design, it is important to mention porcelain, which became a quite popular choice of material. As it’s been mentioned in the previous paragraph, thanks to the invention of LED lights and other modern lighting technologies, lighting design is living its most creative decade. With the many possibilities that porcelain holds, it is a perfect match for LED technology. Porcelain is a very elegant and almost luxurious material which can lift a simple design to the next level, even if the translucency of the material is not in consideration. Just the picture of a well-lit snow-white porcelain composition with its shadow plays can give the feeling of something special (Figure 10).

Figure 11. Cocoon (Özgündoğdu, 2007, p. 92) **Figure 12.** Bone China (Aşan, 2011, p. 149)

One of porcelains most important characteristics is its light transmittance. Light transmittance is the capability of a material to absorb rays of light but transmit some of it. Transmittance is affected by factors such as the materials thickness, molecular and chemical composition (Özgündoğdu, 2006, p. 101). Light transmitting materials can be translucent or transparent. In translucent materials the body cannot absorb the light hitting its surface, so the light passes through the material, and it causes the material to appear translucent or semi-transparent. The capability of light transmittance in porcelain bodies depends on many factors such as microstructure, thickness, grain size, pigments used, porosity, and the number and degree of firings. Porcelain and its new values within the light-ceramic relationship has led to the finding of new techniques and applications. These new techniques are not only about the shaping methods, but about the aesthetic possibilities that porcelain can reach when combined with light. When these works made with porcelain are examined in different light environments, different technical and aesthetic features can be found each time. The common point seen in the different perspectives of the artists can be said to be the examination of the aesthetic quantities that light transmittance and shadow plays add to the works (Aşan, 2011, p. 24). A. Feyza Özgündoğdu and Oya Aşan both focused their studies on the translucency of porcelain as an aesthetic expression. While Özgündoğdu (Figure 11) was experimenting with the addition of colors to create new illusions, Aşan (Figure 12) mainly focused on taking away from the thickness of porcelain to create different depths and light effects,.

Figure 13. Waves (O'Rorke, 2014)
https://bit.ly/3L906Sa

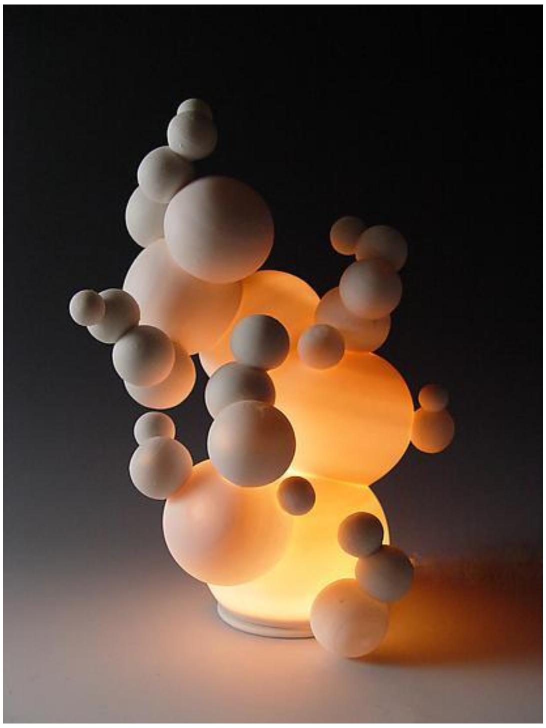

Figure 14. Bubbles (Lotan, n.d.)
https://bit.ly/3qsQzfj

The translucency of porcelain indeed inspired many designers and ceramicists. The creation of a beautiful porcelain luminaire is on the fine line between design and art with its function and form. "Creative artists using translucent clay can now embrace the current lighting technology and consider how the nature of the translucent fired clay combined with a light source can transform a contemporary interior, creating a calm and peaceful atmosphere." (O'Rorke, 2010, p. 14). As it can be seen in some of the latest trends in lighting design, such as sculptural lamps, aesthetics have a bigger role in the current industry than ever before. When talking about porcelain and lighting design, great examples are the works of Margaret O'Rorke artist (Figure 13) and Lilach Lotan ceramic designer (Figure 14). They both work with translucent porcelain, creating lights in organic forms. Their works vary between wall sconces, pendants, table lamps, chandeliers, and while some can be described as lamps, some of them are better to be titled light sculptures.

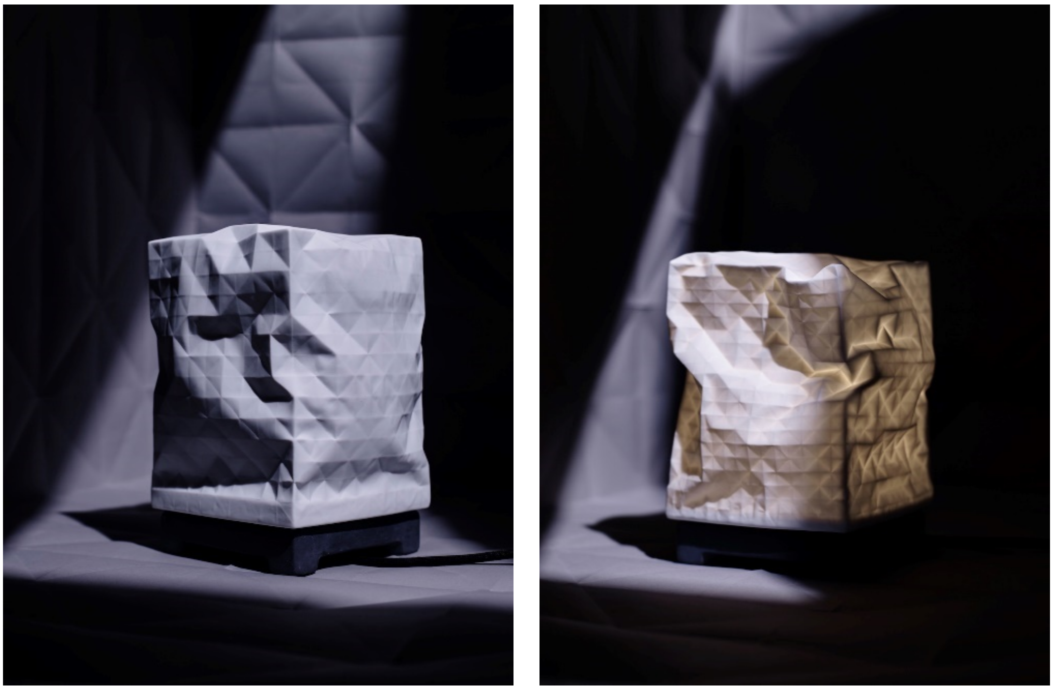

Figure 15. Litorigami (Vig, 2015) https://bit.ly/3eNPlJ2

Good example is also Aliz Víg, Hungarian designers' master's thesis project. She created folded paper like lanterns and illuminated them from inside to really show the details. Her project creates a good connection between paper and porcelain, paper and light, and expresses well the opportunities of porcelain (Figure 15).

1.2.2. Lithophane

It's important to mention lithophanes in relation of lighting design and porcelain because this technique was created for the translucency of porcelain. "Lithophanes are three-dimensional translucent porcelain plaques which, when backlit, reveal detailed magical images." Lithophane can be dated back to the 19^{th} Century when it had its heyday. Before the age of electricity buildings were illuminated by candles and oil-lamps, and lithophanes were included in objects such as night lights, candle shields, tea and food warmers, lamp shades, fairy lamps, etc. With the upcoming of electricity lithophanes were pushed into the background. Lithophanes came back to fashion with the possibilities of new technologies. Today, lithophanes can be easily produced by CNC machines or 3D printing methods, which gives a wider opportunity in experimenting (Carney, 2021, p. 23).

Figure 16. Woman on Bike (Blackwell, 2009) https://bit.ly/3L5AbuG

Figure 17. Push Puppet Lamp (Blackwell, 2011) https://bit.ly/3DdPtvs

Great examples of modern lithophanes are the works of Hannah Blackwell (Figure 16) (Figure 17). Hannah Blackwell is an American artist who was inspired by a piece of lithophane prepared in Hungary from Herend porcelain. Seeing the possibilities in this work inspired her to start researching translucent clay bodies and to spend a few months in Kecskemét, Hungary, where the International Ceramic Studio is located. While, as I mentioned before, there are new technologies to make creating lithophanes easier, Blackwell chose to work in the traditional way.

Figure 18. Marionettes (Romule, 2015) https://bit.ly/3RW6HkZ

Figure 19. Primitive and Technologic Z (Tokgöz, 2017) https://bit.ly/3RKdChK

Other artists were also inspired by the possibilities of Herend porcelain and the International Ceramics Studio in Kecskemét, such as Latvian artist Ilona Romule and Turkish artist Ömür Tokgöz. Ilona Romule has been creating figurative lithophanes and light objects since 1985. She refers to porcelain as a language that should be fluent and flawless, which is why she only uses porcelain in her practice. Her works vary between sculptural object, lithophanes, light objects, etc. (Figure 18). Ömür Tokgöz is also a frequently visiting guest artist at Kecskemét. Her experimental works are really pushing the limits of porcelain thickness. While she is not using this fine, very translucent porcelain to create luminaires, the works presented by her all have beautiful shadow-light effects (Figure 19).

1.2.3. Light and color psychology and physiology

Light has many effects on our health, productivity, and psychology. A poorly lit workplace and the lack of natural light can lead to Sick Building Syndrome, or the lack of sunlight in the darker months can lead to Seasonal Affective Disorder or more commonly known as seasonal depression (Şahin, 2012, p. 41).

Color Temperature (KELVIN)	2700K	3000K	5000K
Light Appearance	Warm White	Warm White	Cool Daylight
Ambience	Cozy, inviting	Warm, welcoming	Crisp, invigorating
Best for	Living rooms, kitchens, bedrooms	Bathrooms, entryways, outdoor	Basements, garages
	Table/floor lamps, pendants, chandeliers	Vanities, overhead lighting	Task lighting, security lighting

Figure 20. The purpose of different light temperatures
https://bit.ly/3Bw57RA

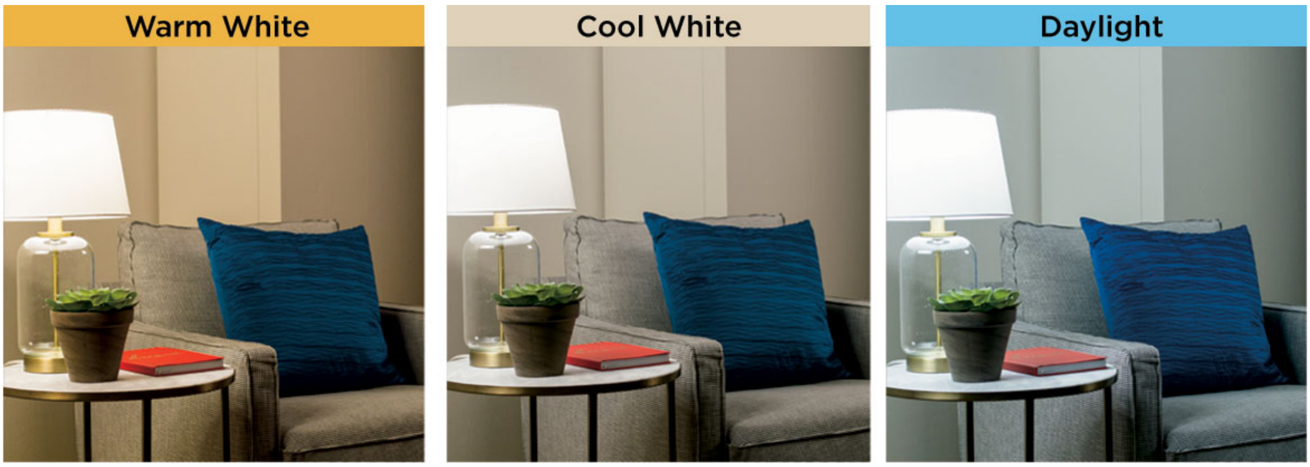

Figure 21. Difference between color temperatures
https://bit.ly/3Bw57RA

It is not only the presence or lack of light that can affect people, but the color of light too. It is important to always choose the suitable color temperature for the area where the light will be used. Color temperature describes the warmth of light from warm white to daylight on the Kelvin scale (2000-6500K). Each color temperature suits different purposes (Figure 20). Warm white at 2700K produces a warm, cozy, welcoming light, usually used at home or by restaurants, hotels. When choosing light for the workplace, cooler colors are better, lights around 3500-5000K provide more clarity and show more details (Figure 21). The reason for this is that light spectrum with more blue components reduces melatonin (sleep hormone) production and helps alertness, while red components increase melatonin production and help with relaxation.

Colors in themselves can have different psychological effects on people. Light in relation to color has three main qualities, brightness, saturation, and hue. Brightness is the amount of light described as lumens or lux. Brighter light can heighten emotions, while low light keeps them steady. Saturation describes the intensity of a color. More saturated colors can intensify emotions and paler colors can lower them. Hue is the color itself or shade. Natural light can have emotional effects on people, but artificially created color lights can also create emotions. As mentioned before, blue light can make us more energetic, and red light can calm us, even improve mental health (TCP, 2017).

1.3. Coloring Porcelain

Porcelain might be best known for its whiteness which is the reason why porcelain objects have been used as the painter’s canvas since the beginning. While an unglazed, pure white porcelain object can perfectly stand its place with its elegance, there is something in its whiteness that inspires artists to pick up the brush and create breathtaking motifs and decorations. Chinese porcelain is a great example of this urge with its bird motifs, flowers, and animals.

Porcelain objects can be colored in many ways. They can be glazed, under- or overglaze paint can be applied to them, or color can be added directly to the paste. Glazing porcelain is not only for aesthetic reasons but for functionality too. Glazing ceramic bodies makes them waterproof and food safe, can help with the durability of the surface and strengthens the whole body. And while porcelain paste can be colored with stains, pigments, or oxides, as Jack Doherty wrote it, “in order to be translucent, the clay must have a low level of light absorption, caused by the presence of metal irons. In practice this means using clays which contain as little iron or titanium oxides as possible.” (2002, p. 31). Because the focus of this thesis is to work with translucency, the options where any kind of oxide or stain is added to the paste had to be excluded. Like Arne Åse wrote, naturally, there are several ways of combining transparency with colors, but if the main goal is to work with the transparency as an aesthetic expression, water-soluble metal salts are the wise choice. Using these soluble colorants is like using watercolor. It can be transferred to the surface of bisque porcelain just like paint, and because the porcelain is still porous it takes the color in without creating an extra layer on the surface. With this technique of coloring, it is possible to keep the translucency. (Åse, 1989, p. 147).

1.3.1. Water-soluble colorants

A water-soluble colorant, from a more chemical point of view, can be described as "…a slurry for use in decorating a ceramic substrate. The slurry [...] includes solid particles of at least one color-contributing metal salt dispersed in a saturated solution of at least one color-contributing metal salt..." (Garcia et al., 2002). According to Arne Åse, who is most well-known for his artistic research of metal salts, describes water-soluble colorants as "…chemical solutions or chemical mixtures that give color to clays and glazes in the temperature ranges that are used in ceramic production." (1989, p. 17). Åse refers to the used colorants as water soluble colorants instead of only calling them metal salt solutions because not all of the chemicals that he tried are metals and not all are salts. In this thesis on the other hand, only metal salts were tested, so calling them metal salt solutions is acceptable.

Figure 22. The metal salts used in this thesis

In ceramics there are many color compounds which consist of pigments in varying mechanical combinations. These color compounds commonly do not dissolve in water or in other liquids that they are likely to be mixed with. Pigments are pulverized minerals or mineral mixtures, mainly oxides, carbonates, etc., mostly from metals. Ceramists today mostly use industrially manufactured pigments, which will act in the same way as the originals, though they tend to dissolve more or less when mixed with glazes or clays. A difference between pigments and water-soluble colorants is that when painting with the latter, it is being absorbed into the pores of the clay, either it is dry, raw, or bisque fired. The porosity plays a big part in the intensity of the color. When pigments are used in the same way, they settle as an extra layer on the exterior of surface. Another difference is that there are fewer colors available when working with solubles. These solubles have hardly been used before by ceramists, but most of the colorants are actually the salts of metals most commonly used as pigments (Figure 22).

1.3.2. Soluble colorants used in this thesis

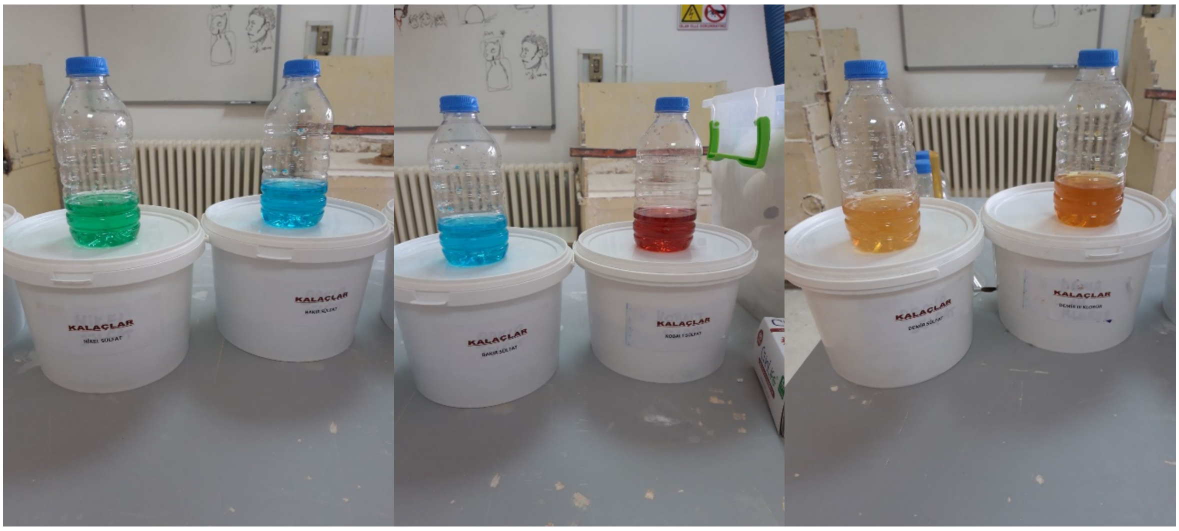

Figure 23. The solutions prepared for the research

Because the goal of this thesis is not to further research metal salts, but to study the possibility of colors in porcelain lighting design, a few already found and tried colors were picked from different sources. These colors will be combined with porcelain to see how they influence its translucency. The metal salts will be described with the help of Arne Åse's book, *Water Colour on Porcelain: A Guide to the Use of Water-soluble Colourants* and Steven Goldate's article, *The Alchemy of Watercolor on Porcelain* based on Åse's book. While Åse mostly done his research on chlorides, Goldate went more into the topic of sulfates, which are actually more easily accessible and relatively inexpensive metal salts (Figure 23).

The metal salts tried in this research:

- Cobalt Sulfate $COSO_4$
- Iron Sulfate $FeSO_4$
- Iron (III) Chloride $FeCl_3$
- Copper Sulfate $CuSO_4$
- Nickel Sulfate $NiSO_4$

Cobalt

Cobalt (II) Chloride: $CoCl_2$ and Cobalt Sulfate: $COSO_4$

Figure 24. Bowl decorated with cobalt chloride (10% sol.) and iron chloride (100% sol.) (Åse, 1989, p. 166)

Cobalt chloride is a poisonous material when swallowed or inhaled, and skin contact can cause allergy. Gloves should always be worn, and proper ventilation must be ensured when handling cobalt. Small amounts mixed with water may be poured out to the sink. It is important to know that cobalt oxide is classified injurious to health, and cobalt nitrate might explode in its container if it is knocked over, or if it is exposed to heat or by a spontaneous chemical reaction.

Cobalt chloride can be used in many different concentrations in solutions. Light blue colors will develop around 5%, medium blues around 10-20% (Figure 24. Bowl decorated with cobalt chloride (10% sol.) and iron chloride (100% sol.) (Åse, 1989, p. 166), while dark blues at approximately 40-50%. Black color can be achieved when mixed with uranyl nitrate (30%), iron chloride (100%) or nickel chloride (50%). The color development of course will always depend on the clay's absorptiveness and the kiln atmosphere.

Copper

Copper Chloride: $CuCl_2$ and Copper Sulfate: $CuSO_4$

As copper oxide, copper chloride is classified as injurious to health. It causes skin irritation and allergic reactions and the dust of it will irritate the eyes. Protective goggles and gloves should be worn when handling this material. When exposed to paper contact long-term, it may be inflammable.

Copper chloride dissolves easily in water and can be useful in many varying concentrations, though without glaze the possible color range is limited. The best colors can be achieved in reduction and/or high temperature firing. 5-10% concentration solutions will produce grey colors that can break into reddish and pink colors. The degree of reduction and reoxidation during cooling can greatly affect the results. The best colors are achieved when the ware is completely sintered. Copper chloride is very suitable for producing red color. 20-30% solutions will produce brownish red to black colors. Åse recommends applying this material both to the dry unfired ware and to the bisque-fired ware.

Copper chloride is one of the colorants that is suitable for the basis of developing black colors in reduction firing. For this a 30-40% concentration is needed. On the other hand, copper compounds are mostly known for their ability to produce greens and blues when combined with glazes and fired in oxidizing atmospheres with temperature ranging around 1300℃. Copper chloride solutions also may be combined with other pigments or soluble colorants to produce shades of greens and blues in oxidizing atmospheres.

Steven Goldate in his research achieved to produce reds similar to copper red glazes with copper sulfate. He used a 25-30% solution, applied in several layers to the bisque ware. As he describes, the firing cycle is very important, if the pieces are oxidized, they will turn a weak yellow and the solution also tends to attack the surface of the ware.

Iron

Iron (III) Chloride: $FeCl_3$ and Iron Sulfate: $FeSO_4$

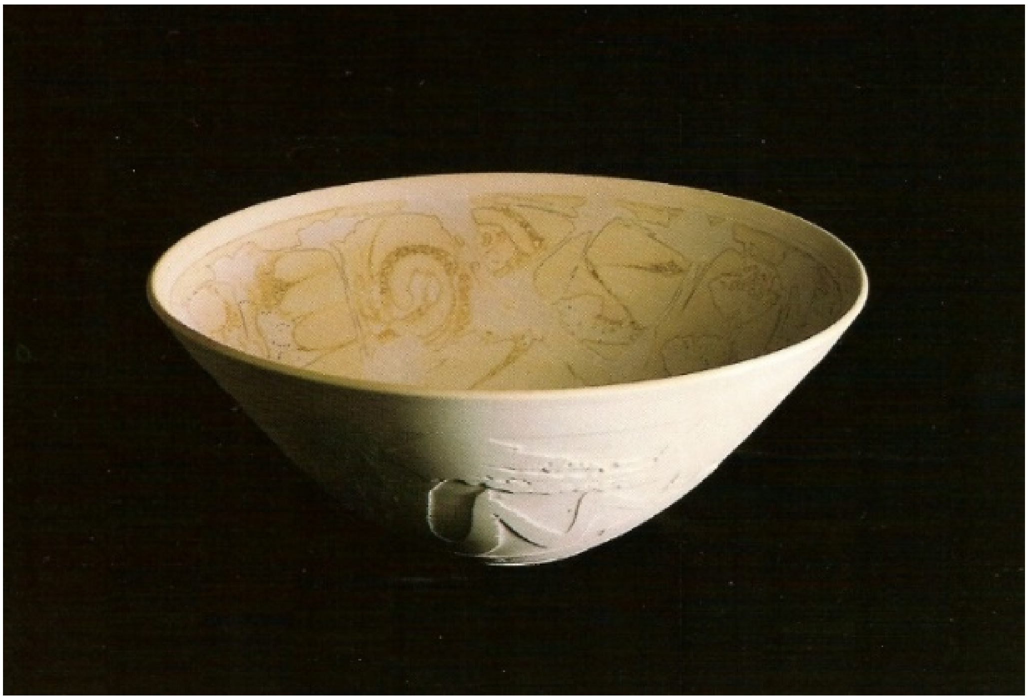

Figure 25. Bowl decorated with iron chloride (100% sol.) and phosphoric acid. (Åse, 1989, p. 168)

Iron (II) chloride is a fairly non-toxic, but iron (III) chloride is classified as being injurious health and a strong irritant. Certain metals can corrode when coming to contact with iron chloride, for this reason it is important to immediately clean the brushes and other tools after use. Small amounts mixed with bigger amount of water may be poured out to the sink.

No matter the solution, iron chloride produces weak colors, ranging between pale yellow to brown (Figure 25). Kiln atmosphere has little influence on the result where no glaze has been applied. The darkest colors are achieved on rather non-porous ware, with a high iron concentration (100%). Iron chloride can be used in all firing temperatures. Strong brown colors can be achieved with mixing iron chloride (100%) with different amounts of potassium chromate, uranyl nitrate or nickel chloride. When combining cobalt chloride and iron chloride, blue-green colors are produced. Iron chloride is fit to mix with other colorants to create subdued new shades. If it is used in great amounts and/or in strong concentrations, it may cause boiling on the surface in reaction with the clay.

Iron sulfate works in the same way as iron chloride, it only produces color in high concentrations and can be mixed with other metal salts.

Nickel

Nickel Chloride: $NiCl_2$ and Nickel Sulfate: $NiSO_4$

Nickel chloride is easily dissolved in water. Nickel compounds are suspected to be carcinogenic, they also might cause allergic reactions such as skin rashes. Dry chemicals should only be used in well-ventilated areas. Avoiding contact with eyes, skin and clothing is important.

Nickel chloride produces shades of brown color, and it is most useful in reduction atmospheres at medium/high temperatures. It can be applied in 10-50% solutions. When applied on dry unfired ware, it has a tendency to spread, even when the ware is bisque-fired it may happen, resulting in blurry lines. To avoid this tendency, thickener may be added to the solution.

1.3.3. Handling metal salts

Metal salts are chemicals, and like with every other chemical, it is important to know how to handle them. People working in the ceramics industry are exposed to many different chemicals, from which some are harmless, but some can be highly poisonous. As long as the procedures on how to use them in a controlled way is followed their hazard can be limited. Cleanliness and care are even more important than in normal circumstances in a studio for the reason of hygiene and because some chemicals have long-term damaging effects.

Another important point when working with chemicals is to package and store them in the exact way described. Regulation in relation with such material must be followed (Åse, 1989, pp. 50-51). It is best to store them in glass jars that can be closed airtight.

When preparing the solutions and using them, it is highly recommended to wear plastic gloves, because the solutions can harm the skin. Handling the dry ingredients, it is best to wear a mask to prevent any inhalation, and protective glasses in case of any spattering. Every tool and surface that comes in contact with these solutions has to be properly cleaned. The brushes used with the metal-solutions can not be used with anything else again. The work area must be well-ventilated.

1.3.4. Painting with metal salts

In their most simple form water-soluble metal salts have a watery consistency. The result that can be achieved with it depend on three factors:

- Capacity of the brush to contain the solution
- Porosity of the clay
- Concentration of metal salt in the solution.

Painting with this colorant gives immediate results and there are very few possibilities to correct what is done. The most fitting way for personal use can be discovered through experimentations. Because it is very hard to correct mistakes it is important to prepare the solution the way so that it gives the intended color. The strength of the solution depends on its concentration and consistency, and on the clay's porosity. Another important factor in the result is the quality of the brush. A good brush that can hold the colorant properly can create long and supple strokes. The speed of application is also something to take in consideration, a quick brush stroke can result in lighter colors, while a slow brush stroke can achieve darker colors (Åse, 1989, pp. 131-132).

> "Although the aesthetic effects obtained in transmittent bodies using metal salts have similar effects to a water color, the search by ceramic fine artists involves meanings beyond creating solely a color value on the surfaces of porcelain ware. The illusion caused by the dimension and tone effects of these colorants overlap with the illusion afforded by the light transmitting body. As the volume effect of the porcelain body diminishes, ambiguous layers created by flying colors and glitters offer the fine artist different perspectives and new means of expression." (Özgündoğdu, 2006, p. 107)

2. CHAPTER: THE DESIGN

2.1. Inspiration

Clouds can be looked at from both a scientific and a more artistic point of view. Thomas Forster describes clouds in a material way as a "*visible aggregate of minute particles of water suspended in the atmosphere"* (1815, as cited in Jacobus, 2006) and on the other hand, as Hubert Damisch writes in his study about painting, "*cloud is a body without a surface but not without substance. . . . Although it has no surface, cloud is visible"* (2002, as cited in Jacobus, 2006, p. 219).

The inspiration for the project came from clouds, a returning topic in arts. Clouds have been always an object of fascination, though their classification was only established in the early 19th century. Clouds also raise the questions for aestheticians and art historians, about the painting's illusionistic uses of space. The poet John Clare also uses clouds to represent states of mind which could not have been described with words.

Figure 26. Cumulus

Figure 27. Cirrus

Figure 28. Stratus

It was in the early 19th century that British chemist and meteorologist Luke Howard created a system naming three basic types of clouds: cirrus, cumulus, and stratus (Figure 26) (Figure 27) (Figure 28). This new discovery inspired artists, such as Goethe, who wrote a series of poems dedicated to Howard. John Constable, British Romantic painter was also greatly influenced by Howard's theory and have created many cloud and sky studies. In his paintings and sketches, clouds represent space, mass, and mood

(Figure 29). For artists and poets of the Romantic period, clouds provided a metaphor for mobility and transformation (Li, 2018).

Figure 29. Cloud Study: Horizon of Trees (Constable, 1821) https://bit.ly/3xikASO

Figure 30. Dark Cloud (Johnson, 2010) https://bit.ly/3d90ovQ

It is not only painters and poets who was inspired by clouds. Clouds inspire everyone, from painters to photographers, from sculptors to ceramists. Each artist tries to catch the beauty and mystery of these forms in the sky on their own mediums. Clouds are the moods of the sky, happy and pink or moody and grey. Artists have been using clouds as messengers of their own feelings too. In the latest decades clouds somewhat became the returning symbol of the situation on our planet in relation of global warming and ecological problems. Contemporary artists use clouds as tools to raise awareness and to communicate the problems that people have to face together. Sarah Anna Johnson for example, created Dark Cloud (Figure 30) to examine our relationship with the environment (Berhkout, 2021).

Figure 31. Miscellaneous Sculptures (Forsberg, 2004-2017) https://bit.ly/3BddEau

Figure 32. Relations (Forsberg, 2019) https://bit.ly/3qytaJq

In relation to this thesis, it is important to mention the artists working with ceramics who gave inspiration. The first to mention is Jennifer Forsberg Swedish artist. One of her main medium is ceramics, which she uses to create organic 'bubbly' shapes and forms that proves well that clay is a material perfect to recreate the forever changing shapes of clouds (Figure 31) (Figure 32). Her practice includes both large scale public projects and studio works.

Figure 33. Stained Cloud with 2 Girls (detail) (Wilson, 2011) https://bit.ly/3Dk0hIy

Figure 34. Stained Cloud with 2 Girls (Wilson, 2011) https://bit.ly/3Bx6JKU

Elenor Wilson, American artist has created *Clouds* during her stay in Taiwan. “Through *Clouds*, I offer quiet reflection on the seductions of modern life. A subdued color palette and undulating forms adrift in space provide a dream-like quality, and unglazed surfaces stained with glassy fragments of hand-painted pattern suggest resolve after strife” (Wilson, 2011). The modular structure of the sculpture is very different from the works of Forsberg, but this is another way to understand clouds (Figure 33) (Figure 34). Clouds move in groups through the sky, interconnected, like a modular system of floating bodies.

Figure 35. “Felhö” lamp family (Opteam, 1976)
https://bit.ly/3xcZSDR

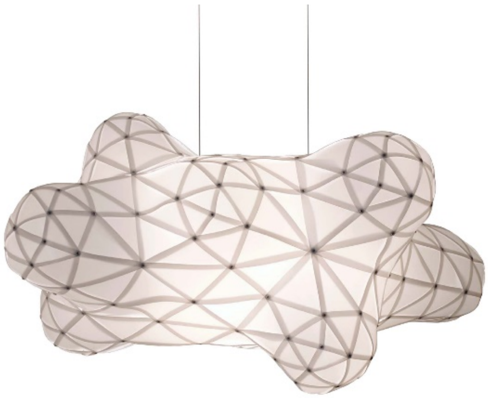

Figure 36. Cloud 125 (Juhasz, 2014)
https://bit.ly/3B9EL6v

Clouds, as mentioned earlier, inspired designers too. We can go back as far as 1976, the year when the Hungarian designer team Opteam created its „FELHŐ” (meaning cloud) lamp family (Figure 35). Their lampshades come with three different size pieces that everyone could vary to their likings, which is a good example for the modularity of clouds as well. These retro luminaires are still well liked today. Hungarian contemporary designer, Adam Juhasz, uses modularity in a different way in his lighting designs. He created simpler shapes with a more difficult geometrical aproach and structural solutions. One good example is his lamp called “Cloud 125”, which is a simple cloud form created of triangles of APET (Amorphous Polyethylene Terephthalate), a type pf plastic (Figure 36).

As painters use the sky and clouds to set the mood of a painting, moody cloud luminaires could be used to set the atmosphere of the space where they are placed in the same way. After all, the painting of a red sky expresses the same feelings that one can have when surrounded by those pink clouds and red sky in real life. As I mentioned in the earlier paragraph about light and color physiology, colors and different lights do have effects on our emotions and productivity depending on the saturation and hue of the color. My project focuses on both the mood of colors that painters use clouds for and the modularity of them, that is a perspective in the works of ceramic artists. With these two elements in focus were my designs created.

2.2. Sketches and models

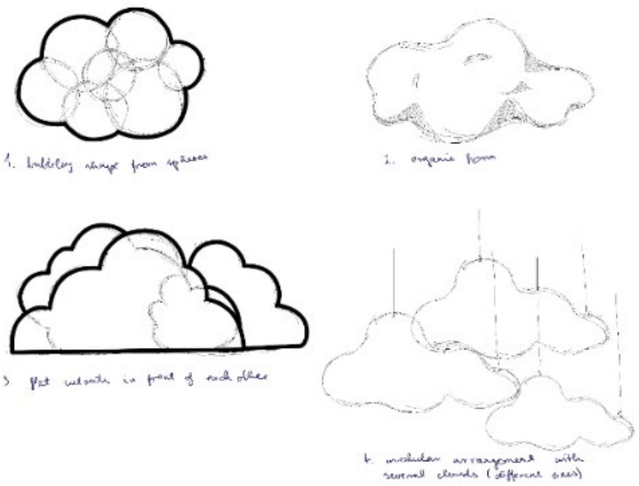

Figure 37. Sketch 1

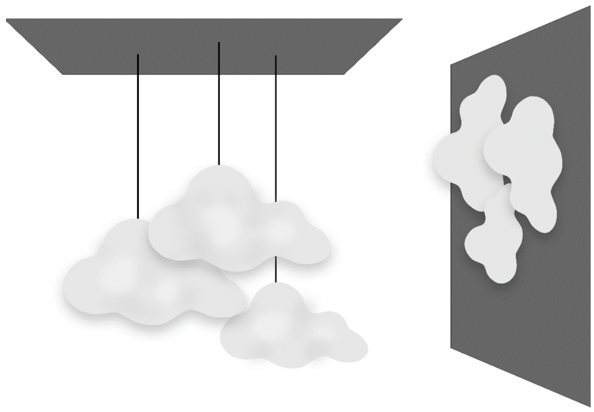

Figure 38. Sketch 2

Figure 39. Clay model 1

Figure 40. Clay model 2

The sketching phase started with the drawing of the most basic cloud shape, Cumulus (Figure 37). The options in mind were a more geometrical form, existing of several different sized spheres, or a more natural looking organic form. As the design shows it too, different sizes were considered to create a more changing shape (Figure 38). After creating a clay model for each option (Figure 39) (Figure 40), the latter had been chosen for the project, because its amorph shape would match the uncertainty of the metal salt (water coloring) results and would improve stackability in case of placing several clouds next/around each other. The idea was to create a blanket of clouds that can be hanged from the ceiling or placed on any surface, each illuminated from the inside.

2.3. Creation of the clouds

2.3.1. Model making process

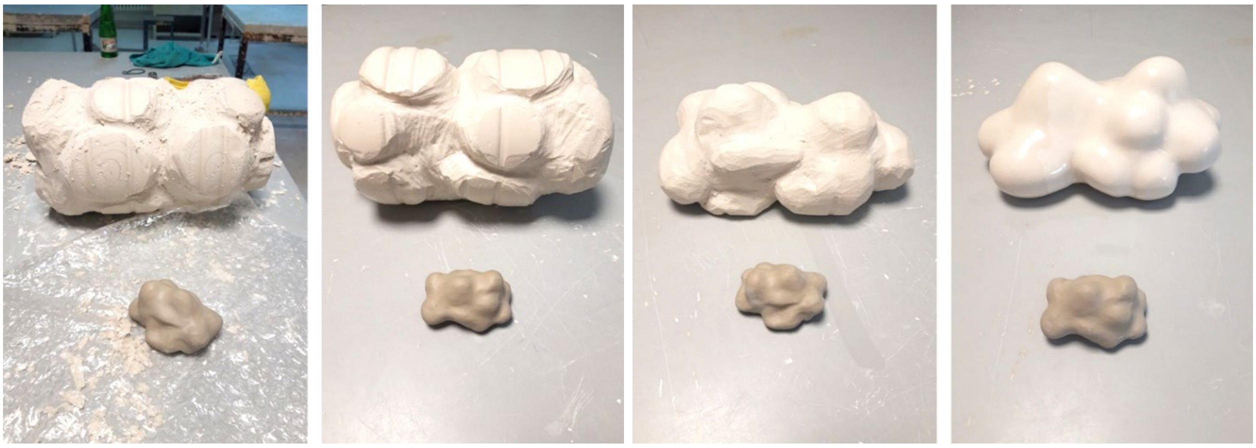

Figure 41. Plaster model

The model for the mold was prepared from plaster. Plaster was preferred over clay because of the shape. While preparing a clay model would have been less time-consuming, the plaster was a more fitting option because the mold had to be made of five parts and the clay model could have been easily damaged at the making of each section of the mold.

The plaster was poured into a big enough container to have the desired volume for the model. Once the plaster reached its highest temperature and started to cool down, the model was removed from the container. The next step was to mark the highest points of the clay model on the plaster (Figure 41), then it was time to carve out the form. When the shape of the clay model was achieved, the plaster model was polished to create a smooth surface.

2.3.2. Mold making process

Figure 42. Mold process

Once the plaster model was ready, the preparation of the large mold started. Open form was also considered as an option, but because of the shape and the size of the clouds it might have resulted in collapsing or deformity when fired. The mold consists of 5 pieces. Four pieces were needed to surround the model without having any problem with removing it from the mold (Figure 42). The final piece was casted on top of the other 4 pieces to hold them together, also this piece has the casting holes for the porcelain. After finishing the last piece, the mold was cleaned out with a sponge to remove all the possible clay and soap remains, finally the edges were cleaned up to prevent any of it from chipping and landing in the slip casting material. When the last touches were done, the mold was placed to a heated room to dry.

The same way the large mold was made, a medium and small size mold had been prepared too. The large plaster model was cut into half to create a medium and a small size model for these molds. These molds are made only of two sections because of the simpler shapes.

2.3.3. Slip-casting the final work

Figure 43. Casting

After the mold had dried out, the slip-casting of the porcelain had started. Witgert porcelain paste was used throughout the whole project because of its chance of high translucency. The porcelain paste had been stirred up well and before each casting it had been filtered to get a smooth consistency. Baby powder was applied to the inside of each mold before each casting to prevent the porcelain paste from sticking to the walls and to help removing the form easier. After filling up the molds with the paste, they were emptied after 4-5 minutes to get the same thickness in every piece (Figure 43).

It was important to move around the mold when emptying it or the wall thickness would have been uneven. Also leaving the mold on one side after emptying it can cause the rest of the liquid paste to collect on one side inside of the form, which again can cause difference in the thickness of the wall. These differences can lead to cracks and warping so it is important to try to avoid them. Casting the smaller clouds was a faster and easier process thank to the size of the molds. The forms were also easier to remove from the mold because of their simpler shape which resulted in less mistakes than working with the big mold.

2.3.4. Firing

Figure 44. Final pieces, before the metal salt solution were applied

After the pieces dried totally, they were bisque fired. After the bisque firing each piece were sandpapered to remove leftover mistakes or any unevenness from the casting (Figure 44). Even with moving around the mold when emptying it, differences appeared in the wall thickness, but they did not cause cracks. These differences added a new visual effect to the clouds, making them look more realistic, and even though they were all casted with the same mold, none of them are exactly the same, just like real clouds. The sanding also gave an extra chance to play with the wall thickness to create different light effects. Translucency could already be observed after the bisque firing.

3. CHAPTER: TESTS AND FINAL WORK

3.1. Porcelain test firing

First of all, to be able to see how the final pieces would look like, test pieces were prepared. Because the main focus is on the colors and their application, the test pieces were casted with Witgert porcelain paste, a porcelain with high possibility of translucency. After casting each piece, they were sandpapered to try to achieve the best wall thickness possible. As mentioned before, the pieces were already showing some translucency after the bisque firing. After the first firing they were ready to apply the solutions on them.

3.2. Coloring tests

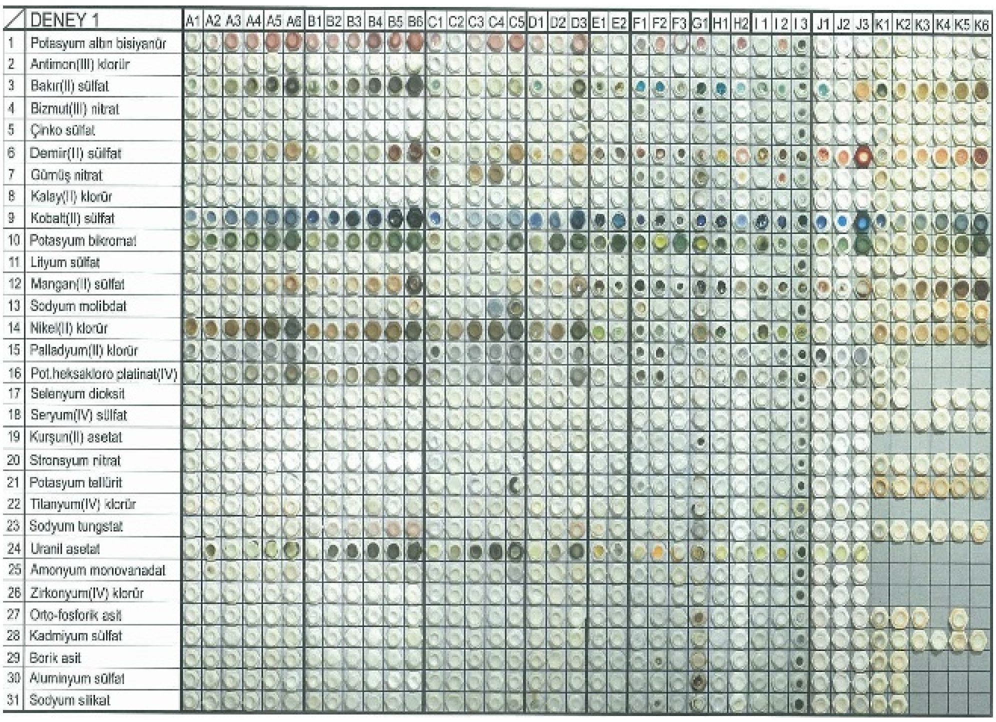

Figure 45. Metal salt tests on different types of porcelains and white clays (Sabuncu, 2008, p. 42)

First, colors were chosen according to previous researches. While Arne Åse describes in his book very well which metal salt will result in what color, and also attached photos of his works, it was Nihal Sarıoğlu Sabuncu's thesis (2008) that gave a more detailed explanation of the color results. Her thesis did not only focus on a few metal salts applied to one type of ceramic, but she ran tests of many metal salts on many different ceramics and porcelains in different kiln atmospheres. The test pieces prepared by her were very detailed and well organized, it gave a good amount of help of what can I expect of which metal salt (Figure 45).

Figure 46. From left to right: Iron Sulfate, Iron III Chloride, Nickel Sulfate, Copper Sulfate and Cobalt Sulfate. From top to bottom: low percentage to high percentage solutions.

The colors that I chose for the project were yellow, orange, pink and blue. In need to achieve this colors, the following metal salts were picked: Cobalt Sulfate, Copper Sulfate, Nickel Sulfate, Iron Sulfate, and Iron Chloride. Each metal salt was prepared in three different percentage solutions following the experiments of Åse (Figure 46).

The solutions were prepared with care and attention, both to my environment and health. After mixing the salts well with water the application started. While Åse applied these solutions with brush to his works, I’ve decided to pour them to achieve a more homogenous color, since applying with brush can result in accidental double layering, causing different color tones. This of course can be done in a controlled way too to create different effects, but it was not the purpose of this project. The solutions were poured into the test pieces to see different results as the solutions spread through the porcelain. This application had different results because of the varying wall thicknesses.

Figure 47. Nickel sulfate solution from highest to lowest percentage from left to right.

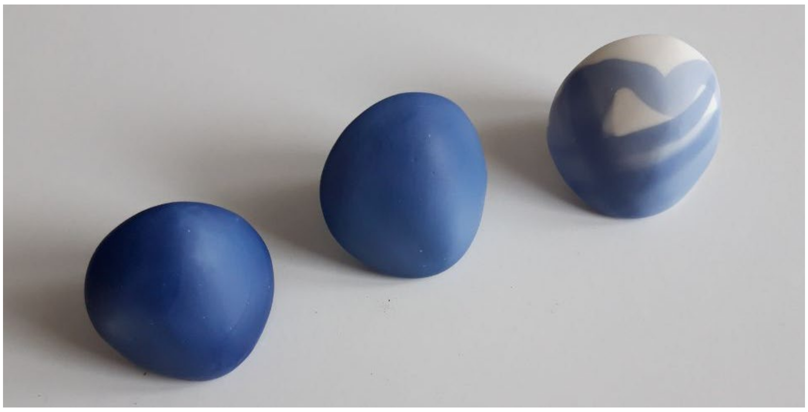

Figure 48. Cobalt solutions from highest to lowest percentage from left to right.

The pieces were fired at 1230℃ degrees. The lower percentage solutions presented better results than the high percentages. The higher the percentage went the least translucency could be observed, also they resulted in a luster like metallic layer. The nickel sulfate solutions were prepared at 5%, 10% and 20%. These solutions resulted in light mint colors with good translucency, even the higher percentage. For the best results it is enough to start around 20%, but also it is not necessary to go much higher, to not affect the translucency. While it may not show much difference in color on the outside, it does visibly affect the color when illuminated from inside (Figure 47). The cobalt sulfate solutions were prepared at 2%, 5% and 10%. These solutions resulted in a medium blue with good translucency. As it is visible on the test piece on the right, where the solution was applied with a brush, color differences can we observed. The best is to use solutions that are maximum 5%, when it reached 10% the translucency diminished (Figure 48).

Figure 49. Copper solutions from highest to lowest percentage from left to right.

Figure 50. Iron solution results.

The copper sulfate solutions were prepared in 10%, 20% and 50%. The copper solution created a light brownish color at low percentage and as it went higher it resulted in a more turquoise color with a metallic touch. At 20% we can already see the turquois color appearing, which has no translucency (Figure 49). It is best to work with solutions between 10%-20% but can go lower too for a few tones lighter color. The iron solutions were both prepared at 25%, 50% and 75%. These solutions resulted in a rust like metallic color between red and dark brown without any translucency, only at low percentage can we observe some light transmittance. To have any translucency it is best to keep the solutions under 25% (Figure 50). It can be also observed in general that the pieces where the solution were applied from the inside resulted in the least translucency because the excess solution could not be removed well, but instead was all absorbed. Because of this the solutions were later applied from the outside by pouring it over the pieces and leaving the excess to be collected on a plate under them.

Figure 51. Test piece painted with copper solution, with a shinny, crackled finish.

Figure 52. Test piece painted with iron solution, with a metallic, rust like finish.

A few of the clouds were also prepared in different color combinations to see the possibilities. The copper solution (50%) resulted in a thick layer with cracles all over it. The reason of it is possibly that, just like the other pieces, the solution was poured into the piece and also was let to be absorbed by the pores for too long. For the same reason, the pieces with iron solutions (75%) were covered in grey metallic spots, kind of like rust eating through the porcelain.

Figure 53. Nickel sulfate and copper sulfate

Figure 54. Iron sulfate and copper sulfate

The pieces where two solutions were used resulted in interesting patterns and textures. The nickel solution and the copper solution didn't mix up very well, it is very easy to tell where does one end (Figure 53). The iron solution and the copper solution resulted in a better pattern, probably because both is creating brownish color when used in high percentages (Figure 54). Of course these pieces have no translucency but could be interesting to try these combinations with low percentage solutions too. These test clouds were also prepared by pouring to solution inside and moving it around, that it why at some areas the two solutions overlap and also that is why the solutions kind of ate through the pieces.

3.3. Preparing the final pieces

Figure 55. Painting the final pieces

After the color tests it was clear that to achieve light colors with translucency, low percentage solutions should be prepared. As for the application of these solutions, pouring them over the porcelain pieces also seemed the better option, seeing as pouring them inside resulted in luster-, glaze-like finishes, and applying it with brush could have resulted in accidental double layering which would have affected the translucency. To be able to apply the solutions without spilling, all the pieces were painted above a tray which would hold the excess solutions, also making it possible to use them again. All solutions were prepared at 5%.

After firing the final pieces, each of them came out with a good translucency except for the thicker ones. Unfortunately, not all colors resulted as expected, further tests should be done to find the exact palette where the color and translucency is in perfect balance. The cobalt resulted in a nice blue and the copper has also a good orange tone to it when illuminated from inside. The nickel neutralized the porcelains natural yellowish color and turned it into an off-white tone.

3.4. Setup

The last step was to set up the final pieces with the lights. RGB LED lights were chosen so that different color options could be tried too. The strength of the lights really helped to emphasize the translucency. The white light option revealed the difference between the metal salts, and when lighted with colorful LEDs, each metal salt resulted in a different tone. The unevenness of each clouds wall thicknesses resulted in an even more cloud-like effect.

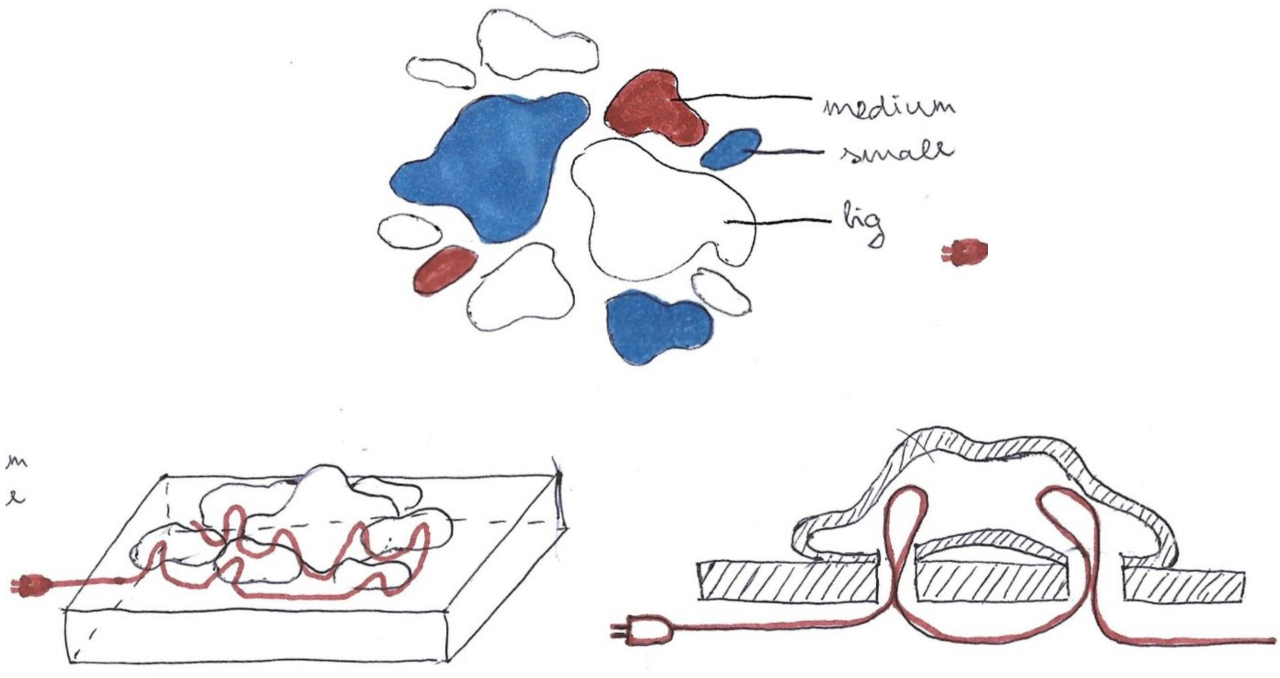

Figure 56. Setup sketches, arrangement and light positions

The idea was to lead a 5-meter-long LED through the pieces, creating a carpet of clouds (Figure 56). Different options were also tried, where the cloud would stand on its own as an individual luminaire or put together in smaller groups. Depending on the number of clouds used in the installation, the project can be used as a simple side table lamp, or as a hanging light installation/pendant too. The options to vary is plenty, giving the opportunity to be used as a functional light or an art piece.

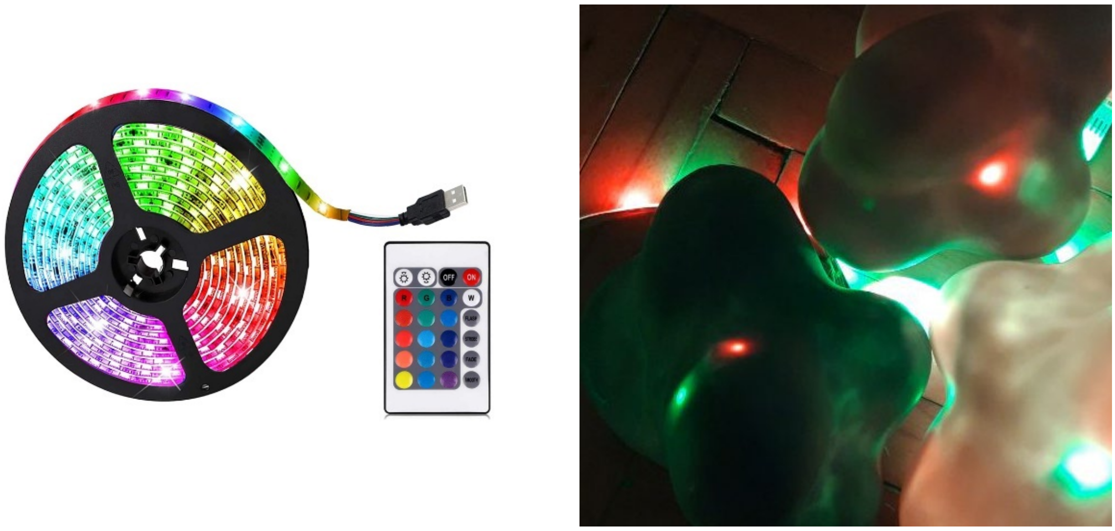

Figure 57. RGB LED strip light

The set up was first tried with an RGB LED strip light, which has different color options from reds through blues to purple. While the strength of this light was good to illuminate the porcelain pieces, the RGB LED was not a good choice all-in-all. RGB lights have separate internal LEDs in the color red, green and blue, and while almost any color can be produced with them, in such a small object as a porcelain light, the internal LEDs are visible one by one, ruining the general color chosen. Another reason for not going with this light is that while colorful light could be used with translucent porcelain, in the case of this thesis, the power of the colors really eliminated the effect of the metal salts, rendering them totally meaningless.

Figure 58. LED string light

After the RGD LED light proved to be an imperfect choice, a simple one-color white LED string light was chosen. This LED spreads the light in a much softer way while still keeping the power of it. The white color chosen also really helped to show off the different colors that the metal salts created. Important to mention that both these LED lights were tried out of convenience, as each cloud only had the casting holes available to place the lights inside them. With further planning and research, the positioning of the electrical parts could have been solved in a more practical way.

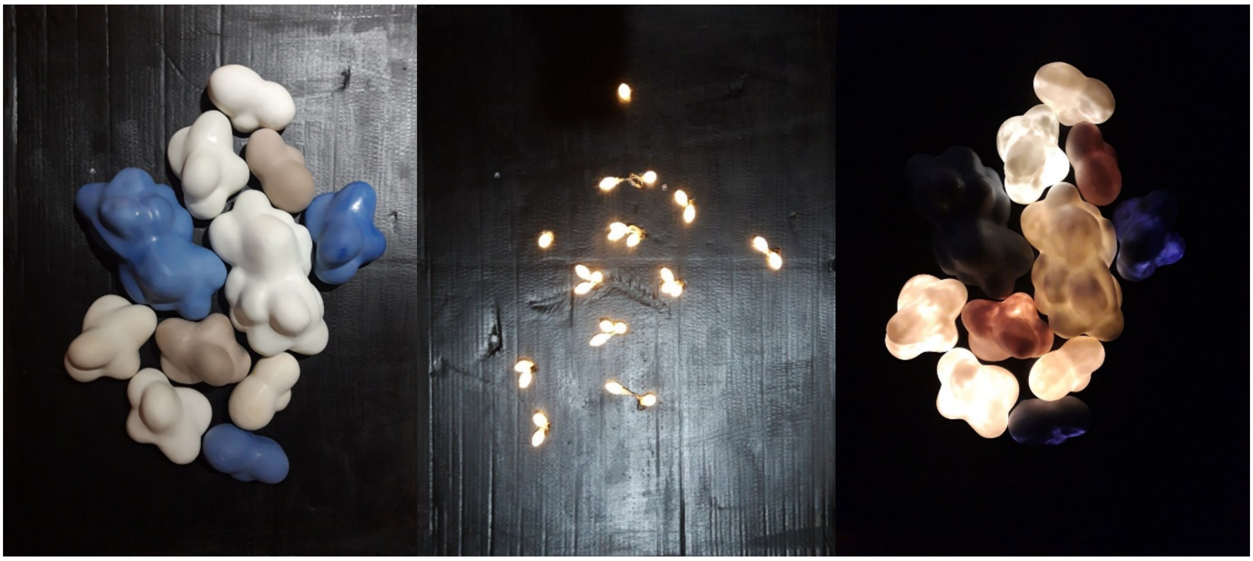

Figure 59. Stages of the setup, positioning, fixing the lights, final arrangement

For the main piece I choose the clouds with the best translucency, and I also included the pieces with the most visible colors. First of all, I arranged them around each other to see the best possible variation, with spreading out the colors, and sizes decreasing from inside to outside. Once I found the best arrangement, I measured the position of each piece to the top of a box. I choose a box to be the platform for the project because it was suitable to cut holes into it for the lights, but of course a wooden platform is more suitable, or pieces could be hanged too. Before the holes were measured to the box and cut out, I painted the box to black to give a better, more contrasted background to the installation. Once the holes were drawn on and cut out, I placed the lights through them and fixed them from the back. After that, I placed the clouds one by one to their chosen places (Figure 59).

Figure 60. The making of the wooden platform

Once the final position of the clouds was decided, a wooden platform was prepared by professional woodworkers using the box as a sample. A mahogany laminated MDF board was used to prepare the platform, the dark color presented a good contrast against the white porcelain pieces and also was a good match with the test pieces that were painted with iron solutions. The size of it was planned to fit the arrangement on it with enough space around, and to hide the electrical parts as well.

3.4.1. The final work

Figure 61. The final arrangement with the lights

The final work achieved exactly what its purpose was. It is a mixture of colors that expresses moods, like in painting, but it is built as a modular system, as it can be seen in other works created by ceramic artists and sculptors. It captured many aspects that inspired artists before. It expresses mobility and transformation, a messenger of feelings. The colors achieved by metal salts create a soft gloom, and with the natural pattern that the porcelain gives to each cloud makes it even more cloud-like, with their beauty and mystery. The clouds can be rearranged by color, size, whatever fits the mood. A simple cloud can stand its place as well as a group arrangement.

3.4.2. Defense exhibition

Figure 62. Defense exhibiton

In the thesis defense exhibition, every piece was presented that shows where the research started and what was achieved with it. Two different light setups were available as well as the successful and unsuccessful examples. The second, one-piece luminaire was exhibited to show the options that colorful lighting could present matched with porcelain. In the front, the final light arrangement was placed.

3.5. Further opportunities

While the setup for the final exhibition showed well the opportunities that porcelain can give in lighting design, it is important to note that much more could be achieved with it with the help of other professionals. The light setup made the clouds presentable, but in long term, the lights chosen and used in this thesis are not very practical. With the guidance of electricians or experienced designers, and with further research, much more practical ways could be produced to illuminate the clouds and to turn them into functional lighting objects, either placed on a flat surface or hanged from above. It is also important to mention that the wooden platform presented in the exhibition could not have been done without the help of professional woodworkers.

In this section I would like to mention the opportunity of turning these cloud luminaires into outdoor lighting objects, as well as indoor luminaires. Porcelain itself could be used outside as it is a hard-wearing, strong material. Bigger scale versions of these clouds could be paired with lights powered by solar panels, which would not only be more sustainable and eco-friendlier, but also would match the idea of the clouds. In bright sunlight they would stand as white, light-colored clouds, at night, illuminated to give soft ambient light.

CONCLUSION

As it was mentioned in the introduction, not many researches are to be found about colorful translucent porcelain and even less about its use in lighting design. In focus of that, color tests were done to prove the possibility of the use of metal salts, and a final arrangement had been presented to show this possibility of metal salts combined with porcelain and light. The tests turned out to be successful and proved the idea that color can be included in lighting design when working with translucent porcelain. With further research even more colors could be involved and the perfect balance between each color and translucency could be established. With the addition of different ways of application even further effects could be discovered.

It had been proved successfully that metal salts are an option to create colorful porcelain luminaires with light transmittance. While the use of water-soluble metal salts in ceramics is a known technique and had been researched before, this thesis managed to find a new purpose for it, where it can be included in lighting design as well. With the opportunity of discovering more colors, the same affect that painters use clouds for could be even more well expressed. While the modularity presented by ceramic artists was executed well, the painter’s capability to invoke feeling with colors could be better researched in relation of this paper to be involved with metal salts.

It is also an important aspect that with the knowledge and help of professionals, either designers or electricians, actual light products could be produced with the method presented in this thesis. While this paper focuses on the light object in relation to porcelain and coloring, obviously, further research will have to take place to figure out the best ways to turn this project into a well-functioning product.

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