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The Experience Map. A Tool to Support Experience-driven Multisensory Design

Abstract
Product designers may struggle to materialize their initial, abstract idea into tangible sensory features forming a product. Being aware of the role of every sensory modality in conveying a specific experience, they are more likely to come up with original and meaningful solutions. However, it can be challenging to manage an experience-driven, multisensory approach. This paper investigates the variables that designers must consider, and how they can design for rich multisensory experiences. We introduce a tool, namely the Experience Map, to improve designers' awareness of the process. The final aim is to support designers in their intuitive choices to design pleasurable products able to elicit meaningful and engaging multisensory experiences for people. We will discuss the possible benefits and applications of the tool, and the results of a small study conducted for educational purposes.

Keywords
Product design; multisensory; design tools; creativity; sensory features

1 Introduction

A rich multisensory experience is usually considered to be a pleasant characteristic in a new product. However, it is not simply through choosing a nice smell, a fancy texture or a nice shape that enables designers to elicit a pleasurable and meaningful experience in users. Even though designers tend to focus on the functionality and the visual aspect of the product, they are becoming increasingly aware of the importance of a multisensory approach. This means considering every modality while shaping the product, so that all product properties co-operate to convey a specific experience to users. The initial, fuzzy idea in the designer's mind must turn into a set of tangible properties that form a product. Several choices must be made, such as making the idea more or less explicit in the product, deciding which sensory properties are more appropriate to convey it, using different modalities without overloading the user, adding sensory incongruences in the product or not, and so on [1-3]. It requires a degree of expertise and sensitivity from the designer to effectively navigate through all these alternatives, and come up with aesthetical and meaningful solutions that can evoke a pleasant experience in users [4]. In this paper, we introduce a tool, namely the Experience Map, to support designers in translating their initial idea (i.e. the product vision) into sensory qualities. The tool draws on a first, preliminary version [5] to follow the process of idea materialization in a more structured way. Whilst the previous version of the tool focused only on the choice of sensory features, the current version includes several levels, to reflect a progressive transformation of the product vision into concrete product properties. In this way, the Experience Map can provide a clear and synthetic visualization of a Multi Sensory, experience-

driven process, from the beginning to the end, guiding designers through the five steps of the approach. To frame the context of the tool, we will first provide a definition of experience and the role of sensory modalities in subjective experiences. Secondly, we will focus on how designers can give shape to their idea and design with a multisensory approach. We will then describe the structure of the tool, going through all the levels, and explain how designers can use the Experience Map. In the present work, we concentrate on the assessment of the tool's usability and clarity. To do so, we applied the Experience Map in an education course, using it for reverse analysis of existing products. The results of this first study with students will be described.

2 A view on Product Experience

In order to understand how to shape the product's sensory qualities to appropriately express an idea, and therefore how to elicit a specific experience in users, we must first define what an experience is and how every sensory modality can fuel it. Product Experience is commonly described through three components [6], namely the aesthetic experience, the emotional experience and the experience of meaning. At the aesthetic level, the sensory qualities of the product can be regarded as distinct sensory channels carrying information, although products are perceived as a whole [7]. Thus, each sense can play a different role in conveying an impression. The natural smell, the fading colours and the woven pattern of a Japanese tatami, for example, stimulate our sensory system in a different way, yet generate altogether a holistic experience. Given the traditionally accepted dominance of the sense of vision, sensory modalities can acquire a different importance depending on the product to design. From a design point of view, for instance, the visual aspect will definitely dominate in a wall clock, while touch can sparkle innovative inspirations in the design of a carpet [3], [8-9]. Moreover, designers may choose to shape all the sensory qualities in a congruent way, which usually results in a more appreciable product, or, alternatively, they can add some incongruities to stimulate the senses in a surprising way [2]. On the cognitive level, people understand how to use a product, which action it affords and what it signifies in terms of its attached symbolic meaning. The product sensory qualities can be considered as small clues, elements of an integrated vocabulary, which communicates a specific semantic association [10]. For instance, a rounded, pale-coloured and glossy toaster will probably link to a 50's style. Hence, *product features* (e.g. the glossy surface and the elongated shape of a Macbook Pro©) make users form *product attributes* (e.g. elegant, allured). The overall bundle of elegance, performance, high-technology etc. makes of the Macbook Pro© a product with a unique and distinctive *character* [11]. Designers aiming at embodying a specific idea into a product can thus exploit this relation in an appropriate way, bearing in mind that meaning is subjective and culture-specific. Lastly, at the emotional level, products are considered for their ability to elicit feelings and emotions in the users [12]. The role of the different sensory modalities in affecting the users' emotional reaction has been found to differ substantially: for instance, tactual and olfactory experiences were found to predominantly lie in the affective domain [9]. Additionally, designers may choose to shape the pattern of sensory qualities to specifically elicit some kind of positive or negative emotions. As mentioned before, they may want to elicit surprise in the user [2] and therefore evoke a more pleasant experience. Or, they may choose to trigger the fear of being chased to motivate the act of running [13]. Thus, designers have several alternatives to make use of the different sensory modalities to materialize their ideas. In the section that follows, we will discuss which factors influence this process and which methods can support designers in the challenge.

3 Designing for a multisensory experience

In this framework, we would like to focus on how designers transform their initial, abstract idea into a tangible product. Designers usually start this process from defining a concept, i.e. the Product Vision, which originates from preparatory activities, such as researching and reflecting on the context of use and on the user-product interaction [14]. In this moment, designers shape their personal and subjective view, which will guide them through all the subsequent phases. The product vision is a product-centred statement that provides straightforward information on the quality of the product. It describes the value to aspire, and the challenge is to understand *what* to create and *how* to create it [15]. The way designers will answer these questions is highly related to the designers' expertise and sensitivity. Consequently, students and novice designers seem scarcely aware of how to turn

an abstract idea into tangible features, while expert designers manage the process with a more conscious approach [15-18]. A possible design strategy to reduce this gap and tackle the process in a more effective way is to progressively decrease the level of abstraction. Designers can start exploring their idea, first at a very conceptual level, to subsequently look at every sensory modality and consider all the properties that will shape the product (e.g. its colour, material, details, etc.). In order to link the conceptual exploration to the sensory description of the product, they may define some specific expressive qualities that support the product vision. For example, they may assert that their idea could be better expressed by a 'fresh', 'elegant' and 'intimate' product. These product expressions help the designer to associate certain patterns of sensory qualities with their idea. Thinking of all the details in the product, and analysing the possibilities from each sensory modality, designers will be able to refine their product in a step-by-step manner. However, in this phase, designers need to alternate between a holistic and specific viewpoint, to ensure the coherence between the different parts of the product and the overall final result, which is never the sum of selected qualities. Two recent examples of methods that support designers in managing the complexity of designing for a specific experience are the Vision in Product Design approach [14] and the Multi Sensory Design approach [19]. The former offers a description of which activities designers should carry out in order to develop an innovative, experience-driven product from an abstract vision based in a future context. The Multi Sensory Design approach addresses instead the exploitation of all sensory modalities in an intentional way to come up with a pleasurable and original result. Both methods examine the theoretical concepts and provide designers with guidelines. Yet, they do not include any specific tool to integrate all the several phases and manage the entire process. The existing literature offers on the one hand overarching theoretical models [20] and design approaches [14], [19]. On the other hand, it supplies tools to address specific activities, already after the concept has been shaped. Examples are tools for material selection [17], [21] or user testing [12], [22-23]. The Experience Map provides instead a comprehensive tool to help designers in transforming their idea into a pleasurable and meaningful product, while taking into account all the sensory modalities.

4 The tool

In this context, the tool we developed supports designers with a structured layout that goes from the abstract level of the product vision to the selection of sensory properties. The main goal is to increase designers' awareness and to make their choices more deliberate, yet reflecting their personal subjectivity. Designers can also be stimulated to consider all the sensory modalities, with new possibilities to enhance the user experience of the product. Furthermore, the tool can help in training designers' sensitivity and their ability to explore the product vision and generate more original solutions. In order to cope with these aims, the design of the tool must meet a number of requirements. First of all, it needs to provide a clear and synthetic overview of the process, starting from the abstract level of product vision until the tangible level of sensory properties. To effectively manage it, the tool must be organised in a structure that reflects the steps of a Multi Sensory design approach. Distinguishing between these different steps aims to enhance the richness of design considerations. For instance, even though products are perceived as complex, multisensory whole, the tool requires designers to consider each sensory modality separately. Our objective is to decrease the chance of neglecting some types of sensory inputs, not to induce rigorous artificial separations between sensory modalities. Secondly, it should encourage designers to adapt the structure to fit their subjective perspectives. The tool needs to allow for intuitive design activities and should, therefore, incorporate more traditional tools, such as moodboards. Lastly, the Experience Map should entail a good structure while being neutral, i.e. not influencing designers' choices. This aspect will be especially relevant for the last step, the sensory analysis phase, which includes a list of sensory properties that must be expressed in an objective way.

4.1 The structure of the tool

The Experience Map is composed of 5 levels, arranged on a radial layout. The structure is based on the Multi Sensory Design approach [19], similarly reflecting the process (Fig. 1). To use it for creative purposes, designers should move from the centre, the most abstract level, to the external level of the map, the most tangible one. The upper part of the map considers the intrinsic properties of the product, such as shape, colour, and material; these are defined as static

properties. The bottom part addresses instead the kind of feedback that the product gives in response to user interaction, and thereby involves the dynamic properties. These are physical qualities that can be appreciated only through the manipulation of the object, e.g. turning a knob, or hearing an alarm. The way in which these dynamic properties are designed highly influences the experience of interaction [24-25] and they contribute to the overall product experience. These features may be of a mechanical nature (as knobs and buttons), digital interfaces or sensory qualities of the product that change over time. Indeed, new advances in materials, electronics and information technologies give more possibilities to control the product's sensory features [26], resulting in artefacts that can change their shape, colour or other features. The starting point to use the map is the centre, corresponding to the statement of the product vision. We will now describe each level of the Experience Map, referring to the example provided in Fig.1 concerning the design of a new laundry-machine.

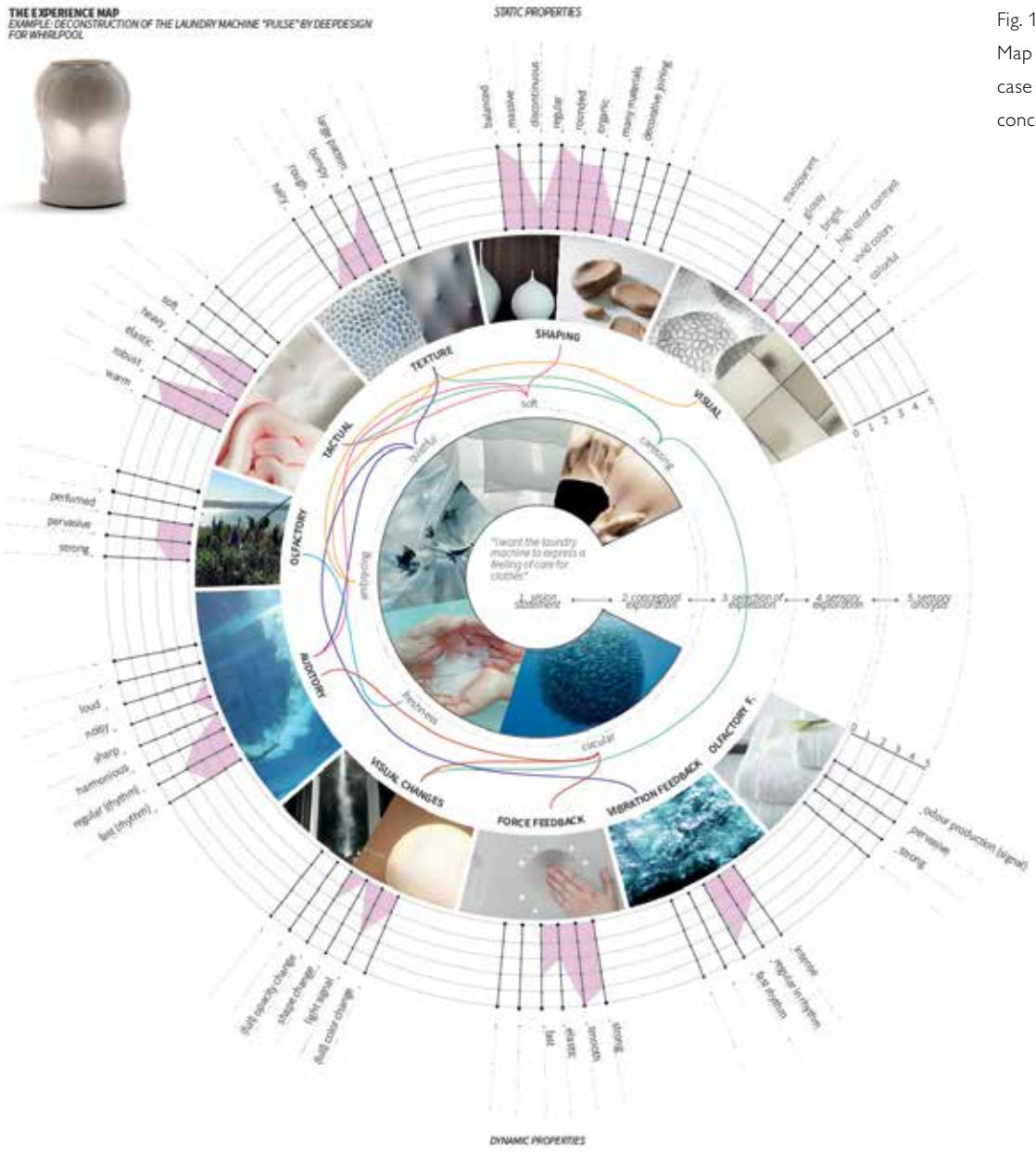

Fig. 1. The Experience Map describing the case study of the Pulse concept by Deepdesign.

Statement of Product Vision (1). At this level, designers should explicitly formulate the product vision they wish to embody in the object. In the example provided, which uses as a reference story the development of the 'Pulse' concept by Deepdesign in the 'Project F' by Whirlpool [27], designers were looking for a product that would express a feeling of care for clothes. This was their starting point.

Conceptual exploration (2). As a second step, designers should explore their idea on a conceptual level, searching for inspirations from various contexts, such as art, exhibitions, culture, trends, etc. They should be representative of the experience that the designer would like to make the user perceive. In the Experience Map, this level includes a mood board, where the designer can either insert images or create collages. Although still abstract in its representation, it corresponds to the first deep interpretation of the product vision, focusing more on 'how' that specific experience can be rendered in a product, than on 'what' kind of experience it will evoke. In (Fig.1), the images describe the feeling of a bubble, a hug and the freshness of laundry.

Selection of expression (3). In a subsequent moment, designers should start elaborating on the expression of the product, trying to describe elements of the product character [11]. With the expression of the product, the product vision develops into more detailed and specific qualities of the user-product interaction. For example, the product vision of the Pulse concept can be described as 'caressing, quiet, faded' (Fig.1). At this step, designers should try to elaborate a set of keywords defining the expression of the product vision. The more specific and unique they are, the better they will help selecting the sensory properties of the product. To further reflect on the product expression, designers can connect the keywords to the sensory properties that better convey that specific expression. For instance, a product can give a soft feeling through its shape and tactual qualities, and it can be characterised by olfactory sensations that evoke freshness (Fig.1). In this step, designers start challenging themselves on the role of the different sensory modalities to communicate the product vision.

Sensory exploration (4). The following level addresses a further moment of conceptual exploration, where designers look for more specific inspirations about each sensory property. This phase includes another mood board, which should describe in a more tangible way the expression of the product, how it must look or feel, its finishing and its dynamic qualities. As in the previous exploration, designers are free to look for whatever source of inspiration they may find: however, they should focus on each sensory property, looking for details. The sensory properties are divided in ten groups to facilitate a distinction between their roles. The static properties are listed as: the visual domain, the shaping of the product, the texture, the tactual aspect and the olfactory properties. The categories including the dynamic qualities of the product are instead: auditory, visual changes, force feedback, vibration feedback and olfactory feedback. Some considerations are needed: first, the category of 'shaping' refers to the qualities coming from manufacturing, rather than to the intrinsic properties of the material, which are included in the visual section. Similarly, a distinction has been made between qualities related to the texture of the product, and the properties related to the tactual domain. In this case, we preferred to clearly distinguish between the tactual experience given by the material itself, i.e. its warmth and softness, and other qualities related to a decorative pattern, which is perceived not only through the tactual system but also through vision.

Sensory analysis (5). Lastly, the external circle of the Experience Map covers the least abstract step, where designers are asked to carry out a sensory analysis (5) based on their personal interpretation of the product expression. For each group, a list of sensory qualities is provided: designers should rate them according to how much that specific quality is relevant to describe the selected expression (0=not all; 5=very much). Some free space is left to let designers add any term they might miss. The list included in the Experience Map was built based on various literature sources (Table 1), with some additions. It is meant to comprehend the possible variables that designers wish to consider while shaping the product. Yet, this selection has not been validated, as it is based on the aggregation of other verified lists present in the literature. Additionally, it is not, strictly speaking, the focus of the tool, and designers are free to adjust it to their personal needs. The list should not be considered as a definite list of sensory qualities to address while designing a product, but rather as a basis

Vision	Shaping	Texture	Tactual	Olfactory
>colourful [21] >vivid colours[21] >high colour contrast >bright >glossy [21] >transparent [21]	>decorative join-ing [21] >many materials [21] >organic [28] >rounded [28] >regular >discontinuous >massive [28] >balanced [28]	>large patterns >bumpy >rough [21] >hairy [28]	>soft [17], [21] >heavy [17], [21] >elastic [17], [21] >robust [17], [21] >warm [17], [21]	>perfumed [21] >pervasive [29] >strong [29]
Auditory	**Visual changes**	**Force feedback**	**Vibration feedback**	**Olfactory feedback**
>loud [29-30] >noisy [29-30] >sharp [29-30] >harmonious [30] >regular (rhythm) >fast (rhythm)	>opacity ch. [26] >shape ch. [26] >light signal >color ch. [26]	>strong [29] >smooth [29] >elastic [29] >fast	>intense >regular (rhythm) >fast (rhythm)	>odour production [26] >pervasive [29] >strong [29]

Table 1. List of the terms describing the sensory properties and corresponding sources in the literature.

Fig. 2. Some examples of completed maps.

to start. Designers are encouraged to add terms and qualities in the free space provided, to customize the map according to the specificity of the project.

5 Study results

The main aim of the Experience Map is to support designers in shaping their ideas through an experience-driven, multisensory approach. Doing so, it can increase designers' awareness of the process. Therefore, the tool can be used to train designers' sensitivity and help them think of all the possibilities given by each sensory modality. Providing a step-by-step guideline, it allows the transformation of the product vision towards a decreasing degree of abstraction. Hence, it is a tool to support design thinking with an experience-driven and multisensory approach. Other possible benefits include using the map to structure and communicate to other stakeholders the abstract complexity that entails the design process. The Experience Map can help presenting to customers the underlying frame of a design project, and therefore facilitate the communication between designers and companies. Moreover, it can foster easier confrontations with technicians and engineers. Here we present the results of a study using the Experience Map for educational purposes. 62 students following the Design for Interaction Master program at the faculty of Industrial Design Engineering (TU Delft) used the tool in a reverse mode (Fig.2). They were asked to utilise the map to deconstruct one object of their choice. They started first analysing the product through its sensory properties, rating how much, from 1 to 5, the suggested qualities could describe the product. Subsequently, they were asked to complete the mood boards, select the expressions and, lastly, to try to infer the designers' intentions underpinning the product. They were provided with an example map (Fig.1) and a vocabulary listing all the sensory properties, with definitions and antonyms to understand them more precisely. Finally, they were asked to fill in a questionnaire with several open questions as a qualitative evaluation and to rate the tool through an evaluation sheet as a quantitative assessment.

5.1 Quantitative assessment

The Experience Map was evaluated according to several criteria, as shown in Table 2. The evaluation sheet was

Criteria	M	sD	Criteria	M	sD
Usefulness	4.97	1.19	Completedness	4.82	1.12
Improved my skills	4.76	1.04	Immediateness	4.18	1.34
Easy to understand	4.79	1.33	Appropriatedness	4.63	1.12
Intention to use it	5.00	1.39			
Visual clarity	5.35	1.55			
Effort demand	5.53	1.21			
Flexibility	3.60	1.18			
Freedom to interpret	3.85	1.25			

Table 2. Results of the quantitative evaluation for the tool (left) and the sensory list (right).

based on a 7-point scale (1=not at all; 7=very much). The mean value (M=4.0) was taken as the test value to consider the criteria as satisfied. Table 2 shows the results of the assessment. Almost all parameters were rated as positive: the Map was found useful, skill-refining, easy to use, visually clear and 82% of the participants stated they would like to use it in other projects. However, other criteria were less satisfactory. As expected, the map required a significant effort, as well as the flexibility can be improved. In the same evaluation sheet, three general questions assessed the list of sensory properties according to its completeness, immediateness and appropriateness. All values were good.

5.2 Qualitative assessment

Students were asked to comment about (1) the usefulness of the Experience Map in the design process and how they would use it, (2) benefits and limitations of the tool, (3) other suggestions on their personal interpretation of the map. Interestingly, many participants reported the willingness to use the tool to support concept generation. They also found the tool useful to first deconstruct existing products and then to generate new solutions. They generally agreed on the tool's ability to stimulate design thinking and the value of the step-by-step guideline. The tool was found very helpful in visualizing the design process, and therefore to discuss ideas with others. In some comments, students suggested to use the map to analyse the product portfolio of companies. The majority of the students reported the need for a greater flexibility (see also Table 2), to adapt it to other uses or phases of the design process, or, more generally, to improve the creative flow. Another point that needed attention was the time-consuming activity of looking for appropriate images; some students suggested to create image databases to accelerate the process.

6 Conclusions

In this paper, we framed the need of a comprehensive tool to support designers in transforming their initial, abstract ideas into a ready-to-prototype concept. This need was found especially relevant in the context of an experience-driven, multisensory approach, which starts from the definition of a specific experience to elicit through the product, to look at the role of every sensory modality in conveying it. Therefore, we introduced a tool called the Experience Map, structured on 5 levels to reflect a step-by-step process that can help designers in progressively decreasing the degree of abstraction, to come up with meaningful and original solutions. The main goals of the tool are to increase designers' awareness of the process without influencing their subjective view on the design problem, and to help them considering all the possibilities given by the different sensory modalities. Side-benefits of the map can come for designers that use it to communicate their intentions and their thinking process to other stakeholders. The tool preserves designers' freedom and subjective interpretation of the design problem, while offering a structured layout to tackle all the steps

of an experience-driven, multisensory design approach. Moreover, it provides a clear overview of all the aspects and facets designers need to consider seeking coherence between the initial, abstract vision and the final, tangible product. The Experience Map should not be considered as a tool telling designers what they should design, rather it supplies a structured layout to organise their intuitions in a purposeful approach. The main strength of the Experience Map lies, therefore, in its visual comprehensiveness and its roots in solid methodological approaches present in literature.

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