non.scents
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Bachelor Thesis

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NON.SCENTS An exploration about the sense of smell and how we could translate it into other sensorial information.

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INTRODUCTION

The environment we live in is multi-sensory: everything we do requires the interaction of multiple senses inputs. Cross model correspondences enable the brain to process all the different sensory information and presents it in different modalities (Hanson-Vaux, 2012).

It creates the foundation on how we see and experience our environment. However, the sense of sight and hearing are the most credited ones according to Aristotelian hierarchy. Both could lead to god and are the senses of aesthetic and intelligence. The sense of smell is described as the lowest of all senses, it's the sense that is often taken for granted and has no aesthetics (Synnott, 1991).

Above all, to detect the sense of smell we often use other senses to describe it: sour or sweet (taste), strong or weak (touch) or refer to objects from which odors emanate (Vanichayanguranon, 2017). There is verbal barrier in the western countries that gets us „tongue-tied" if we try to describe a smell. Limited vocabulary and the lack of opportunities is leaving us with difficulties to express a smell (Gilbert, 2014).

In fact, odors tend to be processed in a direct, non-verbal way by the brain and so elude expression through language. This means that to understand the role of odor in different cultures, one must go beyond language and explore the realm of practice (Classen et al, 1994:113).

So how else can we describe a scent?

Studies who are exploring a way to express scents in another medium are already taken. The latest experiments had the aim to find the connection or interaction between smell and color (Morrot, 2001), smell and texture (Dematte, 2006) or the smell and form (Hanson-Vaux, 2012). But they all applied their outcome on commercial reasons, such as the right form or color of a perfume bottle.

So how can we use this information in another context alike when we want to explain a scent? The main question of this theses is then: are we able to experience smells through other sensorial information such as sound, colors, shapes, temperature and textures.

Statement

Throughout my thesis, I will explore the importance of smell and the connection to the other senses. The aim is to find out if there are possibilities to compensate the experience of smell within the other senses.

Ultimately, the question is how design functions as a tool and which possibilities we have to translate this sensory information.

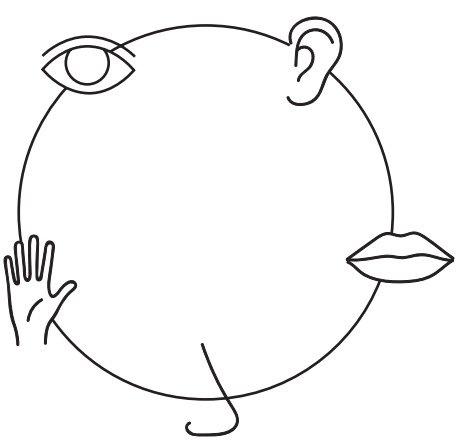
The close connection to memory and emotions will be used to find associations to selected smells. These main scents used in these experiments are in the field of chocolate, as it contains smells that many are familiar with. Several studies and workshops were conducted to help gather this information and to help translate smell into other sensorial outputs.

Interviews with different professionals help start to understand how smell influences our daily life and subthemes like synesthesia and anosmia will approximate the topic from another perspective.

The premise for this thesis is to explore the above mentioned topics for the purpose of compiling valid methods on how smell can be translated into other senses; this then is to be created into a tool from which one can utilize to navigate this unexplored field of scent and design. As a primary example, an extensive study using chocolate pralines to communicate and test these theories was performed. The results of this study show valid evidence to expand these ideas into further investigations and concepts.

SENSES The world surrounds us constantly with different sensorial information Each sense has evolved to perceive this information in a unique way and for a particular purpose (Alderman&Park, 2018). They give us the possibility to understand, recognize and react to our environment. Clustered in five physical senses such as sight, hearing, smell, taste and touch and make sense of the world and encounter what is new and what has changed. We filter and process millions of pieces of sensory information every moment, but we often deal with them without noticing it. They hit us from all different directions and leave us behind with just a full multisensory experience.

A foolish scent, a sweet taste, or a rustling in the grass - each contains a multitude of sensory information that functions as a warning or brings us joy, etc. Many of our pleasures in life come from sensory experiences.



Vision - It is the ability to perceive what surrounds us, helps us to balance and is the foundation of written and printed communication. Accordingly, it detects and interprets the information into light and colors. Vision allows us to recognize shapes, outlines and to see the brightness, colors and movements. It is the most dominant sense we have (Alderman&Park, 2018: 59).

Touch/Haptic - Is a full body impression of what surrounds us. It lets us feel the form, temperature, pressure, vibration and material/texture. Therefore, it requires the direct contact or the movement against something. It can calm us, connect us or overwhelms us (Alderman&Park, 2018: 66).

Hearing - Evaluates pressure in waves of vibrations. It works faster than any of the other senses and therefore helps to augment the other senses. Like sight, it is the next in the hierarchy of the senses (Alderman, 2018: 62).

Smell - Is the intake of chemicals through inhalation of the nose and the further interpretation of the brain. It connects us to places, emotions and is closely connected to long-term memories. Moreover, it is tied to hunger, sexual arousal and how comfortable or uncomfortable we are (Alderman&Park, 2018: 72-73).

Taste - The experience of taste is called flavor and engages different senses. It is a complex combination of the texture, sound, aroma, temperature and appearance. The sense of taste is only giving us the elements of salty, sweet, sour, bitter and umami (Alderman&Park, 2018: 74).

However, the senses are limited and therefore they have to work together to provide us with all the abundance of Information we receive. What we often interpret as perception is usually the combination of two or more senses called modalities.
Modalities are patterns that are flexible in their application, dependending upon which modalities are the most valuable ones for a particular experience. However, it is often hard to even distinguish between them. Our brain has the gift for connecting these different sensations - we are able to link taste to color or sound to different spaces (Alderman&Park, 2018: 127). The union between modalities is called cross modal correspondence and is in charge of merging the large amount of information that our senses are taking in.

The extreme form of cross modal correspondence appears in synesthesia which means "joined" or "coupled" sensations and what can be responsible for not only hearing a song, but also to see, taste or feel it (Cytowic& Eagleman, 2009: 1). Thereby the perception of different sensations happens simultaneously, experiencing a more richly and more textured environment.
One in 20 individuals are carrying the gene for synesthesia and it broadly involves colors. Color is typically the most common element of synesthesia, usually triggered by sound. Responders like touch, taste, sound and smell are comparatively rare, but do sometimes appear.

However, synesthetes and non-synesthetes still interact in the daily world much the same way, synesthetes may have an enhanced reality

(Cytowic&Eagleman, 2009: 20). The difference lies in the visibility of the cross-modal correspondence, as their perception adds for example shapes, colors or taste to their realities.
"Inwardly, we are all synesthetes, we just don't notice how our senses interact" (Lupton&Lipps, 2018:12).

All in all, people generally use the same principles to describe/communicate how we perceive our reality.

Perception - synesthesia - metaphor - language
Perception - modalities information - associations (analogies) - language (words)

Ones perception of an object is determined by the fusion of all the sensory information. This is based on a association of previous experiences/ analogies and is then abstracted by our brain into a understandable language (Cytowic&Eagleman, 2009: 166).

Following the topic Synesthesia conducts as a tool on how other senses could be shown or integrated more 'visibly' into the experience of smell.

SMELL The interaction of senses is particularly obvious if we talk about the sense of smell. Cross modal perception generally occurs in olfactory and indicates that everyone is at least a bit synesthetic. For example, if we perceive the smell of vanilla, we directly expressing it as sweet, even though it belongs to the domain of taste. We not only borrow words from the modality of taste, we also share the experience of flavor. The fusion between scents and taste makes the experience of food. As stated previously, taste itself is relatively boring as it only provides us with the five channels of information: bitter, sweet, sour, salty, umami. The rest is the experience shared between sight, temperature, texture and most of all, the sense of smell.

Besides the enrichment of eating, it also improves and deepens other experiences. Scents facilitate our ability to remember, to learn, it connects us to ourselves and others. It has the ability to trigger emotions as no other sense does.

Through time the sense of vision and hearing have been the dominant senses and the most 'reliable' sources of sensory information. Especially in the western culture currently, the lack of using smell for more primal uses has decreased its utility, overrun by a predominantly visual based environment. Consequently, the better we can see, the less acutely we need to smell (Herz, 2007:25).

Therefore, it is sometimes necessary to shut down vision, to concentrate

on the other senses again. During my workshops I used this, to bring the focus on the smell back.

Following I will introduce the four topics that let me understand on how I can approach another understanding on how to translate scents into another sensory information: pattern / emotions / memory / language.

IT'S ABOUT PATTERN AND RECOGNITION Nevertheless, the sense of smell travels more deeply into our brain than any other sense. With each breath, odor molecules are entering our nostrils and make contact with over 20 million olfactory receptors (Herz, 2007:20). The contacted receptors transport the electric patterns from each scent to the brain. Therefore, each odor molecule has their own pattern of neutral impulses (vibration frequency). Molecules who are producing the same patterns, like citrus odors, have therefore a similar smell (Herz, 2007:28).

In conclusion to that, the sense of smell is happening in our head rather than the nose. The electric impulses that are understood by the brain, make the scent. It doesn't evaluate where the signals or the data is from, it rather takes the signals/extracting patterns and assigns it to a meaning (Eagleman, 2015:6:29).

It's already known that we can marry technology to our senses. Being able to translate the sensory information and pass the signals to the brain (retinal implant, war implant) (Eagleman, 2015:4:40).

Other elements are created for sensory substitution such as aids for those who are blind or deaf. These elements are using other sensorial information (such as touch and sound) to communicate the experience of sight or utilizing vibration to translate spoken words for deaf people (Eagleman, 2015:11:11).
For example, David Eagleman works on a vest that records sound, translating it into a pattern of vibrations that allows the deaf to understand/ interpret conversations in a new way. He assumed that after time, the users brain will have learned to pattern the vibrations, creating a direct perceptual experience of hearing. (Eagleman, 2015:12:10).

In analysis, we can create new learnable brain patterns which can be used to substitute senses for other senses. As an old example, Brail utilizes small bumps on the fingers (sense of touch) to translate language to blind people.

YOU SMELL THEREFORE YOU FEEL Smell is located in the same network of neutral structures as emotions. Therefore, they "are both intertwined and codependent as any two regions in the brain" (Herz, 2007:3). With every first experience of a scent, we detect the context and the emotional value of it. Before that, the scent is meaningless, only after the first experience does the scent take the emotional significance and meaning (Herz, 2007:37).Hence, scents have the ability to influence our mood, behavior and health. Aroma therapy is using this to evoke learned

association with scents. This has not only emotional benefits, it also helps physical. Therefore, this study will use the connection of emotions to trigger scents; attempting to find first associations within the scent.

NOSE-BLIND The condition of Anosmia diminishes the sense of smell and in relation to that the pleasure of exploring the world. About 5% of the population in the world are suffering from anosmia. Most of them lose their sense of smell as a consequence of a nasal condition or a brain injury, while others are anosmic from birth. Anosmia leads to serious psychosocial conditions such as depression, impairment of eating, isolation, anxiety and relationship difficulties (Philpott&Boak, 2014:1).

Regarding to this we lose the countergame between our senses. What leaves us with just "taste" or without the joy of encountering what surrounds us without using the eye.

We consequently feel disconnected from others and ourselves. Molly Birnbaum, who lost her sense of smell after a car accident, experiences the effects of not smelling: "Without my nose, what was I?" (Birnbaum, 2011: 58). During the healing process, she understood the importance of the other senses and how she can perceive smells in another way: "But now I concentrated on the texture, temperature and color so intensely that thy took on a new significance" (Birnbaum, 2011: 70). Hence, other sensorial information could be used, to explore scents in a new way.

REMINDER OF THE UNCOVERED PAST Scents are gates to memories, associations and imaginations. We attach specific memories to specific odors, but we often do it unconsciously (Herz, 2007:67).

Memories that are connected by odors are more (vivid) and emotional than sparked by words or pictures (nose). Scents have the ability to recall older autobiographical memories than those evoked by words or pictures. They instinctively transport us in time and place and are mostly collected outside of our awareness. They allow us knowledge about our environment without seeing it with our eyes.

An experiment by Rachel Herz explored the differences between scent-evoked memories and other types of memories. The result showed that memories collected by smell, hearing and sight are all similar or good (Herz, 2007:67), the only difference is that memories evoked by odors are more distinctive as they are connected to emotions.

This connection to emotions leaves learned odors more likely to be enjoyed as they are based on memories - vanilla- milky, warm - childhood.

Hence, the connection with memories, makes connotations with scents more accessible. Smell evoked memories could be better understood and transformed into new associations.

LACK OF VOCABULARY Scents are invisible and therefore we rely on the verbal and visual context (Herz, 2007:57). But if it comes to language, we are often confronted with a verbal barrier to describe smells. We are getting tongue-tied - as it is not needed to describe scents that often. The words are there, but it is often hard to grasp them – the "tip of the nose'" phenomenon.

Lack of vocabulary in the western culture denies us to proper express smells (nose). We refer to odor-producing objects, brands with iconic scents and tend to borrow their terms like fruity and floral.

Therefore, smells are described in interrelation with other sensory information, mainly borrowing from terms of taste (sour sweet) or referring to the things from which they emanate (olfactory art) – As a result of this information the goal of this thesis is to use this methodology to create a new way of communicating smell.

Scents are processed in a direct, non-verbal way by the brain and therefore were never made to be expressed by words. Thus, we need to find another way to express smells. Authors like Avery Gilbert have the opinion that we need to characterize olfactory and give smell a personality and new meaning. Hence, he proposed three traits to define smell:
Awareness - give smells more attention
Empathy - relate to how other people experience smell and how they respond to it.

Imagination - translate between the senses and invent new ways for scent to speak to the mind and emotions (Gilbert.2014: 128-131).

Odors are imagined in the same way as we imagine visual scenes. A test Gilbert did, showed that if we think of a scent, we imagine the smell mentally. This shows that similar brain areas underline olfactory imagination and real perception (Gilbert, 2014: 132). The same occurs when we scent something with closed eyes - the mind creates images (workshops 1-2).

The brain not only adds images to scents in our head, it also matches learned sounds, visuals and textures. Therefore, we know that when we see for example an orange, what smell we have to expect. Similar to this, are written descriptions of odors. It allows the reader to imagine the scent intensity or character (Gilbert,2014: 134).

Different experiments show that if we use the associations we made with smell - color, visuals, sound, words - humans are able to create the smells in their own head. Therefore theoretically, smells could be synthesized in once mind using related images and haptics.
Based on this research, this thesis tests if we are able to experience smell by only using mental images and learned associations. Memories and emotions will play a primary role as they are the key factors in making connections. Patterns will be recognized throughout the process and through conducting workshops, a new "language" on how we communicate smell will be developed.

WHAT IS SMELL FOR YOU Defined by this knowledge, the interesting part was how professionals integrate and explain scents to other people. Throughout four different interviews, a new understanding was learned.

Sommelier Roland Birr explains wines through colors, to open up the imagination and explores the scents within this color. He also offers wine tasting with one wine but with a changing color-light in the room. Within the color the taste as well as the smell is changing. Thus, the color blue brings more freshness and coldness to the wine and the color of red more fruitiness. Therefore colors, scents as well as taste must be in connection to each other and build on a memory we have with it (Birr, 2018).

In contrast to this experience where sight plays an important role, the museum of all senses in Wiesbaden /Germany, offers a meal in the dark that excludes sight. Matthias Schenk, the owner of the museum, explains that we sometimes need to shut down one sense to focus on the others. As in this case, people do focus more on the scents that surround them and, on the texture and temperature that the food has. We sharpen our other sense to fully understand what surrounds us.

The museum also offers space for people to exhibit their experiments. Matthias Schenk reports on an artist who took photos of the molecule structure of specific scents and then transferred them into sculptures. Scented with the scent, people could experience the scent through:

touch, sight and smell. He explained that people who visited this exhibition got a totally new understanding of the sense of smell. Some of them even closed their eyes to shut down one sense, to concentrate on the other.

He also thinks that both color and form do have an influence on how we experience scents. A hotel in Austria is experimenting with wine glasses and which shape has which effect on the taste and scent of the wine (Schenk, 2018).

As well as Matthias Schenk, Sean Day the author of the book "Synesthetes: a handbook", thinks that color does connect to all our sensorial experiences. Dean is odor-color synthetic and has the ability to experience around 50 different scents with one color. For example, "the smell of freshly moon grass will make me see a large pool of dark purple oily fluid in front of me."

Learned cross modal connections, such as the bright orange color to the scent of an orange is learned throughout the culture and the environment, we live in. Therefore, we build up associations that are similar in the way others experience color and scent.

Therefore "it is quite possible to learn to associate colors and smells. We see this quite commonly taught in various cultures. For example (since it is holiday season), with scented candles: a green candle would be expected to give a scent of perhaps pine, but likely not a smell of citrus fruit or

berries; a red candle might give a scent of cinnamon, but not likely of pine. We find similar things with the coloring of perfumes, colognes, soaps and detergents, for example" (Day, 2018).

The last interview with Anja Krebs, a cosmetic who works with aromatic scents, explains the strong connections to emotions. Scent does have a different effect on each person in terms of the association the people have within the scent. However, some scents do have a more calming effect on persons than other scents have. They can change how we feel and are able to transform us in space and time (Krebs, 2018).

ASSOCIATIONS

Terms derived from other senses are widely used in the daily life of smell. We explain smells through other senses in attempt to define them in their characteristics and the experience one has. So why are we not using this information to enhance our experience of smell?

Smell is the sense that is often forgotten, not noticeable, invisible - but it is the sense that influences most of our sensual experiences. Blindfolded and without the ability to smell, we couldn't detect what is in our mouth (Gilbert, 2014: 91).

When people lose their sense of smell - anosmia - the importance of the sense gets more recognizable. The absence of smell changes the way we perceive things and lets us focus on the other senses. We sometimes need to shut down one sense to focus or explore the other channels.

This is very prevalent when we talk about sight. Some people might think that blindness enhances smell or hearing, but the blind smell the same way as we do, they just focus on the other senses more. They begin to use areas of the brain that are "typically devoted to sight or sound" (Lupton &Lipps, 2018: 12).

Therefore, the brain is able to understand information not caring where they come from. If the information/pattern is learned and understood it doesn't matter from which channel it comes.
"Send in anything and the brain will figure it out" (Lupton&Lipps, 2018: 13).

In further analysis it is shown that we are able to learn a new way of perceiving a sense if we learn a pattern that is recognizable for another channel.

Artists like Odo7 are already using this information to open up new experiences in the sound world. Starting with the first concept that was for blind and deaf people and developing it further for the experience of all. Odo7 creates "smounds" that are a convergence of scents and sounds. He understands the characteristics of the scent and interprets them into sounds: Energetic house music smells like grapefruit blended with castoreum and R&B or rap sounds very much like spices, floral scents and spearmint (Chester, 2017). Creating a synesthetic experience, blind and deaf people are able to experience music and the atmosphere through the extra information of scents.

Inspired by the idea of enhancing the experience for people who are missing one channel by substituting with another-I explored the possibilities for the sense of smell.

We have glasses to help those with defective visions (visual impairments), hearing aids for the partly deaf, and who is going produce an artificial device to improve the smelling ability of people with subnormal noses? (Popular science monthly, 1931)

ASSOCIATIONS

CREATING A NEW LANGUAGE The previous research defined the basis for my main question:
"Are we able to experience smells through other sensorial information such as sound, colors, shapes, temperature and textures."
Therefore, I had to find out how much the other senses are involved and how we can use their information to express smell in another way.

The goal of this thesis is then to create a new language to express smell that can be understood without using the nose.

Based on the knowledge that every scent is connected to a specific memory, feeling or any associations. This chapter explores these associations we already have with specific smells and clusters them in the different senses: sight, touch, taste, sound.

Odors are meaningless before experiencing it the first time, "once you experience it, the context (place, situation, person or event) in which you perceived it, and most important the emotional value of that context becomes attached that aroma and henceforth the odor takes on that emotional significance and meaning - odor- associative-learning " (Herz, 2007: 37).

Throughout five different workshops, that each approached a different sense, I proved to find associations and patterns within specific smells. Based around chocolate, I started with 13 well-known scents. All chosen

of their distinctive aromas and their provocation of memories, association and emotions. Chocolate is often linked to pleasurable experiences and effects multiple senses as sight, smell, touch, taste and was therefore the best fit for this kind of study.

APPROACHES THROUGH OTHER SENSES The cross-modal sensory correspondence between the different senses and olfactory is already discussed in several experiments. Therefore, I already had the knowledge that cross modal correspondence is existing and working. What sets my workshops apart is the field of chocolate and the attempt of combining different senses, as well as the designer perspective. In addition, the field of olfactory is not much discovered as the other senses. None of them explore the absence of smell and how we could express smell through other senses.

All studies approach a different sense and are done by design students from Konstfack in Sweden. Every workshop involved 10-15 people with different ages (20-27) and gender.
Workshop 1 – all senses - to find a lot of association in a short period of time
Workshop 2 - sight - finding specific colors
Workshop 3 - touch - finding textures, weight and temperatures
Workshop 4 - touch/sight - finding shapes
Workshop 5 - sound - finding sounds, melodies and tones
Workshop 6 - sound – finding sounds

ASSOCIATIONS

WORKSHOP 1/ALL SENSES The first workshop aimed to find associations in a short period of time. Associations are, as we know, formed after we experience a smell for the first time. The sense of smell can trigger these associations or imaginations in our brain, by sniffing a specific odor.

Rachel Green calls it the odor - associative-learning as the scent takes on the emotional significance and context (Herz, 2007: 52). We create connections between the odor we smell and what surrounds us. The reason for this is the orbitofrontal cortex that is not only operating scents, it is also the area of the brain that assigns value or hedonic meaning to it (Herz, 2005: 250). Accordingly, the workshops intents were to find these deep associations in order to use them in a later context. To avoid "language "associations" that could create olfactory illusions, the participants were given the scents with a number instead of the odor name. Words can easily manipulate us and create images and expectations in our mind before even smelling (Herz, 2007: 57).

This workshop also aims to prove that there are patterns in these associations and there is a connection between the other senses and smell.

"Specifically, it is hypothesized that odor hedonic perception and odor-related behavior results from a learned association between an odor and the emotional context in which that odor was first encountered "(Herz, 2005: 250).

Experiment

Method Fifteen design students (8 female, 7 male) ranging from 20 to 27 participated in this study. All of them reported having a normal sense of smell. Every participant was unaware of the field of scents and the intention of this study.

Materials Thirteen high-dose chocolate scents from the company "Aroma-bar" were used during this study. Some odors are more complex in their structure and thus allow several possibilities of association.

01 - mint
19 - elderflower
25 - cacao
26 - coffee
27 - cloves
28 - wood
29 - butter
30 - caramel
31 - orange
32 - honey
33 - hazelnut
34 - vanilla
35 - cinnamon
36 - tobacco
56 - blackberry

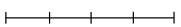
Every scent is presented in a small flask with a number assigned by the company. Additionally, to that, every participant is given thirteen A5 papers (one for every scent) that have different rankings printed on them.
Every sense is given 2-3 different ranking, with two extremes and 3 average values. On the bottom, people can write down associations, memories or landscapes they connect to the scent.

ASSOCIATIONS

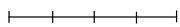
/Workshop 1

number

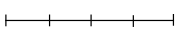
/form

round  sharp

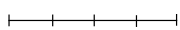
/weight

light  heavy

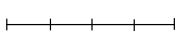
/light

bright  dark

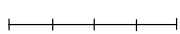
/tones

high  low

/surface

shiny  matt

/volume

quiet  loud

/texture

soft rough

/taste

salty bitter

/temperature

warm cold

/taste

sweet sour

/other associations
(objects, words, landscapes)

Procedure Five tables were set up in a sterile room, where no other odors were present. On each table, three to four scents were positioned with a stack of paper and pencils.

On each table, two participants were seated with a time limit of 1 minute. They smelled the scents and filled out the paper according to their intentions and associations. After finishing the scents on their table, they rotated till they ended up on the last table.

Result Every paper was evaluated in terms of the number given to the different lines: 2/1/0/1/2 and presented in bar charts. Each scent was evaluated separately. Determining which number gained the most votes, decided on the characteristic.

Discussion

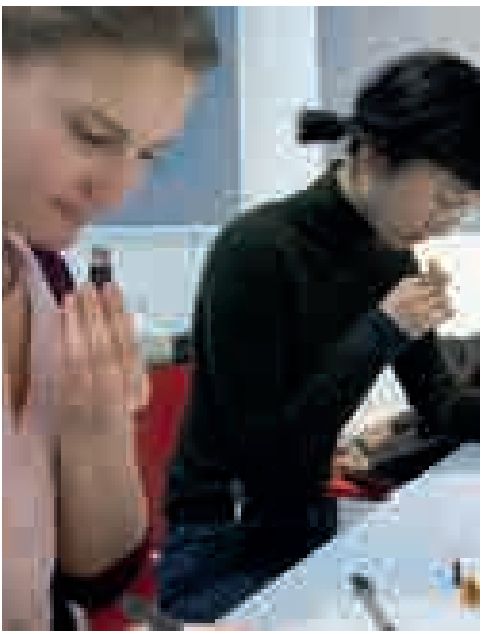
The result of this experiment was to demonstrate that there is possibly pattern in the perception of smells. Participants did not choose the same values every time, but the average shows that participants do have the same associations with specific smells. Patterns in the extremes can be seen and characteristics could then be applied to the scents. The category for sense of sight showed clear results more so than the sense of taste. Participants often had different opinions on how it could taste or when confused, chose the average value.

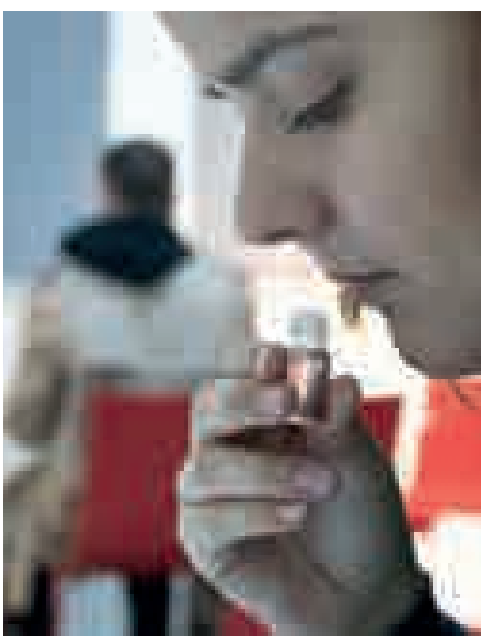
The same applies to the associations asked at the end of the workshop. Associations are different, but some scents do have the same connections. Tobacco, as a scent was often assigned to an old woman's perfume, linen and cinnamon were often connected to Christmas and nuts.

Some participants had difficulties with beginning this exercise, finding it hard to rely on their first intuition they had with the scent. However, most managed to engage with the tasks and it got easier throughout the workshop.

Another observation showed that most participants tried to link the scent to a tangible object. They attempted to recall where the scent was from and tried to reach this memory. Some managed to link it, others (the majority) recognized the scent, but couldn't define it, leaving many with dissatisfaction. Most of the time, participants had association with the scents, they weren't sure about the tangible object the scent was coming from. A reason for this could be that the potency the scents had were much higher than the amount we normally experience the scent.

The workshop was able to demonstrate that associations are often made in the same way and we can access this information through simply smelling the scent. An interesting finding was the short amount of time that was required to create these associations.
As a result, the following workshops built upon these findings to see if the result would differ when scents were tested singularly.





WORKSHOP 2/COLORS Different synesthesia studies have confirmed that all our senses rely and support each other. That means that seeing a color (sight) can evoke other sensorial information such as scents (Vanichayanguranon, 2017: 47). Peter de Cupere a scent artist from Belgium created an exhibition "Touch and smell the colours of this world" to investigate the relationship between odors and colors. Painting large canvases mixed with different scents/colors, he set them in an interactive public space to see if the colors match the expected scent. This association varies from person to person and is developed over time through one's origin, culture and context from where they learned the scent.

People might say that a yellow goes together with a scent of a pineapple (desire, chapter2) or a green with the scent of grass. Respectively, certain smells go together with certain colors. Gil Morrot who wrote the article 'The color of Odors is calling this the semantic odor-color association and tries to demonstrate the existence in a study with wine. As he says: '(...) Color strongly influenced the qualitative, quantitative and hedonic determination of odors' (Morrot, 2001). The odor of a white wine, colored red, was perceived as a red one (Morrot, 2001). That proves that we match the scent to the color the object has.

A similar result was achieved in a study with the scent of coffee. 52 children had the task to pair 3 colors with the scent of coffee. Without knowing what they were smelling, they chose warm/brown colors to the match the coffee scent (Silpakit, 2015).

The study leads me to the question if the same principle applies to the scents I chose. In the previous workshop I gathered information on whether the scents were bright or dark, but an exact color was not chosen. Consequently, this study aims to find out if people have similar odor-color associations with the chocolate scents.

Experiment

Method Ten design students (6 female, 4 male) ranging from 20 to 27 participated in this study. All of them reported having a normal sense of smell. Every participant was unaware of the field of scents and the intentions of this study.

Materials The same thirteen high-dose chocolate scents from the previous study were used.

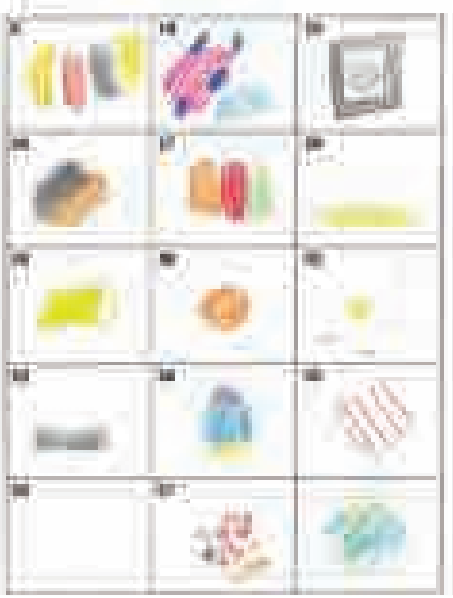
Each participant was given an A4 paper with a tiled chart printed on it. Every box is numbered and assigned to one of the scents. Different crayons were provided to visually express the scents in their assigned box.

The participants were blindfolded to help them focus on the inner pictures/ associations developing in their mind when smelling the scent.

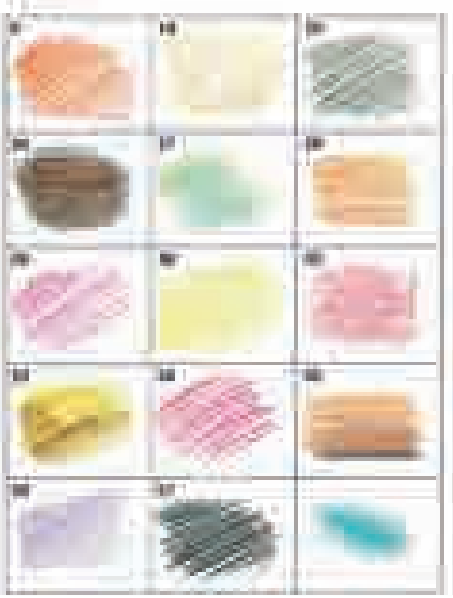
/Workshop 2

/Workshop 2

/Workshop 2



/Workshop 2



Procedure Participants took part in the workshop in groups of 1 to 2 people. In a room with 1 table, the participants were seated and blindfolded. After handing them the scent and smelling it, the participant selected a color in his/her mind, opened his/her eyes again and illustrated the colors mixing the crayons. This process was repeated for every scent.

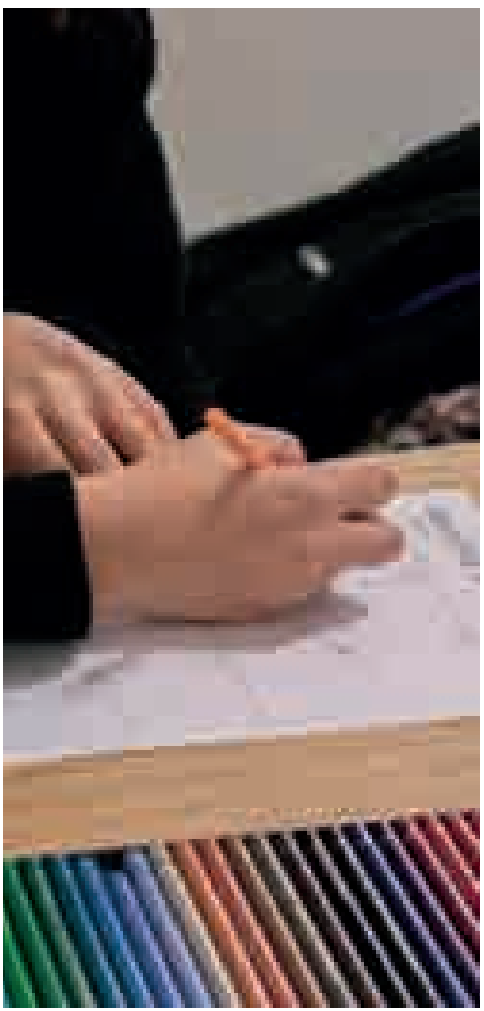
Result The results were evaluated in terms of the brightness and temperature of the color, as well as the color itself. The colors were then digitized and summarized in a new format.

Discussion

The results of this study supported the experiments that were done before. Patterns could be seen in the participants' decision making to choose colors. Some scents are clearer (orange) than others (wood), but they still have the same temperature/intensity of the colors in common.

Another notable finding was how different people approached the task. A few of the participants used shapes/figures and different intensities of colors to underline the experience they had with the smell. These interpretations could be based on other associations that helped them to understand the colors. What all participants had in common, was that almost all needed more than one color to actually describe the scent.

Interestingly, comparisons and similarities could now be made with workshop 1. Many of the participants who had categorized scents as bright or dark in the first workshop, tended to illustrate them in a similar way in workshop 2. Additionally, every scent was given the color of the scent producing object. This enforces the point that memories are linked with scents and it is a nonrandom odor - color association (Gilbert, 2008).



WORKSHOP 3/TEXTURE,MATERIAL,TEMPERATURE,WEIGHT

It's already known that the feeling of texture can change depending on the information another sense is sending to the brain (Dematte et al., 2006). An example of this is provided by the source of Steve Guest (Audio tactile interactions in roughness perception'), which shows that the by altering the sounds we hear, we can change the perception of textures. For example, participants felt sandpaper and by changing the sounds they heard, their perception of the roughness changed.

But how does this work when it comes to odors and textures? "The first reported source dates back to 1932 documented by Lair, who reported that women's judgments on the quality of silk stockings depended upon the scent with which the stockings were impregnated" (Dematte et al., 2006). Inspired by this study, M. Louisa Dematte and other authors undertook experiments to confirm that odors can change our perception of touch. Throughout the experiments, they asked the participants to rate the softness of a fabric while they infused them with different scents. It became clear, that fabrics felt significantly softer when evaluated in the presence of a lemon odor versus when presented with an animal odor. Therefore, they revealed the presence of a cross-modal interaction between olfaction and touch (Dematte et al., 2006).

As other authors before, they believed that this is due to learned associations we experienced through daily life. What means, that when we are repeatedly exposed to the combination of an odor and touch, our brain

learns this combination and saves it. Based on these sources, the next workshop aims to prove that textures, temperatures and weight are also developed associations we have with the selected scents of chocolate.

Experiment

Method Ten design students (6 female, 4 male) in the age range from 20 to 27 took part in this study. All of them reported having a normal sense of smell. Every participant was unaware of the field of scents and the intentions of this study.

Materials The same thirteen high-dose chocolate scents where used, as in the other studies before.

Additional to that, every participant is given an A4 paper that has a chart printed on them. Every window is assigned to one of the scents and marked by its number. A variety of 11 balls that differed in texture, weight and temperature were presented in a box which was only presented after the person got blindfolded.

The reason for blindfolding the participants, again, was to help them to concentrate more on the haptics, rather than on the color or the look/ material of the ball.

ASSOCIATIONS

Glass ball

heavy, smooth, cold

Stone ball

heavy, smooth, cold

Wood ball

medium weight, warm, discreetly rough

Juggling ball

medium weight, slightly dense, slightly textured

Soft ball

light, dense, warm

Stress ball

medium weight, dense, deformable

Massage ball

textures, spiky

Hairy ball

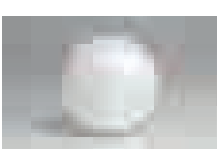
light, expanding, flexible

Braided wood ball

light, texture, braided

Metal ball

light, smooth, cold



Styrofoam ball

non-weight, smooth-slightly rough

Discussion

This workshop established an understanding on how scents relate to textures and proves that there is an odor-touch association. As in the previous studies, a pattern was found and textures were applied.
After the workshop I clustered the balls into different sub themes, most of them were chosen because of the same qualities they had.

main characteristics:
Texture - spiky, hairy, braided wood, (wood)
Density/softness//rough - soft ball, stress ball, Juggling ball+
Soft - stone, glass, metal
Light - Styrofoam ball, metal ball, (wood)
Heavy - stone, glass

These key features made it easier to identify and understand the assigned qualities. However, small differences in these main areas were still counted in. Meaning that when people chose the stress ball more than the soft ball - the density characteristics of the stress ball were included.

Interestingly, most of the participants had the intuition to give a fragrance either the characteristics of a smooth or a textured surface. Especially if we look at the scents that were assigned to the three balls of textures. Scents who were assigned to either one of these, were mostly chosen by everybody.

ASSOCIATIONS

Another investigation was on how people wanted to merge or change the different balls. Some wanted to crack the surface of the glass ball or gave balls the characteristics of disappearing when they would touch it. Someone else merged the glass ball and the hairy ball, as they thought the scent is smooth from the outside but had a hairy structure in the middle.

After the workshop, if I introduced the ball so one could see it, the participants perception also changed. A lot of the participants thought that they would have decided differently as they would have counted in the look and color. Therefore, it was the excluding the sense of sight lead to a more accurate result.

WORKSHOP 4/SHAPES The basis of the next workshop was provided by two sources that both experimented with the connection between shapes and odors. Seo et al. (2010) was one of the first who tried to match abstract forms to odors and proved that certain symbols could continually be applied to odors. Consequently, an odor-shape association is existing. Two years later, Hanson-Vaux et al., used this source as a reference and aimed to find association between wine odors and shapes. Examinations showed that if we talk about wine, we already borrow words from shapes. As an example, one would describe a wine as well rounded or sharp (Hanson -Vaux, 2012).

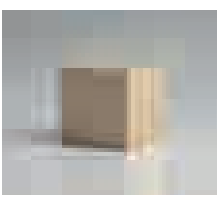
Hanson-Vaux used another contributing source finding that the nonsense word 'baluba' is associated with round shapes and 'takete' with sharp / angular ones. Participants were then asked to rank the odors between these two extremes. An odor-shape relationship was reported by this experiment (Hanson-Vaux, 2012)

Experiment

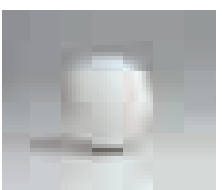
Method Seven design students (5 female, 2 male) in the age range from 20 to 28 took part in this study. All of them reported having a normal sense of smell. Every participant was unaware of the field of scents.

Materials The same thirteen high-dose chocolate scents were used as in the other studies before. Additional to that, each participant was given an A4 paper that had a grid chart printed on them. Every window had a

timeline printed on them, each assigned to one of the scents and marked by its number. The timeline goes from 1 to 7 and each number represents the shape that is in front of the participants. 7 different shapes were used during this workshop, every shape is made out of clay and represents different characteristics. These were provided by the form collection of Cheryl Akner-Koler.

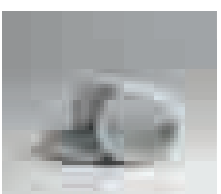


Cube

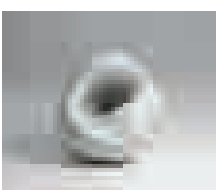


Sphere

Cone

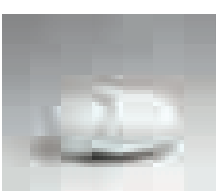


Multilayer



Missing oval

Plane + wave



Joined shape

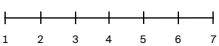
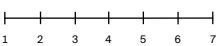
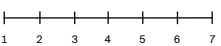
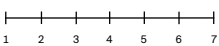
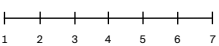
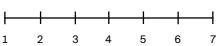
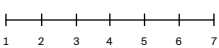
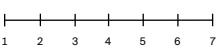
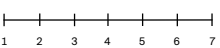
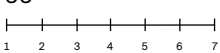
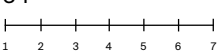
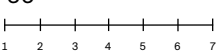
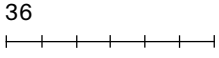
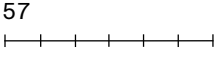
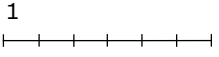
ASSOCIATIONS

Procedure In a room with 1 table, the participants were seated and the shapes were placed in the middle of the table. Every shape was marked with a number, linked to the numbers on the sheets given to the participants. All the scents were handed out to the participants and within a short period of time, each one could smell the scent and assign a shape to it. Shapes were selected by marking 1 or 2 numbers on the timeline and notes could be written down below. This process was repeated with every scent.

Result The results of the paper were evaluated in terms of which shapes were picked and if there were similarities within the selection of shapes. This included if the shapes were geometric/organic, big/small or if they were missing something. This information was summarized in a new form.

/Workshop 4

shape

9 	19 	25 
26 	27 	28 
29 	30 	32 
33 	34 	35 
36 	57 	1 

Discussion

In summary, my findings are in agreement with previous studies. Learned associations lead to the understanding that specific odors do belong to a specific shape, in terms of this study.

Some scents like butter, vanilla and coffee were clearer in how participants selected a similar shape and other were more hidden such as tobacco. The chosen shapes could still show similarities in their characteristics. As in this case, both chosen objects had the attributes of smooth and roundish.

Referring back to Hanson-Vaux et al. (2012) odors easily acquire taste properties when they have been experienced together. It's already found, that sweet taste is associated with round shapes and bitter taste with sharper shapes (Hanson-Vaux et al., 2012) If we transfer this knowledge to this study, sweeter scents like hazelnut (33), vanilla (34) and elderflower (19) have been assigned to round, organic shapes. In contrast to bitter scents, like cacao and coffee where participants selected angular shapes. Some other scents like orange, that do have a both a sweet and sour taste, confused participants making it hard to know where to sign up this scent.

Another interesting element was, that the multilayered object I chose randomly, was picked the most. Even with the lack of clarity, most participants expressed it with diversity, multi-layer, decorative or bloomy. Characteristics that couldn't be expressed by the other shapes.

Again, a link to workshop 1 was shown, seeing that mostly all scents were assigned to the same shapes.

WORKSHOP 5/SOUND Inspired by several art-based projects, this project aims to research the cross-modal connection between scents and sounds. To give this workshop a more scientific background, Balboa et al. revealed an article in 2014 that showed white noise has an effect on the perception of scents. In other words, the pleasantness of an odor can be modulated by the audio that is presented at the same time.

Back to the art-based projects, Bompas&Parr, a company based in London, connects sounds to other sensorial experiences in order to demonstrate that some experiences do enhance when adding sounds. "The sensory accumulator" as well as "The flavor conductor" creates sounds corresponding to scents/taste and promises a new way of exploration. The flavor conductor helps a whiskey drinker to experience and understand the complexity of whiskey flavors. It recognizes the flavor profile of the whiskey and amplifies it by adding music, visuals, aromatic and haptics (Bompas&Parr, 2014).
The same principles were used for the sensory accumulator, where the flavor profile chocolate was merged with sound and visuals to enhance the taste of the chocolate.

In connection to that, Workshop 5 intents to match different rhythms with the thirteen selected scents. The attempt was to demonstrate the connection between scents and sounds/rhythm.

Experiment

Method Seven design students (5 female, 2 male) in the age range from 20 to 28 took part in this study. All of them reported having a normal sense of smell.

Materials The same thirteen high-dose chocolate scents were used, as in the other studies before.
Additional to that, every participant was given an A4 paper that had a grid chart printed on them. Each window is assigned to one of the scents and displays one rating from 1-6. Every numbers in this case, represents one of the following rhythms:

2/4 time
3/4 or 3/8 time
4/4 time
5/4 time
6/4 or 6/8 time
7/4 time

Procedure All participants were seated around one table and handed a scent as well as one of the A4 sheets. The rhythms were played and the participant smelled the scent while listening to the different sounds. After receiving all the different scents, the participant chose the number on the timeline and marked it by a cross or a circle.

Results Depending on the rhythm to which the scent was selected, graphics were created. These graphics demonstrated the rhythm that was the most picked for the different scents.

Discussion

In conclusion this workshop did not work out as it was planned. Participants were overwhelmed by too many different sounds and it was hard to remember them while listening to the next ones. They got frustrated and it showed how important it is to design a workshop in detail. It would have been better if everybody would have had their own control over the music, so they could listen to the sounds in their order and speed.

Therefore, this workshop was not counted in in the further process. This was not done because of the results, but because of the process I chose and the invalidity that was caused by it.

WORKSHOP 6/SOUND,LETTERS Later in this process, I tried another sound workshop that didn't include sounds that were already made. This time, the workshop aimed to encourage participants to create their own sound in relation to the scent they smelled. Sounds were expressed by newly invented words – as from now on, called "nonsense words".

As a base of this workshop, another Charles Spence article provided the necessary information. In 2011 Spence, Kim Ngo and Reeva Misra aimed to highlight the cross-modal correspondence between the cacao

content of chocolate and nonsense words. Finding that more milk in the chocolate resulted in much rounder sounds of the words the participants created (Kim Ngo, 2011). Working off the principles of this article, the next workshop worked to find nonsense words for selected scents and a pattern in which sounds/letters are repeatedly chosen.

Experiment

Method Seven design students (5 female, 2 male) in the age range from 20 to 28 took part in this study. All of them reported having a normal sense of smell.

Materials Six of the thirteen high-dose chocolate scents where used. Additional to that, each participant was given an A4 paper that had a grid chart printed on them. Every window is assigned to one of the scents and displays a method each participant could use. The following scents were used during this workshop: vanilla, honey, orange, hazelnut, cinnamon, cacao.

Procedure In a room with 1 table, all participants were seated and handed 1 scent and 1 sheet. The method was introduced and participants could start to smell the scent and assign letters/ words to it. Within this method, participants smelled the scent first, wrote down two letters and repeated it again to write another two letters down.
At the end they tried to merge the written letters into a self-invented word. This procedure was continued till all participants did all six scents.

Results The results were evaluated in terms of their sounds and also in relation to that which letters were picked. This included if they selected sharp or smooth letters and in which relation they picked the words. This information was summarized in a new form and was discussed with all participants.

Discussion

In comparison to the last sound workshop, the results were much clearer and much more comprehensible than before. Nonsense words were applied easily and often assigned to the same sound or letter. For example, the scent of orange was referred to as an "s" or "sch" sound; which, as a participant explained, may be associated with the freshness of the fruit/scent. Most of the participants used the letter "I" and other sharper sounds, what matches the information from the workshops before.

Other scents like honey, equate themselves through the characteristics of an elongated and softer sound. In summary, every smell could be assigned to a couple of nonsense words, which are similar in their sounds and other characteristics.

/Workshop

words

Describtion:
The aim of this workshop is to interpret the different scents with an imagined word. The word should be a nonexiting word that suits the scent soundwise.
(e.g. baluba, kiki, takete)

Procedure:
Sniff at the first scent and try to imagine two letters. Sniff again and write down two more. By looking at the picked out letters, try to merge or combine theses letters into a word that you feel could describe the smell. You can also add more letters or skip the step if you immediatly come up with a word.

9 first letters: second letters: final:	25 first letters: second letters: final:
32 first letters: second letters: final:	33 first letters: second letters: final:
34 first letters: second letters: final:	35 first letters: second letters: final:

DISCUSSION In conclusion, these studies reflect and verify the results quoted sources have already shown. Cross-modal-correspondence is existing across all sensory modalities and therefore characteristics for every scent could be established.
"Olfactory experiences, then, represents a domain to which attributes from all other sensory modalities can be easily and naturally applied. In other words, they represent a domain that is particularly rich in cross modal correspondence" (Deroy et al., 2013:879).

The first study gave me the basis for this research and was reflected throughout the others' similar results. Therefore, intuition is the access to anchored associations and if not that much information is needed, the first workshop could give an idea of which characteristics the scent might have. However, it was helpful to do the other workshops as they introduced and confirmed new attributes. They prove that odor refers to the other modalities and that repeated exposure to specific colors, textures, shape might learn these combinations and build up associations.

Engen for example suggests that all responses to odors have been shown to be based on associative learning principles. Thus, if an odor is perceived as pleasant, it was first experienced in a pleasant context (Herz&Engen, 1996:307). Based on this, Dematte et al. (2006) relates pleasant smells to softer texture and unpleasant ones to rougher ones. My experiments comparatively showed the same results. As an example: butter and wood: both were considered unpleasant scents and assigned rough textures by

many of the particpants. This could imply that rough textures do signify a scent as unpleasant. The opposite applies to pleasant scents like elderflower or honey that were considered soft textures.
The same can be applied to shapes. Pleasant scents were mostly assigned to round/organic shapes and unpleasant ones to angular shapes. The reason for this could be explained by the sense of sight assigning this shape to this scent. That doesn't mean that they selected the shape that is similar to the odor producing object, but it does mean we already built up some kind of association that is either the object itself, memory or a feeling.

A similar thing is happing recording to sweet taste and round shapes or bitter taste and angular shapes. As studies from Kim Ngo et al. (2011) have proven before, sweet milk chocolate is associated with round shapes and dark, bitter chocolate with angular ones. This taste-shape association can be applied to odors as well. Thus, sweet odors are applied to round objects and bitter odors to sharp object - as mentioned before in 3.2.4. Research into color and odor association works with the same principles. Light colors are associated with subtle scents such as tobacco or butter and strong colors with intense scents such as cacao.
The workshop of color and shape does therefore present the multisensory interaction between olfactory and vision. Dematte et al. (2006) suggests that this cross modality can take place even when the visual information consists only of simple stimulus features. In turn, this could be the color, abstract shapes, as well as the brightness. Vision as a sense is more obvious.

ASSOCIATIONS

It can therefore play a large role in translating odors into other sensory information. Visuals like colors and shapes bring out associations that are experienced similarly among different people. Olfactory activates the semantic knowledge depending on how familiar we are with the scent. It lets us access the multisensory network that brings out the co-union of the senses.

In summary it can be said, that most of the applied characteristics that were made during the workshops are linked to the scent producing object. Especially scents colors are mostly applied to the colors the object has. However, occasionally the colors have been connected to the context the scent is normally experienced with, as cinnamon and Christmas. Therefore, colors as green and red are associated with the scent as well. In this respect, not every scent can be clustered into two extremes, what means, that sometimes we need to step back and look at the context the scent is normally experienced in. Memories and feelings are the gateway to our associations we have with specific scents. Due to this, I will focus on the senses of vision and touch as they both seem to have a strong connection to association with smell.

SCENT LIBARY At the end of the workshop all results were summarized in a library and subdivided into the different sensory information categories. This led to an understanding on which characteristics the scents have and which information is understood/processed by which sense. All in all, this served as the basis for the upcoming design process.

2
1
0
1
2
9-orange
19-elderflower
25-cacao
26-coffee
27-cloves
28-wood
29-butter
30-caramel
32-honey
33-hazelnut
34-vanilla
35-cinnamon
36-tabacco
57-blackberry
1-mint

2
1
0
1
2
9-orange
19-elderflower
25-cacao
26-coffee
27-cloves
28-wood
29-butter
30-caramel
32-honey
33-hazelnut
34-vanilla
35-cinnamon
36-tabacco
57-blackberry
1-mint

2
1
0
1
2
9-orange
19-elderflower
25-cacao
26-coffee
27-cloves
28-wood
29-butter
30-caramel
32-honey
33-hazelnut
34-vanilla
35-cinnamon
36-tabacco
57-blackberry
1-mint
dense

pleasant
2
1
0
1
2
9-orange
19-elderflower
25-cacao
26-coffee
27-cloves
28-wood
29-butter
30-caramel
32-honey
33-hazelnut
34-vanilla
35-cinnamon
36-tabacco
57-blackberry
1-mint
unpleasant

cacao

25

/sight

form - sharp, pointy

light - dark

surface - matt

64

colour - dark, earthy, brownish

/touch

texture - slightly rough

temperature - slightly warm

weight - slightly heavy/non-weight

formable, natural, light

/hear

tunes - low

volume - quiet

/taste

0

slightly sweet

wood

28

/sight

form - sharp, geometrical

light - slightly bright

surface - shiny

colour - bright

65

/touch

texture - rough

temperature - slightly cold

weight - heavy

heavy, a bit of texture

/hear

tunes - high

volume - loud

/taste

slightly bitter

sour

TRANSLATE

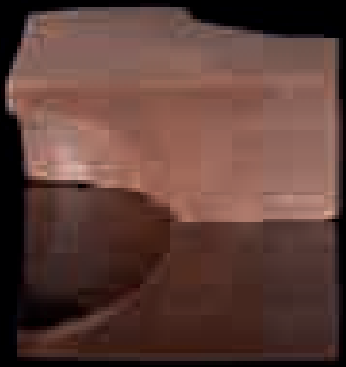
The following chapter deals with the translation of the previously collected information. The main focus is on the sensorial experience of haptics, sight, taste and how they represent the scent. Since all scents are based in chocolate, this continuation takes place in the field of chocolate pralines. Texture, form and taste can be experienced through this examination as one will see the praline first, touch it, feel it and finally taste it. Pralines as a result, give the possibility to explore all sensory information at once, as it carries all senses.

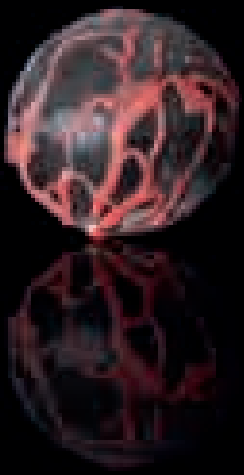
The goal of this practical application is to then create a way to know what the praline contains without using the nose. Therefore, the praline needs to have the look, feel and taste of the scent.

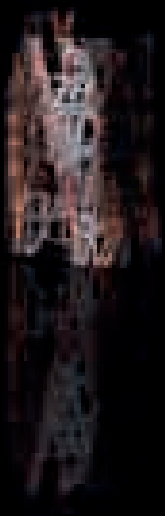
Starting by focusing on the haptics, I explored how form and texture represent the scent. The first period of this phase was to find the right shape to represent the smell. The combination of both determines the look of the praline. To explore this different form explorations and sketches were done, continually improving as the density and weight changed. Once all characteristics were included in the sketches, each scent was assigned to different shapes that differ in form, texture and (dependent upon the ingredients) the weight and density. It was also a challenge to find a material that fulfilled all the requirements.

3D model Two shapes were picked for each scent. Each chosen by their look and simplicity as they needed to be casted and built in chocolate. The selected shapes were then modeled out of clay or designed in 3D to be 3D printed afterwards. This process created 8 forms which were later casted in silicon.

Material exploration During the ideation, different materials were already assigned to the forms; but some needed to be tested to see how the materials behaved within the shape. Especially cinnamon needed a lot of exploration time, as the chocolate didn't do what was expected. Other forms like cacao worked the first time. The forms that were even on 2 sides became easier to handle. Assigning the right color to the praline turned out to be the most complex decision. Food coloring didn't work with every material and it was sometimes difficult to get the right final color.







WORKSHOP 8/PRALINES In order to verify the applied characteristics, the pralines needed to be tested to see if people still connected the form, texture and color to the right scent. In addition, it should establish an understanding of which form and material fits the scent the most. Therefore, the goal of this workshop was to perform the tests for each praline and to get feedback on possible improvements.

Experiment

Method Seven people (5 female, 2 male) in the age range from 20 to 55 took part in this study. All of them reported having a normal sense of smell.

Materials 5 of the thirteen high-dose chocolate scents were used. Every participant was given an A5 paper with the different numbers of the scents printed on them. Thirteen different pralines were presented during the workshop, each praline represented one of the scents:
vanilla, honey, cinnamon, butter, cacao

Procedure The pralines were displayed on a high table, where participants could gather around. Every praline was marked by a number with a corresponding paper. All scents were handed out to the participants and within a short period of time, each one could smell the scent and assign 1-2 pralines to it. This process was repeated with every scent.

Result The results of the paper were evaluated in terms of which pralines and which materials were picked. Depending on the frequency of the picked form and material, the final praline was decided. Refinements that were given by the participants were collected and added to the improvements of the pralines.

Discussion

In summary, my findings were in agreement with the studies before. People surprisingly could recognize their previous assigned associations and were able to match scent and form.

Associations like "it dissolves if I touch it" (butter), were also repeated in this workshop. This leads to the assumption that people do have similar associations, especially if it's presented in front of them.

In accordance with the other workshops, some scents were easier to assign to a specific shape, texture or color. Vanilla and cacao were the easiest and were mostly assigned to the same shape. The texture of cacao was especially easy to define and made the decision much easier for most of the participants, as it matched the expectations.

According to the participants, cinnamon was missing the common powder texture. Due to this, they sometimes decided to choose the cacao shape instead as the texture of the cinnamon praline wasn't the one that matched the scent.

In conclusion, participants are searching for the object that comprises every characteristic they have in their head. If one important characteristic is missing, they tend to select another shape. Even if that it was not matching the other criteria.

The most difficult scent was honey, but not because of its shape, but because of the color mismatch. The golden, orange that belonged to the scent was missing in this attempt. In contrast, the gelatin material fits the scent quite well, as it provides the characteristics of transparency.

At the end of the analysis, 5 different chocolate pralines were created. Each of them differed in form, texture and color.

The experience of taste wasn't included at that specific point and therefore the pralines were only experienced through the sense of sight and haptics. Something that was noticeable was that most of people smelled it and wanted to try it to see if it met their expectations.

VANILLA

color: bright, yellow, orange, brown
form: round, flat, wavelike
texture: rough
weight: medium weight
temperature: warm
ingredient: pudding

CACAO

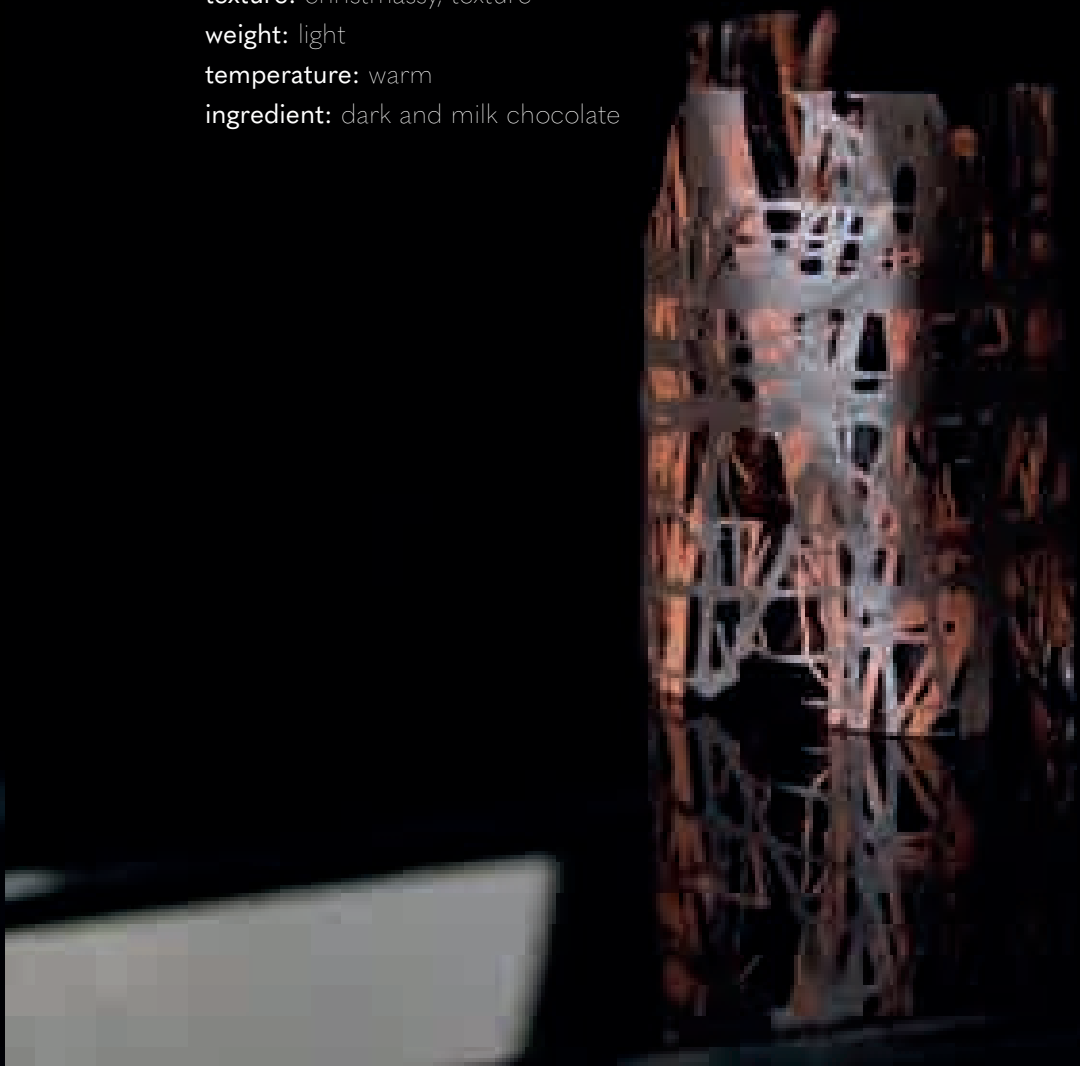
color: dark, brownn, earthy
form: angular, something is missing
texture: rough
weight: non-weight
temperature: warm
ingredient: raw-cake with cacoa powder

HONEY

color: warm colors, red, orange
form: round, organic
texture: soft, dense, see through
weight: a bit light
temperature: warm
ingredient: gelantin

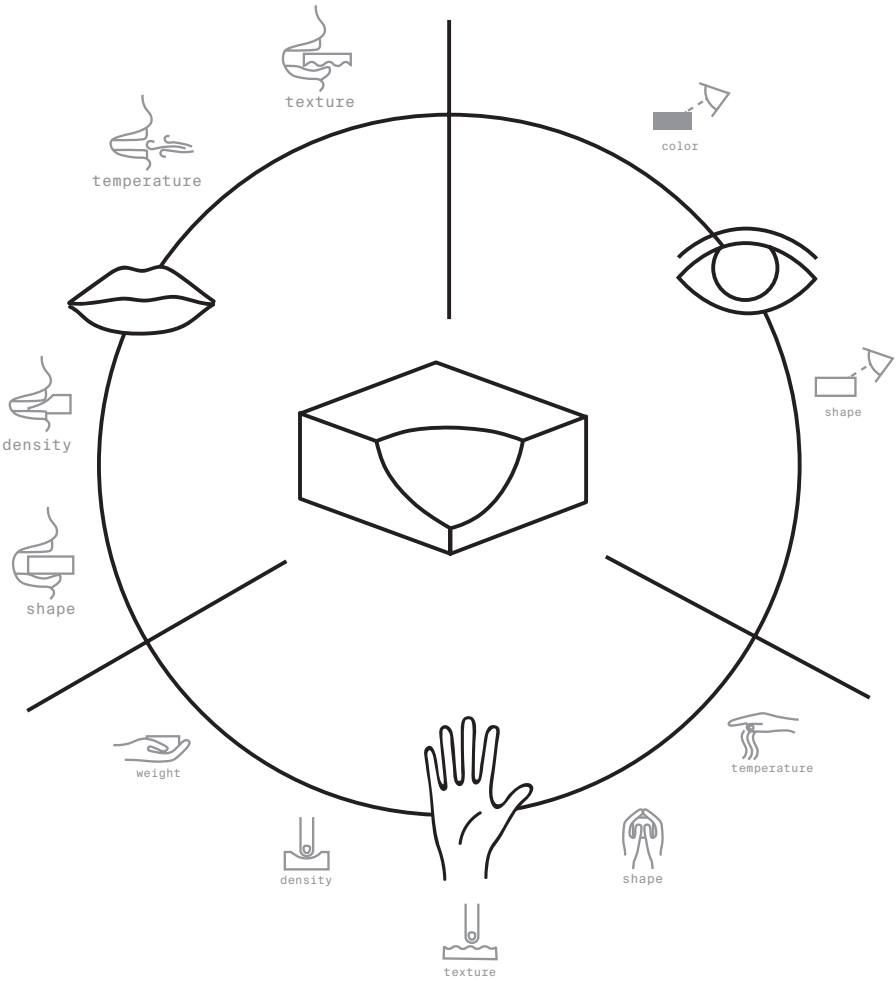
CINNAMON

color: warm colors, brown, orange, red
form: sharp, multi layered, round, decorative
texture: christmassy, texture
weight: light
temperature: warm
ingredient: dark and milk chocolate



BUTTER

color: bright, yellow
form: weird, subtil, deformable
texture: a bit shiny
weight: light
temperature: slightly cold
ingredient: cotton candy


texture
color
temperature
shape
density
shape
weight
temperature
density
shape
texture

TRANSLATION GUIDE-TRANSLATE SCENTS "Unlike the other senses, smell defies language. Smell is metaphorical sense, then, always in comparison to concrete other, a more palpable here" (Birnbaum, 2011: 60)

The goal of this thesis was to find a common language for scents, that is not constructed by words, but by the information the other senses provide. Through the mental images and learned associations we have with scents, the last chapters begin to find these associations and convert them into patterns. These patterns do not fit every person, but give a general idea on how most of the people experience the scent.

The last chapter additionally refines and invents a new method on how we can create an overview about the characteristics of scents and what is important if we design something within this realm. This method is intended to work fast and offer a basis for further design processes. Therefore, this guide offers a multiple-choice questioner that should end up with a suggested object/shape that includes the outer and inner characteristics of this scent.

METHOD Referring back to the conclusion of the second chapter, workshop 1 is the only workshop that is needed to find associations in a short period of time. The moment we first experience the scent, the environment as well as the related object is remembered and linked to that specific scent. This saved information can be retrieved by handing participants a scent and asking them goal-oriented questions.

This does not mean we need to know the origin of the scent. Our brain directly connects the knowledge/memories we have and tells us the connecting associations we have. These associations are sometimes more complicated than others or differ from person to person, but at the end, most of our associations are similar. The color bright yellow as well as the memory of pudding are connected to the scent of vanilla. Which leads to the assertion there are patterns in how we connect scents to specific memories.
"It was still there, smelling the woods. Of the ground. Of the earth. It smelled dark. A dark forest green" (Birnbaum, 2011: 86).

Targeting these patterns, this chapter aims to cluster specific characteristics of scents to make the information more accessible to others. Therefore, characteristics like shapes, textures, colors and density needed to be found and clustered in a deliberate way. Using previous experiments and continued research to develop these features. Prioritizing them by their quality/relevance to avoid overpowering with too many options in the guide. In order to choose which textures/shapes/materials are the right ones, a basic structure of the guide needed to be developed.
This also implemented, in which order the decision should be made and how people will be guide through this procedure

Guide structure The method that is used is based on the fundamental structure of workshop 1 and extended in their choices. This has been done to guide the user through the tool, in order to prevent too many

outcomes. Compromised by 3 of the 5 senses, this tool could include the sense of sight, touch and sound. However, the focus is on sight and touch, as the exploration in sound wasn't as successful. Hence, the sense of sound will be not included in the further test out.

The following diagram/guide is clustered in 4 main sections: shape, texture, color and touch, guiding the user through a fixed process which, based on the previously selected fragrance. They follow the rule of building on each other in order to achieve a shape/object at the end.

This requires a neutral environment without the influence of association aids such as colour and graphic design, as otherwise an influence on the user would arise which would falsify the result. For this reason, the graphic design of the process tree and the online tool is reduced accordingly. The verification of the results is only possible if there is no creative leeway in the query. I am aware that this contradicts the emotionality of the topic, because a large part of olfactory perception is based on memories carried by emotions.

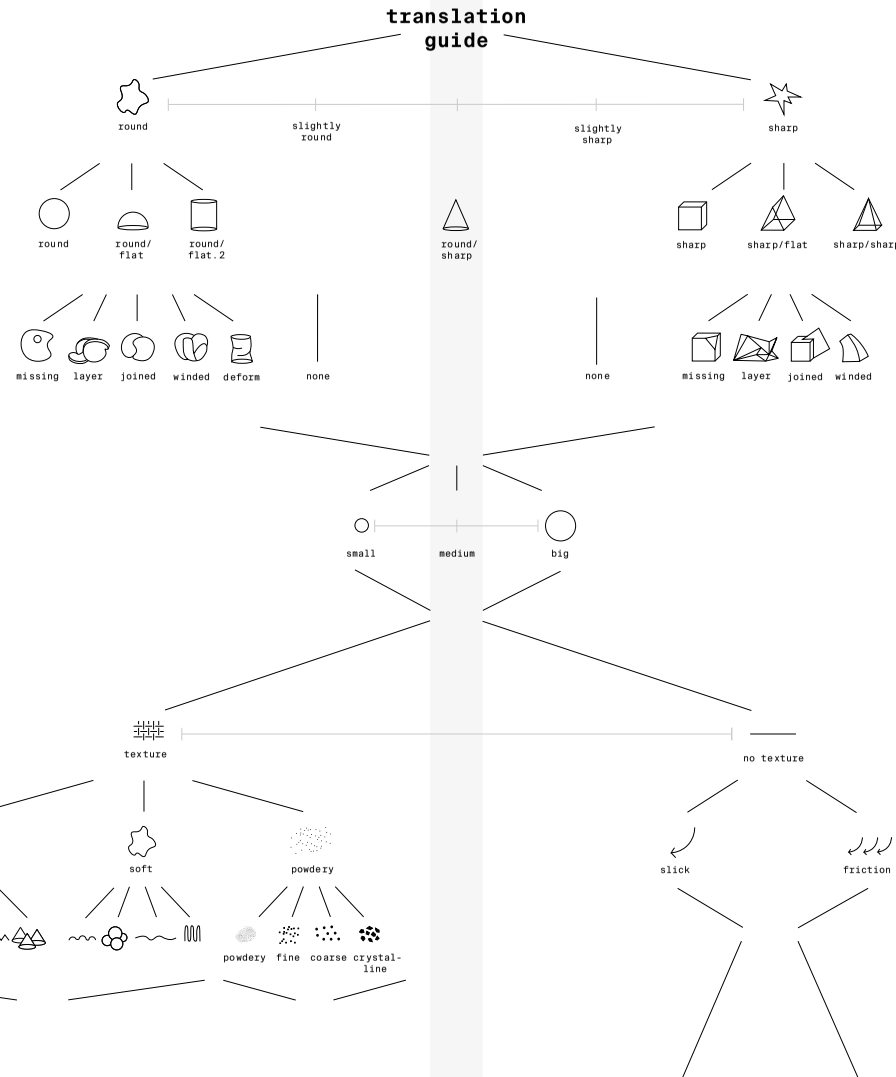
First, the base structure is built on to the shape the user is selecting and is evolved through the sub-shapes, textures and colors. The haptic characteristics such as weight and temperature can be added on later. The same applies to sound and taste, these could be implemented after this.

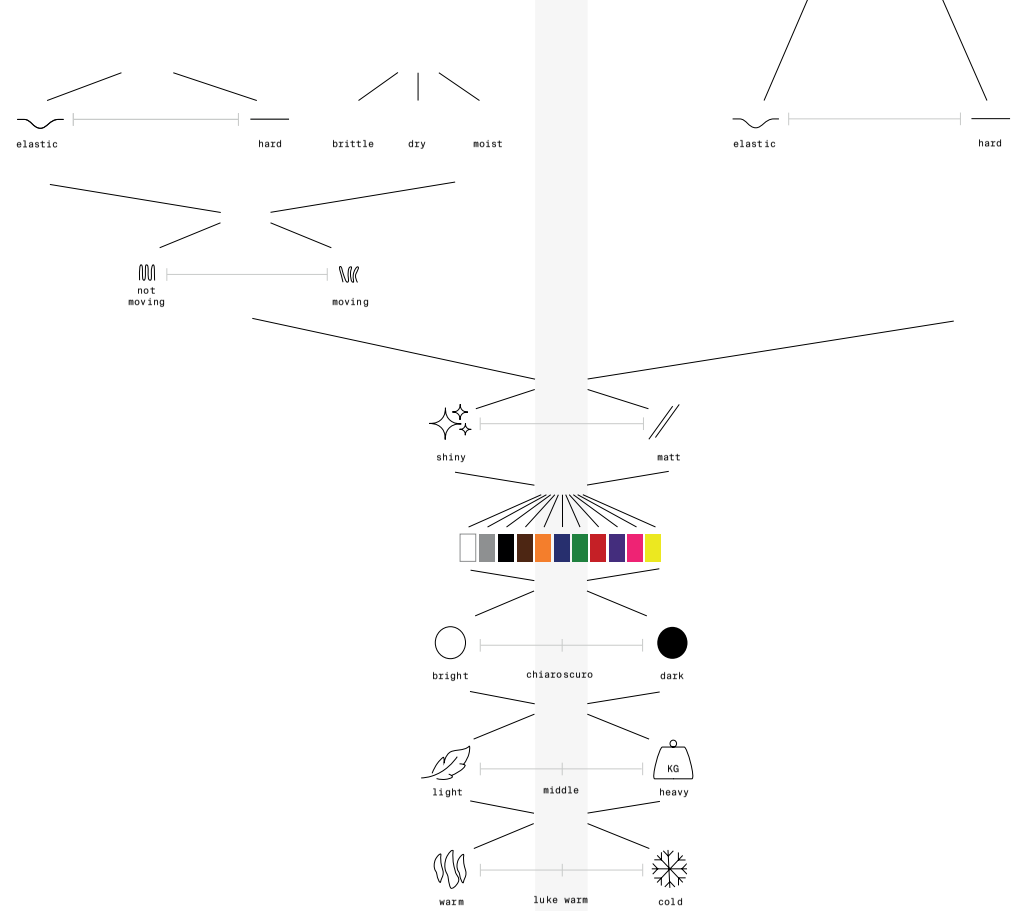
However, after a couple scents, the shape/texture combination will possibly

be repeated as the variety of forms and surfaces is limited. Therefore, this tool needs to count in associations we have with that scent. This could be the scent producing object or an association that many people have – like vanilla pudding for the scent of vanilla.
According to this, the scent palette needs to act in an intelligent way and has to add this information to the base structure of the end shape. In the best-case scenario, it learns with time and adds more and more knowledge to the end object.

Another option would be that the user gets the base shape and can add his/her interpretation of this scent to it. These two options can also be merged, as it is important to change the shape for the different associations individuals have. However, this kind of program cannot be developed in a short amount of time and therefore a more simplified version will be developed.
The scent palette can be applied in a multiple-choice tool on a screen or as a 3D-tool that can be brought to any occasion. As an online application, the atmosphere should ideally be generated by sounds. This forms a subtle framework that supports the process and does not impose any associations on the respondent. The resulting "sound spaces" are intended to create the appropriate scope for emotional decisions. However, this area was not explored in workshops during my studies and is therefore not taken into account in the Bachlor work.

translation guide

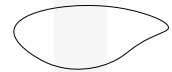




color

haptics

feel



suggested form that can be adapted afterwards

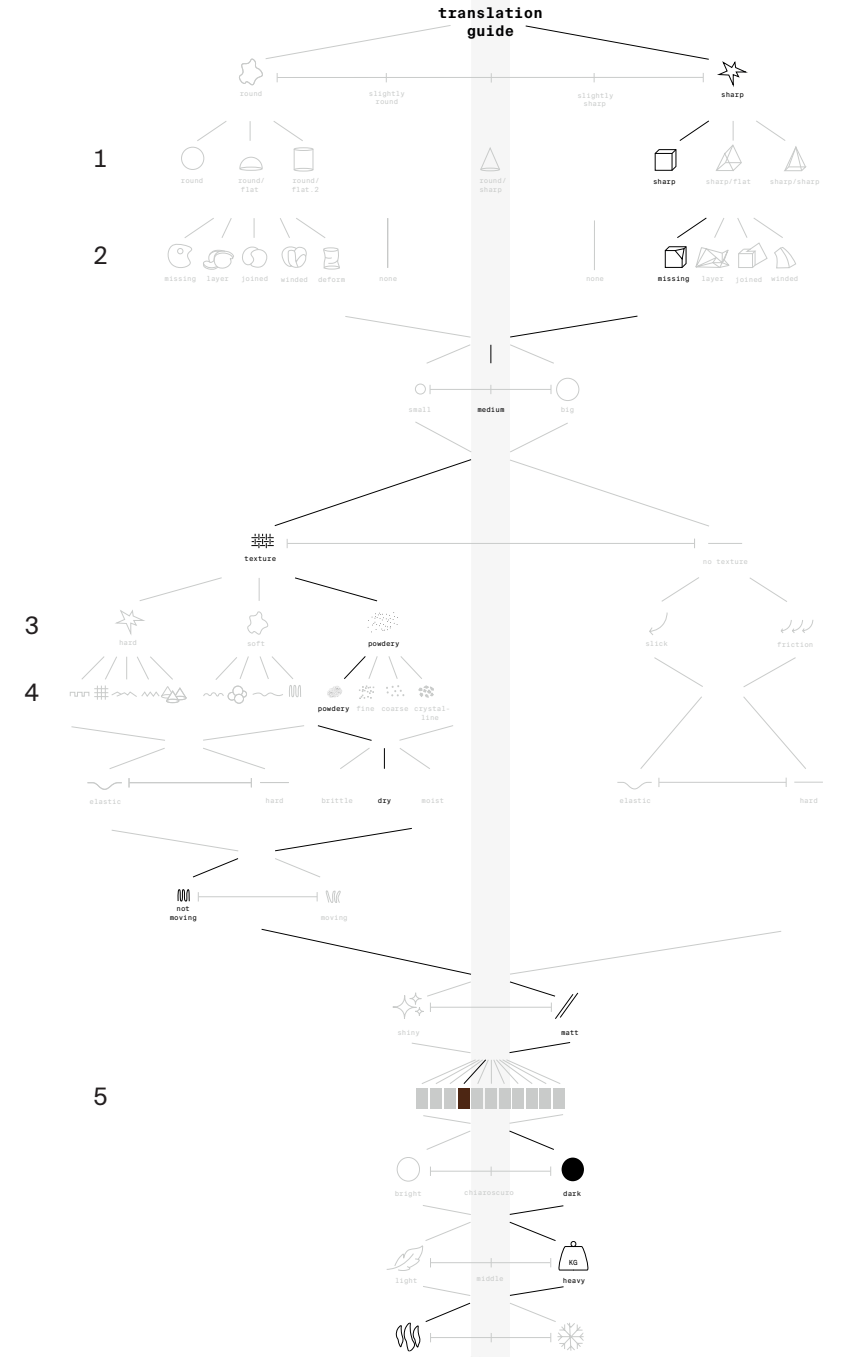
1

2

3

4

5


translation guide
round
slightly round
slightly sharp
sharp
1
round
round/ flat
round/ flat_2
round/ sharp
sharp
sharp/flat
sharp/sharp
2
missing
layer
joined
winded
deform
none
none
missing
layer
joined
winded
small
medium
big
texture
no texture
3
hard
soft
powdery
slick
friction
4
powdery
fine
coarse
crystal- line
elastic
hard
brittle
dry
moist
elastic
hard
not moving
moving
shiny
matt
5
bright
chiaroscuro
dark
light
middle
KG
heavy
warm
luke warm
cold

DIGITAL VERSION The digital version works as the illustration demonstrates. The user will be guided through several multiple-choice questions and has the opportunity to choose between different options. Depending on the question, they have more or less choices. This version has the advantage to offer an option in the choices and to demonstrate a suggested end shape at the end. The evolving object is not shown throughout the process, as it would affect the decision making of the participants.

After receiving the shape, the participant is free to change it to their imaginations, as it only provides a base on how the scent can be translated.

non.scents

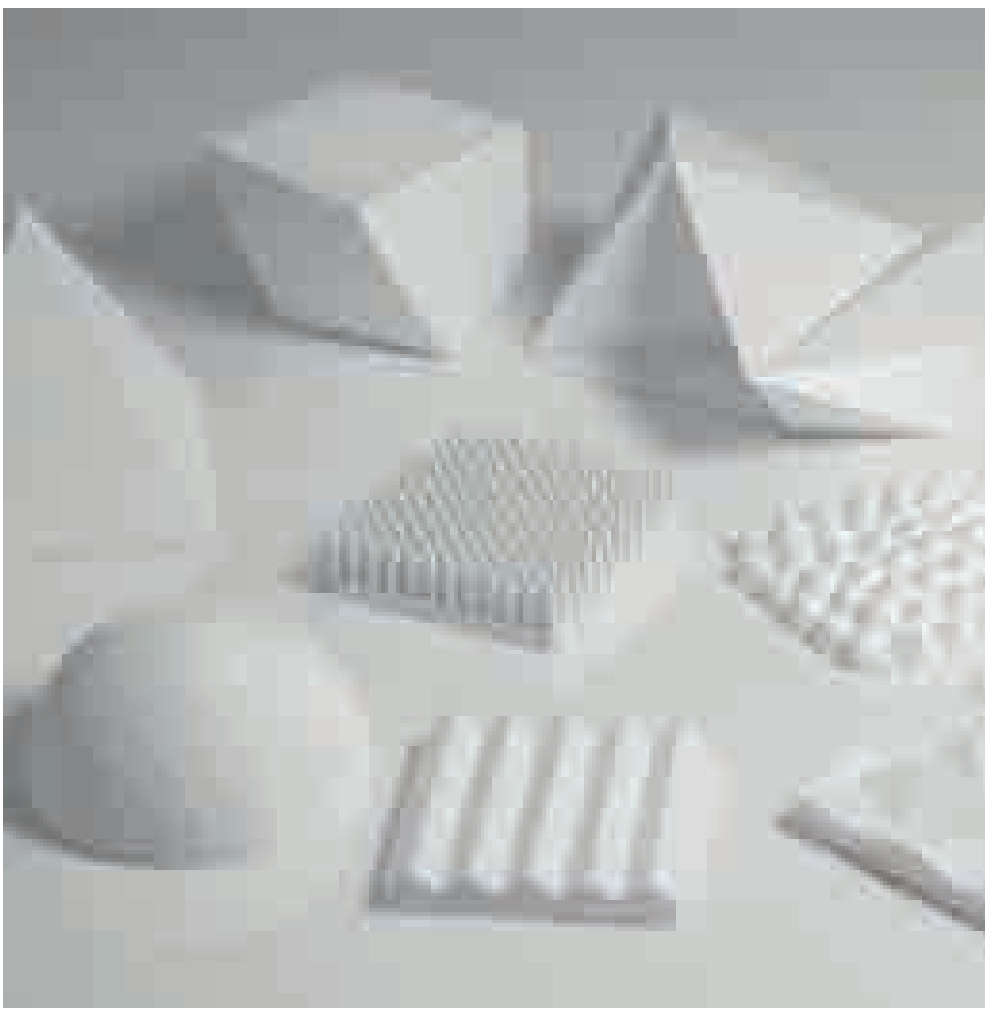
start

ANALOG VERSION As a more simplified version, the tool-kit could help to demonstrate on how the method works and to make it more accessible for the sense of touch. In this case, the tool-kit comes with all the textures, shapes, colors, materials that are presented in the digital version and the scents that will be explored. All of the tools are made out of the same smooth material, that can be either out of plastic, or metal.

Following the same principles as in the digital version, participants choose shape, texture, etc. one after the other.

A disadvantage of this simplified tool is that there can't be a final object at the end, as the materials are fixed and can't be merged into one. Therefore, it is only possible to gather all the materials the scent characterized and start their own visualization of this at the end. This might be a more creative option for designers, as the digital one is more fixed and already determines a shape.

What is important is that both of these options should only create an idea on how the scent could be characterized. At the end the result is not final, it is to be modified by their own associations, feelings and experiences.



SCENT WHEELS To explore this method from another angle, twelve more scents where chosen, depending on which "scent family" they originate. The used "scent families" were defined by Michael Edwards, who developed a reference book for the world of fragrances. Within this book he developed various fragrance wheels that cluster the scents in different families and show how they relate/differ to other families. Each family has their own characteristics that differ from each other.

Many before him, attempted to cluster smells into families/ groups and many flavor wheels were developed. Some would maybe match it to colors, others to the feeling or the taste. Septimus Piesse (1857) arranged smells on a musical scale to show how harmonic they are to each other (Lupton &Lipps, 2018:60). Henning developed the odor prism where he argues that each scent can be applied to one of the six categories: Flowery/fruity/putrid/ spicy/burnt/resinous (Lupton &Lipps, 2018:60).

Kitchen theory signed 4 tastes: sweet, salty, bitter, sour to specific colors. Throughout different studies they assigned:
the color red to sweet taste such as cranberry and rose.
the color white to salty taste such as yoghurt raita with mint and onions.
the color black to bitter taste such as Guinness and dark chocolate.
the color green to sour taste such as lime, cinnamon and coriander (Kitchen Theory, 2015).

Referring to the workshops in this thesis, we can already see that patterns/

cluster can be applied. For example sweet tastes are often interpreted to round shapes and bitter taste to angular shapes. The same with light colors that are associated with subtle scents and strong colors with intensive ones.

For this thesis 5 different families were selected from the scent wheel of Michael Edwards, for each group 3-4 odors were assigned. Throughout this chapter a new "scent wheel" will be developed to find out if it's possible to cluster scents by their various related sense properties. It also maps how participants name groups and to what they refer it – taste, color etc.

WORKSHOP 8/SCENT WHEELS Looking into how professionals develop different formats to summarize scents, this thesis aims to look into how individuals cluster scents and if there are similarities in how we perceive them. Christine Kelly for example developed the Anosmia smell wheel "that illustrates how her sense of smell has been distorted" (Lupton &Lipps, 2018: 11).

The way we classify odors is not so much different from how we perceive them. It differs from person to person and cannot be classified in one "wheel". This workshop aims to find different clusters and asks the question if it is possible to find similarities in how people assign scents to different groups.
In comparison to most of the other wheels, the participants do not know the name of the scent and therefore they need to cluster them by looking into their smell-characteristics and associations they have with them.

Experiment

Method Six people (4 female, 2 male) in the age range from 20 to 25 took part in this study. All of them reported having a normal sense of smell. The workshop was held with one person at a time.

Materials 26 high-dose scents were used during this workshop. This also includes the chocolate scents that were used during the workshops before. The participant is handed 8 cards and different textures that are going to be used during 2 phases of the workshop.

Procedure The participant is seated and an A3 paper that shows the outline of a round circle is displayed in front. Around the paper, all of the 25 scents are arranged and 8 cards, as well as a pencil is aligned.
Phase 1 starts within the time frame of 10-15 minutes. The task is to cluster the scents and arrange them into groups. These groups should be displaced within the circle and the 8 cards are used to write down the name and the characteristics of this "scent family".
The second phase of the workshop is used to find textures that match the characteristics of the "scent families". These materials are borrowed from the analog version of the translation guide, that was developed in chapter 4.

Result The result of each workshop was illustrated and compared to each participant. New scent groups were defined and scent combinations discovered. The textures were added to each scent family that was defined by the results of the workshop.

Discussion

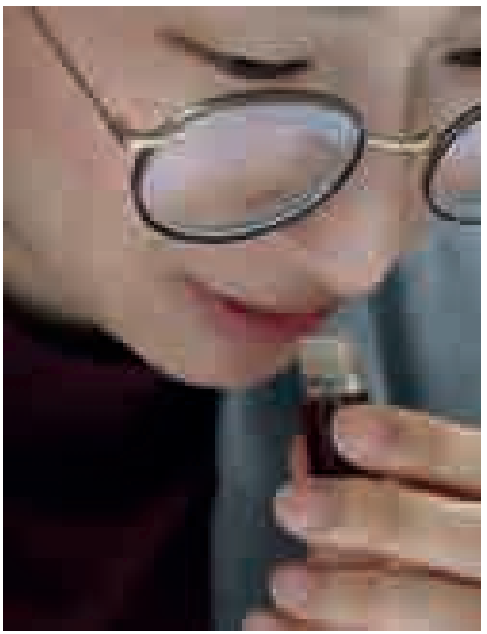
In summary, each participant had a different understanding on how to cluster scents and naming the groups. Some focused on the taste like sweet and bitter, others stuck to associations they had, such as forest or shower. Most of them had a group for the scents they didn't like. The name of the groups were often the scents characteristics showing that participants do focus on the characteristics. Only few defined the categories by the name of their physical scent producing object (banana and apple).

Groups like sweet, floral, fruity and so on were mostly used to describe the scents. Summarized, the groups created by each participant could be merged into eight different groups. Each group has at least one scent that pairs to another specific group:
citrus, fruity, sweet, sticky / spices, forest / flower, cleaning.

What is noticeable is some scents mostly appear with another scent in combination. The following combinations are repeated the most: 5x orange / grapefruit, 4x pine / nutmeg, 4x pine / pepper, 4x straw / tabaco, 4x banana / plum, 4x banana / apple, 4x pine / pepper, 4x banana / apple, 4x caramel / honey, 3x caramel / honey / vanilla, 3x orange/grapefruit/citron, 3x pine / pepper / nutmeg.

From this new data, a new scent wheel could be developed that focuses on the characteristics the scents have. It differs from the other scent wheels as it is not as complex in the amount of scents and in the clusterization of group names.

However, there is insufficient testing to validate if this scent wheel works. If we look into the applied textures, a cluster within the groups could be seen. The forest/spice family was mostly assigned to spiky textures and cleaning/flower family to round and wavy textures. Therefore, scent families substitute similar characteristics and according to similar textures. It would need to be tested if form and color could be applied in the same way.



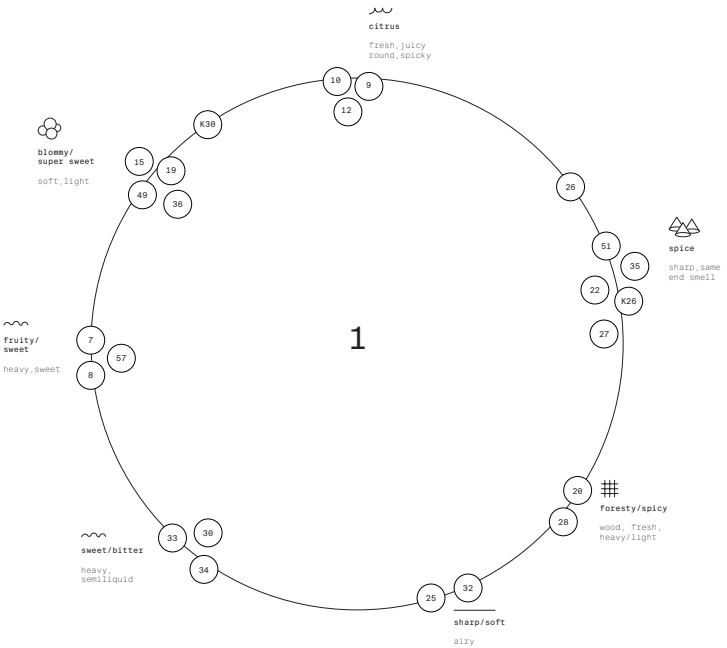
TRANSLATE

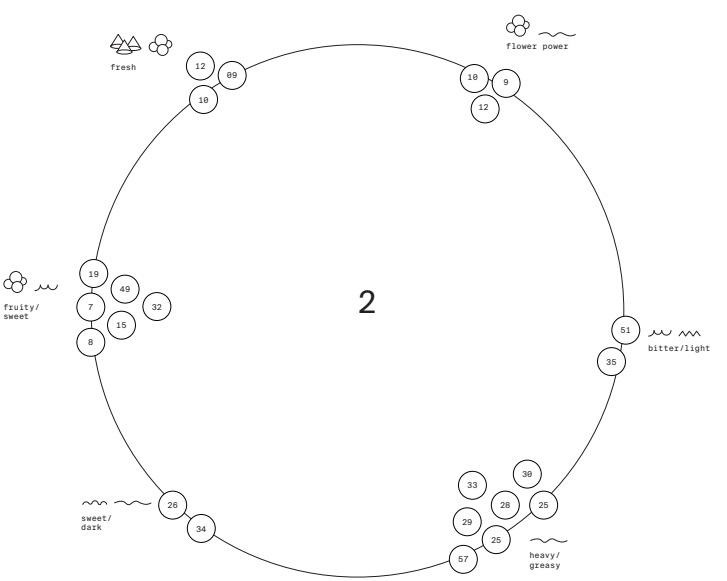
Scents

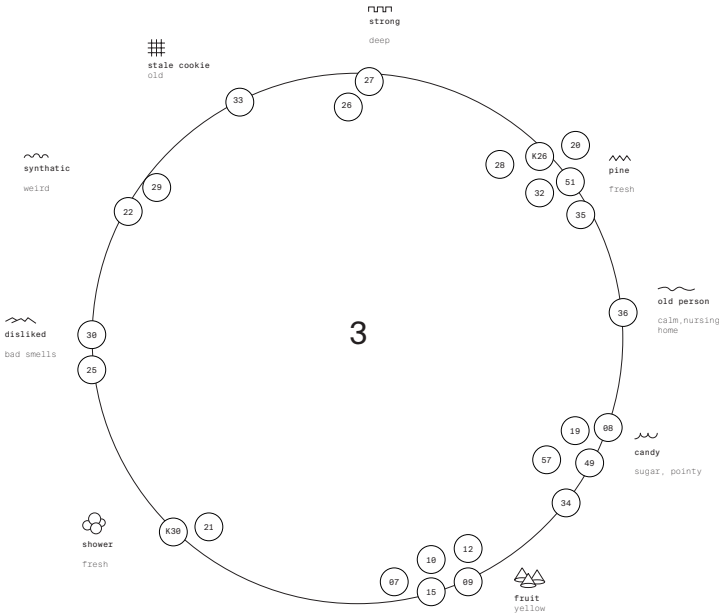
07	banane
08	apple
09	orange
10	grapefruit
12	citrone
15	plume
19	elderflower
20	pepper
21	violet
22	almond
25	cacao
K26	pine
26	coffee
27	cloves
28	cedar wood
29	butter
K30	straw
30	caramel
32	honey
33	hazelnut
34	vanilla
35	cinamon
36	tabacco
49	rose
51	nutmeg
57	blackberry

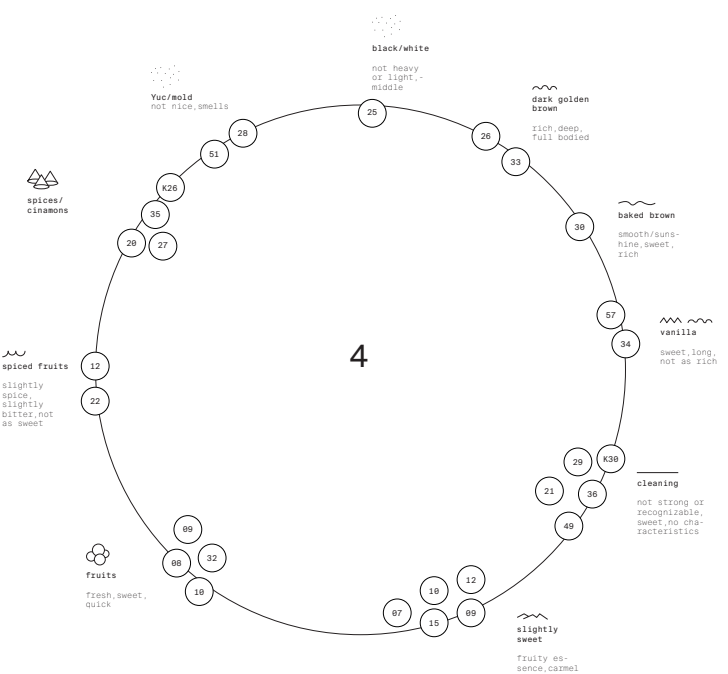
Cards

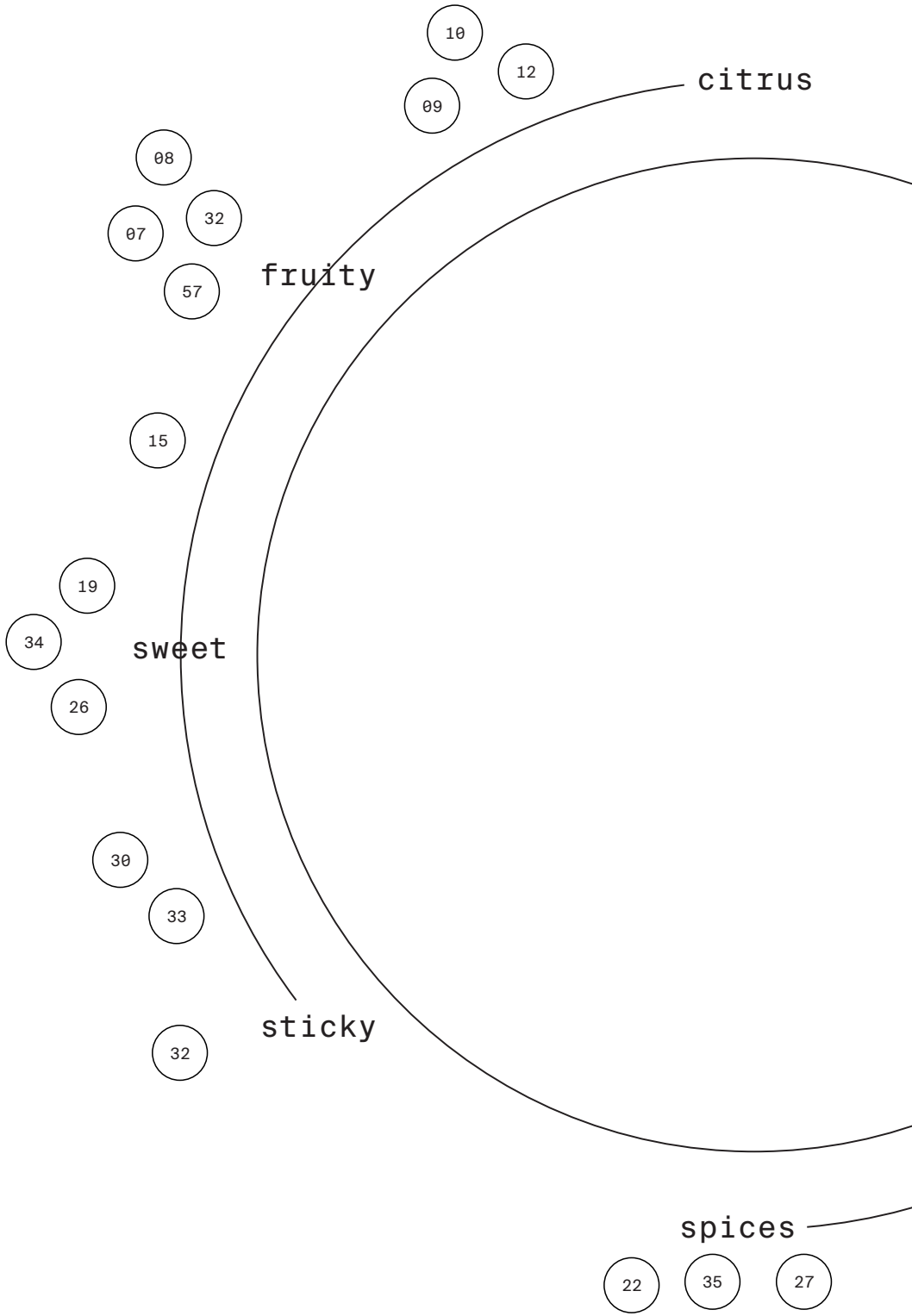
/Group 1	/Group 2	/Group 2
name	name	name
characteristics	characteristics	characteristics

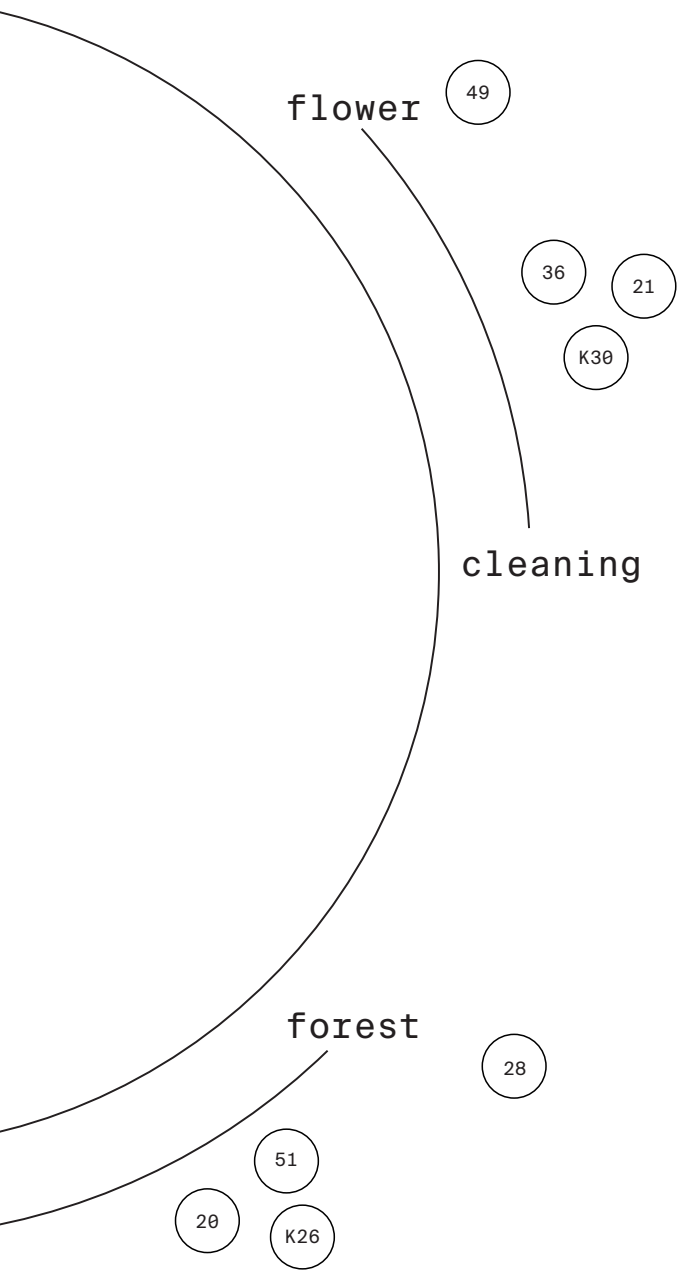

citrus
fresh,juicy
round,spicky
10
9
12
K30
blommy/
super sweet
soft,light
15
19
49
36
26
51
35
22
K26
27
spice
sharp,same
end smell
1
fruity/
sweet
heavy,sweet
7
57
8
20
28
foresty/spicy
wood, fresh,
heavy/light
33
30
34
sweet/bitter
heavy,
semiliquid
25
32
sharp/soft
airy


fresh
12
09
10
flower power
10
9
12
19
49
7
32
15
8
fruity/
sweet
2
51
35
bitter/light
33
30
28
25
29
25
57
heavy/
greasy
26
34
sweet/
dark


strong
deep
stale cookie
old
synthatic
weird
disliked
bad smells
shower
fresh
fruit
yellow
old person
calm,nursing home
pine
fresh
candy
sugar, pointy
3
27
26
33
29
22
30
25
K30
21
07
15
10
12
09
34
57
49
19
08
36
K26
28
20
51
32
35


black/white
not heavy or light,- middle
Yuc/mold
not nice,smells
spices/ cinamons
spiced fruits
slightly spice, slightly bitter,not as sweet
fruits
fresh,sweet, quick
slightly sweet
fruity es- sence,carmel character
dark golden brown
rich,deep, full bodied
baked brown
smooth/suns- hine,sweet, rich
vanilla
sweet,long, not as rich
cleaning
not strong or recognizable, sweet,no cha- racteristics
4
25
26
33
38
57
34
29
K30
21
36
49
09
08
32
10
07
15
10
12
09
12
22
29
27
35
K26
51
28


10
12
09
citrus
08
32
07
fruity
57
15
19
34
sweet
26
30
33
sticky
32
spices
22
35
27


flower
49
36
21
K30
cleaning
forest
28
51
20
K26

TRANSFORM

The following chapter contains the practical elaboration of this thesis. The goal was to apply the founded method to an actual application and therefore augment the senses, experience and feel design in a new way.

The focus of this work is still in the field of scents, but should also map out the importance of the integrating more senses in design. The book "The Senses: Design beyond vision" already deals with the immersive experience in design: "We need to explore, experiment, and invent new formats and combinations of sensory experience, new ways of telling stories" (Lupton &Lipps, 2018: 20). The human mind already has the possibility to connect sensations, so why are we not using it when we design things such as chocolate pralines?

"Sensory design has the power to forge new language" (Lupton&Lipps, 2018: 20)

FEELS LIKE CHOCLATE The tool gave the necessary elements to accurately determine form, texture and color to an applied concept. These traits were then translated into sketches and ideas for how this information could be implemented. Lastly, the sketches were built and explored in an 3D program or clay.

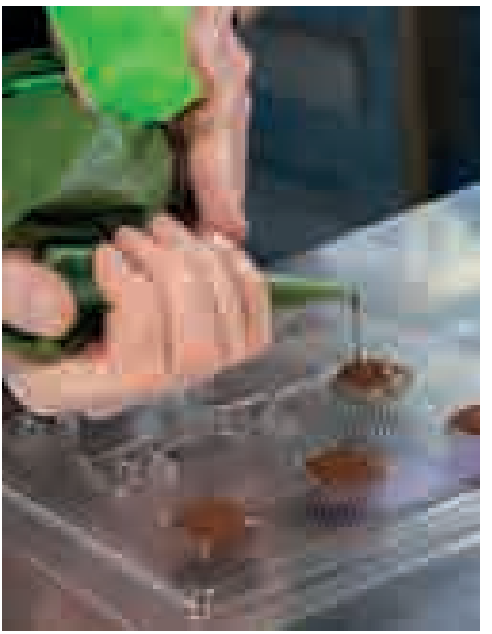
Starting with seven of the chocolate scents, the process explained above was applied to each. This exploration is supported by a local chocolaterie "Chokladfabriken" in Stockholm. It was important to see if this could be

applied in a real context, hence the desire to work with the chocolaterie. The pralines needed to be simplified in their form as they only had limited possibilities in making the molds. In contrast to the first set of pralines, the newly molded ones differed in size and complexity.

Every praline will present one scent and their characteristics at the end. The eye will catch the color, shape and texture. Followed by the hands that will experience the surface, the weight and temperature. Ending by feeling texture and temperature with our lips, followed by the experience of taste.

As most pralines are made with a chocolate shell, the characteristics of density and texture take place inside of the praline. Therefore, the importance of color, shape and texture raised, as the inner texture is only experienced in/at the mouth.

REFLECTION From working with a professional many unforseen alterations to the pralines occured. Being treated as if they were to be mass produced, changes to the color, tetxture and form varied from praline to praline.



CACAO

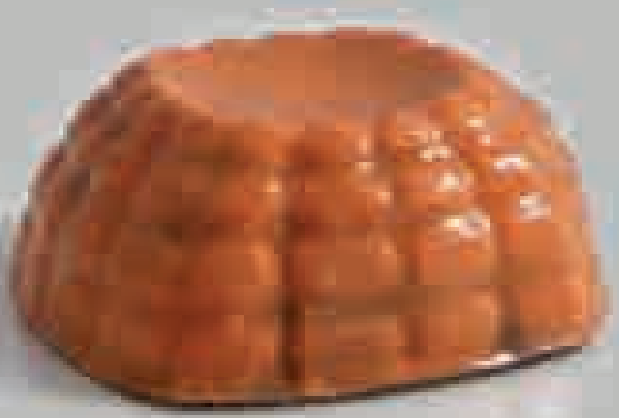
Color: dark, brown, earthy
Form: angular, missing something
Texture: rough
Weight: non-weight
Temperatur: bit warm
Texture inside: cacao nibs

VANILLA

Color: bright, yellow
Form: round, flat, wavelike
Texture: rough
Weight: light/heavy
Temperatur: warm
Texture inside: dense (pudding)

ORANGE

Color: bright, yellow, orange
Form: sharp but also round, pointy
Texture: soft, rough
Weight: light
Temperatur: slightly cold
Texture inside: dense



HONEY

Color: warme colors, red, orange
Form: round, organic, smooth
Texture: soft, dense
Weight: light
Temperatur: warm
Texture inside: liquid but a bit dense

HAZELNUT

Color: bright, brown, earthy
Form: round, layers
Texture: slightly rough
Weight: heavy/non-weight
Temperatur: warm
Texture inside: rough, mouse

CONCLUSION The essential insight from all the investigations on the subject showed general associations with fragrances and a transfer of the smells to shapes, colors, etc. is possible.

From all the studies listed, it is shown that our senses form links in the course of life. These enable our brain to associate sensory experiences with different memories of other sensory perceptions and to associate these mutually. The workshops I have conducted have made it clear there are recurrent patterns to show certain associations are perceived similarly. In particular, people with a similar social or cultural background, associate odors in a similar way.

The resulting „translation tool" is based on this knowledge/findings and gives the opportunity to consider individual nuances of one's personal perceptions. The aim is to transfer the resulting findings (associations) to the design sector. So, if we want to associate a fragrance with an object, or if we want to design an object with which to associate a particular fragrance, this is made possible. Some properties of fragrances are thus visible. Especially in the field of food design, this opens up a variety of possibilities. Because here the senses and the experience of taste are always connected with a haptic and sensitive experience. Thus, for example, the taste of a praline can be manipulated - both in the sense of enhancing the taste experience, as well as to make someone experienceable, who has no smell or sense of taste. The resulting chocolates prove this thesis and give a first insight into unlimited design possibilities based upon this principle.

Looking into other applications, this tool can be used in many kinds of areas. Depending on how many senses should be included, it can either be a more textual exploration, that is in a more two-dimensional way; or it could be a multi-sensorial application, that takes place in a three-dimensional form. But overall it is up to the user to explore how many sensorial inputs he/she would like to include. Besides the application on food itself, following are two other examples on how this tool can be used in a different context.
the taste experience, as well as to make someone experienceable, who has no smell or sense of taste. The resulting chocolates prove this thesis and give a first insight into unlimited design possibilities based upon this principle.

2 DIMENSIONAL-WINE LABELING As demonstrated in this thesis, the two-dimensional space provides the opportunity to express scents throughout textures. Every chapter is assigned to one scent/ texture and demonstrates an idea on how textures could be implemented in designing surfaces. Wine labels will serve as a model to show how the translation tool can be applied in the two-dimensional space. The scents of the wine will be translated into textures/color/etc. and then applied to the label or the bottle.
As Roland Birr said in the interview: To open up the imagery of people I use colors instead of words to explain the flavors of the wine (Roland, 2018). In this case textures could be used to explain the wines characteristics: a fruitier flavor - waves and bubbles, a spicier scent-sharper textures.

This would not only open up the opportunity to explore wines, it also provides a tool for people who can't smell. Allowing them an opportunity to pick the right wine and to possibly enhance their wine experience. By touching the texture while drinking, the wines quality could be understood and be experienced in a new way.

Marinetti already advocated that people should run their fingers over various textures while eating food. He argues that this would augment the mouthfeel and flavor (intensity) of the dish. Inspired by Marinetti, Jozef Youssef, a chef who concentrates on multi-sensory dining, created the Marinetti cubes that have a different texture on each side of the cube and should be touched while eating (Youssef, 2015). Different trials show that guests did perceive a difference in the taste of the dish according to which texture they touched.

"The textures affected around twenty percent of our guests, five percent of whom had pretty strong reactions (which include the guest who got 'cotton mouth' from touching the fuzzy side of Velcro; a table of two who couldn't stop commenting on how much saltier the dishes became once they touched the sandpaper and my favorite, the guest who had to touch the velvet side of the cube to get through one particular dish because she felt the rough textures made everything too crunchy and noisy!)" (Youssef, 2015). Therefore, textures that are provided and experienced throughout the consumption of beverages and/or food, could widen the exploration. However, this is an assumption and needs to be explored further.

OUTLOOKS

3 DIMENSIONAL-CUTLERY If we look into the three-dimensional space, form as well as the haptic experience of weight can be included into the process. Hence, an object could explain a smell or a flavor as the chocolate pralines in the last chapter. If this theory would be implemented in products for example, a smell as well as a flavor could be recalled or enhance the experience at the dinner table.
The Marinetti cube that was explained before, does function as an add-on to the experience of food, but it only focuses on the texture. By adding form, texture, color and other haptics, the cube could evolve to an object that explains/presents the scent even more.

Clustered by the "scent families" or tastes, these shapes could be either expressed in an object itself or merged with an object that already exist on the dinner table. Cutlery or plates could symbolize the floral or the bitter scent, as well as the main scent of this dish – raspberry.

The exploration I focused on was cutlery, held in our hand, we can feel the shape/texture/weight. The handle was chosen to modify as it is the point of interaction with the hand.

In the sector of multisensory dining experience, cutlery is already evolving. Molecule R (Aroma fork) as well as Design Studios like Jinhyun Jeon (Sensory dessert spoons) or Verena Schreppel (Cutlery selection) are already adding scents or textures to cutlery to enhance the taste and flavor of food. All of them add texture to either the grip or the head of

the cutlery to stimulate the fingers or the mouth. The aroma fork from molecule R adds and stimulates the nose within the eating experience and enhances the food by different flavors.

Shapes could be easily applied to cutlery to enhance flavors. Sharing a meal with somebody who is anosmic for example, could widen up conversation about the food and enhances the eating experience again. Many anosmics do have problems during a meal, as they can't take part in the conversation about the meal that they are sharing. Paul Barraco, chef at 20 Brix in Milford, developed a "5 Tastes" dinner that was designed to appeal to anosmics. He defines the flavors and suggests the taste of the food.

So why not embody the scent/flavor throughout the texture/shape/etc. of cutlery? Then, the user can enhance their experience with this cutlery and obtain an idea on which flavor the food has.
I focused my demonstration on one of the "scent families" that was developed during workshop 100 (scent wheel, chapter 4).

DIGEST All of the design proposals demonstrate a way on how a scent or their sensorial information could be implemented in the design process. The proposals shows different ideas that need to be developed further and tested properly in order to create them as working products.
The application possibilities for this tool are endless and can be applied to a wide variety of concepts. Depending on how many senses are included, the tool is capable of building the base/foundation for projects and establishes a new way on how we can start our design processes.

REFERENCES

Alderman, John and Park, Christine W. (2018): Designing across senses, a multimodal approach to product design. Sebastopol: O'Reilly Media.

Balboa, D., Velasco, C., Marmolejo-Ramos, F. & Spence, C. (2014): Crossmodal effect of musical and odor pleasantness on olfactory quality perception. (n.p.): Psychonomic Society.

Birr, Roland (2018). Interview with Roland Birr, 12 november.

Brunsman, Barett J. (2018): Medical device maker's malady inspires restaurant to offer tasting dinner for those who can't smell:https://www.bizjournals.com/cincinnati/news/2018/08/17/medical-device-maker-s-malady-inspires-restaurant.html (Accessed: 28.03.2018).

Bombas and Parr (2016): The Sensory accumulator: http://bompasandparr.com/projects/view/the-sensory-accumulator/(Accessed: 28.03.2018).

Bombas and Parr (2014): The Flavour conductor: http://bompasandparr.com/projects/view/the-flavour-conductor/(Accessed: 28.03.2018).

Day, Sean (2018). Interview with Sean Day, 02 december.

Deroy, O., Crisinel, A. & Spence, C. (2013): Crossmodal correspondences between odors and contingent features: odors, musical notes and geometrical shapes. (n.p.): Psychonomic Society.

Dematte, M., Sanabria, D., Sugerman, R. & Spence, C. (2006): Cross-Modal Interactions Between Olfaction and Touch. Oxford: Oxford Unifersity Press.

Dematte, M., Sanabria, D. & Spence, C. (2006): Cross-Modal Associations Between Odors and Colors. Oxford: Oxford Unifersity Press.

Chester, Nick (2017): I spoke to an 'Aroma Jockey', Who DJs Smells for Deaf Audiences: https://www.vice.com/en_ca/article/9amnq7/i-spoke-to-an- (Accessed: 28.03.2018)

Classen, C., Howes, D. Synott, A. (1994): Aroma, The cultural history of smell. London: Routledge.

Cytowic, Richard E. & Eagleman, David M. (2009): Wednesday is indigo blue, discovering the brain of synesthesia. London: A Bradford Book.

Eagleman (2015): Can we create new senses for humans?, TED talk Available at: https://www.ted.com/talks/david_eagleman_can_we_create_new_senses_for_humans (Acecessed: 28.03.2018).

Gilbert, Avery (2014): what the nose knows. USA: A Synesthetics, Inc. Book.

Gilbert, Avery & Martin, Robyn (2008): Cross-modal correspondence between vision and olfaction: The color of smell. Illinois: University of Illinois Press.

REFERENCES

Hanson-Vaux, G., Crisinel, A. & Spence, C. (2012): Smelling Shapes: Crossmodal correspondences Between Odors and. Oxford: Oxford Unifersity Press.

Henshaw, V., McLean, K., Medway, D., Perkins, C. & Warnaby, G. (2017): Designing with Smell, Practices, Techniques and Challenges. New York: Routledge.

Herz, Rachel (2007): The Scent of desire. New York: HarperCollins Publishers.

Herz, Rachel and Engen, Trygg (1996): Odor memory: Review and analysis. (n.p.): Psychonomic Society.

Herz, Rachel (2005): Odor-associative Learning and Emotion: Effects aón Perception and Behavior. Oxford: Oxford Unifersity Press.

Keller, Andreas (2009): Odor Memories: The First Sniff Counts. New York: Rockefeller Unifersity.

Kitchen Theory (2015): Developing a dish: The 4 Tastes: https://www.kitchen-theory.com/developing-a-dish-the-4-tastes/(Accessed: 28.03.2018).

Kim Ngo, M., Misra, R. & Spence, C. (2011): Assigning the shape and speech sounds that people associate with chocolate samples varying in cacao content. (n.p.): Elsevier.

Krebs, Anja (2018). Interview with Anja Krebs, 14 november.

Lupton, Ellen & Lipps, Andrea (2018): The Senses: Design Beyond Vision. New York: Princeton Architectural Press.

Marinetti, Filippo Tommaso (2014): The Futurist Cookbook. London: Penguin Classics.

Molly Birnbaum (2011): Season to taste, How I lost my sense of smell and found my way. London: Portobello Book.

Morrot, G., Brochet, F. & Dubourdieu, D. (2001): The Color of Odors. (n.p.): Academic Press.

Schenk, Matthias (2018). Interview with Matthias Schenk, owner of the museum of all senses (Schlossfreudenberg), 18 november.

Seo, H., Arshamian, A., Schemmer, K., Scheer, I., Sander, S., Ritter, G. & Hummer, T. (2010): Cross-Modal Integration between odors and abstract symbols. (n.p.): Elsevier.

Silpakit, Panida & Nanta, Piyarat (2015): Crossmodal correspondences between Scent and Color Perception of Coffee. Bangkok: Bangkok University.

REFERENCES

Synnott, Anthony (1991). A sociology of Smell. Canada: Canadian Reviw of Sociology and Anthropology. (n.p.): Canadian Review of Sociology and Anthropology.

Philpott, Carl and Boak, Duncan (2014): The Impact of Olfactory Disorders in the United Kingdom. Oxford: The Oxford University Press

Popular Science Monthly (1931): Can a Robot Have a Nose?. Popular Science Monthly, October, p. 70.

Vanichayanguranon, Chompunuch (2017): Smell and the Subconsciousness in Installation Art. Berlin: BTK Berliner Technische Kunsthochschule.

Youssef, Jozef (2015): Sandpaper and silk: textures and flavor perception. London: Portobello Book.

DECLARATION

I hereby declare that the present bachelor's thesis was composed by myself and that the work contained herein is my own. I also confirm that I have only used the specified resources. All formulations and concepts taken verbatim or in substance from printed or unprinted material or from the Internet have been cited according to the rules of good scientific practice and indicated by footnotes or other exact references to the original source.

Stockholm, 28.03.2018 Jana Maiworm