ENHANCING PRODUCT SENSORY EXPERIENCE: CULTURAL TOOLS FOR DESIGN EDUCATION

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ABSTRACT
Enhancing product experience is a current crux for many companies, since experiencing a product in a more emotive way can be a differentiation advantage on the market. Sensory aspects of user-product interaction play a main role in this process, as emotional experiences are triggered at a first stage by sensorial stimuli. However, in product design education, there seems to be a lack of attention towards the sensory aspects of user-product interaction, and how this can be exploited to generate more pleasurable experiences. A possible strategy to fill this gap is the creation of tools able to transfer knowledge from this research area to design education. This paper aims to assess which cultural and practical tools can be used to improve students' awareness about sensory experiences. Moreover, it evaluates the effect that this knowledge transfer has on design activity and results and how this process can create value for producer companies. In order to do so, a design workshop was performed with students, in collaboration with a company, to design new enjoyable experiences with household appliances, levering on senses. A cultural and a practical tool to convey knowledge to students were developed and tested in the workshop. As a result, concepts emerged that introduced pleasurable sensory stimuli in new product characteristics. Feedbacks from both students and company were collected to assess both the usefulness of the tools and the concepts generated. Eventually, the research group evaluated the educational effectiveness of the tools developed and how they affected the students' activity.

Keywords: Product design, senses, product experience, cultural tools

1 INTRODUCTION

Enhancing pleasurable product experiences is a current challenge for many companies worldwide, since it is commonly agreed that products which provide deeper and more emotive impressions can have a differentiation advantage on the market. How obtaining products with relevant experience impact on the user is an issue concerning the design activity that must take into account emotive aspects connected to the user and to product features.
As studies in this field prove, enhancing sensory and multi-sensory experience can be a fruitful strategy to engage users during the interaction with products [1]; indeed, senses are the way we experience world, and emotional experiences are triggered at a first stage by sensory stimuli. This is why a number of companies are interested in finding new ways to positively stimulate senses with their products. Design research as well, especially in the field of emotional and experience design, is nowadays directed towards the investigation of these aspects [2], [3], [4], [5].
Designers should be aware of the impact that sensory features have on the user's experience, and should be able to control them, in order to create the intended emotional reaction in the user. However, in product design education, there seems to be a lack of attention towards the sensory aspects of the user-product interaction, and how these can be exploited to generate more pleasurable experiences. More specifically, this attention lacks where education is more directed towards the technical aspects of design, which is where the knowledge is referred to the "hard" features of products. [6] Thus, nowadays there is a large distance between companies' interests on this topic and design education orientations.
A possible strategy to fill this gap is the creation of tools able to transfer the knowledge coming from the emotional design research area into design education.

2 OBJECTIVES

This paper aims to assess the relevance of introducing the topic of sensory experience in design education, particularly in the field of Design and Engineering. It aims to evaluate to what extent the knowledge transfer from research to education can affect both students' activity and their results. In doing this, authors also want to explore the role that theoretical and practical tools can have in improving students' awareness on this topic.
Finally, this work intends to consider how this process can create value for companies, in terms of interest towards concepts generated by designers who consciously focus on sensory experiences.

3 METHODOLOGY

In order to reach the goal, a design workshop was set up, to be performed by design students in collaboration with a worldwide company producing household appliances. The workshop represents a real case study used to test the authors' hypothesis about knowledge transfer from research to education, concerning product sensory experience, together with two tools developed for this purpose.

3.1 Workshop setting

The household appliances company addressed to the authors' research group to arrange a design workshop aimed at defining innovative concepts of dishwashers. As required by the company, new properties or features had to be designed with a focus on enhancing the user-product interaction in terms of sensory pleasurable experience provided to the end user, of emotions evoked, of sensitive connection with the domestic appliance.
From the authors' point of view, it was an opportunity to transfer the knowledge coming from previous research to students, creating and testing specific tools, and to see the effect it had on both students' activity and results. The hypothesis of the research team was that providing the students with specific knowledge and tools about core properties of sensory stimuli could give input and lead them to obtain innovative features addressing different senses, to implement engaging interactions.
One theoretical and one practical tool were developed by the authors, basing on previous studies about this topic. The theoretical tool was aimed at transferring knowledge about sensory properties of products to students, while the practical tool was aimed at leading and inspiring designers during the concept generation process.

3.1.1 The theoretical tool: an introduction about product sensory features

The theoretical knowledge to be conveyed to students regards previous studies conducted by the authors' research group, which investigated how product sensory features can create pleasurable and engaging experiences in the user. These studies led to the classification of the stimuli provided by products into *static* or *dynamic* sensorial stimuli [7].
Static sensory features, such as shape, colour, texture, but also sound or smell, are the features designers commonly pay attention to, being the intrinsic features of products. They are connected to the materials, the formal composition and the production technologies of products. Controlling these features during the design process can be one of the possible strategies to create more pleasurable interactions, levering on the sensory experience. Indeed, when perceived by the user, they can provide what Jordan [8] calls physio-pleasure, i.e. the pleasure of the body.
Dynamic sensory features can also be adopted to communicate information to the user. They consist of changing sensations, such as colour changes, shape transformations, movements, sounds, or temperature alteration. For instance, the temperature of a room can be conveyed by a change in the product colour, instead of by a digital interface. These features communicate with users to an unusual extent and have the ability to surprise and to create unexpected experiences during the interaction.
The distinction between static and dynamic sensory stimuli, and the potentials and limits of both, was part of the knowledge that the authors conveyed to the students during the workshop, in order to help them explore different characteristics of products. The knowledge transfer was supported by a theoretical tool in form of presentation, composed by text, images and practical examples.

3.1.2 The practical tool: a map of dynamic stimuli

Dynamic stimuli are less applied than the static ones in product design, but potentially extremely effective in terms of pleasurable experiences, since they are highly engaging. Implementing sensory experiences to communicate information to users can indeed determine a surprise effect and therefore obtain a higher level of attention from the user.

For this reason, the issue of dynamic stimuli in product design was object of a more specific research conducted by the research group [7]. In order to create a more structured knowledge about this topic, an iconographic study was made to collect products and concepts that used dynamic stimuli to convey information to users and a classification was made that divided those products on the basis of the sense they addressed and of the employed stimulus. For instance, products that communicate through visual changes can adopt stimuli like colour, shape, or light changes; tactile stimuli can go from temperature to vibration, to pressure changes.
During the research and the consequent classification, a concentration of dynamic stimuli addressed to the sense of sight was noted. Sight is our most developed sense and it collects nearly 80% of human beings sensorial impressions [9]; nevertheless it was largely assessed that other senses cover a relevant role in our experience of the world, for example touch is a significant integration of sight and the sense of smell has a strong emotive impact [10].
Starting from this statement, the research group intended to encourage the designers to reason upon the possibility to design not only for sight but also for the other senses.
The classification defined so far was arranged in the form of a map of dynamic stimuli, which served as a practical tool for the designers taking part in the workshop (Figure 1).

Figure 1. Map of dynamic stimuli

3.2 Workshop performance

14 students from the Design&Engineering Master Course were involved in the workshop working in pairs for one week, leaded by a team of expert researchers. The theoretical tool - an introduction about the topic of static and dynamic stimuli - was provided at the beginning of the workshop. The knowledge was conveyed to students in the form of a presentation lasting one hour.
After the introduction of the brief made by the committee company, students were provided with the map of dynamic stimuli to be used as a design tool in the concept design activity.
During the week, some reviews of the projects were made by the researchers in order to address the students' work to innovative solutions by using both static and dynamic stimuli.

3.3 Workshop results

Students worked on the brief for one week and produced 12 design concepts that were presented to the company. The concepts integrated both static and dynamic stimuli, directed not only to enhancing product sensory experience but also to highlighting some functionality and usability issues that the company required to consider. Many innovative solutions emerged on the side of both static and dynamic stimuli. Some designers worked on the static features to give relevance to different functions of the appliance; e.g. the concepts named "Eccentric Volubility" and "Efficient Care" used different materials and colours to indicate new possibilities of internal space division and to recognize different functional areas (Figure 2.a; 2.b). On the other hand, dynamic features were used to give feedback about the progress of the appliance work: in the "Light" concept, the designers placed a LED strip in the top front part of the appliance that changes its colour to indicate the progress of the washing cycle. (Figure 2.c). All the projects reflected an attention to the issues introduced by the theoretical and the practical tools. They are an attempt to focus on the sensory experience with the product, by consciously handling its dynamic and static features.

Figure 2.a "Eccentric Volubility" by F. Boria and M. Brasca; 2.b. "Efficient Care" by G. Cafarelli and G. Wilhelm; 2.c. "Light" by M. Broggio and M. Spotti

4 DISCUSSION

4.1 Result analysis

A general analysis of the resulting concepts showed some critical issues related to the design of sensory experiences. Even though students were free to choose the sense to address in order to create new engaging interactions, most of them focused on the design of visual stimuli. Following vision, tactile stimuli were also investigated, mostly connected to static properties of products. Light was employed as dynamic stimulus in many concepts, by exploiting its dynamic behaviour, which is able to convey information and feedback about the product status and its ongoing work. In synthesis, properties connected to the physical and tangible aspects of products, that is visual and tactile features, were the most adopted. This demonstrates that students are able to control the shape and the tactile qualities of materials, which are the *tangible* features of products. Controlling more intangible features, such as sound and smell properties, seems to be a more difficult task: none of the concepts focused on sound, while smell was investigated in one project only. Moreover, the fact that vision was the most investigated sense, confirms again the dominance of this modality both in the human perception and in the design approach [10].

However, it emerged that other sensory modalities can be as effective as the visual one, in arousing pleasurable experiences and sensations. For instance, the concept "Bloom", explored smell as a medium to communicate feedback to users, and it was evaluated as highly engaging by both the company and the research group. This result proves that designers are usually educated to design for sight and in some cases for touch (since it is related to the tactile properties of materials). Indeed, even when they are explicitly required to design for other senses, students find it hard to focus on less obvious modalities. However, the proposed tools turned out to be a valid inspiration for exploring other alternatives.

Another critical issue is connected to the fact that designers more easily tend to design for usability, than for the aesthetical and experiential level. Almost half of the concepts, in fact, focused on the usability aspects of products, such as functionality and performance, instead of just the generation of pleasurable experiences. This confirms again that students are not as used to design for experience, as they are for function. This is probably related to the fact that usability is a more objective issue, while aesthetics and experience are more subjective ones.

Dynamic stimuli were mostly used to communicate the progression of the washing cycle: the designers tried to replace the visual screens with more appealing elements, by using lights or colours to indicate the cycle steps. Even if the concept of dynamic stimuli is not so well-established in product design, half of the projects embedded dynamic sensory elements. Static stimuli, such as unusual colours, shapes or tactile properties of the dishwasher components, were mostly employed to improve the affordance and usability of the product.

4.2 Students' feedback

Feedback from the students was collected through an on-line questionnaire, composed by both open and close questions, in order to assess the usefulness of the theoretical and practical tools.
The first part of the questionnaire investigated the students' prior knowledge about the topic of static and dynamic stimuli. The answers to this section underlined students' little knowledge about dynamic features of products. Most of them had never heard about this distinction and had never been taught to consider it while designing. Nevertheless, none of them declared they found it difficult to apply the notions of dynamic stimuli in their design concepts. In the second part of the questionnaire, students were asked to give their opinion about the provided tools. Answers showed a general positive evaluation about the theoretical and practical tools: both were considered valuable bases to design products with enhanced sensory experiences.
Students assessed that they would not have considered sensorial or emotive aspects in designing the household appliance if not pushed by the lecture given by authors, nor would they have taken into account to design dynamic features to communicate with senses different than view or touch.
The design tool, the map, was evaluated useful to remind the possibilities that dynamic and static stimuli offer to convey different messages; some students considered that the map was too detailed and therefore confusing because it offered too many possibilities. Students generally found the theoretical and practical tools very useful to guide their design activity towards unconventional and more emotive ways to interact with products.

4.3 Company's feedback

Feedback from company was also collected to assess the innovation level of the concepts, in terms of pleasantness of the sensory experience generated by the product from both the design and the marketing point of view. People from the company's design and marketing area took part in the final presentation of the concepts by students. Authors asked them to make comments and to evaluate the concepts in order to proclaim the winner of the workshop. In its evaluation, the company showed interest in unconventional sensory interactions that involved different senses and not only sight.
Moreover, people from the marketing area expressed positive judgements about concepts that innovated the relationship between human and product, such as the project "Enjoyable interaction" that created an emotional and familiar atmosphere, thanks to tactile dynamic features (Figure 3.a). The company showed also interest for innovative interaction facilities that gave a new expressive value to the appliance, e.g. "Pulse" that did not display feedback on a screen, but gave information through coloured lights and a pulsing 'heart' (Figure 3.b). Positive assessment was also given to concepts that explored unusual sensory stimuli, like "Bloom". This concept applied the use of smell to create a widespread feeling of cleanliness (Figure 3.c). Company's attention was drawn by those features that implemented positive values and experiences, especially those using dynamic stimuli, considered more engaging and potentially attractive for users.

Figure 3.a Mood of "Enjoyable interaction" by F. Caresi and F. Lombardi; Figure 3.b "Pulse" by S. Bergamaschi and V. Mullano; Figure 3.c "Bloom" by A. Gatto and P. D'Olivo

4.4 Educational results

Eventually, the research group evaluated the educational effectiveness of the tools developed and how they affected the students' activity. It has to be stated that, as students' feedback reported, introducing theoretical and practical tools about static and dynamic stimuli resulted in the consideration of different senses during the design activity: the students focused more than usual on the sensorial experience that every feature could create in the user. Stimulating students on this aspect created an educative background that they will be able to maximize and exploit in their next design activities.

During the projects reviews some critical issues emerged. For instance, speaking about dynamic features can lead designers to think about dynamic parts of the product, intended as mobile parts. This is obviously a wrong interpretation of the term 'dynamic', which is connected to communicative features rather than to physical components of products. This demonstrates that design students in some cases had difficulties in grasping the concept of dynamic sensory features, because they usually think and design in terms of physical features of products, overlooking more 'soft' communication issues related to what a product says about itself, its functioning and feedbacks.

5 CONCLUSIONS

The analysis of results and feedback confirmed the importance of facing the topic of product sensory experience in design education. As students tend to design for usability rather than for experience and have difficulties in considering senses different from sight, providing knowledge and tools to inspire and support them can turn out to be helpful in designing new and engaging sensory interactions.

From the students' questionnaire, it emerged that design education lacks the aspects related to emotional and sensorial issues. However, it also emerged that the two tools presented in the workshop were useful to encourage students to create new experiences and to explore different senses, efficaciously filling this lack. The proposed tools affected the design process and the results in a positive way, both from the educational and professional point of view; the company marketing and design departments found some concepts very engaging and potentially innovative, particularly the ones showing dynamic features.

In conclusion, giving students knowledge and tools to help them design for sensory experiences resulted in an exploration of new communicative modalities and new interactive experiences with products, with a benefit effect on both the design process and the resulting concepts.

REFERENCES

[1] Desmet, P. M. A., and Hekkert, P. Framework of product experience. *International Journal of Design,* 2007, 1(1), 57-66.

[2] Özcan, E. & van Egmond, R. (2012). Basic semantics of product sounds. International Journal of Design, 6(2), 41-54

[3] Ludden, G. D. S., Schifferstein, H. N. J., and Hekkert, P. Beyond surprise: A longitudinal study on the experience of visual - tactual incongruities in products. *International Journal of Design*, 2012, 6(1), 1-10.

[4] Fenko, A., Schifferstein, H.N.J., and Hekkert, P. Noisy products: Does appearance matter? *International Journal of Design*, 2011, 5(3), 77-87.

[5] Rognoli, V. A broad survey on expressive-sensorial characterisation of materials for design education. *METU Journal of Faculty of Architecture, 2010,* 27.2, pp. 287-300.

[6] Rampino, L., and Gorno, R. Teaching Design & Engineering Students how to handle the Form Giving issue. In *Proceedings of the 13th International Conference on Engineering and Product Design Education E&*PDE11, Dublin, 2011, pp. 454-459.

[7] Colombo, S., Rampino, L., Bergamaschi, S. What are you telling me? How objects communicate through dynamic features. *Proceedings of the xCoAx conference*, Bergamo, Italy, 2013.

[8] Jordan, P. W. (1997). Putting the pleasure into products. *IEE review*, *43*(6), 249-252.

[9] Beccali, M., Gussoni, M., and Tosi, F. In Baglioni A. (Ed.), *Ergonomia e ambiente. Progettare per i cinque sensi. metodi, strumenti e criteri d'intervento per la qualità sensoriale dei prodotti e dello spazio costruito*, Il Sole 24 Ore Pirola, 2003.

[10] Hekkert, P. Design aesthetics: Principles of pleasure in design. *Psychology Science*, 2006, 48(2), 157.