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The Shaping of Form: Exploring Designers' Use of Aesthetic Knowledge

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Abstract

Research on design and designers has emphasized the tacit nature of the aesthetic knowledge that these professionals draw upon to make decisions about formal properties of objects and spaces, but is less clear about how design teams address the difficulties associated with expressing and sharing this type of knowledge. A ten-month ethnography in a design consultancy revealed a range of multi-modal and cross-modal ways in which members of a design team compensate their imperfect capacity of articulating verbally their aesthetic knowledge in order to gradually construct a common knowledge base enabling creative collaboration. In so doing, our study offers two main contributions. It illuminates the interplay between designers' aesthetic experiences, visceral responses, and intuitive cognitive processes that enable designers to draw upon their aesthetic knowledge to support the collective accomplishment of their task, and provides an interpretation of the design process as a form of 'creative' intuition driven by emotional reactions to environmental stimuli and emerging formal solutions.

Keywords: design, creativity, aesthetic knowledge, tacit knowledge, aesthetic experience, intuition

Everything that we have around us has been designed. Anything that isn't a simple, untouched piece of nature has been designed by someone. The quality of that design effort therefore profoundly affects our quality of life. The ability of designers to produce effective, efficient, imaginative and stimulating designs is therefore important to all of us (Cross, 2011, p. 4)

Research in organization studies (e.g. Ewenstein and Whyte, 2007, 2009; Seidel, 2007; Michlewski, 2008; Elsbach, 2009; Elsbach and Flynn, 2013; Seidel and O'Mahony, 2014) and the sociology of professions (e.g. Molotch, 2005) is paying increasing attention to the social and cognitive processes that influence decisions about how objects acquire their formal properties.

Studies in this area have drawn attention to the distinctive cognitive styles (Schön, 1983; Brown, 2008; Kolko, 2010), attitudes (Boland, Collopy, Lyytinen and Yoo, 2008; Michlewski, 2008), and processes (Cross, 2011; Ewenstein and Whyte, 2007; Stigliani and Ravasi, 2012) that designers employ as they approach their task. These studies, in particular, point to the reliance of designers on a distinctive way of cognitively engaging with their environment and their task – a 'designerly way of knowing' (Cross, 1982, p. 223) – alternative to the logical-analytical rationality that characterizes scientific and managerial disciplines. According to these studies, central to this 'way of knowing' is a direct unmediated engagement with sensual properties of objects and spaces, referred to as 'aesthetic knowledge' (Ewenstein and Whyte, 2007; Michlewski, 2008).

The concept of aesthetic knowledge is rooted in a long-standing philosophical tradition distinguishing between logical-analytical and sensory-perceptual forms of knowledge (Vico, 1744; Baumgarten, 1986; Dewey, 1958; Sandelands, 1998), and positing that aesthetic experience represents the basis for intellectual experience (Welsch, 1997). In organization studies, this notion has been also applied more generally in the field of organizational aesthetics (Strati, 1996) to examine how members relate to their organization and workplace environment.

Both lines of inquiry point to the essentially tacit nature (Polanyi, 1958) of this type of knowledge. The notion of 'aesthetic muteness', in particular, refers to the difficulty of translating aesthetic experiences and judgments into verbal, analytical language (Taylor, 2002). Overcoming aesthetic muteness seems crucial for designers to share their aesthetic knowledge in order to inform

and enable the collective accomplishment of their task. Designers' work largely occurs in teams (Sutton and Hargadon, 1996; Molotch, 2005) as a form of 'creative collaboration' (Hargadon and Bechky, 2006; Elsbach and Flynn, 2013), which requires at least a partial disclosure, sharing and exchange of the relevant knowledge of individual members. While past research has drawn attention to the experiential and intuitive processes that characterize the acquisition and use of aesthetic knowledge at individual level (e.g. Schön, 1983; Lawson, 2006), we still know little about how design teams cope with the difficulties commonly associated with the expression and articulation of aesthetic knowledge (Taylor, 2002).

A ten-month ethnographic study of three projects in a Boston-based design consultancy produced insights that begin to address this limitation. The first author engaged in participant observation of designers' work, as the three teams developed a new hospital chair, produced a new concept for a car targeted to first-time parents, and generated alternative visual solutions for the store windows of a telecommunication provider. These observations helped us capture the interplay between aesthetic experiences, visceral responses, and intuitive cognitive processes shaping how designers performed their task. They also highlighted a number of practices – understood as routinized types of behavior, consisting of interconnected bodily and mental activities, tools, and procedures (Reckwitz, 2002) – that helped designers overcome the tacit nature of aesthetic knowledge as they collaborated with other team members.

Our observations improve our understanding of design work by articulating how aesthetic knowledge and experiences shape designers' decisions, and by suggesting an interpretation of this process as a form of 'creative' intuition driven by emotional reactions to environmental stimuli and emerging formal solutions. We further suggest how aesthetic knowledge can be fruitfully conceived as constituted by a procedural and a declarative component, and enrich our understanding of the multi-modal and cross-modal ways in which members of a design team can compensate their imperfect capacity of articulating verbally even the declarative component of their aesthetic

knowledge in order to gradually construct a common knowledge base enabling creative collaboration.

THEORETICAL BACKGROUND

Research on design and designers has emphasized the specific ‘ways of knowing’ (Cross, 1982) that characterize this profession, and how they differ from the more-usually recognized scientific (e.g. Alexander, 1964; Gregory, 1966; Cross, 1982; 2011) and managerial (e.g. Boland and Collopy, 2004) ways of engaging with the world and solving problems. In comparing designers to other professionals, these studies have highlighted the specificities of the design process – in terms of designers’ particular ways of thinking and attitude to problem-solving, and the particular type of knowledge they use and produce when translating abstract requirements into concrete design solutions.

This research has drawn attention to designers’ tendency to physically engage with visual and tangible manifestations of their evolving ideas (e.g. Lawson, 2006; Boland et al. 2008; Michlewski, 2008). Schön (1983) metaphorically refers to this process as a ‘conversation’ with one’s drawings and sketches. Other scholars mention ‘design by drawing’ (Lawson, 2006) or ‘thinking by drawing’ (Cross, 2011) as central to designers’ thinking processes. Similarly, Michlewski (2008) links designers’ distinctive way of solving problems with their ability to visualize and think through their drawings. According to Goldschmidt (1991), designers do not sketch to represent images held in their minds, but to support the generation and refinement of formal qualities of the object being designed, in what she describes as ‘pictorial reasoning’ (1991: 123). Continuously engaging and re-engaging with drawings is what enables designers to respond to the design ‘as it emerges in the drawings’ (Cross, 2011: 71) to envisage new possibilities and ‘to make much more fundamental changes and innovations within one design than would have ever been possible in the vernacular process’ (Lawson, 2006: 26).

These studies suggest that the production of sketches, drawings, prototypes, etc. is not only a way to represent provisional design ideas, but is central to the way in which these ideas are developed

intuitively in the first place (Ewenstein and Whyte, 2007). As Boland and colleagues put it: ‘It is a form of *thinking with their hands* that allows them to experience the perceptual, emotional, and aesthetic feel of the building as they are intuitively thinking their way through the designing of it’ (Boland et al., 2008: 19, italics added).

Aesthetic knowledge and designers’ choices

As the quote above illustrates the particular knowledge that supports and guides designers’ choices represents an important aspect of designers’ ‘way of knowing’. Lawson (2004) described this knowledge as developed through the sensory interactions with objects, people, and events (see also Boland et al., 2008). He explains that designers acquire this knowledge as sensations and feelings stored in their ‘bodily memory’. Michlewski similarly mentions ‘designers’ fondness for using their aesthetic sense and judgment while interacting with the environment’ (2008: 381). Indeed, research shows how exposure to visual stimulation helps designers improve solutions for ill-defined design problems, even if these visual stimulations are not directly related to the problems (Goldschmidt and Smolkov, 2006). Ewenstein and Whyte (2007) refer to the particular type of knowledge that designers derive from and possess about objects and spaces as ‘aesthetic knowledge’.

The term aesthetics derives from the Greek *aesthesis* – a term referring to perceptions from the senses. The notion of aesthetic knowledge has its roots in philosophical distinction between logical-analytical and sensory-perceptual forms of understanding the world (intellectual knowledge vs. sensory knowledge) (Vico, 1744; Baumgarten, 1750; Dewey, 1958; Sandelands, 1998). This philosophical tradition posits that aesthetic experience – understood as a sensory-emotional response to events and interactions (Strati, 1992; Taylor, 2002) – represents the basis for intellectual experience (Welsch, 1997). This position has been corroborated by developments in cognitive psychology (Zajonc, 1980; Damasio, 1994) that suggest that affective responses to aesthetic experiences represent a form of ‘pre-linguistic’ form of interaction with the environment, coexisting with the more recently developed intellectual-linguistic knowledge (Whitfield, 2005).

Research on organizational aesthetics has begun to apply these ideas to the study of organizational phenomena (e.g. Gagliardi, 1990; 1996; Strati, 1990; 1992, 1996). In this tradition, aesthetics is understood as a tacit form of knowledge that ‘resides in the visual, the auditory, the olfactory, the gustatory, the touchable and in the sensitive-aesthetic judgment’ (Strati, 2007: 62), and cannot be entirely translated in intellectual-linguistic form. These scholars advocate the use of an aesthetic form of engagement with organizations as a way to investigate social, cultural and symbolic phenomena otherwise hidden to traditional forms of inquiry (Strati, 1992, 1996; Warren, 2008). Aesthetic knowledge, in their view, combines a researcher’s sensitivity to aesthetic features with a conscious, reflective engagement with one’s aesthetic experiences to grasp the deeper layer of meaning behind these features and revealed by these experiences (Strati, 1992, 1996; Gagliardi, 1996; Hancock, 2005).

Consistent with these ideas, Ewenstein and Whyte define the aesthetic knowledge that designers rely on as consisting of a symbolic dimension – understood as ‘fluency and literacy with signs’ (2007: 689) – and an experiential dimension in the forms of ‘feelings and embodied experiences’ (2007: 691). In a similar vein, Michlewski (2008) reports how designers rely on their ‘aesthetic sense and judgment’ (p. 381) while interacting with the environment, and how this ability is what allows designers to act as ‘cultural explorers’ and to open up new conceptual and commercial spaces. By interacting with what Cross (1982: 224) calls ‘the objects of our material culture’, designers are believed to be able to access the knowledge ‘carried’ by these objects in order to produce new design solutions thanks to their ability to ‘read and write in this culture’ (1982: 225).

Past research, however, is less clear about how designers manage to overcome the difficulties commonly associated with the expression and articulation of aesthetic knowledge (Taylor, 2002) to enable collective interaction. Ewenstein and Whyte recognize that the work of design teams rests on the interplay between individually held and collectively shared knowledge; they mention ‘joint discussions’ and ‘design meetings’ as ‘mechanisms for sharing and developing aesthetic knowledge’ (2007: 704), but are less clear about how members overcome the tacit nature of this type of

knowledge to enable collective decisions about formal properties of objects and spaces. Improving our understanding of this issue seems important in light of the impact of such choices on how users perceive innovations (e.g. Eisenman 2013; Hargadon and Douglas 2001; Rindova and Petkova 2007) and respond emotionally and behaviorally to the aesthetic properties of objects (Veryzer and Hutchinson 1998; Cox and Cox 2002; Rafaeli and Vilnai-Yavetz 2004; Creusen and Schoormans 2005; Tractinsky and Lowengart 2007).

METHODS

Our ethnographic study relied on the participant observation of three projects at Continuum, a worldwide design consultancy headquartered in Boston (www.continuuminnovation.com). At the time of our study, the Boston office employed over 100 employees, including product designers, graphic designers, brand designers, design strategists, mechanical engineers and model makers. We selected three projects that were about to start when the first author began her/his observations. The first project (Car) was aimed at developing a new concept of car for first-time parents. The design team developed a set of design properties to make the vehicle a way to preserve and affirm users' identity, while being reliable, comfortable and within reach. The second project (Chair) was aimed at developing a new hospital chair that would create a new aesthetic paradigm in hospital furniture. The design team chose a set of design properties (bright colours, simple and harmonious shapes, soft textures) to make the chair a means to provide optimism, joy, and to promote wellbeing. The third project (Store window) was aimed at creating the seasonal design of the store windows of a mobile-phone provider. The design team developed three main themes to be displayed in store windows across the different holidays –‘reinvented traditions’, ‘relationships’, and ‘rescue’– and defined decorative elements for each of them.

Data Collection

Data collection followed common recommendations for ethnographic work (e.g. van Maanen, 1979; Spradley, 1979), and combined data that the first author collected over a period of ten months. In particular, we gathered data from three main types of sources:

Observations. The first author followed the three projects from the beginning to the end. S/he attended 79 meetings, during which s/he took careful notes and pictures of people and artifacts. S/he also attended 17 additional meetings (see Table 1 for a breakdown of these meetings). Finally, s/he had several informal conversations with managers, designers, engineers, and clients. Lacking a design background, his/her participation to the projects consisted in the performance of various roles (e.g. collecting information for the project, writing down minutes and taking pictures during meetings, etc.). Drawing upon overt involvement, but not performing the role of a team member *stricto sensu*, he/she managed to balance the roles of participant ('going native') and observer (remaining objective) (Spradley, 1980).

Semi-structured interviews. The first author also conducted 52 semi-structured interviews: 17 were preliminary interviews with senior managers, 15 debriefing interviews with members of the project teams, and 20 retrospective interviews focused on some past projects (see Table 1 for more details).

Archival data. Intranet documents, including the guide for newcomers, internal presentations of the practices, guidelines for project managers, maps of the development process, etc. were helpful in familiarizing ourselves with the organizational context. Other archival data, such as presentations, case studies of past projects, meeting minutes, project updates, correspondence with stakeholders, pictures, design briefs, as well as objects produced and/or used in the course of the projects supported the interpretation of the dynamics we observed.

Data Analysis

As customary in ethnographic research, we conducted data analysis in two steps. A first-order analysis relied on standard ethnographic guidelines aimed at discovering themes and patterns in informants' accounts and events. In performing this analysis, we employed primarily descriptive, observational data, represented both by the field notes quickly jotted down during meetings, and by longer and richer descriptions of meetings and events happening in the different projects, which the first author used to write regularly when back from the research site. Field notes proved crucial in

producing an extensive write-up for each of the three projects, detailing the different phases of the process and the activities included in each phase. When doing so, we initially mapped both the functional and the aesthetic issues designers encountered when developing new products, but we eventually concentrated our attention on the aesthetic ones, in line with our research question. We compared the three write-ups in order to identify common activities designers engaged in and the language they used to make sense of what they did when dealing with aesthetic issues. The first-order reporting, thus, takes the form of a brief ethnographic narrative of designers' work at Continuum, integrating informants' accounts with the first author's experiences as an ethnographer. This account reflected the way our informants understood and described the design process as organized around a sequence of phases that enabled them to move from early intuitive ideas to a detailed specification of the formal properties of objects and spaces.

The second-order analysis moved to a more abstract and theoretical level, wherein we examined the raw data and first-order findings to discover underlying dimensions that might be relevant for domain beyond this study (Spradley, 1980; van Maanen, 1979). As part of this analysis, we examined the ethnographic data from a theoretical perspective to try to detect deeper patterns and dimensions of understanding. Based on our first-order findings and consistent with our research question, we re-interpreted our observations in order to understand and explain how designers relied on their aesthetic knowledge when defining properties of new objects and spaces.

To do so, we carefully and systematically tracked episodes involving reported aesthetic experiences and/or the observed sharing of aesthetic knowledge. We used past research to classify the former (aesthetic experiences) into two different types of emotional reactions (Rafaeli and Vilnai-Yavetz, 2004), and we grouped the latter (sharing of aesthetic knowledge) into four more general practices. We then mapped episodes onto the phases identified in the first-order analysis to produce a second-order theoretical interpretation of how designers built, used and shared aesthetic knowledge to collectively accomplish their creative tasks.

In both stages, we complemented observational data with interview transcripts in order to enrich, reinforce and triangulate our emerging theoretical interpretations. We resorted to the internal documents and other archival material to increase our general understanding of the organizational setting. Table 1 summarizes our data sources and their use in our data analysis.

[Insert Table 1 about here]

To ensure that our analyses met Lincoln and Guba's (1985) criteria for trustworthiness, we employed an insider-outsider approach (Evered and Louis, 1981; Gioia and Chittipeddi, 1991). The first author, who conducted the ethnography, acted as the insider researcher and had primary responsibility for gathering and initially analyzing the data. The second author acted as the outsider researcher and adopted a more general orientation, noting areas requiring additional data collection, formulating follow-up interview questions, playing the 'devil's advocate' by offering alternative explanations for developing findings, and considering the data at a level beyond the details contained in the large qualitative database. Both authors were involved in the actual data analysis so that the credibility of the findings would not rely solely on the interpretations of a single analyst. Consistent with this approach, and to ensure further trustworthiness, both authors analyzed data independently, and then compared their analyses. We solved discrepancies in our independent coding through discussion and/or the occasional reinterpretation of data.

FINDINGS

First-Order Findings: Design Practices at Continuum

Our informants described the design process in their organization as a sequence of phases characterized by different tasks and intermediate goals. Our study focused on the early phases of this process –what designers at Continuum referred to as Learning & Definition, Creative Exploration, and Concept Development & Refinement– when team members make core decisions about basic functionality and material properties. In this section, consistent with common conventions for reporting ethnographic data (van Maanen, 1979), we present the practices carried

out in these phases as we observed them and as they were interpreted by designers themselves (first-order narrative). In the next section, we offer our second-order interpretation of the theoretical relevance of these observations for our inquiry.

Table 2 summarizes how the process unfolded through the various phases in the three projects we observed: the main activities designers performed, the main issues they encountered, and the choices they made. For the sake of simplicity, in this section we use project Chair as a running example. Table 3 summarizes the main concepts designers used to describe and interpret their task, and exemplifies them with reference to this project.

[Insert Tables 2 and 3 here]

Learning and Definition. In the beginning of each project, designers agreed with clients on a common definition of the main goal to be achieved through a specific design, what they referred to as the ‘design intent’ – i.e. the fundamental goal to be achieved by the project through design choices – and the ‘design attributes’ – i.e. the emotional responses and symbolic associations to be elicited by the formal properties of an object (see Table 3). For example, Project Chair’s designers, together with their client, defined the design intent as to make the chair ‘the new reference point for patient room aesthetics’, and the desired attributes as to ‘promote the recovery and wellness of patients’, and ‘inspire a sense of optimism in users’ (both patients and caregivers) (see Table 2 for other projects).

After having defined the overall goal of the project, designers engaged directly with prospective users to develop an understanding of their latent and unarticulated needs. The envisioning of the new hospital chair, for instance, was preceded by one month of field research, which they referred to as ‘in-context research’. During this period, designers interviewed and observed patients and nurses to understand how these two types of users interacted with hospital chairs. As a designer involved in project Chair explained:

Sometimes, I don’t know about the product necessarily – especially if it’s a medical device. So the research that we do and being able to experience the product by myself are very important, not only to understand something new, but also

to feel more comfortable with the use of the product – how the product would be used, how the product would be sold, how the product makes people feel – so that later on, when I design, I design towards that. (Adam, industrial designer)

These observation and first-hand experiences led designers to conclude that most current chairs looked ‘institutional’, ‘corporate’, ‘dull’, ‘cumbersome’ and even ‘discouraging’ (see Table 2). This observation also helped them refine the intended design attributes, by specifying that, in order to facilitate patients’ recovery and to support their wellbeing, the new chair needed ‘to look welcoming, to feel warm and soft, and to communicate positive emotions (joy, optimism, etc.)’, as explained in an early internal presentation.

Designers also conducted what they referred to as a ‘competitive survey’ of the form of existing products: they visited stores to purchase competitors’ products, and they browsed books, magazines, and websites to develop deeper insights into aesthetic trends and user tastes. They reviewed existing ‘design languages’ (a term they used to refer to coherent sets of visual properties that characterized objects and spaces), and they mapped current ‘design landscapes’ (visual comparison of the most common design languages to highlight relationships between formal properties and the meanings they conveyed) to inspire choices about how to express the design intent in formal properties (see Table 2). As Image 1 shows, in creating the design landscape of Project Chair designers did not limit themselves to reviewing existing hospital chairs, but also studied the typical design language of office and airline chairs to identify ways to differentiate aesthetically and symbolically the chair under development from these other chairs.

[Insert Image 1 here]

Designers looked for inspiration about materials, colors, textures, finishes, etc. in objects or spaces that were not strictly related to the project. As another designer involved in project Chair explained after a meeting:

When I get a project, I start to have thoughts of how that [project] relates to other things that I have seen, references, you know, like in other areas that are similar, like architecture or even fashion, and I might start collecting and finding examples of forms or other details that I feel instinctively or intuitively attracted to ... If you look at some of the sketches that are up on the walls [*showing the armrests of the chair*], you can see some details that have been inspired by some of the pictures here [*showing a picture of a throw draped over an armchair*] (Greg, industrial designer)

Designers attempted to more vividly express the knowledge they had gathered during this preliminary phase in large assemblages of artifacts called ‘boards’, which used visual images and samples of materials to illustrate design attributes and languages. Designers also used boards to articulate visually desired attributes that were difficult to explain verbally. As a designer explained:

A lot of our clients tend to look for certain visual or brand attributes in their products, whether it be they want it to look powerful, rugged, or businesslike, so we need to create visual boards around those attributes for each project that help us design to those words (Jennifer, brand designer)

So-called ‘mood boards’ tried to capture the intended aesthetics and symbolism of new objects or spaces and align it with the mandate and the characteristics of the clients. Another informant thus explained how they used visuals to fill words with meanings and direct subsequent design choices:

We think of the words that they have in their brand, and this is usually words that they give us that they use already ... And we would analyze these words, and how these words relate to their brand in terms of how the company works, as well as the products, the advertising, so it’s like to keep things consistent within the brand ... And then from those words, we look at what they have in their company already in terms of like marketing, products, things like that, and at the same time that we do that, we look at what we call analogous products, products that carry the same attributes or maybe speak the same language, but you know they don’t have to look the same, but they have to have the same feeling or they have to achieve the same things as those attributes. And then, from there we start developing “mood boards”because we would first align ourselves with what the company is about, and what they want to achieve. (Michel industrial designer)

In the case of Project Chair, designers created two mood boards: one with visual references communicating the design attributes and languages of existing hospital chairs (as a result of the in-context research and of the competitive survey conducted) and the other with images conveying the desired attributes of the chair under development (see Image 2 and 3).

[Insert Images 2 and 3 here]

These boards were usually generated during so-called ‘Visual Library Meetings’, visual brainstorming sessions aimed at generating and collecting a set of images conveying the desired attributes. Before these meetings took place, the project manager communicated the words around which the visual brainstorm would be about, and ask participants to bring images that in their opinion were related to those words. This excerpt from our field notes illustrates a typical interaction during one of these meetings:

Mike, project Chair manager, opens up the Visual Library meeting by explaining: “This chair is going to go into a particular environment [hospital rooms], and it is supposed to promote health, to be warm, playful, light, inviting and welcoming, and make you want to sit in the chair”. He had sent us an email before the meeting with a list of words related to Project Chair and he had asked us to bring “anything that in our opinion visually expresses these words”.

Everyone shares their images and explains why they picked those images. For example, Greg shows the picture of some colorful balloons explaining that for him balloons embody the idea of lightness and playfulness at the same time. Maddy shows the picture of a white feather conveying in her view the idea of warmth and lightness. Damien shows the picture of a mother and her son wrapped in a red blanket to express the notions of warmth and welcoming. After we all have shared our images, we discuss which ones are the most effective, and we select a subset that we will use for the mood-board.

As exemplified by this excerpt, designers in a team differed in terms of the aesthetic experiences they had been through and in the aesthetic knowledge they had accumulated, as reflected in their different take on the intended attributes. These meetings helped them translate in visual terms relatively abstract, project-related ideas and aesthetic experiences that they found difficult to express verbally, and to share and exchange personal interpretations of these concepts (we return on this point in the next section).

The Learning and Definition phase typically ended with the creation of a ‘design brief’, a document outlining the main elements of the project – such as current market trends and preferences, the design problem to be solved, possible areas of opportunities, project requirements and objectives – as well as a project ‘design vocabulary’ summarizing the main concepts designers used to describe and interpret their project (see Table 3), which guided them in the following phases.

Creative Exploration. In a second phase, designers individually developed a number of possible creative interpretations of the revised mandate formalized in the brief. Initially open and unconstrained, although within the boundaries outlined by the ‘design vocabulary’, this phase aimed at creating a high number of ideas without worrying too much about the details and the execution. In this phase, designers produced sketches and drawings that incorporated the desired design language and addressed the intended attributes. Again, these sketches and drawings reflected in part the distinctive aesthetic knowledge of team members; yet, as the project progressed, we could observe a gradual convergence around the desired attributes and how to achieve them, facilitated by the visual material designers produced, exchanged, retained, assembled or discarded.

In the case of Project Chair, the previous phase had led designers to refine their understanding of the intended design attributes as to convey ‘optimism’, ‘warmth’, ‘welcoming’, and ‘lightness’.

In order to express these words, designers selected and used visual imagery of colorful balloons, a blue sky, a yellow kite, a white feather, a red blanket, orange socks, etc. (see Image 3). A designer explained how these images were important because ‘they will always be in the back of our minds when we design this chair, because every single line, every single detail, every single feature we design should promote that word, that feeling inspired by these images (Damien, industrial designer)’.

When the object under development required a high level of interaction with the user, designers also produced rough and small-scale mock-ups to directly experience what they referred to as the initial ‘look and feel’ of the concept. By ‘look and feel’, designers referred to the main properties of the appearance, surfaces and interfaces of a new design; from a user’s perspective, it described the sensory experience triggered by interacting with the object or space. Very early on in the development of the hospital chair, for instance, designers built a 3-dimensional model, which they called ‘Buck 1’ (see Image 4). Buck 1 was initially a rudimentary chair, composed of different parts directly received from the client and mainly used to test the functioning of the reclining mechanism. As the creative exploration proceeded, discussions centered on which materials to use, and on how to design the edges of the chair so that it would be experienced as ‘warm’ and ‘cozy.’ As a consequence, Buck 1 was progressively modified and enriched with details aimed at conveying the intended ‘look and feel’: a fabric of a certain color and with a certain texture, armrests and headrest of a certain size and of a certain shape, etc. (see Image 5).

[Insert Images 4 and 5 here]

Concept Development and Refinement. In the following phase, designers refined and prototyped the most promising concepts, and presented them to their clients. The selection of concepts produced by the interaction of different team members required an evaluation of the coherence between the design intent and the ‘design execution’ – that is the actual shapes, materials, colors, finishes etc. of the final design (see Table 3). During meetings called ‘design critiques’, designers discussed the different concepts and selected those that best delivered on the project’s goals.

Reference to the project goals helped designers resolve disagreements among team members about appropriate aesthetic properties; in these circumstances, the project leader played a pivotal role in steering the discussion and facilitating the integration of different ideas.

In Project Chair, the final concept emerged from the combination of formal elements embodied in the sketches of two designers that attempted to convey the ideas of a blanket and of pillows (two elements of the visual imagery associated with the design language, as shown in Image 3), as well as that of lightness (one of the intended attributes of the new chair). The following excerpt from the field notes illustrates the initial convergence of team members around some ideas for the design of the new chair:

Today we are meeting for a design critique. Mike, the project manager explains what our next step is: "In one week from today our task is to select from all the sketches we have individually worked on the ones that most strongly communicate what this chair is about. It's crucial to emphasize all the different aspects of the design that we think are important to communicate to the client". At this point, he invites Damien and Greg to illustrate their sketches. Damien puts his sketches in the middle of the table to let everyone see them, and points to those portraying the shape of the legs of the chair. Then, it's Greg's turn. He explains that he tried to convey a sense of stability and continuity in the shapes, and to hide the engine of the chair. Mike likes Greg's sketches and emphasizes the importance of smoothly connecting the back to the seat: "I like the idea of elegantly associating, but separating them, as if there was a blanket over them!" He goes on and says: "I like this pillow thing as well; it's very welcoming, but at the same time it can be something difficult to clean; we need to keep that in mind". Then, turning back again to Damien's sketches he says: "I like these gestures of the legs" pointing at a drawing portraying the chair with elegantly curved and winding legs, "and I think that we should keep the edge thin, but put all the parts together in order to try to minimize the gap". "I can even see this chair in warmer colors" Mike adds, "Think of the sense of richness that it would acquire and transmit to the users. And I think we can combine both your sketches in one single design. That's great, Damien and Greg! Good job!"

Once they had agreed on one or two promising concepts, designers shared them with their clients. During so-called 'concept sharing' meetings, they described the different concepts, both in terms of their formal properties and the messages they intended to convey. They showed clients pictures and sketches, and they invited them to interact with the physical models.

In the case of the Project Chair, for instance, during a meeting, one of the clients pointed out that the current shape of Buck 1 did not look 'welcoming' like a maternal embrace (a metaphor often used by designers to invoke the idea of welcoming), as the back of the chair looked too masculine and aggressive. Based on the feedback received, the project manager used some black duct tape to reduce the size of the back of the chair to make it look 'more feminine' and more welcoming (see Image 6).

[Insert Image 6 here]

Finally, designers focused on the selected concept to guarantee coherence across different aesthetic details – materials, finishes, surfaces, colors, textures, etc. In the case of the hospital chair, the final ‘design execution’ was based on the use of warm and positive colors (i.e. green, orange), soft and cleanable fabrics, smooth surfaces, and feminine shapes (see Image 7). Consistent with the initial design intent and the desired design attributes, the team selected this set of material properties in order to make the chair’s appearance ‘more residential and playful, and contributing to a sense of comfort, well- being, and mobility’ as stated in the final presentation to the clients.

[Insert Image 7 here]

At this stage, designers typically built a more refined prototype to fully convey the agreed ‘design intent’ and ‘look and feel’ of the object. This stage usually required multiple iterations and different versions of the same model, until designers reached the desired result. In the case of project Chair, designers eventually opted for green fabrics to represent hope, an adjustable headrest to increase patients’ comfort, wide and pillow-friendly armrests to make the chair look “homey”, and a narrow back seat and harmonious legs to make it look welcoming and inviting (see Image 8).

[Insert Image 8 here]

Second-Order Findings: Aesthetic Knowledge and the Shaping of Form

In the previous section, we have described designers’ work in the terms that informants used to interpret their own reality. We now draw on our ethnographic observations to produce second-order interpretations that address the more general theoretical issue of how designers use aesthetic knowledge – individually and collectively – to shape formal properties of new objects and spaces.

Table 4 summarizes how designers’ different reactions and practices are observed in different phases of the design process.

[Insert Table 4]

The theoretical framework emerging from our analysis (summarized in Figure 1) foregrounds the interplay between designers’ aesthetic knowledge and the formal properties of objects and spaces

they are exposed to and/or designing. Design scholars often mention the “intuitive” nature of designers’ choices (Lawson, 2006; Michlewski, 2008); our framework explains this intuitive nature in terms of the aesthetic knowledge and experience involved in these choices. Moreover, it links individual-level use of aesthetic knowledge with collective-level collaborative efforts by highlighting practices that help designers overcome aesthetic muteness, and the dynamic interaction between individual-level processes and collective ones.

[Insert Figure 1]

Acquiring and deploying individual aesthetic knowledge to inform design choices. Our ethnographic observations, informal conversations, and follow-up interviews confirmed the centrality of aesthetic knowledge in what designers described as intuitive choices they made about the properties of objects and spaces (represented in the bottom left part of Figure 1). Many informants pointed out how these choices were guided mostly by their ‘senses’ and ‘gut feelings.’

As a designer explained:

What I rely on is kind of my senses and my intuition and what I feel is going to look good and what I know might work better than others. It’s kind of [using] your knowledge and your intuition as a designer (Mike, industrial designer)

Designers considered this peculiar knowledge – about how to elicit a desired emotional response though the design of formal properties – a distinctive competence, a know-how partly resulting from their training and education, partly from the aesthetic stimuli they had been exposed to over time through learning by doing (see also Lawson, 2004). As another designer explained:

A lot of our understanding of why the idea is right is based on these intuitive reactions or emotional reactions.....but it’s not something that comes just out of the blue. It’s something that’s built upon the learning – the data, I guess you would call it... (Kristin, design strategist)

Designers linked this know-how to a more general aesthetic fluency and literacy – an understanding of product aesthetics and symbolism – which was constantly enriched by the project-specific knowledge they accumulated as they moved from one project to the next. Another informant explained how “every project is very different: today I might be working on a baby stroller, and three or four months later, I might be working on cars; therefore, every project that we work on is like we’re building our knowledge base as designers (Peter, design strategist).”

Designers, in this respect, differed from one another. The different aesthetic experiences they had undergone in their career had endowed them with different sensitivity to aesthetic properties of objects. These differences partly manifested in their different takes on how to pursue a project's goals and intended attributes. For instance, team members who had worked repeatedly with a particular client in the past usually possessed a more nuanced understanding of the aesthetic properties that were more likely to fit the client's preferences, desired brand positioning, and product portfolio.

These observations are consistent with research in cognitive psychology, which distinguishes between declarative knowledge (or 'know-that') and procedural knowledge (or 'know-how') (e.g. Ryle, 1949; Stillings et al., 1995). The former refers to factual information about the world stored in memory, while the latter has been defined as the knowledge exercised in the accomplishment of a task, thus including knowledge which cannot be easily articulated by the individual, since it is largely non-conscious (or tacit). In the case of designers, these two types of knowledge were manifested respectively in their knowledge about objects, their aesthetic properties, and the relationships among objects and properties (declarative component) – which was occasionally articulated in visual libraries, mood boards, design landscapes, etc. – and knowledge about how to infuse objects with the aesthetic properties required to trigger the desired responses (procedural component) – which was manifested in the design choices they made.

The importance of aesthetic experiences for building and refining designers' aesthetic knowledge (represented in the top left part of Figure 1) was evident since the initial steps of the projects. During a debriefing interview, for instance, a designer explained the importance of being alert to direct sensory experiences and reflecting upon them as a source of inspiration:

I do a lot of window-shopping. I go out all the time and I look at what stores carry, what the buyers are buying ... When you go into a retail environment like that, it's great because there's so many different ones out there. So if you go into a mall, for example, and you look at what all the retailers are doing is kind of cool to be able to see, for example, what someone's doing in their windows as a display, and what the season's colors are, what the trends are, and that's stuff that you can open a magazine and look at, but *you don't get a sense of it unless is something physical in front of you. I like that better... to be able to touch things, buy things and kind of feel and understand what it is.* (Claudia, brand designer, italics added)

Emotional responses triggered by sensory stimuli mediated the acquisition of project-specific knowledge – by directing attention to relevant aesthetic properties of objects within a given domain – and directed its deployment in subsequent design choices. As another informant explained:

Magazines are more widely used than books because a lot of times people just need inspiration, and for that inspiration they want to look through whatever the newest magazines are on *as a way of just pulling kind of quick emotional reactions* to whatever architecture turns them on or product design or furniture design ... That's how design develops: design is not just pulled out of a vacuum. It's pulled out of our environment; it's pulled from *objects that people respond to*... it might be a car, you know, it could be a chair, it could be everything. (Alan, industrial designer, italics added)

Research indicates that emotional reactions to aesthetic stimuli can be of two types, referred to as primary and secondary reactions (Rafaeli and Vilnai-Yavetz, 2004). Spontaneous primary reactions – or *visceral reactions* (Norman, 2004; Rindova and Petkova, 2007) – manifest as feelings of attraction or repulsion, pleasure or discomfort, triggered by the sheer aesthetic properties of an object (see also Zajonc, 1980). Designers experienced these responses as they deliberately exposed themselves to a flow of sensory stimuli, seeking inspiration in possibly unrelated domains (see Table 4). In this respect, a product designer illustrated how the feelings sparked by the experience of some designs could guide the generation of conceptual sketches:

When I have to generate ideas on paper, I usually leaf through books and magazines ... It influences the kinds of forms you put down on paper, because you're going through a magazine and then you respond to certain forms, certain colors, certain gestures, and you recognize that *you're responding to those things, and then you try to figure out how to recreate that same feeling in what you're doing when you're sketching* (George, brand designer, italics added)

Another designer reported the excitement sparked by the set of images and pictures collected during the in-context research and pinned up in a project room:

A project room with all these visual aids available... the moment that you walk into it you're immediately visually stimulated. ... When we go to meeting rooms, it's when we want to focus, when we want to get to the point... If I want to have a focused conversation, then I'll find a room that has clean walls, that does not have all these busy images... and when I want to have visual stimulation, then I come to the project room and I'll look at all these visual aids. Besides visual stimulation, they evoke some emotions... you know, when I look at some shapes, some colors or some materials I feel excited, I feel confident, I feel like there's no boundary, that the possibility is limitless, because apparently other designers came up with all these solutions, so it allows me to feel like I could come up with something different and what is on these walls now is just some of the possible solutions. (Heather, design strategist)

Secondary emotional reactions, instead, are mediated by a conscious processing of the aesthetic properties of an object, and stem to a large degree from the *symbolic associations* that these objects evoke (Pratt and Rafaeli, 1997). This second type of responses was manifested, for instance, as designers processed aesthetic properties of objects or spaces more consciously, by comparing them

and assembling them in the design landscapes and mood boards described in the previous section (see Table 4). These efforts would help them identify formal properties that would make an object look ‘safe’, ‘approachable’, ‘domestic’ or else, inducing users to feel reassured, attracted, or comfortable.

These visual artifacts helped designers organize part of the aesthetic stimuli they encountered by more consciously linking formal and symbolic properties of objects and spaces through the emotional responses they triggered. As an informant exemplified:

We want to see how people want this product to look [it’s a hair removal device]. So we don’t know if they want it to look very safe and medical, because it’s a laser, and dangerous, and it’s in your home, or they want it to look more familiar, more like a beauty product because it helps you feel more beautiful. So we have a whole bunch of illustrations of what it could look like. It could look very technical, very safe and then there were some in between and then it could look just like something that’s in your bathroom already. [We asked ourselves] What makes something look safe? What makes something look medical or professional? ... We looked at professional lasers, and they all have big displays, they all have dials, instead of, like, the microwave buttons that are very smooth and easy to use... So if you want to make something look medical you take some of those details, and have a dial – instead of, you know, a nice and soft button – and you have a display. Little details. For example, they also have metal; metal is a very serious material, so in one of those illustrations we had metal feet and made it very serious. It was very geometric. While the more beauty product was more rounded, it was a whole-ball shape, a nice soft green, no hard edges. (Julia, industrial designer)

As we discuss later, these practices helped them surface part of the aesthetic knowledge that they had acquired – by being alert to and reflecting on their aesthetic experiences – and make it available to the team to deploy it in the project. These practices, in other words, help them rendering part of this knowledge less tacit, by codifying it in a combination of visual and verbal expressions that could be shared with the rest of the team (see, for instance, Images 2 and 3).

These responses also influenced the examination of issues of harmony and balance of shapes, as the application of formal principles of design (see for instance Butler, Holden and Lidwell, 2003) to a particular object was really shaped by less conscious feelings of pleasure or discomfort triggered by exposure to current or evolving designs. As a designer working on project Chair explained:

When I look at that chair behind you, I see something that is so kind of odd... the seat and the back have nothing to do with each other. You’ve got this back that has one color and one texture and then you have the seat that’s another color and another texture, and they look like as they came from two different chairs. It represents the most primitive non-design. It’s literally just a utilitarian series of parts that do a job, and are really dead visually. And then, you have this [*he points at another chair*], which is maybe a step-up from the wheel chair, because it does look like someone might have tempted to design it, trying to reach some sort of harmony. But it’s still not there yet (Greg, industrial designer)

Even at later stages of development (see Table 4), during project meetings, the first author frequently observed designers doodle and sketch ideas on paper or fiddle with materials available in

the project rooms while having conversations with the other members of the team, sometimes with no apparent plan or direction, but with the aim to stimulate the generation of ideas, as explained by an informant in a follow up interview:

We all have like a process of how we help our brains go through something.....a lot of people draw to do it. I need something in my hands like clay or something...like we all have these weird manual things that we need to do in order to work through it (Susan, industrial designer)

Importantly, despite the initial effort to articulate aesthetic knowledge and experiences relevant to the project in mood boards and design landscapes, designers' sketching or the construction of physical prototypes was only loosely guided by conscious understandings of linkages between aesthetic properties, emotional responses, and the symbolism of objects and spaces. A designer referred to this process as 'emotional exploration' to highlight the importance of his own emotional responses to the forms and shapes gradually emerging from his open-ended efforts.

These observations suggest that the process through which designers imbue objects and spaces with formal properties is only partly conscious. New ideas did not develop from the carefully planned and deliberate application of design principles to address clear problems, but from the relatively free engagement of designers with matter. What followed was a mindful adaptation of design choices to the designer's own emotional responses to tentative formal properties. These responses alerted designers of the relative fit of tentative solutions with the design intent, thus guiding their intuitive attempt to induce the same responses in users interacting with the same object or experiencing the same space.

Sharing and co-constructing aesthetic knowledge at group level. While designers acknowledged the importance of 'gut feelings', they routinely found themselves in need to explain ideas that reflected personal aesthetic knowledge and experience to their teammates or their clients. In these circumstances, designers had to confront the tacit nature of the aesthetic knowledge they relied upon, or, as an informant put it, the fact that 'there are things that you just cannot explain with words' (Richard, Model Shop Manager).

Research on organizational aesthetics uses the term ‘aesthetic muteness’ (Taylor, 2002) to refer to the difficulty of representing or communicating aesthetic knowledge verbally, as sharing this tacit knowledge requires the ‘translation of holistic aesthetic experience into the more discursive signal system of language’ (Taylor, 2002: 823). Aesthetic categories (e.g. the beautiful, the grotesque, the comic, etc.) represent an attempt to codify a range of aesthetic experiences in linguistic form (Strati, 1992). Some scholars, however, argue that these categories may defy articulation in that they may lack clear semantic content and are essentially ‘defined by the emotions that aesthetic experiences evoke’ (Whitfield, 2005: 11).

According to Langer (1942), different forms of knowledge require different forms of representation, with tacit knowledge being represented more effectively through artistic, rather than discursive forms. Gagliardi (1996: 576) similarly remarks how expressing aesthetic experience requires ‘allusive, poetic language’ to attempt to evoke similar reaction in a listener. Strati (2008) also points out that organizational actors are able to describe and articulate their aesthetic knowledge by using ‘evocative terms of metaphorical language pertaining to aesthetic understanding and not in logical-analytical terms’ (2008: 235). Research on intuition came to similar conclusions about the difficulties of articulating verbally feelings associated with intuitive judgments:

Individuals may be unable to communicate the somatic aspects of their intuition or their tacit knowledge in conventional, precise, literal ways. However, it may be possible for them to convey, through the use of metaphor, the feelings that accompany intuitive judgments and the tacit elements of their mental models (Sadler-Smith, 2008: 502).

Indeed, designers frequently used *metaphors* to express actual or desired aesthetic experiences, as they discussed design attributes (see also Lawson, 2004; Seidel and O’Mahony, 2014). As mentioned earlier, when developing the new hospital chair, for example, designers would constantly use aesthetic metaphors like ‘blanket’ or ‘pillow’ when talking about the intended look and feel of the product under development. The main purpose of these metaphors was to qualify better intended aesthetic experiences by evoking aesthetic associations stored in their team members’ minds by using analogical thinking. Islam, Endrissat, and Noppeney (2016) show how perfumers similarly use

metaphors in order to communicate the intended mental associations that they want a new scent to trigger.

While useful, however, according to Hodgkinson and colleagues, even metaphors are limited as ‘a translation into symbolic means of an affective state ... is not the equivalent to the affective state itself, the latter by definition being purely subjective (Hodgkinson et al., 2009: 290).’ Also, the inherent polysemy of metaphors – as illustrated by the abandonment of the idea of an airplane seat to inspire designer’s work in the project we described – make them prone to multiple interpretations based on the different experiences of team members (Lakoff & Johnson, 1980). Indeed, our observations revealed four more practices that designers used in order to ‘transfer’ and ‘share’ the aesthetic knowledge underlying their proposed solutions to the rest of the team or to collectively co-construct a common, inter-subjective knowledge of relevant aesthetic properties.

These practices were characterized by the more or less effortful attempt to articulate tacit, pre-linguistic experiences in verbal, visual and/or material modes. Borrowing from research in social semiotics, by “mode” we refer here to the visual, aural, spatial or linguistic resources used to communicate (Kress, 2010). In our context, these resources were represented by the artefacts designers collected, used or produced, as well as by the conversations that unfolded around these artefacts.

Typically, these practices unfolded during team meetings, when the design team would meet to illustrate the aesthetic solutions generated by designers along with the reasons underlying their choices, to get feedback from their colleagues on how to improve their solutions, or to build common consensus around emerging new design directions (see Table 4).

At a most basic level, designers relied on the simple *expression of their visceral reactions*. As exemplified in excerpts from the field notes displayed in the previous section, during meetings, it was not uncommon to hear designers express their liking or disliking on objects or images collected in a preliminary phase, or on some of the numerous sketches and drawings produced at a later stage, when designers had to evaluate different concepts (see Table 4). Despite designers’ attempt to better

qualify their opinions ('I do not like this shape because it is not harmonious' or 'I feel like that is not going to work given the goals of the project'), most of these expressions were the result of their subjective personal taste. Often, these comments would not even elaborate on the response, nor try to articulate what formal properties generated what affective response, but they merely expressed primary visceral reactions (for a similar instance in a different context, see the flutemakers described by Cook and Yanow, 1993) in a succinct verbal mode. As a junior designer lamented:

It's hard because when you're designing something you have someone from marketing, or you have your senior designer coming in and saying "oh, well. I don't like this curve". So, you're like "Why?" And he's like "I just don't like it..." (Brian, design strategist)

These comments, therefore, represented the most basic and immediate attempt to voice aesthetic responses and express and share aesthetic knowledge. Voicing pleasure or displeasure, however, could account only for the simplest, primary visceral reactions. We have already mentioned how designers would often use metaphors to try to express more nuanced emotional responses and link them to formal properties of objects and spaces. Take for instance this excerpt from our field notes:

Mike stands up and draws the reclining system of Alan's sketches on a mobile whiteboard in order to explain those aspects of the reclining system he thinks are important. He comes back to sit down and keeps on talking about Alan's drawings, but Alan seems much more interested in Damien's sketches: 'I like your chair very much; it's simple, but there's enough stuff going on'. Also Mike likes it, even though for a different reason: 'I like it too because of the sense of *solidity* it conveys.' 'Yes, there's a sense of solidity, but also harmony in these shapes ... this chair seems as it *dances* [*italics added*].'

Even metaphors, however, were considered limited, as they were open to multiple interpretations. While the semantic richness of metaphors has been linked in the past to their generative potential (Schön, 1983), it could occasionally hamper the effective sharing of aesthetic experiences. In the case of Project Chair, for example, the 'airline chair' was initially proposed as a metaphor for the seating experience designers intended to deliver. The proponent of this metaphor recalled the relaxation he had experienced on a business class seat on a flight to Korea. The metaphor, however, soon proved impractical as different members, as well as the clients, associated this notion with different aesthetic experiences, some pleasant, other unpleasant.

Because of this reason, designers found it crucial to be able to expose each other to the same stimuli, as well as to experience objects and spaces directly, rather than relying exclusively on the

report of users. These practices effectively relied on multiple signifying modes, as they combined tentative verbalization with direct exposure to selected visual/material artefacts. Theoretically, we could refer to this attempt to build common aesthetic knowledge as *inducing aesthetic experiences*. Project rooms, in this respect, proved particularly useful, as they allowed designers to refer to visual imagery, materials, fabrics, sketches, drawings, and other objects available in these rooms in order to trigger in team members or clients the same feelings and sensations they had previously felt. In this way, designers could explain the proposed aesthetic solutions on display by exposing their audiences to the same sensory stimuli they had responded to when developing those solutions, and could get feedback from them on how to improve them. An excerpt from field notes taken during a project meeting of Project Window illustrates this point:

Today we're meeting in the project room to share the different aesthetic solutions generated by Claudia, Susan, Christine and Ethan for the store windows of 'Back to School'. The 'Ball Room' is set up for the meeting. On one side of the room, they put two boards: one called 'Back to School content', and the other called 'Back to School style'. Both boards are full of images taken from magazines and stock photography databanks. Those on the 'Back to School content' board are images related to the 'reinvented traditions' theme, previously selected in agreement with the client – images of blackboards, of lockers, of kids using abacus, of school music bands, of the yearbook, of football teams and cheerleaders, etc. Those on the 'Back to School style' board are images illustrating the style and the look and feel designers intend to convey, and suggesting some stylistic ways of executing the 'reinvented traditions' theme, as GB explained to me – images of people's faces, of doodles, of grids of objects, etc. On the opposite side of the room, they pinned up the sketches they're going to illustrate to the rest of the group.

We start with Claudia explaining the 'Reinvented traditions' concept, and how she decided to translate that concept to 'Back to School' design execution. She makes it clear that, according to the look and feel they want to convey, she decided to develop sketches showing a mosaic of people's faces reminding the yearbook layout, a collection of historical iconic school objects, and kids' doodles on their notebooks in ballpoint pen. While she's talking, the other designers observe the sketches on display and start giving their feedback on how to modify or improve her ideas. RC [the creative director], for instance, says: 'I think that the big challenge in all these sketches is visually communicating how that, like the doodling thing or the grid of objects, gets reinvented. Otherwise they [customers in store] are just going to think 'it's all dated'. George steps in to say: 'you know, a possible way to visually communicate how the mosaic of people's pictures reminding the yearbook gets reinvented can be putting a collage of faces used as a screensaver. So you can visually convey the idea of a school book laptop or something like that; something that people can download on their laptop, instead of having the old school book with pictures of their classmates'. (...)

Once every designer has illustrated and explained their ideas, getting feed-back from the rest of the team, Richard, the project manager, says: 'so, what I think we should do is going back to our desks and keep working on these ideas trying to invigorate them. We'll meet tomorrow for another internal sharing and maybe we can critique a little bit more'.

In this respect, the joint selection of visual and tangible references marked the convergence around a common understanding of aesthetic experiences. As a team member of Project Chair during a debriefing interview explained:

We have selected some of the design attributes that we think the potential future chair should have and for each of them or for each group of design attributes we have selected an image of a particular chair or armchair already existing on the market able to convey that message. As an example, to the groups of words 'friendly, hopeful, warm', we have associated these colorful and joyful plastic chairs, to the words 'fabric and drape' we have associated this famous blue chair which is inspiring the shapes the chair has started to take, finally to the words 'inviting and soft' they have

associated this other chair with many colorful pillows. This is very important, because it allows us to translate in real shapes the design attributes we think the chair should have and convey to the users.’ (Gianfranco, industrial designer)

In the process, therefore, the project room effectively became a multi-modal representation of an emerging body of collectively co-produced, project-specific aesthetic knowledge.

Project rooms – along with some of the artefacts they contained (mood boards, design landscapes, etc.) – illustrate how mutual exposure to aesthetic experiences were often part of a more general practice of shifting from verbal to visual mode – multiple times over the course of the project – to gradually construct a common understanding of aesthetic and symbolic requirements and how to express them in design choices. As mentioned in the previous section, the goals of a project were initially agreed with clients in verbal mode. At this stage, however, the content of these words and their implications for the project were still relatively vague. Field observation and visual libraries helped produce visual artefacts that qualified the meanings associated with these words. Mood boards and landscapes generated additional knowledge, later to be expressed in partly verbal mode, as designers tentatively labelled their experiences to share them with team members or clients.

As the projects progressed, designers switched periodically from verbal (written documents articulating design intent, attributes, etc., as well as more general conversations) to visual mode (mood boards, sketches, drawings, etc.), and back, whenever the current mode seemed incapable of properly capturing relevant aesthetic experiences or of ensuring consensus around an emerging set of meanings setting the direction for design choices – a practice we refer to as *cross-mode shifting*. By doing so, we argue, designers could compensate the inherent limitations of each mode, and push the project forward by expanding the resources available to members to express, access, and share original aesthetic experiences.

Essential to this task was the multiliteracy (Kress, 2003) of team members, whose professional training had accustomed to shift between multiple forms of representation. The difficulty created by

the absence of multiliteracy were most evident when the team transferred ideas to clients that were less used to engage with the visual. As a designer explained:

[Clients] are never visual people ... they are decision makers, but they don't necessarily have the ability to translate something from a piece of paper to their brains. (Rich, Model Shop Manager)

Finally, according to Taylor, part of the difficulty of communicating aesthetic knowledge and aesthetic experiences depends on the absence of a 'legitimate discourse about aesthetic experience in most modern organization (Taylor, 2002: 822)', by which he refers not only to the absence of linguistic categories to describe these experiences, but also to the uncertain appropriateness of open discussion of aesthetic matters in the workplace. The absence of a legitimate discourse, according to Taylor, lowers the salience of aesthetic experiences and makes it difficult for organization members to grasp them and recall them ('aesthetic amnesia'), in part because they have no name for them.

As illustrated in the first-order narrative, at Continuum, this problem was compensated by the development of an elaborate 'design vocabulary' – a set of linguistic categories that designers routinely used to frame the discussion of aesthetic issues (see Table 3). Terms like 'design intent', 'design attributes', 'look and feel', 'design language' offered a *legitimate aesthetic discourse* that directed attention to aesthetic experiences and reminded of their salience and relevance to the task to be accomplished. By doing so, this discourse supported what Ewenstein and Whyte (2007) term 'aesthetic reflexivity' –that is a capacity to notice and reflect on one's aesthetic experiences, which is central to the development and deployment of aesthetic knowledge– and offered a linguistic infrastructure for the collective engagement in these reflections (see Table 4).

Importantly, this aesthetic discourse not only rested on a common language but was also substantiated by tools and practices that actioned this discourse in the course of design projects. 'Visual library' meetings, the construction of 'mood boards', and the mapping of 'design landscapes' represented common milestones in the unfolding of projects, along other activities, such as the review of existing and emerging technologies, the identification of users' ergonomic needs, the creation of functional mock-ups, aimed at addressing functional and technical issues. These

practices periodically brought the attention of designers back to the desired aesthetics and symbolism, and structured their collective reflections on how to accomplish these responses through their choices about the formal properties of objects and spaces. Project rooms gradually collected relevant sources of aesthetic experiences contributed to the accumulation of project-specific aesthetic knowledge by reinforcing collective exposure to a common set of sensory stimuli.

DISCUSSION

Past research on designers' work has highlighted the intuitive, non-analytical nature of their engagement with aesthetic properties of objects and spaces – conceptualized as 'aesthetic knowledge' or 'aesthetic knowing' (Ewenstein and Whyte, 2007; Michlewski, 2008) – but we have only limited understanding of how designers address the tacitness of their aesthetic knowledge to enable collaboration in design teams. Our ethnographic study illuminates this underexplored and undertheorized issue, by beginning to unpack how design teams move from individual intuitive judgments to more conscious choices about the material properties of objects and spaces, and by enriching our understanding of how designers express and share aesthetic experiences and judgments based on aesthetic knowledge to enable creative collaborations.

The interplay between aesthetic experience, aesthetic knowledge, and intuitive judgments

Past studies characterize designers' work as based on 'intuition' (Lawson, 2006; Michlewski, 2008) to highlight the non-analytical approach that designers follow as they address their task. Boland and colleagues, for instance, present intuition as an important part of what they call 'a design attitude' to solving problems (Boland et al., 2008); they discuss how architects make constant reference to their intuition when making decisions about the design of a building, and point to physical engagement with objects (models or real building sites) as a way to stimulate intuitive insights.

Organizational scholars have used this concept in the past to label cognitive processes that entail the rapid, effortless, non-conscious, and holistic processing of information (see Akinci and Sadler-Smith, 2012, for a review of this literature). Research on intuition has recognized how this process

can take many forms, and recent advances in neurosciences show that these different forms activate different portions of the brain (Gore and Sadler-Smith, 2011). Most research in organization studies, however, has focused on a particular type of intuition – expertise-based intuition (see Salas, Rosen and DiazGranados, 2009 for a review) – based on the quick and unconscious recognition of patterns stored in long-term memory (Simon, 1987) and resulting from cumulative experience (Simon and Chase, 1973) as relevant to solve a present task.

Ewenstein and Whyte also connect designers' aesthetic choices and professional expertise, as they describe the deployment of aesthetic knowledge as a 'professional judgment based on cultivated sensitivity (2007: 701)' resulting from repeated exposure to aesthetic stimuli. What we observed, however, cannot be entirely explained in terms of expertise, and the activation of consolidated action scripts. First, intuition was equally important to how both experts and novice designers made choices about material properties of objects and spaces (see also Lawson 2006, for a similar observation). Second, emotional reactions to visual and material cues were prominent in their description of these intuitive judgments (see also Sinclair and Ashkanasy 2005).

Organizational research acknowledges the relevance of aesthetics – the 'directness of knowing' (Sinclair and Ashkanasy, 2005: 357) – and emotional responses for intuitive judgment (Dane and Pratt, 2007), but its focus on expert-based processes explains only in part the emotionally-laden, aesthetically-driven intuitive processes – 'intuition-as-feelings' (Hodgkinson et al., 2009) or 'creative intuition' (Dörfler and Ackermann, 2012) – that characterize designers' work. While this work recognizes that 'creative cognitions' may manifest as intuitive judgments, it tends to associate these intuitions to slow-to-form 'serendipitous associations' or 'eureka moments' occurring after a period of incubation (Hodgkinson et al., 2009; Gore and Sadler-Smith, 2011).

The process we observed was quite different. Our observations, combined with informants' own attempts to articulate how they make their design choices, portray a process driven by the aesthetic stimuli that designers deliberately expose themselves to, and by the primary and secondary emotional reactions triggered by these stimuli. It is in this sense, we argue that designers 'know'

their material environment and gain an understanding of what material properties induce cognitive, emotional, and behavioral responses. This knowledge, however, is largely tacit. In this respect, we argue, the visualization process that past research alludes to as so important for designers' creative thinking (Lawson, 2006; Cross, 2011) helps designers access and deploy this tacit type of knowledge.

As shown in Figure 1, our study suggests that mindful, deliberate exposure to formal properties of objects and spaces and alertness to one's responses is essential at an early stage to enrich designer's project-specific aesthetic knowledge. Later, the tentative, open-ended, experimental nature of sketching, drawing, and model-making stimulates the recreation of aesthetic experiences of which designers may have only imperfect memory and limited consciousness. These practices help designers gauge and refine emerging solutions based on their own emotional responses to the sketches, drawings, and models that they produce with only a general sense of direction. Designers, in other words, intuitively 'know' they are on a right track, as their 'feelings of certitude' (Dane and Pratt, 2007) reassure them about the appropriateness of their tentative solutions. This observation is particularly important because it enriches the idea of aesthetic knowledge as literacy, fluency and competence (Ewenstein and White, 2007) by drawing attention to a heightened awareness of aesthetic experiences as a precondition to designer's fine-grained capacity to respond to, interpret, and manipulate the aesthetic properties of objects.

The process we have just described is intuitive – and indeed our informants perceived it and described it as such– to the extent that i) it occurs unconsciously and largely draws on tacit knowledge, and ii) it is driven by emotional responses and produces affectively charged judgments (Dane and Pratt, 2007). Unlike 'experts intuition', the process we observed is not characterized by a rapid response to a structured problem, based on pattern recognition. Indeed, the problems that designers face are usually ill-defined, ill-structured and open-ended, and presents multiple possible solutions (Buchanan, 1992). It resembles instead the less studied process of 'creative intuition', leading to novel, divergent solutions – rather than converging ones – based on the recombination of

knowledge (Gore and Sadler-Smith, 2011). Contrary to current understandings of this process, however, the creative intuitions we observed are immediate and triggered by aesthetic experiences, rather than being characterized by slow incubation, unconscious processing of the element of the problem, and sudden enlightenment.

In this sense, designers' intuitive, creative insights could be interpreted as the result of the rapid, spontaneous and nonconscious activation of aesthetic knowledge, which precedes the more conscious combination and elaboration of these insights into novel ideas embodied in new artifacts. This observation highlights connections between intuition and aesthetic knowledge, whereby intuitive judgments can be manifested as visceral, emotional reactions to aesthetic stimuli, triggering a more conscious reflection to rationalize these responses. In this respect, our findings outline a different form of creative intuition, where pre-conscious solutions to a problem are not generated on the basis of reliance on expert schemas and heuristics, as suggested by previous research (Akinci and Sadler-Smith, 2012), but by the interaction between a flow of sensory stimuli – some of which produced by designers themselves – and an individual's aesthetic knowledge.

Aesthetic knowledge as a collective, collaborative process

Strati describes aesthetics as an “intersubjective form of knowing ... a sentiment which is both individual and collectively constructed in the interactive acts by individuals of experiencing, understanding and judging through sense and taste (2003: 54).’ While highlighting the importance of aesthetic knowledge for designers' work, however, past studies are less clear about how collective interaction is accomplished in the face of the tacit nature of the processes involved.

Past studies have shown how verbal and visual representations of ideas help designers bridge individual and collective cognitive work (Stigliani and Ravasi, 2012) and coordinate design tasks (Seidel and O'Mahony, 2014; Scarbrough, Panourgias and Nandhakumar, 2015). This research is important because it suggests that shared aesthetic experiences may facilitate the collective generation of new creative ideas, but it falls short of examining the particular challenges posed by the peculiar form of knowledge associated with these experiences. Our study contributes to address

this issue by enriching our understanding of the nature of aesthetic knowledge, and the practices through which this knowledge is inter-subjectively constructed.

The insights reported in this article, in particular, differ from prior work drawing on the same study (Stigliani & Ravasi, 2012) because in our prior publication we examined how visual and material artefacts support cognitive processes, such as memory, categorization, and concept building; here we focus instead on the aesthetic experiences and emotional responses that visual and material artefacts elicit. Whereas our prior publication examined how designers' converge around a common understanding of the problem they face and how to solve it, we explore here how they co-construct a common body of aesthetic knowledge that informs their choices about the aesthetic aspects of their solutions.

These processes partly overlap, to the extent that part of the conceptualization of the problem that designers face regards its aesthetic aspects, but they are also largely independent. The material practices we described in our prior work support cognitive processes that enable collective interaction more generally. They do so as what we described as the "materialization" of mental content helps compensating team members' limited capacity to process environmental cues and reflect on their own ideas, and the potential misalignment of distributed recollections of exchanges and understandings of a problem. In the current article, we focus instead on how combining visual, verbal, and material forms of communication (or shifting across them) enables team members to compensate the intrinsic difficulty of articulating the aesthetic knowledge required for the accomplishment of their task. Both issues are crucial for coordinating work in a design team.

These two articles, therefore, are complementary in that they offer a more comprehensive understanding of the cognitive and emotional processes that enable design teams to move gradually from early individual insights to collective accomplishments. In our prior publication, adopting a broader, cognitive perspective enabled us to offer a theoretical framework that could be applied to a broad range of instances of future-oriented collective sensemaking, such as strategy making or product innovation, but it prevented us from elaborating on the specificity of designers' work. In

this article, by focusing on how designers make choices about formal properties of objects and spaces, we could offer a more fine-grained theorization of the interplay between the cognitive and emotional processes that drive these choices.

Our observation of designers' efforts to articulate and share aesthetic experiences through the collective practices described in the previous section (visual library meetings, mood boards, mapping design landscapes, etc.) also extends a conception of aesthetic knowledge as having a dual component –symbolic and experiential (Ewenstein and Whyte 2007) – by suggesting that designer's aesthetic fluency and literacy can be conceptualized as having a declarative and a procedural component. The designers we observed, in other words, not only possessed the sensitivity required to appreciate – and, importantly, articulate – the aesthetic experience that an object delivered (for instance by being perceived and experienced as 'approachable', 'touchable', 'quiet', 'powerful', etc.), but also the competence required to make a certain object look and feel so by making more or less conscious choices about its material properties (shapes, materials, textures, etc.). The first type of knowledge is collectively constructed, for instance, as designers review existing products and map the existing design landscape, or produce mood boards and enrich a common visual library. The second allows them to identify the appropriate 'design language' for a product under development, and how to translate that language into a concrete 'design execution' conveying the intended 'look and feel'.

Contrary to common understandings of declarative knowledge, however, designers' understanding of aesthetic and symbolic properties of objects is also, at least initially, largely tacit. It is only in the course of the projects that, through the construction of mood boards and design landscapes, designers attempt to articulate this knowledge in visual and verbal form. They do so partly to support more conscious decisions about how to convey the intended aesthetic and symbolic responses, partly to share this knowledge with the rest of the team (and, later, the client). These maps partly reflect project- and domain-specific knowledge (e.g. patterns of differences and

similarities across objects or spaces, and the aesthetic responses that they elicit in designers), and partly more general knowledge about the symbolism of form.

This observation is part of a more general contribution of our study to our understanding of how aesthetic knowledge can be ‘shared’, facilitating the exchange of experiences and the intersubjective construction of team-level knowledge enabling creative collaboration. Our study highlighted five practices that enabled design teams to harness multiple contributions, including those of their clients, to infuse new objects and spaces with desired aesthetic properties. These practices are characterized by different levels of effortful attempts at verbal articulation, ranging from the mutual exchange of visceral responses and exposure to induced aesthetic experiences, to the use of metaphorical language, and a legitimate aesthetic discourse supporting interaction within the frame of collectively agreed upon linguistic and cognitive categories.

Importantly, designers seem to turn to the less verbally sophisticated ways of expressing aesthetic knowledge when dealing with the most ineffable, tacit and pre-linguistic part of aesthetic knowledge that could not be otherwise codified and shared through language and discourse. Past research has highlighted the importance of verbal articulation and dialogical exchanges in making tacit knowledge relevant to the situation at hand (Obstfeld, 2012) and supporting collective interaction in creative project teams (Baralou and Tsoukas, 2015; Tsoukas, 2009). At Continuum, expressions of visceral reactions, shared aesthetic experiences and the use of visual language also played an important part in building an intersubjective agreement on the appropriateness of certain formal properties to elicit the desired emotional reactions.

Our observations also highlight the importance of multi-modal communication – that is communication that combines multiple modes – and frequent cross-mode shifting in the collective co-construction of aesthetic knowledge. In the past, scholars have traditionally considered artful and visual modes of representation (e.g. Langer, 1942; Gagliardi, 1996) as more appropriate than verbal ones to express aesthetic knowledge. Our observations, however, suggest that in order for the team to perform its task, some degree of semantic consensus (between the team and the client, and within

the team) is required. Past research has shown how analogies can be used to translate aesthetic experiences across different modes to help perfumers develop scents that can inspire synesthetic associations between olfactory stimuli and mental imagery (Islam et al., 2016). Similarly, our observation indicate that designers use visual and material modes of communication to periodically tap into broader personal and cultural semantic areas to enrich members' understanding of their mandate, constraints, and potential lines of development. However, they also show how an alternation between visual and verbal modes of expression of the relevant aesthetic knowledge is necessary to compensate the relative indeterminacy and open-endedness of visual and metaphorical communication, to periodically realign the team and coordinate its efforts towards a common design direction. In this respect, the designers we observed worked both cross-modally and multi-modally.

These observations contribute more generally to the open debate on the nature of aesthetic experience and aesthetic knowledge. As discussed earlier in this article, past research has highlighted the unconscious nature of aesthetic knowledge (Gagliardi, 1990; Strati, 2007). Our findings, however, suggest that designers are not only aware of their aesthetic responses as they experience them, but are also able, to some extent, to verbalize these responses – by using linguistic categories and metaphors – or recreate them – by resorting to supporting visual imagery and/or material references like images, sketches, drawings, physical models, etc. to enable intersubjective convergence around content and expressions of aesthetic experience.

CONCLUSIONS

Our ethnographic study of designers' work examined how aesthetic knowledge shapes designers' choices about objects and spaces in the context of creative collaborations. Our study documented tools and practices that helped designers generate creative solutions to relatively unstructured problems implying decisions about the form of objects and spaces. These practices were well established at Continuum, but, while the design consultancy did claim a distinctive approach to addressing design issues, to a large degree they were common to the professional field of design.

Designers were first introduced to these practices during their education, and they refined them as they applied them to project after project.

Our findings extend past research on designers' work by proposing a more fine-grained theorization of designers' reliance on intuition, visualization, and aesthetic engagement with reality described by past studies. Our theoretical account highlights a form of 'creative' intuition that differs from the more widely studied manifestations of this process based on pattern recognition or unconscious elaboration of cues (see Gore and Sadler-Smith, 2011), and it articulates the role of aesthetic experiences and emotional responses in shaping designers' conscious choices. Our findings also add to our understanding of how creative collaborations can be facilitated in the presence of an imperfect capacity of expressing aesthetic experience and knowledge verbally, by pointing to a broader set of practices that designers engaged in to express these experiences, not only metaphorically –as described by past studies– but also multi-modally and cross-modally.

It could be argued that the material nature of the object of designers' choices might have made them particularly sensitive to aesthetic experience, and to overrely on aesthetic knowledge, as opposed to more rational and analytical approaches to the design of form. Conscious of this potential bias, we tried to reduce the influence of the physicality of the outcome on designers' engagement with their task by purposefully sampling projects across different design disciplines. The gradual extension of the scope of the design profession from material to intangible objects, however, seems to indicate the relative transferability of a 'designerly way of knowing' and approaching problem solving to aesthetic and experiential issues in other domains such as, for instance, the design of websites (Tractinsky and Lowengart, 2007) or perfumes (Islam, Endrissat and Noppeney, 2016).

Industrial designers and architects, however, are not the only professionals concerned with the aesthetics of objects, spaces and experiences, and whose job requires aesthetic sensitivity and reflexivity. Research on *haute cuisine* chefs, for instance, has emphasized the central aesthetic concerns of this profession. These studies draw attention to the 'self-conscious aesthetic rhetoric'

(Fine, 1996: 94) and the high ‘aesthetic sensibility’ (Fine, 1996: 104) that characterize these chefs, and their reliance of their senses, feelings, and intuition in order to create the ultimate dining experiences (Svejenova, Mazza and Planellas et al., 2007; Stierand, Dörfler and MacBryde, 2014). The ‘creative intuition’ these chefs rely upon may differ from what we have theorized for designers only for the relatively higher influence of gustatory and olfactory experiences, suggesting the potential transferability of our insights about aesthetic knowledge, intuition and creative collaboration also to other – less studied – ‘creative’ professions, such as filmmakers (Svejenova, 2005), craftsmen (Cook and Yanow, 1993) or modern dancers (Harrison and Rouse, 2015). Future research may explore more systematically whether the form of creative intuition that we have observed among designers also feature among these professions, and whether and how the different nature of their work or the forms of interaction with other actors influence the process.

To the extent that the practices we describe are not specific to the definition of the formal specification of an object, but they help express and discuss aesthetic experiences they could have interesting practical applications outside the boundaries of design projects, to address more general issues in organizations. Research on organizational aesthetics has drawn our attention to how, despite the importance of this dimension on how members experience their organization (Strati, 1999), lack of a legitimate aesthetic discourse commonly prevents aesthetic issues to be openly acknowledged and discussed. In recent years, heightened awareness of the social and environmental impact of organizations has produced a ‘CSR vocabulary’ – alongside the more traditional economic one – which has legitimized and facilitated the discussion of these issues in organizations (Taylor, 2002). In a similar vein, we argue, intensified attention to aesthetics in organizations –by academicians and practitioners alike–may produce an ‘aesthetic vocabulary’ that may bring these issues to the attention of decision makers and encourage their consideration in organizational policies and decisions.

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Table 1. Data sources and use

Data source	Type of data	Use in the analysis
Observations	<i>Field notes from project meeting attendance (79 meetings: 24 from Project Car, 35 from Project Chair, and 20 from Project Store Window).</i> Extensive and detailed record of social interaction, conversations, and practices observed in the three projects from the early stages until final presentations.	Develop an ethnographic story of the design process at Continuum, identify designers' common practices, and understand how designers relied on their intuition and aesthetic knowledge when defining properties of new objects and spaces. Triangulate interpretations emerging from interviews.
	<i>Field notes from organizational meeting attendance (17 meetings).</i> Brief account of the content of 1 'brainstorming day', 3 practice induction meetings, 6 'Visual Library' meetings, 5 'Lunchtime series' project stories meetings, and 2 'Lunch with the founder' meetings.	Familiarize ourselves with the organizational context, gain trust of informants, and understand designers' practices and the outcomes of these practices.
	<i>Informal conversations.</i> Informal talk with managers, designers, engineers, and support staff, ranging from brief exchanges to longer talks before and after meetings, and during work breaks.	Informally discuss insights from observations, clarify uncertainties regarding project-related decisions, and support emerging interpretations.
	<i>Pictures.</i> Visual documentation of material and textual artifacts produced during work meetings (boards, thumbnails, sketches, etc.)	Keep record of the outcome of designers' practices, and share it with the second author
Interviews	<i>Preliminary interviews (17)</i> with all senior and middle managers, to investigate Continuum's history, culture, and work processes.	Familiarize ourselves with the organizational context.
	<i>Debriefing interviews (15 – 5 with team Car, 6 with team Chair, and 4 with team Store Window)</i> to discuss insights or observations gathered during project meetings; we interviewed key informants for each project twice, at the beginning and at the end of the projects.	Integrate observations with informants' accounts, to improve our understanding of how aesthetic knowledge, knowing, and intuition interact in shaping the design of new objects and spaces.
	<i>Focused interviews on past projects (20)</i> understanding the main activities performed by designers, the most recurrent challenges they had to face, and the conditions facilitating or hindering the phases of the creative process.	
Archival data	<i>Company-related documents:</i> guide for newcomers, internal presentations of the three groups, guidelines for project managers, maps of the development process	Familiarize ourselves with the organizational context.

Data source	Type of data	Use in the analysis
Observations	<i>Field notes from project meeting attendance (79 meetings: 24 from Project Car, 35 from Project Chair, and 20 from Project Store Window).</i> Extensive and detailed record of social interaction, conversations, and practices observed in the three projects from the early stages until final presentations.	Develop an ethnographic story of the design process at Continuum, identify designers' common practices, and understand how designers relied on their intuition and aesthetic knowledge when defining properties of new objects and spaces. Triangulate interpretations emerging from interviews.
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	<i>Informal conversations.</i> Informal talk with managers, designers, engineers, and support staff, ranging from brief exchanges to longer talks before and after meetings, and during work breaks.	Informally discuss insights from observations, clarify uncertainties regarding project-related decisions, and support emerging interpretations.
	<i>Pictures.</i> Visual documentation of material and textual artifacts produced during work meetings (boards, thumbnails, sketches, etc.)	Keep record of the outcome of designers' practices, and share it with the second author
Interviews	<i>Preliminary interviews (17)</i> with all senior and middle managers, to investigate Continuum's history, culture, and work processes. <i>Debriefing interviews (15 – 5 with team Car, 6 with team Chair, and 4 with team Store Window)</i> to discuss insights or observations gathered during project meetings; we interviewed key informants for each project twice, at the beginning and at the end of the projects. <i>Focused interviews on past projects (20)</i> understanding the main activities performed by designers, the most recurrent challenges they had to face, and the conditions facilitating or hindering the phases of the creative process.	Familiarize ourselves with the organizational context. Integrate observations with informants' accounts, to improve our understanding of how aesthetic knowledge, knowing, and intuition interact in shaping the design of new objects and spaces.
	<i>Project-related documents:</i> design briefs, meeting minutes, project updates, correspondence with stakeholders, clients' presentations	Support, integrate, and triangulate evidence from observations and interviews.

Table 2. Designers' common practices during the design process at Continuum

Phase	Project Car	Project Chair	Project Store Window
Learning and Definition			
<ul style="list-style-type: none"> Defining the design intent and the design attributes 	The design intent was to design a new car that would preserve and affirm users' identity through a professional, trendy and cool look, while being reliable, comfortable and within reach.	The design intent was to design a chair that would set the new aesthetic standard in hospital furniture by facilitating wellness and inspiring a sense of optimism	The design intent was to use an innovative approach to create an energetic and exciting holiday experience for customers while communicating the client's brand pillars
<ul style="list-style-type: none"> Connecting to user experience through ethnographic observations 	The direct observations of and interviews with first-time parents revealed daily routines, needs, aspirations and preferences for car styles of target users	In-situ observation and directly experiencing how it felt to sit in patient chairs revealed how difficult it was for patients to get in and out of the chair, and for nurses to move patients and keeping chairs clean	Visits to local malls to take pictures of a broad range of store window designs; revealed main trends in seasonal store window designs
<ul style="list-style-type: none"> Reviewing the existing design language landscape to identify trends, patterns, and gaps 	The review of the design language of existing cars (minivans, sedans, SUVs, etc.) and of products targeted to first-time parents (strollers, clothing, baby products) showed that cars and products targeted to these users looked anonymous and flat	The review of the design language of existing hospital chairs showed that hospital chairs looked too much like office chairs, i.e. too corporate, institutional, dull, cumbersome and discouraging	A review of main trends in store window design (the 'seasonal retail audit') by using pictures taken during visits and from magazines and websites led the team to identify three approaches to store window designs: Seasonal Cues, Season in context, and Season TM
<ul style="list-style-type: none"> Defining the design language of the potential product in terms of the overall 'look and feel', and of the design attributes 	Designers decided to sharply differentiate the look and feel of the new car from that of traditional 'mommy mobiles' (i.e., minivans, SUVs, wagons) and to make it closer to that of a sedan (considered to be cool and trendy) to better facilitate the transition from being a couple in love to being parents	Designers decided that the chair needed to look welcoming, to feel warm, and soft, and to communicate a sense of joy, optimism, playfulness, and lightness. The metaphor of a maternal embrace was often used to communicate the look and feel.	Designers decided to focus on Season TM as a proprietary approach to create a holistic and impactful retail experience for key retail seasons (Back to School, Winter Holiday, Valentine's Day, Mother's Day and Dad's and Grads) with a simple, clean, unique, iconic and sophisticated visual language
Creative Exploration			
<ul style="list-style-type: none"> Visually illustrating a range of creative concepts that meet the design or the brand strategy 	<ul style="list-style-type: none"> Designers created visual frameworks illustrating how the attributes of the new car could facilitate the targeted lifestyle transition. The leading metaphor 	Designers created sketches of the intended hospital chair. Most sketches took inspiration from the visual imagery used to represent the design language. In particular, the image of a blanket and that of a pillow	Designers individually created sketches based on the intended design language. Sketches revolved around three main themes: 'reinvented traditions', 'relationships', and 'rescue' in accordance

objectives, the design attributes and the 'look and feel' previously identified	when developing design attributes was that of a car as a 'shared space'.	were recreated in the shapes and surfaces of the chair	with the client's brand pillars (i.e. network, value, capability)
<ul style="list-style-type: none"> Developing rough 3-dimensional versions of potential product concepts for direct experience 	A rough mock-up of the envisaged car was created to test functional requirements but also to experiment with the intended look and feel of the car.	Designers created a full-scale prototype of the chair, named 'Buck 1', to test the reclining mechanism but also the feel of sitting in the new chair; a small-scale prototype was created to experiment the harmony of the overall chair	Designers created small-scale banners embodying some of the sketches and some mock-ups of store windows to experience the coherence of the visual language across different visual touch-points

Concept development and refinement

<ul style="list-style-type: none"> Evaluating the coherence between design executions and the design language previously identified, and selecting leading concepts 	The mock-up and the different frameworks were shared with the client and evaluated for further refinement. In light of the feedback received, the team converged around an organization of the design attributes of the car based on Maslow's pyramid of needs	Some of the sketches and 'Buck 1' were presented to the clients, who experienced what it felt like sitting in the new chair. Based on the feedback received, the design team realized that the back of the chair needed to be smaller in size in order to give it a more feminine (maternal) look	Designers consulted the client in order to evaluate and select one single theme. The theme selected was 'reinvented tradition' most strongly delivered on the design intent.
<ul style="list-style-type: none"> Defining the final aesthetic design execution in terms of materials, finishes, surfaces, textures, colors, etc. 	Based on the feedback from the evaluation stage, the final aesthetic design execution of the car was defined in terms of sport sedan shape, metallic colors, sunroof, leather seats, ultra-thin door trims, durable arm rests, camera to see baby's face, stadium seating, backseat entertainment screens, easily cleanable surfaces.	Based on the feedback from the evaluation stage, the design designers design execution in terms of bright colors, soft fabrics and smooth surfaces, feminine shapes, etc.	Designers generated a few creative explorations of the reinvented tradition theme for the upcoming Back to School season. Designers used visual imagery revolving around three concepts: old school/new school, slice of life, and doodles.
<ul style="list-style-type: none"> Developing a more refined visual or physical representation of the chosen concept 	A final video was created to illustrate various design scenarios where users interacted with the new car	A more refined 'look and feel' version of the buck, named 'Buck 2' was created to illustrate the final aesthetic characteristics of the chair and to be shared with users	Full-scale banners and renderings of the 3 retail concepts were created to illustrate the holistic and impactful experience for the Back to School season

Table 3. Building a ‘Design Vocabulary’ for the Project ‘Chair’

Term	Definition	Chair project
<i>Design Intent</i>	The general purpose that designers intend to achieve through design choices.	The chair aimed to provide the aesthetic cornerstones to the patient room and to establish a new reference point for patient room aesthetics.
<i>Design Attributes</i>	The desired emotional responses and symbolic associations to be elicited by the formal properties of an object that the design under development should convey. Designers use these attributes to communicate the design intent internally and externally.	<p>The design team initially defined two major design attributes:</p> <ul style="list-style-type: none"> ◆ Facilitate an active participation in wellness ◆ Inspire a sense of optimism in both patients and caregivers <p>Based on preliminary analyses, the team refined the desired attributes as looking <i>welcoming</i>, feeling <i>warm</i> and <i>soft</i>, and communicating a sense of <i>joy</i>, <i>optimism</i>, <i>playfulness</i>, and <i>lightness</i>.</p>
<i>Design Language</i>	The set of visual signs, symbols, and icons that designers can adopt to deliver a certain message through the definition of different design aspects such as shapes, materials, color schemes, patterns, textures, or layouts (Verganti, 2003).	The design team initially explored aesthetic properties common to hospital chairs on the market; their analysis highlighted a prevailing design language characterized by angular shapes, cold colors and hard surfaces.
<i>Look and Feel</i>	The main properties of appearance, surfaces and interfaces of a design (being it a product, a poster, etc.). As a further specification of design attributes, it describes the sensory experience a consumer should have when using and interacting with an object or space.	In contrast with the prevailing language, the design team considered important that the new chair looked and felt <i>inviting</i> , <i>reassuring</i> and <i>comforting like a maternal embrace</i> . Designers referred to the metaphors of a ‘ <i>blanket</i> ’ and ‘ <i>pillows</i> ’ when talking about the intended ‘look and feel’ of the chair.
<i>Design Execution</i>	The concrete translation – shapes, materials, colors, finishes, textures, etc. – of the design attributes into the (final) look and feel of the product.	<p>The desired design attributes were translated into the following characteristics:</p> <ul style="list-style-type: none"> ◆ Bright colors of the fabrics (i.e. green and orange, red) ◆ Soft fabrics and smooth surfaces ◆ Thin gel padding ◆ Pillow-friendly armrests ◆ Soft adjustable headrest

- ◆ Soft and feminine shapes: narrower back seat, elegant and harmonious legs, armrests resembling wings, thin front seat edge
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Table 4. Practices of co-construction and use of aesthetic knowledge in the design process.

Phase	Acquiring and deploying aesthetic knowledge	Sharing and co-constructing aesthetic knowledge
Learning and Definition		
<ul style="list-style-type: none"> Defining the design intent and the design attributes 		<p><i>Building a legitimate aesthetic discourse</i> ('design intent', 'design attributes') helps designers discuss and articulate intended emotional and symbolic responses to the formal properties of the object under development.</p>
<ul style="list-style-type: none"> In-context research: observing users and uses 	<p><i>Alertness</i> to own <i>primary emotional responses</i> triggered by exposure to aesthetic stimuli directs designers' attention to visceral aesthetic experiences (pleasure, excitement, boredom, etc.) elicited by specific formal properties.</p>	<p>Both in the field and during meetings, designers share their aesthetic experiences by <i>expressing visceral responses</i> to what they observed and by sharing the sources of these responses with the rest of the team (through pictures, etc.) to <i>induce similar reactions</i>.</p>
<ul style="list-style-type: none"> Reviewing the existing design landscape 	<p><i>Conscious processing of formal properties</i> of objects helps designers identify patterns and trends. <i>Secondary emotional responses</i> enable them to link patterns and combinations of formal properties with symbolic associations.</p>	<p><i>Building a legitimate aesthetic discourse</i> ('design language', 'design intent') structures the analysis of current product aesthetics and symbolism.</p>
<ul style="list-style-type: none"> Defining the desired design language 	<p><i>Conscious processing of formal properties</i> of visual imagery to express desired aesthetic experiences through mood boards; alertness to <i>secondary emotional responses</i> guides the search and selection of appropriate imagery.</p>	<p><i>Building a legitimate aesthetic discourse</i> ('design attributes', 'design language', 'look and feel') helps designers translate the goals of the project in desired formal properties. Using <i>metaphorical language</i> helps designers converge around an understanding of the emotional responses associated with the intended design attributes. <i>Cross-mode shifting</i>, e.g. between verbal design attributes to visual imagery used to exemplify them (and back) helps designers share their individual aesthetic experiences and knowledge, and reach more easily consensus about the desired design language.</p>
Creative Exploration		
<ul style="list-style-type: none"> Development of creative concepts 	<p><i>Mindful adaptation of tentative design of objects and spaces based on emotional reactions</i> to doodles, sketches.</p>	<p>Feedback on one another's tentative solutions in the form of <i>metaphorical language</i> and <i>expression of visceral responses</i>. <i>Induced aesthetic experiences</i> help illustrate tentative ideas in terms of the outcome of the preliminary phase. <i>Legitimate aesthetic discourse</i> ('design attributes', 'design language', 'look and feel') structures the interaction among team members. <i>Cross- mode shifting</i> facilitates intra-team communication about each other's tentative solutions.</p>

- Rapid prototyping for direct experience

Expressing visceral responses to communicate aesthetic experience of exposure to prototype. *Legitimate aesthetic discourse* ('design attributes', 'look and feel') structures the interaction around the prototype.

Concept development and refinement

- Selecting most promising concepts

Mindful adaptation of tentative design of objects and spaces based on emotional reactions to more elaborate drawings and prototypes.

Expressing visceral responses and using *metaphorical language* facilitates the exchange of experiences and convergence around a provisional solution. *Inducing aesthetic experiences* help connect with the outcome of the preliminary phase. Building a *legitimate aesthetic discourse* ('design attributes', 'look and feel') structures the interaction among team members. *Cross-mode shifting* between aesthetic discourse and sketches facilitates reaching consensus about most promising concepts.

- Defining the final design execution

Building a legitimate aesthetic discourse ('design attributes', 'look and feel', 'design execution') guides the definition of the desired formal properties of the new object or environment. *Inducing aesthetic experiences* help designers collectively fine-tune the desired look and feel.

- Developing a more refined prototype of the chosen concept

Expressing visceral responses and *inducing aesthetic experiences* facilitate exchange between the design team and the clients. *Building a legitimate aesthetic discourse* ('design attributes', 'look and feel', 'design execution') structures the evaluation and interaction around the final prototype.

Figure 1. Aesthetic knowledge and the shaping of the formal properties of objects and spaces

