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BUILDING RELEVANT CONTEXTS TO DESIGN EXPERIENCES

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ABSTRACT

In advanced phase of design, it is essential to anticipate consumers' expectations. But this information should not restrain designer's creativity, and should encourage innovation. By basing us on Kansei engineering, sensory metrology and experience design, we built an exploratory tool to collect users' sensory trends and their cognitive impact. Two experiments were led: an analytical approach on the sound dimension (Sound Trends Research, not presented here [1]) and a synthetic approach on four senses (smell, sight, touch, hearing). Results are communicated to designers, but lately this methodology could be spread to the whole process of experience design.

Keywords: *advanced phase design process, experience design, emotional design, Kansei engineering, co-creation.*

1. EXPERIMENT PRESENTATION AND OBJECTIVES

The purpose of this experiment is to integrate a "user-experience-centered-approach" in the very-early phases of conception. Create relevant experiences requires understanding underlying mechanisms of the target population: we want to provide designers more information on user's hedonist, sensory and semantic representations concerning a product to be designed.

We created a new experience design tool, in order to establish relationships between sensorial stimuli and high level keywords. We use it here in a sensory marketing approach with a non expert panel. This interface implements four senses: sight, touch, hearing, smell. Research objectives mainly focus on how people perceive and describe those stimuli and the way they link their sensations to a product to come (or to be designed). Results are presented to designers in a final report. By providing new sensory and semantic information on user's representations, this information enables designers to design experiences rather than products. We conduct a pilot study for an X-ECO vehicle. "X" refers to the type of vehicle, ECO to ecological.

2. STATE OF ART

2.1. An automotive experience?

From mass production vehicles, all identical as the canonic example of Ford's T-Model, automobile ranges progressively extend, with a large number of concepts adapted to the societal

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needs. New "spaces" adapt to specific experience (monospaces, SUV…) with revolutionary objects as the radio [2], cup holders so successful in the U.S. [3] [4], or IT connections [2]. Today, new concerns demand to reconsider the driving experience: protection of the environment requires ecological vehicles, and even to think profoundly its use. At last, globalization presents numerous profiles which must be suitably answered [5].

2.2. Design evolution: from mass production to experience design

Continuously, design adapts itself in order to answer people's expectations. From the "good shape" concept, it gradually took care of *people's physical needs*. The user-centered approach, initiated by ergonomics, has been diversified in specific fields, such as interaction design for computing products [6] [7] [8], creativity meetings [9] [10], or co-creation with future consumers integrated in early conception [11]. Then, *people's subjectivity, motivations and feelings* were taken into account. In the 1980's, Kansei engineering spread in Japan [12] [13], whereas emotional design started in Europe and North America [14] [4]. Related disciplines (marketing, psychology, neurosciences) provided good basis for those new approaches that aim at evoking the right emotion. Nowadays, the approach becomes holistic, considering all sensory properties and referring to the *people's global experience*. In particular, "design for Experience" is taught in Delft University of Technology [15] [16]. Schifferstein & Spence [17] underline the danger of a product presenting an involuntary sensory incongruity that can destroy the interaction with the user. While the scientific discipline is rapidly growing, concrete developments of experience design are still very limited. With this paper, we set up a frame convenient to experience design in an industrial context, by combining sensory, hedonist and semantic data to widen designer's inspiring scope.

2.3. Designers' activities

Our research deals with two specific design fields: exploratory phase of design (before or during sketching first concepts) and experience design [16]. Mougenot [18] presents a synthetic model of design's early phases: before receiving specifications (design brief), designers already have pre-existing mental images from personal or professional surveys (magazines, internet, exhibitions). What kind of information is relevant to provide them so as to design sensory and emotional experiences? We suggest extending data's nature from visual and tactile samples to sound, smell, and sensory combinations. Mougenot also describes design activities as a movement between reasoning and external production: We should keep in mind that the information provided should be integrated in their mental structure as well as potentially be reused in tangible productions.

2.4. Importance of the cognitive process

To meet people's expectations, it is advisable to study the deep mechanisms constructed between user and product [4]. We believe that giving designers an overview of user's mental image leads to a better understanding and the possibility to design appropriate experiences. Perception and cognition are built on a complex process, studied by psycho-cognitive sciences [19], marketing [20], emotional design [14] [4] and recently sound design [21]. A stimulus is never treated from scratch, but its recognition depends on external factors (context) and internal ones (idiosyncrasy). Comparing stimulus to already memorized data leads to the activation of a label or a lexicon category [21]. In this study, numerous samples have been gathered so as participants can first "express" themselves without words. Indeed, using a multi sensory approach may activate specific memory's areas and eventually lead to new experiences, hard to express with the verbal modality

only. Three scientific approaches provide tools for measuring and analyzing data: sensory metrology [22] [23], emotions measuring [24] [25], semantic analysis [26] [27] [28].

3. PROBLEMATIC AND HYPOTHESES

3.1. Problematic and main hypothesis

From our state of art, we formulate the following problematic: *How to aggregate, to synthesize and to build relevant contexts to facilitate a holistic approach in order to design experiences?*

> ➔ To make experience design possible, it is necessary to define and to integrate a specific approach in advanced phase. This approach takes into account feelings and senses produced by multi sensory contexts. It is led with consumers.

3.2. Experiment hypotheses

H1. Sensory modalities may play at different level in the cognitive process and / or in the memory. We expect some specificity (emotions, lexicon used, semantic association) to be related to each sense. *(Semantic analysis and cognitive process)*

H2. When exploring the sensory database, people prefer to work with a sensory modality rather than another. *(Sensory analysis)*

H3. People build sensory arrangements in a common direction. *(Sensory analysis)*

H4. Participants' subjective choices can be linked to objective properties and categorized. *(Hedonist attributes and values)*

H5. It is possible to find links between the different senses, and those links can be associated to specific hedonist attributes and values. *(Hedonist attributes and values)*

4. METHOD

Our method is divided in three main steps *(figure 2)*. First, an expert's prospective work made aims at constituting a relevant Kansei sensory database (chapter 5). Then, the experiment protocol is defined regarding objectives, integrated in an exploratory environment and submitted to participants (chapter 6). We finally analyze study's data using various existing tools (statistics, lexicon analysis, color analysis, etc.) and present results to designers (chapter 7).

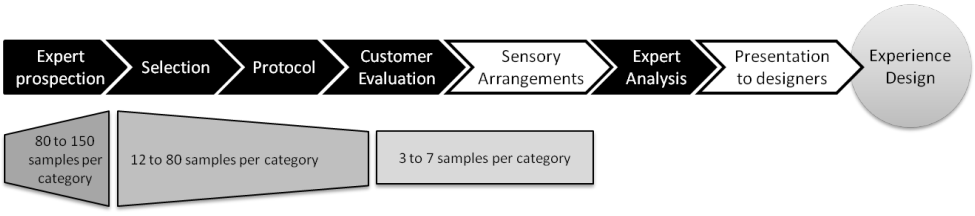


Figure 2: Global overview of the experiment.

5. MULTISENSORY DATABASE BUILDING *(EXPERT PROSPECTION)*

This step aims at gathering samples of different kind. For each sensory property, we used the same brainstorming session so as to widen our scope. Some samples were even chosen for their provocative side in order to provoke surprise and idea appearance. We involved designers to select colors, materials, textures and pictures. An extensive collection of 500 pictures and 150 material

samples was reduced to 88 images,75 materials, 38 patterns, 42 colors. For sound, we applied the recommendations made in a previous study [1] and selected 20 musical excerpts. An interface based on Pure Data programming software was built to play and assess sounds in an interactive way. 12 odors were chosen, half very simple ones (citrus, almond) and half more complex (combination of flavors that creates a specific mood). How many samples to select? This was a constant dilemma. Too many samples are harder to analyze thereafter (more data, less correlation, huge work to find inner correspondences). Too few samples might be frustrating participants, not answering to specific expectations, and most of all impose "experts' filter". However, we turned to a quite exhaustive selection: priority is given to participant verbalization, even if it implies a greater amount of information to be treated.

6. EXPERIMENT (CUSTOMER EVALUATION)

6.1. Protocol

Figure 3 synthesizes the protocol. Experiment is 55 minutes long. 40 minutes are dedicated to the exploratory phase, 15 minutes to arrangement constitution and keywords addition. First participant explores separately sensory workshops. For each workshop, we repeat the following statement: *"Choose the 3 samples that fits best to your idea of a X-ECO vehicle. The point is not to think about a specific aspect, but more about the global concept"*. After selection, participant explains his/her choice in semi directional interviews. We gather denotative (sensory description) and connotative (concepts, experiences evoked, self projection) information.

Once the six sensory categories have been explored, participant is asked to build an arrangement (a family, a harmony) among collected samples, with at least one sample of each sensory modality. What is interesting is the relationship between elements rather than a non coherent "best of". Some participants wished to make more than one arrangement, which was allowed. Arrangement(s) is (are) then described in semi directive interview. By the end, participant discovers 69 preselected keywords, and chooses as many as needed to describe his work; he/she is asked to select the most significant ones, but can also mentions personal concepts.

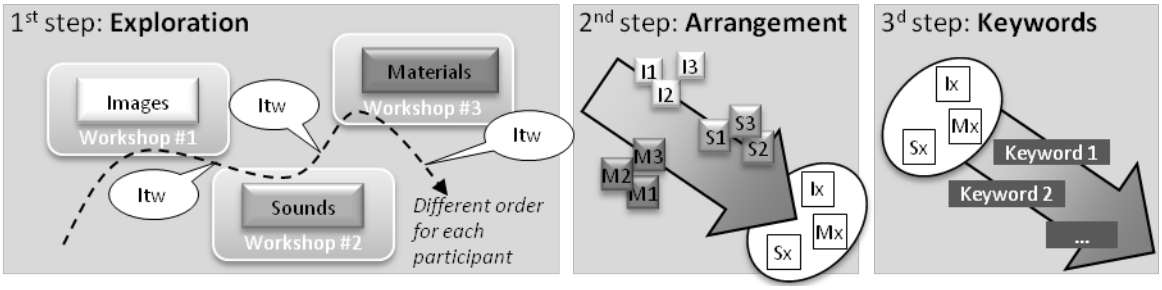


Figure 3: Experiment protocol. Workshops orders differ among participants.

In sequencing activities and making participants verbalize, this protocol avoids disorientation during the exploratory phase. Arrangement building is quicker than expected (or expressed) by participants, since they mentally start this work before (when choosing and verbalizing samples). **This experiential interface starts from hedonist sensations and ends with verbal communication**; the goal is to let emotions and experiences emerge directly from inspiring sensory samples. Two verbalization phases occur. After each sensory workshop, participant explains his/her

selection's earliest reasons, at a conscious level. Then, when making a personal arrangement, participant emits a global meaning, not always expressed before.

6.2. Panel's information

For confidential reasons, this pilot study was conducted among an internal panel of 40 people, mainly composed by young European engineers, aged of 31 in average. 30% of them were women; the three main nationalities were Belgian (11), French (10) and Italian (8).

7. RESULTS (EXPERT ANALYSIS)

To present the results, we will follow the protocol logic, from the sample selection to the arrangement constitution, and to the meaning associated *(figure 4)*.

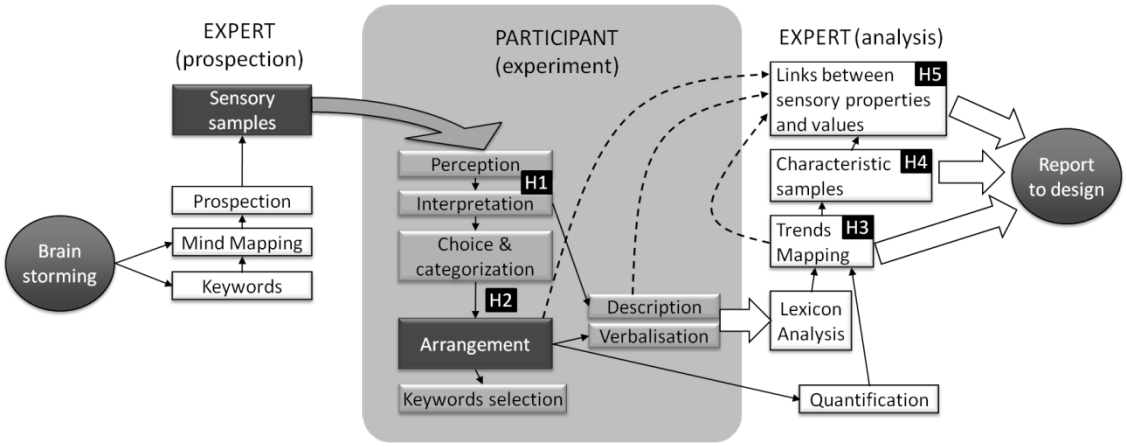


Figure 4: Global process with assumptions, cognitive process and obtained results

7.1. Specificity of each sensory modality (H1)

A lexical analysis on participants' comments on chosen samples allows us to determine if sensory modalities have specificities. Globally, lexical groups are not that specifically linked to senses: we observe subtle nuances. Concerning perception's lexicon, obvious specificities appear: visual vocabulary for images, colors and textures, musical and auditory terms for sound, etc. Two concepts are transverse, however: temperature (hot / cold) concerns almost all the terms; the perception of softness applies of course to materials, but also to smell (soft = subtle, sweetened), sound (soft = calm), visual samples (soft = pastel). For concepts, differences are less marked; for example, "Fun" is used for all senses, as well as the ideas of combination, contrast, association.

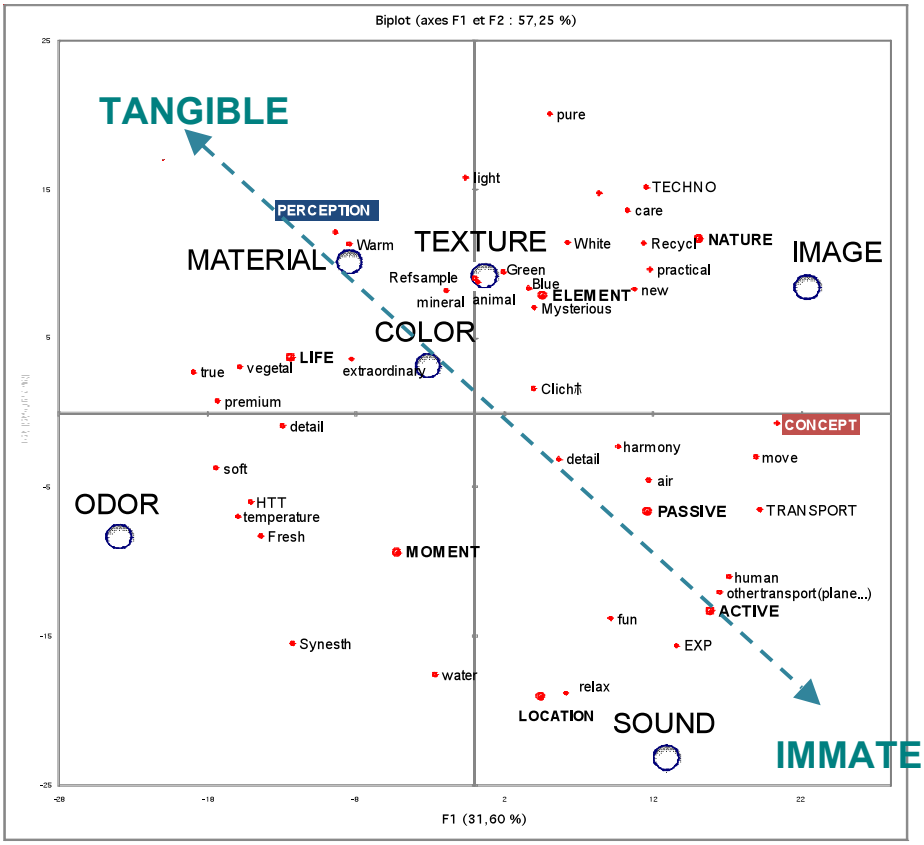


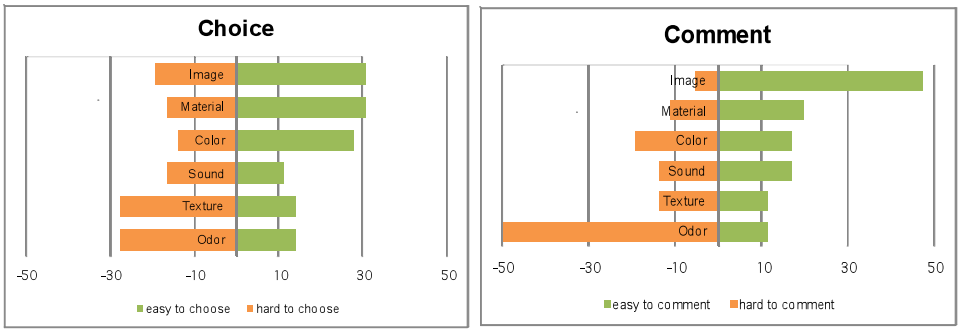
Figure 5: PCA to determine the lexical specificities of each sensory modality.

After having selected the most discriminating factors, a Principal Component Analysis is calculated *(figure 5)*. It shows the distribution of sensory modalities and concepts which are attached. A diagonal axis, from top left to bottom right, goes from more tangible lexicon and senses to more immaterial (abstract) notions and senses. Material, texture and color are described in a rational and tangible way, with comparisons to other samples (RefSample), references to living world (animal, mineral, vegetal), blue and green colors. Textures share with images a more immaterial vocabulary: mystery, technology, purity, whiteness, as well as the ideas of recycling, care, practicality, novelty. This "immaterial" trend extends to sound, with concepts such as harmony and detail. Sound is a dimension which involves more participants: activity is a key concept (movement, fun, experience), but its opposite, passivity, is also important. As remarked by Schifferstein & Spence [17], sound and odor have a strong suggestive power, with spatio-temporal descriptors (time, place), idiosyncrasy, culture and memory. Finally, smell is said to be difficult to describe (HTT = hard to tell). It evokes essentially freshness and sweetness. It shares with materials the notions of preciousness (premium), sophistication (detail) and authenticity (true). H1 is partially confirmed: *the various sensory modalities bring specific nuances and enrich the verbalization, but most of the notions are cross-sensorial*.

7.2. Participants' preferred sensory modalities (H2)

During arrangement's constitution, we recorded the order privileged by participants. By the end, we asked him/her the following questions: "*Which is the easiest / most difficult sensory modality to choose samples? With which one did you feel easy / difficult to explain your choice?*" Globally, the more it is easy to choose in a sensory modality, the more it is perceived as easy to comment *(figures 6 and 7)*. From

easiest to most difficult, we have: image, material, color, sound, texture, smell. Participants feel at ease with visual and tactile modalities; smell was pointed as a difficult dimension to work with. To a certain extent, it indicates that cognitive process starts before verbalization, when participant chooses samples.



Figures 6 & 7: Participants' expressed feelings, regarding choice and comment on senses (%)

Besides, the order privileged by the participants to realize their family corresponds to ease and difficulty expressed. From the start of arrangement constitution to its end, participants choose first image, then material, texture, color, sound, and smell. The 4 visual/tactile modalities are on top. By attributing coefficients to modalities regarding selection's order, 64 % of the participants use at first samples easy to choose and/or to comment, and finish by the most difficult. 75 % first use the samples for which it was easier to them to speak. If image is the starting point for the constitution of 33% of the families, it is important to note that sound is either for the beginning of the arrangement (18 %, thus the second sensory modality participants start with), or taken lastly (38 % of cases). It is partially due to a manipulation problem: it is not movable as smell flasks or tangible samples, and so "forgotten in the computer". H2 is validated : *participants use preferentially visual and tactile modalities, either in verbalization or acts. Smell remains a sense difficult to apprehend* (18 spontaneous remarks).

7.3. A network of trends rather than a common direction (H3)

This experiment presents a great complexity (300 samples, free verbalization, no quantitative scales), so a simple PCA can't provide a consistent representation. Instead of discriminating and categorizing groups, the goal is to stress out cognitive associations between senses. We characterize each arrangement using keywords associated by participants, since those keywords are common and described the whole work done. Participants associate words with close meaning or make combinations between contrasted notions; the given instruction is to choose the most significant ones. We clustered keywords in 10 trends (not exposed because of confidentiality); for every arrangement, points were attributed to every trend following the number of keywords. In doing so, it is possible to quantify the trends. We then used a specific method that led to a trend mapping *(figure 8)*. This trend network is a 2D representation of a multidimensional space. 4 trends *(1 to 4)*, strongly linked, emerge. 3 underlying trends *(5 to 7, represented with fragmented petals)* cross four first ones but do not constitute a strong trend, since they lack nucleus. Finally, strongest relations are represented by thick lines. With such a representation, it is possible to get back to each chosen sample and its description by participant. We can re-discuss hypothesis H3: *the participants, by building their family (ies), establish a network between various notions*. It is possible to articulate a design

step within this network, either by positioning in a precise zone, or by developing trends situated in different zones.

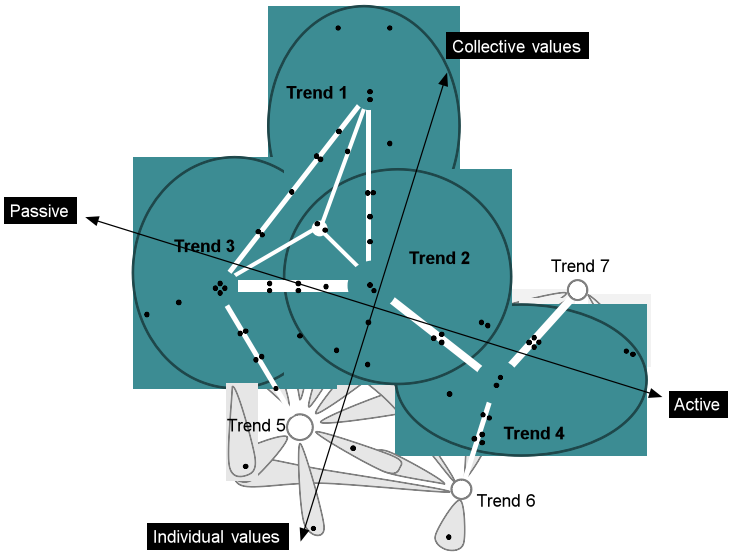


Figure 8: trends mapping. Participants' arrangements are represented by black dots

7.4. Sensory properties and lexical structures connected with the subjective trends (H4)

To connect the samples in a cross sensory way, we used the trends mapping as a filter which we applied to every modality to extract them. We concentrated on the four main trends, and put in relation their specific samples by taking into account position in the trend and choice's frequency. For each trend, most chosen samples belong to specific modalities, and indicate the main meaning(s). Every trend can be considered as a sum of internal components with specific sensory properties *(figure 9)*. Some trends are more built on visual and chromatic notions; others are articulated on concepts brought by image or sound, described according to what they represent (i.e. *self reflective emotions* [4]) rather than to their *visceral* aspect (color, form, textures…).

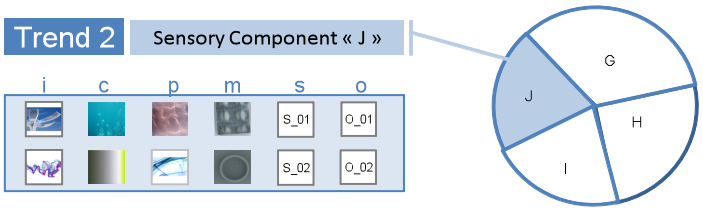


Figure 9: One sensory component

7.5. Sensory links, experiences and high-level values (H5)

Trends expressed in this experiment on the representation of a X-ECO vehicle are connected with high-level values. Participants were more focused on the ecological aspect ("ECO" quoted 157 times, "Nature" 89 times, "Natural" 90 times) rather than the type of vehicle ("X" quoted 100 times, "Car" quoted 67 times). We observe a global trend to individualism and personal happiness (preferences for round shapes, softness, concepts of cocoon, hut, heat. Openness to others is still present but not as a central value. However, we should be very careful with these observations and

put in perspective these results according to the nature of the proposed stimuli: touch, smell, hearing are senses which are related to intimacy, what may influence the individualism noticed.

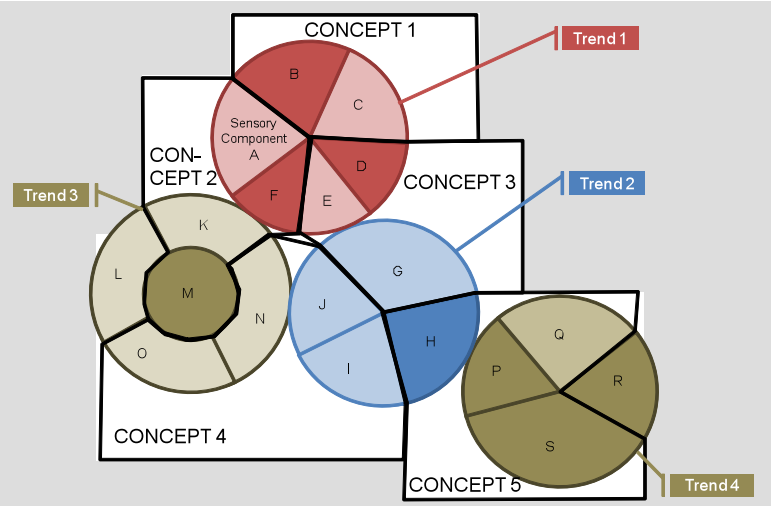


Figure 10: Trends mapping, with their sensory components represented in district. The clearer sensory components are of connotative order (concept), the darkest of denotative order (perception, low level description).Five high level concepts cross trends.

Those results enable us to question back our initial brainstorming and the keywords we chose for the study. Some trends turned to be almost inexistent, and people added many keywords into a trend we underestimated. It shows that our process, with a prospection/selection phase made by experts, does not fix trends at the beginning and encourage the emergence of participants' voice. Finally, these sensory components can be linked with 5 high-level concepts *(figure 10)*. As 4 concepts cross two trends, we observe the exercise of sensory arrangement implies a big interweaving of the notions rather than discrimination.

8. DISCUSSION

8.1. Hypotheses discussion

All hypotheses are validated; however, some must be nuanced or deepened. Hypothesis H1, *sensory modalities may play at different level in the cognitive process and memory, and we expect some specificity to be related to each sense,* is validated but must be put in perspective. Sensory modalities are described with nuances rather than strong specificities. Perception vocabulary logically discriminates senses, apart from temperature and softness. For concepts, associations and experiences, differences are more subtle. We distinguished a group of more "tangible" sensory families (material, texture, color) and another more "immaterial" (image, sound, smell).

Hypothesis H2, *participants prefer to work with a sensory modality rather than another one during the phase of exploration,* is validated and widened. Visual and tactile modalities are generally easier to choose and comment, while working with odors is felt harder. We extend this consideration to arrangement's elaboration: on average, the privileged order begins with images, materials, textures and colors and finishes by sounds and smells. We confirm Schifferstein & Spence's observations [17] on the ascendancy of the vision. Whereas it's the 5th modality chosen for arrangement in average, sound is the second one which impulses this exercise: sound's inspiring capability is confirmed by a mapping of senses and associated lexicon *(figure 5)*.

Hypothesis H3, *people build arrangement in a common direction,* is validated and nuanced. Four strong trends and three minor ones emerge. Elicited arrangements are complex and mix several concept and values; their distribution is multidimensional. The trends mapping is a good tool to represent them, although it reduces the complexity of families to few constituents.

Hypothesis H4, *participants' subjective choices can be linked to objective properties and categorized* is validated. Of course, the trends mapping reduces the arrangements' complexity. Nevertheless, internal structures appear, and each trend is described with 4 to 6 homogeneous sensory components *(figure 9)*.

Hypothesis H5, *it is possible to find links between the different senses, and those links can be associated to specific hedonist attributes and values,* is validated. By quantifying keywords, new trends are revealed while some other are totally ignored: indeed we can reconsider our lexical database. We notice a global orientation towards individual values rather than to collective ones; however, this result must be put in perspective with the more "intimate" nature of the exercise.

8.2. Experiment's limits

Smell's assessment is to be improved: numerous difficulties were expressed (saturation of the sense of smell, difficult to verbalize), and its contribution to the exercise was lesser. We also pointed a deviation inferred by a sensory approach, which tends to overexpose the individual values to the detriment of collective ones. Finally, it would be advisable to investigate other types of exercises: to propose negative choices *"Which sample is least [investigated notion] for you?"*, to measure emotion regarding arrangements with Pr Emo application [26], to ask people about their personal values and draw links with their sensory preferences, etc.

8.3. Perspectives

If we collected a significant number of *visceral* feelings (in hedonist choices) and *self reflective* ones (in the arrangement's description), behavioral emotions are less present. To gather more data on effective experience, it could be interesting to connect such a tool with creativity meetings. A deeper work on the link between sensory properties and high-level values should be done, by using more psychological questionnaires to the participants. At last, digitalizing such a tool would reinforce its versatility and portability (networking, worldwide survey…), with new questions about implementing smells and materials.

9. CONCLUSION

This experiment proposes a multisensory experience which is then put into words: we start from hedonic sensations to end with the verbal description of a meaningful arrangement. We proved the validity of this methodology with an internal panel: it would be necessary to test it with consumers and to link results with lifestyles investigated by marketing. From this confrontation, it will be possible to propose a design brief enriched with sensory properties and values associated, and therefore enable designers to create relevant experiences.

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