TU Delft X FUGDZZI

GRADUATION PROJECT: DESIGN FOR INTERACTION

d'accord

Utilizing Crossmodal Correspondences to Select Fragrances

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28 02 2025

abstract

The retail perfume industry often lacks the multi-sensory engagement needed to frame the perception of a fragrance and thus facilitate the fragrance selection process. Scent is very ambiguous and needs cues from other senses to better place a scent (Pierzchajlo et al., 2024). This project, conducted in collaboration with the Dutch perfume brand Fugazzi, explores how cross-modal sensory correspondences, combining scent with visual, auditory, and tactile cues—can create immersive and intuitive experiences. Through a series of exploration sprints, associations between fragrances and sensory modalities such as color, texture, shape, and sound were investigated. These findings were later applied to develop a concept in two deepening sprints. These sprints build on each other, and the concept is iterated through these sprints.

Findings revealed that multi-sensory integration can influence customer perception of fragrances and align their expectations with the olfactory experience. These insights were applied to the chosen design direction: d'Accord, a display enabling customers to select preferred fragrance accords and receive suggestions that correlate with the chosen accord. The user receives sensorial stimuli that frame the perception of a scent. The found associations between scent and color, shape and context are used in this concept.

Cross-modal correspondences between smell and vision can be used to frame the perception of a fragrance. Visual stimuli could make the perception of a fragrance less ambiguous. D'Accord had the highest effect on the pleasure scale, making the perception of fragrances with a less defined emotion profile less ambiguous.

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introduction

The project focuses on experience design in the perfume retail industry. Its key stakeholders include the Fugazzi brand and its customers. The perfume industry continues to underutilize experience design that luxury fashion brands have successfully adopted when introducing new or existing products to the market. Fugazzi is a fast-growing perfume company in the Netherlands. They have the opportunity to pioneer the perfume industry, by offering these experiential elements into their retail strategy.

By integrating immersive, memorable and multi-sensory experiences into their retail stores, Fugazzi could set themselves apart in the perfume industry. This initiative would not only enhance the shopping experience but also create more resonance and, thus, a deeper emotional connection between the brand and its customers.

Smell is a uniquely powerful sense, deeply connected to emotions and memories. It is processed in the Olfactory cortex of the brain's limbic system, located near regions responsible for emotions and feelings. Research by Willander and Larsson (2007) shows that scent can trigger emotional reactions, with smell-evoked memories being particularly emotional. However, as Stephen Pierzchajlo et al. (2024) suggest, our perception of smell strongly relies on predictions informed by other senses. While often seen as basic, smell is actually a complex and active sense, yet humans struggle to recognize scents without contextual cues.

This absence of sensory cues presents a design opportunity. In stores, perfumes are usually accompanied by their name and color, giving customers little sensory information to understand the scent. By leveraging multi-sensory cues, I aim to influence consumers' expectations of a smell and create a richer, more engaging experience. Does the perception of the scent change when the expectations of the scent are defined by an experience that utilizes other or multiple senses?

Research into cross-modal correspondences, such as the association between color and fragrance, showed that aligning sensory cues could enhance perceived uniformity and product attractiveness (Schifferstein & Tanudjaja, 2004). The product feels more cohesive and appealing when a color complements a fragrance. While this doesn't always directly boost purchase intentions (as other factors like fragrance appeal and packaging also play a role), it improves the sensory experience. This principle of cross-modal correspondences, which links sight, smell, and potentially other senses, provides a strong foundation for improving the customer experience in Fugazzi's retail environments. By designing with these sensory associations in mind, we can create a more immersive and emotionally resonant experience for their customers. The goal is to design a multi-sensory context for perfume bottles to shape and enhance the olfactory experience of a scent for Fugazzi's customers in a retail environment.

Since fragrances are very ambiguous, people's perceptions of smell can vary profoundly. This raises the question:

Can the perception of a fragrance be disambiguated by utilizing cross-modal correspondences to provide sensorial cues and frame the perception of the scent?

literature review

The literature review examines research on cross-modal correspondences between smell and other senses, providing a foundation for the design solution, which explores how these principles can be applied to shape fragrance perception.

One well-documented cross-modal correspondence is the association between odor and color. Research from Spector and Maurer (2012) showed that adults make consistent and non-random associations between color and odors. While some of these associations could be explained by prior experiences (for example, the association between the smell of lemon and the color yellow), other associations could not be gained through learning (for example, the association between the scent of lavender and the color green). Thus, this suggested that cross-modal correspondences might have resulted from both learned experiences and natural preconceptions within the brain's sensory systems. Research from Schifferstein and Tanudjaja (2004) also concluded that odors were associated with colors systematically, but they state that these associations were driven mainly by the emotional responses that odors evoke. The pleasure dimension of emotion played a significant role in how odors and colors were associated. The more pleasant the odor, the closer the link to specific colors. Results indicated that the most significant factor was brightness, followed by saturation and hue. Floral fragrances were associated with lighter and more vibrant colors, while heavier scents were associated with darker shades.

Beyond color, research also explored the connection between smell and shape. Hanson-Vaux et al. (2012) examined how different odors, particularly those found in wine, were consistently associated with angular or rounded visual forms. The study examined how some odors can be consistently associated with angular or rounded visual shapes. Participants rated the odors on a 9-point Likert scale between two visual shapes: angular (kiki) and rounded (bouba). Lemon and pepper were consistently rated as more angular, while raspberry and vanilla were rated as more rounded. The other odors fell between these extremes, suggesting they might have been associated with more intermediate shapes. Angular shapes were associated with acrid, bitter, complex, earthy, or spicy odors. Rounded shapes were more closely linked to pleasant, floral, fruity, and sweet odors.

Further extending the study of cross-modal correspondences, Belkin et al. (1997) looked at the relationship between pitch and odor. They show that individuals were consistently able to match scents to musical tones. Building on this, Crisinel and Spence (2011) explored how specific odors found in wine, correspond to musical notes and instruments. Their findings showed that fruit-related odors were consistently linked to high-pitched sounds, while musky or woody scents were associated with lower-pitched tones. In addition, a scent's complexity and hedonic value influenced its musical correspondence—pleasant floral and fruity odors were paired with high-pitched instruments like the piano. In contrast, more intense or complex odors were linked to deeper, brass-like sounds.

The interplay between smell, sound, and touch was also explored in research by Speed et al. (2021), which examined how these associations developed across different age groups. Their study focused on olfactory-tactile correspondences, building on Ludwig and Simner's (2012) tactile scales—rough-smooth, hard-soft, and sharp-blunt. They found that certain scents were consistently associated with specific textures: onion was associated with rough textures, while caramel, lemon, menthol, and raspberry were linked to smooth ones. The study observed that these associations strengthened with age. This suggests that experience in life plays a crucial role in shaping cross-modal perceptions.

To test and implement the literature review findings, I planned to develop and utilize a new iterative design method to generate a design solution: Parallel Progressive Sprints (PPS).

design method

Parallel Progressive Sprints ensures that insights are continuously integrated throughout the process. This approach is also useful when designing with the idea of cross-modal correspondences because these associations frequently differ between people. PPS functions as a structured system that offers flexibility in handling complex challenges. In the first five weeks, I focused on exploring and gaining knowledge on cross-modal correspondences between smell and other senses in one-week sprints. Each sprint focused on smell and another sense. It did occur that the design input received from one sprint was validated or used in another sprint.

The core of the design method lies in running the key phases of design, research, ideation, prototyping, and testing, in short, focused sprints. Initially, each sprint spans one week. These sprints are called exploration sprints. Exploration sprints enable me to gain knowledge on various topics through literature and physical research. The acquired knowledge helps advance ongoing ideation, prototyping, and testing. As the project progresses, the sprints become longer. These sprints are called deepening sprints. They allow for the growing complexity and sophistication of the prototypes and experiments. This enables me to conduct more comprehensive tests, build better prototypes, and analyze the results in-depth as the concept evolves and becomes more sophisticated. The Deepening Sprints took three weeks or longer to complete, whereas the Exploration Sprints took one week. This method ensures that the approach remains flexible to the project's evolving requirements, eventually resulting in a strong, solid design solution.

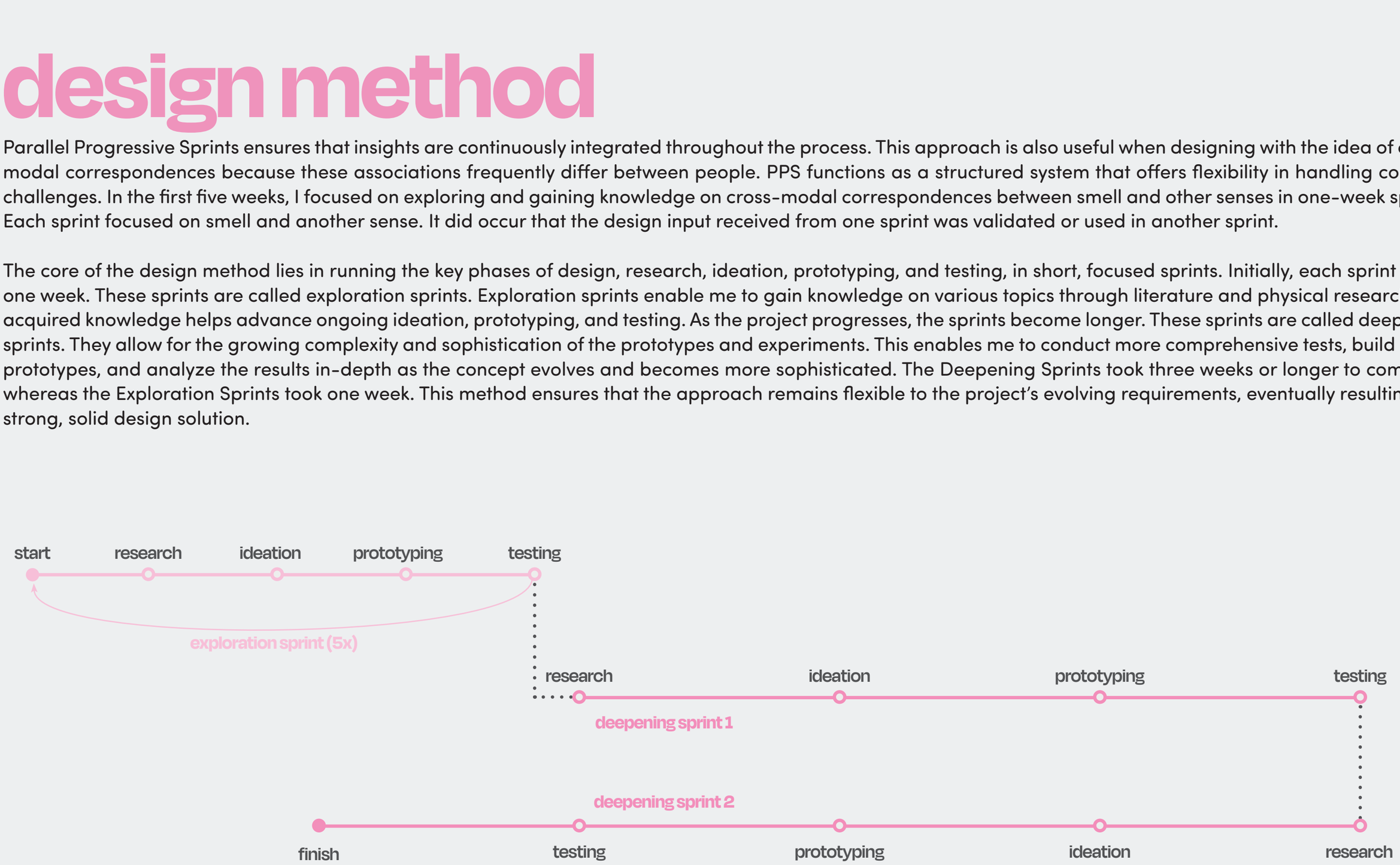


Figure 17.5: Updated Progressive Sprints

e1: odour & colour

The overall theme of this exploration sprint is Odour and Color. The literature review states that people make consistent and nonrandom associations between colors and odors. Floral fragrances are associated with lighter and more vibrant colors, while heavier scents are associated with darker shades. The goals of this week's exploration sprint are to gain textual descriptions of the fragrances and emotion profiles of the fragrances, to test whether the fragrances have associations with hue, brightness, and saturation, and to test whether the colors used by Fugazzi for the marketing of the fragrances have associations with the corresponding fragrances.

tools & equipment

- Fragrance test strips are used to enable the participants to smell the fragrances. A number is written on the test strips. The number correlates to a specific scent. The strips are inside a glass container with a cork lid. This ensures that the smell stays inside the container.

- Coffee beans are used to make sure the noses of the participants are neutralized after each scent.

- To improve the workflow of picking out colors, a p5 model was created. This p5 model lets the participants choose a hue first. Then they are able to see a grid of 4x4 where different versions of the hue appear. On the x-axis, the saturation rises in increments of 33, while on the y-axis the brightness rises in increments of 33. In this manner, I can test whether fragrances have associations with different hues, brightness and saturation.

- A color combination is made for each fragrance, by analyzing the marketing of Fugazzi of the fragrance.

- A phone recorder is used to record a textual description of the scent.

procedure

The test takes about 40 minutes. Eight participants are involved in the test. The participants are going to smell six fragrances of Fugazzi. For each fragrance, the participant is asked to give a textual description of what the fragrance reminds them of and what kind of feelings arise. Afterward, they are going to rate the fragrance on the 5 scales of pleasure, arousal and dominance (see Figure 1). Then they will pick color(s) on p5 that fits best with the fragrance. At last, they will rate the association with given color combinations (6). Coffee beans are used to neutralize the nose in between different fragrances.

pleasure			*arousal*			*dominance*		
happy	—	unhappy	active	—	relaxed	powerfull	—	powerless
satisfied	—	unsatisfied	wild	—	lazy	influential	—	influenced
cheerfull	—	melancholic	nervous	—	lethargic	impressive	—	humble
hopefull	—	despairing	awake	—	sleepy	independent	—	dependent
suprised	—	bored	stimulated	—	indifferent	brave	—	carefull

Figure 1: Five scales of pleasure, arousal and dominance

results
emotion scales

For each fragrance the means of the emotion scales are calculated. When a mean scores lower than 3 or higher than 5, the emotion correlates with the fragrance.

Angeldust does not elicit a lot of distinct feelings, except for Humbleness (**2.75**). Angeldust is described by Fugazzi as an introverted scent. This can be the reason that it does not score high on the different emotion scales, while Goudh evokes distinct feelings. It can be concluded that Goudh is a dominant and powerfull (**5.375**) scent. It evokes feelings of arousal, but it does not evoke feelings of pleasure, except that it suprises people. Thirsty elicits the most distinct feelings of all the fragrances. It scores really high on the pleasure scale, while it also evokes feelings of arousal and dominance. Compared to Goudh, Thirsty is less powerfull (**5.375**) and influential (**3**), but it is more independent (**2.5**) and even brave (**2.25**). Workaholic does not elicit a lot of distinct feelings, except for Lazy (**2.875**) and Stimulated (**2.75**). During the test, participants had difficulty in describing and apprehending the scent. It is quite a complex scent, which could be the reason it does not score high on the emotion scales. Sugardaddy was often described as a sweet fragrance and this can be found in the data retrieved. It scores high on the pleasure scales. Orange crush is not a dominant scent, but it evokes feelings of pleasure, for example: Satisfied (**2.25**) and Hopefull (**2.625**). See Figure 2 for the emotion profiles for the each fragrance.

thirsty

pleasure	arousal	dominance
happy (2.25)	active (5.13)	powerfull (5.38)
satisfied (2)	stimulated (2)	influential (3)
cheerfull (2.25)		independent (2.5)
hopefull (2)		brave (2.25)
suprised (2.88)		

workaholic

pleasure	arousal	dominance
	lazy (2.88)	
	stimulated (2.75)	

sugardaddy

pleasure	arousal	dominance
happy (2.25)	stimulated (2.75)	
satisfied (2.13)		
cheerfull (1.75)		
hopefull (2.65)		

orange crush

pleasure	arousal	dominance
satisfied (2.25)	stimulated (3)	
cheerfull (2.75)		
hopefull (2.63)		

angeldust

pleasure	arousal	dominance
		humble (2.75)

goudh

pleasure	arousal	dominance
suprised (2.34)	active (3)	powerfull (5.64)
	awake (5.25)	influential (2.25)
	stimulated (2.5)	independent (2.75)

Figure 2. Emotion profiles of the fragrances

choosing colors

The analysis of the colors selected by participants in the p5 model reveals the specific hues, saturation levels, and brightness associated with each fragrance. This mapping helps to identify which color properties participants naturally associate with different scents. The outcomes are not that distinct, but three of the six fragrances, were associated with a color that comes near to the color Fugazzi uses for their marketing.

The first choice weighs the most and the weight of the second and thirst choice decreases. The scores are calculated while keeping the difference in weight in mind. When one color is chosen the hue, saturation and brightness have a score of 1. When two colors are chosen the hue, saturation and brightness have the following scores: 0.67 and 0.33. When three colors are chosen the scores are: 0.58, 0.29 and 0.14.

Angeldust was most associated with low saturation and high brightness. The most associated hue is red. Goudh was most associated with the hue blue. There were no real distinct associations between brightness and saturation. Thirsty was most associated with the hue blue and medium saturation, high brightness or high saturation and medium brightness. For Workaholic, people associate it with the color orange. The saturation and brightness are high. Sugardaddy was associated with high-brightness colors. It is mostly associated with the color pink, low saturation and high brightness. Orange crush is most associated with the color orange, high saturation and high brightness. In Figure 3 you can see a visualisation of the results of participants choosing colors. The colors are visualized in saturation and brightness level of the most chosen hue.

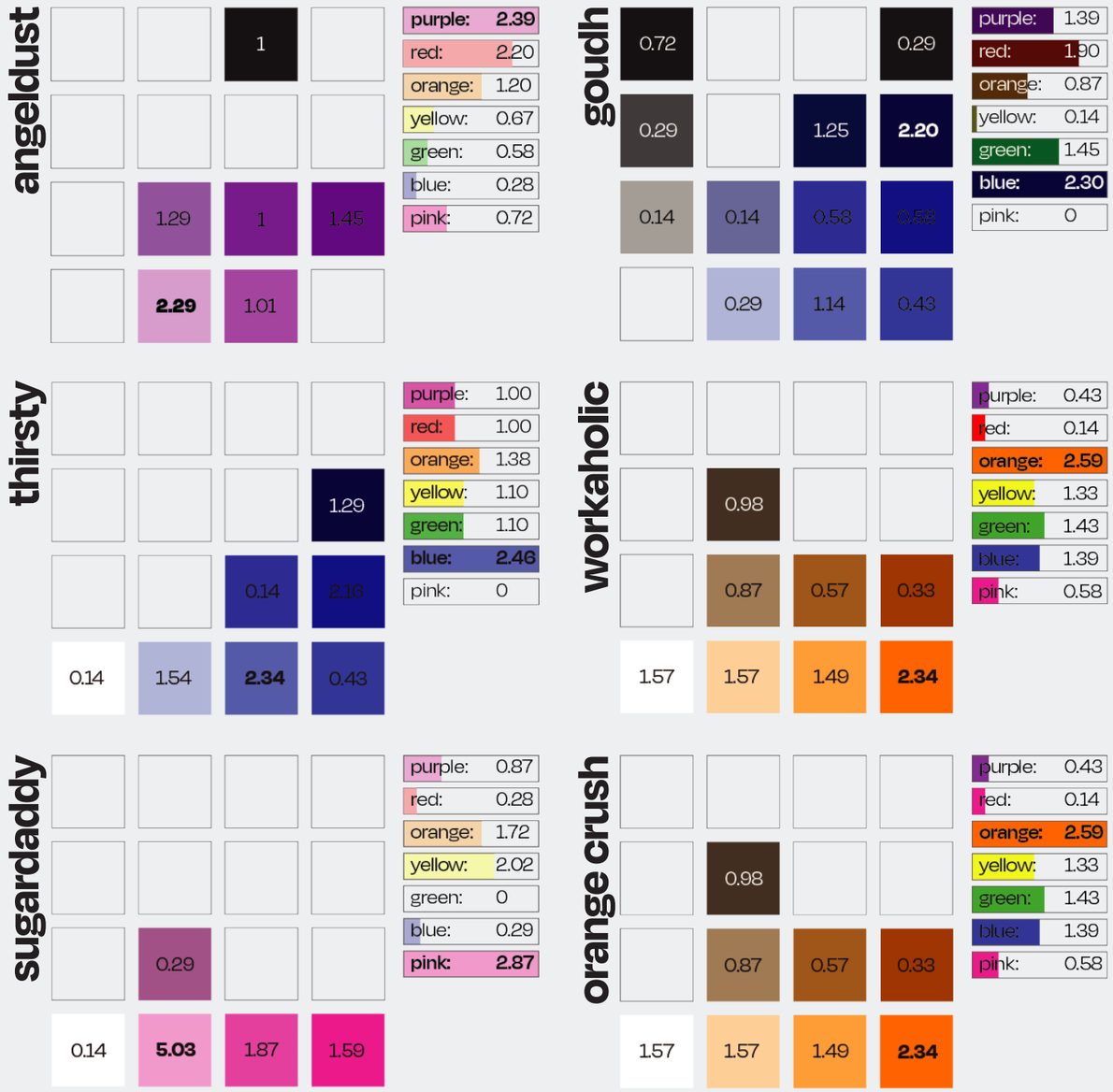


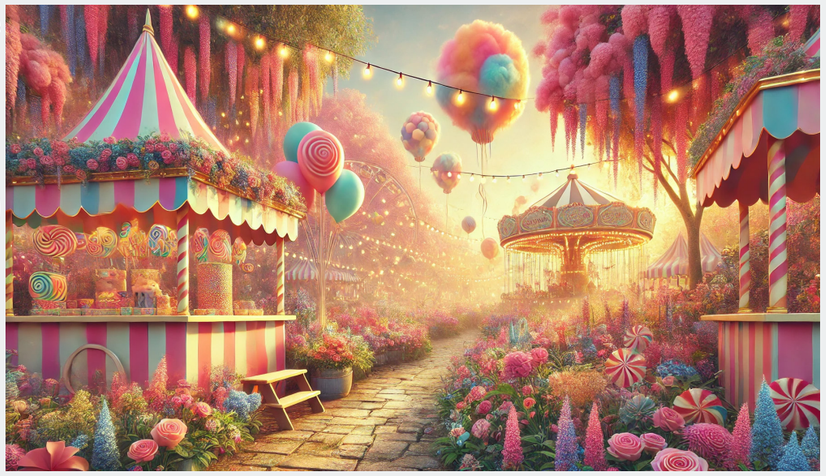
Figure 3: Visualisation of results of participants picking colors

textual description

The textual descriptions for each fragrance are transcribed and used to prompt images, using GPT-4o. The following images were generated for the fragrances (see Figure 4).

1. goudh

2. sugardaddy



3. orange crush

4. angeldust

5. thirsty

6. workaholic

Figure 4: Generative AI Images

color combinations

Participants noted that three out of the six color combinations had a strong association with the colors used in Fugazzi's fragrance marketing (Goudh, Thirsty and Workaholic). Two combinations had a less strong association with the colors that were used in the marketing by Fugazzi (Sugardaddy and Orange Crush). See Figure 5 for the color combinations. As you can see in Figure 6, there is a diagional pattern (except for Angeldust), where a color combination is associated with the correct fragrance.

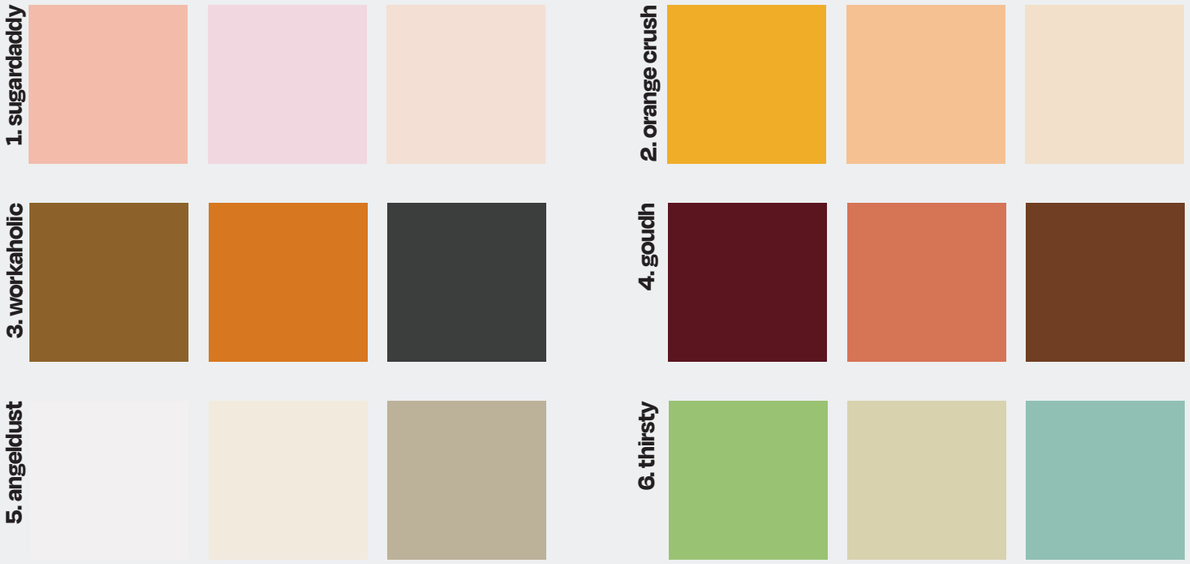


Figure 5: Color combinations used by Fugazzi

	Colors 5	Colors 4	Colors 6	Colors 3	Colors 1	Colors 2
Angeldust	3.63	4.63	4	4.5	3.89	4.5
Goudh	2	5.13	2.38	4.5	1.5	2.25
Thirsty	4.5	3.63	4.63	2.75	3.75	3.75
Workaholic	2.88	4.5	2	4.75	3.38	5
Sugardaddy	4.38	2.38	4.5	1.63	4.88	5.13
Orangecrush	4.13	3.13	4.75	3.13	3	4.5

Figure 6: Confusion matrix of the color combinations

conclusion and discussion

By analyzing the results from this week's test I can conclude that each fragrance features a distinct emotion profile. The emotion profile says a lot about the characteristics of each fragrance. These emotions elicited by the fragrances are going to be used to form the different soundscapes.

According to Schifferstein and Tanudjaja (2004), the pleasure scale has the most influence on how much a fragrance is associated with a color. In this manner, Sugardaddy, Orange crush and Thirsty would have the strongest association, but the results say otherwise. Sugardaddy did have one of the stronger associations with the hue pink and did have a strong association with low saturation and high brightness, but this can not be said about Thirsty and Orange crush. What is remarkable is that Workaholic, which did not score high on the pleasure scale, has a really strong correlation with the hue orange. Schifferstein and Tanudjaja (2004) also mentioned that floral fragrances were associated with lighter and vibrant colors, while heavier scents were associated with darker shades. The results confirm that conclusion partly. Goudh, which is a heavier scent is associated with darker shades, but it does have some floral notes. Thirsty, Angeldust, Sugardaddy and Orangecrush are more floral fragrances and are associated with lighter and more vibrant colors. Workaholic on the other hand is also a heavier fragrance, but it is associated with a vibrant orange color. The contradiction with the conclusions of the literature can be explained by the fact that the Fugazzi scents are very complex. The scents contain different layers, which may cause these outcomes.

With the results, I can conclude that fragrances are systematically associated with a certain hue, brightness and saturation. Some associations are more distinct than others. In the part where the participant picks colors, three out of six fragrances were associated with a color that comes near to the color used for their marketing. The textual descriptions generated images consisted of a color close to the color used by Fugazzi. The ratings of the given color combinations also correlated with this insight. Remarkably, the results from all the different parts of the test conclude that the colors used by Fugazzi, correlate (in some way) with the paired fragrances.

e2: odour & shapes

In Exploration Sprint 2, I focus on the associations between Odour and Shapes. The literature review shows that angular shapes are associated with complex earthy scents, while rounded shapes are associated with more pleasant and sweet scents. In this Exploration Sprint, I want to test whether the fragrances have associations with shapes and whether the results align with the literature. Besides the shapes, I want to gain knowledge on generative AI images that resulted from the previous sprint and whether people can recognize the ingredients in the fragrances.

tools & equipment

- Fragrance test strips are used to enable the participants to smell the fragrances. A number is written on the test strips. The number correlates to a specific scent. The strips are inside a glass container with a cork lid. This ensures that the smell stays inside the container.

- Coffee beans are used to make sure the noses of the participants are neutralized after each scent.

- Pictures of the ingredients of each fragrance are used. These pictures come from Fugazzi's website. The bottles with names are deleted with the use of Photoshop.

- A p5 model is created to make the workflow of picking shapes, smoother for the participants. The shapes I offer to the participants are: circle, rectangle, square, triangle, pentagon, wave and line. These shapes are inspired by the shapes used by Collier (1996) to research the emotional similarity between pairs of geometrical shapes.

procedure

In Exploration Sprint 2, eight participants completed three tasks.

In the first task, each participant smelled a fragrance, viewed six different images, one at a time, and rated each image on a 7-point Likert scale to indicate how well it matched the fragrance. Coffee beans were provided between samples to reset the sense of smell, and this process was repeated for the five other fragrances.

The second task followed a similar structure but included ingredient recognition. Participants identified any ingredients they detected in the fragrance after viewing an image of its ingredients, then rated the match between the image and fragrance on a Likert scale from 1-7. This was repeated for each fragrance, again using coffee beans to neutralize olfactory senses.

In the third task, participants expressed their impression of each fragrance by selecting a maximum of three shapes from a set displayed on a P5.js interface. The first shape chosen weighs the most and the weight of the shapes after that decreases. After smelling coffee beans to reset, they repeated this selection for the five other fragrances.

results
gerenative ai images

You can find the images in E1: results: textual description. In Figure 7 you can see the results in a confusion matrix. Angeldust is not strongly associated with any image. The means for every image are at half of the Likert scale.

Goudh gets the most associated with Image 4 (**4.67**), this image is generated from the textual description of Angeldust. It scores the lowest for image 2 (**3.67**), which was originally paired with Sugardaddy. Goudh is the heaviest fragrance, while Sugardaddy is the sweetest fragrance.

Thirsty gets the most associated with image 5 (**5.11**). This image is originally paired with Thirsty. The lowest fit of degree is with image 1, Goudh (**2**) and image 6, Workaholic (**1.67**). Thirsty is considered a fresh fragrance, while Goudh and Workaholic are considered heavy fragrances.

Workaholic is most associated with image 6 (**5**), which is also originally paired with the fragrance. The lowest associations are for image 2, Sugardaddy (**2.22**) and image 5, Thirsty (**1.44**). Workaholic has a negative association with the two sweetest fragrances.
Sugardaddy is most associated with image 2 (**5.11**). This image is also originally paired with the fragrance. Again there is a negative association with the two images of the heavier fragrances.

Orange crush has the highest association with image 5, Thirsty (**5.22**). It scored not high for the association with the originally paired image 3 (**4**). This is because image 3 shows a Moroccan market. Participants had strong associations with that image, but could not find it in Orange crush. Again Orange crush has a negative association with the two images of the heavier fragrances. In the confusion matrix, a diagonal pattern can be found, where Goudh, Angeldust and Orange crush did not have a strong association with their originally paired image.

	Image 4	Image 1	Image 5	Image 6	Image 2	Image 3
Angeldust	4	3.89	3.78	3.55	3.33	2.55
Goudh	4.67	3.67	3.89	3.89	2.44	3.67
Thirsty	4.22	2	5.11	1.67	3	2.89
Workaholic	3.22	4.67	2	5	2.22	3.78
Sugardaddy	3.67	1.44	3.88	2.11	5.11	3.55
Orangecrush	3.89	1.44	5.22	2.33	4.33	4

Figure 7: Confusion matrix of the generative ai images

Ingredients

As you can see in Figure 9, there is no diagonal pattern. A word cloud is created for each fragrance. The size and saturation of the word indicate how many times that ingredient was recognized by the participants (see Figure 10). There are no strong correlations between the ingredient images and the fragrance Angeldust. The most common ingredients recognized are: Woody, Orange and Apple. There are no apples and oranges in the ingredients of the fragrance.

There are no strong correlations between the ingredient images and Goudh (see Figure 9). The most recognized ingredients are: Flower, Pepper, Wood and Orange peel. Flower is an over-arching term used for flowers. There are a lot of floral ingredients in Goudh: Bulgarian rose, muguet, sambas jasmin and patchouli. The wood can be found in the following ingredients: Indonesian patchouli (has a woody scent), oudh, vetiver java, Indonesian and Indonesian sandalwood. The mandarin and grapefruit in Goudh may often be recognized as orange-peel. Pepper cannot be found in Goudh.

There are no strong correlations between the ingredient images and Thirsty, except that images 1, Orange crush (**2.55**) and 4, Workaholic (**2.11**) are negatively associated with the fragrance. Lime, Flower and Grapefruit are often recognized in the fragrance. There is no lime nor grapefruit in the ingredients of Thirsty. There is jasmine and rose in the ingredients, which are floral notes.

There are no strong correlations between the ingredient images and Workaholic. The most recognized ingredients are: Wood, Coffee beans, spice and oudh (see Figure x). Oudh cannot be found in the fragrance. A woody ingredient that is in the fragrance is: Australian sandalwood. Coffee beans can be found in the ingredients. A spice scent can be found in the nutmeg.

There are no strong correlations between the ingredient images and Sugardaddy. The most recognized ingredients are: orange, apple, wood and fig. Only orange can be found in the ingredients of Sugardaddy.

There are no strong positive correlations between the ingredient images and Orange crush. There is a negative association with ingredient 4, Workaholic (**2.33**). A lot of people did recognize the orange peel and orange. Some people did recognize the wood, which can be found in the ingredients (transparent wood).

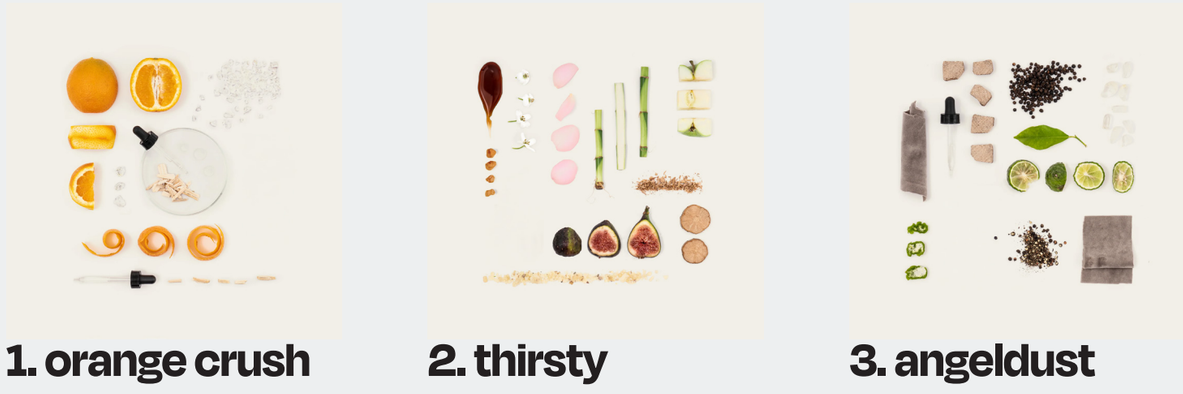


Figure 8: Images of the ingredients of the fragrances

	Ingr 3	Ingr 5	Ingr 2	Ingr 4	Ingr 6	Ingr 1
Angeldust	3.33	4	3.88	4.11	3.88	3.55
Goudh	3.77	4	4.33	4	4.11	3
Thirsty	3.88	3.33	3.55	2.11	4.11	2.55
Workaholic	2.67	4.67	3	4	4.33	3
Sugardaddy	3.22	4.33	3.78	3.22	4	4.33
Orangecrush	4.44	3.44	4.33	2.33	3.78	4.44

Figure 9: Visualisation of results of participants picking colors

1. orange crush

2. thirsty

3. angeldust

4. workaholic

5. goudh

6. sugardaddy

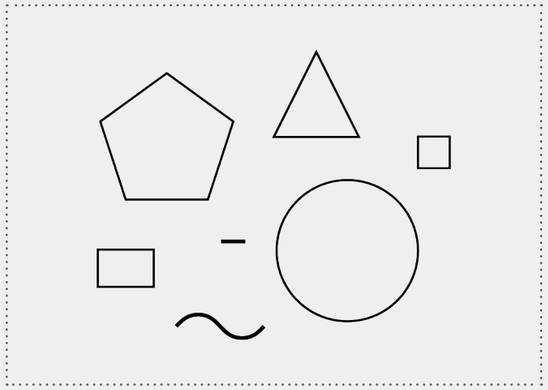
Figure 10: Wordcloud of Ingredients recognized

shapes

To process the data received from the test the same weight method is used as in the previous exploration sprint. The first choice weighs the most and the weight of the second and thirst choice decreases. The scores are calculated while keeping the difference in weight in mind. See Figure below for the results

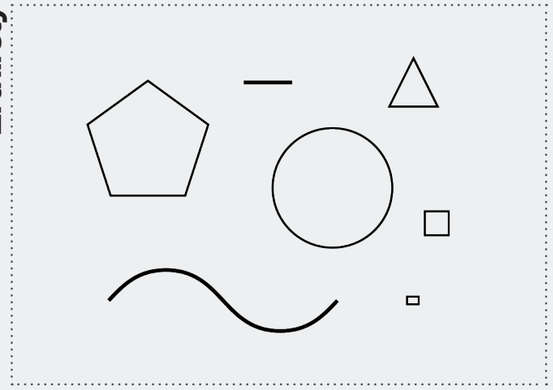
Orange Crush has the strongest correlation with the shapes: circle (**2.54**) and pentagon (**2.39**). Four people associated the fragrance with a circle and five people with a pentagon.

1. orange crush



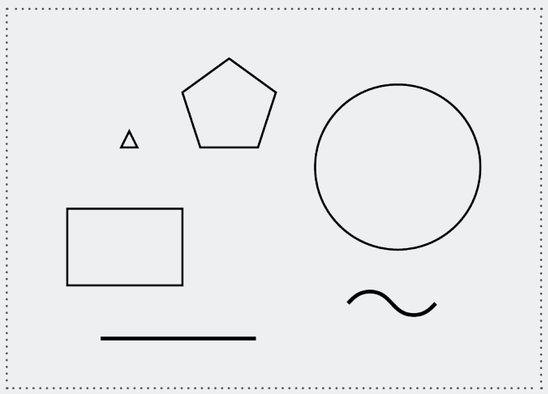
Thirsty has the strongest correlation with the shapes: Wave (**2.74**), pentagon (**2.17**) and circle (**2.15**). Seven participants chose the shape wave, 5 participants chose the shape pentagon and 6 participants chose the shape circle.

2. thirsty

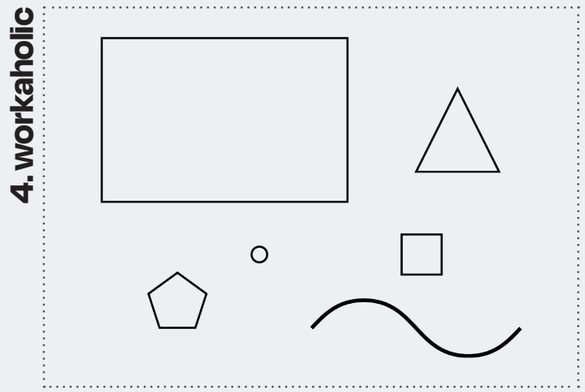


Angeldust has the strongest correlation with the shapes: circle (**2.79**) and line (**1.86**). Six participants chose a line and five participants chose a circle.

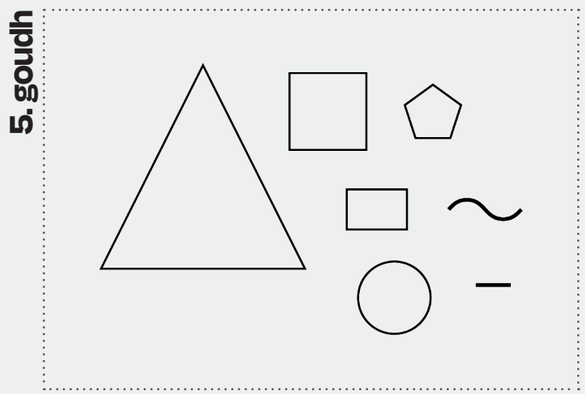
3. angeldust



Workaholic has the strongest correlation with the shapes: rectangle (**2.94**) and wave (**2.5**). Six participants chose a rectangle and five participants chose the shape wave.



Goudh has the strongest correlation with the shape: triangle (**3.66**). Six participants chose a triangle.



Sugardaddy has the strongest correlation with the shape: circle (**4.79**). Eight participants chose the circle.

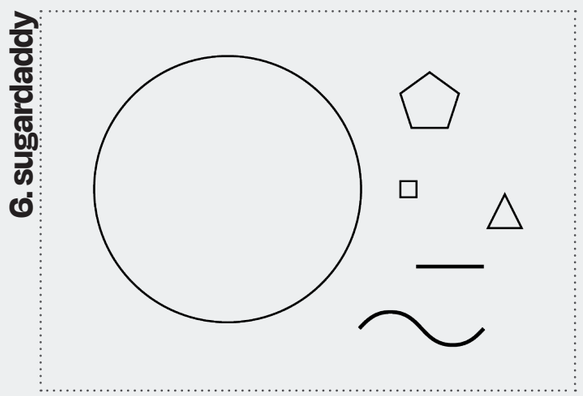


Figure 11: Results of association with shapes

conclusion and discussion

Three out of 6 images are associated with their corresponding fragrance (Sugardaddy, Workaholic and Thirsty). It is worth mentioning that the images made for the sweet fragrances had a negative association with the heavier scents and the same goes for the other way round. Participants had sometimes stronger associations with certain images than associations between the images and fragrance, for example, the image that corresponds to Orange Crush. A lot of participants told me they would expect a Moroccan scent in a way. When utilizing vision as an association, I should present abstract images or the images should fully align with the fragrances, which is also possible.

The ingredient images used by Fugazzi on their site do not relate well. Participants did not know what the ingredients were that they saw and they only recognized overarching terms as floral or woody. Participants also recognize fruits by their names. A lot of times participants recognized ingredients that were not in the fragrance itself. This could indicate that people's perceptions of fragrances are influenced by visual stimuli.

There are strong associations between shapes and the fragrances. The results from my experiment correlate with the outcomes of Hanson-Vaux et al. (2012) research. The sweeter and more floral fragrances (Angeldust, Thirsty, Sugardaddy and Orange crush) are associated with rounded forms. Thirsty also gets associated with a pentagon, which is a medium angular shape. This can be explained by the dominant and stimulating properties of the fragrance (see Figure x). Orange crush also is often associated with a pentagon. This fragrance also has a stimulating property. Angeldust is often associated with a line. This can be explained by the humble property of the fragrance. Goudh and Workaholic are often associated with angular shapes because these two are the more heavier fragrances.

e3: odour & sound

Exploration Sprint 3's primary focus is the associations between Odor and Sound. The literature indicates that pleasant odors are linked to higher-pitched, pleasant-sounding instruments, while more complex or intense odors are linked to lower-pitched instruments. Based on the literature and emotional response from Exploration Sprint 1, I created six soundscapes, one for each fragrance. This Sprint aims to test whether these soundscapes have associations with the fragrances.

tools & equipment

- Fragrance test strips are used to enable the participants to smell the fragrances. A number is written on the test strips. The number correlates to a specific scent. The strips are inside a glass container with a cork lid. This ensures that the smell stays inside the container.

- Coffee beans are used to make sure the noses of the participants are neutralized after each scent.

- In total six soundscapes are made. Each soundscape is made for one fragrance. The soundscapes are made with a producer in the program FL Studio. They are made according to the research of Crisinel and Spence (2011) and the emotion profiles that resulted from exploration sprint 1 (odour & color).

- A laptop is used with the headphones: Sennheiser HD25, to let participants hear the soundscapes.

procedure

In Exploration Sprint 3, eight participants completed the experiment. The participants were given one fragrance at a time. For each fragrance, they heard and rated the degree of fit of the six different soundscapes on a Likert scale from 1-7. The participants had to elaborate on their ratings. In between each fragrance, the participants had to smell coffee beans to neutralize their noses.

The soundscapes can be found with the following LINK.

results

The soundscapes did have distinct associations with the fragrances. In Figure 12 you can see the results in a confusion matrix.

Angeldust has no strong positive correlation with any soundscape. It does have a negative correlation with soundscape 4 (**2.57**), which was designed for Orange Crush. The made soundscape for Angeldust is soundscape 3 (**3.42**). Participants found the soundscape too dark, while the fragrance was perceived as fresh. The low pitch of the soundscape did fit with the fragrance

Goudh has a weak positive association with soundscapes 1,2,3 and 4. It has a negative correlation with soundscape 6 (**2.71**), which was designed for Thirsty. Thirsty is also a dominant and powerful fragrance, but it is more on the sweeter/ fresher side, while Goudh is dominant, powerful and woody. The soundscape designed for Goudh is 5 (**3.57**). Participants found the soundscape too dark and tense. Goudh also has the property of being a floral and smooth smell, besides the dominant side of the fragrance. I should incorporate this into the next iteration if the sense of hearing is going to be used in the next phase of the project.

Thirsty has a positive association with soundscapes 3 (**4.71**) and 6 (**4.57**), but these associations are not that strong. Soundscape 6 is designed for Thirsty while soundscape 3 is designed for Angeldust. It has a negative correlation with soundscapes 4, Orange crush (**3**) and 5, Goudh (**3.14**). Thirsty did not have a strong association with its soundscape, because I overlooked the dominant property of the fragrance. The fresh characteristic of the fragrance is well incorporated in the soundscape.

Workaholic has a strong positive correlation with soundscape 1 (**5.57**), which was originally designed for Sugardaddy. It has strong negative correlations with soundscape 4, Orange crush (**2.42**) and 5, Goudh (**2.71**). Initially considering the results of the other tests, Goudh and Workaholic would be closer to each other, because they are a non-sweet fragrance, but in the associations with soundscapes they score not alike. Workaholic was suddenly described often as a fresh fragrance, while in the previous tests, it was often described as a cozy fragrance. I should incorporate the fresh feeling of the fragrance as well in the soundscape.

Sugardaddy has a positive correlation with soundscape 1, Sugardaddy (**4.57**) and 6, Thirsty (**4.86**). Sugardaddy and Thirsty are the two sweet fragrances. Sugardaddy has a negative association with soundscape 5 (**2.43**), which was originally designed for Goudh. This negative association is logical and is also seen in previous experiments regarding order stimuli.

Orange crush has strong associations with soundscape 1, Sugardaddy (**5.43**) and 6, Thirsty (**5.57**). It has associations with soundscapes designed for sweet fragrances. It has a negative association with soundscape 2 and 4, which were designed for Workaholic and Goudh. Soundscape 4 was originally designed for Orange crush. This soundscape scored low for every fragrance, except for Goudh. Participants often described the rhythm in the soundscape as not fitting for the fragrances. Goudh did kind of fit with the rhythm because it is a powerful and heavier fragrance.

	Soundscape 3	Soundscape 5	Soundscape 6	Soundscape 2	Soundscape 1	Soundscape 4
Angeldust	3.42	3	3.85	4.14	3.71	2.57
Goudh	4.43	3.57	2.71	4.71	4.71	4.43
Thirsty	4.71	3.14	4.57	4.57	4.43	3
Workaholic	3.71	2.71	4.29	4.43	5.57	2.42
Sugardaddy	3.14	2.43	4.86	3.57	4.57	3.29
Orangecrush	3.71	2.71	5.57	2.86	5.43	3.14

Figure 12: Confusion matrix of the soundscapes

conclusion and discussion

The results of this week's experiment correlate in a way with the findings of Crisinel and Spence (2011). But in their experiment, they made use of a singular scent, while the fragrances of Fugazzi are pretty complex.

While making the soundscapes I made use of their emotion profiles, but I overlooked the characteristics of the fragrances. For example for Goudh, I tried to make a soundscape that was very dominant and low-pitched, but I overlooked that Goudh also has a smooth characteristic due to the floral ingredients. Sugardaddy, which is more simpler fragrance did have positive associations with the soundscapes made for the sweeter fragrances and a negative association with the other soundscapes.

Making soundscapes that fit well with a fragrance is hard, but feasible.
Participants did have distinct associations between the soundscapes and the fragrances. The order of the soundscapes presented to the participants was not randomized. This should be done in the future, because it could have influenced the outcomes. As you can see in figure x, the first soundscapes have a lot of positive associations with the fragrances and this reduces for the subsequent soundscapes.

Multiple participants noted that the perception of the fragrance was influenced by the soundscapes. For example, Workaholic which I initially thought was only a heavy fragrance, was often positively associated with the soundscape made for Sugardaddy, which was also the first soundscape presented to the participants. This soundscape brought up the fresh characteristic of the fragrance, influencing the perception of it. Not only the soundscapes influenced the fragrances, but also the fragrances influenced the soundscapes.

e4: odour & haptic

In this Exploration Sprint, I focus on the associations between Odour and Tactile. The literature review shows that scents have distinct associations with different tactile properties. In this sprint, I will validate the literature and test what kind of tactile properties are associated with fragrances. Following Ludwig and Simmer (2013), I used the three tactile scales: rough-smooth, hard-soft, and pointed-round. However, to shorten the duration of the task, three rather than six objects were used for each scale.

tools & equipment

- Fragrance test strips are used to enable the participants to smell the fragrances. A number is written on the test strips. The number correlates to a specific scent. The strips are inside a glass container with a cork lid. This ensures that the smell stays inside the container.

- Coffee beans are used to make sure the noses of the participants are neutralized after each scent.

- For each tactile scale, I made sure that there were three options, ranging within the scale.
  - **Rough - Smooth**
    Sand paper with a low grit (P150) is used for the roughest stimulus. Sand-paper with a medium grit (p400) is used for the medium rough stimulus, while no grits is used for the smoothest stimulus (see Figure 13).
  - **Hard - Soft**
    Stimuli comprised three foam surfaces, ranging from hard to soft. Each surface was covered in an identical textile fabric (see Figure 14).
  - **Angular - Round**
    Three three-dimensional shapes (6cm high) ranging from angular to round were used. These shapes were 3d printed and sanded to a smooth surface. (see Figure 15)

- Three cardboard boxes, with an opening are made to ensure that the participants could not see the objects (see Figure 16).

procedure

Participants were asked to place a hand through the opening in order to feel the nine individual objects, which were hidden from view. Before the experiment began, participants were informed that they would be feeling objects varying from rough to smooth, hard to soft and angular to round. At first, they felt the two extremes of each scale once to determine the range of the sensations. For each scale, the three objects are presented to the participants. Participants were instructed to feel each object on the scale and pick one of the three objects that they associated the most with the fragrance and try to explain why.

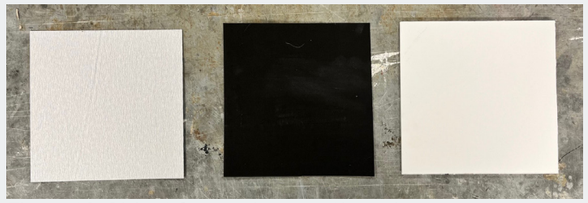


Figure 13: Object for rough-smooth scale

Figure 14: Object for soft-hard scale

Figure 15: Object for angular-round scale

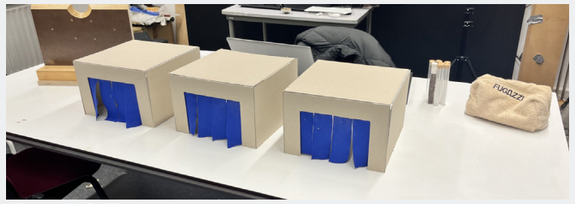
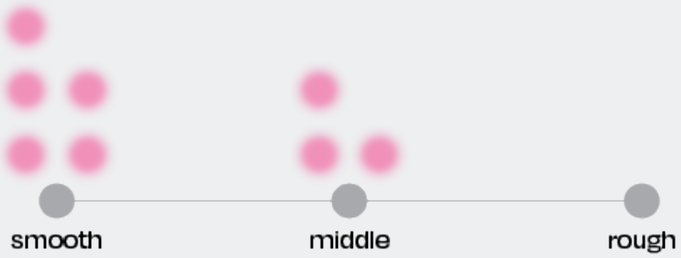


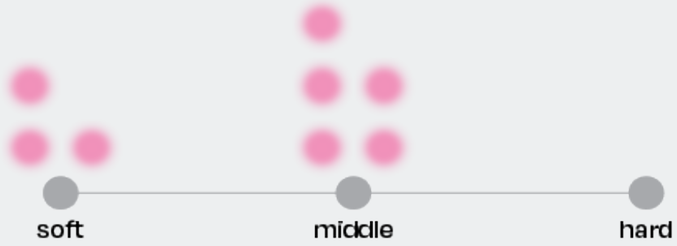
Figure 16: Test set-up

results

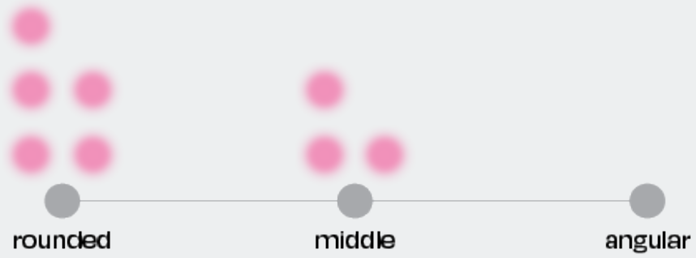
angeldust



People who picked the smooth surface often described the fragrance as: soft, light or linear.



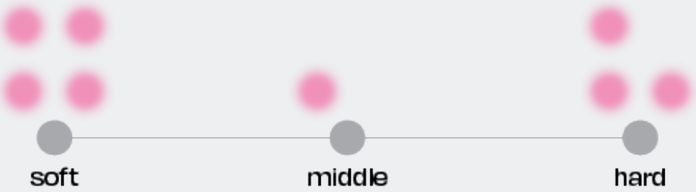
People who chose the middle softness associated it with different things, for example: strawberry, gender neutrality, firmness and how it will pop.
The participants who picked the soft surface explained that the fragrance itself was perceived as a soft fragrance.



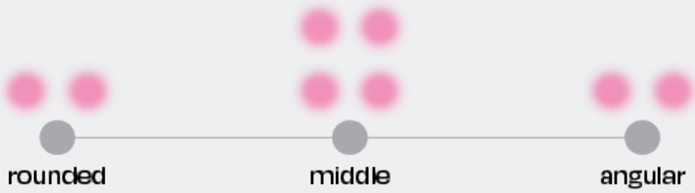
Participants who chose the rounded object explained that the fragrance is accessible, friendly, soft, and not intense

goudh

The participants who picked the rough surface described the fragrance as strong or pungent.
Participants who picked the smooth surface described the fragrance as smooth

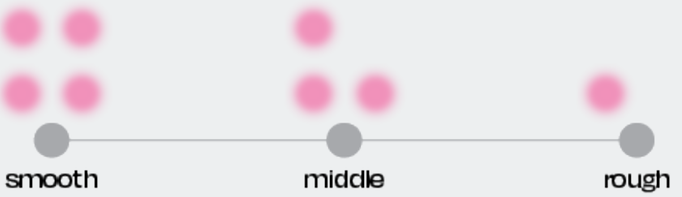


Participants who picked the soft surface had different associations. Varying from flowery, peaches, fur coats to dreamy and smooth.
Participants who picked the hard surface found the fragrance very pungent and strong.

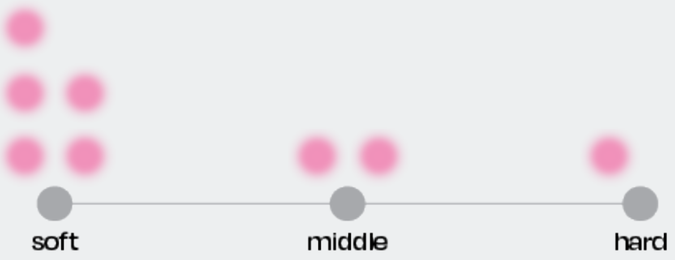


Participants who associated the fragrance with the middle object described the fragrance as first strong but found it smooth as well

thirsty



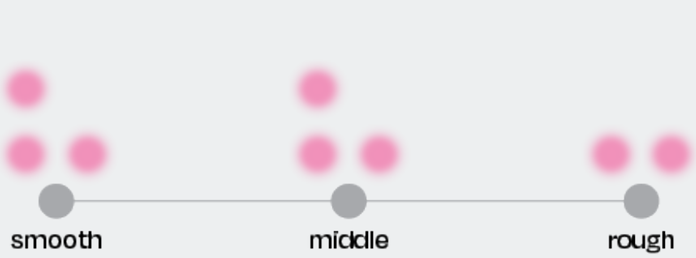
Participants who picked the smooth surface often described the fragrance as sweet, well-balanced and not harsh.
The associations with the middle surface are often described as the fragrance being sweet/smooth, but also having a strong smell.



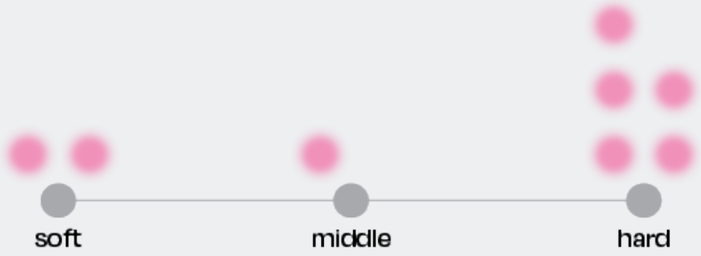
Thirsty was often associated with a soft surface, because of the sweet, flowery smell.

The participants who associated the fragrance with rounded objects, perceived the fragrance as well-balanced or natural.
The participants who chose the angular object described the fragrance as sharp, tingly or fresh.

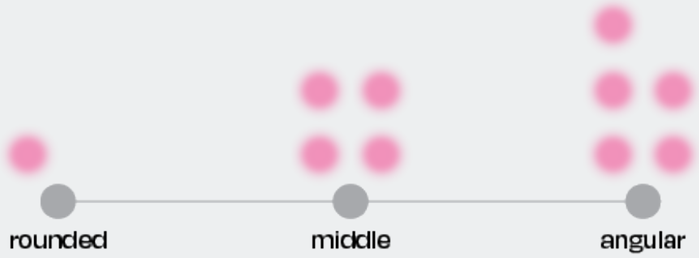
workaholic



The associations vary a lot for this fragrance and scale.



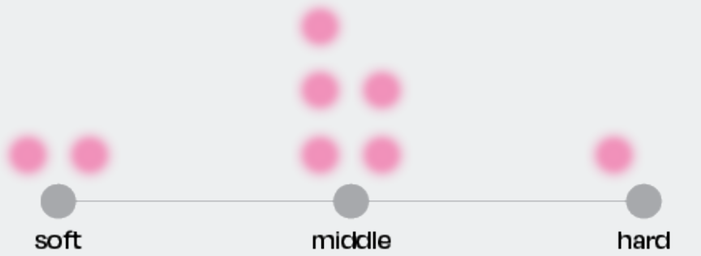
Participants who picked the hard surface often described the fragrance as pungent or sharp.



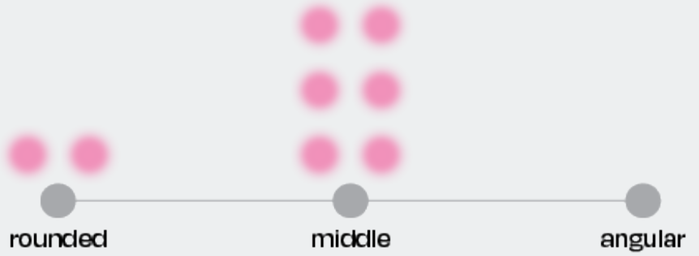
Workaholic is often perceived as pungent and strong, but also smooth and subtle.

sugardaddy

Sugardaddy is often associated with a smooth surface, because it is sweet and flowery. Participants also chose the rough surface, because the fragrance is strong and intense.

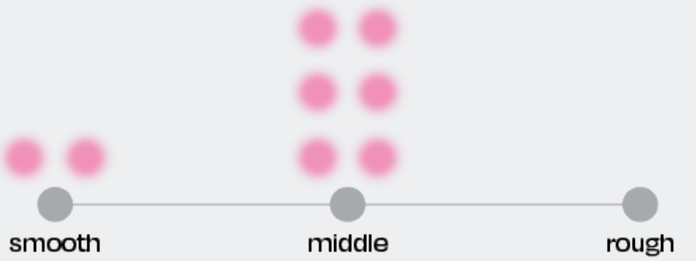


Sugardaddy is often perceived as a sweet fragrance, but participants found that it is not too sweet and that it has some body.

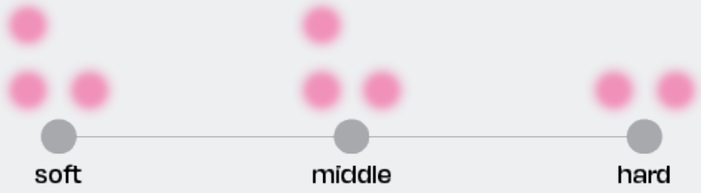


Participants often described that the fragrance has something pointy, but is still pretty soft. The fragrance consists of both worlds.

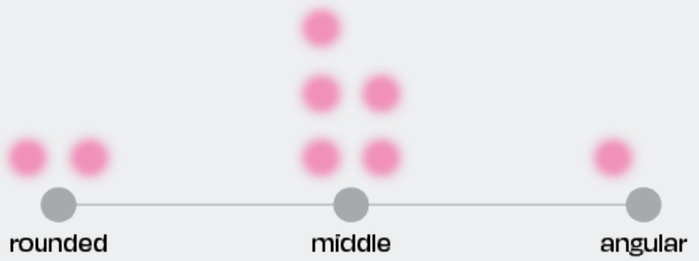
orange crush



People often described orange crush as smooth, but still stimulating.



The participants who chose the soft surface described the fragrance as: pleasant, feminine, welcoming and soft.
The participants who chose the middle surface found the fragrance not bland, but more active and intense.



People often described orange crush as smooth, refreshing, comfortable, but also strong, hence the choice of the middle object.

conclusion and discussion

With the results of this experiment, I can conclude that there are distinct associations between fragrances and haptic feedback. Remarkably, Angeldust had the most distinct associations with haptic feedback, while it had lesser associations with other sensorial stimuli. With the results, I can conclude in a way what kind of haptic feedback is fitting with the fragrances. I will translate the results into materials that will have the same characteristics as the fitting haptic feedback and test the association in the next experiment.

The results state that it may be possible to direct the users' perception of the fragrance by playing with these characteristics of haptic feedback. For example, the fragrance Goudh is perceived as a strong and smooth fragrance. When utilizing haptic characteristics I can direct the user and accentuate the characteristics of the fragrance. When a smooth surface is used, the smoothness of Goudh will arise, but when a rough surface is used the strongness will arise.

e5: odour, haptic & color

Based on the previous Exploration Sprint and Exploration Sprint 1 results, I made six different objects. The goal of this week's exploration sprint is to validate the combined results of E1 and E4. In E4, I concluded the haptic properties associated with each fragrance. I tried to translate those properties into materials. The angular-rounded scale is disregarded due to the time it takes for prototyping. The materials are connected with the colors that resulted from E1.

selecting materials

There is no literature to be found regarding the associations between odour, haptic and color. I integrated the results from Exploration Sprint 1: Odour & Colour and Exploration Sprint 4: Odour & Haptic.

With the help of Chat GPT 4o, I could translate the results of Odour & Haptic into potential materials. I tried to find these materials in the correct color. I made six different objects. Each object is paired with a fragrance (see Figure 17). The following materials are used for the fragrances:

1. angeldust
Core: Middle hard foam
Outer layer: Viscose
Color: Low saturated purple

2. goudh
Core: Hard foam
Outer layer: Smooth leather
Color: High saturated purple

3. thirsty
Core: Soft foam
Outer layer: Satin
Color: Medium saturated blue

4. workaholic
Core: Hardwood
Outer layer: Woodstain
Color: High saturated orange

5. sugardaddy
Core: Middle hard foam
Outer layer: Cotton teddy
Color: Low saturated pink

6. orange crush
Core: Middle hard foam
Outer layer: Canvas
Color: High saturated orange

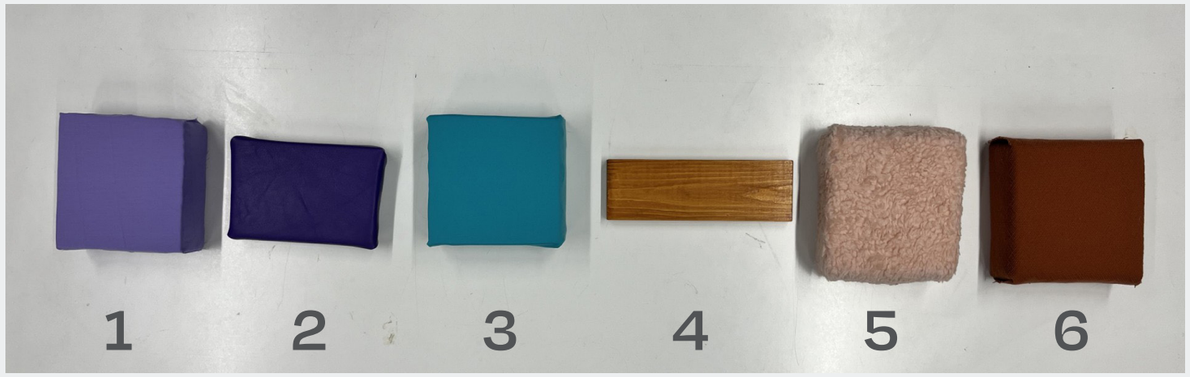


Figure 17: Six objects

tools & equipment

- Fragrance test strips are used to enable the participants to smell the fragrances. A number is written on the test strips. The number correlates to a specific scent. The strips are inside a glass container with a cork lid. This ensures that the smell stays inside the container.
- Coffee beans are used to make sure the noses of the participants are neutralized after each scent.
- Six different objects are used. Each object is made to associate with one fragrance.

procedure

The participants are presented with six objects. These objects are designed while taking into account the results of E1 and E4. Each object pairs with a fragrance. The participant is given a fragrance. He or she has to touch each object while smelling the fragrance and has to rate the degree of fit on a Likert scale from 1-7, between each object and each fragrance. The participant has to explain why the combination is given the rating.

results

The results can be found in the confusion matrix in Figure 18.
Angeldust should have had the highest association with object 1 (**4**), but it did not. Regarding the participants, the color did associate with the fragrance, but the material did not. The material was too soft for the fragrance it should have been harder. Angeldust scored higher in association with object 5 (**4.55**), which was initially made for Sugardaddy. It scored well because the object is perceived as soft and firm at the same time, due to the material and foam. This is associated with the sweetness of Angeldust. The outer material should be a little bit firmer, but also soft, like the material of object 5. The fragrance did have a negative association with object 4 (**2.78**).

Goudh scored the highest for object 2 (**4.11**), which is made for Goudh. The color was associated with the fragrance. Initially, I wanted to convey the dominance of the fragrance by utilizing a harder foam, but it could be better conveyed by using a material that also has stimuli, for example, velour or a suede material. This material would convey the dominance, but also the smoothness of the fragrance. Goudh has a negative association with object 5 (**2.88**), which was made for Sugardaddy.

Thirsty has the highest association with object 3 (**4.44**), which was designed for the fragrance as well. Participants described that it felt pleasant combining the two and the object reminded participants of the ocean, which also correlates with the smell of Thirsty.

Workaholic scored the highest for object 4 (**5.11**), which was made for the fragrance. This combination has the highest degree of fit for this experiment. It also scored high with object 6 (**4.78**), which was initially designed for Orange crush. Object 6's color and texture correlate with the fragrance. Both objects are orange, which also concluded from weeks 1 test. Object 6 also consists of a stimulating material, while workaholic is also a stimulating fragrance. Workaholic has negative associations with other objects.

Sugardaddy associated the most with object 2 (**4.55**), which was initially made for Goudh. The second highest score of degree of fit is for object 5 (**4.33**), which was made for Sugardaddy. The participants who rated the degree of fit low, perceived the fragrance as pungent and strong and that perception did not correlate with the soft object, but the participants who did perceive the fragrance as soft and sweet, gave a high rating of the association. I have to find a way to also include the strongness of the fragrance in the stimuli.

Orange crush has the lowest association with object 6 (**3.22**), which was made for the fragrance. People found the fragrance fresh, but the object was not. The saturation needs to be lower to fit the fresh feeling of the fragrance. Also, people found the material too stimulating. Orange crush scored the highest with object 1 (**4.88**), which was made for angel dust. This object capsulates the freshness and softness of the fragrance well. I have to find a lower-saturated orange cotton fabric, which needs to be soft as well.

	Object 1	Object 2	Object 3	Object 4	Object 5	Object 6
Angeldust	4	3.67	4	2.78	4.55	3.55
Goudh	4	4.11	3.33	3.67	2.88	3.67
Thirsty	4	3.67	4.44	3.78	3.78	3.22
Workaholic	3.22	3.44	3	5.11	2.44	4.78
Sugardaddy	4.22	4.55	4.11	2.67	4.33	3
Orangecrush	4.88	4	4	3.22	3.67	3.22

Figure 18: Confusion matrix of the objects

conclusion and discussion

With the results of this experiment, I can conclude that the object had nuanced associations with the materials, colors and textures of the objects. By combining two sensorial stimuli, I expected the objects to have stronger associations with the fragrances. The colors did have good associations with the fragrances, but the materials need to be revised. Every object, except workaholic needs a revision. These findings emphasize the importance of tailoring object characteristics to capture both the dominant and subtle qualities of each fragrance.

key-findings

exploration sprints

- The fragrances of Fugazzi have distinct emotion profiles
- The fragrances have high associations with certain hue, brightness and saturation levels
- The generative AI images that resulted from the textual descriptions have high associations
- The fragrances have distinct associations with shapes
- People find it hard to recognize ingredients in fragrances
- People can recognize overarching terms to categorize fragrances
- The soundscapes did not result in high associations
- There are distinct associations between the fragrances and the three tactile scales
- The fragrances have nuanced associations when material, color and texture are combined

design method

Initially, I planned to run the key phases, research, ideation, prototyping and testing, parallel in these sprints. In reality, I focused on exploring and gaining knowledge in sequence in the first weeks. These fast Exploration Sprints were very important for my project. To gain knowledge of multi-sensory associations, it was important to not only dive into the literature but also test the findings of the literature in the physical world. As the context of my tests was different from the context of the literature, it sometimes resulted in findings different from those of the literature. The Exploration Sprints resulted in a lot of interesting insights, which I could utilize not only in the design but also in further research and testing. The findings of the Exploration Sprints were used in the Deepening Sprints. In these sprints, I actually ran the key phases in parallel. Each sprint resulted in a prototype, which I eventually tested and the findings resulted in input I could utilize in the next deepening sprint.

This new design method was very helpful in navigating this complex project. It helped me quickly test and integrate the literature findings into my context. The design method is split into the exploration and deepening phases. In the exploration phase, you must focus on gaining insights through the literature research, integrating literature into your context and setting up tests to validate the research. All the knowledge gained from the exploration phase is the base for the deepening phase, where you apply it to a concept and prototype. These deepening sprints need to be iterative, where the sophistication of the concept and prototype constantly increases from one sprint into the other. You gain insights in one deepening sprint and apply it to the next one.

problem definition

Additional research, besides the results of the exploration sprints, is needed to define the problem I want to solve with my design directions. Combining a storyboard of visiting Fugazzi's store, an interview with a store clerk, the results of exploration sprints and the overarching problem that smell needs sensorial cues will result in a problem definition.

storyboard

1. Customer enters the store and looks at the fragrance display.

2. Fifteen different fragrances are presented. Only the names indicate the smell.

3. Customer smells fragrance with smelling stone.

4. Customer picks up a smelling stone from another fragrance.

5. Customer smells other fragrance.

6. Customer picks up a blotter.

7. Customer sprays fragrance on the blotter

8. Customer smells blotter.

9. Customer picks up another blotter.

10. Customer sprays other fragrance on the blotter.

11. Customer smells the other blotter.

12. Customer has multiple blotters in hand and needs to pick a favorite or spray another fragrance.

Figure 19: Story board of testing fragrances in the Fugazzi store

own experience

During my visit to de Bijenkorf to pick out a fragrance for my sister's birthday, I ran into several problems, which caused me to have a bad experience. In a fragrance department, a lot of fragrances are displayed, grouped by brand. When picking out a fragrance from one brand only, you will have to choose from 15 fragrances minimal. In Figure 20 you can see how confusing it is to look at the different fragrances. The perceptual experience of these fragrances is only supported by the name of the fragrance. There is no other indication of how a fragrance will smell. To perceive a fragrance you will have to use the blotters. These blotters are easily mixed up and you will find yourself with 4 blotters in your hand, forgetting which one is which.

results exploration sprints

The exploration sprints gave me tools to work within the next phase of the project. I can conclude that there are cross-modal associations between fragrances and other senses. Some senses cause stronger associations than others, for example, vision. Other senses, like haptic and sound, indicate that it might be possible to alter the perception of the fragrance by utilizing sensorial cues.

interview store clerk

I had a short interview with a store clerk van Fugazzi. She told me that she did not particularly experience any problems with helping the customers test out fragrances. Fugazzi's store is visited by a lot of different sorts of customers. Most of the customers come by to test out all the fragrances and some customers have a particular fragrance in mind. When a customer visits the store, the clerk always asks if he or she needs help, if it is not busy in the store. To reduce the amount of options to smell, the clerk asks the customer what kind of fragrance he or she is looking for. It could be a woody, fruity, or floral fragrance. It could happen that a customer is looking for a woody fragrance and leaves the store with a citrus fragrance because the customer does not know what kind of fragrance he or she wants. For each overarching term, the clerk gives three to four options and sprays the fragrances on blotters. She leaves the blotters in front of the corresponding fragrance so that there is no misunderstanding about what blotter is what fragrance. When the blotters get mixed up the clerk knows what fragrance is sprayed on the blotter.

Figure 20: Image from the Fugazzi store.

problem statement

Customers often face difficulties when choosing a fragrance in retail stores because there are no clear sensory cues besides the name of the fragrance. This problem is common in stores like Fugazzi, where many fragrances are displayed, and the selection process depends on blotters. Customers can get confused when blotters are mixed up, making it hard to remember which fragrance is which. This confusion creates frustration and makes the experience less enjoyable.

Store clerks try to help by narrowing down options and organizing the blotters, but this solution is not always possible when the store is busy. Research from exploration sprints highlights the potential of leveraging cross-modal correspondences—such as visual, haptic, or auditory cues—to enhance not only the smelling experience, but also the fragrance selection experience.

design goal

The new insights gathered resulted in the following design goal:

Design a multi-sensory context for perfumes that not only shapes and enhances the olfactory experience but also transforms the process of selecting a fragrance into an intuitive and engaging journey for Fugazzi's customers.

design directions

All design directions are set up to enhance the scent and fragrance selection experience by giving sensorial cues to support and improve the perception of the fragrances. The design directions Odyssey & Headspaces are more focused on enhancing the scent experience, while d'Accord focuses more on the fragrance selection experience.

odyssey

In this design direction, I will come up with a display that can be put in the Fugazzi store or any other retail store. This display enables the users to get an overview of the different fragrances and dive deeper into their world by smelling the fragrance with the smelling stone. The smelling stone consists of a material that correlates with the corresponding fragrance. Each fragrance has an LED screen behind it. Visuals will be realized that correlate with the fragrances. A visual consists of a passive mode and an active mode. The passive mode is enabled when customers look at the different fragrances on the display. This visual in passive mode is an abstract visual that causes users to gain expectations of the fragrance. When the customer wants to try a fragrance and picks up the smelling stone, the movement will enable interaction between the user and the visual. When the customer raises the smelling stone to the nose to smell the fragrance, the visual will transform into the active mode. The visual in this mode enables the customer to meet their expectation and fully align with the fragrance. Each fragrance will be supported by a soundscape, using directional speakers.

When a customer likes a fragrance he can pick a blotter with the corresponding name and color of the fragrance. He walks to the fragrance wall and sprays the corresponding fragrance on the blotter. In this way, the customer will not be confused by the different blotters, because they are labeled and colored.

This direction enables the user to get a quick overview of all the different options available, when the user wants to smell the fragrance, he or she will be immersed into the world of the fragrance. This direction improves choosing a fragrance by enhancing the scent experience.

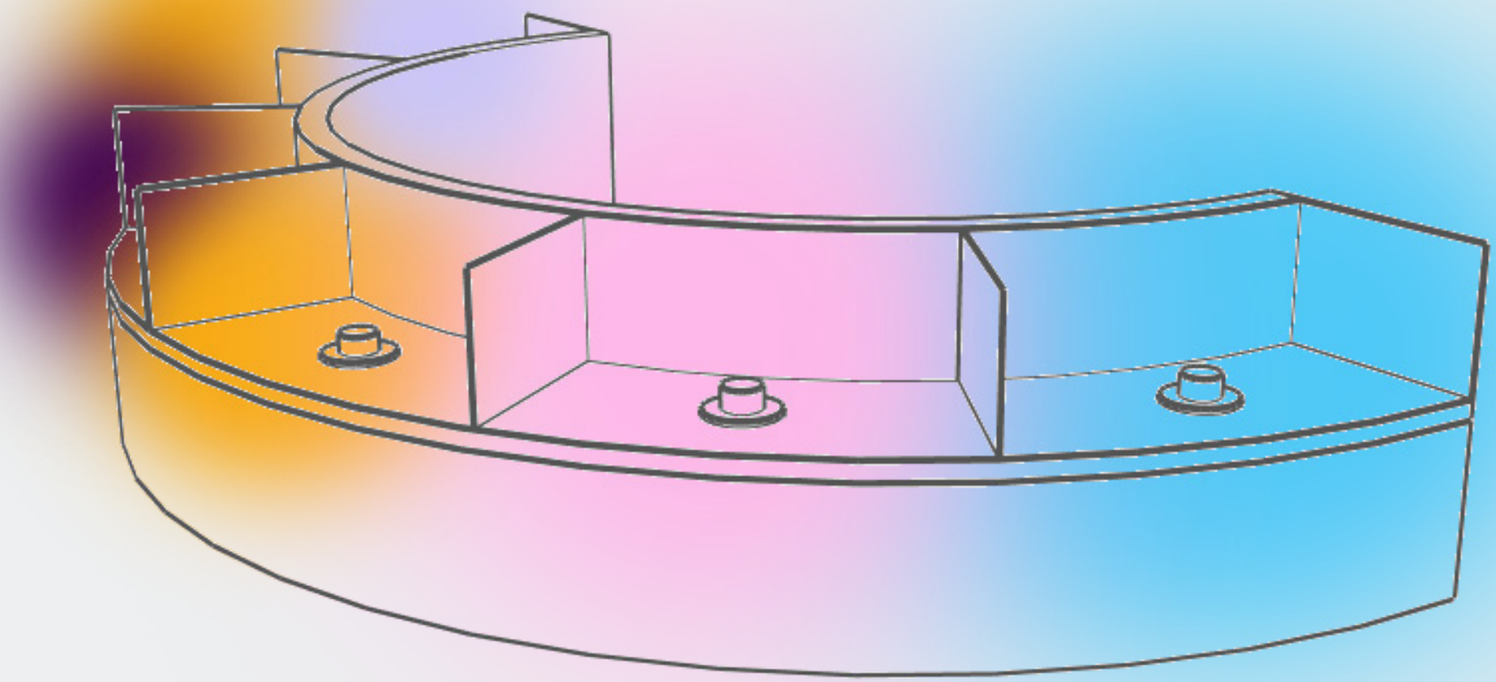


Figure 21: Visualisation of odyssey

headspaces

In this design direction, I will come up with an installation that could be implemented in a pop-up store. I envision this direction currently as a space where different shapes hang from the ceiling. Each shape correlates with a fragrance and is covered with a material that also correlates with the fragrance. These shapes and materials enable the user to get expectations from each fragrance. When he wants to know more about the fragrance and smell it, he puts his head in the shape. Within the shape visuals are shown, soundscape is played and the fragrance can be smelled.

When a customer likes a fragrance he can pick a blotter with the corresponding name and color of the fragrance. He walks to the fragrance wall and sprays the corresponding fragrance on the blotter. In this way, the customer will not be confused by the different blotters, because they are labeled and colored.

This direction enables the user to get a quick overview of all the different options available, when the user wants to smell the fragrance, he or she will be immersed into the world of the fragrance. This direction improves choosing a fragrance by enhancing the scent experience.

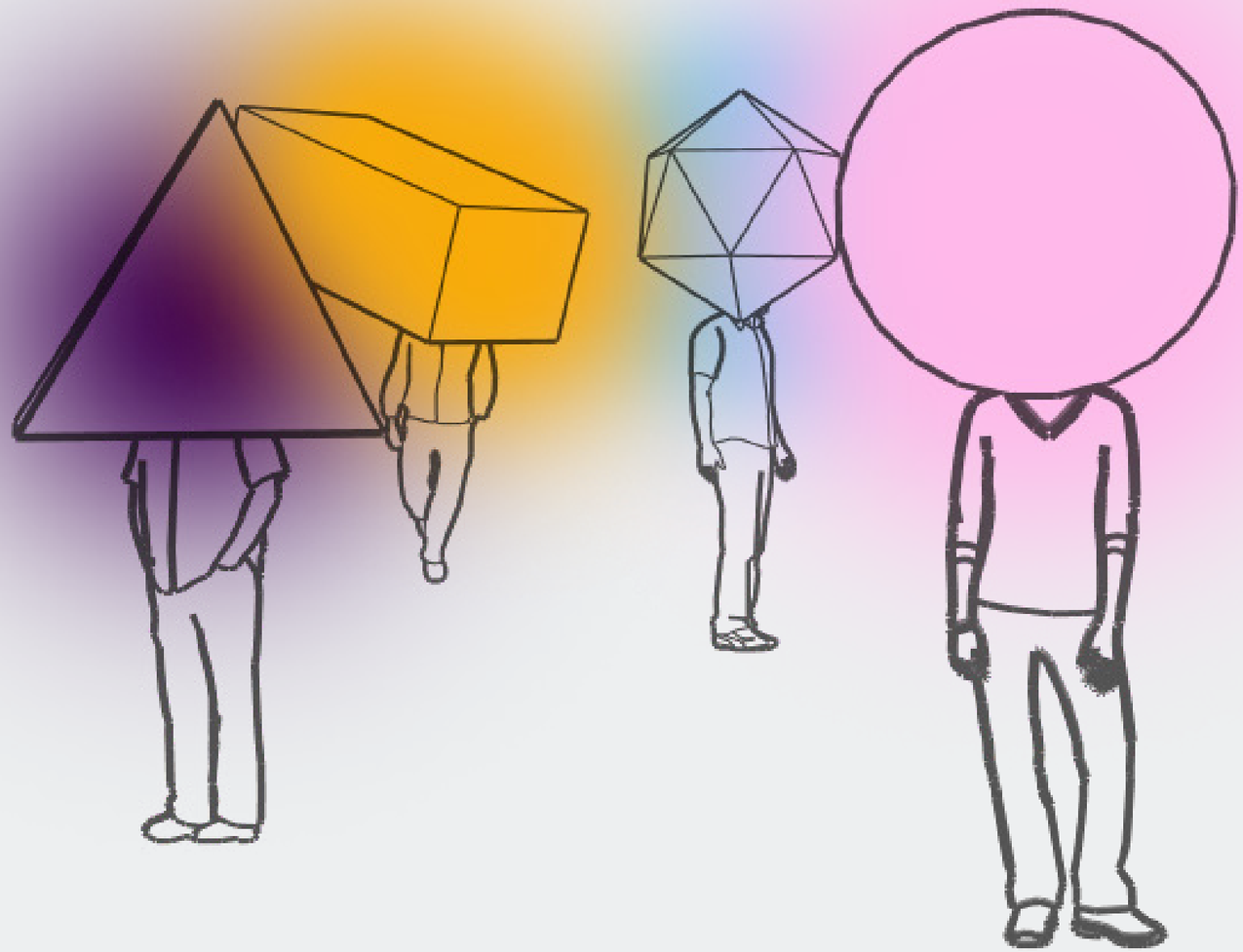


Figure 22: Visualisation of Headspaces

d'accord

In this design direction, I will come up with a display that enables customers to click on the accords the fragrance should meet. These accords are not determined but could consist of woody, floral, fruity, citrus, musky, and powdery. When the preferred accords are clicked on, the surface of the suitable smelling stones of the fragrances will light up. The smelling stone consists of a material that correlates with the corresponding fragrance. When a smelling stone is picked up and smelled, the LED screen will show visuals that correspond to the fragrance. A soundscape will be played and the users will perceive the fragrance with multiple senses.

When a fragrance is liked, the participant can pick a blotter, that is colored and labeled with the correct fragrance. He walks to the fragrance wall and sprays the corresponding fragrance on the blotter. In this way, the customer will not be confused by the different blotters, because they are labeled and colored.

This direction enables the user to pick accords he or she likes and the suitable options are visible. When the user wants to smell the fragrance, he or she will be immersed in the world of the fragrance. This direction improves the scent experience by narrowing down the options.

Figure 23: Visualisation of d'accord

chosen design direction

The concepts of Odyssey and Headspaces have similar functions but differ in appearance. Although both directions initially intrigued Fugazzi's founder, Bram, they were eventually considered impractical because of their spatial requirements. Headspaces, designed as a pop-up store concept, did not align with Bram's vision. Nor was Odyssey, which would be most effective in a boutique store, feasible because Fugazzi does not currently have such retail space. Instead, Bram saw the most potential in d'accord because of its sorting functionality. However, he emphasized the importance of ensuring the solution was not perceived as too technological and expressed his preference for LED displays. This presents the challenge of providing visual cues in a way that feels sophisticated and non-technical.

The d'accord concept consists of several aspects, each with a specific function. Each aspect requires specific ideas, prototypes and tests to develop it effectively. These aspects will be further explored in the next two in-depth sprints. The main aspects are accords, visual cues, and the process of testing a scent.

d1: d'accord v1

Based on the chosen design direction, I will design the first prototype of d'Accord. The concept consists of multiple design elements that have to be solved. The first element is the suggestion feature, and the second element is the visual cue. In addition to making the prototype, it will also be tested.

accords

There are a lot of different ways to categorize different types of fragrances. It can be done by ingredients, but keeping the results from Exploration Sprint 2 in mind, it is not a good way to categorize fragrances. Users do not know the ingredients and notes, but they know the overarching terms like floral, fruity, and woody. Michael Edwards developed the fragrance wheel, a way to categorize fragrances (Fragrances of the World - Discover Michael Edwards' World of Fragrances, n.d.). It works the same as a color wheel. It groups categories in a way that allows for overlap and gradual variances. It provides a visual representation of the olfactive spectrum. It uses four major scent categories: floral, oriental, woody and fresh. Each category then has subgroups that further define the fragrance characteristics based on aromatic variances.

In the design direction d'accord, I want the user to be able to select different accords. The user is also able to combine accords. With this in mind, I can simplify the fragrance wheel, by deleting the overlapping categories. This resulted in the following seven accords overarching the fragrance wheel: Oriental, Woody, Fresh, Floral, Citrus, Fruity and Powdery. By utilizing these accords and their combinations, every fragrance can be categorized.

Fragrantica is an online fragrance encyclopedia and community platform where users can explore detailed perfume profiles, reviews and notes. I utilized this platform to select the accords the fragrances of Fugazzi have. The fragrances consist of the following accords.

1. angeldust
- Powdery
- Woody
- Citrus

2. goudh
- Woody
- Citrus
- Floral
- Oriental
- Fruity

3. thirsty
- Fruity
- Woody
- Floral
- Fresh
- Powdery

4. workaholic
- Oriental
- Floral
- Powdery

5. sugardaddy
- Fruity
- Citrus
- Woody

6. orange crush
- Citrus
- Oriental
- Powdery
- Woody

Figure 24: Accords of Fugazzi fragrances

Figure 25: Fragrance Wheel by Michael Edwards

visual cue

For the visual stimuli, I will be using TouchDesigner for this deepening sprint. TouchDesigner is a node-based visual programming language for real-time interactive multimedia content. I will use the shapes that resulted from Exploration Sprint 2. These shapes will be transformed into a 3D model, while this 3d model will be visualized in particles. With these particles, I can play with abstractness. When the particles move slowly, more of the 3d model will be visible, but the shapes will be abstracted when the particles move faster. Initially, I tried to implement the AI-generated scenes that resulted from Exploration Sprint 1, but I chose to use the shapes due to the time. In Figure 26 you can see the particle visualization for each fragrance.

The TouchDesigner project consists of 6 different states. Every state consists of a visual that corresponds to a fragrance. The associations used are shapes and color. I will manually change states in TouchDesigner, due to time limitations. A video of the transitions between fragrances can be found with the following link.

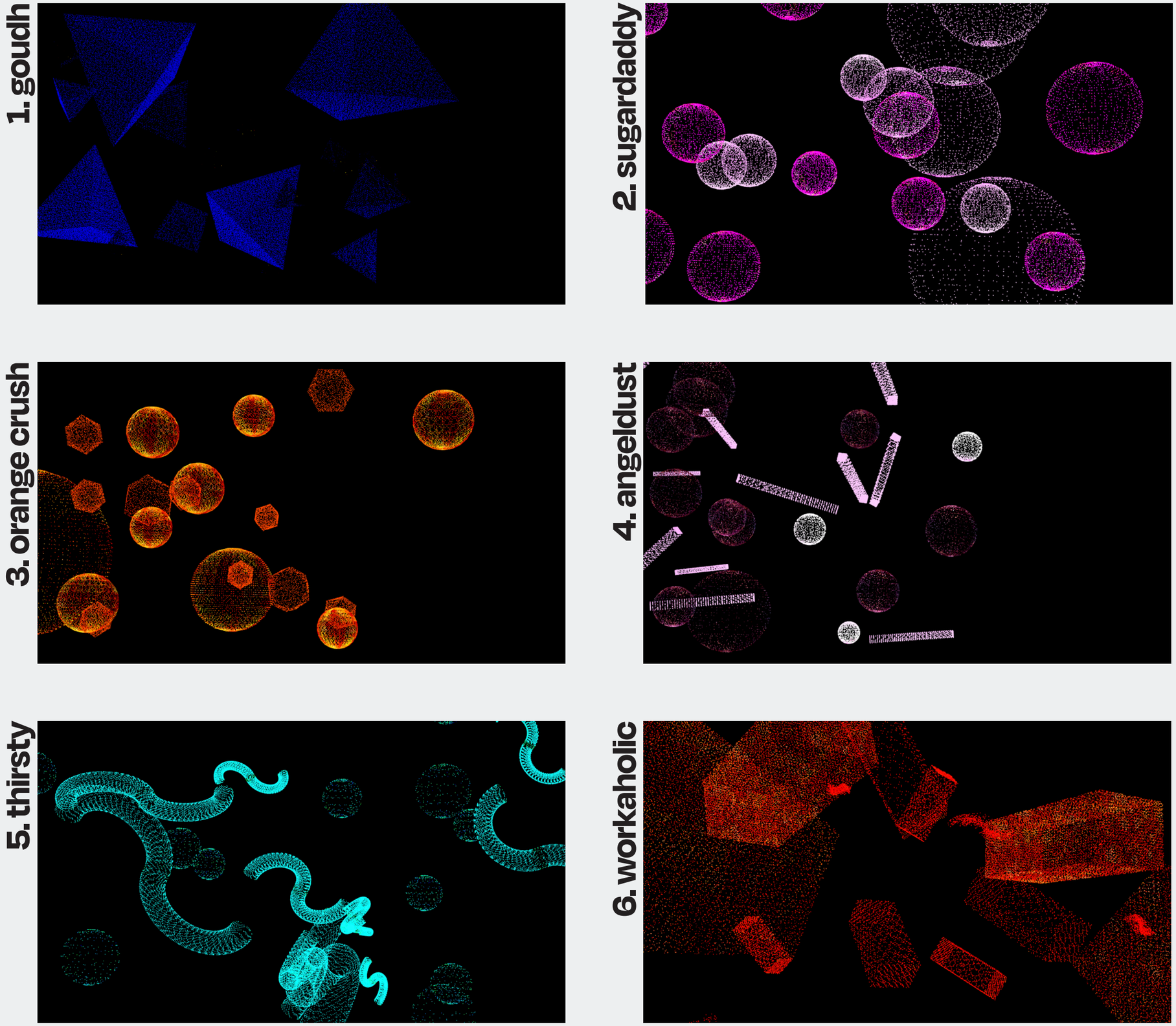


Figure 26: Particle Visualisation

prototype

The prototype consists of two parts, the display with the accords and a monitor with the visual (see Figure 27). The display is made with coding in Arduino IDE. The accord display consists of multiple hardware elements:

- Seeeduino Lotus: Micro Controller to control the sensors.
- 6 Chainable RGBW NEO LEDS: Visual cue of suggested fragrances.
- 7 Chainable RGBW NEO LEDS: Visual cue of selecting and deselecting accords.
- I2C Touch Sensor V3: A capacitive touch sensor with 8 channels is used to offer buttons.
- 7 bolts: Used as buttons.
- Plastic: Used as a diffuser for LEDs for the visual cue of suggested fragrances.

I want users to be able to select and deselect accords. The accords are: Powdery, Woody, Citrus, Floral, Oriental, Fruity and Fresh. When an accord is selected the LED that corresponds to that accord will turn green, when it is deselected it will turn into its original state: white. With the selected accords, the display will suggest fragrances, if the fragrance consists of the selected accords. The suggestion will be visible by turning the fragrance LED's into the color that corresponds with the fragrance. Bolts as buttons are chosen due to prototyping limits. I make use of an I2C Touch Sensor V3, with 12 channels. Each channel can be used as a button. A video of the display can be found with the following link. A video of the combinations of display and monitor can be found with the following link.

test goal

The goal of the first deepening sprint is to test the experience of the concept d'Accord and to test whether the visual stimuli provided has an influence on the perception of the fragrance.

tools & equipment

- Fragrance test strips are used to enable the participants to smell the fragrances. A number is written on the test strips. The number correlates to a specific scent. The strips are inside a glass container with a cork lid. This ensures that the smell stays inside the container.
- Coffee beans are used to make sure the noses of the participants are neutralized after each scent.
- A laptop is used with an interactive visual made in TouchDesigner.
- A prototype of d'accord is used.
- Fragrance test strips are used to enable the participants to smell the fragrances. A number is written on the test strips. The number correlates to a specific scent. The strips are inside a glass container with a cork lid. This ensures that the smell stays inside the container.
- Coffee beans are used to make sure the noses of the participants are neutralized after each scent.
- Six different objects are used. Each object is made to associate with one fragrance.

procedure

The test focuses on the experience of the concept. Participants are asked to select a fragrance they want to buy, using the prototype of d'accord. They select the accords they are interested in and smell the given suggestion while being supported by the visual stimuli. Afterwards, they are asked to fill in a questionnaire with questions regarding the experience and a little bit about the performance of the concept. I had eight participants.

Figure 27: Prototype 1

results

The questionnaire was split up in questions regarding experience and questions that give me an indication on performance. The results of the test of Deepening Sprint 1 can be seen in the figures below. The means can be found on the right side of the chart (1-5 Likert Scale).

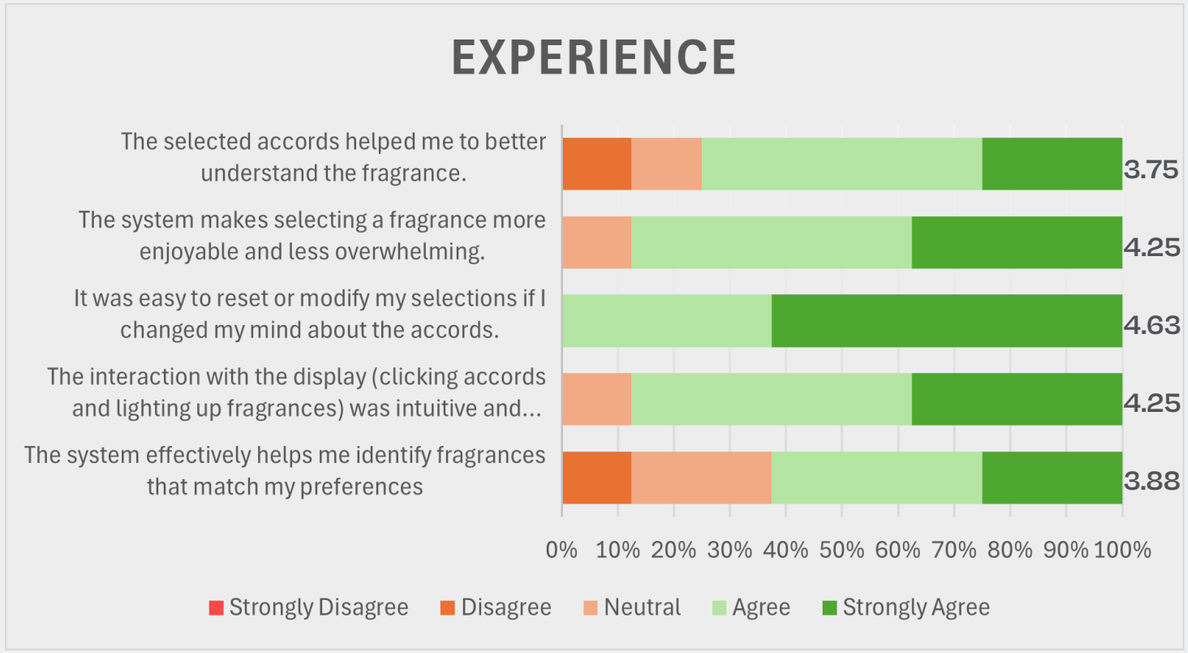


Figure 28: Results Experience

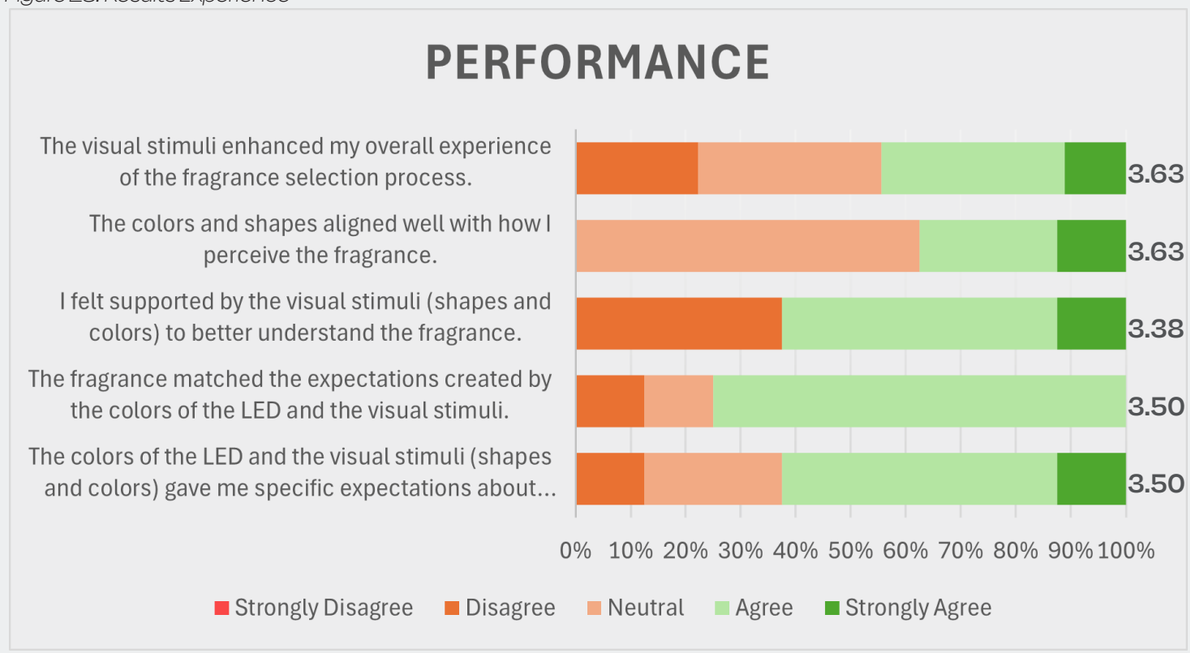


Figure 28: Results Performance

conclusion & discussion

The results of this deepening sprint test were insightful. The prototype scored well in terms of the concept's experience but had a lower performance.

The system did not score high in helping users identify the fragrances that match their preferences. This is due to the number of fragrances I used in my prototype. I used six Fugazzi fragrances. Participants told me that with this amount, it is possible to test all six of the fragrances instead of trying only the suggested fragrances. Participants told me that when there are eight or more options, they would not smell every fragrance, but just the suggested ones.

The interaction was very intuitive, but for the buttons, a few participants had the initial idea to turn the screws instead of pushing. For the following prototype, I will make use of a button that offers the affordance of pushing. It was really easy for participants to modify their accord selections. Many participants tried different accord options to ensure they smelled every fragrance, which also helped them identify the fragrances.

The prototype made selecting a fragrance more enjoyable and less overwhelming. However, it did not score particularly high on whether the selected accords helped better understand the fragrance. Some participants wanted to compare the fragrances, such as how woody a fragrance is compared to others. I will implement this feature in the following prototype.

The LED colors and the visual stimuli did not particularly give users expectations of the fragrance. This part could be iterated. Participants were mainly focused on the display and sometimes looked at the visuals. I have to find a way to let users focus on the visual stimuli. The prototype did not score high on this part since the visual stimuli did not give high expectations of the fragrances. The next iterations should give participants more expectations of the fragrances.

Participants found the shapes and colors of the visual stimuli too abstract. The shapes and colors did not highly align with the users' perception of the fragrance. It had no high value on the fragrance selection process, and felt detached from the whole experience. When looking back at my exploration sprints, the scenes made with generative AI, had the highest associations. I should integrate this into the concept.

In conclusion, this deepening sprint test provided valuable insights into the prototype's strengths and weaknesses. While the interaction was intuitive and made the scent selection process more pleasant and less overwhelming, there are key areas for improvement. Adjustments to the buttons will ensure they can be better pressed, and incorporating a comparison feature will allow users better to understand the scents in relation to each other. In addition, the visual stimuli need significant refinement, as their abstract nature did not match well with the perception of the scents and did not create clear expectations. Incorporating and integrating the more associative and engaging generative AI visuals from previous exploration sprints could improve this aspect. The next iteration will focus on refining these elements to improve the prototype's performance and create a more cohesive and immersive experience

d2: d'accord v2

Based on the results of Deepening Sprint 1, the concept needs to be adjusted, and new features need to be added. I will change the visual cue, find a way to integrate it into the display, and add a fragrance-comparing feature. In Deepening Sprint 2, I will refine the concept, make the final prototype, and validate it.

integrated media

To integrate visual media into the display, a monitor will be positioned behind the shelves that hold the fragrances. This monitor will be incorporated into the display using a physical grid, allowing for varying degrees of abstraction. From a distance, the visuals will appear more defined, while up close, the grid structure will become more prominent, creating a dynamic and layered visual experience.

To determine the optimal grid size, I conducted tests using a 3D model featuring a monitor displaying visuals behind three grid variations: small, medium, and large (see Figure 29). The small grid proved most effective in balancing abstraction levels. Up close, the visual appears pixelated, while from a distance, it becomes more refined, aligning with the Gestalt principle, law of proximity. The medium grid allowed for greater visibility of the visual, but due to the abstract nature of the imagery, the overall definition was reduced. The large grid provided the highest resolution but failed to create a strong abstraction effect, as most of the visual remained clearly visible, diminishing the impact of the Gestalt principle. Based on these findings, the small grid was chosen for its ability to enhance visual perception dynamically across different viewing distances.

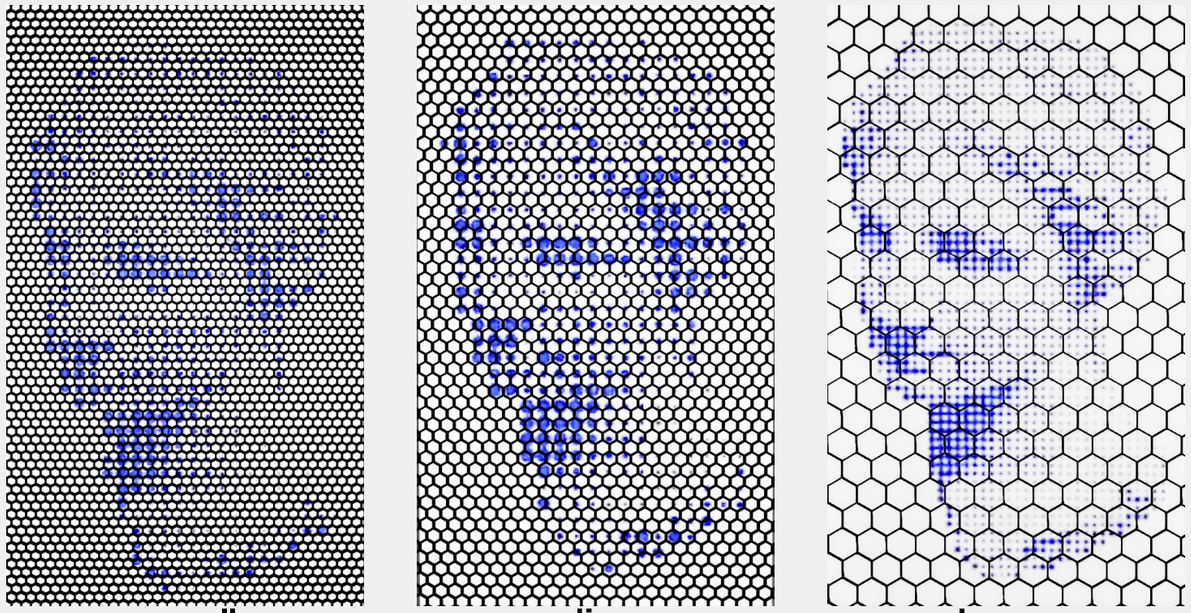


Figure 29: Test Grid

comparing fragrances

I want to add the feature that enables users to compare accords among fragrances. I will make use of the integrated monitor, to give visual suggestions to the users. I gave fragrances a score for each accord, based on the database of Fragrantica (Fragrantica, n.d.). The score is given in relation among the fragrances. This score will control the size of the shape that will appear behind the fragrance (see Figure 30). It resulted in the following scores (when a fragrance doesnt have the accord, the score will be 0).:

1. angeldust
- Oriental: 0
- Woody: 10
- Fresh: 0
- Floral: 0
- Citrus: 10
- Fruity: 0
- Powdery: 60

2. goudh
- Oriental: 10
- Woody: 40
- Fresh: 0
- Floral: 30
- Citrus: 20
- Fruity: 20
- Powdery: 0

3. thirsty
- Oriental: 0
- Woody: 30
- Fresh: 100
- Floral: 10
- Citrus: 0
- Fruity: 40
- Powdery: 10

4. workaholic
- Oriental: 40
- Woody: 0
- Fresh: 0
- Floral: 50
- Citrus: 0
- Fruity: 0
- Powdery: 10

5. sugardaddy
- **Oriental:40**
- **Woody: 10**
- **Fresh: 0**
- **Floral: 10**
- **Citrus: 20**
- **Fruity: 40**
- **Powdery: 0**

6. orange crush
- Oriental: 10
- Woody: 10
- Fresh: 0
- Floral: 0
- Citrus: 50
- Fruity: 0
- Powdery: 20

Figure 30: Accord Scores

visual cue

In Exploration Sprint 2, I tested the associations between the generated images and the fragrances. This led to high associations, but Angeldust, Goudh and Orange crush needed a revision. The utilized generated scenes can be found in Figure 31.

- The original scene of Goudh was focused on the dominance of the fragrance, but the smooth characteristic of the fragrance was not found in the image. The following revision ensures that all characteristics of the fragrance are in the image.
- Angeldust did score the highest association with the image it was created for. I want the next iteration to be more focused on the linear, heavenly and accessible characteristics for the fragrance.
- The image of orange crush was highly associated with a Mediterranean market, but the fragrance was not. The next iteration of the image does not focus on the market, but more on the characteristics of the fragrance.

rasterization

The generated images will be rasterized in the shape that's most associated with the fragrance. This rasterization will interact well with the physical grid and the law of proximity. When the user is close by, the rasterization will be abstract and not much of the scene will be visible. The user has to take a step back, to see a more defined version of the scene. This interaction encourages participants to take a physical step back to fully experience the fragrance. In Figure 32, on the next page, you can see the abstract scene and the more defined scene.

states

The visual display operates in three distinct states: (A) Idle, (B) Accord, and (C) Scene.

- **State A (Idle):** When there is no user interaction, an abstract visual is displayed to attract customers and encourage engagement with the fragrances.
- **State B (Accord):** Upon selecting accords, a shape appears behind each flacon. The shape's color corresponds to the fragrance, while its size reflects the degree of overlap between the fragrance and the chosen accords.
- **State C (Scene):** When a customer picks up a flacon and blotter, the display shifts to an abstracted scene of the selected fragrance, expanding across the monitor. Stepping back not only clarifies the image but also interacts with the grid, enhancing the visual effect. This encourages simultaneous engagement with the scent and its visual representation, creating a richer multisensory experience.

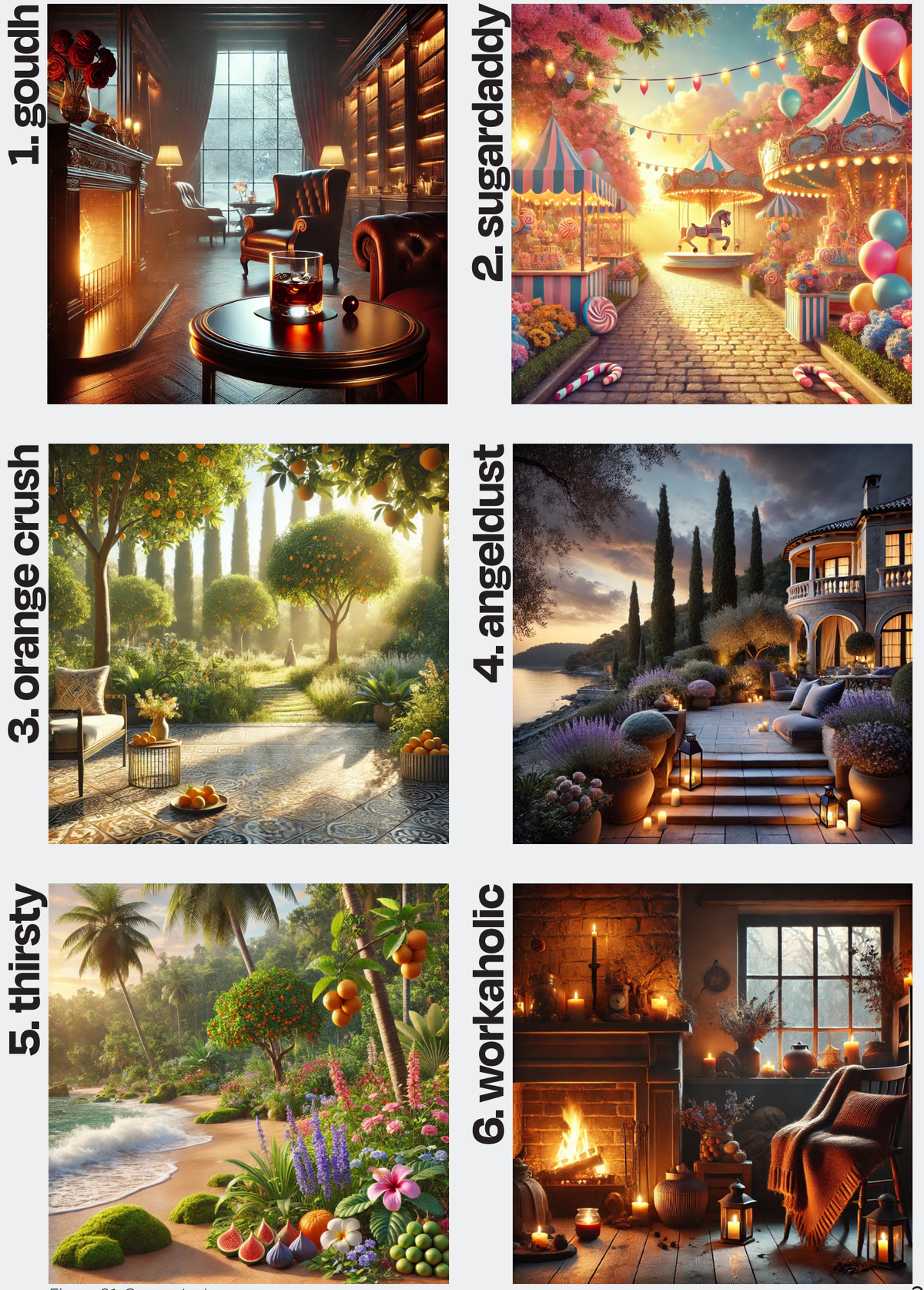


Figure 31: Generated scenes

5. thirsty

3. orange crush

1. goudh

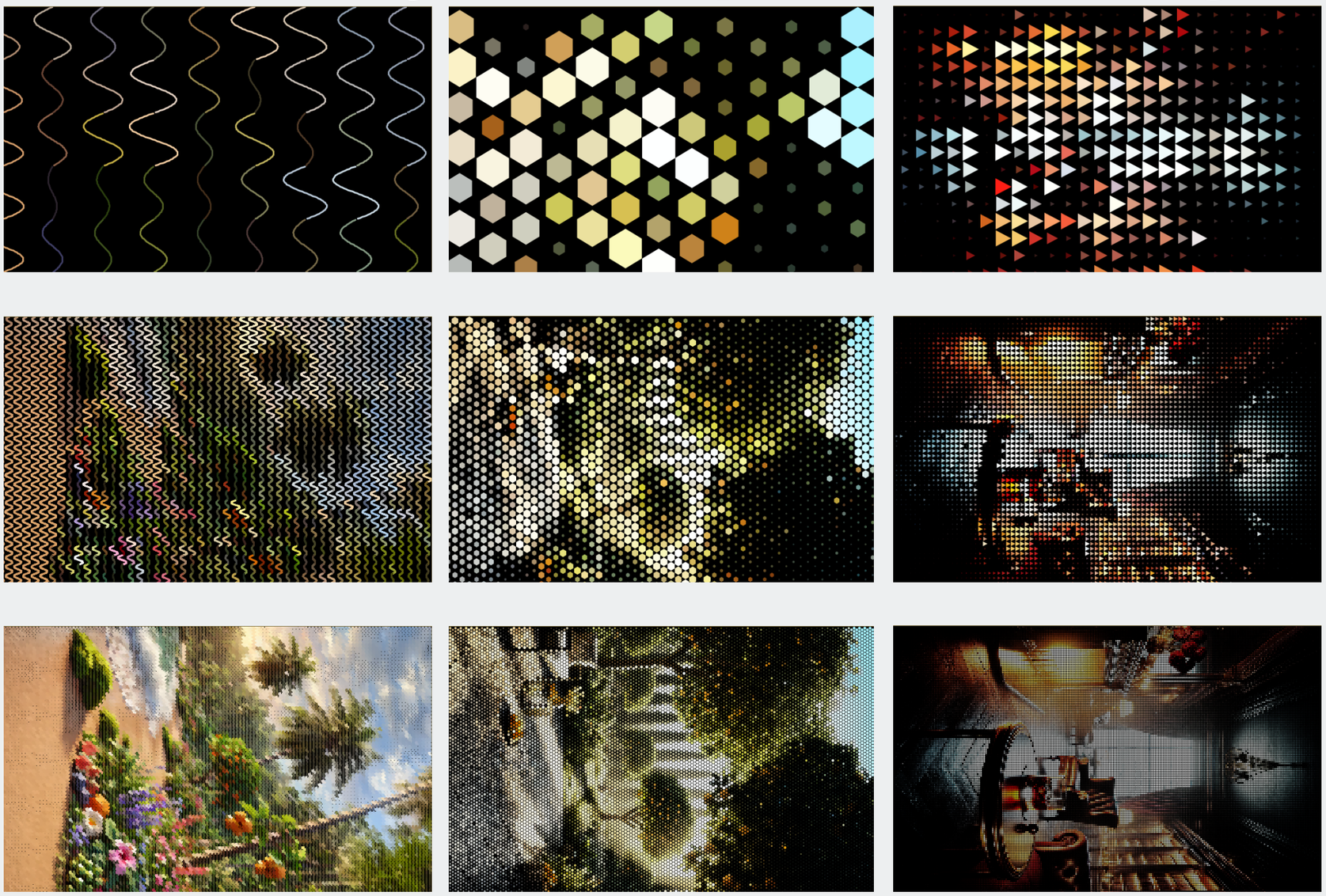
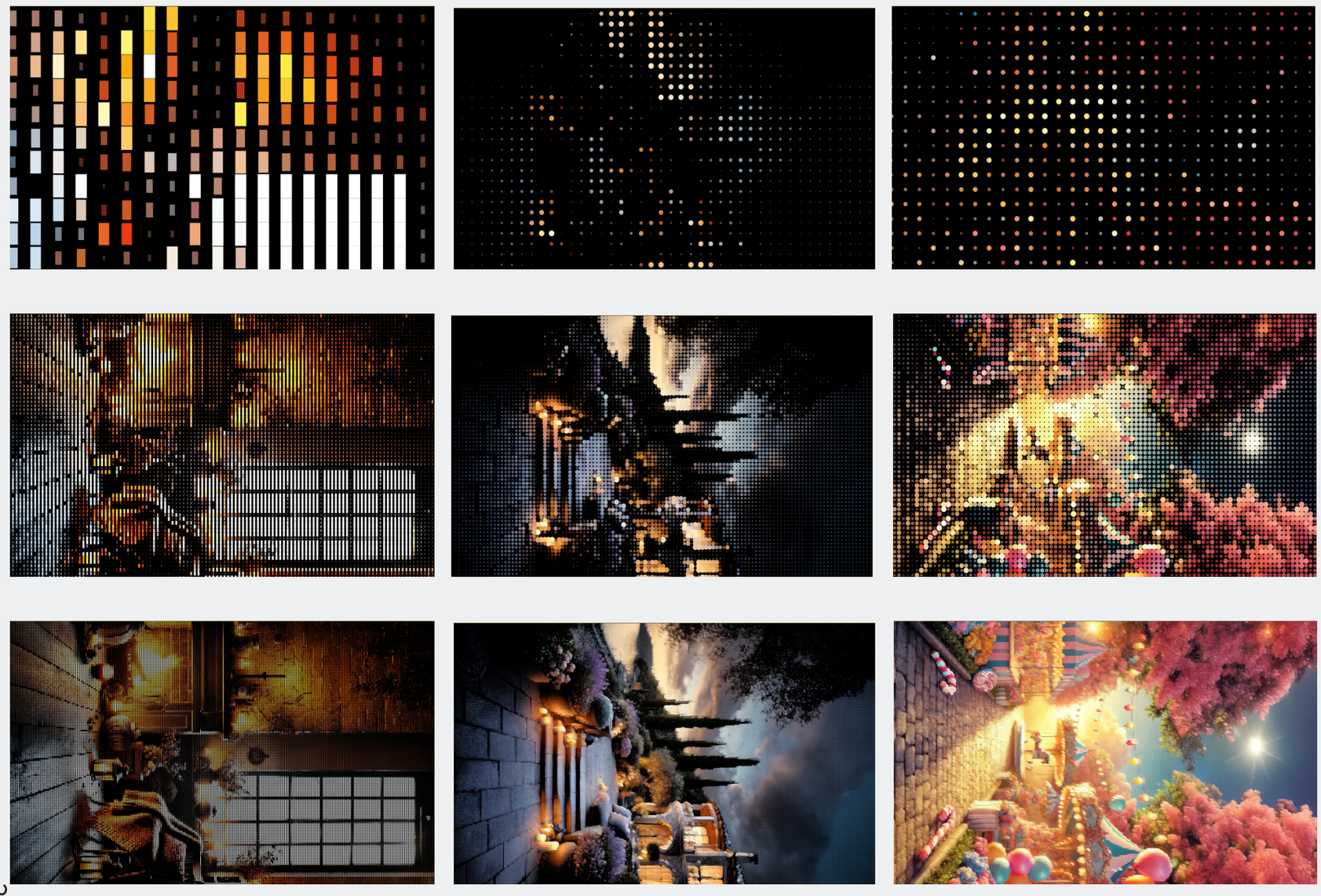


Figure 32: Rasterized scenes

6. workaholic

4. angeldust

2. sugardaddy



prototype 2

The prototype consists of three parts, all integrated into each other: the hardware, the visual and the physical display itself. The following hardware is used:

- Raspberry Pi M4 Grove: Micro Controller, with high memory to control the sensors.
- 7 Chainable RGBW NEO LEDS: Visual cue of selecting and deselecting accords.
- I2C Touch Sensor V3: A capacitive touch sensor with 8 channels is used to offer buttons.
- 7 Copper buttons: Used as buttons.
- 7 Time of Flight sensors (VL53L0x): 6 Sensors are used to toggle state among the visual and 1 sensor to continuously measure the distance, to control the rasterization.
- I2C 8 Hub Multiplexer: Allow for 7 VL53L0X Time of Flight sensors.
- Diffusion paper: Used as a diffuser for LEDs for the visual cue of suggested fragrances (see Figure 36).

The coding for the hardware is done in Arduino IDE. The sensors will control parameters, through Serial, in the visual created in Processing.

The physical display is designed in Solidworks (see Figure 33) and the components are laser cut (see Figure 34). A new feature that I added, is to give the visual cue of the selected accords, by lighting up the letters of the accords. The letters of the accord are cut out, a diffusion paper is placed behind the letters and the letters light up by creating a lightbox for each accord.

The finished protype in the three states can be seen in Figure 37. A video of the working prototype can be seen through the following link.

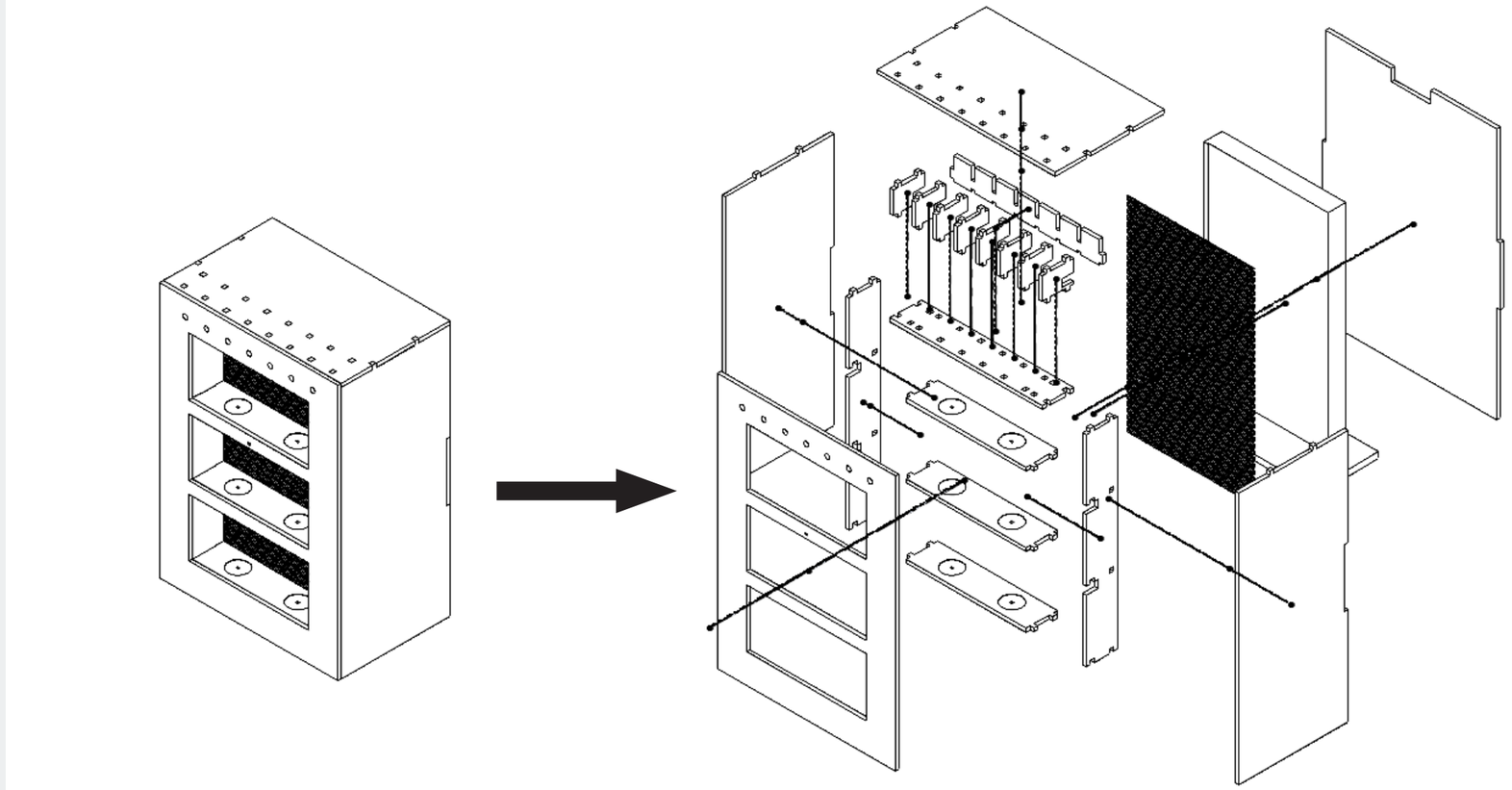


Figure 33: Exploded view components

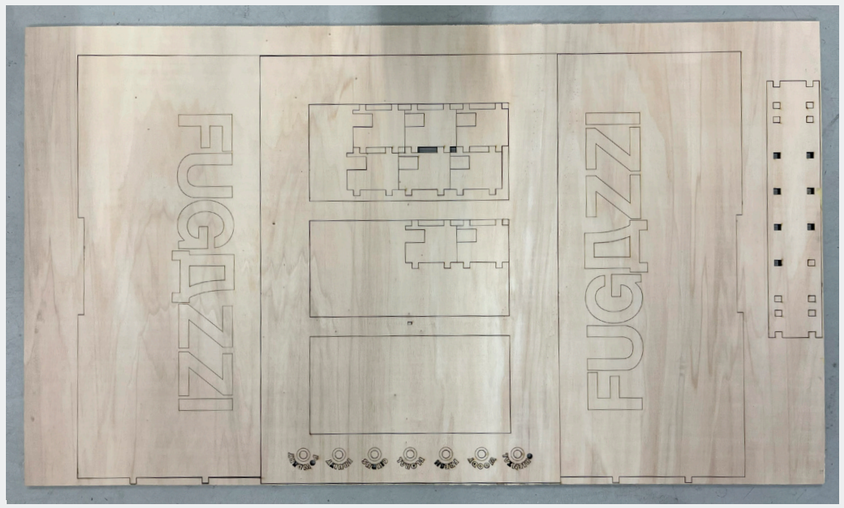


Figure 34: Lasercut

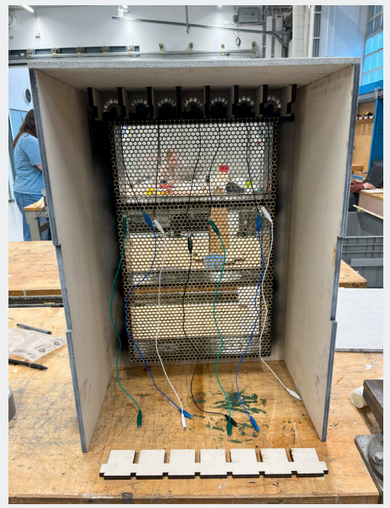


Figure 35: Hardware with display

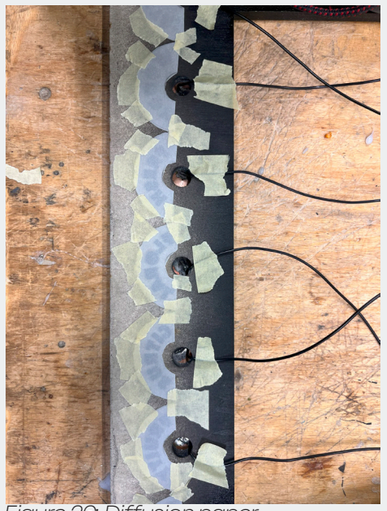


Figure 36: Diffusion paper

state 1

state 2

state 3

Figure 37: Prototype 2 in 3 states

test goal

This test aims to determine whether the perception of a fragrance can be made less ambiguous by using cross-modal cues to influence and frame the olfactory experience.

hypothesis

If cross-modal correspondences are used as sensorial cues, then participants will show a higher degree of agreement in their fragrance perception compared to a control group with faulty cues.

tools & equipment

- Bottles of 100 ml are used to let participants test the fragrances.
- Blotters are made specifically for each fragrance.
- Fragrance test strips enable the participants to smell the fragrances. A number is written on the test strips, which correlate to a specific scent. The strips are inside a glass container with a cork lid, which ensures that the smell stays inside the container.
- Coffee beans are used to ensure the participants' noses are reset after each scent.
- The second prototype of d'accord is used.

procedure

I plan to have 16 participants. Each participant will initially smell the fragrances without associations. They are asked to rate the fragrances on emotional response, pick out their most and least favorite fragrance and give each fragrance a name.

Then they are asked to complete several tasks, interacting with the display. This will result in them testing each fragrance again. For each fragrance, they receive the visual stimuli, and before they smell the fragrance, they are asked to guess which fragrance fits the visual stimuli. After smelling the fragrance, they must rate it again on emotional response.

Very Unpleasant	——	Very Pleasant
Very Calming	——	Very Stimulating
Very Submissive	——	Very Dominant

After completing all the tasks, they are asked to pick the most favorite and least favorite fragrances again. They again have to answer the questions related to this topic.

Afterwards, they are asked to fill in a short questionnaire about the experience of the display.

adjustments

Participants have difficulty connecting the visual stimuli to the fragrance's made-up name. By asking the participants to give the fragrances a name, I ask them to give their initial association. This name is more important to the participants than I thought. Initially I thought the name would be a mean for participants to remember the fragrance, but it results in associations. To solve this problem, I won't use a name to let participants remember the fragrances. I will give them the visual stimuli by interacting with the prototype and ask them to choose a test tube that best fits the fragrances.

results

selection process

The average rating of the most favorite fragrance is slightly higher when participants use d'Accord, while the rating of the least favorite fragrance is slightly lower when participants use d'Accord (see Figure 38). This suggests that the display improved their ability to distinguish between scents. For the blind selection process, the participants were less confident in their choices (6.94). Utilizing d'Accord, their confidence was higher (7.69).

Figure 38: Results Selection Process

emotional response

The fragrances are mapped between pleasure-arousal (see Figure 39), pleasure-dominance (see Figure 40), arousal-dominance (see Figure 41). The circles with an outline are the results after the use of d'Accord. In Appendix A you can find the results for each fragrance. The difference in standard deviation can be seen in Figure 42.

Participants perceived Angeldust as more pleasant while using d'Accord (7.44) than without d'Accord (6.69). The standard deviation decreased from 1.62 to 0.96. This means that responses became less spread out, indicating a greater agreement among participants when they used the prototype.
The average score for the arousal scale decreased from 5.19 to 3.63, while the standard deviation decreased slightly. There is almost no difference in the mean for the dominance scale. The standard deviation is slightly decreased.

For Goudh, the mean for the pleasure scale is almost the same, but the standard deviation is significantly lower (from 1.62 to 0.96). This indicates that the variation between scores decreased. There is not much difference in the arousal and dominance scales. For both scales, the standard deviation decreases. There is slightly more agreement among participants for these scales.

Thirsty scores significantly higher on the pleasure scale if the prototype is used. The mean increased from 5.69 to 6.44, while the standard deviation decreased from 2.06 to 1.46.

Participants tended to give higher ratings for pleasure after the intervention, and the responses became less spread out. Thirsty is perceived as slightly more calming when the prototype is used. The standard deviation also decreased from 2.05 to 1.75. The fragrance is also perceived as slightly less dominant when d'Accord is used (6.24-5.81). There is also a decrease in standard deviation (1.93-1.75).

d'Accord did not significantly influence Workaholic's emotional responses. The standard deviation of the pleasure scale decreased from 1.7 to 1.21, but it increased slightly for the other two scales.

The participants rated Sugardaddy as slightly more pleasant, while the standard deviation was slightly reduced, from 1.57 to 1.39. There was not much influence on the other two scales. The standard deviation of the ratings of the dominance scale even increased a bit.

The average of the pleasure scale did not change much, but the standard deviation decreased from 1.7 to 0.89, indicating a higher agreement among participants. Orange Crush was rated less stimulating and more dominant after the participants used the prototype. There is almost no difference in standard deviation for the arousal scale, but there is a reduction for the dominance scale, from 1.82 to 1.58.

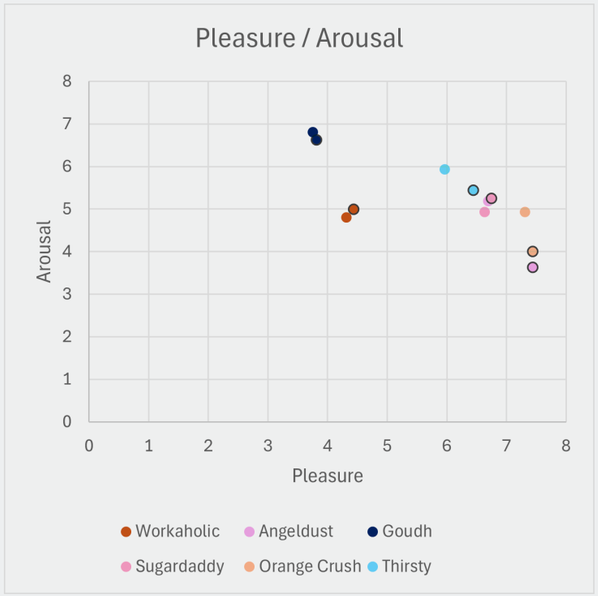


Figure 39: Results Emotional Response (PA)

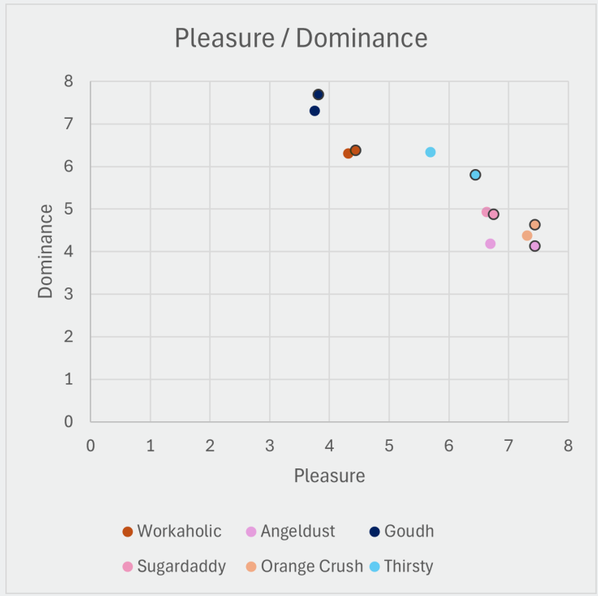


Figure 40: Results Emotional Response (PD)

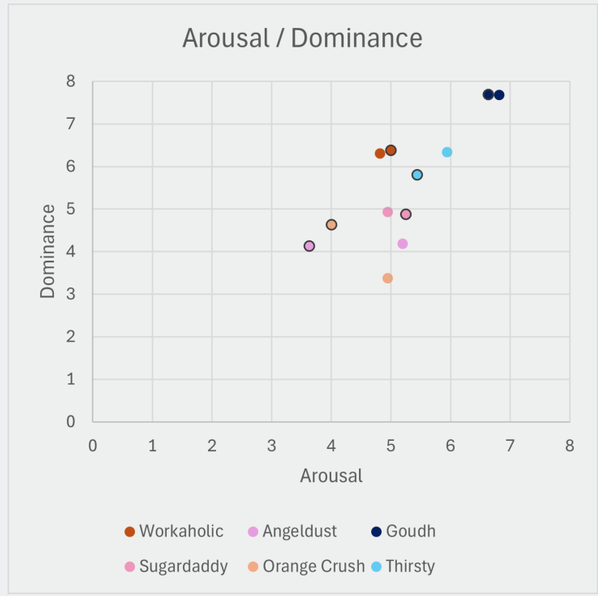


Figure 41: Results Emotional Response (AD)

Figure 42: Results Emotional Response Standard Deviation

expectations

For the visual stimuli, Sugardaddy and Thirsty had the highest correct expectancy rates, both at 50%. Goudh followed with 47%, while Workaholic had a correct selection rate of 44%. For Orange Crush, 38% of participants identified the correct fragrance. The lowest accuracy was observed for Angeldust, with only 19% of participants making the correct association. See Figure 43 for a visualisation of the results.

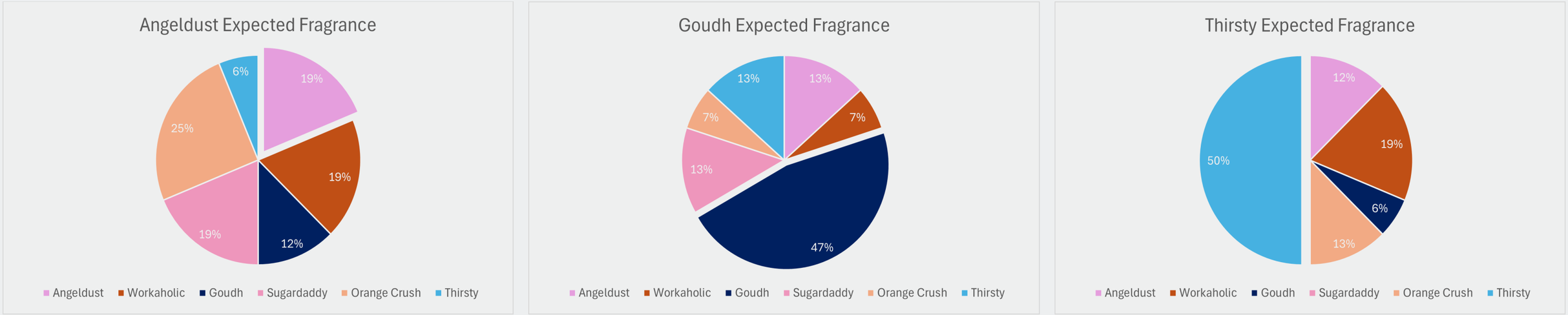


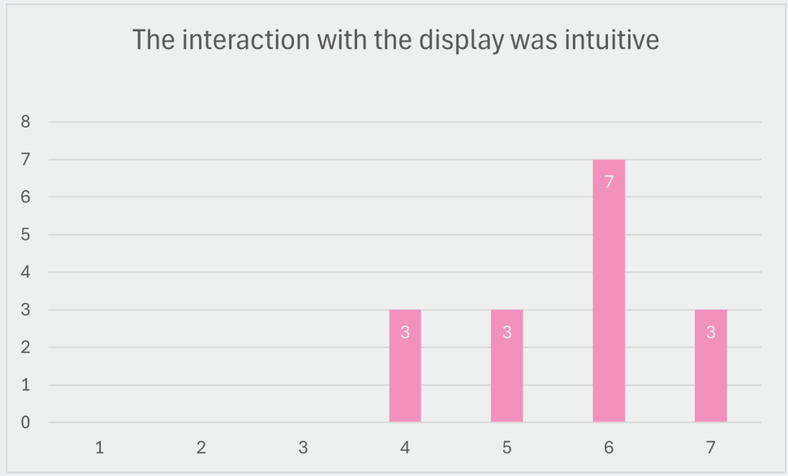
Figure 43: Results Expectations

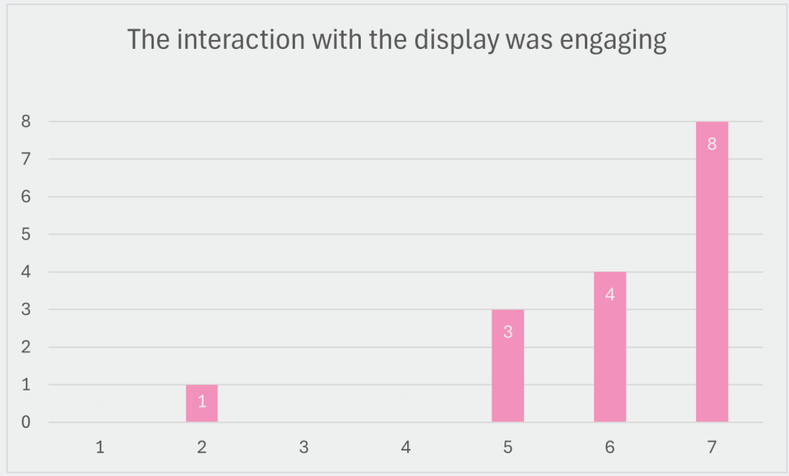
experience

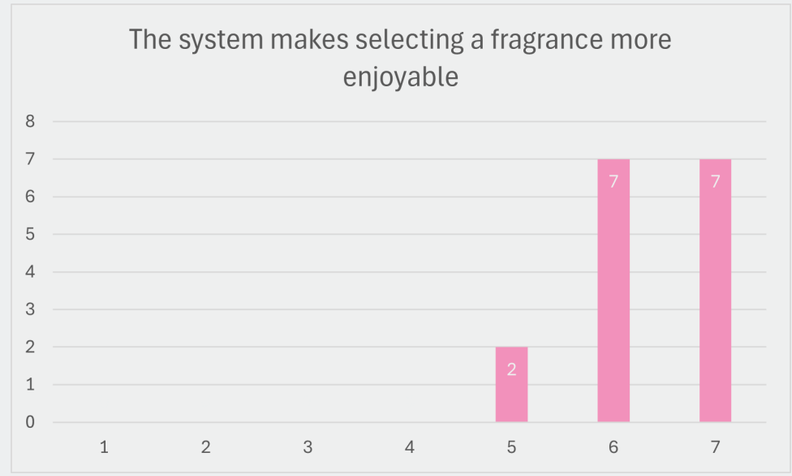
The results of each question are shown in Figure 44. Participants found the prototype intuitive. The buttons had the affordance of being pushed, and the way d'Accord suggested and compared fragrances was very intuitive. Some participants noted that they preferred the buttons to be on the bottom display, making it ergonomically easier to reach them. Another aspect to improve is the interaction of walking back to see the scene fully as some participants found it disorienting. Interacting with d'Accord was very engaging.

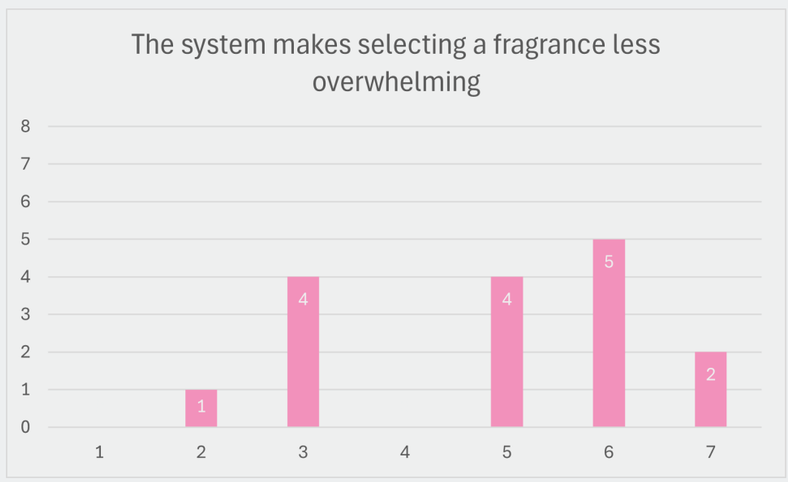
The concept made the selection process more enjoyable, but there was a split among the participants about whether the concept made the selection process less overwhelming. A small group found all the stimuli received overwhelming, but the majority found it less overwhelming.

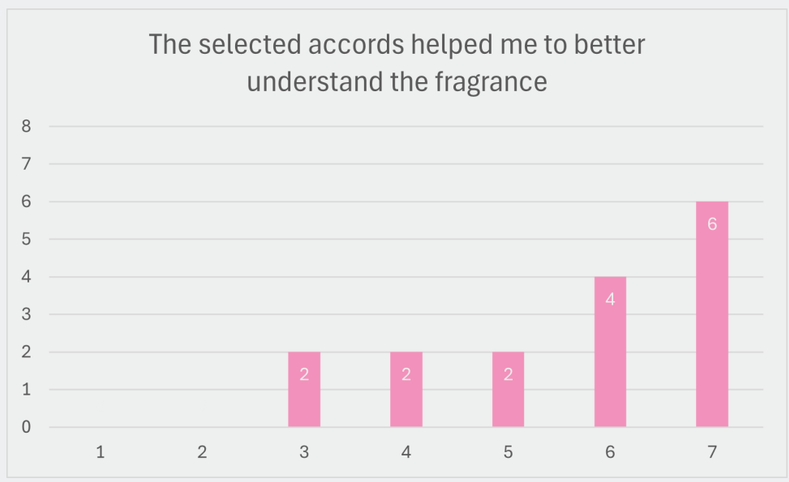
The selected accords helped participants better understand the fragrance, and the comparison feature played a major role in this. The visual stimuli did not score high in terms of whether the participants felt supported by them, but some participants stated that they helped them better place a fragrance. They told me that they were confused about a fragrance when they smelled it blind and that they could place it better when they received the visual stimuli. The visual stimuli could be improved when this concept is realized.











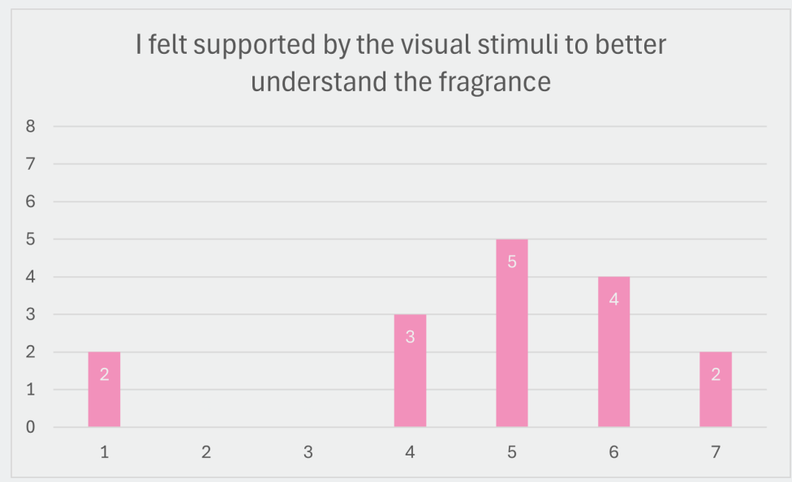


Figure 44: Results Experience

conclusions & discussion

The findings on the selection process imply that d'Accord enhances fragrance selection by making preferences more distinct and boosting participants' confidence in choices. For most fragrances, the standard deviation of ratings decreased, meaning participants' responses became more consistent when using d'Accord. This suggests that the prototype helped create a more uniform perception of the scents.

Angeldust and Thirsty were rated as more pleasant with d'Accord, and Sugardaddy also saw a slight increase in pleasantness. Goudh and Orange Crush showed no significant change in average pleasure ratings but higher agreement among participants. Workaholic's pleasure rating remained largely unchanged. When d'Accord was used, Angeldust and Thirsty were perceived as more calming, while Orange Crush was also rated as less stimulating. For most fragrances, dominance scores remained stable or showed only minor changes. Thirsty was perceived as slightly less dominant and Orange Crush was rated as slightly more dominant.

The emotional response to Workaholic and Sugardaddy remained largely unaffected. d'Accord generally helped participants agree more on their scent perceptions by reducing variation in ratings. It increased the perceived pleasantness of some fragrances (Angeldust and Thirsty) and made some fragrances feel more calming. However, it had little impact on dominance ratings and did not significantly influence Workaholic and Sugardaddy.

When combining the results of d'Accords impact on emotional response with the accuracy of the visual stimuli and fragrance pairings, several patterns emerge:
Angeldust had the lowest visual accuracy (19%) but saw a significant increase in perceived pleasantness and calming effects with d'Accord. This suggests that while the visual did not strongly align with participants' expectations, d'Accord still influenced their experience positively and it might be able to direct the perception of a scent.

Thirsty had one of the highest correct visual matches (50%) and showed a strong improvement in pleasure and calming perception of the fragrance. This suggests that the visual stimuli effectively reinforced the fragrance characteristics. Sugardaddy and Thirsty had the highest correct expectancy rates (50%). Thirsty saw a higher increase in pleasure ratings than Sugardaddy. Goudh (47%) and Workaholic (44%) had relatively good visual accuracy. Still, d'Accord had little to no impact on their perceived pleasantness, suggesting that correct visuals alone may not be enough to alter perception significantly.

Orange Crush (38%) and Angeldust (19%) had both the lowest visual accuracy and the highest improvement in agreement and pleasantness. This implies that when the visual stimuli is further away from the intended perception, it has the highest influence on the emotional response. The lower the visual accuracy, the higher the emotional impact of d'Accord. When visuals were not aligning well, d'Accord helped reshape perceptions and increase agreement. When the visual aligns well with the fragrance, d'Accord has less of an effect on emotional response, but the visual stimuli for Thirsty effectively reinforce the fragrance characteristics.

It is noteworthy that the fragrances with a more defined emotion profile (see page 8) had a higher rate of correct expectancies. Thirsty, Sugardaddy, and Goudh had the most defined emotional response in the Exploration Sprint 1 test. These fragrances scored the highest in correct expectancies, while Workaholic, Orange Crush, and Angeldust had a less defined emotional response and the lowest correct expectancies. The fragrances with a less defined emotional response also had the biggest decrease in standard deviation for the pleasure scale. This suggests that fragrances with a less defined emotional response are more ambiguous and that d'Accord had the highest effect on a higher agreement among participants in the pleasure scale.

D'Accords interaction is intuitive and engaging. However, the interactive element of walking backward could be improved, as participants found it confusing. The concept makes selecting a fragrance more enjoyable for everyone, but the sensorial cues overwhelm a small group. The majority find that the concept makes selecting a fragrance less overwhelming. The feature that allows users to select accords helps them to understand the fragrance better. The visual stimuli also contribute to this, but this feature can be improved.

In conclusion, cross-modal correspondences between Smell and Vision can be used to frame the perception of a fragrance. Visual stimuli could make the perception of a fragrance less ambiguous. D'Accord had the highest effect on the pleasure scale, making the perception of fragrances with a less defined emotion profile less ambiguous. The results suggest that it is possible to direct the perception of a fragrance by utilizing visual stimuli that are farther away from the common perception, but this needs to be tested in the future. D'Accord has the ability to bring a higher level of agreement among people on the emotional response to a fragrance, but it might also be able direct the perception of a fragrance.

recommendations

Based on the findings of user test of Deepening Sprint 2, the following recommendations aim to improve the design's functionality and usability:

The visual stimuli in state three need to be improved to better support users in understanding the fragrance. They could better align with the fragrance or direct the perception of a fragrance. For the second option, further research needs to be done on how to direct the perception of a fragrance to a certain emotional response.

The concept needs to be integrated into a retail environment. I made the first iteration of how the concept can be manifested in the Fugazzi flagship store (see Figure 45). See Appendix B for more renders. The three states are shown in Figure 46. For state 2, the suggestion shape needs to be similar to the shape of Fugazzi's flacon. There also needs to be a visual cue that when accords are selected or deselected, they influence the suggestions. This can be done by drawing a line from the place where the accords are selected to the suggested fragrances.

The place where the accords are selected is moved to the bottom of the integrated media wall. This ensures that it is ergonomically easier to select and deselect accords. This placement is also more intuitive (see Figure 47).

To develop this concept, we need to consider what happens when a new fragrance is launched and how the visual stimuli are updated when there are more d'Accords worldwide.

Figure 47: Interaction Box

Figure 45: d'Accord in retail environment

Figure 46: Three states

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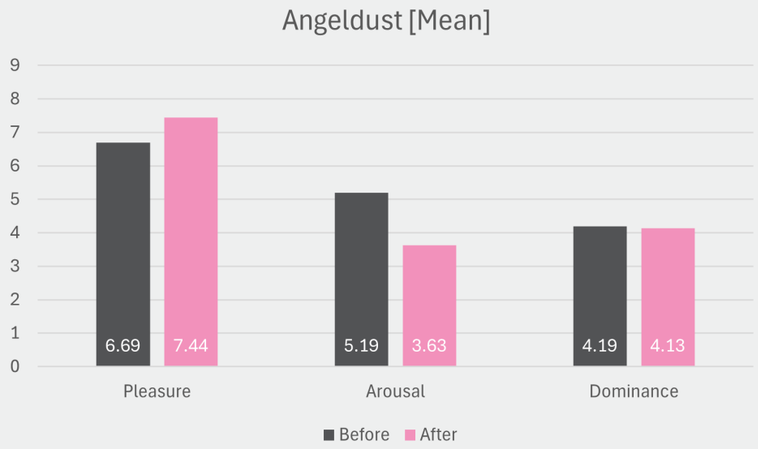
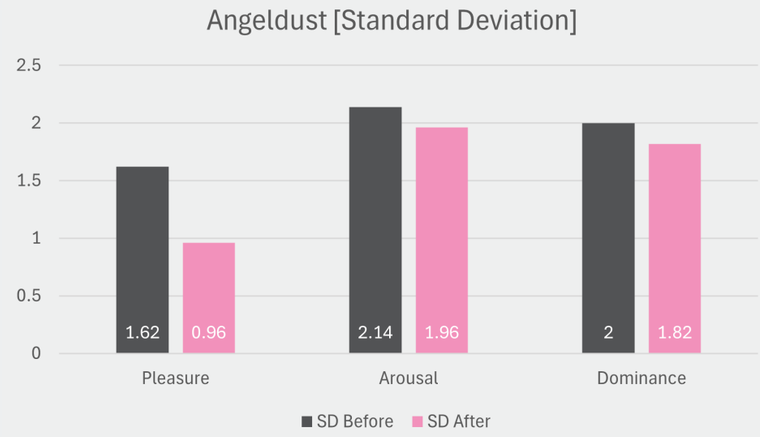
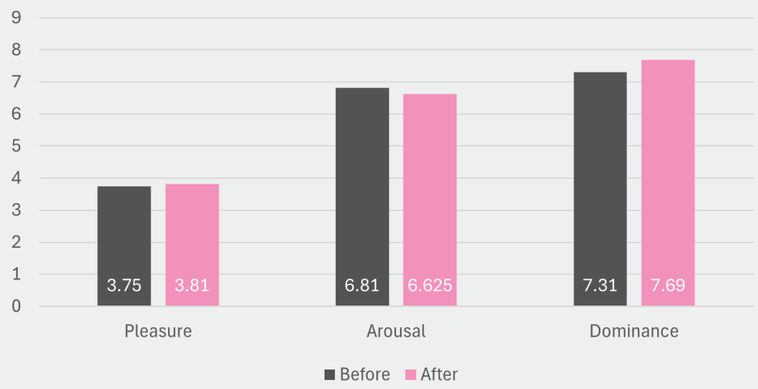
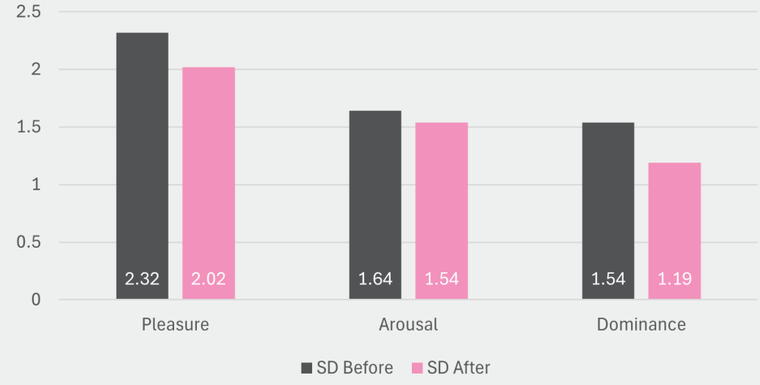
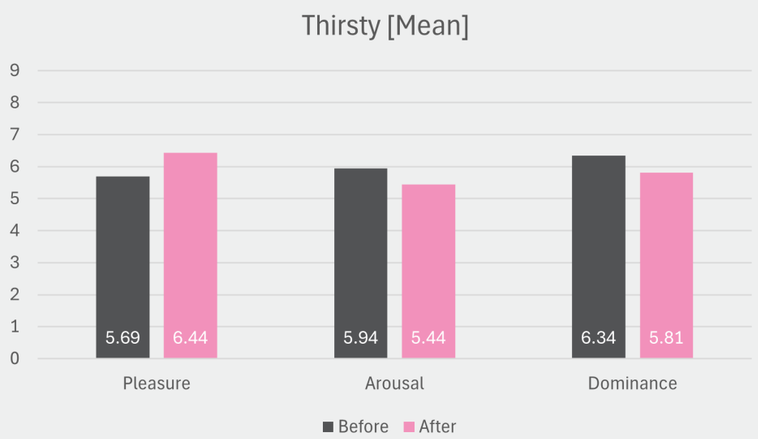
appendix a

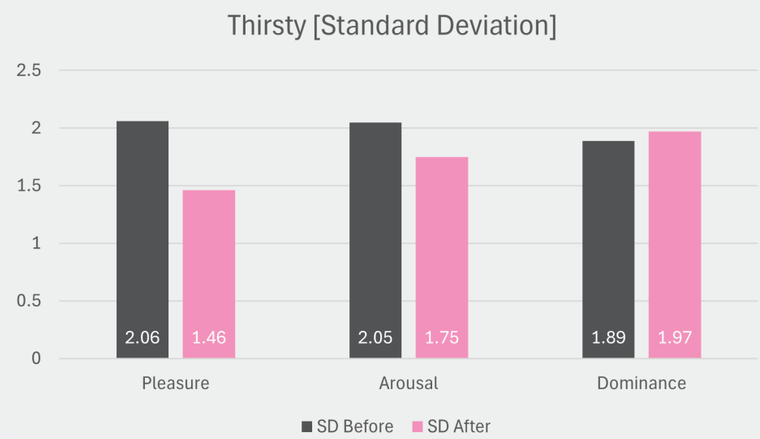

Angeldust [Mean]
9
8
7
6
5
4
3
2
1
0
6.69
7.44
5.19
3.63
4.19
4.13
Pleasure
Arousal
Dominance
Before
After


Angeldust [Standard Deviation]
2.5
2
1.5
1
0.5
0
1.62
0.96
2.14
1.96
2
1.82
Pleasure
Arousal
Dominance
SD Before
SD After

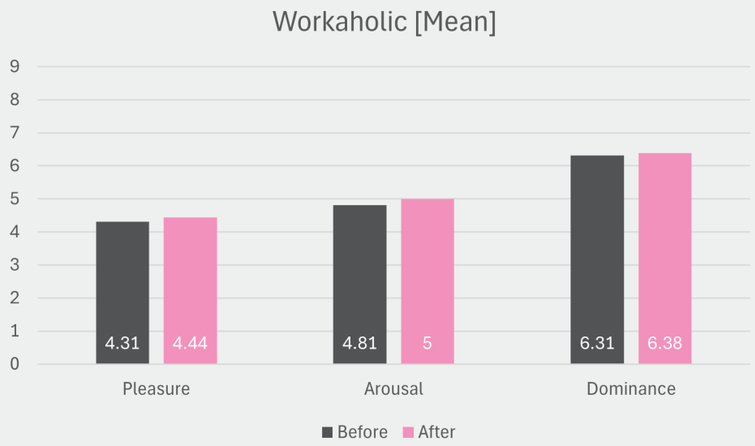

Goudh [Mean]
9
8
7
6
5
4
3
2
1
0
3.75
3.81
6.81
6.625
7.31
7.69
Pleasure
Arousal
Dominance
Before
After


Goudh [Standard Deviation]
2.5
2
1.5
1
0.5
0
2.32
2.02
1.64
1.54
1.54
1.19
Pleasure
Arousal
Dominance
SD Before
SD After


Thirsty [Mean]
9
8
7
6
5
4
3
2
1
0
5.69
6.44
5.94
5.44
6.34
5.81
Pleasure
Arousal
Dominance
Before
After


Thirsty [Standard Deviation]
2.5
2
1.5
1
0.5
0
2.06
1.46
2.05
1.75
1.89
1.97
Pleasure
Arousal
Dominance
SD Before
SD After

appendix a


Workaholic [Mean]
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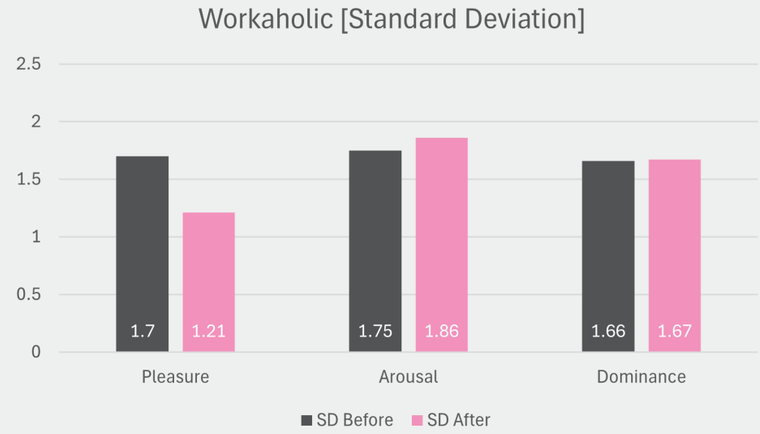
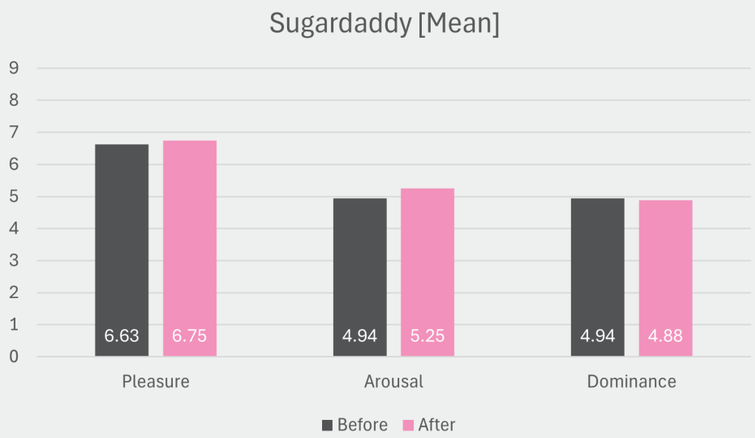
8
7
6
5
4
3
2
1
0
4.31
4.44
4.81
5
6.31
6.38
Pleasure
Arousal
Dominance
Before
After


Workaholic [Standard Deviation]
2.5
2
1.5
1
0.5
0
1.7
1.21
1.75
1.86
1.66
1.67
Pleasure
Arousal
Dominance
SD Before
SD After


Sugardaddy [Mean]
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8
7
6
5
4
3
2
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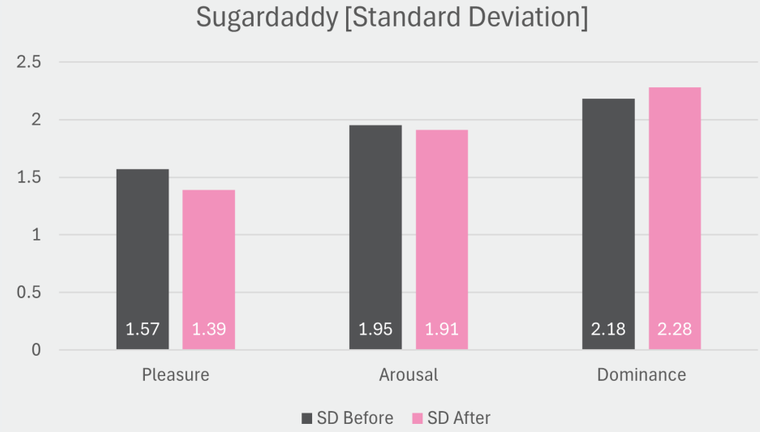
0
6.63
6.75
4.94
5.25
4.94
4.88
Pleasure
Arousal
Dominance
Before
After


Sugardaddy [Standard Deviation]
2.5
2
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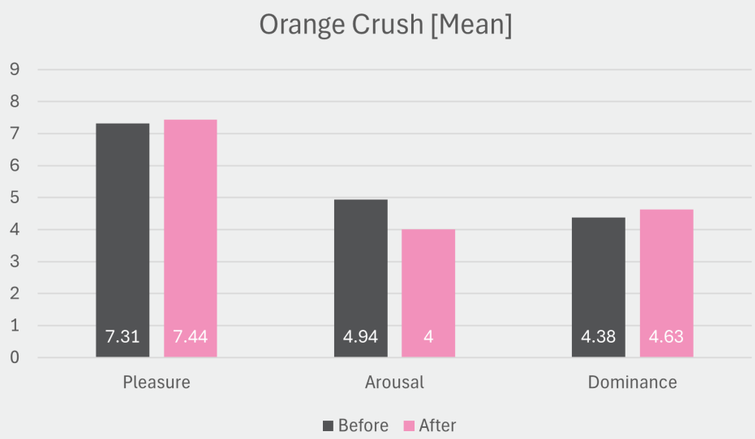
2.28
Pleasure
Arousal
Dominance
SD Before
SD After


Orange Crush [Mean]
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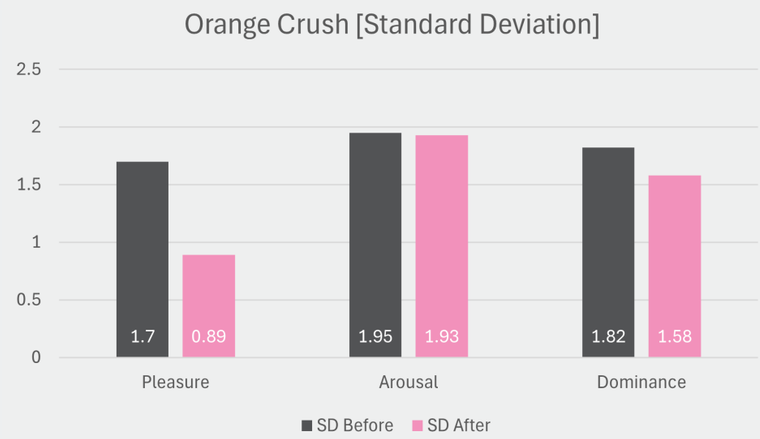
8
7
6
5
4
3
2
1
0
7.31
7.44
4.94
4
4.38
4.63
Pleasure
Arousal
Dominance
Before
After


Orange Crush [Standard Deviation]
2.5
2
1.5
1
0.5
0
1.7
0.89
1.95
1.93
1.82
1.58
Pleasure
Arousal
Dominance
SD Before
SD After

appendix b


FUGUZZI
WOODY
POWDERY
FLORAL
ORIENTAL
FRUITY
CITRUS
FRESH


WOODY
POWDERY
FLORAL


FUGUZZI
FUGUZZI