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**THE MATERIAL SIDE OF CREATIVITY:
ARTIFACTS AND AESTHETICS
IN PRODUCT DESIGN**

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**PRODUCT DESIGN:
A REVIEW AND A RESEARCH AGENDA
FOR MANAGEMENT STUDIES**

ABSTRACT

In the realm of practice, the influence of product design – both as a process and as an outcome – on competitive advantage and corporate renewal has long been acknowledged. Different branches of the social sciences have addressed this phenomenon from different perspectives, producing a considerable amount of knowledge. It seems, however, that little efforts have been made to build on each other's work, and almost no attempt has been made to develop a unitary framework and to take advantage of mutual cross-fertilization. In this paper I compare extant literature on product design in five different fields – technology and innovation management, consumer research, marketing management, design studies, and organization studies – highlighting the fundamental tenets and research findings of each stream of inquiry. Building on this review, I propose an integrative framework of the phenomenon under investigation, emphasizing links between different viewpoints and potential benefits to be gained by a more intense cross-fertilization among perspectives, and I argue how organizational scholars may be in a particularly favorable position to facilitate the integration among different perspectives and upgrade our understanding of design-related issues.

INTRODUCTION

In the last two decades design and designers seem to have played an increasingly central role in the construction and renewal of competitive advantage (Lorenz, 1986; Thackara, 1997; Walsh et al., 1992; Berry, 2004; Lojacono and Zaccai, 2004; Ravasi and Lojacono, 2005; Verganti 2006). Companies like Philips, whose design push has boosted sales of its consumer products to about twice the industry average (Echikson, 1999), and Apple, whose hip-looking products not only have started setting the standards for product design (Scanlon, 2007), but have also enhanced market share and profits, are but some of the most widely acknowledged cases. Yet, with some notable exceptions (e.g. Hargadon and Sutton, 1997; Hargadon and Douglas, 2001; Rindova and Petkova, 2006), organization scholars have traditionally dedicated little attention to how the form and function of an object, and how they come to be defined in the design process, influence, and are influenced by, social processes in and around organizations.

According to the Oxford English Dictionary design is defined as “a plan or drawing produced to show the look and function or workings of something before it is built or made; the art or action of producing such a plan or drawing; and the underlying purpose or planning”. Therefore, design can be perceived in different ways: as an outcome, as a process, as the purpose of that process, and as the ability (or capability) to reach that purpose. Indeed, as design historian John Heskett (2003) observed, “discussion of design is complicated by an initial problem presented by the word itself. ‘Design’ has so many levels of meaning that it is itself a source of confusion” (2003: 5).

In business studies, product design has been conceived of as a phase of the broader process of product development (Verona, 1999), defined as the “transformation of a market opportunity and a set of assumptions about product technology into a product available for sale” (Krishnan and Ulrich, 2001: 1), and on which there is an extensive body of work encompassing the academic fields of marketing, operations management, and engineering. Despite the broad attention devoted to product design, Krishnan and Ulrich (2001) in their review of research in

product development have denounced the paucity of academic research on product design, which they define as the activity largely concerned with the form and style of products. Although different branches of the social sciences have addressed this phenomenon from different perspectives, thus producing a considerable amount of knowledge, it seems that little efforts have been made to build on each other's work, and almost no attempt has been made to develop a unitary framework.

In this paper, I compare extant literature on product design in five different fields – technology and innovation management, consumer research, marketing management, design studies, and organization studies – highlighting their fundamental assumptions. Building on this review, I propose an integrative framework of the phenomenon under investigation, emphasizing links between different viewpoints, and potential benefits to be gained by a more intense cross-fertilization among perspectives.

DEFINITIONS OF DESIGN

The multiplicity of perspectives from which the topic of design has been analyzed has generated different definitions of design. Table 1 provides a list of the most important ones in a chronological order.

Table 1 about here

For the purpose of this paper, design is defined as the complex set of choices regarding both the form and the function of a product turned out on an industrial basis as well as the activities and capabilities necessary to carry out a product with a form and a function.

From this perspective, therefore, design is considered not only in terms of the final outcome, but also in terms of the process leading to that outcome, a process which can be influenced by social and cultural stimuli. The motivation behind defining design as “what it is”

and “what it does” is consistent with the objective of developing an overarching framework to classify extant research on the topic.

LITERATURE REVIEW

In the following sections, I will review the five main streams of research that have approached the topic of design - namely technology and innovation management, consumer research, marketing management, design studies, and organization studies – and I will highlight their fundamental assumptions about design and their distinctive contribution to our understanding of the phenomenon (see Table 2 for a summary).

Table 2 about here

Technology and Innovation Management Perspective on Design

Early definitions of design (Alexander, 1969; Simon, 1969) focused on the concept of fit between form, function and context. Design was initially perceived of as a problem solving process (Alexander, 1969; Simon, 1969), or, more precisely, as the search of a form as a solution to a certain problem. In the first Ph.D. thesis in design methods, Christopher Alexander (1964) gives a succinct but meaningful definition of design and of the process of design:

Every design problem begins with an effort to achieve fitness between two entities: the form in question and its context. The form is the solution to the problem; the context defines the problem. In other words, when we speak of design, the real object of discussion is not the form alone, but the ensemble comprising the form and its context (Alexander 1964: 15-16)

In a similar vein, Simon (1969) talks about design as the gradual connection of actions to ends, and about the process of design as the search for desired solutions devising artefacts to achieve specific objectives:

Design is concerned with how things ought to be, with devising artifacts to attain goals (...) Design solutions are sequences of actions that lead to possible worlds satisfying specified constraints (Simon, 1969: 114, 124)

Building on these works, Clark (1985) defines product design as the search for information and new understanding in conditions of uncertainty and instability. For the first time he speaks of “*goodness of fit*” between basic functional parameters (form) and socio-economic and technological context, and of “*design hierarchies*” both in the nature of the object and in the process through which design problems are solved:

Design is a search for understanding of what the object or product is, and ought to be, given the context in which it must function. (...) The hierarchical structure of design may be reinforced by the process through which design problems are solved (Clark 1985: 241)

Building on these ideas, scholars in technology and innovation management focused on a conception of design as the outcome of a problem solving process, and converged around a definition of design as a configuration of technological product parameters (Abernathy and Utterback, 1978; Tushman and Anderson, 1986; Clark and Fujimoto, 1990; Henderson and Clark, 1990). Traditionally inclined to a functionalist aspects of design – even though they usually talk about form, they generally refer to a set of parameters that defines the functionality of a product – scholars in this tradition tried to understand not only what makes a good design, but also why and under what conditions a design becomes dominant, and the role of design in the dynamics of technology and innovation (i.e. Abernathy and Utterback, 1978; Clark, 1985; Tushman and Anderson, 1986; Clark and Fujimoto, 1990; Henderson and Clark, 1990) (see Figure 1).

Figure 1 about here

Abernathy and Utterback (1978), in their seminal work, proposed a model relating patterns of innovation within a certain unit and that unit’s competitive strategy, production capabilities,

and organizational characteristics. Drawing on anecdotal evidence they conclude that a productive unit's capacity for, and methods of innovation depend critically on its stage of evolution from a small technology-based enterprise to a major high-volume producer. Furthermore, they introduce the concept of "dominant design", a particular configuration of technological product parameters defined as the "dominant new product synthesized from individual technological innovations introduced independently in prior products (1978: 46)". In particular, they pinpoint that radical product innovation represents the emergence of a dominant design in the market and that a dominant design is typically followed by incremental product innovations and/or by process innovation. In other words, in this article design is represented as the milestone of change in the patterns of industrial innovation. In other words, this study seems to suggest that:

P₁: the goodness of fit of a design will influence the emergence of that design as dominant

Drawing on Abernathy and Utterback's model, Clark (1985) provides a more detailed characterization of the process of problem solving in design. Examining the interaction between design decisions over time and the choices of customers, both considered as problem solving processes linked by mutual interaction and influence, he develops a conceptual framework for explaining the sequence of technological changes that underlie the development of industries. More precisely, Clark argues that the logic of problem solving in design and the formation of concepts that underlie choice in the marketplace also impose a hierarchical structure on the evolution of technology. Put it differently, the pattern of innovation, the kinds of design changes introduced and their timing and sequence depend not only on the technical alternatives available but also on the interactions between the hierarchies which dominate the internal logic of the product and the evolution of customer requirements.

By the same token, Tushman and Anderson (1986) investigate patterns of technological change and their impact on environmental conditions. Building on the understanding of

Abernathy and Utterback (1978), and on case-based evidence collected in different industries, they argue and empirically demonstrate that patterned changes in technology dramatically affect environmental conditions, in terms of uncertainty and munificence. But more importantly, they elaborate on the concept of dominant design defining it as “a synthesis of a number of proven concepts (1986: 383)”. In their view, a dominant design reflects the emergence of a product-class standard, ending a period of technological ferment and competition between different “designs”, thus becoming a guidepost for further product or process incremental change.

Collectively, these studies seem to suggest that:

P₂: the available technologies will determine the range of possible design choices

P₃: the purpose for which a product is designed will determine the range of possible design choices

P₄: the fit (or misfit) between the range of possible design choices and the socio-economic and technological context will influence the goodness of fit of a design

Abernathy and Utterback’s (1978) model and Clark’s (1985) idea of product are at the basis of the work by Henderson and Clark (1990). They demonstrate the incompleteness of the traditional characterization of innovation as either incremental or radical. Indeed, building on idea of product as a set of components embodying core design concepts and performing a well-defined function, two key dimensions are used to define innovation, knowledge of components and knowledge of linkages among these components, and two new concepts of innovation, modular and architectural innovations, are added to incremental and radical ones. Therefore, the authors expand upon the concept of design hierarchies to develop that of architectural innovation, that is of an innovation that changes the architecture of a product without changing its components and their core design concepts.

Clark’s (1985) conceptualization of design is also at the basis of the concept of product integrity proposed by Clark and Fujimoto (1990), whereby internal product integrity refers to the “consistency between a product’s function and its structure” while external integrity refers to the

“consistency between a product’s performance and customers’ expectations” (Clark and Fujimoto, 1990: 108)

With respect to Clark (1985) these authors go further and argue how product integrity might play a key role in fostering product development effectiveness and in creating a sustainable competitive advantage. Drawing on anecdotal evidence, they explain the difference between success and failure in an organization on the basis of product integrity (both internal and external). Product integrity, and the capacity to create it, is therefore postulated to provide a sustainable competitive advantage that cannot be easily matched, and to represent what differentiates successful companies from those not so fortunate in turbulent, and intensely competitive markets.

These studies seem to suggest that:

P₅: the fit (or misfit) between the range of possible design choices and the socio-economic and technological context will influence the integrity (both internal and external) of a product

P₆: the integrity (both internal and external) of a product will influence the emergence of the design of that product as dominant

Consumer Research Perspective on Design

Consumer researchers have mostly tended to focus on the aesthetic aspects of product design. As a matter of fact, typical of these scholars are more narrowly focused definitions of design conceived of as product aesthetics or as product appearance (Holbrook and Zirlin, 1985; Bloch, 1995; Veryzer, 1999). Design is considered as the set of all those formal elements of a product discernable by the five senses (aesthetic) or only by the sight (appearance). As a consequence, for these authors the terms product design, product aesthetics and/or product appearance are often used interchangeably:

[product design] represents a number of elements chosen and blended into a whole by the design team to achieve a particular sensory effect (Bloch, 1995: 17)

The design of product inherently involves aesthetics. Moreover, aesthetics aspects of a product are a potential source of pleasure for the consumer (Holbrook and Zirlin, 1985)

In other words, they have tried to understand how the form of a product, or its aesthetics, affects consumer reactions, preferences and, ultimately, their product choices:

Indeed, as Bloch (1995) eloquently pinpointed, designers make choices regarding characteristics, such as shape, scale, proportion, materials, color, reflectiveness, and texture, but they also decide how to mix these elements and determine the level of congruity that should exist among them.

Past research in this field has documented that product design can capture consumer attention (Berkowitz, 1987), provoke positive emotional reactions (Veryzer, 1993), influence consumer liking (Cox and Cox, 1988; Veryzer and Hutchinson, 1998; Cox and Cox, 2002), affect brand categorization (Kreuzbauer and Malter, 2005), and have a positive effect on quality appearance and perception (Page and Herr, 2002). More precisely, some researchers have emphasized the ability of product form to influence consumers' liking or stronger aesthetic affective preferences (affect) (see Figure 2).

Figure 2 about here

Cox and Cox (1988), for instance, examine the effects of repetition on liking for advertisements, finding that consumer evaluations of advertisements with complex layouts increase between first and second exposures, while evaluations of simple layout advertisements do not. Veryzer (1993) illustrates the ability of product aesthetics to systematically influence consumers' perceptions and evaluations of products and to spark emotional reactions. In this paper he investigates the systematic nature of aesthetic responses to products and proposes a conceptualization of aesthetic response as formed on the basis of intrinsic elements of the stimulus, and encompassing strong attention and involvement. Veryzer and Hutchinson (1998) empirically examine the effects of two aesthetic design characteristics, unity and prototypicality, on consumer liking for the product, suggesting that product designs which are highly unified and prototypical are most liked by consumers. Finally, Cox and Cox (2002) investigate the effects of

stimulus complexity on consumers' aesthetic preferences, showing that preferences for visually complex product designs tend to increase with repeated exposure.

Collectively, the previous studies seem to suggest that:

P₇: the form of a product triggers affective reactions, ranging from simple liking to stronger aesthetic reactions

P₈: the intensity and valence of affective reactions to a product depend on its perceived form

Others have advocate the ability of product form to influence how an object is interpreted (cognition) in order to create product-related beliefs, quality-related beliefs, and categorization-related beliefs. Berkowitz (1987) shows how product design can generate consumer inferences regarding several product attributes. More precisely, he explores the mechanism by which an easy-to-spot attribute such as the shape of a product can be used to infer more important but less easy-to-spot attributes, such as comfort or freshness, thus triggering preference decisions. Thus:

P₉: the form of a product elicits beliefs about its attributes and performance

Page and Herr (2002) investigates how product design interacts with brand strength to influence consumers' product liking and quality evaluations. Results from their experiments document that product design alone has a positive effect on consumers' liking, while a combination of product design and brand information positively influences quality judgments. More precisely, liking judgments appear to be readily formed through a process that integrates product design cues, to the exclusion of brand category information, while quality judgments appear to take longer to process involving some integration of design and brand information.

Therefore:

P₁₀: the form of a product elicits quality judgments about the product itself

Kreuzbauer and Malter (2005) test the effects of changing product form on consumer perceptions of a product's uses and brand-category membership and explain how embodied cognition and perceptual symbol systems enable product designers to influence consumers by communicating key perceptual features through subtle changes in product design elements.

Hence:

P₁₁: the form of a product influences how the product is categorized within and among product classes

Some other scholars have highlighted the ability of product design to influence customers' choices (behaviors).

Research on architectural spaces and retail atmospherics (Bitner, 1992; Donovan and Rossiter, 1982) has investigated customers' behavioral responses to space and interior design.

Donovan and Rossiter (1982) suggest that store atmosphere, engendered by a myriad of in-store variables, is represented psychologically by consumers in terms of two major emotional states, pleasure and arousal, acting as mediators of intended shopping behaviors within the store.

Bitner (1992) advances a conceptual framework for exploring the impact of physical surroundings on the behaviours of both customers and employees.

Both works describe behavioral responses as either approach or avoidance, where approach behaviors reflect an attraction to a design and include spending time in a site and exploring it, while avoidance behaviors represent the opposite of approach responses.

Finally, Bloch (1995) claims not only that behavioral responses to product design can be considered along an approach-avoidance continuum, but also that they are mediated by psychological responses (cognitive and affective). More specifically, when a certain product elicits positive psychological responses, the consumer will tend to engage in approach activities, such as extended viewing, listening, or touching of the product. Approach behaviors also include seeking information about the product and willingness to visit retailers selling the product, purchase. When, on the other hand, a product elicits negative beliefs and affect, the consumer may distance him- or herself from the object, and decide not to buy it.

As a whole, previous findings seem to suggest the following propositions:

P₁₂: the form of a product triggers behavioral responses, mediated by psychological responses

P₁₃: the stronger the positive (negative) psychological responses to a product's form, the greater the propensity to approach (avoid) the product

P₁₄: the form of a product influences its commercial performance, mediated by psychological and behavioral responses

Behavioral responses to a certain product, especially considered in terms of purchase decisions, can have an important impact on commercial success of that product, measured in terms of product turnover and product turnover growth.

Therefore:

P₁₅: the stronger the propensity to approach (avoid) the product, the higher (the lower) the commercial performance of that product

Marketing Management Research on Design

Marketing management scholars have emphasized the strategic power of design as well as its strong connection with the marketing function of the firms. In other words, they have primarily focused on the concept of design as a capability increasing commercial success by properly tailoring products to markets, and company performance by adding value to products. Product design is, thus, acknowledged as an opportunity for differential advantage in the marketplace (e.g. Kotler and Rath, 1984; Lorenz, 1986; Walsh et al., 1992, Bruce and Jevnaker, 1998; Gemser and Leenders, 2001; Von Stamm, 2003). As Phil Kotler observes:

Design is the process of seeking to optimize consumer satisfaction and company profitability through the creative use of major design elements (performance, quality, durability, appearance, and cost) in connection with products, environments, information, and corporate identities (Kotler and Rath, 1984: 17)

Therefore, according to these authors the purpose of design is to create high satisfaction for the target consumers and profits for the enterprise by blending creatively the major elements of the design mix (namely performance, quality, durability, appearance and cost), thus generating design ideas that should at least be market-tested, and preferably be market-sourced or stimulated by market survey data.

Some marketing management scholars insist on a definition of design as a set of activities (constituting the design process) and of distinctive capabilities of the firm. In very broad terms, Von Stamm (2003) speaks of design as a set of activities by which information is transformed into an outcome:

Design is the conscious decision-making process by which information (an idea) is transformed into an outcome, be it tangible (product) or intangible (service) (Von Stamm, 2003: 12)

By the same token, but in more specific terms, Walsh et al. (1992) define design as “the activity that transforms the brief or initial market specification into design concepts and prototypes and then into the detailed drawings, technical specifications and other instructions needed to actually manufacture a new product (1992: 18)”, and Bruce and Jevnaker (1998) as “a capability of the firm based on the aptitude to foster the creative processes as a set of value-creating activity (1998: 4)”. As a whole, these scholars have tried to understand and demonstrate how design affects performance (see Figure 3 for a summary).

Figure 3 about here

Early anecdotal evidence has shown that product design can have positive effects on company performance. Kotler and Rath (1984), for example, leveraging on some cases of outstanding design (B&O, Crate & Barrel, Hanes etc.) argue that “design is a strategic tool” enabling marketers to match customer requirements to a product’s performance, quality, durability, appearance and price. Furthermore, good design can help companies to gain a sustainable competitive advantage by enhancing products, environment, communication, and corporate identity. In other words, the objective of design seems to be that of creating high satisfaction for the target consumers and profits for the enterprise, blending the major elements of the design mix.

In a similar vein, Lorenz (1986) extensively illustrates six examples of companies who have elevated design to fully-fledged membership of the corporate hierarchy: Olivetti, Sony, John

Deere, Ford, Philips, Baker Perkins, and he observes how these companies have gained a competitive advantage by allowing their designers a high involvement in a whole range of decisions about product and market strategy. “In these firms” he argues “product design is used as a key competitive weapon (1986: 3)” and “industrial designers seem to be acting not only as an invaluable source of ideas, but also as facilitator, coordinator, evaluator and completer (1986: 7)”.

In the last decade, more specific studies have tried to enhance the understanding of the conditions under which design increases company performance (Walsh et al., 1992; Gemser and Leenders, 2001; Perks, Cooper and Jones, 2005).

Walsh et al. (1992) conduct two studies in Great Britain, examining to what extent the receipt of design awards was positively associated with company performance. To this end, the company performance of award-winning firms was compared with the performance of a random selection of “typical” firms competing in the same industries. In both studies it is found that firms with “good design” credentials performed significantly better on several company performance indicators (including turnover and profit growth) than the randomly selected sample of typical firms.

Gemser and Leenders (2001) take a step forward and try to investigate how and when integrating design in the product development process can enhance a company’ competitive position. The data show that the extent to which firms integrated design in new product development projects had a significant and positive influence on company performance (in terms of profits, profit growth and turnover growth), in particular when the strategy of investing in design is relatively new for the industry involved. Furthermore, they find that design innovation had significant positive performance effects in both types of industries regardless of whether the use of design was mature or emerging.

Focusing on the role of design in the new product development process and adopting a multiple case study methodology, Perks, Cooper and Jones (2005) investigate the nature of the design’s involvement in new product development in order to articulate the scope and type of

designers tasks and activities, and the skills associated with such actions and to unravel the key contextual factors explaining these dynamics. The derived taxonomy is characterized by three roles for design in new product development: design as a functional specialism, as a part of a multifunctional team, and as process leader. Evidence collected shows that those companies where design was a crucial aspect of the product development process and/or is seen as a major force for innovation had a superior new product development performance and company performance.

In summary, these works seem to suggest the following propositions:

P₁₆: the relationship between the integration of design capabilities in the product development process and the commercial performance of the product is mediated by customer satisfaction

P₁₇: the relationship between the integration of design capabilities in the product development process and company's profitability is mediated by product value (in terms of performance, quality, durability, appearance and price)

Design Studies Perspective

With the label of design studies I refer to a field of inquiry directed toward a better understanding of the ideas and methods lying behind design practice to which renown designers, historians, and theorists have contributed (see Buchanan and Margolin, 1995). They tend to consider design as a sort of a creative professional practice (made up of activities and capabilities) located in the social, historical, and cultural context as well as in the organizational one (e.g. Papanek, 1972; Sparke, 1986; Thackara, 1988; Buchanan and Margolin, 1995). Starting from this definition of design, they have primarily focused their attention on the social, cultural and ethical utility of design, trying to figure out how design practice does and should relate to this broader context (see Figure 4 for a summary of their approach).

Figure 4 about here

The first to stress this point is Victor Papanek, an industrial designer, who in his book *Design for the Real World* introduces the concept of socially responsible design emphasizing the demand for high moral and social responsibility from industrial designers.

There are professions more harmful than industrial design, but only a very few of them (...) design must become an innovative, highly creative, cross-disciplinary tool responsive to the true needs of men (...) Design is the conscious and intuitive effort to impose meaningful order (Papanek, 1972: ix, 4).

Papanek's book proves extremely helpful in describing the kinds of social products designers must create. Using as a framework a socially-oriented design office, he provides long lists of products addressing social needs (from all kinds of teaching aids to medical diagnostic devices, and to devices addressing pollution problems). In other words, he advocates the social role of design, and calls on a new agenda for designers. As a matter of fact, since Papanek's book appeared, others have responded to his call emphasizing also the cultural role of design.

More precisely, Buchanan and Margolin (1995)'s collection of essays reflects the growing recognition that the design of the everyday world deserves attention not only as a professional practice but also as a subject of social, cultural, and philosophic investigation:

Many writers have not hesitated to extend their work beyond the narrow bounds of design practice to speculate on cultural and philosophic matters, finding that design cannot be adequately understood apart from the issues and concerns of contemporary cultural discourse (1995: ix)

The essays focus on three main issues: how to shape design as a subject matter, how to distinguish the activity of designing in the complex world of action, and how to address the basic questions of value and responsibility that arise in the discussion of practice in contemporary design. Far from providing definite answers to such issues, this collection of essays has the purpose to give prominence to the debate about the role design and designers in cultural and social life encouraging the pluralism of perspectives on it.

Sparke (1986) tries to examine both the way in which culture has influenced design in the twentieth century and the manner in which design has, in its turn, played a part in creating culture through the objects, institutions, personalities and the patterns of behaviour and thought that have accompanied it. Through the combination of a chronological and a thematic case-study approach, the author describes twentieth-century design in as broad a cultural context as possible, indicating many of the different forces that have determined its evolution and describing a number of the more significant developments that have taken place. What emerges is a role of design as an important medium of communication which expresses the values of the system within its functions:

Design becomes one of the forms of mass communication in modern society inasmuch as it plays a fundamental role, both practical and psychological, within daily life (1986: xxi)

Furthermore, following radical critiques of the idea that science and technology are neutral, Thackara (1988) underlines the responsibility that design and designers have in everyday life. More specifically, he defines design as “neither neutral nor apolitical”, but as a planning activity dictated by commercial and political interests, and responsible for products and environments that sometimes fail to meet even basic human needs.

Overall, despite debate and fragmentation, among representatives of this field there seems to be consensus about the fact that designers don't live in a vacuum and have to cope with different design goals and constraints when developing a new product. What this literature suggests is that goals and constraints of a design project are often influenced by the cultural and social context. As a matter of fact, designers are embedded in cultures or subcultures and belong to certain social groups. Therefore in designing a new product they will be likely to infuse those meanings that are desirable within their cultures or subcultures. Hence:

P₁₉: design goals and constraints are influenced by the cultural and social context they are embedded in.

In part, however, given the commercial purpose of products, designers will attempt to create an object that will be successful both in terms of form and in terms of function. In this

respect, designers should produce a product that is pleasing to target customers while simultaneously satisfying relevant design goals and constraints (Lawson 1983). Among the possible design goals and constraints the most cited ones by extant literature are: performance objectives and constraints (Hollins and Pugh 1990, Nussbaum 1990, Lawson 1997;), ergonomic constraints (Osborne, 1987; Norman, 1988; Nussbaum, 1988; 1993), production and cost constraints (Hollins and Pugh, 1990; Dumaine, 1991), regulatory and legal constraints (Nussbaum, 1990; Lawson, 1997), designers constraints (Papanek, 1972; Nussbaum, 1990; Lawson, 1997).

It is likely to suppose that as design objectives and constraints increase in number, the design process becomes increasingly complex.

Therefore:

P₁₉: the form of a product is influenced by the set of goals and constraints applicable to the design project. The greater the number of applicable goals and constraints, the more complex the design task.

P₂₀: the function of a product is influenced by the set of goals and constraints applicable to the design project. The greater the number of applicable goals and constraints, the more complex the design task.

Organization Studies perspective

In the field of organization studies, the word “design” has traditionally been referred to the definition of structural properties of an organization (see Chandler, 1962; Woodward, 1965; Lawrence and Lorsch, 1967; Perrow, 1967; Galbraith 1973). Traditionally, studies on organization design have started by assuming that organization designers understand well the design contexts and what design should achieve, rather than perceiving design goals as in any way problematic (Dunbar and Starbuck, 2006). Therefore, attention has been devoted to what components to include in the design of the organization and how to evaluate the performance of such design. Will research in this tradition is vast and fortunate, the focus of this paper is on product, rather than organizational design.

In the last decade, organization studies seem to have been characterized by the emergence of a growing number of insightful studies, with apparently loose relationships with mainstream paradigms and debate, and with a focus on the dynamics interweaving product design and different organizational processes (e.g. Sutton and Hargadon, 1996; Hargadon and Sutton; 1997; Hargadon and Douglas, 2001; Rindova and Petkova, 2006; Ewenstein and Whyte, 2007), thus opening up new areas of investigation so far overlooked in the organization studies field.

Some of these scholars tend to share an idea of design as a formal property of artifacts influencing and influenced by emotional, cognitive and institutional processes (Hargadon and Douglas, 2001; Rafaeli and Vilnai-Yavetz, 2004; Rindova and Petkova, 2006). In other words, they try to investigate how the design of product form may affect individual and collective responses to new products, technologies, and the organization.

Rindova and Petkova (2006) highlight the influence that product form design can have on customer perceptions of the value potential of the product itself by triggering different emotional and cognitive responses underlying initial perceptions of value.

Rafaeli and Vilnai-Yavetz (2004) emphasize the emotional aspects of the impact that artifacts can have on organizations, by claiming that the exposure to physical artifacts is an “affective event” for organizational constituents that can have subsequent direct and indirect effects on attitudes and behaviors toward the organization itself.

Hargadon and Douglas (2001) investigate the role of product design in mediating between innovations and established institutional fields as entrepreneurs try to introduce changes. Analyzing Thomas Edison’s system of electric lighting, they explain how design and design strategy can allow entrepreneurs to exploit the established institutions while simultaneously retaining the flexibility to displace them, thus showing the influence that design can have on a collective level.

Others share a conception of design as a creative process, and have used product design firms as research settings of their studies in order to study creativity (Sutton and Hargadon 1996),

innovation (Hargadon and Sutton, 1997), and the dynamics of aesthetic knowledge in organizations (Ewenstein and Whyte, 2007). In these studies the focus of attention is on knowledge flows, and on what type of knowledge is used and produced in design.

Hargadon and Sutton (1996) and Sutton and Hargadon (1997) emphasize the importance of leveraging on a multi-domain knowledge, and on frequent and intensive brainstorming sessions for the effective generation of creative ideas during the early phases of the product development process. Building on the organizational memory theory, they show how the innovative accomplishments of IDEO – the product design firm where they performed their study – stem from the transferring of knowledge over time and across projects.

Finally, Ewenstein and Whyte (2007) focus on aesthetic knowledge, defined as a knowledge deriving from the senses and particular situations and experiences, describing how it is generated and applied in design projects, shared between practitioners and developed at the level of the organization.

The previous review, although casting light on some promising themes of research, leaves the impression that these studies represent isolated attempts to unpack the dynamics involving product design at the organizational level, thus lacking a clear-cut common thread.

A TENTATIVE INTEGRATIVE FRAMEWORK AND A RESEARCH AGENDA

Figure 5 presents a schematic overview of the tentative theoretical framework resulting from the integration of the different streams of research previously reviewed.

Figure 5 about here

Collectively, these streams of research seem to suggest that in order to fully understand the phenomenon it is necessary to uncover it from different perspectives.

More specifically, this figure consists of boxes and arrows representing respectively central themes and concepts in the literature on design, and already tested or only hypothesized relationships between them. As a consequence, this framework clearly reveals the complexity of the topic and the many concepts, definitions, considerations and linkages at stake.

Furthermore, it also stresses the importance of adopting a conceptualization of design acknowledging the different aspects of this phenomenon as well as the relationships among them. As a matter of fact, the conceptualization of design here adopted acknowledges both aesthetic and functional components of design as well as the design capabilities necessary to develop a certain form and a certain function.

But what's more important is that, although complex, it has the benefit of highlighting those concepts and those relationships deserving further thought and investigation.

In other words it has the merit of suggesting a future research agenda, as shown in Figure 6.

Figure 6 about here

Indeed, based on the model and propositions introduced here, there are some promising directions for future design research.

Design Capabilities and Design Management

One area worth investigating is represented by the role of design capabilities in the new product development process. As already mentioned, marketing management scholars have empirically documented that a higher integration of design capabilities in this process leads to higher commercial success and company profitability.

Nevertheless, there seems to lack a specific definition of what design capabilities really are.

Swan, Kotabe and Allred (2005) have talked about a specific kind of design capabilities, the so-called “robust design capabilities (functional, aesthetic, technological and quality)”, conceived

of as “the abilities to develop acceptable products to broader market segments, events, and/or conditions with costs offset by the anticipated organizational benefits” (2005: 146), and have documented the existence of a relationship between them and firm performance in conditions of environmental uncertainty. However, this seems to be an isolated example.

In other words, future research needs to better define the concept of design capabilities, and hence to develop specific measures for them. Moreover, there is a need for further clarification regarding whether and how design capabilities influence aspects of firm performance other than profitability, as well as the ways firms can develop design capabilities in order to increase their performance regardless of environmental uncertainty. It could be also interesting to investigate the influence they can have on the interrelations between product form and product function.

Finally, among marketing management scholars, the shared understanding of design as a process, and as a set of activities and capabilities has led to the need to identify methods to properly manage design and, thus, to the development of the (not undisputed) concept of “design management”. To be precise, the term has been introduced for the first time by Gorb in 1988 during a Conference on Design. However, since then neither a clear-cut definition nor a theory of design management have been developed. Rather, there are many practical guidelines on how design management should be introduced inside the firm. Future research could address these gaps as well.

Product Function and Product Form

Another area worth examining is represented by product function. Surprisingly, although being an integral component to product design, and a long-term product success (Ulrich and Eppinger, 1995), little attention has been paid to the ability of product function to influence customers’ responses. Technology and innovation management scholars have stressed the importance of the level of fit between context and functional parameters in order to elicit customers’ responses, but have not investigated the specific responses stemming from it. Page

and Herr (2002) have started addressing this point, but future research is needed to clarify whether product function can directly elicit emotional responses besides cognitive ones.

Furthermore, the connections between product function and product form are still unclear. As Veryzer (1995) pinpoints, if on the one hand it is true that form follows functions, on the other hand it is also true that function follows (is determined by form). In other words, we can assume that these two elements of product design interact between each other. In this respect, research is needed to figure out how they really influence each other, how the goodness of fit between them affects consumers' responses, and which kind of responses (cognitive and/or emotional) are mostly affected by the level of goodness of fit.

Finally, further investigation is also needed to determine which specific elements of product form and product function trigger particular emotional and cognitive responses.

Consumers Characteristics

Also promising is further study exploring the effects of individual characteristics (tastes and preferences) on consumers' responses. Some scholars (Bloch, 1995; Jones, 1991) have hypothesized a moderating effect of individual tastes and preferences on responses to product form. In other words, in principle, products that are congruent with individual tastes and preferences are evaluated positively. On the contrary, negative reactions are likely to occur when there is low congruence. The challenge for future research is to investigate whether this is true in practice, and whether tastes and preferences moderate only emotional responses or also cognitive responses.

Furthermore, future research should focus on figuring out which are those variables that, in their turn, influence tastes and preferences. According to Lewalsky (1988), some preferences seem to be innate or acquired early in life. There are over one hundred Gestalt principles that constitute the most well known formalizations of innate design preferences (Katz, 1950). For example, Papanek (1972) argues that people inherently prefer objects with symmetry, unity, and harmony among elements, and Veryzer (1993) empirically confirms that consumers prefer

product designs following Gestalt laws of proportion and unity over designs violating these laws. A few scholars have even attempted to understand innate design preferences using a teleological perspective. According to them, there are innate preferences for forms following natural, organic principles (Papanek, 1972). Future research should explore whether it is true that some people have innate design preferences, and, if it is true, how they can be measured.

Others have suggested that tastes and preferences are influenced by design acumen, something with which certain people are born (Csikszentmihalyi and Robinson, 1990). These people are supposed to make quicker sensory connections and exhibit more sophisticated preferences regarding the design of things than do those with little design acumen.

Additionally, some researchers have also examined how taste is cultivated. Osborne (1986) argues that the development of design connoisseurship requires education, exposure to beautiful things, and motivation. Through such experience, a person learns what to look for in a product design and what the determinants of attractiveness are. In other words, it seems that some people place great emphasis on the aesthetic characteristics of products. The challenge is to identify these persons and determine the scope of their involvement. Therefore, future researchers should develop reliable instruments to assess both design acumen and experience, and should investigate to what extent design-focused consumers influence others, and how.

Design goals and constraints

Provided that designers do not design in a vacuum, but have to cope with different goals and constraints when developing a new object, it could be worth investigating how they deal with them. More precisely, it would be interesting to understand to what extent firms and managers alike in different industries are aware of and take into consideration the design goals and constraints previously mentioned, and whether some specific types of firms (e. g., high tech, high fashion) are more likely to consider a wider set of goals and constraints than manufacturers as a whole. Finally, attention could be devoted to better investigate which factors (culture, management style, etc.) influence companies' approach to designing products.

CONCLUSIONS

This paper contains the early endeavours towards the classification of the substantial volume of empirical and conceptual work on the topic of product design and the comparison of the different fields of inquiry wherein product design has been an important subject of investigation.

As noted, different schools of thought have focused their attention on specific aspects of design, developing, at least apparently, autonomous definitions and perspectives of inquiry.

Technology and innovation management scholars have emphasized the functionalist aspects of design and its links with innovation, technology evolution and industry dynamics, consumer researchers have privileged the study of the influence of product form and aesthetics on consumer behavior, marketing management scholars have investigated the role of design in enhancing company performance, scholars in the design studies field have pinpointed the role of design and designers in the social and cultural context, and finally, some organization studies scholars have started investigating the dynamics linking design issue and organizational processes.

Drawing on this review, I tried to develop a comprehensive framework of the phenomenon of product design integrating the main contributions of the different streams of research. The hope is that such integration will serve both as a record of intellectual ground that has already been traversed and as a starting point in evaluating the state of our current knowledge of this phenomenon, and in stimulating further thought and investigation.

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Table 1. Different definitions of design in chronological order

Author	Definition of design
Alexander (1964)	“Every design problem begins with an effort to achieve fitness between two entities: the form in question and its context. The form is the solution to the problem; the context defines the problem.”
Simon (1969)	“Design is concerned with how things ought to be, with devising artifacts to attain goals;” “Design solutions are sequences of actions that lead to possible worlds satisfying specified constraints”
Papanek (1972)	“Design is the conscious and intuitive effort to impose meaningful order”
Kotler and Rath (1984)	“Design is the process of seeking to optimize consumer satisfaction and company profitability through the creative use of major design elements (performance, quality, durability, appearance, and cost) in connection with products, environments, information, and corporate identities”
Clark (1985)	“Design is a search for understanding of what the object or product is, and ought to be, given the context in which it must function. (...)”
Holbrook and Zirlin (1985)	“The design of product inherently involves aesthetics.”
Lorenz (1986)	“The activity which spans both the form and function of manufactured products – industrial design.”
Sparke (1986)	“On the forms of mass communication in modern society inasmuch as it plays a fundamental role, both practical and psychological, within daily life”
Thackara (1988)	“A planning activity dictated by commercial and political interests”
Walsh <i>et al.</i> (1992)	“The activity that transforms the brief or initial market specification into design concepts and prototypes and then into the detailed drawings, technical specifications and other instructions needed to actually manufacture a new product”
Bloch (1995)	“[Product design] represents a number of elements chosen and blended into a whole by the design team to achieve a particular sensory effect”
Buchanan and Margolin (1995)	“Not only a professional practice but a subject of social, cultural, and philosophic investigation”
Jevnaker (1998)	“A capability of the firm based on the aptitude to foster the creative processes as a set of value-creating activity”
Veryzer (1999)	“Design involves a number of important considerations ranging from the specification of product components and functional concerns to the external and aesthetic aspects of the product with which consumers directly interact
Hargadon and Douglas (2001)	“The particular arrangement of concrete details that embodies an innovation”
Von Stamm (2003)	“Design is the conscious decision-making process by which information (an idea) is transformed into an outcome, be it tangible (product) or intangible (service)”

Table 2. A comparison of the main streams of research on design

Stream of research	Shared definition of design	Focus of investigation	What do we know?
<i>Technology and Innovation Management</i>	Design as a technical solution to a problem	How solutions come to be, and come to be replaced	<ul style="list-style-type: none"> ◆ Design has a pivotal role in the dynamics of technology and innovation (i.e. dominant design) ◆ The problem solving in design is to be found in the search for fit between function and context
<i>Consumer behavior</i>	Design as product form	How aesthetic aspects of product design influence consumers' reactions	Product form can influence: <ul style="list-style-type: none"> ◆ affect ◆ cognition ◆ behavior
<i>Marketing management</i>	Design as a capability	How connection between design and differential advantage enhance profitability	<ul style="list-style-type: none"> ◆ Design is a strategic tool at the service of companies ◆ Design capabilities can positively influence commercial performance ◆ Design capabilities can positively influence company performance
<i>Design studies</i>	Design as a creative practice, interacting with a socio-cultural context	How design can acquire a social, cultural, and ethical role in society	<ul style="list-style-type: none"> ◆ Product design has a social and cultural utility ◆ Product design is influenced by a set of goals and constraints ◆ Product design is influenced by the cultural and social context
<i>Organization Studies</i>	(1) Design as a property of artifacts (2) Design as a creative process	(1) How product form design can influence and be influenced by cognitive and institutional processes (2) How knowledge flows during the design process, and what type of knowledge is used and produced in design	<ul style="list-style-type: none"> ◆ Product design can elicit cognitive and emotional responses at a societal and individual level

Figure 1. Technology and Innovation Management Perspective

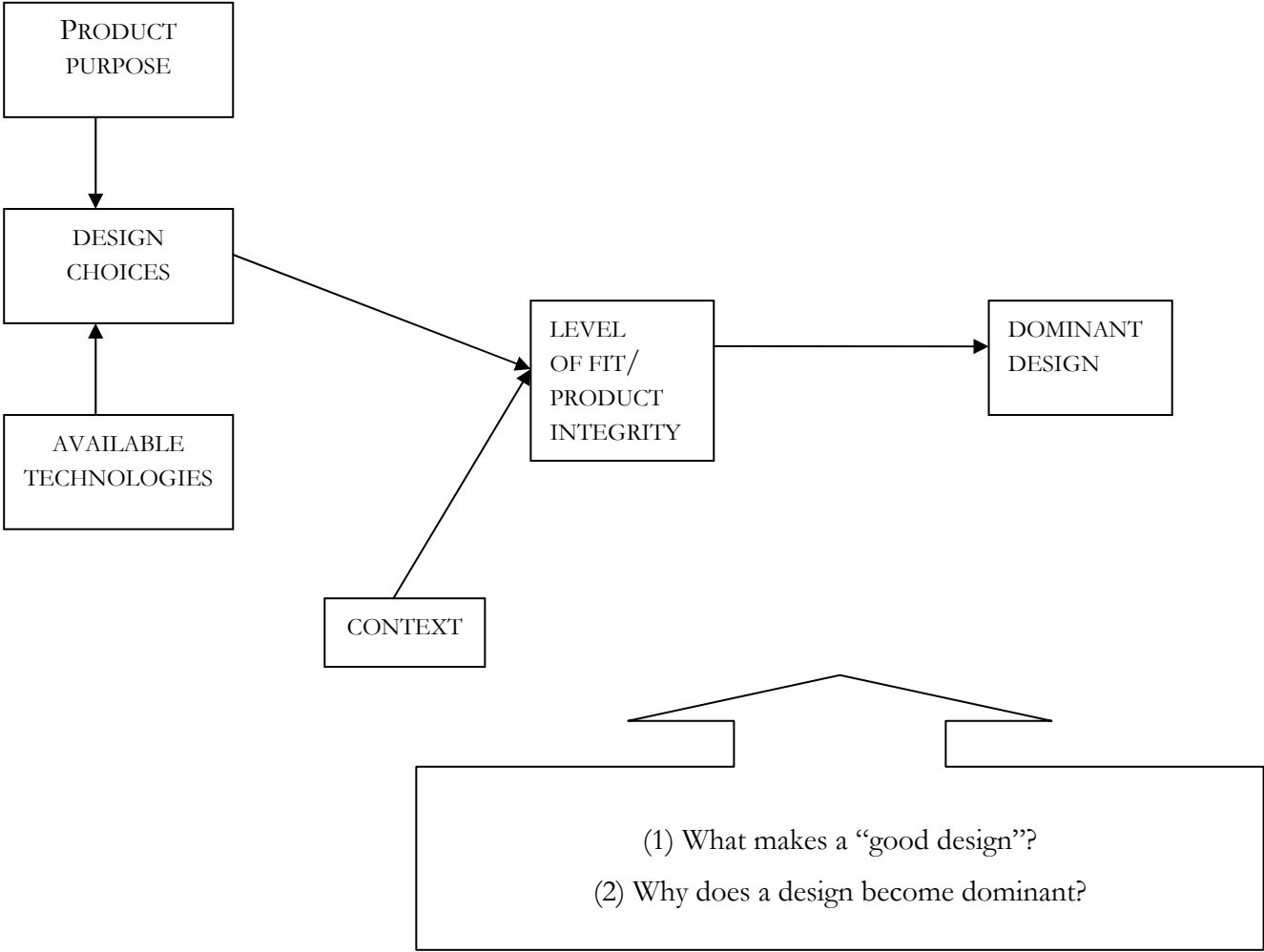


Figure 2. Consumer Research Perspective

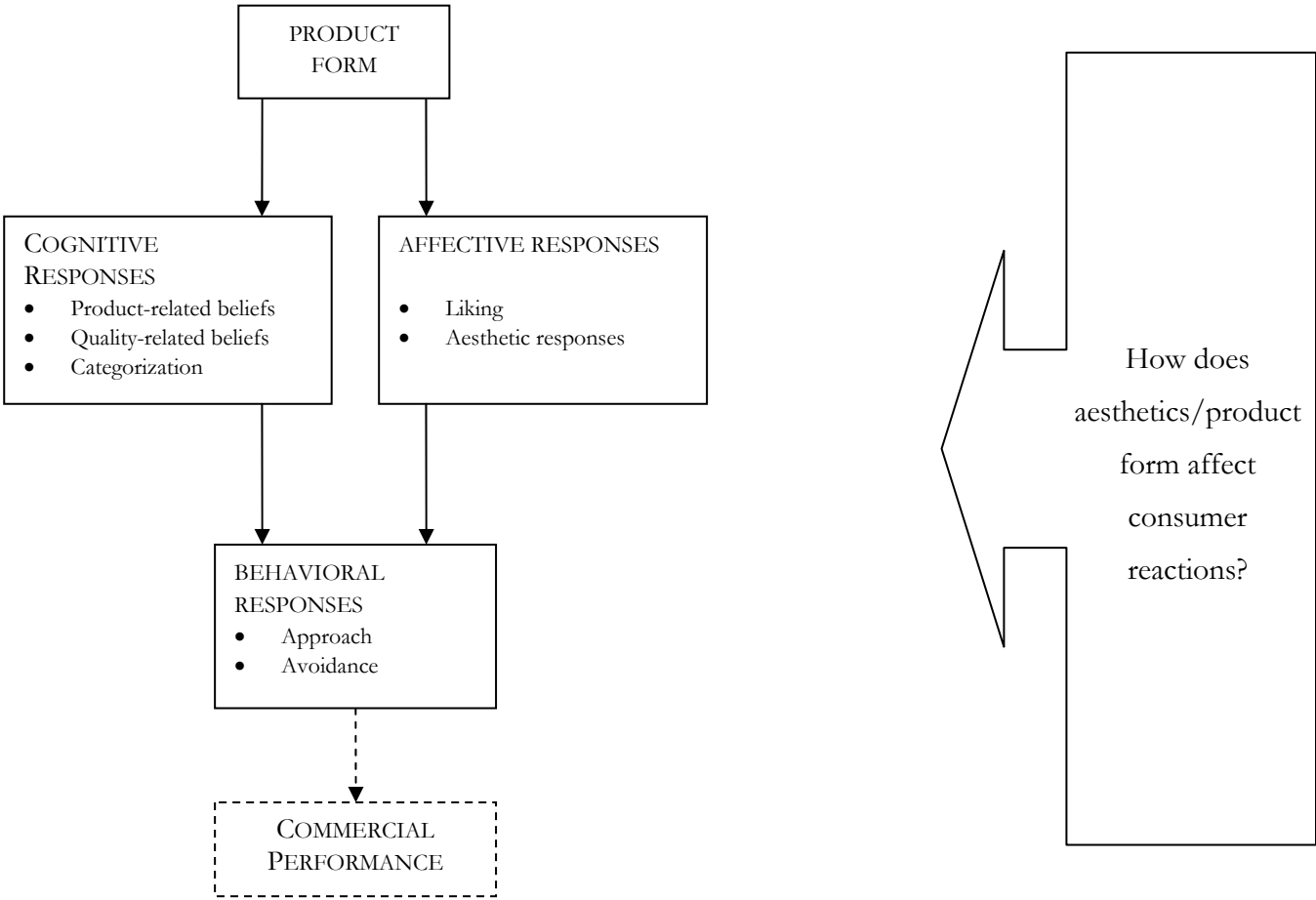


Figure 3. Marketing Management Perspective

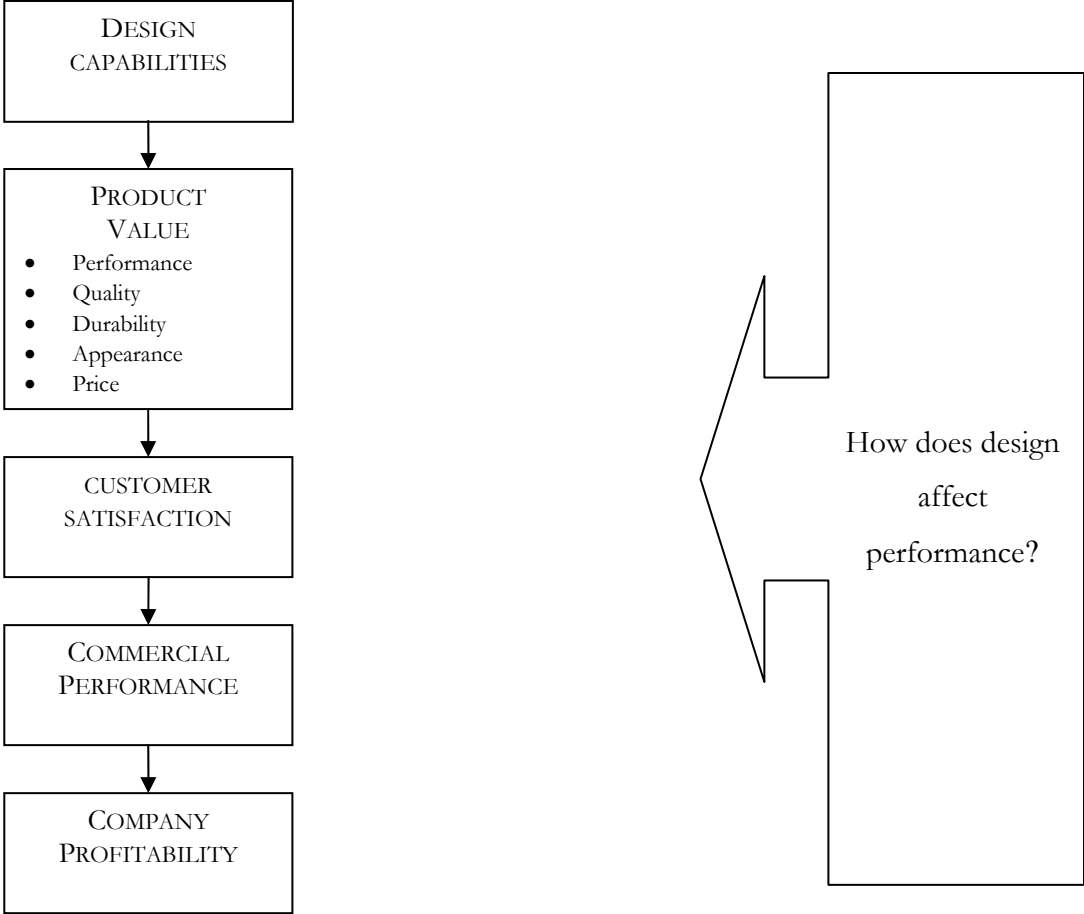


Figure 4. Design Studies Perspective

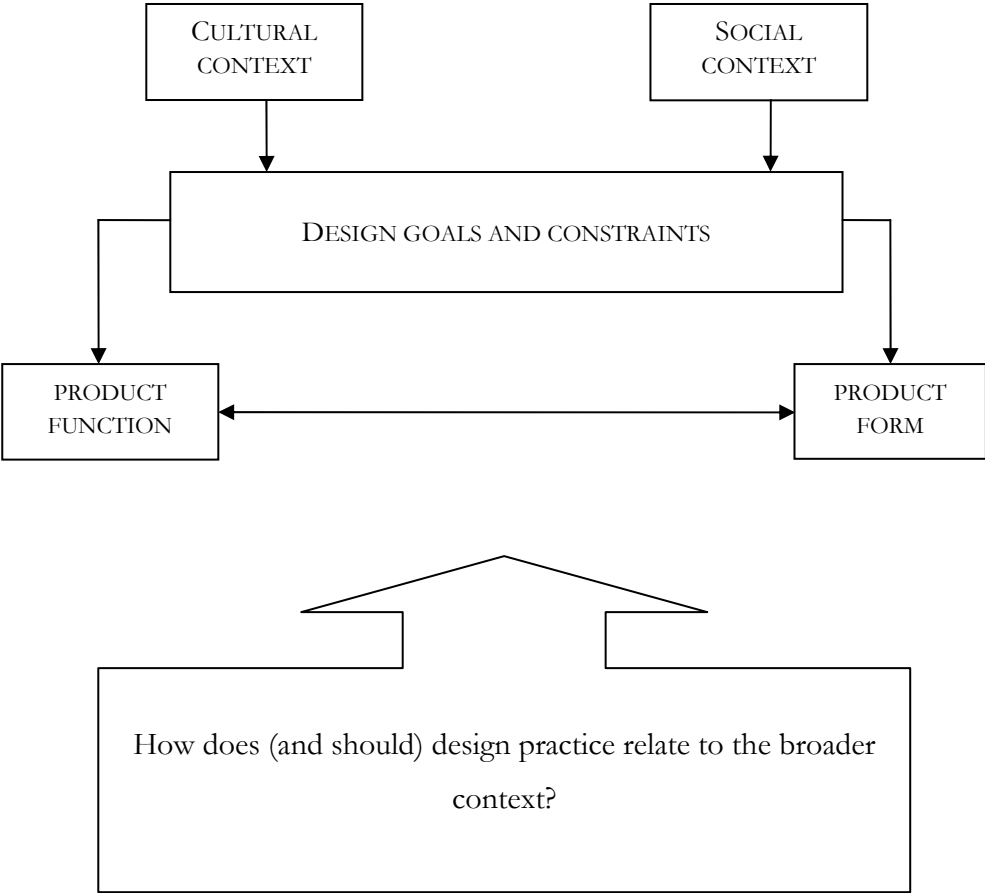


Figure 5. A Tentative Integrative Framework

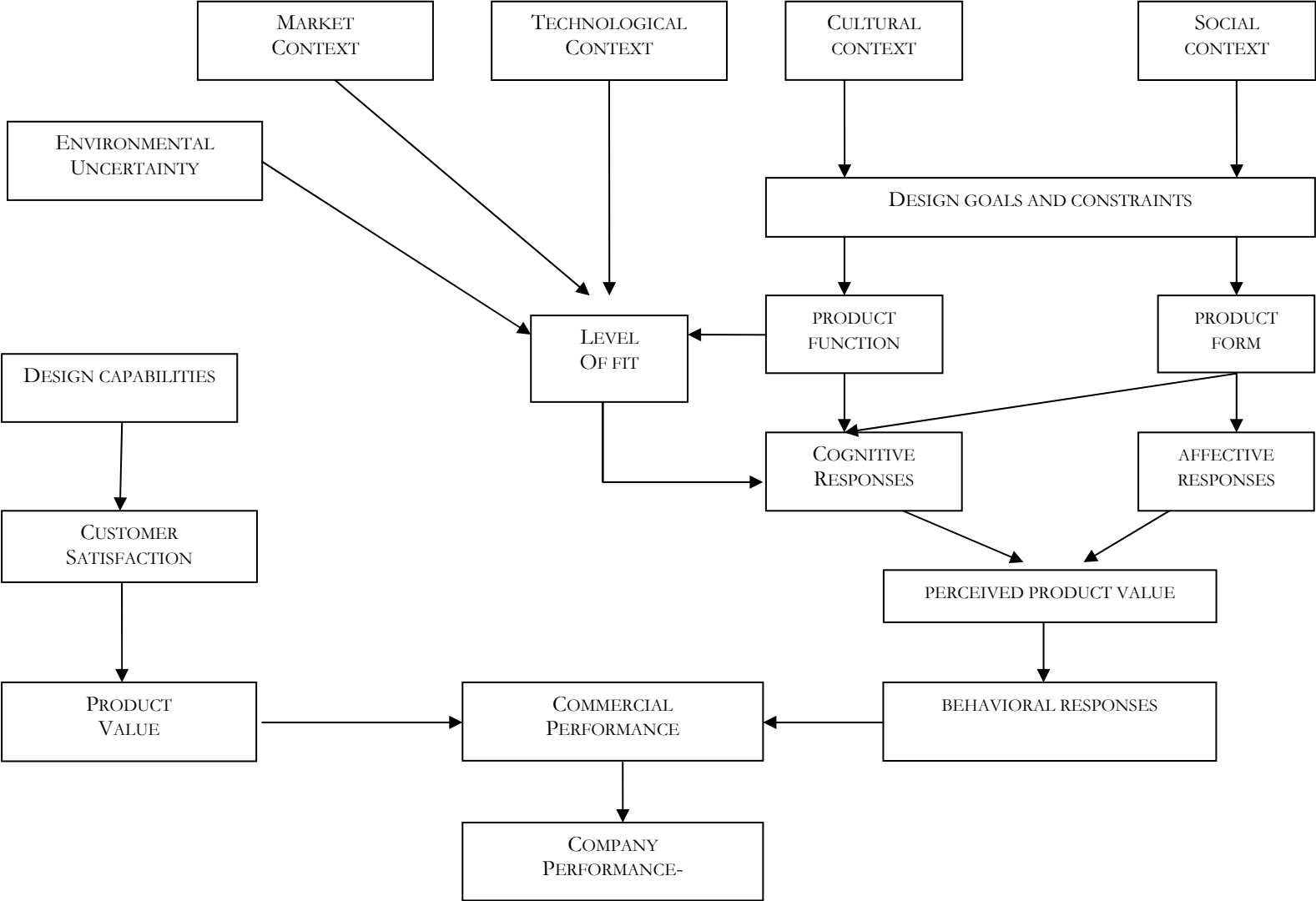
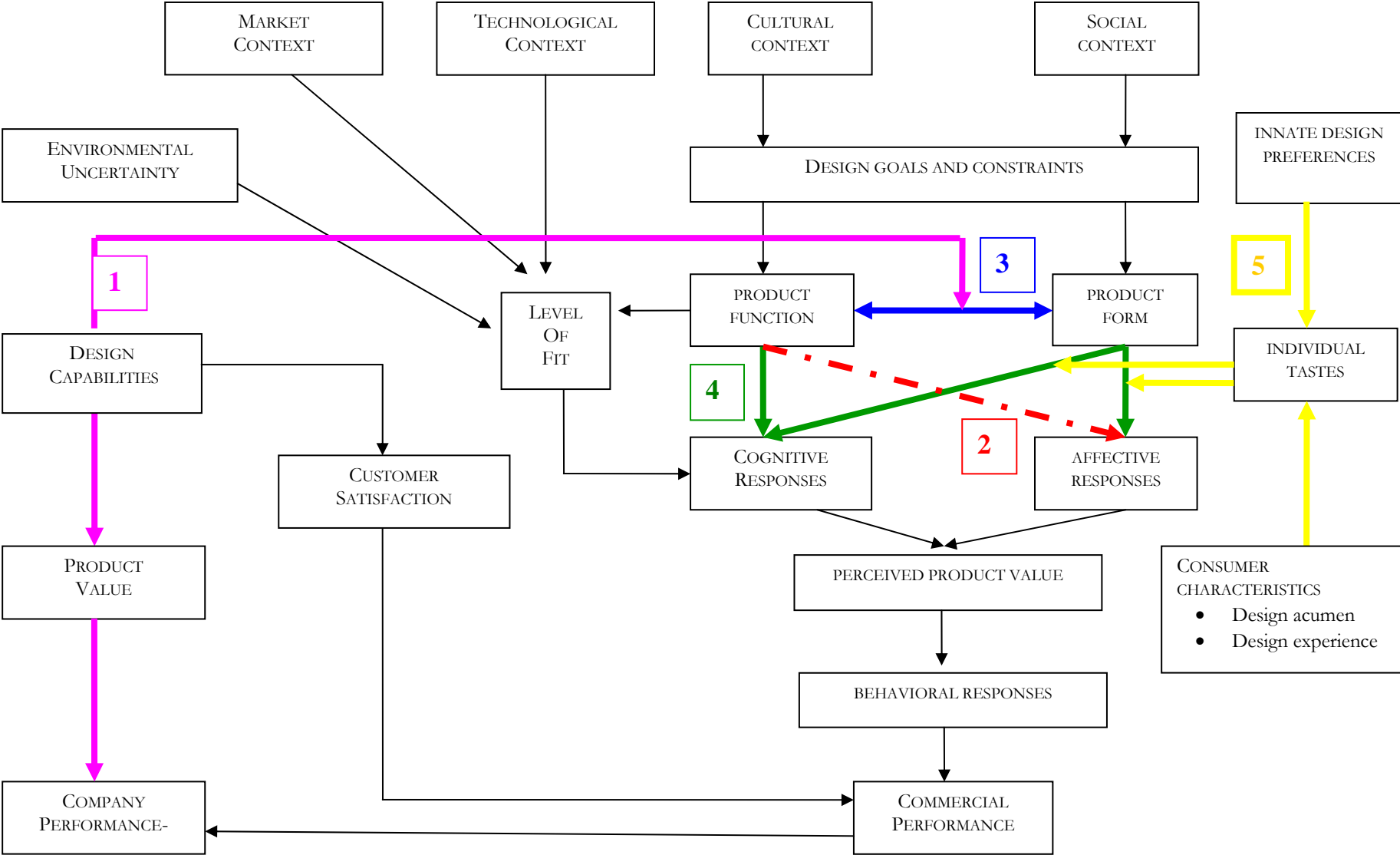


Figure 6. A future research agenda



**THE MAKING OF FORM:
EXPLORING AESTHETIC KNOWLEDGE IN PRODUCT
DESIGN**

ABSTRACT

Previous works have extensively investigated the new product development process emphasizing its functional aspects. On the opposite, the aesthetic aspects of those processes leading to the development of new objects seem to have been overlooked so far. Furthermore, despite the growing interest towards organizational aesthetics and the influence of product aesthetics on consumer behaviors, there seems to be no field-based account of how products come to acquire aesthetic properties. In other words, a rich, comprehensive understanding of how aesthetic knowledge influences the shaping of objects seems to be still missing. In this paper, by drawing on an ethnographic study of a product design consultancy, I develop a deeper understanding of the dynamics involving aesthetic knowledge along the new product development process. More specifically, the collected evidence suggests three main processes related to aesthetic knowledge: building and expressing aesthetic knowledge, sharing aesthetic knowledge, and accumulating and disseminating aesthetic knowledge.

INTRODUCTION

Recent studies in the organizational field have pointed at how formal properties of products influence users' perception of innovations (e.g. Hargadon and Douglas, 2001; Rafaeli and Vilnai-Yavetz, 2004; Rindova and Petkova, 2007). Findings from these studies are corroborated by consumer research showing how product form influences consumers' responses and behaviors (e.g. Berkowitz 1987; Cox and Cox 1988, Veryzer 1993; Veryzer and Hutchinson 1998, Cox and Cox 2002). Despite this multiple evidence of the influence of form on how individuals relate to an organization's products and technologies, little is known about the processes through which these products and technologies acquire their formal properties.

Past research on how individuals relate to formal properties of their organizational environment broadly falls within two streams of research. A fortunate series of studies, rooted in organizational symbolism (e. g. Morgan, Frost and Pondy, 1983; Gagliardi, 1986; Turner, 1990) has investigated widely the symbolic properties of artifacts such as buildings (e.g. Berg and Kreiner, 1990), uniforms (e.g. Pratt and Rafaeli, 1997) and office décor (e.g. Elsbach 2003, 2004, 2006). A second stream of research, known as organizational aesthetics, has more generally pointed at the influence of multiple aesthetic stimuli – not only formal, but also tactile, auditory, etc. – on organizational processes (e.g. Witkin, 1990; Fine, 1992; Gagliardi, 1996; Guillet de Montoux, 2004; Strati, 1990; 1992, 1996). Collectively, these studies provide a rich representation of how organizational members respond to aesthetic properties of their environment or the objects they use.

Research on how organizational members shape aesthetic properties of organizational artifacts – rather than merely responding to them – however, is still at an embryonic stage, and it has focused mostly on symbolic manipulation of organizational artifacts (e.g. Elsbach 2003, 2004). A recent study of architectural work (Ewenstein and Whyte, 2007) has introduced the notion of aesthetic knowledge as a useful concept to understand how aesthetic properties of artifacts are shaped in the interaction between individuals. A rich, comprehensive understanding of how aesthetic knowledge influences the shaping of objects however is still missing.

In this paper, I seek to address this gap through an ethnographic study of the early phases of the new product development process of a product design consultancy. Findings emerging from this study improve our understanding of how aesthetic knowledge is developed, expressed, shared, and accumulated in an organizational context.

The remainder of the paper is structured as follow: in the next section, I briefly review the theoretical background of this study. In the following sections, I present and discuss the methodology applied, and I describe the first-order and second-order findings springing from my study and combining three different perspectives: (1) a first-order view from my perspective as an ethnographer; (2) a related first-order view based on the informants' point of view; and (3) a second-order view induced from the raw data and the first-order findings reflecting my interpretations and including my colleague's feedback. Finally, in the "Discussion and Conclusions" section I articulate the emerging conceptual framework and discuss its implications for research.

THEORETICAL BACKGROUND

Officially, the term aesthetics was used for the first time at the end of the eighteenth century by Baumgarten (Dickie, 1997), who advanced the idea of aesthetics as epistemology. More precisely, he suggested that logic was the study of intellectual knowledge, while aesthetics was the study of sensory knowledge, a type of knowledge learnt through the senses, and through the experience of being in the world. Aesthetics, therefore, was considered to be one of the two components of the theory of knowledge. Later philosophical thinking has agreed that this experiential or aesthetic type of knowledge was not only a separate type of knowledge, but that others forms of knowledge – like those derived from rational thought – depended on, and tended to grow out of aesthetic experiences (Dewey, 1958; Gagliardi, 1996). Similarly, in the organizational literature Polanyi (1978) advanced the idea of tacit and embodied knowledge, roughly corresponding to sensory/aesthetic knowledge, especially because it is often opposed to intellectual and explicit knowledge. Like tacit knowledge, aesthetic knowledge has been mainly described as a pre-linguistic and embodied knowledge, often unconscious and ineffable,

deriving from senses and from the perception of particular situations and experiences – *sensory-perceptual* – (e.g. Gagliardi, 1996; Whitfield, 2005).

Started as a branch of philosophy, aesthetics, and the nature of aesthetic knowledge and of aesthetic experience have progressively become subjects of inquiry and issues of debate in other disciplines, such as psychology (e.g. Berlyne, 1971, 1974), sociology (e.g. Bourdieu, 1986; Grunow, 1997), anthropology (e.g. Douglas, 1982), marketing (e.g. Holbrook and Zirlin, 1985), and organizational studies (e.g. Gagliardi, 1996; Guillet de Montoux, 2004; Strati, 1990, 1999).

In particular, in the past two decades in the realm of organization studies there has been a growing interest towards the systematic study of aesthetics in organizations (e.g. Witkin, 1990; Fine, 1992; Gagliardi, 1996; Guillet de Montoux, 2004; Strati, 1990; 1992, 1996). In other words, the aesthetic dimension of organizational life has increasingly become a strand of organizational research and a part of the organization theory (Strati and Guillet de Montoux, 2002).

Stemming from complaints about the exclusion of aesthetics from the study of organizations (Ackoff, 1981; Pfeffer, 1982) and from some pioneering works on the role of physical design inside organizations (e.g. Becker, 1981; Becker, 1982; Steele, 1973), the interest in the aesthetic dimension started developing for the first time within the intellectual movement called the “cultural turn” in organizational studies. This movement, also referred to as “organizational symbolism”, was aimed at investigating organizations as “cultures” or as “symbolic fields” and emphasized the aesthetic dimension and the “style” of organizations (e.g. Morgan, Frost and Pondy, 1983; Gagliardi, 1986; Turner, 1990). Although the aesthetic perspective has found a solid grounding in this intellectual movement, it has developed a distinct strand within that movement. If it is true that the aesthetic perspective shares with the “cultural” movement the emphasis on the aesthetic dimension and on the “style” of organizations, it is also true that it does not share its predominant cognitivist stance (Gagliardi, 2006).

As Gagliardi (2006) pointed out, other research approaches and intellectual interests – arisen in organizational studies, but also in sociology and anthropology – seem to have created a fertile ground

for the legitimization of organizational aesthetics as a separate field of inquiry. These include: the increasing awareness of the aestheticization of the economy and of social life (Lash and Urry, 1994); and the development of the practice of ethnography, highlighting sensate life as a worthwhile object of analysis, and the researcher's "sensuality" as an epistemological disposition and a tool to understand reality (Fine, 1996).

Traditionally, scholars of the field have focused their attention on physical organizational artifacts such as offices (e.g. Strati, 1992), chairs (e.g. Strati, 1996) or conference rooms (e.g. Witkin, 1990). More recently, the attention has been devoted to more ephemeral artifacts, like performances (e.g. Höpfl and Linstead, 1993; Nissley *et al.*, 2004; Strati, 2006). Furthermore, the emphasis has been put on the benefits of analyzing organizations through an aesthetic lens (e.g. Dean *et al.*, 1997; Ebers, 1985; Ramirez, 1996).

These scholars have progressively used the term "aesthetic" in a broad and general sense to refer to "all types of sense experience and not simply to experience of what is socially described as 'beautiful' or defined as 'art'" (Gagliardi, 2006: 702). In other words, for scholars of this field aesthetics is concerned with knowledge that is created from sensory experiences, including how sensations, feelings, and reasoning around these experiences inform cognitions (Taylor and Hansen, 2005).

Therefore, the fundamental premise of this form of knowledge and knowing is considered to be the aesthetic experience, defined as the perception of and the interaction with objects or the participation in events and situations representing a basis for practical sensory knowledge (e. g. Strati, 1992; Gagliardi, 1996). In this respect, past studies in this field of consumer research have documented that the perception of and the interactions with products can elicit different kinds of responses. More precisely, they have shown how the aesthetic characteristics of products can capture consumer attention (Berkowitz 1987), provoke positive emotional reactions (Veryzer 1993), influence consumer liking (Cox and Cox 1988, Veryzer and Hutchinson 1998, Cox and Cox 2002), affect brand categorization (Kreuzbauer and Malter 2005), and have a positive effect on quality appearance and perception (Page and Herr 2002).

The nature of aesthetic responses elicited by products represents a central issue in this field of inquiry. An aesthetic response is the reaction a consumer has with respect to an object – e.g. a product – based on the perception and interaction with that object (Berlyne, 1974). Although, as pinpointed by Veryzer (1993), there does not appear to be any generally accepted definition of these responses, there seems to be some consensus on the fact that they involve some sort of affect or pleasure related to the conscious and unconscious influences of the characteristics of an object. Whether or not these responses are an act of the mind, or emotional, or even a bodily sensation is still an open debate. Some have argued that responses are cognitive, and emotions play no part in them (Kreitler and Kreitler, 1972). Others argued that feeling is a central part, or that they are primarily sensory responses (Osborne, 1979). Finally, more recent contributions have advanced the concept of “flow” of experiences encompassing mental, emotional and sensory processes (Csikszentmihalyi and Robinson, 1990; Csikszentmihalyi, 2002).

In most of this research into organizational aesthetics, it has been the researcher who was asked to take an aesthetic perspective. In this respect, Strati (1992; 1999) proposed a nontraditional approach to study the aesthetic dimension within an organization, named aesthetic approach. This approach was based on the assumption that although organizations are social and collective constructs (Berger and Luckman, 1966), they are not only cognitive ones, but derive from the knowledge-creating faculties of the human sense (Strati 1996, 2000). Consequently, the aesthetic approach, besides shifting the focus of organizational analysis from dynamics for which explanations can be given to dynamics more closely connected to forms of tacit knowledge, changes the researchers’ attention rules while they conduct empirical and theoretical inquiry. In other words, researchers have to leverage on their abilities to see, smell, touch and taste and their aesthetic judgment when studying and understanding organizational life.

On the opposite, this research seems to have overlooked the role of organizational members’ aesthetic knowledge and knowing within the organizational life. In other words, despite some isolated attempts to investigate organizational members’ aesthetic experience (Taylor, 2002) and aesthetic

knowing (Taylor, 2000; Ewenstein and Whyte, 2007), the role of aesthetic knowledge as the object of inquiry – and not as a means for it – and how it influences organizational dynamics and processes has not been systematically studied. Among them, the processes for which aesthetic knowledge seem to be crucial are those aimed at developing objects with which different people will be interacting from different standpoints. In this respect, Ewenstein and Whyte (2007) have made a first attempt to explore aesthetic knowledge in the context of architectural work. They provided initial evidence that this knowledge can influence organizational processes. Furthermore, by advancing the concept of “aesthetic reflexivity”, they suggested that aesthetic knowledge could be transferred and shared between practitioners and at the organizational level. Nevertheless, it seems that the study of the dynamics and of the processes interweaving the development, the expression, the sharing and the accumulation of such knowledge has not received systematic attention.

METHODS

In order to understand better the dynamics and processes involving aesthetic knowledge in product design, I relied on an ethnographic study of an organizational setting where the phenomena under investigation were highly visible. The ethnography, which lasted ten months from early September 2006 to the end of June 2007, was conducted at the Boston branch of Continuum design consultancy. The use of this approach seemed to be preferred to other methods – e.g. laboratory experiments – for three main reasons: (1) the study of informants’ knowledge involves the study of their interpretation and meanings systems; (2) understanding the aesthetic implications of the development of new products requires an accounting of the meanings ascribed also by the members of the organization – and not only by the researchers studying that organization; and (3) understanding any subjective organizational phenomena requires that the researchers be grounded in the organization’s culture.

I initially began this research with an open-ended and vague research question: “How do designers develop new products?” concentrating my attention to the early phases of the development

process making up the design process. Quite early on during my observations, I realized that designers used to work both on functional aspects and on aesthetic ones when developing solutions to design problems. This sparked my curiosity about the different possible aesthetic implications of product design. Therefore, I devoted the following 9 months investigating this specific theme and collecting data accordingly. Particularly, based on previous discussion in the theoretical background section, I adopted a working definition of aesthetic knowledge as “the ability to classify, and categorize in a pre-conscious and pre-linguistic way sensory stimuli acquired through the direct interaction with objects and/or a physical environment. Following this definition, I considered as evidence of aesthetic knowledge every fragment of data that would suggest that such type of designers’ knowledge was involved.

Research Setting

Continuum is a worldwide product design and innovation consultancy located in West Newton, a suburb of Boston, MA, Milan, Italy, and Seoul, Korea (www.dcontinuum.com). Currently the second largest product design consultancy in the world, Continuum was founded in Boston in 1983 by the current CEO and President, Gianfranco Zaccai, and his partner Jerry Zindler, respectively an industrial designer and a mechanical engineer, in the belief that a better and more efficient product development process would result from tight integration between these two disciplines. Since then, the company has experienced a continuous growth leading to the establishment of other locations all around the world, and to the integration of other disciplines, such as “design strategy”, and “brand experience”, following the logic of “a continuum between disciplines, people, perspectives, and backgrounds”, as frequently by the founder and by the senior managers on official occasions.

During its 25-year life Continuum has designed hundreds of successful products for clients working in a broad range of industries, going from medical and diagnostic devices to household consumer products, and from computers to design solutions for retail environments, thus building an extensive industry expertise in many domains. It has consistently won honors for its innovative product

design. So far, it has won more than 190 awards for outstanding innovation, including more than forty Business Week Industrial Design Excellence Awards. Successful products include the Reebok Pump for Reebok, the Swiffer for Procter and Gamble, the Titanium Series padlocks for MasterLock, Sprint retail graphic design and messaging for Sprint-Nextel, , the Omnipod insulin management system for Insulet, etc.

The Boston office (where the study was performed) employs over 130 product designers, mechanical, electrical and human factors engineers, design strategists, brand designers, and model makers organized in three big practices: Strategy, Product, and Brand. The Strategy group is responsible for formulating design strategies grounded in consumers' behaviors, motivations, and needs. The Product group deals with the engineering and product design work by leveraging on the understanding of customer needs and human behavior. The Brand group is primarily engaged in communicating the brand essence through the coherent design of the different elements of the corporate identity. Overall, therefore, they consider themselves as a multi-disciplinary group of experts working side by side with their clients to help them develop and build successful design solutions. Projects approximately last from a few months to one year and a half, with an average of about 8-9 months.

Data Collection

Over a period of ten months, I spent from four to five days per week, and from six to eight hours per day in the field. Although I often interacted with and talked to senior managers, my data collection was primarily focused on interviewing, watching and talking to product designers, brand designers, engineers, design strategists, and model makers. The reason why I adopted this focus was that my main aim was understanding how people directly engaged in the design process tended to work to develop new products. In doing so, I constantly alternated between observations and informal talks with the informants, and more formal ethnographic interviews. The observations and informal conversations would spark some insights that I would investigate more extensively in formal interviews. Subsequent

observations and casual talks during meetings would help me corroborate the evidence collected until then or spark additional insights according to an iterative process.

Therefore, data collection relied on multiple data sources:

Observations

I followed as a participant observer three different development teams working on three new projects. The first project was led by the Product group and was aimed at developing a new product for the Health Care industry (from now on named project Health). The second project was led by the Strategy group and was aimed at developing a new product concept for the transportation industry (from now on named project Transport). The third one was lead by the Brand group and was aimed at developing the designs of store windows for the Holidays season for a communications services provider (from now on named project Window). I started following these projects quite early on until the end of the core design process. More precisely, I started following the first project, which lasted approximately 9 months, from the initial research phase until the final presentation of the prototype and of the product architecture to the client was made. I followed the second project, which lasted approximately 6 months, soon after the research phase was completed until the final big idea and the product concept were presented to the client. Finally, I followed the third project, which was still under way when I left the research site, from the planning of the initial big brainstorming event until the designs for the ‘Back to School’ store windows were put into production. I had the chance to attend almost all the meetings – approximately 80 – included those with clients. During meetings, I wrote down notes, recorded the conversations and took pictures¹ of people and objects, when allowed. I followed these projects as a participant observer. Lacking a design background, I couldn’t be directly involved in the design work with specific tasks, but I was always invited and welcome to share my ideas and suggestions with the rest of the team and to discuss those generated and proposed by my “teammates”, thus representing another point of view inside the team².

¹ For confidentiality reasons I am not currently allowed to show pictures in this paper.

² Although initially lacking a design background, during the projects I had the chance to learn a lot from designers in terms of capacity to understand better the aesthetic implications of an object. In other words, by observing them while they were interacting with objects, by listening to their comments when they were evaluating each other’s aesthetic solutions, and by

In addition, I attended as a participant observer the big “brainstorming day” that took place at the beginning of project Window, six “Visual Library” meetings open to the whole company and aimed at visually brainstorming around specific words, five “Lunchtime Series” Project Stories where the story and the learnings of particularly successful released projects were told to the rest of the company, some orientations sessions led by the principals of the practices aimed at familiarizing new employees with the practices themselves and with the company’s culture, and two “Lunch with the founder” meetings where interns and newcomers to the organization met the founder and were told about the history and the philosophy of the company.

Finally, I had many informal conversations with managers, designers, engineers, and support staff ranging from very brief exchanges to longer talks over lunch in the Continuum’s kitchen, before and after meetings, during work breaks, and in the hallways. I also had a few spot conversations with clients after the client meetings.

Semi-structured interviews

As summarized in Table 1, I conducted 52 semi-structured interviews: 17 were preliminary interviews with senior managers, 15 were debriefing interviews with my “teammates” during the unfolding of the projects, and 20 were retrospective interviews about some past projects. Almost all the interviews were recorded and then transcribed. When not allowed to use the recorder, I took some notes of the conversations. Preliminary interviews focused on Continuum’s history, culture, and evolution of the work process. Debriefing interviews aimed at investigating insights and/or clarifying doubts emerged during the observations. Finally interviews relating to past projects were focused on the 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 processes.

interviewing them about the aesthetic implications of the design process, I gradually improved my ability to appreciate the aesthetic characteristics of an object, and to consciously articulate the sensations and feelings springing from the interaction with that object.

Insert Table 1 about here

Archival data

Another source of data was represented by the written materials and objects that each of the groups used to perform and support their work. The documents included presentations, meeting minutes, project updates, and correspondence with stakeholders, meeting pictures, marker board pictures, and design briefs. I had access to some intranet documents including the guide for newcomers, internal presentations of the practices, explanations of the company's philosophy, guidelines for project managers, maps of the development process, etc. I also observed the sketches, the thumbnails, the pictures, the physical models, the image boards, the frameworks and the presentations made by designers and engineers. This evidence proved to be useful in triangulation of data, as well as in increasing my understanding of the organizational context.

Data Analysis

As customary in ethnographic research, my analysis was conducted in two steps. Both first- and second-order analyses were appropriate to this research approach. The first-order analysis relied on standard ethnographic guidelines aimed at discovering themes and patterns in informants' accounts and events. In performing this analysis, I employed primarily descriptive, observational data. These data were represented both by the field-notes quickly jotted down during meetings – aimed at capturing insights and significant quotes that I tried to report verbatim – and by longer and richer descriptions of meetings and events happening in the different projects, which I used to write almost everyday when back from the research-site. I also relied on interview transcriptions to reinforce the interpretation developed through the ethnographic analysis, while the internal documents and other archival material served to increase my general understanding of the corporate context.

The first-order reporting, therefore, takes the form of an ethnographic story of the process of development of product design at Continuum, integrating informants' accounts and interpretations with my interpretations and experiences as an ethnographer.

The second-order analysis moved to a more abstract and theoretical level, wherein the raw data and first-order findings were examined to discover underlying dimensions that might be relevant for domains beyond this study (Spradley, 1979, 1980; Van Maanen, 1979). As part of this analysis, I examined the ethnographic data from a theoretical perspective to try to detect deeper patterns and dimensions of understanding. More precisely, the second-order analysis involved the following steps. At first, after writing the first-order findings, I explicitly distinguished between functional and aesthetic aspects of the process in order to identify and emphasize those activities strictly and uniquely connected to the aesthetic dimension of the process itself. This left the impression that when dealing with aesthetic aspects designers tended to activate and rely upon a particular kind of knowledge different from the technical knowledge used to solve functional aspects. Therefore, I re-interpreted the entire process in the light of this insight in order to disclose the dynamics interweaving this knowledge.

In order to increase reliability, I shared a large part of data analysis with a knowledgeable colleague, who was not involved in the field study. I frequently discussed with him my emerging interpretations continuously getting comments and suggestions.

Moreover, triangulation among different sources – observations, interviews and archival data – helped me refine and strengthen the emerging interpretations until I arrived at a process-model, which I considered robust across projects and informants.

Overall, the findings combine three different perspectives: (1) first-order view based on the informants' point of view – as shown in Figure 1; (2) a related first-order view from my perspective as an ethnographer – as shown in Figure 2; and (3) a second-order view induced from the raw data and the first-order findings reflecting my interpretations and including my colleague's feedback – as shown in Figure 3.

FIRST ORDER FINDINGS: A GENERAL OVERVIEW OF THE CREATIVE PROCESS

Generally speaking, at Continuum the entire development process is interpreted by informants and represented in formal documents (see Figure 1) as a linear progression of sequential phases, going from what they call “Learning & Definition” (Phase 0) to final “Production and Rollout” (Phase 4).

Insert Figure 1 about here

Although projects tend to be very different from one another with respect to many variables, such as target customers, industry expertise, average length, intermediate and final deliverables, level of involvement of the clients, and number of disciplines involved, they tend to follow the same sequence of phases. Each phase is characterized by different activities, specific goals, general procedures, and expected results. For instance, the “Learning & Definition” phase is aimed at developing tools and guidelines that can serve as a map for subsequent design development by identifying new market opportunities and by creating a refined design brief, while the “Development & Refinement” phase is aimed at developing, refining and prototyping the prime concept, and approving the final design before the prime concept is developed for production. The involvement of the different practices tends to vary as well. The Design Strategy group is usually involved only in Phase 0, and sometimes partially in Phase 1³, whereas the Product Innovation group and the Brand Experience group are involved all along the process.

As already mentioned, I primarily devoted my attention to the early phases of the development process – the design process – trying to understand how people engaged in these phases were able to develop new products. For this reason, I have directly observed only the unfolding of Phase 0, Phase 1 and Phase 2. Figure 2 portrays the observed phases emphasizing the main activities performed by designers in each of them.

Insert Figure 2 about here

³ Therefore, pure Design Strategy projects (like project Transport) tend to include just the “Learning and Definition” phase and occasionally part of the “Concept” phase.

Therefore, in the following sections, I will first provide a description of the design process at Continuum –from Phase 0 to Phase 2 –, and then I will supply a second-order narrative induced from the raw data and the first-order findings.

The two first-order views have been integrated into a single narrative resulting from both my experience as an ethnographer and the accounts of the informants. My perspective is framed according to the different temporal phases and activities that emerged during the unfolding of the three projects that I followed. The informants' perspective is represented mainly by and framed around words in brackets and verbatim quotes, extracted from interview transcripts and field-notes, depicting themes derived from the analyses.

Phase 0: Learning and Definition

The beginning of every project aimed at collecting as much information as possible in order to allow the designers to understand the problem that they needed to solve and to inform purposefully the following phases. As mentioned by many senior managers during preliminary interviews, sometimes clients turned to Continuum without having a clear understanding of their needs and problems. Therefore, designers tended to devote more and more attention and time to the very early steps of every project to clearly identify and *define the problem* so to develop an appropriate creative solution, as explained by an Industrial Design principal:

The inception of an idea is back here [at the beginning of the project], down here is thousands of things coming out of the production line. We spend more time here in the early layers and over the years we're shifting to have earlier and earlier influences in what's really...pretty cool, this is where we are right now, we're realizing the benefits of what we call design thinking, creative problem solving, and helping to solve business problems as well (MA, Industrial Design Principal)

To this end, a preliminary alignment process intended for the *identification of clients' needs, goals and expectations*, usually followed by a period of *in-context research*, characterized this phase.

As pointed out by many informants, the initial alignment with clients was used to drive the entire project planning, to guide the type of research specifically conducted for each client, and to define the form that the design or the brand strategy would take. Therefore, at this stage designers tried to understand in depth the clients, their problems, their business needs, their corporate culture, their

decision making process, their stakeholders⁴, their competitors, the target audience for their product or their brand, and their goals and their expectations with respect to the project under way.

Based on their own interpretations of client's needs, goals and expectations, designers created a detailed project plan outlining the process that they were going into as well as the type of research they might be doing for that specific project – in terms of protocols, research candidates, methodologies, etc.

During in-context research, designers tried to learn as much as they could with respect to the target industry and to the target audience. By reviewing already existing research, understanding existing client knowledge, and developing additional knowledge with respect to markets, brands, and technologies, designers familiarized with the target industry. By observing and interviewing people in their homes, in their work contexts, and in daily purchasing processes, designers connected to the users' experience, and learnt about their needs, habits and behaviors, as pinpointed by a design strategist:

We speak to them, ask them dozens of questions, sometimes we shadow them in their daily routines, we observe, take pictures and make videos of the objects they use and how they use them in order to have deeper insights into what they need, what they usually do, what they care about etc... (HR, Design Strategist)

They also went to malls, to industry tradeshows, and to clients and competitors' dealers in order to understand current market, technology, and lifestyle trends.

For instance, project Transport required about a-month field research during which design strategists went out to interview consumers in three different locations of the United States. They made them do some "home exercises" aimed at understanding their routines, their daily schedules, their habits, the usual interactions with the product at stake, the drivers of choice, the key actors in the decision making, their needs, their tastes and their aspirations. The team members were also engaged in some "guerrilla observations" in malls' parking lots. This allowed them to film and take pictures of people behaviors while they did not know they were observed. They also arranged meetings with experts of the field in order to understand some technical and legal aspects of the product. They made trips to tradeshows and to industry dealers which helped them figure out which the available market

⁴ To underline the importance of identifying the stakeholders of a project, one informant defined them as "anyone who, by action or inaction, can drive a stake through the heart of the project and cause it to fail".

offer was, and conducted a broad desk research through newspapers, magazines, internet blogs and websites which let them immerse in the consumers' world and to start thinking like them.

Furthermore, in order to map the competitive landscape both in terms of "functional features" and in terms of "aesthetic characteristics" of existing products, designers conducted a "competitive survey" by visiting stores to purchase competitive products.

For example, project Window started with a few trips to malls in the Boston area in order to conduct a process of auditing of the designs of the windows of different stores, which might or might not be strictly related to the category of communication services providers.

Finally, they also resorted to books, magazines, and websites, to develop deeper insights into aesthetic trends and user tastes, and to better review the existing "design language landscape" in order to identify some "design language" options. In other words, they reviewed the set of visual signs, symbols, and icons embodied by existing products of the same category or of similar categories to identify how the product under developed could be positioned in this "landscape" based on the message designers wanted to convey.

As an example, in project Health the design team was engaged in designing a product that would sit in hospital rooms and that aimed at "becoming a reference point for the aesthetics of these rooms". Therefore, designers reviewed what they referred to as the "design language" of the existing products in this category and in analogous categories in order to identify ways to differentiate aesthetically the product under development.

During in context research, the correct identification of the stakeholders proved to be important also when deciding the research candidates. Again, project Health was emblematic in this respect. Besides becoming an aesthetic reference point, this product was supposed to make the patients' stay and recovery better and quicker. Although it was addressed to patients, the role that caregivers (doctors, nurses and hospital support staff) had both in the decision making process and in the interactions with this product could not be overlooked. Therefore, when visiting hospitals, designers not only interviewed, observed and took pictures of patients, but they also talked extensively to nurses, invited

them to show how they usually interacted with the product concerned, asked them about issues and obstacles caused, and needs unsatisfied by the current products in use. Actually, nurses were continuously queried as the project was going along, thus giving useful suggestions and feedback to the design team all the way through the project.

The result of the research phase was typically a “summary of findings” document – in the form of a PowerPoint presentation –describing the process designers went through during the research, and provides a brief analysis of the findings. In its turn, this document is leveraged upon by designers to develop the brand or the design strategy, as explained by a Brand principal:

Set up the summary of the findings of all our research, the next step would be turning that into, for our group, turn that into a brand strategy where we’re saying: “based on what we know of you as a company, based on what we know of your target audience, based on what we know of the competitive landscape that your company and your products sit within”, then we typically develop a brand strategy that incorporates those elements into something which companies can use to communicate about what their company is, what their brand is....that’s typically a brand strategy document. And the things that are in there are typically a brand positing statement, a vision statement, a mission statement, core brand attributes, what’s central to their corporate culture or what they wanna project to their potential customers and often we get into language which helps them represent their product offering and their brand offering” (MC, Brand Principal)

The brand and the design strategy, therefore, were built upon the opportunities identified in the analysis of the findings, and aimed at providing directions for the following design development. These directions might involve the development of products and/or services addressing unmet customer needs, exploiting emerging technologies, embodying a “design language” considered appealing by the target customers, or allowing a brand repositioning or a new brand experience for customers.

For instance, the design strategy developed by the Transport team contained a top-line idea –the so-called “big idea” – indicating a new vehicle concept, targeting a specific customer segment and addressing the unmet “hierarchy of needs” – from aspirational to psychological – of that customer segment. Furthermore, the strategy emphasized some actionable design opportunities recognized by mapping the extant competitive offer, as well as some more specific design recommendations, in the forms of “critical design attributes” and possible “design executions”.

Once the brand or the design strategy was completed, it was usually distilled into a creative or design brief, outlining again the main stakeholders of the project, the goals and objectives, the target audience, the expected deliverables, the process to be followed. The design brief also contained a short

description of the “design intent”. In its turn, the design intent tended to guide designers throughout the development of solutions until the refinement of the final design, as it represents a sort of assignment they have to accomplish.

For instance, in project Window the intent was “to create a holistic retail experience across all seasons, which incorporates image strategy, 2D & 3D retail elements, and promotional messaging; all components should work in harmony with core messaging within the store, and be easily interpreted for multiple touch points outside of the retail environment”, whereas in project Health the design intent was “to create a product providing ergonomics benefits to the users and support to the caregivers in performing their jobs, and inspiring positive feelings and emotions both in users and in caregivers⁵” as explained in the design briefs.

The development of the design strategy, of the design brief and of the design intent allowed the definition of the boundaries of the design problem needing a solution.

Phase 1: Concept

Informants described this phase as a “creative exploration” or, in other words, as the *generation of many different creative concepts* according to the assignment received, as pointed out by a project manager:

In phase 1 everything begins with a creative director or a project manager usually leading a couple of other designers in the creative exploration where you give them the creative brief and you tell them “this is what we’re designing, this is the strategy we are designing against” and then usually it’s like a very broad exploration of concept regardless of what the application is (MAR, Industrial Design principal)

Whereas in the previous phase the team members tended to work in close collaboration with one another and with their clients, at this point they tended to work more often in isolation in order to have “their own take on the project”, as emphasized many times by informants themselves. Sometimes, though, as in the case of products with a complex architecture or when an aspect of the design proves to be particularly tricky very early on along the process, rather than first sketching on their own and then sharing sketches with the rest of the team, designers gave life to informal brainstorming sessions or group sketching meetings, where they sketched on white boards trying to come up with a collective solution to the problem at stake.

⁵ The confidentiality agreement prevents me from disclosing further details of the design intents.

Typically, in order to generate new concepts designers tended to rely extensively on what they had learned during the in-context research as well as on their own expertise and knowledge base. In this respect, an industrial designer emphasized the importance of being involved in the research stage and the potential risks coming from not being involved in it:

It's very important to be involved in the research phase. I think that every industrial designer was trained to do the research too, at least in school. Sometimes we get cut up in not doing the research, so we forget how to do it, and then we end up just sketching, which is probably really bad to do, because....I mean for some people it's just fine, because this is the part that they love the most, so they enjoy the most, but for me it's the deeper understanding of the whole thing is what influences the design. So, if I'm not participating in the beginning, then I have trouble developing and catching on at the end or being inspired towards the development of the product (MAL, Industrial Designer)

In some cases, as in project Window, the creative exploration and might be preceded by formal brainstorming sessions involving the clients and the main stakeholders. Project Window was part of a bigger project involving different ongoing initiatives – including retail-promotion, merchandising design and brand communication – aimed at creating a more impactful retail presentation for the stores of a long-time client. Provided the high number of parties involved – different functions on the client side, advertising agencies, communication agencies, etc – designers opted for a collaborative approach. To capture fresh ideas around themes for the different seasons, and to begin explore how the seasons could be strategically linked throughout the year so that they could develop an integrated store presentation for each of the retail seasons, a “brainstorming day” was organized. Afterwards, the team members leveraged upon the ideas emerged from this brainstorm to generate and develop different creative concepts.

Initially open and unconstrained, although within the boundaries set by the design strategy or the brand strategy, this generation aimed at creating a high number of conceptual ideas without thinking too much about the details and the actual execution, as explained by a brand designer:

You know, when we are in the middle of the creative exploration, we usually tend to generate as many ideas as possible and as quickly as possible, and only after that we have to narrow them down slowly. (CC, Brand designer)

From an aesthetic standpoint, what designers had to comply with in this early generation were what they called the “design attributes”, namely the set of characteristics that the design under development should respect and have, which designers used to communicate the design intent

internally and externally. These attributes were usually distilled in a few words related to the message that designers intended to communicate. In project Health, for examples, some of the attributes were “hopeful”, “joyful”, “friendly”, “light”⁶, etc, connected to the idea of a product conveying positive feelings and emotions. Then, these attributes were translated into visual imagery expressing those words in designers’ view. This imagery would help and guide designers when transforming the attributes into aesthetic characteristics.

Differently from brand and industrial designers, engineers had to take under considerations a higher set of constraints when initially generating new ideas, as explained by a mechanical engineer involved in project Health:

You know, for the engineering ideas there are fairly objective metrics: costs, complexity, feasibility, whether you can actually make the thing, whether it’s moldable, whether we’re meeting the industrial design’s vision, that’s very important on some projects, whether we’ve matched with the rest of the company on the rest of the design criteria... so, we have to meet some constraints that are provided by the project itself, whether they can be provided by the ID or by the client or by the research done by the DSG or by the research done by the human factors engineers. So, there are constraints that we have to work on, and once we get to a certain point, we have to make decisions on which direction we wanna take (DC, mechanical engineer)

An Industrial Design principal explained to me that one of the major risks of this stage is a lack of inspiration on the designers’ side, which he, as a creative director, tried to overcome by encouraging designers to go out of the office and look for new sources of inspiration:

I think it’s the job of the creative director to try to unblock and to figure out different directions you can push designers and that will get them over whatever is blocking them...it’s a very personal thing and I don’t think there’s really a formula for that. Hopefully, you hire good designers, and if these good designers are having a sort of creative block you, as a creative director, just have to find fine ways to redirect them, to open up their thinking...that might be when you sent someone off to the bookstore to go and, you know, do again a little bit of research or figure out something that is gonna inspire them that can be either related to that project or something that will just help them recharge creatively; and then you hope that they come back and they begin exploring and doing something new (AC, industrial design principal)

Another way to overcome possible creative blocks and to guide the generation of ideas was creating rough mock-ups for early functional testing or simply for the direct experience of what they referred to as the initial “look and feel” of the potential product concepts, especially when the product at stake required a high level of interaction. Designers conceived of the “look and feel” as being the set of main features of appearance, surfaces and interfaces of a design. From the consumer’s perspective, it

⁶ For confidentiality reasons, I have used words slightly different from those actually used by designers.

described the sensory experience a consumer should have had when using and interacting with that design. Therefore, the reliance on rough physical models was considered important.

For instance, very early on during project Health, besides creating sketches and thumbnails, the team started building a 3-dimensional version of the future product, which they used to call “Buck 1”. At first Buck 1 was a very rudimentary chair, made up of different parts and components directly received from the client, mainly used to test the functioning of the reclining mechanism that had proved to be a tricky aspect since the very beginning. As the creative exploration and the generations of ideas were proceeding, and the concept of this chair was taking a more and more definite shape, Buck 1 was progressively modified and enriched with additional details – a fabric of a certain color, and with a certain texture, armrests and headrest of a certain size and of a certain shape, etc. – aimed at conveying the intended “look and feel”.

During this phase, designers did not restrict themselves to generate a series of ideas, but working primarily in teams they also started *grouping* the ideas developed. More precisely, designers at first shared their ideas with the rest of the team, as illustrated by this passage extracted from the field-notes taken during one of project Health meetings:

When I arrive at the project room MS is putting her sketches up on the board in a very regular and schematic way. Firstly, the drawings relating to the different single parts of the chair, secondly those illustrating the frame and architecture of the chair, with particular attention to the reclining system and to the connections between the back and the seat, and finally the drawings showing the softer aspects of the chair, that is exterior padding and the materials. In the meantime MAR and AM arrive bringing a blue patient chair they got from one of the two hospitals they visited a couple of weeks ago. Now also DV is here, so we can begin the meeting. MAR starts saying: “in one week from today our task, in some form or another, is to put together all the sketches we have somehow individually worked on. It’s crucial to emphasize all the different aspects of design that we think are important to communicate to the client”. GF, who has recently been involved in this project, asks some clarifications about the meeting with the client. “next Friday they are coming here, in two weeks we are going there for the final meeting of this phase” MAR clarifies “therefore, today I want everyone to share with the others the sketches he/she has developed, sketches that we’ll put together in the next review session before the meeting with the client”.

At this point, he invites DV to illustrate his sketches. DV puts his sketches in the middle of the table to let everyone see his drawings and starts depicting his work concentrating his attention to those drawings relating to the position and the movements of the armrests. He also explains that he has focused on the idea, emerged during the meeting with Diana, the external consultant on materials, of covering up the engine of the chair (to protect it from the dust), but also on the possibility to attach the frame to the engine of the chair, and to the different positions of the legs. Now it’s AM’s turn. Differently from DV, he has concentrated his attention on the framework and/or architecture of the chair. His sketches show the chair both in the vertical and in the reclined positions. After a short discussion about the reclining mechanism, GF

starts illustrating his own ideas. He makes clear that he has tried to convey a sense of stability and continuity in the shapes and to hide the engine of the chair itself. AM is surprised and amused by the fact that GF's drawings show the chair from the back perspective: "you chose the perspective of those outside the window," he says laughing and everyone laughs with him. MAR seems to appreciate GF's ideas and emphasize the importance of somehow connecting the back to the seat: "I like the idea of elegantly associating but separating them!" In this respect, he thinks that illustrating to GF what they learnt about the sheet and chuck could help him [GF] clarifying his idea. (...) After explaining to GF what they had learnt during the visits to hospitals, MAR concludes: "therefore what we are going to think of in the next few days is how to put all this stuff together and how to hang stuff on the walls and tag what we think is important". (...) Then after one hour and a half of discussion, they go back to work.

The mutual sharing of ideas allowed seeing overlaps, commonalities and emerging themes across designers' ideas both with respect to functional features and with respect to aesthetic characteristics. This way ideas could be more easily grouped into a few categories, each of which was attributed a representative label. This *grouping* process usually involved the entire group, although frequently led by project managers, as illustrated by an industrial designer involved in project Health during a debriefing interview:

When you look at all over them, you sort of start seeing groups, and that's what MAR did there. He grouped them into these kinds of categories.....into these groups driven by the three concepts of pillows, soft slab, and blanket. In the case of this project these three categories were generated primarily by MAR [the project manager], but it's usually a group thing. So, he did those, and then we got together as a group, and then he wanted us to explore further options in those categories and then GZ got involved and I think together, between him and MAR, they made the decision "Let's not pursue the other two. Let's only go for blanket". And it became clear for DV and me that that's where we needed to go. (GF, industrial designer)

Similarly, upon completion of the brainstorm for project Window designers culled through all the initial ideas generated, in search for "common threads and overarching ideas rising to the top". These recurrent themes guided designers throughout the creative exploration, thus leading to the identification of three main design themes – labeled "Reinvented traditions", "Rescue" and "Relationships"⁷ – which the designers' concepts tended to load on. These labels became a sort of metaphors used within the group and when communicating with clients to refer to emerging themes and categories.

This phase usually unfolded in an iterative way, with each iteration leading to a more refined version of the initial concepts, and to a more refined categorization according to the feedback received during internal meetings and/or during mid-phase reviews with clients.

⁷ These three main themes were presented to the client, who chose the "reinvented traditions" one, according to the new brand positioning efforts engaged in by the company. After that, designers were asked to develop specific design concepts for the "Back to School" season coherently with the design theme selected.

Phase 2: Development and Refinement

This phase was primarily directed to developing, refining and prototyping the leading concepts selected among the whole set of concepts previously generated. The *selection of concepts* required an *evaluation* process based upon some specific criteria⁸. What designers concretely do is arranging some internal “design critiques”. These critiques are a way to understand and explore the current direction of the design. Unlike a brainstorming meeting, a critique meeting was focused on evaluating a set of existing ideas, and possibly on identifying future directions or changes to drive the design forward. More precisely, during these meeting the main purpose was assessing the different concepts, and identifying those that, in each of the categories, were “the best or the strongest” in terms of their ability to deliver on the project’s goals, as explained by many informants during interviews or informal talks. Typically, the evaluation process involved the entire group. Precisely, each member of the team was asked to express his or her opinion with respect to the concepts on display – both their own and their colleagues’ – and the reasons why he or she thought one concept looked good or did not look good, and why he or she thought one concept worked or did not work with respect to the goals and objectives of the project under way. A passage extracted from the field-notes taken during a project Health “design critique” shows this point:

“DV”, Mike says, “explain to us your sketches. Thus, DV starts explaining that based on yesterday’s meeting he had developed some extra sketches, but that this morning he had a conversation with GZ who asked him to make further modifications with respect to the thickness of the chair seat. However he shows his doubts in this respect: “I know that if the seat is too thick the patients will not make it, but if the seat is too thin the chair doesn’t convey anymore a sense on softness and coziness” he says. “Well, you are right but I think, and I’m also sure, that we can find out a compromise” MAR reassures him. He goes on describing the details of the back of the chair. He points out the possibility to have a mechanism to tuck the sheet not in the back, but in the front of the chair, as GZ suggested yesterday, so that it can become an aesthetically appealing element of the chair itself, and finally the different gestural expressions of the legs of the chair. Closely observing the sketches, MAR says: “I like this one what the gap [between the back and the seat], even though it does not yet look inviting and soft...I wonder what happens if you allow some thickness at the edge”.

“I think that we can do that since we don’t want that the entire chair is made with this material with this flexibility, right?” DV asks. (...) MAR, turning to GF’s sketches, says: “I like this pillow thing; it’s very welcoming, but at the same time it can be something difficult to clean.....And I also wonder whether we can do it in a different color”. Then turning back again to DV’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”. Now, it’s GF’s turn and he describes his sketches: “I did not have time to color all of them, but in this one using different colors I wanted to create a volume inside another volume graphically”.

MAR says: “I like it....and I was also wondering whether we could use the arms to tuck the sheet, making the arms pull up and down.....but anyway do you know what is really difficult to design and draw? The super simple shape of the chair”. MAR goes on talking about this issue and finally he suggests to GF to combine some “color accents with some overlapping to convey the idea of a blanket”.

⁸ It is worth noting that early evaluation and selection could happen also in the previous phase, especially when designers had to present to clients the work that they had developed until then, as happened for project Health.

“I definitely like the idea of a well definite chair. I like your chair very much; it’s simple, but there’s enough stuff going on” AM says referring to DV’s sketches. Also Mikes seems to like 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 of harmony in these shapes...this chair seems as it dances”, DV answers. “I can even see this chair in warmer colors” MAR adds, “think of the sense of richness that it would acquire and transmit to the users....It’s great, DV!”

This would trigger group discussions and exchange of feedback among teammates aimed at agreeing upon a set of concepts that the entire team thought was the most relevant. During a debriefing interview, a brand designer explained to me how the feedback provided by teammates might trigger further thought and inspiration:

It’s always been a group process, even though sometimes you just have to make decisions yourself and catch the other group up, you know, depending on whether people are on vacation or...you know, there are so many things...., but most of the times it’s definitely a group process. We put them all up, you know, two or three people, you have little post-its, you put them on that one and then you write down why. (...) And at the end, we leave the room with a few ideas we all think are the best... that’s usually the way that we decide on either little sketches or big sketches (MAL, brand designer)

The evaluation seemed to be based upon the different criteria stated in the brand or design strategy. Therefore, they included the ability of the concepts to resonate with customers’ needs and the environment of use of the future product, the feasibility of product architectures as well as the coherence between the intended “look and feel” and the “design attributes”, and their concrete translation into shapes, materials, colors, etc., namely what they call the “design execution”, as illustrated by project Window project manager:

You know, we have these meetings when we evaluate; its’ like a critique where people can say what’s working most effectively, where we discuss the ideas, you know, realizing “here’s what we need to do”. Then, we evaluate concepts based on the criteria that we have agreed on...it’s typically based off of the brand or the design strategy, so if I’m designing something for like a middle-age businessman, concepts that might be developed that feel edgy or reverent or too useful would be not necessarily appropriate for that target of audience. Or if we’re designing a product or a brand for kids and there are some directions that are very conservative or serious or more adult oriented that would be inappropriate.... (GB, Brand principal)

Even the evaluation stage might happen iteratively through different working sessions aimed at developing more and more refined versions of the leading concepts before the final choice of those concepts that will be presented to clients during the official design reviews. What usually happened after these working sessions was that designers went back to their desks to work individually or in couples on those concepts – or just on subset of them – needing further elaboration and refinement according to the directions emerged during the meetings, until the following design critique. Therefore, it might happen that some concepts, initially evaluated as not particularly relevant to the goals of the project or

not particularly outstanding, were modified and refined by designers according to the inputs received from colleagues and then included in the final selection shown to the clients. This is what happened in the case on project Window. While working on the specific concepts for the “Back to School” season, EY, one of the designers involved, had developed a series of sketches displaying different school tools. At first, the creative director and the rest of the team had considered these sketches as “too iconic” with respect to the new information acquired⁹, but they did not abandon the idea of exploring this creative direction. Therefore, EY had the chance to revise, nurture and refine his conceptual sketches that went through different critique rounds and were finally included in the concept labeled “Tools” presented to the client – together with “Slice of life” and “Old school & new school” –.

The result of these evaluations, therefore, was generally a *selection of a few leading concepts*, which were presented to the client for feedback and approval¹⁰.

The *external concept sharing* was usually held in house, inside conference rooms (and not in project spaces) that were purposely set up to recreate the different steps of the process taken until then, in order to show to the client how the designers came up with those concepts. Sometimes, as in the case of project Window, the external concepts sharing might happen through conference calls. During these meetings, designers recapped the goals and the objectives of the project, went through the main steps taken along the process, described the different concepts on display both in terms of the messages they intended to convey and in terms of their visual details, explaining the main reasons why they had developed and selected those particular concepts. On their side, clients looked at the sketches and renderings, touched and tried the physical models, expressed their opinions and chose the final concept deserving further refinement, also based on the recommendations made by designers. Sometimes, it might happen that clients made a decision at the end of the first concept sharing. Other times, though,

⁹ The new brand positioning strategy hadn’t been communicated to the design team at the beginning of the project, but only after the generation of the design themes, so quite downstream along the process.

¹⁰ It is worth noting that clients are usually involved also in other steps during the process –the so-called “mid-phase reviews” and “final-phase reviews” – with the purpose to make sure that “everybody is on the same page” with respect to goals, scope, expectations, and results. If they change during time, these review meetings are set up regularly through the entire process, as kind of recurrent checkpoints along the way.

different iterations were required before the final choice was made. This was the case of project Window, as explained by the excerpt taken from the field-notes of an external concept-sharing meeting:

Once RD has concluded his presentation of the three leading concepts (“Tools”, “Slice of Life”, and “Old school & new school”) supported by the input provided by the other members of the team, J. and M. start commenting on what they have seen. Both of them seem puzzled with respect to the coherence between the visual details and the objectives designers had to deliver on. J. says: “I see too much nostalgia, too much tradition, not so much reinvented traditions”. M. agrees with her and adds: “I personally don’t understand how the visuals are connected to the traditions theme”. They both suggest the designers step back and revise the concepts to make them more strongly tied to the new brand positioning. M. stresses the need to figure out a better and straightforward transition from “what we’ve been” to “where we’re going now”. J. concludes: “Copy is fine, but from a visual language standpoint we’re not still there”. (...) The meeting ends up with the agreement to revise the concepts presented according to the feedback received by clients and to present them again in a few days.

At this stage, one big challenge for designers might be finding a compromise between what clients wanted and what designers thought the best solution was, as a brand designer explained to me during a debriefing interview:

That is very difficult, because we know what looks good and right and sometimes the clients might want something different. Sometimes they want something completely different. So how do you either find a compromise where you can be happy with, where you can live with? And I think the challenge is “you don’t have to like it, but you have to live with that, and you have to be ok with that”. Ideally, it would be great to create something wonderful that you absolutely love and the client loves. That’s what we all want, but that would be ideal. So most of the times it’s a little give-’n-take. (MT, brand designer)

Once one concept was chosen, designers devoted themselves to its *refinement* working on the different components of the future product to guarantee coherence among them, and on the different aesthetic details – in terms of materials, finishes, colors, textures, etc. – based on the final “aesthetic direction” established at this stage.

In other words, at this point the design team focused on the design detailing and refinement both of the form and of the function concurrently, as explained by an Industrial Design Principal:

In this phase, our job is to refine, test and resolve the leading design direction to a point that it holistically describes the overall design approach and defines the key product characteristics and attributes. This is done both by establishing the right aesthetic direction of the future product and by investigating its functional features. That’s why at this step it is important that the engineers consult and provide technical guidance to designers. (AC, industrial design principal)

To this end, and generally with the support of the internal model makers, designers started building a prototype, demonstrating the functionality of the final design, or a visual model¹¹, embodying the “design language” identified and conveying the planned “design intent”. This stage could require many subsequent loops focusing on specific details of the design of the concept and leading to the

¹¹ Differently from prototypes, which are fully functioning physical models, visual models are physical models conveying the design intent, but having as much functionality as possible.

construction of different interim models or of different versions of the same model. According to whether designers needed to emphasize the shapes and the general harmony and integrity of the design or the surfaces and the tactile aspects of it they can build “looks-like” or “feels-like” models”.

At this point, the model makers and the model shop started playing a prominent role in the creative process¹². The interactions with them and the design team became more frequent, and tighter, such that many informal working sessions would take place in the model shop.

Health project leader explained to me the reasons of this during an informal talk:

You know, the Monday calls and the other formal meetings are more for internal and external communication, whereas most of the creative process takes place here in the model shop, because this is where we can develop ideas, share them among each other, and test them out immediately. (MAR, project leader)

While commenting on the contribution of the model shop and of the model makers to the refinement of the final design, the model shop manager extensively confirmed this point:

Inevitably, at this point something that has been designed doesn't work or doesn't look the way they [the designers] thought, and that's where we also get involved. So, they'll be: “Can you make this work? Can you make it look like we want it to look like?” And we'll be “Ok! We have some ideas”. Because, you know, the model makers are genuinely or generally...you know, they're pretty crafty people that can build just about anything, so they have an idea about how things work or look, so they're good people to talk to about “This doesn't work, this doesn't look right. What are your ideas?” And also because, we have so many examples of successful products down here, we have things all over the place. And so the engineers and designers will come down to the shop and they'll say “hey, do you have an example of something like this?”, and we'll say “oh, yes, we do”. Then all of a sudden, a conversation sparks out of nowhere, and that's super-important to the process, because we promote a social environment where people are free to talk to others, and come up with ideas and solutions to problems. (RC, model shop manager)

The previous description of the unfolding of the design process at Continuum has highlighted how, when developing solutions to design problems, designers tend to address two different sets of issues: functional and aesthetic ones (see Figure 3).

Insert Figure 3 about here

As pointed out many times by the founder and by other project managers, when creating a new design, these sets of issues should evolve simultaneously in order to guarantee the integrity and the

¹² According to what the model shop manager told me, designers may resort to the model makers' support also in the initial concept generation to ask for suggestions or for examples of previous products developed internally. Nevertheless, what I observed was a more pronounced reliance on model makers' support in the refinement phase.

internal coherence of the product under development. This perspective seemed to be the natural consequence of the philosophy of this company, as explained in the “Core Values” document:

“At Continuum we believe that being able to understand and to carefully design a total customer experience is an essential part of a successful and sustainable business strategy. All points of contact between customers and any company are points where this experience is affected, either positively or negatively. Therefore, our job as researchers, designers and engineers of products, service systems, environments, and communication is to understand uniquely the dynamics that occur in all key points of contact and to translate this knowledge into design solutions that are people delighting, technologically superior, and rewarding for both customer and producer”

In this respect, the reliance on multi-disciplinary teams of people with expertise in different disciplines – from psychology, to physiology and physics,— is deliberately aimed at taking under consideration the different aspects and implications of a new product, not only the technological, functional and ergonomics ones, but also the aesthetics ones.

Therefore, the following section will be devoted to illustrating the aesthetic implications of the three phases I have directly observed.

SECOND ORDER FINDINGS: THE AESTHETIC DIMENSION OF CREATIVE PROCESSES

The first order findings provide a narrative of the activities conducted by designers along the creative process, disclose some elements of the informants’ meaning systems, and already reveal some insights about the aesthetic implications of the observed creative process, thus representing the basis for explicating an informative analytical framework through a second-order analysis. Such analysis, conducted both on the raw data and on first-order findings, focused on unpacking the dynamics involving the particular type of knowledge designers rely upon when dealing with aesthetic issues along the design process.

Earlier in this paper, I introduced the concept of aesthetic knowledge defined by previous research as a form of pre-linguistic knowledge, sometimes tacit and ineffable, derived from senses and from the perception of particular situations and experiences (e.g. Gagliardi, 1996; Whitfield, 2005). In particular, Ewenstein and Whyte (2007) have recently emphasized how aesthetic knowledge consists of knowledge both in the form of signs and symbols – *symbolic* – and in the forms of feelings and

embodied knowledge emerging through knowledge use – *experiential* –. Hence, according to them, aesthetic knowledge is “both something that designers come to possess as a personal and identifiable style, and something that becomes manifest in their practice as a specific competency” (2007: 1).

The evidence collected seemed to confirm this definition. Many informants pointed out that the knowledge they relied upon when dealing with aesthetic issues was based mostly on sense experience, intuition and feelings, as explained by a brand designer during a debriefing interview:

What I rely on is kind of my base knowledge and my intuition and what I feel is gonna look good and what I know might work better than others. It's kind of your knowledge and your intuition as a designer (MT, brand designer)

Moreover, informants confirmed the double dimension of aesthetic knowledge, as explained by a brand designer involved in project Window:

As designers, we have different knowledge bases, different personalities and different styles, different ways of doing things. Do you know what I mean?. So, all of us have a great set of skills, all of us have style and knowledge....just from being a designer you have a sense of style, you know what looks good and what doesn't, and what works and what doesn't, and we use that. (MT, brand designer)

In other words, designers considered themselves as characterized by a distinctive style, and by a stock of aesthetic knowledge, which was the result of both the design education and training they received and the aesthetic experiences they had collected from one project to another. Therefore, designers conceived of their aesthetic knowledge as being continuously accumulated and incremented over time through learning by doing (Lawson, 2007), as emphasized by a design strategist involved in project Transport:

Every project is very different. Today I might be working on a baby stroller project, and 3-4 months later, I might be working on cars. Therefore, every project that we work on is just kinda like we're building your knowledge base as designers. (PB, design strategist)

Finally, based on my observations I noticed that when dealing with aesthetic issues designers tended to rely upon not only their knowledge about objects – but also shapes, colors, etc. –, their attributes, and the relations between them and their attributes, but also their knowledge on how to accomplish their tasks in order to attain the intended aesthetic results. Put it differently, designers showed to have both a knowledge related to objects and to the properties characterizing them – for instance a knowledge allowing them to categorize a certain object as “approachable”, “touchable”, “quiet”, “powerful”, etc. – and a knowledge on how to make a certain object look “approachable”,

“touchable”, “quiet”, “powerful”, etc. For example, the first kind of knowledge seemed to be what helped them review and map the existing “design language landscape”, while the second type of knowledge seemed to be what allowed them to know how interpret that landscape, how to identify the “design language” appropriate for the product under development, and how to translate that language into a concrete “design execution” conveying the planned “look and feel”.

Drawing upon previous research in the realm of cognitive psychology, these two kinds of knowledge can be labeled *know-that* or *declarative knowledge*, and *know-how* or *procedural knowledge* (e.g. Ryle, 1949; Stillings *et al.*, 1995). The former has been defined as 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, unlike declarative knowledge, cannot be easily articulated by the individual, since it is largely non-conscious (or tacit).

The analysis suggested the identification of three main processes involving aesthetic knowledge cutting across the observed phases of the development process. A first process, named *building and expressing aesthetic knowledge*, mainly aimed at developing aesthetic knowledge specific to the project under way, and at expressing this knowledge by combining it with designers’ pre-existing aesthetic knowledge. The second process, named, *sharing aesthetic knowledge*, was based on transferring and sharing designers’ aesthetic knowledge inside the team, thus developing team-level aesthetic knowledge. Finally, the third process, named *accumulating and disseminating aesthetic knowledge*, unfolded at the end of the projects, and aimed at gathering, preserving, and diffusing the new aesthetic knowledge developed along the design process inside the organization. Figure 4 provides a visual representation of these processes in an integrative process-model.

Insert Figure 4 about here

Building and Expressing Aesthetic Knowledge

A first theme emerging from my observations, and confirmed by many informants, was the role of the *aesthetic experience* in building aesthetic knowledge. More precisely, the importance of such type of

experience became evident since the initial steps of the projects when, as already described, designers undertook in-context research. When talking about this research phase, many informants referred to it as a “deep immersion into the outside world”. In other words, designers tended to embed themselves in a flow of sensory experiences from which they ended up drawing hints, clues, and insights when they had to generate ideas (Csikszentmihalyi, 1991). During a debriefing interview, a brand designer working on project Window explained to me how important sensory experiences in real life contexts were 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 for the stores because that gives you a sense of what stores are selling out there, what people wanna buy, what is not working and what is. I think also that when you go into like 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 kinda 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, I think it's nicer to be able to touch things, buy things and kind of feel and understand what it is. (CC, brand designer)

Furthermore, recreating the same interactions with and perceptions of products that target customers usually have in their daily lives seemed to help designers to orient properly the product being developed towards that target customers and their needs, as explained by an industrial designer during a retrospective interview:

Sometimes, I don't know about the product necessarily, especially if it's a medical device. So the research and being able to experience the product by myself are very important not only to understand something new, which I really enjoy, 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 pretty much. So it's like the clues, and you figure out the clues, and then you answer the questions. (AC, industrial design)

This was also the reason why designers might decide to engage in participant observations that allowed them to embed themselves in the flow of experiences of those they were designing for. For instance, during an informal talk with a brand designer, she explained to me that after working for a while on some retail projects for a big client, she decided to take a few months off and to go work in a retail store during the Holyday season. The main reason was that she wanted to really experience how being day by day in a real retail environment felt like, so that when designing again for a retail environment she would leverage upon those experiences to develop better design solutions.

The interactions with and the perceptions of different kinds of objects – ranging from pictures to real products – seemed to play a key role in the initial definition of the design problem, and especially in the definition of the “design language” of the future product.

As explained by an industrial designer involved in project Health during a debriefing interview, being able to experience a broad array of visual and physical objects from a sensorial point of view – primarily with the sight, but also with the touch, the sense of smell and the sense of hearing – allowed designers to make a set of aesthetic choices more consciously and to move from the conceptual to the practical level:

For instance, we bought this chair and we bought that chair so that we could experience how a real chair feels like. So now we know what the physical dimensions are like; we know how the cushion feels like; we know how it's like to sit in; we know how the mechanism works; we know what that color really looks like; we know what the surface feels like to sit in. Therefore, when we define what look and feel our chair should convey we know what we want our chair should have and we know what our chair should not have (AM, industrial designer)

It is worth noting that, although the role of aesthetic experience proved of primarily importance in the initial stages of a project, visual and physical interactions with objects, and the sensory experiences springing from them were important in other phases of the process as well. In this respect, the model shop manager explained to me the importance of experiencing physical models, sketches or images to guide the creative exploration and the deliver of the final design:

You know, each model is an experience, and is a learning tool. So, if we didn't have the possibility to experience examples, and sketches, and images, then, it would probably take us as twice as long to get to the end result, and we probably wouldn't explore as many ideas as we do, which is really important, because in order to get to the right idea you have to sort of develop a lot of wrong ideas (RC, model shop manager)

In its turn, the aesthetic experience seemed to elicit some responses in designers through the sensory engagement it provoked (Charters, 2006). Put it differently, the activation of the designers' perceptive-sensory faculties triggered both emotional and cognitive reactions. As already mentioned, previous studies in consumer research have defined “aesthetic responses” as the reactions that a person has to an object, to an event or to a situation on the basis of his or her perception of and interaction with the object, or the participation in the situation or the event (see Berlyne, 1974; Veryzer, 1993).

More precisely, at the emotional level, designers might have spontaneous and visceral reactions (Norman, 2004; Rafaeli and Vilnai-Yavetz, 2004), and secondary emotional reactions (Rindova and

Petkova, 2006). The former arose from the appeal of the intrinsic characteristics of the stimuli – embodied in objects or springing from situations and events lived directly by designers – they were exposed to during the aesthetic experience (Bloch, 1995), as well as from subconscious responses to certain shapes, colors, and textures (Norman, 2004). The latter (ranging from simple liking and disliking to stronger emotions like love and hate) were based on aesthetic characteristics of the stimuli, but they also entailed attention and involvement (Bloch, 1995). During a retrospective interview, a design strategist clarified the different levels of these emotional reactions sparked by the set of images and pictures collected during the in-context research and pinned up in a project room:

Well, you know, I think that a project room with all these visual aids available....the moment that you walk into it you're immediately visually stimulated. And because these are presented loosely, visually you get the cue that "ok, you're stimulated and you're here to add more to these loose boards, and you're more allowed to add more ideas to it". So, it really inspires creativity rather than going to a meeting room. Because when we go to meeting rooms, it's when we want to focus, when we want to get to the point. So, my personal opinion is that, if I want to have a focused conversation on something, then I'll find a room that has clean walls, that does not have all these busy images so that you can focus, 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, I also think 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". So, they stimulate me because I feel like I could do whatever I want or just to add more to what's out there. (KH, design strategist)

At a cognitive level, the responses usually took the shape of mental activities, especially when examining issues like the harmony and the balance of shapes, during which the emotional component of the aesthetic experience was less evident. An industrial designer involved in project Health provided me with an explanation of how these cognitive responses unfolded:

you know, like 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 know. So, 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 just the most kind of 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, which is maybe a step-up from the wheel chair, because it does look like someone might have even tempted to design it trying to reach some sort of harmony, but it's still not there yet. So, yes, they all start acquiring meanings... they are here as a representation of some level of effort" (GF, industrial designer)

These responses, both at an emotional and at a cognitive level, seemed to play an important role in influencing the creative exploration. According to many informants, the responses they had to objects they collected or to situations and events they encountered during the research phase guided the types of ideas they generated. In this respect, an industrial designer explained to me 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, but a lot of times it's kind of like listening to a song that makes you feel a certain way. I'm just using that as an example of how it works. If you're looking through a magazine that is full of a lot of really beautiful design, it just kinda makes you feel a certain way, so then when you start to sketch you try to recreate that. I mean, 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. The song was just an example, because, you know, when you're listening to music you tend to retain that, whatever that feeling is that it gave you, you kinda hang on to that for a little while.

Overall, the evidence collected seemed to suggest that designers' aesthetic experiences of objects and/or events and situations, along with the aesthetic responses provoked by them, allowed the development of aesthetic knowledge that was specific to the project under way and additional with respect to the pre-existing stock of aesthetic knowledge designers have at any point in time. As emerged during my observations, when exposed to this flow of sensory stimuli, designers learnt through their senses. In other words, the visual and physical interactions with objects and the perception of events and situations seemed to activate the perceptive-sensory faculties and the sensitive-aesthetic judgment of designers guiding them in the development of new aesthetic knowledge (Strati, 1996; 2006).

More precisely, during projects – with particular reference to those with a high aesthetic content – designers tended to rely upon the stylistic details and the “design executions” – in terms of materials, colors, textures, finishes etc. – of existing products that might be strictly related or just loosely related to the project under way. In this respect, therefore, the initial activities of review and identification of the current *general aesthetic trends* and the mapping of the existing “design language landscape” (see Figure 3) aimed at exposing designers to a flow of sensory stimuli from which they could learn accumulating additional aesthetic knowledge.

For instance, the seasonal retail audit process conducted by designers in the research phase of project Window allowed them to understand the dominant trends in store-window design during seasons, and the recurrent choices for seasonal treatments. More precisely, they had identified three main approaches in the design language of the seasonal store-window design. The first approach evoked the seasons through decorating the store with traditional themes and imagery using iconic visual references to the season not integrated with the product or the brand. The second approach was based on aesthetic choices aimed at placing the products within seasonal settings in order to create product

relevance during a certain season. Finally, the third approach applied brand attributes and created product relevance to make the season proprietary, by merging visual icons of the season with visual cues of the brand, and by integrating seasonal themes with unique brand attributes. The review of existing store-window designs and the identification of these approaches provided designers with the knowledge basis necessary to understand that the most appropriate approach for the goals they had to achieve was the third approach, and with some suggestions on how to translate that approach into an aesthetic execution for their client.

During a retrospective interview, a brand designer emphasized the importance of accumulating aesthetic knowledge with respect to *industry trends* and *industry norms*, especially when dealing with different clients working in different industries:

So, when I'm trying to come up with something like this [website design], I would read the supporting documents, just to clear my mind exactly what kind of information, so I will kind of make myself a checklist. Then I'll look at design magazines to see what's out there in terms of trends, and at the design books that we have in our library to see "ok, what are the successful website design look like. It helps me to see like "ok! The market trend right now uses certain color schemes, or the market trend right now likes very simple design". Because every client works in a very specific industry, and within that industry they have very specific norms. So in order for us to design for a particular client, we need to understand their market and what's popular in their market, and then we can decide if this client should look like the rest of the market or it should be so different from the rest of the market. (CY, brand designer)

The additional aesthetic knowledge developed during the initial phases of a project, then, was used in the generation of preliminary aesthetic expressions. More precisely, when designers had to generate new aesthetic solutions, they tended to be guided and inspired by what they had seen or experienced and they had responded to during the aesthetic reviews and comparisons.

In this respect, during a debriefing interview an industrial designer involved in project Health explained to me that some of the early sketches generated by the team members had been influenced and inspired by some shapes and "design executions" they had seen and noticed also in domains not strictly related to that of the healthcare furniture:

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. This is what we have done here for this project. If you look at some of the sketches that are up on the walls, you can see some details that have been inspired by some of the pictures here. (GF, industrial designer)

During a debriefing interview about the same project, the CEO clarified this point emphasizing the role of the combination of aesthetic knowledge and of aesthetic responses in influencing designers' aesthetic expressions:

When talking about the pictures of other chair designs on display in the project space: "They are very important, because we work on those concrete examples to develop our chair. Designers always tend to work on existing products and shapes they like or they are attracted to. I mean, if you look at DV's sketches, you can see that the headrest's shape refers to some of the shapes in those pictures. And this is true in general. I mean, designers do not start completely from scratch but are always inspired by what already exists!" (GZ, CEO)

Using additional aesthetic knowledge required the blending of this knowledge with designers' pre-existing aesthetic knowledge in order to develop a new aesthetic solution. In this respect, many informants pointed out that, when working on a new project and developing new aesthetic solutions, they always tried to have their "own take" or their own personal interpretation of what they had learnt during the research phase by relying on their knowledge as designers. Moreover, during my observations I noticed that designers' aesthetic solutions were quite different from one another, even though designers having in mind the same "design attributes" and the same intended "look and feel" had generated them. When I asked the Health project leader about the reasons of the variety of the chair designs generated by the team members, he explained to me that this was due to the different knowledge they had developed both at school and from experiences, and to their different styles. This seemed to suggest that designers expressed their new aesthetic knowledge, emerging from the combination of their pre-existing knowledge and the additional one, through some aesthetic choices – in terms of shapes, colors, textures, etc. – aimed at evoking specific emotional responses. Furthermore, this also seemed to suggest that the combination of these choices was the result of a unique and distinctive *style* recognizable in their own aesthetic expressions.

In other words, aesthetic expressions seemed to hold and communicate the aesthetic knowledge of their creators both in the form of the new aesthetic solutions developed by them and in the form of their creators' personal and identifiable style, as illustrated by an industrial designer involved in project Health:

Sketches and drawings represent designers' ideas, the quality of those ideas, as well as their ability to express the ideas. You know, and that is the beauty of sketches. They have life in them. Especially when you know the designers, you really appreciate where they came from even more, because we can see that person and his background represented in those

sketches. Like, those are DV's sketches, and they are just amazing, and then you look at GF's and they are just as amazing but they are more like him as a person. You know, they are just more restrained. DV's are more expressive and they are livelier, while GF's just look more restrained. But the designs in themselves are really beautiful. (AM, industrial designers)

Sharing aesthetic knowledge

During my observations, I noted that designers tended to transfer and to share with the rest of the team the aesthetic knowledge previously built and expressed in new aesthetic solutions. Typically, the transfer and sharing happened during team meetings and working sessions, when, as already mentioned in the “first order findings” section, the design team would meet to illustrate the aesthetic solutions generated by designers along with the reasons underlying their choices, and to get feedback from their colleagues on how to improve their solutions. More precisely, I observed different ways in which the transfer and sharing occurred.

A first way occurred by developing conceptual and linguistic categories aimed at defining some characteristics of the aesthetic expression/experience. The first-order narrative allowed to point out how the interactions among designers tended to rely on the definition of terms reflecting concepts through which my informants interpreted aesthetic issues (see Table 2). In other words, designers tended to build a “design vocabulary” specific for the project under way and shared among teammates. Specifically, this vocabulary seemed to be that part of designers’ aesthetic knowledge that could be codified and shared through conceptual and linguistic categories. Therefore, the possibility to use these common categories to refer to some characteristics of the aesthetic expression/experience facilitated the sharing and the mutual exchange of teammates’ aesthetic knowledge.

Insert Table 2 about here

A second way was based on the simple *expression of designers’ personal aesthetic experiences*. In other words, the first and most immediate transfer of one’s own aesthetic knowledge tended to take place by voicing the aesthetic responses springing from the interaction with others’ aesthetic expressions – in the

form of sketches, drawings, physical models, etc. – as explained by a brand designer during a debriefing interview:

Sometimes it comes down to personal taste. You can say “I like it or I don’t like it”. I’m definitely not afraid of saying “I feel like that’s not gonna work” or “I feel like something that’s not working there”. You know, when you throw up a bunch of ideas and concepts, it’s not about right or wrong, but it’s just about which ones come out a little stronger, which one might not work at all. And sometimes you can improve upon. Sometimes there are some strong ideas there, but the execution might be a little bit on the weaker side. (MT, brand designer)

Another way of sharing aesthetic knowledge was based on the use of *aesthetic metaphors* by designers. In other words, I observed the tendency to resort to words or concepts aimed at evoking aesthetic expressions on an analogical level. In project Health, 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 using such metaphors seemed to be qualifying better the characteristics of the aesthetic expression/experience by evoking aesthetic associations stored in designers’ minds (Strati, 2008). In this respect, during a meeting I heard a brand designer using the word “volcano” when referring to a particular shape he had seen on a teammate’s sketch. When, later on, I asked him the reason why he had used a metaphor to describe that shape, he explained that it was a way both to elicit further inspiration by means of the associations provoked by the word “volcano” and to communicate the content of the aesthetic expression to clients:

You know, I wrote down this inspirational thing like: “this one looks like a volcano” which meant that for me it radiated something, a signal. And, then, I wrote this down, because maybe later on we can get inspiration to design towards it or we can use it to present it to the client and to get them on the same thinking level. (MAL, brand designer)

Finally, designers tended to share their aesthetic knowledge through *induced aesthetic experiences*. Being aesthetic knowledge partly a pre-linguistic knowledge, often tacit and ineffable, it was sometimes difficult to be expressed and communicated by words. Designers, therefore, tried to overcome this limit by turning to alternative forms of communication. One of these was attempting to reproduce the same, or at least a similar, aesthetic experience they had had in order to provoke in their colleagues [audience] the same feelings and sensations they had previously felt. This occurred mostly by referring to visual and tangible references – in the form of visual imagery, materials, fabrics, sketches, drawings etc. – available in the project rooms. This way, designers could explain the aesthetic knowledge expressed in

their aesthetic solutions on display by exposing their peers to the same sensory stimuli they had responded to when developing those solutions, and could get feedback from them on how to improve them.

A passage extracted from the field-notes taken during a project Window meeting shows this point:

Today we're meeting in the Window project room to share the different aesthetic solutions generated by CC, SM, CK and EY 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 CC explaining the "Reinvented traditions" concept, and how she decided to translate that concept to "Back to School" design execution. She makes clear that, according to the style and 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 gonna think "it's all dated". GB 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, RC 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 a similar vein, many working meetings of project Health focused on figuring out and establishing the final "aesthetic direction" for the product under development as well as the exploration of different materials, colors, and finishes able to convey the established design attributes and the intended look and feel. More precisely, during these meetings designers would focus on how to modify Buck 1 – the first physical model built at the very beginning to explore the functional features of the future chair – so that it could convey positive feelings and emotions according to the planned design intent. Many discussions centered on which materials to use, and on how to design the edges of the chair so that it could result warm and cozy. These discussions were supported by referring to real samples of materials – gels, padding, fabrics, etc – that team members would touch, feel and observe, directly trying out the "look and feel" they conveyed, and by the visual imagery pinned up on the walls of the project room. Sometimes, during these conversations the project leader would sketch out the shapes discussed about and agreed upon by the team.

Sometimes the visual and tangible references could be used to create self-induced aesthetic experiences, as explained by the CEO during a debriefing interview about project Health:

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.” (GZ, CEO)

By sharing their aesthetic knowledge, and by mutually exchanging feedback on the expressions of their aesthetic knowledge, team members tended to create aesthetic expressions that were more and more the result of joint efforts and that embodied aesthetic knowledge developed at a team level or, in other words, aesthetic knowledge that was shared by the members of the team. Moreover, my observations, confirmed by some informants’ accounts, highlighted the role of project rooms in allowing the creation of this shared aesthetic knowledge. As a matter of fact, being collections of sensory stimuli evolving together with the evolution of the project, project rooms facilitated the exposure to the same kind of stimuli, thus promoting shared aesthetic experiences, more conscious discussions about these experiences, and as a result collective learning.

Accumulating and Disseminating Aesthetic Knowledge

The end of each project was usually devoted to properly store all the information collected along the project itself. Specifically, designers scanned and digitally stored in the project folder all the visual imagery they used throughout the project, included the sketches, the drawings and the renderings they generated, together with other documents, like meeting minutes, project updates, correspondence with stakeholders, design briefs, etc already uploaded into the folder during the project. Furthermore, they archived physical models and/or prototypes built by the design team. At that point, therefore, project folders moved from being mere repositories of information used by designers for strictly practical reasons – i.e. sharing and quickly exchanging information related to the project – to being repositories of the knowledge – technological and aesthetic – developed during the development process. In other words, these procedures allowed designers to record what they had learnt as a team during a project, and to store the new aesthetic knowledge developed by the team members and mostly embodied in material objects.

These repositories of information and knowledge might be used by future design teams when dealing with other related projects, as explained by an industrial designer involved in project Health:

When we start a new project that in some sense can be related to a previous one, then we'll go back and look at it [previous project folder]. Because there might be stuff in there that you did that you wanna revisit. There might be sketches that you wanna look at again. Probably not from the very, very beginning of the project, but you know, just to kinda get a feel for the kinds of things that you did in that conceptualization process. You may go back and look at that, you know. (AM, industrial designer)

Many informants emphasized the fact that the reliance on past projects' aesthetic knowledge aimed at drawing just a few cues and insights, and not at replicating the same aesthetic solutions in the new project. As explained by another industrial designer involved in project Health, this seemed to be related to designers' mindset:

Sometimes, we also use previous projects' folders. Like on a project that I was on we did a lot of cases, and I'll sometimes go back and look and see what was done in the past, to see if there's anything there.... You know, in similar projects.....because a lot of times, even though the ideas were generated one or two years ago, they're still good ideas. Of course it would make me feel bad taking something that was done and just, one to one, reusing it....I would feel obligated to do something to make it new, or better, or different. It's kind of funny, but we as designers do sometimes feel obligated to be creative and original and not to tread on other people's creative territories (GF, industrial designer)

Moreover, at the end of each project, designers were required to write a project story. This project story was a summary of the project emphasizing “the big picture in terms of the main objectives, the approach adopted, the main deliverables, and the key moments – unique, interesting and compelling aspects of the project itself” as explained in some intranet documents. This story, recapitulating the key learnings associated to a project, was intended both to be used by individual team members for their own reference and to be shared at a company level, thus facilitating the dissemination of this *project-level knowledge* at an individual and at an organizational level.

If designers' *individual aesthetic knowledge* can be conceived of as being continuously accumulated and incremented over time through learning by doing, it is reasonable to think that the aesthetic experiences collected by team members during a project end up nourishing designers' stock of aesthetic knowledge. This knowledge was stored mostly in designers' minds, but sometimes it was also stored in the forms of the visual and physical representations created during a project, which designers tended to keep in their drawers as personal collections. As explained by a mechanical engineer during a debriefing

interview, these personal collections acted both as reminders of group efforts and as possible future triggers of inspiration:

I personally, like if I worked on a project that was really cool I'll keep some prototypes or samples, because it's kinda nice to have some of that stuff that reminds me of what we have done as a group. It's nice because some of it is inspirational, like so I'm like "ok! We figured out how to make a snap in a really weird way, and I'll keep this because maybe I'll use it again". But it's nice because some if it gives you a sense of accomplishment like "I did that!". Personally, I like having stuff around that I worked on. Some of the things that I keep from projects areas, I don't keep them on my desk but I have, you know, my big drawer of stuff that I worked on, so when I need some inspiration I open the drawer and see these models. A lot of people here keep things, but we keep them in our drawers or we may keep them and put them in the ME library. I think many people do hold on to things definitely, in the ME group at least.

Furthermore, the availability of project folders and of project stories on the company server allowed disseminating the knowledge embedded in them among designers that might browse these folders or read these stories in search for cues and insights for other projects.

Based on my observations, I also noticed attempts to consolidate this project-level aesthetic knowledge in order for it to be shared and diffused throughout the whole organization. Precisely, the dissemination of this knowledge at an organizational level tended to occur in two main ways. A first way was by sharing with the rest of the company the main learnings of a project. In this respect, Monday meetings and the "Lunchtime Series" Project Stories were two evident examples. For instance, one of the final deliverables of project Transport was a movie illustrating the big idea behind the design strategy developed by the design team, and showing concretely the main design recommendations included in this strategy. This movie was shown to the rest of the company during a Monday meeting, with the design team explaining the main steps of the project, its turning points, the most compelling experiences they had collected, and the big learnings resulting from them. In a similar vein, during the "Lunchtime Series" meetings designers would share with the whole company past projects they were involved in by telling the story of those projects, and by bringing to the meetings models and prototypes created during the projects themselves.

A second way seemed to be the natural consequence of being in the same company working together for a long period, as explained by an industrial designer:

I think that when you hang out with a group of designers for a long time, you start to learn each other's tastes in objects, and I think it's one of the reasons why design tends to move a little bit like schools of fish. Because we're all surrounded by the same stuff for the most part, and we respond to things in a similar way; I mean, you certainly have people to disagree about the things that they like and don't like, but there comes this kind of design vocabulary that you end up absorbing just by being around it. And so, people do end up agreeing on a lot of things; you might disagree on a few things here and there, but

there's somewhat of a consensus. I just think that because you do spend time in talking to each other, in reading the same magazines and being influenced by the same designers, and seeing the same stuff on television. And, you know, people's taste in what constitutes good design and bad design in a given design firm is somewhat consistent, you know. So, back to your question or whether people react to all this stuff in exactly the same way, no, but they might react in ways that are along a median line, along an average of reactions. (AM, industrial designer)

In other words, it seemed that by working together and being exposed to similar objects, designers were able to categorize from a linguistic standpoint the aesthetic characteristics of these objects and of the aesthetic responses resulting from their interactions with these objects, thus developing a shared aesthetic knowledge at an organizational level.

DISCUSSION AND CONCLUSIONS

Previous works have extensively investigated the new product development process (Krishnan and Ulrich, 2001), portraying it as a logical problem-solving process leading to the development of a satisfying solution to technical problems, and thus emphasizing its functional aspects (e.g. Alexander, 1964; Simon, 1969; Clark, 1985). On the opposite, the aesthetic aspects of those processes leading to the development of new objects seem to have been overlooked so far. In other words, despite the growing interest towards organizational aesthetics and the influence of product aesthetics on consumer behaviors, there seems to be no field-based accounts of how products come to acquire aesthetic properties.

In this paper, by drawing on an ethnographic study, I highlight the importance of both functional and aesthetic dimension of the new product development process, and I develop a deeper understanding of the dynamics involving aesthetic knowledge along this process. In particular, the collected evidence suggests three main processes related to aesthetic knowledge: *building and expressing*, *sharing*, and *accumulating and disseminating aesthetic knowledge*.

These findings seem to contribute to previous works on aesthetics and aesthetic knowledge in many ways (see Table 3). First, they provide further evidence of the existence and of the importance of aesthetic knowledge in organizational settings. In particular, they provide further evidence of the sensory-perceptual nature of aesthetic knowledge claimed by scholars of the field (e.g. Gagliardi, 1996, Whitfield, 2005) by showing how designers relied upon their perceptions and sensory experiences of objects, events and situations in order to build and develop additional aesthetic knowledge that was

specific to the project under way. Moreover, they support the conception of aesthetic knowledge as having a dual component – *symbolic* and *experiential* – proposed by Ewenstein and Whyte (2007). As a matter of fact, informants converged on emphasizing the fact that as designers they possessed both a set of skills acquired by training and by experience and a unique and distinctive style recognizable in their aesthetic expressions. Furthermore, findings seem to expand Ewenstein and Whyte’s (2007) definition by pointing out that designers seem to possess an aesthetic know-that or aesthetic declarative knowledge as well as an aesthetic know-how or aesthetic procedural knowledge. More precisely, designers showed to have both knowledge about objects, their aesthetic attributes and the relationships between objects and attributes and knowledge on how to give objects the required aesthetic attributes and on how to effectively attain the intended aesthetic results.

Moreover, this study seems to provide some interesting insights on the articulation of aesthetic knowledge. In this respect, previous works have so far emphasized the tacit nature of aesthetic knowledge. In particular, Whitfield (2005) has advanced the notion of aesthetics as a pre-linguistic knowledge preceding the evolution of language and, thus, providing the foundation for linguistic-based knowledge. Hence, he has contended the difficulty to articulate it linguistically as well as the difficulty of investigating and understanding the processes through which designers arrive at a certain design. In a similar vein, Strati (2008) has pointed out that aesthetics and aesthetic knowledge are rooted in the tacit dimension of knowledge whereby organizational actors are able to describe and articulate their knowledge “in the evocative terms of metaphorical language pertaining to aesthetic understanding and not in logical-analytical terms” (2008: 235). Findings from this study extend existing theory by showing four different ways through which designers tend to share and manifest their aesthetic knowledge among each other. In particular, a first analytical way seems to be the use of a linguistic infrastructure in the form of a common “*design vocabulary*” that allows the codification of designers’ aesthetic knowledge and its intersubjective communication. A second way is more analogical, and it tends to rely upon the use of *aesthetic metaphors* aimed at evoking and sparking aesthetic associations and expressions stored in designers’ minds by analogy. Finally, two aesthetic ways seem to be used by designers. A first and

immediate aesthetic way is based on the *expression and verbal articulation of the aesthetic responses* elicited by the sensory experience and perception of objects, events and situations. A second aesthetic way observed seems to rely upon *induced aesthetic experiences*. In other words, designers tend to expose their teammates to the same sensory stimuli they were exposed to in order to spark in them the same feelings and sensations. It is plausible to hypothesize that the resort to this way of articulation was necessary when dealing with the most ineffable, tacit and pre-linguistic part of aesthetic knowledge.

This study also seems to contribute to the open debate on the nature of aesthetic experience and on what it entails, or in other words on the nature of the aesthetic responses springing from it. Past research has so far highlighted both the unconscious and the tacit nature of aesthetic experiences. For instance, Gagliardi (1990) has emphasized the unconsciousness of sensory experiences and of sensory maps activated in the interaction between the senses and the objects, event or situation experienced, both conceived of as belonging to the realm of intuition. In addition, Taylor (2002) has pointed at the difficulty of organizational members of talking about their aesthetic experiences, and of translating that “felt sense” into language. On the opposite, the evidence collected in this study indicates not only that designers are aware of the aesthetic experiences when they are living them, but also that they seem to be able to talk about these experiences and to qualify them better by using words – in terms of linguistic categories and metaphors – and by resorting to supporting visual imagery and/or material references – in the form of images, sketches, drawings, physical models, etc. Moreover, informants’ accounts show that designers are also aware of the reactions sparked by aesthetic experiences. In particular, it seems that the combination of designers’ aesthetic knowledge and of these realized responses to sensory stimuli plays a crucial role in influencing their aesthetic expressions. With respect to the debate about the nature of these responses, this study contributes to cast further light by showing how they might encompass different levels. Precisely, findings seem to suggest that they can range from spontaneous sensory and visceral reactions to sensory stimuli (Norman, 2004; Rafaeli and Vilnai-Yavetz, 2004), to emotional responses to aesthetic characteristics of the stimuli entailing some sort of attention and involvement (Bloch, 1995), and to cognitive responses in the form of mental activities (Kreitler and

Kreitler, 1972). Overall, therefore, collected evidence seems to confirm the most recent position on this issue emerged in the field of psychology (Csikszentmihalyi, 1991; Csikszentmihalyi and Robinson, 1990; Csikszentmihalyi, 2002) based on the concept of “flow experience” encompassing mental, emotional and sensory processes.

Limitations

This study presents some limitations. A first limitation is related to the possible idiosyncrasy of the findings with respect to the organizational setting investigated. In other words, one might object that the observed processes involving aesthetic knowledge are the specific results of the culture of this organization. In fact, the attention to aesthetic issues of new products seems to be typical also of other product design firms – e.g. Hargadon and Sutton’s study on IDEO (1997). Moreover, the attention to the aesthetic issues of new products is not even conceived by informants as the distinctive feature of their organizational culture and work processes.

A second limitation is represented by the fact that aesthetic knowledge might be considered specific to designers as community of practice, also provided that Ewenstein and Whyte attempted to investigate aesthetic knowledge in the context of architectural work. Nevertheless, by emphasizing the aesthetic dimension of organizational life past works on aesthetics in organizations suggested that all organizational members might experience the organizational actions and the organizational artifacts through an aesthetic approach (e.g. Strati, 1990, 1992, 1999; Taylor, 2002). In other words, these studies seem to imply that not only designers, but also people in general can experience objects, events and situations from an aesthetic standpoint and can develop aesthetic knowledge from those experiences. It is plausible to hypothesize that designers, thanks to the design education and training received and to the experiences accumulated, might have developed a more pronounced aesthetic knowledge. This does not seem to undermine the generalizability of these findings, but, on the opposite, it makes the organizational setting investigated particularly suitable for studying a phenomenon characterizing human behavior in general.

A final possible limitation is connected to the possibility that the findings of this study might have been influenced by the specific set of activities under investigation, namely the activities aimed at designing objects with which different people will be interacting. Nevertheless, it can be argued that the design of new product does not represent the only chance to manipulate aesthetic stimuli within organizations. Further cases might be represented by service design, by the design of communication systems, like websites, corporate brochures, etc., and by office design and office attire. In other words, it could be interesting to explore from an aesthetic perspective the implications of the manipulation of those organizational artifacts that have been so far studied from a symbolic standpoint. For instance, future research might focus on understanding how the aesthetic dimension of these artifacts and the aesthetic experiences springing from the interactions of organizational members with them influence some organizational dynamics, such as the effectiveness of communication, the efficiency of work tools, or the level of satisfaction for work tools and for work environment.

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Table 1. Interviews summary table

<i>Type of Interview (Number of informants)</i>	<i>Position</i>	<i>Number of informants (Number of interviews)</i>
Preliminary Interviews (15)	Industrial Design Principal	1
	Industrial Design Principal	1
	Industrial Design Principal	1
	Industrial Design Principal	1
	Brand Experience Principal	1
	Design Strategy Principal	1
	Vice President of Product Dev.	1
	Mechanical Engineering Principal	1
	COO	1
	VP Product Development	1
	CFO	1
	Vice President Marketing	1
	Founder and CEO	1 (2)
	Vice President Brand Experience	1 (2)
	Vice President of Product Practice	1
Debriefing interviews (12)	Health	
	Industrial designers	2 (3)
	Human factor engineer	1
	CEO	1
	Transport:	
	Design strategists	4 (5)
Window:		
	Brand designers	4 (5)
Retrospective interviews (14)	Industrial designers	7 (10)
	Brand designers	1
	Mechanical Engineer	3 (5)
	Human Factor Engineer	2 (3)
	Design strategists	1
Total Interviews		41 (52 interviews)

Table 2. Building a project “design vocabulary”

TERM	DEFINITION	THE CASE OF “INSINKERATOR ¹³ ”
<i>Design Intent</i>	The purpose that designers intend to achieve through a specific design.	Developing two different models of garbage disposers: one “looking quiet and conveying the message of unobtrusive clean-up”, and the other “looking powerful and conveying the idea of less food in trash” [two highly desired disposer benefits], both “giving consumer a reason to pay at least what they expected to pay”.
<i>Design Attributes/Criteria</i>	Set of principles and/or characteristics that the design under development should respect and have, which designers use to communicate the design intent internally and externally.	After a phase of qualitative consumer research designers defined two key attributes, <i>Quiet</i> and <i>Powerful</i> , and two supporting attributes: <i>Ultimate</i> and <i>Safe</i> .
<i>Design Language</i>	The set of visual signs, symbols, and icons that designers can adopt to deliver a certain message (Verganti, 2003) through the definition of different design aspects such as shapes, materials, color schemes, patterns, textures, or layouts.	The attributes were translated into the following design language: With respect to <i>Quiet</i> : <ul style="list-style-type: none"> ◆ Slightly wider shoulders ◆ Soft top cap ◆ Exposed stator band With respect to <i>Powerful</i> : <ul style="list-style-type: none"> ◆ Wide shoulders and cinched waist belt ◆ Strong two-chamber look ◆ Strong and consistent use of branding
<i>Look and Feel</i>	The main features of appearance, surfaces and interfaces of a design (being it a product, a poster, etc.). When relating to the consumer experience, it describes the sensory experience a consumer should have when using and interacting with that design. Synonyms like “aesthetic approach” and “aesthetic direction” can be used as well. The former indicates the intended look and feel, while the latter indicates the actual trajectory taken from an aesthetic standpoint.	The intended look and feel was defined as follows: With respect to <i>Quiet</i> : <ul style="list-style-type: none"> ◆ Less industrial looking and more attention to aesthetics: visually subdued, no/few extraneous details, not showy or garish and no visibly moving parts ◆ Softer shapes: soft, touchable or sound dampening materials

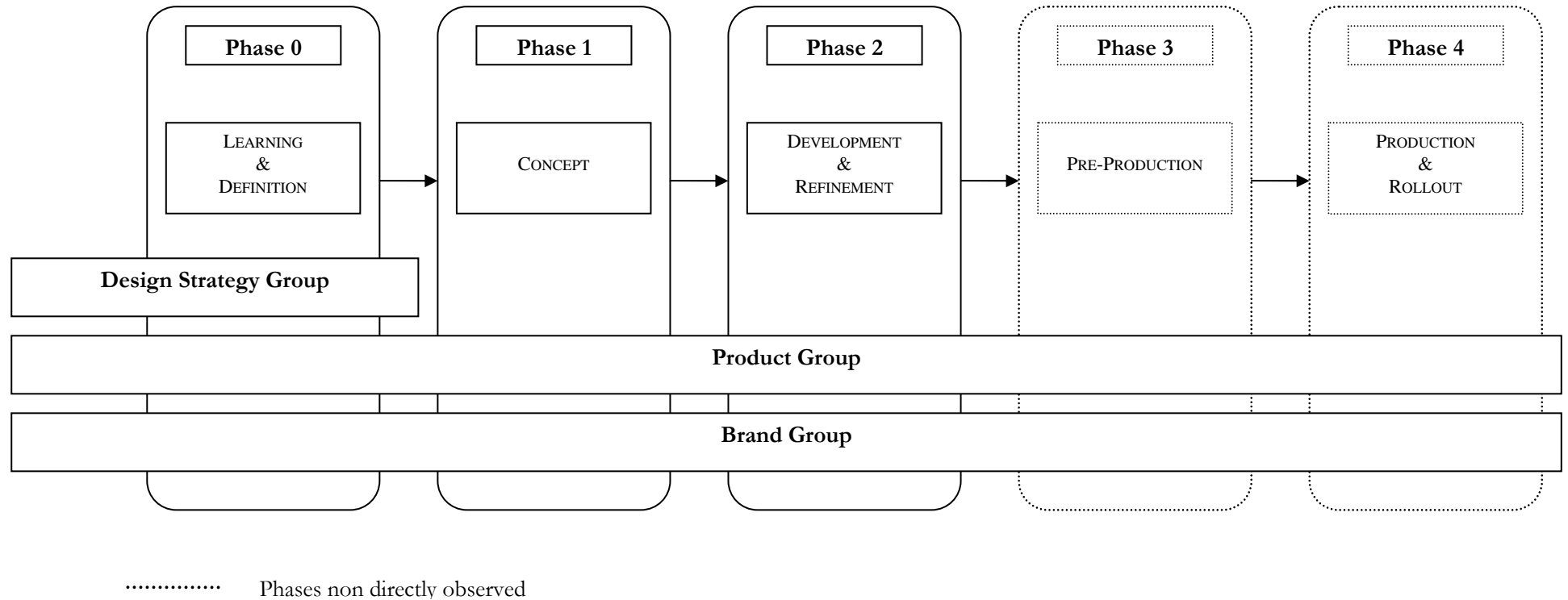
¹³ For confidentiality reasons I am displaying the “design vocabulary” developed by designers for one of the released projects, which were object of retrospective interviews.

		<p>With respect to <i>Powerful</i>:</p> <ul style="list-style-type: none"> ◆ More industrial looking: exaggerated detailing, showing evidence of construction and/or manufacturing processes, showing air intake/exhaust for cooling the inside; should not look touchable ◆ Masculine shapes: muscular/chest puffed out, showing mechanical complexity, restraining powerful internals (metal exterior)
<p><i>Design Execution</i></p>	<p>The concrete translation – shapes, materials, colors, finishes, textures, etc. – of the design attributes into the (final) look and feel of the product.</p>	<p>The design attributes initially defined were translated into the following final look and feel:</p> <p>With respect to <i>Quiet</i>:</p> <ul style="list-style-type: none"> - Simple construction - Less exposed construction elements like bolts, rivets, etc. - Smooth (nothing exposed) outside - Matte plastic - Brushed metals <p>With respect to <i>Powerful</i>:</p> <ul style="list-style-type: none"> - Exposed rivets, bolts, skeletal elements - Large shoulders - Matte plastic - Two chambers - Dark material - Construction of one solid material

Table 3. Aesthetics and aesthetic knowledge: past research and insights from collected evidence

TOPIC	WHAT WE KNEW BEFORE	WHAT WE KNOW NOW
<i>Aesthetic Knowledge</i>	<ul style="list-style-type: none"> • Sensory-perceptual (e.g. Gagliardi, 1996) • Pre-linguistic and Tacit (e.g. Whitfield, 2005) • Symbolic and experiential (e.g. Ewenstein and Whyte, 2007) 	<ul style="list-style-type: none"> • Sensory-perceptual (e.g. Gagliardi, 1996) • Partly Pre-linguistic and Tacit • Symbolic and experiential • Made up of aesthetic <i>know-that</i> and of <i>aesthetic know-how</i>
<i>Manifestation of Aesthetic Knowledge</i>	<ul style="list-style-type: none"> • Mostly tacit and ineffable (e.g. Gagliardi, 1996; Strati, 1999) • Can be articulated only through evocative terms and aesthetic metaphors (e.g. Strati, 2008) • “Aesthetic reflexivity” (e.g. Ewenstein and Whyte, 2007) 	<ul style="list-style-type: none"> • Partly tacit and ineffable • Can be shared and manifested in four main ways: <ul style="list-style-type: none"> ▪ <i>Linguistic categories</i> (analytical) ▪ <i>Aesthetic Metaphors</i> (Analogical) ▪ <i>Expressing personal aesthetic experiences</i> (aesthetic) ▪ <i>Induced aesthetic experiences</i> (aesthetic)
<i>Nature of Aesthetic Experience</i>	<ul style="list-style-type: none"> • Unconscious and Intuitive (e.g. Gagliardi, 1990) • Tacit, thus impossible to be expressed (e.g. Taylor, 2002) 	<ul style="list-style-type: none"> • Conscious • Can be talked about, expressed and qualified both through language and through supporting visual and material references
<i>Nature of Aesthetic Responses</i>	<ul style="list-style-type: none"> • Still an open debate • Diverging positions: <ul style="list-style-type: none"> ▪ Responses are entirely cognitive (e. g Kreitler and Kreitler, 1972) ▪ Responses are emotional and sensory (e.g. Osborne, 1979) ▪ Responses are mental, emotional and sensory, and result from the “flow” of experiences (e.g. Csikszentmihalyi, 1990, 2002) 	<ul style="list-style-type: none"> • Responses may encompass many levels ranging from sensory to emotional and, finally, to cognitive, and result from the flow of aesthetic experiences

Figure 1. A process model of the major steps of the development process as described at Continuum



Source: Map of Continuum's Development Process

Figure 2. A first-order process model of the design process at Continuum

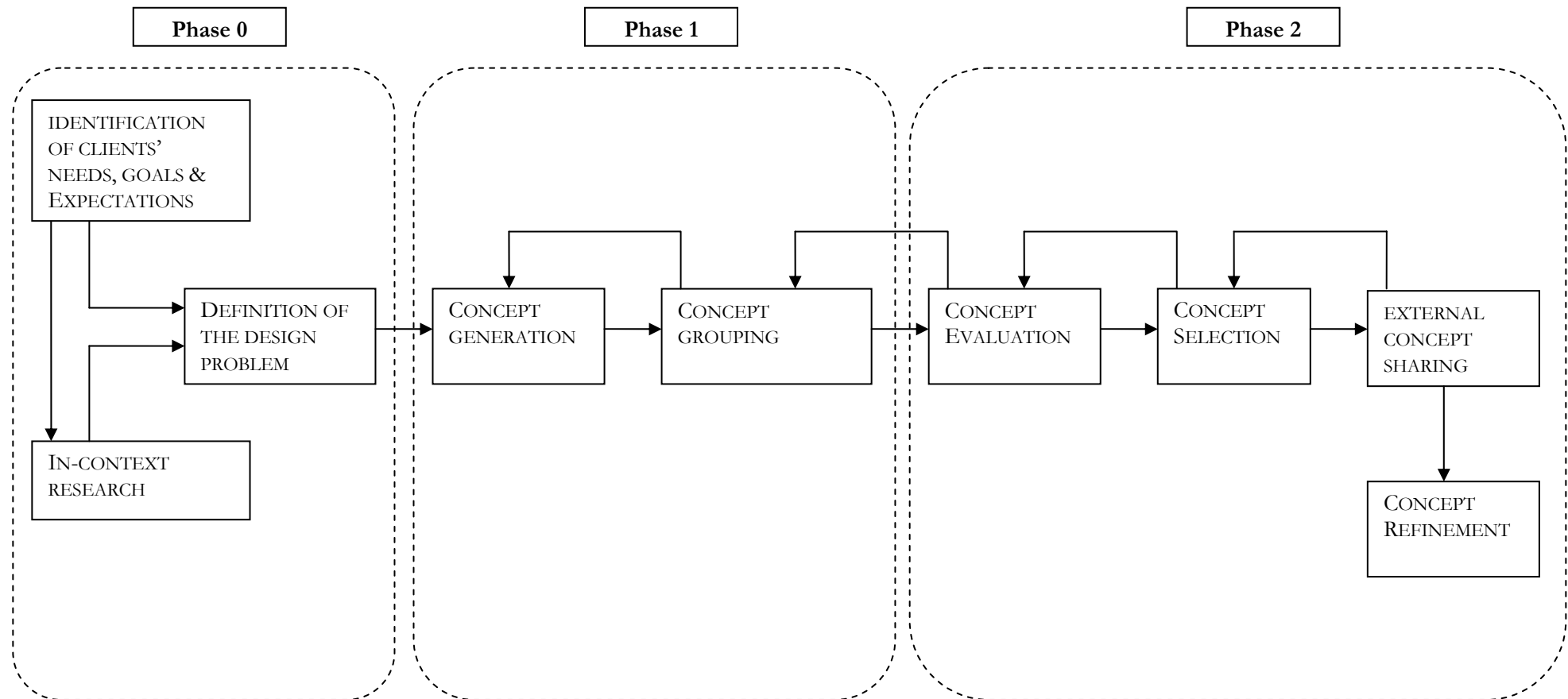
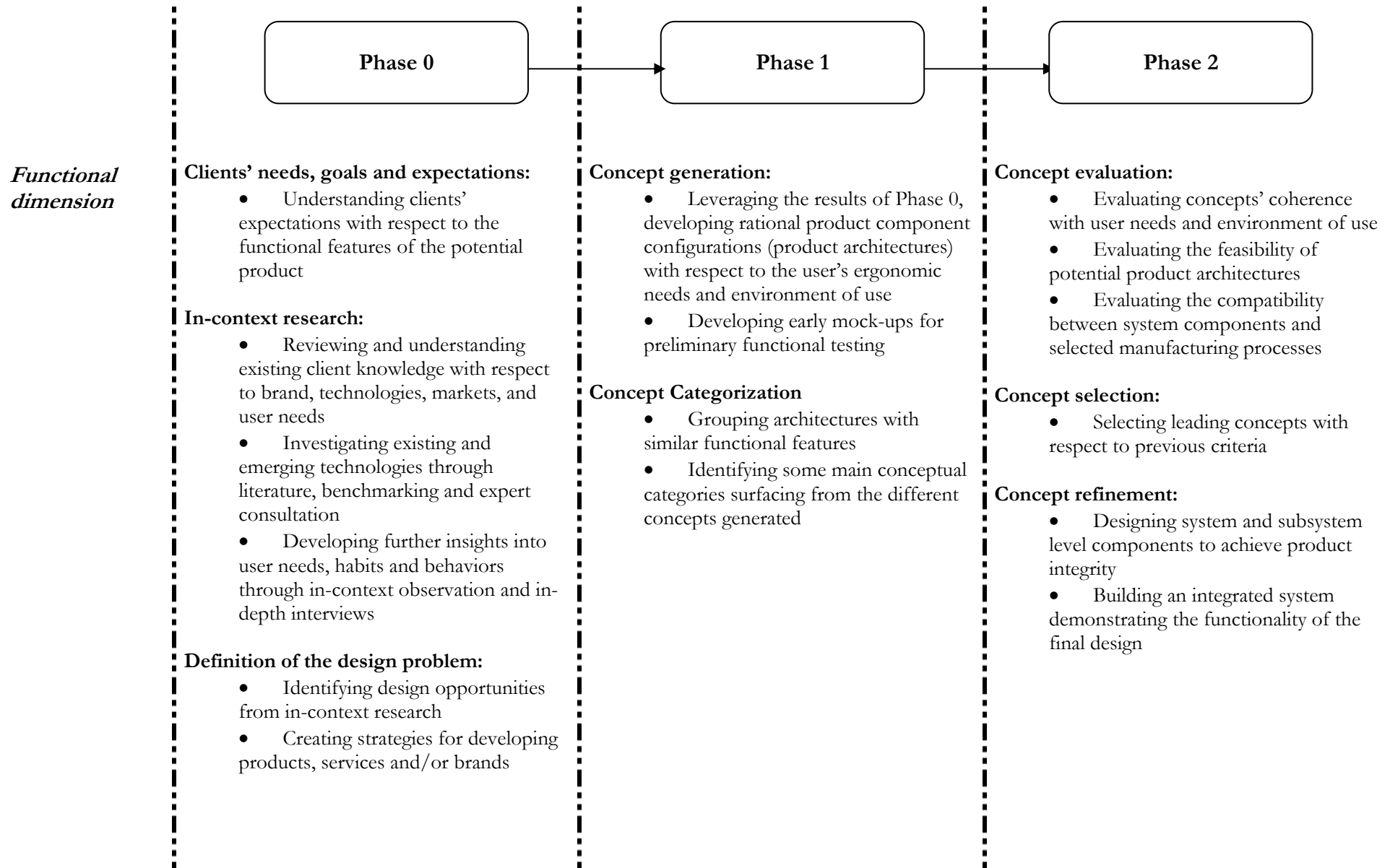


Figure 3. Activities related to functional and aesthetic issues along the design process at Continuum



Aesthetic dimension

Clients' needs, goals and expectations:

- Understanding clients' expectations with respect to the aesthetic desiderata of the potential product

In-context research:

- Developing deeper insights into aesthetic trends, lifestyles, and user tastes through magazines and websites review
- Connecting to the buyer and user experience through observation and immersion techniques
- Reviewing the existing design language landscape using visual references

Definition of the design problem:

- Identifying trends, patterns, and gaps in the design language landscape
- Defining the design language of the potential product in terms of the overall "look and feel", and of the design attributes
- Defining preliminary recommended product directions and design executions

Concept generation:

- Exploring and visually illustrating a range of creative concepts that meet the design or the brand strategy objectives, the design criteria and the "look and feel" previously identified;
- Developing rough 3-dimensional versions of potential product concepts for direct experience

Concept categorization:

- Grouping creative concepts with similar aesthetic characteristics;
- Identifying some main conceptual categories surfacing from the different design executions

Concept evaluation:

- Evaluating the coherence between design executions and the design language previously identified

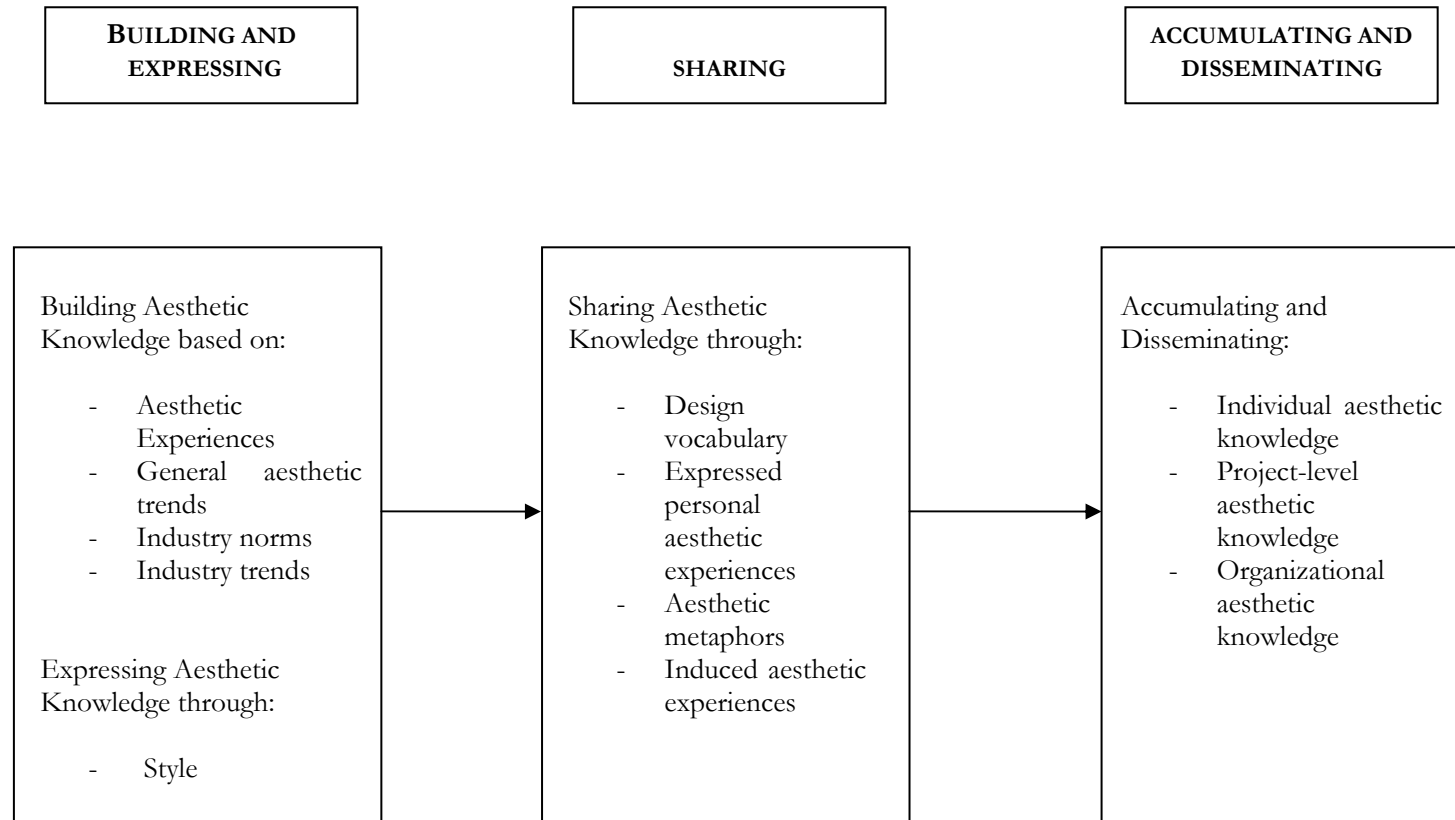
Concept selection:

- Selecting leading concept(s) with respect to previous criteria

Concept refinement:

- Design detailing and refinement of the chosen concept(s) establishing the final aesthetic design direction for the potential product
- Exploring and refining the aesthetic details of the chosen concept(s) (e.g. materials, finishes, textures, colors, etc.)
- Developing a more refined visual or physical representation of the chosen concept(s) embodying the design language previously identified and conveying the design intent

Figure 4. A second-order process model of the processes involving aesthetic knowledge



**ARTIFACTS AND CREATIVITY:
THE ROLE OF ARTIFACTS DURING THE CREATIVE
PROCESS IN A PRODUCT DESIGN FIRM**

ABSTRACT

So far research on organizational artifacts has mostly focused on three main areas of inquiry: (1) individual identity processes within organizations; (2) inter-group status and conflict; (3) cross-organizational knowledge management. Furthermore, literature on creative cognition has largely paid attention to artifacts as outcomes of the creative processes. Although, both streams of literature present some insights on how artifacts can act as inputs of the dynamics of creativity, there seems to lack a systematic investigation in this respect. In this paper, building on an ethnographic study of a product design firm, I investigate more closely how artifacts are used during the creative process. The emerging findings highlight that a vast array of artifacts – “visual tools” ranging from pictures, magazines, and sketches, to samples of products, samples of materials, physical models, and videos used by designers to accomplish their tasks – can support, shape, and influence the development of creative solutions in three main phases of the creative process, here named *individual sensemaking*, *collective sensemaking*, and *sensegiving*.

INTRODUCTION

Artifacts are an important part of organizational life. They literally surround people working in organizations, help them accomplish their tasks, mediate the communication processes (Bechky, 2003a), and influence the transfer and the management of knowledge (Carlile 2002, 2004; Bechky, 2003a, 2003b). Embedding the knowledge of their creators, they can serve as boundary objects, conveying information between groups and mobilizing action (Star and Griesemer, 1989; Henderson, 1999; Carlile 2002). In other words, objects are intertwined in the social dynamics of organization, actively participating in their construction through interpretation.

In organizations, a broad variety of objects ranging from uniforms, logos, stationery, and visual tools, to buildings, as well as to the products themselves, – collectively referred to as organizational artifacts – provide cues about how members interpret their organization (Gagliardi, 1990; Rafaeli and Pratt, 2005) or would like it to be perceived externally (Olins, 1989; Rindova and Schultz, 1998). Although artifacts represent an important aspect of organizational life, scholars in the field tend to agree that organizational artifacts are generally overlooked and under-explored (Rafaeli and Pratt, 2006; Bechky, 2008). Furthermore, despite the investigations and strides made in the creative cognition field to enhance the scientific understanding of creativity, scholars tend to consider artifacts primarily as the outcomes of the creative processes (e.g. Finke *et al.*, 1992; Smith *et al.*, 1995; Ward *et al.*, 1999). In other words, there seems to lack a systematic investigation of the supporting role of artifacts along the creative processes. Finally, although recent studies have started investigating the influence that the simple exposure to objects with different shapes and forms can have on cognitive and creative processes (e.g. Fitzsimons *et al.*, 2008) the issue seems to be still under-explored, and no rich, field-based accounts of the phenomenon exist to date.

Therefore, in this paper I seek to address this gap through an ethnographic study of the creative processes of a product design consultancy. The findings emerging from this study highlight how a vast array of artifacts – “visual tools” ranging from pictures, magazines, and sketches, to samples of products, samples of materials, physical models, and videos used by designers to accomplish their

tasks – can support, shape, and influence the development of creative solutions in three main phases of the creative process, here named *individual sensemaking*, *collective sensemaking*, and *sensegiving*.

The remainder of the paper is structured as follow: in the next section I briefly review the theoretical background of this study. In the following sections, I present and discuss the methodology applied, and my observations regarding the informants' interpretations of the role of artifacts in the creative process. Finally, in the “Discussion” section I articulate the emerging conceptual framework and discuss its implication for research.

THEORETICAL BACKGROUND

In the broad realm of cognitive psychology, a group of scholars have adopted an approach to the study of creativity, called creative cognition, based on the experimental methods of creative science and aimed at identifying those cognitive processes and structures that contribute to creative acts and products. Provided that the purpose of this paper is to understand those creative processes, included cognitive ones, leading to the development of creative solutions, the review of literature on creative cognition seems to be pertinent to the topic under investigation.

Furthermore, this study is routed in a growing stream of research investigating organizational artifacts and their role in supporting different organizational dynamics at the individual, intergroup, and organizational level.

Literature on creative cognition

Proponents of the creative cognition approach to understanding human creativity (Finke *et al.*, 1992; Smith *et al.*, 1995; Ward *et al.*, 1999) claim that the hallmark of normative human cognition is its generative capacity to move beyond discrete stored experiences, and that creative accomplishments are based on those ordinary mental processes that are observable, at least in principle. Therefore, creative cognition is a natural extension of cognitive psychology with the twofold purpose of advancing the scientific understanding of creativity by adapting the concepts, theories, methods, and frameworks of mainstream cognitive psychology to the study and characterization of the cognitive

operations producing creative thought, and of extending the scientific understanding of cognition by conducting experimental observations of those cognitive processes operating when people are engaged in plainly generative tasks.

An early general framework for the creative cognition approach was the Geneplore model of creative functioning (Finke *et al.*, 1992), whose central proposal was that many creative activities can be described in terms of an initial generation of candidate ideas followed by further creative exploration of those ideas. These initial ideas are conceived of as “preinventive” in the sense that they are not complete concepts for some new product, or clear-cut solutions to certain problems, but they may be untested proposals or even mere germs of an idea holding some promise of producing creative outcomes, that is novel and useful. This model, therefore, assumes that creative outcomes are the result of the alternation between generative and exploratory processes, through the progressive interpretation of the preinventive structures (e.g. symbolic visual patterns and diagrams, representations of three-dimensional objects and forms, etc.) constructed during the initial phase, according to the demands or constraints of the particular task (Ward *et al.*, 1999).

Drawing on this model, other scholars of the field have carried on further investigations aimed at disclosing those cognitive processes that are crucial to creativity. Some have focused on insight (Metcalf, 1986; Metcalf and Wiebe, 1987; Schooler and Melcher, 1995) redeeming it from the realm of the unconscious, of the unintentional, and of the unpredictable, and showing creative ways of evoking and studying the remarkable phenomenon of insight through the application of basic cognitive psychology approaches to creative thinking.

Others have devoted their attention to conceptual expansion, namely to extend concepts in the service of developing new ideas (Ward *et al.*, 1997). Precisely, a number of recent studies have attempted to characterize how the central properties of known concepts or recent experiences influence the development of new ideas (Jansson and Smith, 1992; Marsh *et al.*, 1996; Smith *et al.*, 1993, Ward, 1994; Cacciari *et al.*, 1997) showing that people’s knowledge about the typical features of familiar categories structures their imaginative creations, even for unfamiliar or unusual categories, called structuring effects. In other words, when instantiating the problem of developing a new idea,

creators are drawn to retrieve typical, specific instances of a known concept, and then to project the properties of those instances to the empty frame of the novel idea.

Furthermore, recent studies have addressed the topic of recently activated knowledge, documenting the influence of features depicted in previously seen examples on creative products (Smith *et al.*, 1993; Marsh *et al.*, 1996) pointing to the need for special care when relying on examples to solve problems. In a similar vein, studies of memory blocking have begun to provide new insights into the nature of creative thinking, both suggesting ways to facilitate creative thinking and revealing those cognitive processes underlying incubation, intuition and other phenomena traditionally regarded as un-researchable (Smith *et al.*, 1993; Smith, 1995).

Another topic under investigation by researchers in the field of creative cognition is conceptual combination, namely the synthesis or merging of previously separate concepts (e.g. Hampton, 1997). These researchers have not only emphasized the high generative power inherent in considering novel combinations of concepts, but also pointed at it as a crucial part of human creativity.

Moreover, other studies have provided evidence of the central role that imagery plays in creative cognition (Getzels and Csikszentmihalyi, 1976; Perkins, 1981; Finke, 1990) suggesting that delaying the search for creative interpretations until after the preinventive structures are initially completed may enhance creative discovery. Put it differently, these studies seem to suggest that in order to foster innovation, in addition to the approach of letting the form of an idea be derived from the function it must satisfy, another approach may be let the form itself suggest new and potentially useful functions.

The review of the previous studies leaves the impression that, despite the valuable efforts to provide a thorough explanation of the cognitive processes and structures contributing to creative thinking and discovery, the investigation of how artifacts support the cognitive processes underlying the development of creative solutions remains still largely sporadic and unsystematic.

In fact, a few recent studies in the field of social cognition and consumer research have attempted to examine how the exposure to objects with different shapes and nature influence cognitive, behavioral, and creative processes (e.g. Fitzsimons *et al.*, 2008). For instance, Fitzsimons *et*

al. (2008), show how the exposure to objects, like goal-relevant brands, representing a positively valenced characteristic – e.g. “to be creative” – elicits goal-directed behavior – e.g. “behaving more creatively”. In other words, when the brand is goal relevant, people respond to them by behaving in line with the brand’s characteristics and with no conscious awareness of the influence.

Nevertheless, the issue seems to be still under-explored, and no rich, field-based account of the phenomenon does seem to exist so far.

Literature on organizational artifacts

In the management field, the concept of artifact was initially used by students of organizational culture (Schein, 1985) to indicate all the visible, audible and tangible expressions of a culture – such as buildings (e.g. Berg and Kreiner, 1990), uniforms (Pratt and Rafaeli, 1997), stories (Martin *et al.*, 1983), rituals (Trice and Beyer, 1984), etc.

Later research on organizational symbolism expanded the notion that organizational artifacts influence interpretation processes within organizations, and explored more in details how and under what conditions objects – broadly defined – help create and maintain meanings in organization (Pondy, Frost, Morgan and Dandridge, 1983; Gagliardi, 1990). At the same time, however, research in this tradition emphasized the embedded character of organizational artifacts as “symbols”, the meanings of which are determined by the very cultural context in which they are located (Louis, 1983).

More recently, scholars have tried to reach beyond the symbolic role and implications of artifacts within organizations, focusing their attention on: (1) how people use artifacts in order to maintain and legitimize their individual identities within organizations; (2) how artifacts support and make possible membership and status enactment by groups, and (3) how organizations transform and manage the knowledge embedded in material objects (Bechky, 2008).

Artifacts and identity-related processes

Work in the management field investigating systematically the connection between artifacts and identity-related processes inside the organization has suggested how objects and settings may become

meaningful to individuals and groups insofar as they are perceived as salient to individual or group identity. In other words, previous research has showed how artifacts, as markers of identity, may support the construction, the expression, and the affirmation of both professional and personal identities by the members of an organization (e. g. Pratt and Rafaeli, 1997; Rafaeli et al., 1997; Elsbach, 2003, 2004, 2006).

Artifacts like personal possessions (photos, mementos, etc.) are often used by persons to express and signify their distinctiveness, and to differentiate themselves inside the organizations (e.g. Elsbach 2003, 2004). Professional identities, instead, are usually constructed, expressed and affirmed by drawing on artifacts, like organizational dress, awards, diplomas, etc., that in a certain cultural context are automatically associated to certain professional categories (e. g. Pratt and Rafaeli, 1997; Rafaeli et al., 1997).

At a cognitive level, the social processes of construction, expression, and affirmation of identities occur through two main mechanisms: signaling and categorization. Signaling one's own personal and/or professional identities to other organizational members involves the deliberate display of artifacts that are meaningful to the individual or to the groups showing them. In other words, these artifacts are displayed as symbols of people's uniqueness or symbols of their membership to a certain professional category (e. g. Pratt and Rafaeli, 1997; Elsbach 2003, 2004). Categorization, instead, implies a process of classification of the identities of other members of an organization into existing professional and social categories, drawing on the observation of objects usually displayed in corporate office settings (e. g. Elsbach 2003, 2004, 2006).

Signaling and categorization may unfold also at an organizational level. In this respect, the body of research on Corporate Identity has showed how organizations use artifacts representing visible and tangible manifestations of what the company is – such as company logo, brands, buildings, corporate architecture, etc. – to express their distinctiveness to external constituencies, and how the categorization of organizations by external constituencies based on these visual manifestations may have implications for company image and reputation (Olins, 1989, Van Riel, 1995; Fombrun, 1996; Schmitt and Simonson, 1997).

Artifacts and group membership and status

Anthropologists have been the first to examine how material artifacts impact on the construction, definition, and stratification of the complex set of relationships making up a social system. Put it differently, previous studies in the anthropological field have highlighted how artifacts that are meaningful to a certain social group can be used by individuals as symbols of their membership in that particular social group (see Bechky, 2008).

Even in this case, at a cognitive level the processes of construction of the social relationships occur through signaling and categorization. The display and use of objects representative of a certain social milieu, such as an organizational subculture or an occupational community, is a key mechanism for the members of that group to signal their membership status (e.g. Mauss, 1976; Douglas and Isherwood, 1979; Bourdieu, 1984). On the opposite, the observation of artifacts displayed by others proves to be crucial to classify them into pre-existing social and/or cultural categories (e.g. Mc Cracken, 1988).

Organization theorists have reached beyond symbolism, and have highlighted artifacts' constitutive nature of status in organizations. In other words, artifacts, such as drawings, machines, and software, are not only used as symbols of social status, but can be themselves the means through which the status of social groups, like occupational groups, are negotiated and enacted inside organizations (e. g. Bechky 2003a, 2003b).

In a similar vein, in the area of distributed work, some recent studies have pointed out that the use of the same work tools and processes are used to construct and enact intergroup conflict and status in virtual organizations (Hinds and Mortensen, 2005; Metiu, 2006).

Artifacts and knowledge management

Some studies have brought to the fore the role of objects in the processes of knowledge management in organizations, showing how artifacts embody and construct organizational knowledge (see Bechky, 2008). Embedding the knowledge of their creators, artifacts can act as boundary objects between groups, conveying information and mobilizing action (Latour, 1986; Star and Griesemer, 1989).

More specifically, some researchers have argued that objects are deeply intertwined in the dynamics of boundary crossing between different groups inside organizations, and affect the social process through which knowledge is transformed and transferred (D'Adderio 2001, 2003; Carlile, 2002, 2004; Bechky, 2003; Carlile and Rebentisch, 2003;). Because such objects, like drawings, parts, machines, etc., can be understood in more than one community of practice, they act as means to represent, learn about, transform, and transfer knowledge across group boundaries inside an organization. In other words, they facilitate the sharing of cognitive schemas thus helping solving problems (especially technical ones), and fostering collective decision making.

Other researchers have adopted a stance toward objects as repositories of organizational memory, showing how their presence and interaction can sustain processes of organizational remembering in firms operating through projects. Artifacts, such as modules of the final products, can be used by these firms, in addition to routines and social networks, to store competencies that are used across different projects (e. g. Davies and Brady, 2000; Grabher, 2004). Simple artifacts, like Excel workbooks, can be used as distributed memory systems, providing points of connection across projects, and the professional communities involved in them (Cacciatori, 2008). Finally, artifacts, in the form of toys, models, and other physical objects, may be used to facilitate acquisition, storage, and retrieval of knowledge (e.g. Hargadon and Sutton, 1997).

METHODS

In order to improve the understanding of the dynamics between artifacts and creative cognition I relied on an inductive study based on the grounded theory building methodology. This empirical study was embedded in a larger qualitative study, consisting in ten-month ethnography at the Boston branch of Continuum design consultancy from early September 2006 to the end of June 2007. The use of grounded theory building seemed to be preferred to other methods – e.g. laboratory experiments – for two main reasons: (1) the phenomenon under investigation is, for now, poorly understood, in that there seems to be no field-based investigation and account of how creative processes are supported by artifacts along the development of creative solutions in real organizational

settings, and (2) the interpretations of people involved in these processes matter for developing a theoretical framework coherent with the empirical evidence collected.

I initially began my study with an open-ended and vague research question: “How does creativity in context unfold?” Quite early on during my observations and preliminary interviews, I realized that designers made an extensive use of a broad array of artifacts, which they call “visual tools”, during their work processes. This sparked my curiosity about the different possible roles that they could perform during the creative process. Therefore, I devoted the following 9 months investigating this specific theme and collecting data accordingly.

Research Setting

Continuum is a worldwide product design and innovation consultancy located in West Newton, a suburb of Boston, MA, Milan, Italy, and Seoul, Korea (www.dcontinuum.com). Currently the second largest product design consultancy in the world, Continuum was founded in Boston in 1983 by the current CEO and President, Gianfranco Zaccai, and his partner Jerry Zindler, respectively an industrial designer and a mechanical engineer, in the belief that a better and more efficient product development process would result from tight integration and mutual empathy between industrial design and mechanical engineering. Since then, the company has experienced a continuous growth leading to the establishment of other locations all around the world, and to the integration of other disciplines, such as design strategy, and brand experience, following the logic of “a continuum between disciplines, people, perspectives, and backgrounds”, as repeated many times by the founder and the senior managers.

Renowned to the large public for the Reebok Pump shoes and for the Swiffer, in fact, during its 25-year life Continuum has designed hundreds of successful products for clients working in a broad range of industries, going from medical and diagnostic devices to household consumer products, and from computers to retail environment design solutions, thus building an extensive industry expertise in many domains. It has consistently won honors for its innovative product design. Regularly praised in the design literature and in the design community, so far it has won more than 190 awards for outstanding innovation, including more than forty Business Week Industrial Design Excellence

Awards. Successful products include the Titanium Series padlocks for MasterLock, the Evolution Series of garbage disposers for InSinkErator, the nTAG Interactive Event Data Management System for nTAG Interactive, the A-2000 BIS Monitor for Aspect Medical, Sprint retail graphic design and messaging for Sprint-Nextel, the MoGo mouse for Newton Peripherals, the Omnipod insulin management system for Insulet, the Hundred dollar laptop for MIT Media Lab, etc.

The Boston office (where the study was performed) employs over 130 product designers, mechanical, electrical and human factors engineers, design strategists, brand designers, and model makers organized in three big practices: Strategy, Product, and Brand. The Strategy group is responsible for formulating design strategies grounded in consumers' behaviors, motivations, and needs. The Product group deals with the engineering and product design work by leveraging on the understanding of customer needs and human behavior. The Brand group is primarily engaged in communicating the brand essence through the coherent design of the different elements of the corporate identity.

On the whole, therefore, they represent a multi-disciplinary group of experts working side by side with their clients to help them develop and build successful design solutions.

Projects approximately last from a few months to one year and a half, with an average of about 8-9 months. Deliverables varies a lot from project to project ranging from sketches of product concepts, to "feels like" and "looks like" models, from videos communicating a product concept to CAD databases, from "window posters" to working prototypes.

Data Collection

Over a period of ten months, I spent from 4 to 5 days per week, and from six to eight hours per day in the field. Although I often interacted with and talked to senior managers, my data collection was primarily focused on interviewing, watching and talking to product designers, brand designers, engineers, design strategists, and model makers. The reason why I adopted this focus was because my main aim was to figure out how people directly engaged in the creative process worked to develop creative solutions, and not how the creative process was conceived of by management and

support staff. In doing so, I constantly alternated between observations, and informal talks and more formal interviews with the informants. The observations and informal conversations would spark some insights that I would investigate more extensively in formal interviews. Subsequent observations and casual talks during meetings would help me corroborate the evidence collected till then or spark additional insights according to an iterative process. Moreover, formal interviews were used to capture further evidence that was not directly observable, such as individual creative processes happening in designers' minds.

Therefore, data collection relied on multiple data sources:

1. Observations

I followed as a participant observer three different development teams working on three new projects. The first project was led by the Product group and was aimed at developing a new product for the Health Care industry (from now on named project Health). The second project was led by the Strategy group and was aimed at developing a new product concept for the transportation industry (from now on named project Transport). The third one was lead by the Brand group and was aimed at developing the designs of store windows for the Holidays season for a communications services provider (form now on named project Window). I started following these projects quite early on until the end of the core design process. More precisely, I started following the first project, which lasted approximately 9 months, from the initial research phase until the final presentation of the prototype and of the product architecture to the client was made. I followed the second project, which lasted approximately 6 months, soon after the research phase was completed until the final big idea and the product concept were presented to the client. Finally, I followed the third project, which was still under way when I left the research site, from the planning of the initial big brainstorming event until the designs for the 'Back to School' store windows were put into production. I was granted the chance to attend almost all the meetings, included those with clients. During meetings, I jotted down notes, recorded the conversations and took pictures¹⁴ of people and artifacts, when allowed. I followed these projects as a participant observer. Lacking a design background, I couldn't

¹⁴ For confidentiality reasons I am not currently allowed to show pictures in this paper.

be directly involved in the design work with specific tasks, but I was always invited and welcome to share my ideas and suggestions with the rest of the team and to discuss those generated and proposed by my “teammates”, thus representing another point of view inside the team.

In addition, I had many informal conversations with managers, designers, engineers, and support staff ranging from very brief exchanges to longer talks over lunch in the Continuum’s kitchen, before and after meetings, during work breaks, and in the hallways. I also had a few spot conversations with clients after the client meetings.

2. Semi-structured interviews

As summarized in Table 1, I conducted a total of 56 semi-structured interviews: 17 were preliminary interviews with senior managers on Continuum’s history, culture, and evolution of the work process, 15 were debriefing interviews with my “teammates” during the unfolding of the projects, 24 were interviews focused on the use of objects/artifacts during the creative process with people belonging to all the three practices in proportions according to their weight – in terms of number of employees – inside the company. Almost all the interviews were recorded and then transcribed. When not allowed to use the recorder I took some notes of the conversations. Interviews relating to the use of objects/artifacts started with a description by informants of which artifacts they typically made use of during the creative process, and whether objects were used individually, in group or both. Then, they were focused on the understanding of how and when along the process these objects were used (see Appendix 1 for the Interview Protocol adopted).

Insert Table 1 about here

3. Archival data

Another source of data was represented by the written materials and objects that each of the groups used to perform and support their work. The documents included presentations, meeting minutes, project updates, and correspondence with stakeholders, meeting pictures, marker board pictures, and

design briefs. I had access to some intranet documents including the guide for newcomers, internal presentations of the practices, explanations of the company's philosophy, guidelines for project managers, maps of the development process, etc. I also observed the sketches, the thumbnails, the pictures, the physical models, the image boards, the frameworks and the presentations made by designers and engineers. This evidence proved to be useful in triangulation of data, as well as in increasing my understanding of the organizational context.

Data Analysis

Data analysis followed common procedures for grounded theory building, starting with open coding to uncover common themes and initial set of categories to break up the data for further comparative analysis (Glaser and Strauss, 1967; Strauss and Corbin, 1990; Locke, 2001). Interview transcripts served as primary data for the analysis, the field-notes written during the observations were used to reinforce the interpretation developed through grounded theory building, while the internal documents and other archival material served to increase my general understanding of the corporate context. This approach entailed an iterative process of theoretical sampling, comparing and contrasting examples from the data to build theoretical categories which were then compared and interrelated to form the basis for this paper.

Since the interview transcripts were the primary data for the analysis, I read and coded all of them. In a first stage, I conducted a microanalysis of data, searching the interviews line by line for relevant "text segments"— phrases and passages that referred to how, why, when along the process, and by who artifacts were used, as well as to the main roles that artifacts seemed to have for the informants. All these passages were initially labeled with in-vivo terms and phrases used by the informants (Locke, 2001: 65). While labeling data, two main operations were performed: (1) questioning – asking questions like: "Which objects are used? How? When? By who? Why are these objects used? How do they influence the development of creative solutions? etc. –, and (2) making comparisons – comparing incident to incident in search for similarities and/or differences. At the

same time, I jotted down several memos capturing my thoughts, interpretations, questions, and directions for further data collection and analysis.

In a second stage, following multiple re-readings of data, I gradually combined codes that, although varying in specific terms, were similar in essence, into first-order categories. These categories were associated to analytical codes – working labels induced by the researcher but that could still be considered meaningful to the informants. For instance, the first-order category “observing current aesthetic trends” grouped in-vivo codes such as “up-to-date in design”, and “trends going on” the first-order category “allowing direct experience of envisioned outcomes” grouped codes such as “walking clients through artifacts”, “helping clients visualize the ideas” and “helping clients imagine the final outcomes”, etc. This step allowed me to move from provisional to more substantive categories (Locke, 2001: 73).

As I grouped in-vivo codes into first-order categories, I started identifying some conceptual links among the emerging categories; accordingly, first-order categories were tentatively combined into fewer, broader and theoretically relevant groupings that addressed more directly the overarching question leading the investigation. As data collection and analysis proceeded, these categories were “tested” more systematically against my data base. During these rounds, I carefully scrutinized the database for data that would – or would not – fit with each emerging category or suggest a redefinition of it. Following this process, I dropped those in-vivo codes that were not supported strongly by evidence collected in the field (Corbin and Strauss, 1990: 7). After this stage, I examined again the coded data for possible further aggregation into second-order categories and dimensions. This process led to the assimilation and labeling of the code groupings at a more theoretical level. The main outcome of this stage was the emergence of three overarching dimensions of analysis: “individual sensemaking”, “collective sensemaking”, and “sensegiving”.

Figure 1 depicts the data structure that emerged through this process, presenting the first-order concepts and their relationships to second-order ones, along with the overarching dimensions.

Insert Figure 1 about here

As core categories emerged from the analysis, I turned to axial coding (Strauss and Corbin, 1990: 123) to uncover relationships among these concepts. I drew on field-notes written down during direct observations, on statements from multiple informants as well as on memos written all along the data analysis to infer possible linkages between each category.

In order to increase reliability, a large part of the analysis was conducted independently by a knowledgeable colleague, who was not involved in the field study. Independently generated categorization schemes were compared at the end of each round of coding. Discrepancies were resolved through discussion and agreement before proceeding to the following round. Moreover, triangulation among different sources helped me refine and strengthen the emerging categories until I arrived at a framework, which could be considered robust across informants.

THE ROLE OF ARTIFACTS DURING THE CREATIVE PROCESS

The analysis of how artifacts were used by designers during the development of creative solutions suggested an interpretation of the creative process as an alternation of sensemaking and sensegiving processes (Gioia and Chittipedi, 1991; Weick, 1995) happening both at an individual and at a collective level. With the term sensemaking I mean “the process of social construction in which individuals attempt to interpret and explain sets of cues from their environment” (Maitlis, 2005: 21). The term sensegiving is described by current literature as the interpretive process “in which actors influence each other through persuasive and evocative language” (Maitlis and Lawrence, 2007: 57).

More precisely, the evidence collected allowed identifying three main phases that were named *individual sensemaking*, *collective sensemaking* and *sensegiving*. In this section the roles performed and the support provided by different types of artifacts along the three phases are described. Although in principle these phases are presented and illustrated as logically distinct between each other, in practice the boundaries between them may be loose, they can be overlapping, and they are usually reiterated many times along the creative process. In this section, I rely only on a selected set of examples to

illustrate my observations and to outline the core constructs and the relationships derived from these observations. Tables 2-10 show additional evidence supporting each theoretical construct.

Table 2-10 about here

Artifacts supporting individual sensemaking

Exposure to environmental stimuli. A theme emphasized across informants was that each project was initially characterized by a period of deliberate exposure of designers to a rich set of stimuli coming from the outside world. This period of exposure usually corresponded to the beginning of a project, when designers referred to the external environment in search for inspiration and insights relying on different design research techniques (interviews, observations, focus groups, competitive intelligence, etc).

In other words, this exposure was aimed at looking for and identifying a set of aesthetic and conceptual cues directly related or just loosely related to the project under way. At this stage, indeed, the exposure was mainly free and unconstrained although within the boundaries defined by the objectives of the project.

This research was usually carried on by observing current aesthetic trends, by reviewing existing product ideas, by observing current lifestyles and patterns, and by experiencing material samples.

Observing current aesthetic trends. Many informants pointed out the importance to understand what was up-to-date in terms of shapes, colors, and other aesthetic details in order to get inspired. The search for contemporary aesthetic trends was performed by browsing books and design magazines, as emphasized by an informant:

It's all about having magazines that are this month's stuff that is going on right now. Maybe it might help you identify a trend, or maybe it just might help you understand what it is that other people are thinking of creatively. (MT, industrial designer)

A brand designer explained that the purpose of this search was not to copy already existing aesthetic solutions, but to foster the generation of new ideas:

I start looking through books and magazines, that would be just to kinda look for inspiration and anything that sparks ideas. It's not that you're going and ripping stuff off; it's just using them as a catalyst to kind of get your mind going. (CC, brand designer)

Generally performed by designers at an individual level, this activity could also be shared with the other teammates. For instance, during the project Gamma, the team leader would schedule group meetings where the four brand designers would sit in the project room leafing through design books and magazines like *Abitare*, *Vogue Home*, etc., seeking for concrete examples that could spark their imagination on how to design the new 'Back to School' store windows for their client.

Reviewing existing product ideas. Looking at products already existing in the marketplace represented another important component of the designers' exposure to environmental stimuli. This review generally related to clients' products and competitors' products. Sometimes it could also be extended to products apparently unrelated to the project at stake, but which, in the designers' opinion, could lend themselves to the development of creative solutions, as explained by an informant:

I like to look at other products, like competitors' products and clients' products and even some work that I've done in the past, for inspiration. If I know that I need to put a button, you know, on a small consumer product, and I need to have it actuated somehow, so I think about other products that do that, or also I can think about maybe another product that I've done in the past, same size of what I need to do, and I'll go back and I'll reference that. (CC, mechanical engineer)

Even in this case, the review was not aimed at replicating exactly the same functional solutions on the new product, but to spark inspiration, as the same informant pointed out:

I don't use exactly what is out there, but sometimes is inspirational for me to kind of start coming out with a new way of doing the same kind of thing or sometimes even I end up using same kind of mechanism because if it worked well the first time and we've already figured out all the kinks with it. (CC, mechanical engineer).

The project rooms of the three projects I observed, therefore, were usually full of real products – or of pictures of them – the designers would continually refer to when developing ideas or when looking for a solution to a functional problem.

Observing current lifestyles and patterns of behavior. Designers tended to rely extensively on direct observations of people in real life situations and in their everyday contexts. Visits to malls, tradeshows, stores, but also to people's homes and workplaces were aimed at understanding how

people acted in their everyday lives, how they interacted with the objects they used on a daily basis, how they managed their daily schedules, etc. Pictures and videos were the two main artifact categories used by designers to record these observations and to capture what stroke their attention at that moment.

For instance, project Transport required about a month of interviews and observations of consumers in three different locations of the United States, in order to understand their routines, their habits, and the usual interactions with the products at stake, the drivers of choice, and the key actors in the decision making, their needs, and their aspirations. The team members also engaged in some “Guerrilla observations” in mall parking lots which allowed them to film and take pictures of people behaviors while they didn’t know they were observed.

These artifacts could inspire the generations of creative solutions, as a mechanical engineer explained:

Take for example a project we’re doing now, like a monitor, so a couple of people of the team went to different hospitals and took pictures of how they were being used by users in the set-up of it, you know, in real life situations; so I guess it was inspirational in figuring out the placement of buttons, in figuring out interactions and how people are using them. (CC, mechanical engineer)

Experiencing material samples. The inspirational role of materials was emphasized by many informants. An industrial designer explained to me that being able to touch tangible samples of fabrics, wood, steel or whatever material available in the material library seemed to play an important role in sparking new and original uses of that material, as and industrial designer told me:

I do use the material library usually in the very first part, when I try to come up with an idea, and sometimes the material itself will offer some different solutions.... The Alpha project is another big example where we had foams; we were exploring the foam, which is a new material, outside of where they typically are, just to get a sense for different densities, different material qualities, and that does spark new ways of thinking about that. (MAL, industrial designer)

Another designer emphasized the support that the direct experience of different materials could play in better figuring out the feel that designers want to communicate through a certain material:

We use the material library a lot; it is full of samples of stuff that can really make you think of how you can use it for your project going on (...) you know, there are so many different feelings that you get from...that are connoted by the

different materials. It's good for us to have those samples to understand what feeling we wanna communicate and also to communicate it to our clients. (DV, industrial designer)

Responding to external stimuli. As aforementioned, during the exposure designers tended to keep track of what they saw, heard and learned, collecting a whole set of tangible evidence – pictures, videos, interview transcripts, magazines, samples of materials, products, parts and components, etc. This evidence – at this stage still an undistinguished body of cues and stimuli – was usually arranged in different types of boards¹⁵. “Image boards” collected images aimed at triggering insights for a new design language. “Mood boards” collected images aimed at conveying the overall feel of a project. “Research boards” collected pictures and text excerpts mainly resulting from interviews, observations, and desk research. “Sample boards” collected samples of fabrics, of materials, products, parts and components aimed at suggesting stimuli for materials, furnishing, and finishes. What informants converged on was the fact that they tended to respond to this flow of symbolic and aesthetic stimuli they were exposed to.

Responding to aesthetic cues. As almost all the informants pointed out, new ideas were “not pulled out of a vacuum”, but were often sparked by something that was seen, heard, touched or noticed. It could be the feel conveyed by a material, a certain detail of a competitors’ product, the general feeling expressed by an image or whatever else they “responded to”. Therefore, the whole array of the visual and tangible “tools” they relied on seemed to provide a rich set of sensory stimuli provoking unprompted and often unpredictable responses by designers. These responses, usually unfolding at an emotional level, might be spontaneous and subconscious reactions to certain shapes, colors, and textures, but might also entail a more conscious involvement as the words of an industrial designer make clear:

I think, you know, to certain designs that you put up on an image board....you know, you might be attracted to specific ones that would just be kinda of sitting there, and then there's your subconscious and there's your conscious too, and you would be responding to them as you were sketching.” (JS, industrial designer)

¹⁵ The use of these boards varied across practices according to the partially different nature of their work. Therefore, the design strategists seemed to rely more on research and sample boards; the brand designers seemed to rely more on mood, and sample boards, while the industrial designers and engineers seemed to rely more on image and sample boards.

Responding to symbolic and conceptual cues. Besides responding to aesthetic cues, designers emphasized their tendency to respond to symbolic and conceptual cues as well. In other words, some of the external stimuli they were exposed to might acquire different meanings, might stand as the symbols of something related to the project, and might help the designer to develop a certain “frame of mind” with respect to the project under way, as illustrated by an industrial designer:

I look at things, you know, the different categories, and they represent the client’s heritage, who they are as a company, where they’ve been, what they stand for, and these tools help you see them; to me they’re about, you know, non verbal communication, like ‘what are the messages?’. So each one has a meaning that you have to keep in mind when you’re doing what you do, ‘cause they help you get in the right frame of mind. (GF, industrial designer)

Also the thought provoking role of these conceptual cues was emphasized by many informants. During a debriefing interview with a brand designer involved in project Window, he pointed out how the words coming out from a big initial brainstorming event together with the images and pictures they had collected during the exposure to the external environment were stimulating insights and thoughts:

You know, sitting here [in the project space] and just looking over across all the pages and looking at all these words and at all these images...it’s gonna continue to make me think as I’m developing another idea, so the experience for me of reading all of this it’s now more than just a tool...it puts you in a different mindset. (GB, brand designer)

Original recombination of stimuli. As emphasized by previous studies, innovation, especially breakthrough innovation, seems to rely on creatively recombining ideas, people, and objects from past technologies in ways that spark new technological revolutions (see Hargadon, 2003). In a similar vein, according to informants, the aesthetic and symbolic stimuli represented the starting point of their early ideas. As a matter of fact, early ideas seemed to spring from the recombination in new and original ways of those aesthetic and symbolic stimuli they responded to both at an emotional and at a cognitive level, as a brand designer illustrated with respect to project Window:

For example, this stuff here, one of the things that we talked about was, for ‘Back to School’, the idea of kids doodling on their note-books in ball point pen, that kind of bad look of someone scribbling all over their note-books, and then we just happened to find these in a magazine and they kinda have that same look and feel, we liked them and so we pulled them back. We also talked about having a mosaic of imagery hanging in the store window, this isn’t the right imagery, but it conveys just the right look and feel of a mosaic. So, we basically select imagery that we respond to because we think best convey the look and feel of the ideas we wanna deliver on, but we never find an image and we say ‘we’re gonna do exactly this!’. You know, it’s always a combination of things that we find that represents a sort of what we wanna do. (CC, brand designer)

The original recombination of existing stimuli seem to happened both through the combination of cues and through the connection of very early ideas.

Combining cues. Many informants told me that early on in the process of sketching they tended to combine stimuli. It could be stimuli previously noticed during the initial exposure to the external environmental that “sit in the back of their mind” and influence what they put on paper, or it could be stimuli physically available on the boards that designers looked at and referenced to. During my observations I noticed that designers tended to sketch out early ideas in the project rooms where the different boards were all laid out in front of them. Even when they were sketching at their desks, they often had some images on a board or some physical objects collected during the research phase, as explained by an industrial designer:

Earlier, I was at my desk putting together a bunch of images for a project that I'm working on right now, using both the results of the brainstorm, but also using you know, what we have collected during the research; you know, what it is that I feel I need to help me be inspired and target what my pen does on paper, because without combining what you heard when talking to people, when having a brainstorm, and what you see on these images that are gonna inspire what the attributes of the product are, all you have is a piece of paper, and you're just drawing shapes. (DV, industrial designer)

As a matter of fact two different industrial designers involved in project Health, told me that the design of the product they were developing was the result of the original recombination of little details in shapes, colors, surfaces, textures, etc. noticed on the images and products available in the project room. Combining elements, differently from just copying, was illustrated as an additive process based on merging together different details to create something new and original. A brand designer illustrated what they typically do:

We don't use them to do “me-too” products. What we try to do is ...for instance, we would take, let's pretend that the word is approachable, we would take like a Jasper Morrison Coffee maker and we identify it not so much by saying “ok. Let's do this. Let's do a geometric box”, but what we do is that we analyze it and we say “what makes this approachable? Is this idea of the round corner, of the simple interface?” and things like that. We can achieve that goal of doing like maybe a softer product with less complicated interface and that's what we try to do. Because if there's products out there that achieve that already, so it's just knowing how someone else achieved it, and pretty much not taking it exactly how it is and throwing it on another product. So, it's more of like....it's more just building off of that. (MAL, brand designer).

Connecting early ideas. Besides combining cues, also connecting early ideas seemed to be important to originally recombining external stimuli.

Once the very early ideas had been developed by single designers, they started connecting them both at an individual level and with their teammates during informal conversations or internal

meetings. As many informants said, having all the artifacts collected during the exposure phase, together with very quick doodles embodying early ideas – right in front of them helped see the links between their own ideas and sometimes between their ideas and those of their teammates, and helped make the first “creative leap” from a set of stimuli to a novel recombination of them, as a design strategist explained to me:

if you have all around you, it’s like this totally streamline process where you don’t have to stop and search for something, or stop and flip through your notes and find something that you thought a long time ago, because it’s pinned to the wall right over there, and you can just immediately make that connection between that thing and this other thought that you had two weeks later that is on the wall over there (HR, design strategist)

Objectification of ideas. Informants converged on the idea that artifacts, at this stage mainly in the form of thumbnails and quick sketches, were the tangible and objectified representations of designers’ ideas. In other words, through the physical separation between ideas and persons, ideas were not anymore in the minds of the designers, but they are available in front of them, thus becoming what they frequently referred to as the “visual support” or the “physical handle” that designers could use to start figuring out whether they made sense. This point was illustrated by a mechanical engineer:

A type of sketches that I use a lot is the mechanical sketches. So, when I’m trying to figure out how a mechanism works, I do a lot of sketches on paper just to try to figure that out, figure how the movement works; those are very, very helpful for me before they can help me figure out whether what I’m thinking makes sense in reality before I get into a 3-D database (PG, mechanical engineer).

The objectification of ideas was allowed by the support provided by artifacts to three main activities: the recording, the evaluation and the comparison of ideas.

Supporting the recording of ideas. As the informants pointed out, the first support provided especially by thumbnails and quick sketches was to help designers record and fix their initial thoughts on paper. At this stage, as emphasized by many of them, it was very important to record ideas in order to allow a smooth unfolding of the creative process, as explained by a brand designer:

individually what I try to do first, and this happens in the thumbnails, is that I try to get everything out that I have right now in my head; anything, anything that I just think of immediately I just try to take it out and to get my mind going (CY, brand designer)

A design strategist emphasized the importance of capturing their initial thoughts:

So, I always sketch on paper just as a reminder to myself of everything that I thought of, you know, just to capture as many ideas as possible (KH, design strategist).

The process of “thumbnailing” thoughts and insights on paper was usually very intense early on in the creative process, but it tended to unfold all along the process itself. One day before a meeting an industrial designer involved in project Health explained to me that at first, when the design problem is still ill-defined and the ideas are fuzzy, “thumbnailing” is more devoted to convey the overall message behind the ideas, what he called “the initial overall gestural expressions”. Once the ideas start taking a more definite shape and being translated in more and more refined sketches, “thumbnailing” still happens with respect to single details, such as the edge of the back of a chair, the shape of the legs, the buttons fastening the fabrics, etc.

Supporting the comparison of ideas. Once early ideas had been quickly generated and captured on paper, designers started examining and comparing their initial ideas. Informants explained that having all their thoughts laid out on a board facilitated this comparison and the choice of those ideas that will be further developed. These decisions might be made at an individual level, but might also involve a few colleagues or the entire team. A brand designer illustrated what she was doing with a teammate:

I have a whole wall full of thumbnails right now by my desk that I did with Alex, very quick, not too detailed; we put them up, we looked at them, and we chose those that we thought were better in delivering on some purposes of the project, and now we’re taking those making them realistic to the size of the product, and then making them more presentable to the client. (MT, brand designer)

Supporting the evaluation of ideas. Thumbnails and quick sketches proved to support also the evaluation of designers’ ideas. According to informants, looking at their ideas helped them understand whether they looked right on paper as well:

they [thumbnails] are small little ideas that don’t take architecture or dimensions into consideration, you know, just something that inspires you, and you put it down just to see whether they look right or it is just in our head (MAL, industrial designer)

At this stage rough models or “mock-ups” might start coming into play. Depending on the product being developed they could be full-size or just small-size three-dimensional representations of the product-to-be. Even more than thumbnails and sketches, models seemed to really facilitate the

appraisal of what is right or wrong about early ideas, as a mechanical engineer pointed out with respect to size:

I think models are one of the most important things when you're developing a product, because it is one thing look at it on a screen or look at pictures of something, but when you actually get it in your hands it makes such a huge difference.... For instance, the placement of the hand and how you're actually interacting with it makes such a big difference in trying to make it easy to use; so sometimes you are looking at it [a monitor] and it's so big, and then when you get a model, it is much smaller and you hadn't realized that before. (DC, mechanical engineer)

Artifacts – especially models – might go on supporting the evaluation of ideas all along the process. In this respect, a brand designer explained to me how the small-scale mock-up of a store helped the team and the clients clarify some doubts before the final design of the store was approved:

Very far in the process we decided to do a mock-up of a store, of a restaurant that we did; and we also did a section through the store where we actually used the real materials, so that we could see the relationships of the materials, and the clients simply loved it, becauseit took all the insecurities away, and answered all the questions that they had and that they had been scared to ask until then.” [GB, brand designer]

In summary, many informants' accounts suggested how artifacts can effectively support processes of individual sensemaking by designers. As a matter of fact, every project seems to start with a certain degree of chaos and uncertainty represented by the broad and rich set of environmental stimuli designers are exposed to. At first designers do not yet have clear and definite ideas of what they will develop, so they look for information in the external environment moving in many directions – what Weick (1995) would call “environmental scanning”. Therefore, the collections of all sorts of artifacts that somehow capture their attention during this exposure seem to represent a first attempt to organize this indistinct and somehow chaotic stream of events and inputs.

These artifacts, then, provide designers with a tangible support that allows them to start orienting themselves, both at an emotional and at a conceptual level, towards some cues and groups of them. In other words, by responding to aesthetic and symbolic stimuli offered by artifacts designers start mentally filtering the stream of inputs they are exposed to, thus extracting and setting apart a set of cues that will be used for sensemaking, also guided by their mental models acquired during their work, their training, and their experience – a process that Weick (1995) would name as “noticing and bracketing”.

The cues noticed on these artifacts are, then, combined in new and original ways giving birth to new ideas embodied in tangible supports – thumbnails, sketches, quick mock-ups. These supports, as objectified representations of designers thoughts and ideas allow them to understand there ideas better, according to the sensemaking recipe “how can I know what I think until I see what I say” (Weick, 1995). In other words, artifacts facilitate the retrospective reconstructions of the set of cues previously noticed and extracted by designers, thus allowing them to start making sense of the initial puzzle.

Artifacts supporting collective sensemaking

Supporting collective interpretations. Another theme emphasized by informants was the support provided by artifacts – in the form of designers’ sketches, of quick mock-ups, but also of boards – in sustaining common interpretations among the members of the team. All along the creative process, designers alternated between periods of individual work and periods of group work when they would share their ideas and their individual interpretations about how the design problem was going to be solved, how the product-to-be was going to look and feel like, etc. In order to support collective interpretations artifacts were used to spark conversations, to explain designers’ personal interpretations, and to elicit multiple and different interpretations.

Using artifacts to spark conversations. What informants frequently pointed out was that artifacts, when used in a team setting, could facilitate dialogue and conversations among teammates. Being external representations of designers’ ideas and thoughts, they seemed to offer the material support around which discussions and explanations were woven. An industrial designer emphasized the importance of having visual imagery when talking about the design attributes of a future product:

You know, we had to develop this product that is in between a medical device and a beauty product, and we had to figure out how consumers wanted this product to look like. We didn’t know if they wanted it to look very safe and medical or if they wanted it to look more familiar, more like a beauty product. We figured that out through a lot of discussion among the teammates, actually looking at and pointing to images of other things. So we do a lot of....do you know the visual library? We do lot’s of that sort of things. So what makes something look safe, what makes something look medical or professional, using examples of existing products, and then we try to incorporate those aspects into our drawings. (JS, industrial designer)

Many of the meetings I observed were almost entirely devoted to talk about the message conveyed by some images put up on a wall, the feel of a certain fabric, the resistance of a material, the working of a mechanism physically available in front of designers, the attribute associated with a particular shape noticed in a sketch, the behaviors of some consumers watched in a video or in a picture, the needs they have expressed during an interview, etc. In these meetings, artifacts served both as triggers and as reference points of the conversations unfolding.

Using artifacts to explain personal interpretations. According to informants, referring and pointing to real artifacts in front of them not only facilitated conversations, but also made explanations easier and everyone's ideas accessible to the rest of the group. During informal design reviews and during working sessions, each member of the team shared their ideas with the rest of the group, explaining them by the use of a visual or a tangible support, as explained by a brand designer

You know, you have to be good at 'selling' your ideas; you have to know how to talk about your ideas; they have to be substantial, so having visual tools... I think that helps support them [the ideas] (CY, brand designer)

Images, sketches, or real products were used by designers not only to illustrate their own ideas, but also to explain how they had developed certain interpretations, as an industrial designer involved in project Health described:

If I have a certain idea of how the chair has to look like and of the materials to use I can put pictures up on the wall to illustrate the materials, you know, and the materials treatments and the manufacturing process. And if I want to explain why I don't want to do a plushy chair, I can point of an image and say 'You know, this more plushy chairs up here might feel too big, or it might feel inappropriate for a hospital'. So, you know, it's that kind of things, so it's all about having visual imagery to talk about and to refer to as you develop a design. (AM, industrial designer)

Using artifacts to elicit multiple interpretations. As the informants pointed out, artifacts also proved useful in stimulating different interpretations. Every designer is naturally going to have "their personal take on the project", and to express a different point of view even with respect to the same artifact. A designer's sketch or a particular image on a board may be seen and interpreted from different perspectives and may, then, acquire different meanings. At this stage the richness of the different interpretations seemed to be highly appreciated and even encouraged, as some of the project leaders told me during informal talks. One way to elicit multiple interpretations using visual

artifacts was by setting “visual library meetings”. The visual library is a visual brainstorming technique aimed at developing a set of images that in the designers’ view might be associated to one word, usually representing a design attribute of the product (e.g. energizing, safe, approachable, etc.). During these meetings the whole company is invited to participate and to bring images, pictures, or physical objects that they think best communicate that word. An industrial designer explained to me the importance of having in these meetings people coming from different backgrounds:

It is important to bring in as many different perspectives. People from different backgrounds see things in different ways, you know, we don’t get just designers, we also get people from the front desk that, you know, are also creative in their own ways you know, even if they’re completely linear thinking there’s a lot of value to the way different people think, because ultimately, when we’re putting something out or when our client’s putting something out in to the market that we designed for them is for people of all different thoughts and backgrounds. We wanna make sure that we come up with the smartest solutions (KY, industrial designer)

Developing a common interpretation. Another theme emphasized by informants was the need to develop a commonly shared understanding of the design problem. In other words, after stimulating diverse personal interpretations, it was important for the team to condense this richness of many points of view into an agreed upon interpretation. This usually involved a negotiation process supported and facilitated essentially by group boards—collecting an initial selection of the artifacts developed individually by designers— and rough three-dimensional models. A mechanical engineer told me how models proved to be useful bargaining tools when developing a common understanding, especially when dealing with another practice:

And even when working with the designers, I think it’s really important for them to see a 3-D model, because you can see together the ergonomics and the aesthetics. We had this project, and when we were doing that, we made models all the time. So, I worked on that one and we were so, so tight on that; so, we kept growing it and we made models of it, and designers would be like ‘no, it’s not the intent of what it need to look like’, but when you show them the inside of it and how the boards were really pushed out, and how the boards were fitting in there, it was easier for them to understand why we needed to grow certain things as opposed to just saying ‘well, we need to grow up, believe me’. So it’s a kind of a bargaining tool I think. It works very well. (PG, mechanical engineer)

During this negotiation process artifacts were used by designers to exchange feed-back, as reminder of evolving group interpretations, to build on each other’s ideas, and to reconcile the different interpretations.

Exchanging feed-back (connecting). As informants explained, sketches acted as trigger of mutual exchange of feed-back. Internal design or creative reviews had the purpose of looking at the work done at an individual level by designers and commenting on it. Designers would express what they

liked and what they didn't like about their teammates sketches, what they thought worked and what they thought didn't work. As explained by a brand designer, this could also happen informally, when a designer stop by another designer's desk to ask for an opinion:

It just happens sometimes that I'm sitting with people who are on my team, like I sit around them; we're obviously sketching at our desks, but sometimes we'll stop at each other's desk and we'll share those sketches with each other, just 'hey! What do you think about this idea? What do you think about this other idea?' But again, we are not like really sketching side by side, but we'll talk about while we're doing it. (EY, brand designer)

Even physical models might prove useful in stimulating opinions inside the team, as explained by a human factor engineer:

I think it is very important for the whole team to be involved in the building of models and to see them, because, one, when you're building the models you learn a lot from them, so I think it's important because there's more than one engineer on a project, and usually there's different portions of it, but everything has to work together, so it's really important for them to see your portion you're working on and see how it's working out, and you get feedback from them. Someone might say, you know, 'Maybe if you change the location of a certain feature, this can work better'. So, again, looking at the screen is something, but when you have a 3-D object in front of view is much easier to explain to somebody you're working with as well as to get feedback from them. (BS, human factor engineer)

During my observations, I noticed that by exchanging feedback designers start seeing the links between ideas coming from different people inside the team, start noticing similarities and overlapping areas, and begin roughly connecting them, thus taking the first step towards the development of a common interpretation, as confirmed by a brand designer:

The sketch is like people adding their input, more and more few other input, and we see for common threads that are coming together (GB, brand designer)

Building on each other's ideas (combining). The exchange of feed-back, along with the identification of potential links and similarities between ideas, was usually followed by the combination of different ideas leading to ideas and physical artifacts – sketches, drawings, renderings, or models –that are more derivative of group collaboration:

So, there's a lot of thumbnails, there's a lot of individual concepts and ideas, and the sketches are combinations based on commonalities or things that kind of...like somebody might say 'oh! I really like this sketch with the idea of transparency in that little thumbnail. Can we combine that with this?', and then we combine those two things together and it becomes a bigger sketch (GB, brand designer)

In other words, the development of a common interpretation through the combination of ideas seemed to happen in parallel with the physical construction of more and more refined artifacts, as explained by another brand designer:

if I consider this as a ladder, then t, as you go on, this [thumbnail] is personal, this [sketch] is more social, renderings are even another step more social or more integrated with everybody's thinking, because the renderings have typically been developed from several renditions of sketches in the group by more people, and then the drawings are generated from many approvals from renderings, so more and more people...it's like a pyramid, as you go down the list, more and more and more people have reviewed and been involved. So, they become much more social as you go from thumbnails to drawings. (CY, brand designer)

Interestingly, many informants pointed out that the combination of ideas by building off of each other seems to be fostered by having project rooms exclusively dedicated to a certain project where to collect, preserve and display all the artifacts related to that project. Very often these rooms were compared by informants to the combination of "their brains". Therefore, the possibility to "look at other people's thoughts and ideas" allows designers to more easily and quickly see the commonalities and combine ideas together, working as a catalyzer of the creative process.

It's very hard to work at your desk by yourself, because it's like designing in a vacuum. Project rooms are the anti-vacuum, you know. It's a sharing of ideas. It's all these things we're talking about coming together to help you create something. And it's also communicating between the team members, because I could put something up in here that could totally change everybody's attitude towards something. It's a shared experience (GB, brand designer)

Using artifacts as reminders of evolving group interpretations. The process of developing a commonly shared interpretation inside a team could take from a few weeks to many months depending on the project. During this period of time, designers could be engaged in more than one project, sometimes relating to completely different industries. It might happen, therefore, that designers lost track of the unfolding of the group thinking. In this respect, as informants pointed out, the artifacts collected in the project room served as reminders of the evolving group interpretations, as "stakes in the ground" supporting their memory and helping them stay focused on the project under way, as illustrated by a design strategist:

When you're working on multiple projects, and you have so many different things going on, it's nice to have a project room, because when you go into it, it puts you into that frame of mind, it puts you back into that experience, it might make you recall things that you forgot, it might make you see something in a different way, it might make you catch something you didn't see before. (HR, design strategist)

Reconciling multiple interpretations. Artifacts, as the informants converged on saying, might also facilitate the reconciliation of different interpretations into one agreed upon perspective, by gaining clarity inside the team, and solving possible misinterpretations, especially when teammates have

different backgrounds, as explained by a brand designer with respect to a rough small-scale model of a restaurant:

In Captain D's the perfect example was that, you know, we developed some concepts, and Craig did these really high-end 3-D renderings, and they were great, and they were beautiful, but other people on the team, especially me because I'm not a 3-D person, I'm not used to thinking that way, I didn't really have a grasp of what would have really meant if you were in the environment, because I was looking at these flat pictures all the time. And it was hard, because you could only see a certain view at a time, you're not in the space, you know, so when we decided to build a model, that was after the renderings, all these things started coming to the surface, like "oh, I didn't know this was really here, I didn't know this was in your view when you were looking at these". You know, so, doing that rough model, it was just a rough working model for us, it wasn't even showed to the client, but it was so really helpful, so that the whole team could be sort of gathered around this little thing and work it out, as opposed to Craig being by himself doing these renderings. (CC, brand designer)

Reconciling different interpretations by using artifacts proved to be important also before presenting to the client, in order to make sure that all the team members agree on the message conveyed, as explained by an industrial designer:

If the team is giving a presentation to the client, and we're really trying to organize that we make sure that the message that we give is consistent, then I'll get together with the team and we'll do little thumbnails just to try to organize and try to figure out what it is that we're gonna be working on, like what pages, what content, and what we're gonna be talking about. (MAR, industrial designer)

In summary, informants converged on emphasizing the support provided by artifacts in processes of collective sensemaking engaged in by teams of designers. As mentioned above, artifacts as tangible representations of ideas, provide the material support around which talks, discourses, conversations, and explanations are woven, thus facilitating the sharing of ideas among designers. Artifacts seem to mediate the social contacts and interactions taking place among teammates, thus becoming vessels of socially constructed meanings. Indeed, as the project goes on, the artifacts progressively acquire collective meanings, as the result of the collective interpretations and explanations of sets of cues, coming from different sources, by the teammates. Put it differently, through the conversations woven around them, these objects start "making sense and speaking" to those people who are actively engaged in the project, allowing them "to be on the same page" and to develop a common interpretation. More specifically, artifacts become "*conversation pieces*" that guide the collective process of interpretation and meaning construction of the ideas that unfolds in parallel with the physical construction of the artifacts themselves.

Artifacts supporting sensegiving

Reconciling differences in cognitive and symbolic references. For a design consultancy an important part of the creative process, as revealed by informants and also confirmed by my observations, was the sharing with clients of the creative solutions developed by the design team. These moments of sharing were frequently repeated along the process. Usually at the end of each phase of the development process the design teams would set up a client meeting. In these meetings, as mentioned by designers themselves, while presenting the creative solutions developed until then, it was also important to fill any gap existing between clients' cognitive and symbolic references and designers' ones. This proved to be particularly important especially when dealing with clients lacking a design and a visual background. Artifacts provided their support in facilitating this reconciliation, as explained by a mechanical engineer with respect to three-dimensional models:

Our clients are not always engineers. Every once in a while you can have a marketing person in front of you, maybe you reach a very important milestone and you have to make a big presentation. That's when the models are more important. Because, when you are an engineer, you can kinda talk way through things and people understand it more, but when somebody who's not technical comes to a meeting models are extremely, extremely important or just something physical for them to understand it makes it much easier. (DC, mechanical engineer)

More specifically, this reconciliation is allowed by using artifacts to share symbolic references of thought processes, and to make designers' interpretations explicit.

Sharing symbolic references of thought processes. Informants converged on saying that during client meetings artifacts – pictures, sketches, models, frameworks, storyboards, videos, etc. – helped them share with clients the symbolic references they used while developing their ideas. In other words, through the display of these artifacts and the narratives woven around them designers were able to share the whole context in which the creative solutions are embedded.

This way they could more easily transfer to clients – who were not involved in the process of meaning construction – the meanings that these references had acquired for designers along the way, as well as the meanings ascribed by them to the creative solutions. As a design strategist explained to me, storyboards – merging together in the same artifact visual and textual information – could be really helpful in that respect:

Everything contained in the project room is definitely meaningful, it's your creation, it's your ideas, it's your thoughts, yours own and your team's. It's growing, it's alive, and hopefully from what's on the walls they will bloom into a great

product. So, I think it's very meaningful. I think to clients it might not be the same kind of meaning. So...If we realize that they don't get the meanings we attach to them, we may try to use another method. Maybe we can try to use the storyboards. You know, it depends on what the issue is, and what they don't understand, but I think storyboarding is pretty successful. We have used it both with sketches and with photographs of each step to tell the story behind the solutions we were presenting. (PB, design strategist)

A mechanical engineer emphasized the need to combine the display of artifacts with verbal explanations when trying to convey certain meanings to clients:

It's always a hard bounce because you want the images to be able to live on their own when they go back, but I also think there's a few things missing. So, I think you do that, I mean you put images together or you put those stories together so they can understand the basics of it and then it's more the face-to-face that gets into the deep details of everything and helps them truly understand what are all those images and what that stories actually mean. (CC, mechanical engineer)

It is interesting to notice that the sharing of the symbolic references relying on physical artifacts and narratives proved important even with new members of the team, as explained by a brand designer:

if I had to go into and even work with another team on something that I don't know anything about, it definitely takes from a few days to a week to get up to speed or really understand what's going on, because I'd say some of them [the artifacts] do have meanings for me, and some I would have no idea of what they're talking about, 'cause they're so deep into some aspects of their projects that I have no idea of what they're trying to solve, and I don't even know what the goals are. So, the visual tools are not instant, like they're useful, but they're not instant things. So, they kind of need some kind of narrative around them to start becoming meaningful. You know, most of them, they can't just speak for themselves all the time. You know, it's all about the person that has expanded it explaining it to you. I think it's a combination of both those things that really brings it to life. (CC, brand designer)

Making interpretations explicit. As the informants emphasized, artifacts supported them in making their interpretations clear and explicit to clients. By physically showing them the artifacts collected or created during the process, clients could more easily identify the different steps of the designers' thought process, and understand how and why designers developed those interpretations. During an informal talk, a mechanical engineer told me that although they frequently have conference calls with their clients, they prefer having face-to-face meetings when they reach a milestone in the process and they have to present the creative solutions developed until then. Another mechanical engineer confirmed this point adding that the set up of the meeting room is usually aimed at facilitating the clients' understanding of their mental schemas:

That's the reason why, when we have a meeting we set up the room with a whole bunch of stuff: models, pictures, boards. That absolutely facilitates their understanding of what's going on, of how and why we've come to those conclusions and those results. Having pictures and models in front of them helps them to understand the process we went through, what's happened....it just makes it more clear. (PG, mechanical engineer)

Compensating verbal limits and lack of a design background. According to informants, artifacts might prove useful also in compensating language shortcomings as well as in compensating the lack of a design background in clients. Not always designers dealt with clients having a design or an engineering background. Sometimes, especially in big official presentations, their counterparts were marketing managers or sales managers. In these occasions, visual and physical artifacts could both allow a direct experience of the envisioned outcomes and supplement verbal explanations, as pointed out by a brand designer involved in project Gamma:

We're looking at store windows here as opposed to a pile of ideas represented by bullets points in a PowerPoint. I think this is what makes it real for them...we can talk and talk as long as you want about what we were thinking, but until we show them they're not gonna get that potentially. And, you know, they're pretty savvy. Like, a lot of times I've had to do with clients and they are just really like thick when it comes to use their imagination, and to try to visualize things. So clients can be so literal, you know, they need to see it in order to understand it. They can't just imagine it. (CC, brand designer)

Allowing direct experience of envisioned outcomes. As informants revealed quite consistently, visual and physical artifacts might facilitate the transfer of the meanings ascribed to them by designers. As mentioned above, the frequent lack of a design background by clients often prevented them from imagining or visualizing how the final product was going to look like and work. Therefore, the direct experience of artifacts, representing the envisioned versions of the final product, combined with the narratives woven around them, allowed clients to really understand the essence of the ideas behind them. In this respect, a design strategist explained to me the support provided by storyboards in "walking clients through" the envisioned outcomes:

Storyboards really help paint the picture of what the clients could expect from the product we're developing or the idea...it really brings it to life when you put it in context. In a way, if you don't have say a prototype or even a mock-up, but all you have you have it's these images to work with because you're still in the development process, then storyboards kind of walk a client through that scenario and help it become just a little bit more real. (HR, design strategist)

Furthermore, a human-factor engineer told me that physical models that can be touched and tried out by clients may allow them to adopt the consumers' perspective and to understand why a certain product needs to have certain features, thus facilitating also the decision process:

Often for us the battle is informing the client and getting them to understand why we need a particular device that we're working on, why we need, for example, a stand that is adjustable this far on this machine for blood collection. (...) So, these [two mannequins] are two completely different people with completely different reaches, and visual access, and what this person can reach on, and what this one can reach is very, very different. And people in general, really can only look at things from their own perspective, they can only really relate to things from their own perspective, and in this case, the client, one of the head people on this project, is a very, very tall woman, so she doesn't understand what shorter women are having to deal with when they are using some of these products that are sold worldwide. So, this is a big

“show and tell” piece. We can do this analysis in other places, and I can do it in CAD and I can do it Excel, showing them the numbers and saying ‘you know, this needs to be this high up more’. But this piece is essential to showing and getting them to understand why they need it.....more than a bunch of numbers or some data.....absolutely... (BS, human factor engineer)

Supplementing verbalization. As emphasized by many informants, in order to effectively communicate to clients their interpretations and the messages of their ideas, verbal explanations were not sufficient. Because of the very nature of the ideas communicated, language needed to be supplemented by visual and physical artifacts, as explained by a brand designer:

Having all these visual aids is really important, because I think that also helps us communicate with our clients. Because, you know, we’re dealing with a lot’s of things that are hard to express. So sometimes it’s easier to point to an example and say ‘this is kind of what we think it should be’, rather than using words. (CY, brand designer)

Although very often clients were not “visual people”, that is people used to thinking in visual terms, and although they should be more familiar with words than with visual information, when verbal explanations were supported by artifacts, according to informants, the communication was faster and more immediate, and clients’ understanding was more thorough, as emphasized by a mechanical engineer talking about the handle of a medical device:

I can tell you right now that on a PowerPoint this is even easier to use, but they [the clients] don’t understand that until they actually feel it. I can tell them ‘you know what? This is likely to slip out because in here it’s reduced slipping, right?’ But until they could really see it, it’s just words on a piece of paper or on a PowerPoint screen (PG, mechanical engineer)

Guiding clients’ interpretations. Client meetings also provided the chance for designers to shape and somehow influence clients’ interpretations towards a preferred direction. Working as consultants, the design teams were asked to provide their clients with what they thought the best solutions to a certain problem were. Even though the final decision was generally made by clients, it was not uncommon and surprising that clients often tended to choose the designers’ preferred solutions. This is not to say that designers acted in bad faith or out of self-interest, but they try to convince the client to adopt a solution they really believe is going to prove successful in reality. Many times, before official client meetings or the informal weekly conference calls, I heard the designers talking about how to convince the clients that “they were going down the right path” and how to dissuade the clients from taking a direction they thought would be the wrong answer to the clients’ needs.

Typically the purposeful selection of the artifacts shown to clients and the suggestion of a preferred interpretation seemed to be, on the basis of what the informants said and of what I observed, the two main ways they tried to influence clients' interpretations.

Purposefully pre-selecting ideas. Before each client meeting, the meeting rooms were set up on the basis of a previous selection of the ideas and of the artifacts collected and created by designers. In other words, not the whole content of every project room was brought to a client meeting, but only a careful selection of it. With the exceptions of few cases – like project Transport where the counterpart on the client's side was frequently involved during the working sessions held in the project space – clients did not necessarily see the project spaces. The decision was generally up to the project leader depending on some variables, such as their level of confidence in the solutions developed, or how far along the process they were. Anyway, the type of client they were dealing with proved to be a key driver of choice, as clarified by a brand designer:

And if it is that they are not designers I don't think they would have an appreciation for the early sketches. It depends a lot on the audience you have, because again it comes down to, you know, the kind of personality that you're dealing with, because if they're very detail focused kind of people and they are very interested in your process, maybe they wanna see it. Some people just want the answer, and they just wanna move on. It's not in their interest. So, it depends again on the client. (MC, brand designer)

An industrial designer explained to me the potential danger of showing to clients the thumbnails and doodles developed early on in the process, which designers call "the dirty work":

It's rare to show thumbnails to a client. Although sometimes we can do it at the very end, you know, as a way to sort of, showing them our dirty work and I don't necessarily agree with it, but some managers like the idea because that shows how much work went into it, so it doesn't look like we just kind of fold one idea out. The danger is that they may see things that you didn't take into consideration. So they can say 'oh, I saw that little sketch back here and I wanna see that one'. So that's kind of a danger of presenting everything, because it's kind of your way of guiding the process, because clients will listen to what you say but most of the time it's kind of their decision. So it's kind of your way of controlling the process a little bit. (GF, industrial designer)

Suggesting preferred interpretations. As mentioned above, although exploring different creative solutions embodying different interpretations, the design team tended to identify one or a few preferred interpretations they believe in most. Therefore, when interacting with their clients they would be naturally inclined to sustain these interpretations.

During many of the meetings I observed, the clients would explicitly ask designers to suggest “their favorites”, the ideas that they would pick if they were in the clients’ shoes. The designers usually know that, and before meetings they talk about everyone’s favorite ideas and try to align themselves on one or two preferred ideas.

In summary, informants’ accounts suggested how artifacts can sustain processes of sensegiving from designers to clients. Also when interacting with clients, artifacts provide the material support that through narratives and storytelling triggers and sustains the transfer of the meanings of the ideas developed by designers (senders) to clients (receivers). Specifically, by reconciling differences in cognitive and symbolic references, and by compensating verbal limits and the lack of a design background, artifacts acts as a common ground facilitating the reduction of equivocality, and possible misinterpretations. Furthermore, by guiding clients’ interpretations drawing upon a purposeful selection of artifacts presented, and the suggestion of their favorite solutions, designers can influence the sensemaking and meaning construction of clients toward a preferred interpretation of the problem at stake (Gioia and Chittipedi, 1991). In this respect, besides the careful selection of artifacts on display, also the frequent conference calls with the clients, the mid-phase and final-phase reviews, the creative concept sharing meetings, the design reviews, and the “ad-hoc” set up of the rooms are all sensegiving strategies in guide clients’ interpretations and meaning construction, and to focus their decision making process.

DISCUSSION

In this paper, by drawing on a systematic empirical study, I developed a grounded understanding of the uses and supportive roles of artifacts in the development of creative solutions. Figure 2 summarizes the conceptual framework emerging from data. It presents some theoretical constructs mostly drawn from existing literature, but also highlights some new relationships among them along with the artifacts mostly used at each step.

Insert Figure 2 about here

The remainder of the discussion is devoted to highlight the contributions of the paper with respect to three main streams of literature: literature on creative cognition, literature on organizational artifacts, and literature on sensemaking and sensegiving processes. Finally limitations of the study are discussed.

Literature on Creative Cognition

According to some scholars in this field (e.g. Finke *et al.*, 1992), the basic cognitive processes related to creativity may be explained in terms of a succession of generative phases and exploratory ones. In the initial, generative phase, creative people construct mental representations, the so called preinventive structures, having various properties that promote creative discovery. These properties are then exploited during the exploratory phase in which creative people seek to interpret these preinventive structures in meaningful ways. These preinventive structures can be conceived of as internal precursors to the final, externalized creative products and would be generated, regenerated, and modified throughout the course of the creative exploration.

The informant's accounts collected converged on highlighting the role that artifacts have in supporting the comparison and the evaluation of ideas, thus guiding the further development of these ideas in more refined creative solutions along the creative process. Generally speaking, this evidence seems to confirm and emphasize the role attributed to the pre-inventive structures pointed out by Finke *et al.* (1992). As a matter of fact, the artifacts used by designers during the creative processes seem to play a key role in creative exploration and discovery.

Nevertheless, the findings of this study seem to expand previous research by suggesting some additional elements with respect to the role of preinventive structures that, if further confirmed in future research, could enrich our understanding of them. A first additional element provided by empirical evidence relates to the internal feature of these structures. Differently from the view of preinventive structures as internal mental representations of creative thoughts, informants seemed to converge on the ideas that it is the very objectification of their mental structures in material artifacts

that allows guiding the further creative exploration and refinement of ideas. In other words, the externalization of designers' thoughts and their materialization in tangible artifacts facilitate, through different iterations, the development of the final creative solutions. These insights seem to be confirmed by previous studies in the realm of cognitive psychology (e. g. Magnani et al. 1999) showing how the physical manipulation of material objects may guide creative and scientific discovery.

A second characteristic of the preinventive structures on which the empirical evidence collected seems to cast light on is represented by implicit meaningfulness. According to Finke and colleagues (1992), preinventive structures are characterized by implicit meaningfulness, as if they had a hidden, underlying meaning to them, which encourages further exploration and search. In their view, this implicit meaningfulness is the natural and coherent consequence of the structure of certain forms. On the opposite, the insights provided by this study seem to suggest that the meanings attached to artifacts are socially constructed by designers (Berger and Luckmann, 1966). Interactions and conversations woven around artifacts allow the construction of meanings that are commonly shared by those participating to the meaning construction itself. This implies that the same artifact representing the same structure of forms will acquire different meanings for different group of designers.

Finally, one of the assumptions of Finke *et al.* (1992) is that the most basic and recurrent types of generative processes consist of the retrieval of existing structures from memory and the formation of associations among these structures. In a similar vein, the empirical evidence collected seems to suggest that artifacts, especially but not exclusively those collected during the exposure to the external environment, can trigger inspiration and spontaneous generation of early ideas, as they provide designers with sensory cues and visual reminders (Hargadon and Sutton, 1997) that can be recombined in new and original ways leveraging on different thought processes (Gentner, 1983; Runco, 1991). Furthermore, findings contribute to enrich existing research by casting light on the role of both aesthetic and symbolic cues in triggering those cognitive processes that allow the original recombination of past knowledge. In other words, findings seem to suggest that the responses, both

emotional and cognitive, to a set of cues extracted from the environment activate the retrieval of existing knowledge from short-term and long-term memory.

Literature on Organizational Artifacts

The findings emerging from this study also contribute to increasing the understanding of organizational artifacts, as they suggest two additional roles played by artifacts inside and across organizations (see Table 11).

Insert Table 11 about here

So far research on organizational artifacts has mainly focused on the role played by artifacts as (1) identity markers, (2) status symbols, and (3) boundary objects. As identity marker, artifacts may support the construction, the expression, and the affirmation of professional identities, allowing the members of the organization to signal their own professional identities to others inside the organizations (e. g. Pratt and Rafaeli, 1997; Rafaeli et al., 1997), as well to categorize the professional identities of others into existing professional categories (e. g. Elsbach 2003, 2004, 2006). As status symbols, artifacts may sustain the processes of construction, definition, and stratification of the complex structure of the social relationships making up a social system. Also in this case, artifacts allow the members of a group to signal their membership status in a particular social milieu (e.g. Mauss, 1976; Douglas and Isherwood, 1979), such as an organizational subculture or occupational community, but also to classify others into pre-existing social and/or cultural categories (e.g. Mc Cracken, 1988). Finally, as boundary objects, artifacts may facilitate knowledge transfer and transformation across groups and organizational units, allowing the sharing of different cognitive schemas among occupational groups in organizations, and helping solving problems and making decisions (Carlile, 2002, 2004; Bechky, 2003a; Carlile and Reberntsch, 2003;). Although any artifact is likely to load simultaneously on different dimensions, organizational artifacts seem to acquire an important symbolic value for the members of an organization, with the exception of boundary objects, which appear to have a more prominent instrumental function.

My findings suggest two main roles that artifacts can play in the unfolding of the creative process: (1) they can act cues for *creative sensemaking*, and (2) they can support sensemaking.

Creative sensemaking, defined as the cognitive activity of generating new and original interpretations based both on the attempt to make retrospective sense of sets of cues from an ambiguous environment – according to the classic sensemaking theory (Weick, 1995) – and on the responses to these cues. Initially, new projects are often characterized by design problems that are ill-defined and somehow unclear. At this stage, many different interpretations of the problems might be plausibly generated, and different directions might be reasonably taken by designers to solve the design problems. Therefore, designers tend to retrospectively interpret the set of cues collected during the exposure phase with respect to aesthetic trends, existing products, consumer needs, and available materials by developing early plausible explanations driven by their responses to these cues. As already explained in the findings sections, some artifacts, mainly those naturally encountered by designers during the exposure phase, provide designers with a set of sensory cues and insights that designers tend to respond to both at an emotional and at a conceptual level. Emotionally, reactions can be spontaneous and visceral arising from subconscious responses to certain shapes, colors, and textures, and/or secondary emotional reactions entailing strong attention and involvement (see Bloch, 1995). Cognitively, when exposed to this broad set of sensory cues, designers become aware of the fact that some of them have struck their attention and they start grouping them in their minds for closer attention, thus somehow placing them into some kind of frame – i.e. “noticing and bracketing” (Weick, 1995). This way, designers by combining relevant cues and connecting their early ideas can recombine in new and original ways those aesthetic and symbolic stimuli they responded to, thus generating new interpretations. In this respect, therefore, findings seem to emphasize the key role of the aesthetic dimension of artifacts in actuating creative sensemaking.

As designers engage, individually and in groups, in creative sensemaking, they start physically building new artifacts embodying the early developed ideas. These newly constructed artifacts sustain and guide the further development and refinement of interpretations – ways of perceiving and understanding artifacts. As external, objectified, and tangible representations of designers’

interpretations, these artifacts seem to help them better understand, and explain their own interpretations. In other words, the physical construction of artifacts representing personal interpretations allows the transformation of subjective interpretations into something more tangible, thus helping designers understand whether their interpretations really make sense in reality. Since according to Weick (1995) action shapes cognition, the very act of creating an artifact starts the sensemaking processes both at an individual and at a collective level. More precisely, at a collective level artifacts sustain and promote the development of a common interpretation – a way of perceiving the artifacts shared by those participating in the development. Put it differently, they support the ongoing collaborative process of social construction of the meanings attached to the artifacts themselves. In this respect, therefore, they acquire an important symbolic value for those taking part in the meaning construction. Nevertheless, reaching beyond symbolism, the findings importantly highlight the instrumental role that such artifacts play along the creative process. Even before being vessels of individual and collective interpretations, they are tools used by designers to better accomplish their tasks and to more effectively reach their goals. As already emphasized in the findings section, artifacts allow the ongoing evaluation and refinement of ideas all along the creative process, facilitate internal alignment among the team members, foster external agreement with clients and other key stakeholders, and guide the decision making process.

Literature on Sensemaking and Sensegiving

According to Weick *et al.* (2005), “sensemaking involves the ongoing retrospective development of plausible images that rationalize what people are doing (...) and unfolds as a sequence in which people concerned with identity in the social context of other actors engage ongoing circumstances from which they extract cues and make plausible sense retrospectively, while enacting more or less order into those circumstance” (2005:409). Previous research on this topic has shown that sensemaking activities can help top managers to significantly influence strategic change and other key organizational decisions (e. g. Gioia and Thomas, 1996; Thomas, Clark and Gioia, 1993), and can affect how other stakeholders construct their identities (Pratt, 2000), preserve the

image of their organization (Dutton and Dukerich, 1991) and respond to organizational crises (Gephart, 1993).

The term sensegiving, coined by Gioia and Chittipedi (1991) describes the “process of attempting to influence the sensemaking and meaning construction of others toward a preferred redefinition of organizational reality” (1991: 442). As displayed by previous research, this process is used both by leaders (Gioia and Chittipedi, 1991; Corley and Gioia, 2004) and by other stakeholders of an organization, including middle managers, directors, and other employees (Maitlis, 2005; Maitlis and Lawrence, 2007).

A central feature of both these processes is the dominant role played by language, talk, and communication. As emphasized by Weick (1995) “sense is generated by words that are combined into the sentences of conversation to convey something about our ongoing experience. If people know what they think when they see what they say, then words figure in every step”. Therefore, the creation of meaning, both individually and collectively, unfolds through words. By the same token, language, and in particular evocative and persuasive language, is important in sensegiving processes. As a matter of fact, narratives, storytelling, metaphors, and visionary images are counted among the most efficient strategies to influence the meaning construction of others (e.g. Gioia *et al*, 1994; Dunford and Jones, 2000).

In this respect, the findings of this study contribute to expanding literature on sensemaking and sensegiving processes by suggesting that artifacts sustain the construction of meanings as well as the transfer of these meanings to external parties (in this specific case mainly clients and other relevant stakeholders), complementing verbal forms of communication. More specifically, artifacts seem to facilitate two main activities of sensemaking and sensegiving: (1) retrospective interpretation, and (2) articulation.

According to Weick (1995) sensemaking is retrospective by nature, that is people use retrospect “to make sense of the situations in which they find themselves and their creations” (1995: 15). The informants’ accounts showed how artifacts, both those naturally encountered and those built by designers, can help designers to make retrospective sense of their own ideas. In other words,

designers need to justify any concept or idea they generate first of all to themselves, and then to their teammates and to their clients. In this respect, artifacts prove useful because, through the material objectification of ideas, they allow to capture and to crystallize those external stimuli that have triggered the early interpretations, and to keep track of the different stages of the emerging interpretations. This happens both at an individual and at a collective level. When working in groups, artifacts are used to retrospectively explain designers' personal interpretations to the rest of the team, but also to further elicit different retrospective interpretations of artifacts that designers directly see and experience when interacting with each other, and to remind the team members of the evolving group interpretations. When dealing with clients, retrospective interpretation is actuated by sharing with them the symbolic references of the designers' thought process, and by making their interpretations explicit. This way, designers can retrospectively "walk clients through" the evolving path of their interpretations, thus facilitating the transfer of meanings and influencing the clients' sensemaking.

Strongly connected to the role of communication in sensemaking and sensegiving, is the activity of articulation. Weick et al. (2005) define articulation as "the social process by which tacit knowledge is made more explicit or usable" (2005: 413) drawing upon talk and conversation. The findings seem to suggest that in sensemaking and sensegiving processes articulation is not only verbal but also material. As a matter of fact, during individual sensemaking, by supporting the comparison and the evaluation of early ideas, artifacts allow designers to clarify, and to give a more explicit shape to intuitions or early interpretations still ambiguous and confused in their own minds. Moreover, during collective sensemaking, by sparking conversations, and by fostering the connection and the combination of personal interpretations, artifacts help to make the evolving group interpretations clear, understandable and accessible to the entire team. Finally, in sensegiving, articulation is made possible by allowing clients to directly experience the external and tangible representation of designers' interpretations, as well as by supplementing the limits of verbal communication.

Limitations

This study does, of course, have some limitations. One possible limitation is represented by the fact that material artifacts were the essence of the task in this firm. In other words, one might say that the reason why material artifacts proved to be so useful in supporting and facilitating the development of creative solutions was because designers were required and expected to rely on these artifacts. Nevertheless, this potential objection might be overcome by simply considering how supportive visual images prove for management scholars when, while writing a paper, they have to conceptualize the relationships between concepts and to develop a theoretical framework.

A second possible limitation is related to the possibility that the emphasis on objects might reflect cultural practices specific of the organizational setting investigated. Nevertheless, previous studies in other product design firms, relying on a different cultural approach, have highlighted the importance of objects in the creative process. For instance Hargadon and Sutton (1997) in their study of IDEO have pointed out how objects like toys, models, and other physical artifacts are used to provide a visually rich environment supporting the memory of designers and promoting its sharing.

Finally, this paper has mainly focused on how objects can support, facilitate, and improve creative processes. However, it is plausible to suppose that under certain circumstances objects might constrain and hinder the unfolding of these processes. In this respect, during interviews some informants have pointed out that objects might become obstacles in the accomplishment of their tasks. More precisely, they might create a sort of cognitive commitment for designers that might prove to be a constraint along the development of creative solutions. In other words, if on the one hand the materialization of designers' ideas in tangible artifacts can help designers understand whether their ideas make sense in reality, thus facilitating the development of the final creative solutions, on the other one it might bind designers' minds to certain ideas which they might be unable to depart from.

Furthermore, objects might also hinder the relationships with clients. Showing clients very polished artifacts tends to set in their minds specific expectations with respect to the final results of

the project under way. This might prove problematic if, for one reason or another, designers decided to move away from the ideas presented, because clients might exercise a reverse influence on designers so that their expectations can be met. That's why designers preferred not to show clients too refined artifacts until they were certain about how the final products would be like.

Nevertheless, the evidence collected in this respect is fragmentary, and limited. Therefore, future research should address this point, trying to investigate under which conditions and how objects might become obstacles to creativity.

CONCLUSIONS

In summary, this paper presents an early attempt to investigate how a broad array of material artifacts support and aid the development of novel and original solutions by designers in a product design and innovation consultancy. My insights suggest that these artifacts sustain three main phases of the creative process that I have named *individual sensemaking*, *collective sensemaking*, and *sensegiving*. More specifically, my observations support the argument that artifacts, as objectified external representations of designers' mental structures, support the processes of meaning construction through which individuals and groups of individuals attempt to interpret and explain sets of cues from their environment. Moreover, my observations also suggest that artifacts, by sustaining and complementing verbal communication, facilitate the transfer of meanings from senders (designers) to receivers (clients), and the influence of the sensemaking processes of the receivers toward a preferred interpretation.

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Table 1. Interviews summary table

<i>Type of Interview (Number of informants)</i>	<i>Position</i>	Number of informants (Number of interviews)
Interviews on artifacts (24)	Product Group:	
	Industrial designers	8
	Mechanical engineers	3
	Human-factor engineer	1
	Model maker	1
	Brand Group:	
	Brand designers	5
Strategy Group:	Design Strategists	6
	Health	
	Industrial designers	2 (3)
Debriefing interviews (12)	Human factor engineer	1
	CEO	1
	Transport:	
	Design strategists	4 (5)
	Window:	
	Brand designers	4 (5)
	Preliminary Interviews (15)	Industrial Design Principal
Industrial Design Principal		1
Industrial Design Principal		1
Industrial Design Principal		1
Brand Experience Principal		1
Design Strategy Principal		1
Vice President of Product Dev.		1
Mechanical Engineering Principal		1
COO		1
VP Product Development		1
CFO		1
Vice President Marketing		1
Founder and CEO		1 (2)
Vice President Brand Experience		1 (2)
Vice President of Product Practice		1
Total Interviews		51 (56 interviews)

Table 2. Selected evidence supporting the concept “Exposure to environmental stimuli”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Observing current aesthetic trends</i>	<p>2.1 “I’ll go through some of the current...usually, it’s always magazines, because that’s where you really get to see where things are going, ‘cause it’s evolving...you know, the time....so, I have kind of my favorites, but it also depends on what the project is and what the references are.”(AM, industrial designer)</p> <p>2.2 “So, for brainstorming on something we always wanna see what’s available and what’s have been done or if it’s for a “look and feel” we use these for inspiration, then we look at pictures and books for inspiration. It’s like when you’re decorating your living room, you know, and you kinda have an idea, and maybe you want to look like this, and so you look through, you know, a bunch of magazines like Abitare or Vogue or something like that because you want get some inspiration.” (GB, brand designer)</p> <p>2.3 “When you are in the process of sketching like early in a project what designers would do typically is just look for appealing shapes, colors and maybe details.” (MA, industrial designer)</p> <p>2.4. “Then we use other visual tools, like pictures, books, and magazines as references, visual references, like we dig through piles of books, pictures and magazines. And we dig through pictures and books to find similar usages of ideas.”(GF, industrial designer)</p>
<i>Reviewing existing product ideas</i>	<p>2.5 “Client’s and competitors’ products are also used a lot. Everything you see around here in this room comes from the clients of from their competitors. They’ re basically used at the beginning of a project in order to sort of understand what already exists out there.” (MA, industrial design)</p> <p>2.6 “Usually when I’m looking for inspiration, I start up by seeing what’s have been already done in a similar way on a similar project...but I don’t usually open it up too wide, it’s usually pretty specific to that product.” (GF, industrial design)</p> <p>2.7 “You know, if you look through the magazines with what you thought was a good idea ‘oh! I wanna do a big red ball in the middle of the store windows! It’s so creative! It’s the best ideal’, and then you open up the front page of some design magazines, and there’s a store with the big red ball, so you can see that someone else has already done that. So you say ‘Ok! Next one!’” (GB, brand designer)</p> <p>2.8 “I like to look at other products, like competitors products and clients products and even some work that I’ve done in the past, for inspiration. If I know that I need to put a button, you know, on a small consumer product, and I need to have it actuated somehow, so I think about other products that do that, or also I can think about maybe another product that I’ve done in the past, same size of what I need to do, and I’ll go back and I’ll reference that.” (CC, mechanical engineer)</p>
<i>Observing current lifestyles and patterns of behavior</i>	<p>2.9 “We use magazines and samples of materials in order to understand what’s outside and what’s going on....it’s just like the pictures, how I started off with pictures at grad school ‘what’s going on out there?’” (KH, design strategist)</p> <p>2.10 “Pictures is something that I think comes from what I did in school. For me it’s kind of the same thing that we do when we talk to people at the beginning of a project; it’s capturing all these little snapshots of what’s really happening in the real world, and that’s why I have a hard time with stock photography, because it’s already somebody else’s vision of what this thing should be, and so there’s too much to capture there.” (BW, design strategist)</p>

	<p>2.11 “We do a lot of observations, because in most cases it’s just good to get out there to find out about consumers; so we go to their homes or, if we’re designing a consumer product , we tend to go out to the place where it is sold, and then we take pictures and videos; it’s pretty front-end, just to understand what it is that we’re designing and who we are designing for is to go out there and just get out into the world to see what’s going on...” (DV, industrial designer)</p> <p>2.12 “Take for example a project we’re doing now, like a monitor, so a couple of people of the team went to different hospitals and took pictures of how they were being used by users in the set-up of it, you know, in real life situations; so I guess it was inspirational in figuring out the placement of buttons, in figuring out interactions and how people are using them.” (CC, mechanical engineer”</p>
<p><i>Experiencing material samples</i></p>	<p>2.13 “The materials can really make you think, and a really good materials library that’s complete and has a lot of great stuff can really be inspiring if you just spend some time to look through it.” (AM, industrial design)</p> <p>2.14 “Or I’m looking for a new fabric or material to put on a chair, and sometimes you don’t even know what you’re looking for, if you are not even looking for a particular project, you might find something that makes you think ‘oh! That would be fun to use here!’. I mean, I like materials and stuff like that. It can be a lot of fun. And it’s inspiring.” (CC, brand designer)</p> <p>2.15 “The materials are gonna act as inspiration just like a magazine picture, because it might drive you to think in a different way like ‘what would happen if we, instead of, you know, print it on white paper, what would happen if we printed it on this new material?’ or ‘what would happen if we covered the walls of the store with some really new wallpaper or something?’” (GB, brand designer)</p> <p>2.16 “I can think of a time when we wanted a certain color finish or material and I’ve gone back into my own archives, and dug up from previous projects the color palette that worked on something that I re-used.” (GF, industrial designer)</p>

Table 3. Selected evidence supporting the concept “Responding to external stimuli”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Responding to aesthetic cues</i>	<p>3.1 “You know, 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.” (AM, industrial designer)</p> <p>3.2 “When designers look for inspiration, they wanna look through, you know, whatever the newest magazines are on as a way of just pulling kind of quick emotional reactions to whatever, you know, architecture turns them on or product design or furniture design.” (DV, industrial designer)</p> <p>3.3 “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” (AM, industrial designer)</p> <p>3.4 “I’m looking right now at a bunch of client’s chairs, a bunch of chairs that are classic designs, and things of that nature; and just the particular image of a chair, the composition of that image of a chair can be a lot more powerful in the way that it’s depicted, the way it’s cropped off, the way it is positioned on a page, the way that light and shadow are falling down. I mean, really digging in deep and really looking at certain images that I think I would probably use even in future boards, just because it’s inspiring... you know, the serenity of a certain chair, a certain kind of design of that chair and the way it is depicted in that image versus anything else may really make me respond to it.” (DV, industrial design)</p>
<i>Responding to symbolic cues</i>	<p>3.5 “If you’re really looking at the objects on a great detail level, you find meanings in materials, you find worth in coolness and emotional quality they’re up in color, you know, you find meanings in materials, in treatments of those materials, in textures.” (AM, industrial designer)</p> <p>3.6 “Well, it depends on what you’re looking at, but they’re all thought provoking, and like if I look at that wall where there are pictures of Winter Holiday and there’s a lot of red, and then in that case red is the symbol for something. And without even knowing what this project is about, I could say that all this red has something to do with Christmas, because the tone of that...you know, even if I look at the individual pictures.....they are symbols, they represent something.” (GB, brand designer)</p> <p>3.7 “A lot of times in a brainstorm or early on a project when you kinda get some inspiration on what you’re doing, you look through different pictures or pictures of people using prototypes and what they’re doing, you know, how they hold things, how they working with the products and that kinda helps you to figure out the best way to do the ergonomics or the best way to make the product work for the consumer.” (CC, mechanical engineer)</p> <p>3.8 Explaining how competitors and clients products are used: “What we try to do is that we...for instance, we would take, let’s pretend that the brand attribute we wanna deliver on is approachable, we would take like a Jasper Morrison coffee-maker and we identify it not so much by saying ‘ok. Let’s do this. Let’s do a geometric box’, but what we do is that we analyze it and we say ‘what makes this approachable? Is this idea of the round corner, of the simple interface?’ and things like that.”</p>

Table 4. Selected evidence supporting the concept “Original recombination of stimuli”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Combining cues</i>	<p>4.1 “I think that makes the difference between good designers and bad designers. It’s very easy to copy something, and that’s what I think a lot of people do, but I think that the way people her work or the way my mind works is that I enjoy combining...and the pictures of somebody else’s ideas might inspire or modify my ideas just a little bit. Not to copy them, but to add on to them. So, it’s like an additional...it’s an additive process.” (GB, brand designer)</p> <p>4.2 “So, sometimes the pictures are strictly related to the project that you’re working on, but sometimes they don’t. I mean, if we are developing a chair, we don’t necessarily restrict ourselves to pictures of other chairs. In fact, it’s richer if you move outside the furniture, because everything has been done and it’s better starting relating or referencing things that are outside of that area.” (GF, industrial designer)</p> <p>4.3 “You know, it can be something as simple as an edge treatment, you know, whatever interacts with a surface, you know, and it’s really seen as being perfectly ok to “steal and quote” shapes and treatments that you might see in a magazine.” (MA, industrial designer)</p>
<i>Connecting early ideas</i>	<p>4.4 “Going from thumbnails to sketches most of the times is kinda subjective. What I’ll do is sometimes lay them out, look at all of them together and see if there are recurring ideas, groups, and then I’ll start linking them, you know, connecting them.” (GF, industrial designer)</p> <p>4.5 “Now, it seems like we are kinda jumping, we’re going through thumbnails picking internally, you know, with the group or with yourself narrowing it down to 3 or 4 or to whatever the number might be.” (DV, industrial designer)</p> <p>4.6 “But if you have all this stuff around you, it’s like this totally streamline process where you don’t have to stop and search for something, or stop and flip through your notes and find something that you thought a long time ago, because it’s pinned to the wall right over there, and you can just immediately make that connection between that thing and this other thought that you had two weeks later that is on the wall over there, and it’s just like so much faster.” (KH, design strategist)</p>

Table 5. Selected evidence supporting the concept “Objectification of ideas”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Supporting the recording of ideas</i>	<p>5.1 “many times I will have little iconic thumbnails, just to some very quick sketches that help remind me of something we’re talking about. Like if somebody says a word that inspires me to think something, I’ll draw or sketch thumbnails as references of the conversation going on.” (GB, brand designer)</p> <p>5.2 “Sometimes I just sketch on paper just as a reminder to myself of something that I thought of.” (JS, industrial designer)</p> <p>5.3 “Thumbnails are typically personal, while the sketches are more a group thing. So, I’ll sketch thumbnails which remind notes to myself, but they’re my personal interpretations of something.” (GF, industrial designer)</p> <p>5.4 “The sketches we use in our group aren’t necessarily even object or product sketches but just sketches of ideas. So, sometimes I just sketch on paper just as a reminder to myself of something that I thought of, you know, just to capture ideas.” (HR, design strategist)</p>
<i>Supporting the comparison of ideas</i>	<p>5.5 “So, I turn through lots of thumbnails, and most of them are not even shared with anyone else. Because when the idea has some gesture or personality that you can capture in a small thumbnail, you know, it forces you to just make it, narrow it, and focus it to right down to just what is important.” (GF, industrial designer)</p> <p>5.6 “You can build a little model of the space, the size of a shoebox, and you hold it up in your hands, and you look inside of it, and that totally changes you perception of what it is. Or that adds and clarifies something. It can make you say ‘oh! We did really understand it’ or ‘oh! This is really wrong!’” (DC, mechanical engineer)</p> <p>5.7 “When I’m selecting ideas, what I’ll do is I’ll pull out one or two ideas that I think are working, and I’ll add some color to them so they almost become mini-renderings on the thumbnail page. So, it’s kind of a way to just streamline them a little bit.” (AM, industrial designer)</p>
<i>Supporting the evaluation of ideas</i>	<p>5.8 “And, you know, even if you don’t have the luxury of building full-size models, they can really clarify a lot of questions or, you know, you might say “oh! I thought this is gonna be really great and it turns out to be totally stupid” or “all this thing is way too big or is way to small....proportions don’t look exactly like what I was looking for.” (JS, industrial designer)</p> <p>5.9 “If you’re gonna really have to interact with it, you gonna make sure that things are in the right place, and if it’s a chair, you have to sit in and have a lot of interactions with...so, it’s very important to get into modeling very quickly.” (BS, human factor engineer)</p> <p>5.10 “I do a ton of thumbnails, more than most people do probably...you know these very small thumbnails, and I found them very useful, because I think that if I can capture it in a small scale then I feel it’s gonna be a good idea, ‘cause it’s more iconic and if it looks right at this size it’s not because you’ve designed things based on details.” (GF, industrial designer)</p>

Table 6. Selected evidence supporting the concept “Using artifacts to support collective interpretations”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Using artifacts to spark conversations</i>	<p>6.1 “For instance in the case of this project we wanted to call attention to kind of the historically important chair design in the last 10 years, and so we happened to have some books on that, and so we were able to make some copies of images and we ended up putting those up. And in some cases, you know, they might have triggered some aspects of the design or they were just something to put up on a wall to talk about.”(AM, industrial designer)</p> <p>6.2 “We usually meet and present our ideas. That’s a good example right there. [we are doing the interview in a project space] You know, we look at everybody’s work, and then we’ll see what stands out as hitting the target, and people can get the feeling that you’re on the right path. It’s a kind of an informal design review.” (CC, brand designer)</p> <p>6.3 “All the visual imagery we use can really facilitate discussions inside the team, because you can point at things and you say ‘I wanna do something like this!’” (MAF, design strategist)</p>
<i>Using artifacts to explain personal interpretations</i>	<p>6.4 “So you can point to something like this and say “well, you know, we know we can do cast metal base because look they did it here and they did it here”. If you wanna do a plastic part, you can point to products like those and say “you know, we can get the same level of resolution of the parts, and the same level of materials quality.” (DC, mechanical engineer)</p> <p>6.5 “You kinda like to see the use of design elements by someone else somewhere else, you know, either in a previous chair or in a singular type of chair, you know, maybe you put a picture of a chair up on the wall to illustrate why you don’t wanna do something that way.” (AM, industrial designer)</p> <p>6.6 “So, I think that sketching some little illustrations is the fastest and clearest way to convey your ideas and your interpretations. So, I use them in all my projects.” (GB, brand designer)</p>
<i>Using artifacts to elicit multiple interpretations</i>	<p>6.7 “When we sit here, and we look at these together, everybody has to talk about what they’ve seen, and walk through each one, and then it’s really enlightening, because somebody else might have seen something different that you had never even thought.” (SF, design strategist)</p> <p>6.8 “All these objects have different meanings for us, because it’s just like a panting that for everybody is different. Everybody’s eyes are gonna catch something different. If I were looking at that wall, I might be catching up.... the red, whereas Claudia or Ethan might be seeing the type treatment....they might be looking at the fact they used the word “sale” on that one or the word “gift” on this one. And maybe their eyes see something different than mine. So, I think everybody sees them in a different way.” (GB, brand designer)</p> <p>6.9 “They have a certain meaning for me, and maybe a different meaning for somebody else, because if I have pulled an image because it reminds me of a possibility that we could execute on for this project, I’m interpreting it in one way, and someone else on the team might be interpreting it in a different way. So, until you go and start doing like the rough layouts and everything, the images can have different meanings to everybody. So, I think to go from this to actually design some banners and stuff is gonna be....that’s where you gonna see “oh, this is what you meant by that; or this is what you meant by that.” (SMK, brand designer)</p>

6.10 “It’s like all this stuff is just kinda floating around, bubbling around in your head, and even though everyone else is looking at the same stuff, they’re looking at it from a different angle, and once you start like creating this physical thing that it needs to fit into, and people can start putting everything in from their own perspective, then it’s like we’re connecting brains.” (KH, design strategist)

Table 7. Selected evidence supporting the concept “Developing a common interpretation”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Exchanging feedback (connecting)</i>	<p>7.1 “Thumbnails can be considered as a series of ideas, while sketches and also renderings are combinations of these ideas; and how we go from series of ideas to more refined combinations of them is through mutual feedback....you know, the steps always happen through feedback from people on the team.” (GB, brand designer)</p> <p>7.2 “The sketches are more derivative of a group....you know, like the ones we’re doing now for this project. So, I get feedback on sketches, my own sketching and I give feedback on somebody else’s sketches; you know, sketches for me are generated from a group exchanging feedback and giving input, while thumbnails are typically generated by me just thinking through something.” (CC, brand designer)</p> <p>7.3 “Like the meeting that we had, you know, the last meeting with everybody where I was sketching, I might have had a little thumbnail or I might have been thinking about something on my side, and then they were giving me feedback, they were feeding more and more ideas that got turned into the sketch and the sketch got bigger....the scale of the drawing got bigger.” (GB, brand designer)</p> <p>7.4 “You know, if I’m drawing on my book during a meeting, someone might look over and say ‘that’s what I was thinking!’ of my thumbnail and then they would give me more feedback, and then I might draw a bigger and include their comments on that, because it becomes much easier to read for them when they start giving feedback...so, the process of a sketch always happens with more input from the thumbnail, but it’s always...you know, sketches are always instigated by thumbnails for me.” (AM, industrial designer)</p>
<i>Using artifacts as reminders of evolving group interpretations</i>	<p>7.5 “You know, it’s clearly because even though when you write stuff down it’s not permanent, it’s a marker saying “yes. Remember? We talked about this, and more we decided this”, and I feel it when we talk about things, and we don’t have those little reminders, people’s memory....like people remember things differently, or then they remember different things....I don’t know, I just feel like there would be a lot more arguing, and a lot less moving forward.” (KH, design strategist)</p> <p>7.6 “And you know, we need all these visual aids, because they kind of like sit around in the room with us, they kind of remind us what’s there.” (MAF, design strategist)</p> <p>7.7 “As a group we use pictures as kind of reminders or references for other things that are going on for example with competitors.” (CC, mechanical engineer)</p>
<i>Building on each other’s ideas (combining)</i>	<p>7.8 “As you get more and more comfortable with the people you work with you realize that people know your capabilities and you don’t have to prove yourself anymore, and you’re able to sort of pick things from other people’s work. And you might see something in someone else’s sketches and just take it and run with it. I think it’s a better dynamic, when you feel comfortable enough with your group and with yourself to just borrow....I think that’s the whole point of the group....so using each other’s ideas to inspire ourselves.” (GF, industrial designer)</p>

	<p>7.9 Talking about renderings: “I would show it to someone else on my team, I would show the renderings to them or they would show them to me, so we can see, we can critique, we can figure out how to do that better, talk about color, talk about finishes, talk about whatever it is that we want to refine in that rendering, but ultimately we all separate and do it on our own.” (DV, industrial designer)</p> <p>7.10 “With renderings, that also really depends on the project, but generally when I do renderings I do them alone at my workstation just because....you know, the big collaborative part before you present the renderings of course would be.... I would show it to someone else on my team, I would show the renderings to them or they would show them to me, so we can see, we can critique, we can figure out how to do that better, talk about color, talk about whatever it is that we want to refine in that rendering, but ultimately we all separate and do it on our own. And the same thing with drawings” (DV, industrial designer)</p>
<p><i>Reconciling multiple interpretations</i></p>	<p>7.11 “anything that we do to communicate with the client is also important to gain clarity within the team. Because everyone has their own view of what’s going on, and in many cases they are different, they are just different ways of looking at the same thing. And, everyone’s so busy all the time that, like, if you’re not...if you’re never sitting in a room together saying “ok. What do we think of this, what do we think of that?”, everyone’s like developing their own ideas and going off and bringing their own experiences as everything else into it.” (KH, design strategist)</p> <p>7.12 “So, anytime you have a clear time when you have to present something to a client, it’s so useful to just force everyone to agree on exactly what it says on this poster or on this PowerPoint presentation or whatever, because that’s when you have the discussion about what, you know, “well, this means this to me, this means to me, oh yeah...ok really what we both think is this”, and then we’re clear on what everyone thinks and we make one statement that supports what everyone brings in.” (HR, design strategist)</p> <p>7.13 Describing the role that physical models may have for the member of the team: “So, it’s like we both see things from the same point of view, now, and it all lines up, and that’s when you know you have something real, if it fits....it’s taking all those pieces and putting them together, and if they fit, then you know you have something real.” (CC, mechanical engineer)</p>

Table 8. Selected evidence supporting the concept “Reconciling differences in cognitive and symbolic references”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Sharing symbolic references of thought processes</i>	<p>8.1 “When Jen [the client] saw the photographs in the slide show of these boards with all this stuff, she couldn’t believe that...she was like “oh my God! Look at all that stuff!”. And if you actually can come in here and experience all around you, it’s totally different....so, I think it’s very important, because it also helps them understand your thinking... ‘Cause this is our mind...this is stuff that’s in your brain...and they might come in and say ‘oh! I hadn’t thought about that! I had no idea you thought about that!’” (GB, brand designer)</p> <p>8.2 “when we’re in a project room, anyone that sees this and that is working on the project with you has all these links without you have to spell it out, but when you bring the clients in and you wanna share with them, they’re gonna have to understand that piece value and that’s why you need these other tools to help them make these connections, and that’s why we use video clips of this thing that we think out, and a storyboard of this other thing that we are talking about, and a poster that outlines how all of these phrases and words add up to this one word.” (HR, design strategist)</p> <p>8.3 “For example, posters are a way of communicating an idea and making it all in one place and all so clear and linking it from all the stuff that we’ve been doing over the past few months and linking it to all of that, so that it’s not “oh, here this is what we think you [the clients]should do”, but “this is how we got here, this is why we think you should do, and you know all this stuff” (BW, design strategist)</p>
<i>Making interpretations explicit</i>	<p>8.4 “the big part of working with the client is making them understand how design works, and some people already understand that, and some people don’t. Like for instance a big part for the designers is represented by these things called attributes, which is a word that describes some characteristic of the design that you’re trying to express. You know, we create presentations for the clients to show them how design works on a very kind of primitive level, you know, that a lot of times relates to things as simple as “special expressions”, and “tactile”, and, then, you know, forms, the shapes of the very, very simple forms, something you can actually talk about, you can describe, verbal attributes like “solid” or “light” using pictures.” (MA, industrial designer)</p> <p>8.5 “It always makes a big difference between when you show something on the screen and when they see it in a 3-D model, because it shows them that the work is real and they start to understand exactly what you’re doing a little bit more. Again, I think it is a great communication tool. So, is it not just a matter of documenting what you’re doing, but also a matter of facilitating their understanding of what you’re doing.” (CC, mechanical engineer)</p> <p>8.6 “your other challenge is getting them [the clients] to understand what we need them to understand, and that’s where prototypes are really, really important. And the way that we use prototypes more often than drawings is not to get them to understand what a finished product would be, but more to get them to understand the essence of what our idea would be” (KH, design strategist)</p> <p>8.7 “when you get to a rendering, it’s more like trying to get to what is that gonna look like in reality with materials, finishes, colors, reflections, but also trying to make forms understandable for someone [the clients] who’s not a designer so that they can understand your intent, because sometimes a sketch or a thumbnail might be so crude that they can’t see through it. You can see it, as a designer, but they can’t see it.” (GF, industrial designer)</p>

	<p>8.8 “Especially when you have models, they [the clients] can see them, and you can show them and it definitely helps understanding a little bit better; (...) it also helps to clarify confusion sometimes, especially when you’re working on a mechanical system. Because, you know, our clients are not always engineers. Every once in a while you can have a marketing person in front of you, maybe we you reach a very important milestone and you have to make a big presentation. That’s when the models are more important.” (CC, mechanical engineer)</p>
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Table 9. Selected evidence supporting the concept “Compensating verbal limits and lack of aesthetic knowledge”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Allowing direct experience of envisioned outcomes</i>	<p>9.1 “When we have to communicate to people outside the team what a sketch means, or what is the idea behind it, we can use different forms. You know, depending on where we are in the process, we might model it in CAD program so we can rotate it, and put colors and textures on it. We might do better renderings, and we might try to drop it in some sort of an environment so to help the client visualize what is gonna look like, you know, and we might make models. You know, if it is a small object we can model it 1 to 1 or we might make foam model or use the Zip machine.” (PG, mechanical engineer)</p> <p>9.2 “Designers are trained to look at drawings, at 3-D drawings. We can look at a plan, and in our minds extrude it, and understand how the flow is gonna work. The clients....people that aren’t trained don’t get that. They don’t understand that. Some are lucky and some can, but on average they can’t. So, models are really good at let them envision a product in 3-D.” (MT, industrial designer)</p> <p>9.3 “And when I realized that they [the clients] had a problem because they thought it was glowing too much, then I took them to the location where we were gonna use them and they were ok with that and said “ah. Ok. Now I see why you’re doing that”. But because they had a hard time putting that in context, I had to find out what had them confuse” (GB, brand designer)</p> <p>9.4 “Because, you know, a lot of times we’ll be moving along and saying “this works really great in the renderings”. And they [the clients] say ‘yes! This is really great!’ But in the back of their minds they’re thinking ‘yes. I think that works really great, but I’m not really sure how this is gonna look like’. So, sample boards, and samples applied to models and prototypes are really, really helpful, because they help them [the clients] visualize how it’s gonna look like.” (CC, brand designer)</p> <p>9.5 “It’s good for us to have those samples also to communicate with our clients. You know, “this is what we’re thinking about”. When they have something to hold and touch means more than a picture, always.” (BW, design strategist)</p> <p>9.6 Explaining why having a visual illustration of the next-generation buck was more useful than having a list of features: “well, because, you know, we know what we want and we know what we are gonna do, but I think it was to make sure that the clients understood what we are gonna do....you know, so that when Buck 2 comes around they will no be disappointed at what they get” (MA, industrial designer)</p>
<i>Supplementing verbalization</i>	<p>9.7 “Our work is more visual, so we need to support our explanations with visual stuff. And I also think that it’s just an impatience with anything that has to be described too much, because you look at a picture and bang! It’s all already there!” (AM, industrial designer)</p> <p>9.8 “It’s all about being able to point at images, whenever possible rather than writing. Because, it communicates in a so much more immediate way than writing does. Because, even though I write something, you still have to support it with an image in order to really communicate well in this industry. You know, in this industry people just expect images rather than verbal descriptions.” (MA, industrial designer)</p> <p>9.9 “That’s the importance of having physical objects or images in front of you: so we can point to a reference and say “we don’t want our chair to have anything to do with this! You know, you can explain your ideas better.” (GF, industrial designer)</p>

9.10 “If we’re using reference images as a basis for us to modify a design, we as designers know that it’s not perfect and we know we’re gonna move on from that, but we still like the basic concept of the design of an idea, sometimes it’s very hard for the clients to make the leap to the next...to say “is this really gonna work better if we just do these few things to it?”. Sometimes it’s hard for them...or a lot of times it’s hard for the client to make the leap. So, we show them something as a reference image or we sketch something out” (KH, design strategist)

9.11 “And it took a while to figure out what really bugged them about it, ‘cause they couldn’t verbalize what they didn’t like about it. They just said “we don’t like color; we don’t like this plastic”. And I kept having to dig and dig “but what is that you like and what is that you don’t like?” and we had to look at them in different locations.” (GB, brand designer)

Table 10. Data supporting the concept “Influencing clients’ interpretations”

<i>Associated first-order concept</i>	<i>Representative quotes</i>
<i>Purposefully pre-selecting ideas</i>	<p>10.1 “You know, we don’t put up a bunch of sketches on the wall and have to be arbitrary and say ‘ok, we have ten! Pick three and just go!’ or you know ‘here’s fifty, and pick the one that you like best’. It’s normally not like that. We usually show them a smaller set of the ideas we’ve developed” (DV, industrial designer)</p> <p>10.2 “What it is that we put up on the wall in presentations or in a power point is more targeted and we try to avoid pretty much anything we don’t believe will be successful, because chances are that the client will pick that and then we’ll start designing something that we don’t believe in, and ultimately probably that will not be the right answer.” (DV, industrial designer)</p> <p>10.3 “During clients meetings we don’t usually show them all our dirty work, you know, but we usually kind of bring just some elements from that [project] room down to the clients or the ones that make sense for them.” (MA₂, industrial designer)</p> <p>10.4 Talking about the ideas presented to clients: “You’re not showing them the whole set of ideas you’ve developed, but you’re narrowing it down to a smaller group of options” (GF, industrial designer)</p>
<i>Suggesting preferred interpretations</i>	<p>10.5 “After all they come to us to consult, some try to come up with answers that best fit what our client’s needs are. And a lot of times we do that collaboratively, but all the times we give strong recommendations of what we think they should do.” (DV, industrial designer)</p> <p>10.6 “And that’s what gets a little tricky, because we have to be very clear about what our intention is with the prototype and design or create it specifically to those intentions.....and at the same time help the client understand that “even though we’ve made this beautiful drawing of this thing or we’ve made this really refined and finished product this is not what we think you should make, has nothing to do with what we think you should make.” (KH, design strategist)</p> <p>10.7 Explaining how they decide what to show during clients meetings: “The rule of thumbs is ‘never show anything you’re not willing to make” (PG, mechanical engineer)</p>

Table 11. The role of artifacts in the organizational artifacts literature: past research and insights from empirical evidence

	Artifacts as identity markers	Artifacts as status symbols	Artifacts as boundary objects	Artifacts as cues for creative sensemaking	Artifacts as support for sensemaking
<i>Social processes</i>	Expression, affirmation, and construction of identity	Construction, definition, and stratification of the social relationships (authority, legitimacy, knowledge, etc.) within a social system (e. g. Bechky, 2003 a, b)	Knowledge transfer and transformation across groups (e.g. Carlile, 2002, 2004; Bechky, 2003; Carlile and Reberntsch, 2003)	Individual and inter-subjective generation, of new interpretations	Development and refinement of collective interpretations
<i>Cognitive processes</i>	(1) Signaling (e.g. Pratt and Rafaeli, 1997; Rafaeli <i>et al.</i> , 1997) (2) Categorization (e.g. Elsbach, 2003, 2004, 2006)	(1) Signaling (e.g. Douglas and Isherwood, 1979; Bourdieu, 1984) (2) Categorization (e.g. Mc Cracken, 1988; Orlikowsky, 1992, 1993)	(1) Sharing of cognitive schemas in collective decision making (e.g. Carlile, 2002, 2004; Bechky, 2003) (2) Organizational remembering (e. g. Hargadon and Sutton, 1997; Davies and Brady, 2000; Grabher, 2004)	Sensemaking (noticing and bracketing)	Sensemaking (interpretation)
<i>Level</i>	Individual Organizational	Inter-group	Inter-group	Individual, inter-subjective	Individual, inter-group, inter-organizational
<i>Types of artifacts</i>	Individuals: workplace objects (e.g. office décor, layout, dress, etc.) Organizations: visual identity (logos, brands, brochures, buildings, office décor, etc) (e. g. Olins, 1989; Schmitt and Simonson, 1997)	Work tools (e. g. drawings, machines, software, etc.)	Work tools (e.g. drawings, parts, machines, technology, charts, etc.)	Naturally encountered artifacts (e.g. images, magazine pictures, existing products, parts and components, etc.) Manipulated artifacts (thumbnails, quick mock-ups)	Manipulated artifacts (sketches, drawings, boards, models, parts, etc)
<i>Prominent dimensions</i>	Symbolic	Symbolic	Instrumental	Aesthetic	Instrumental, symbolic,

Figure 1. Data Structure

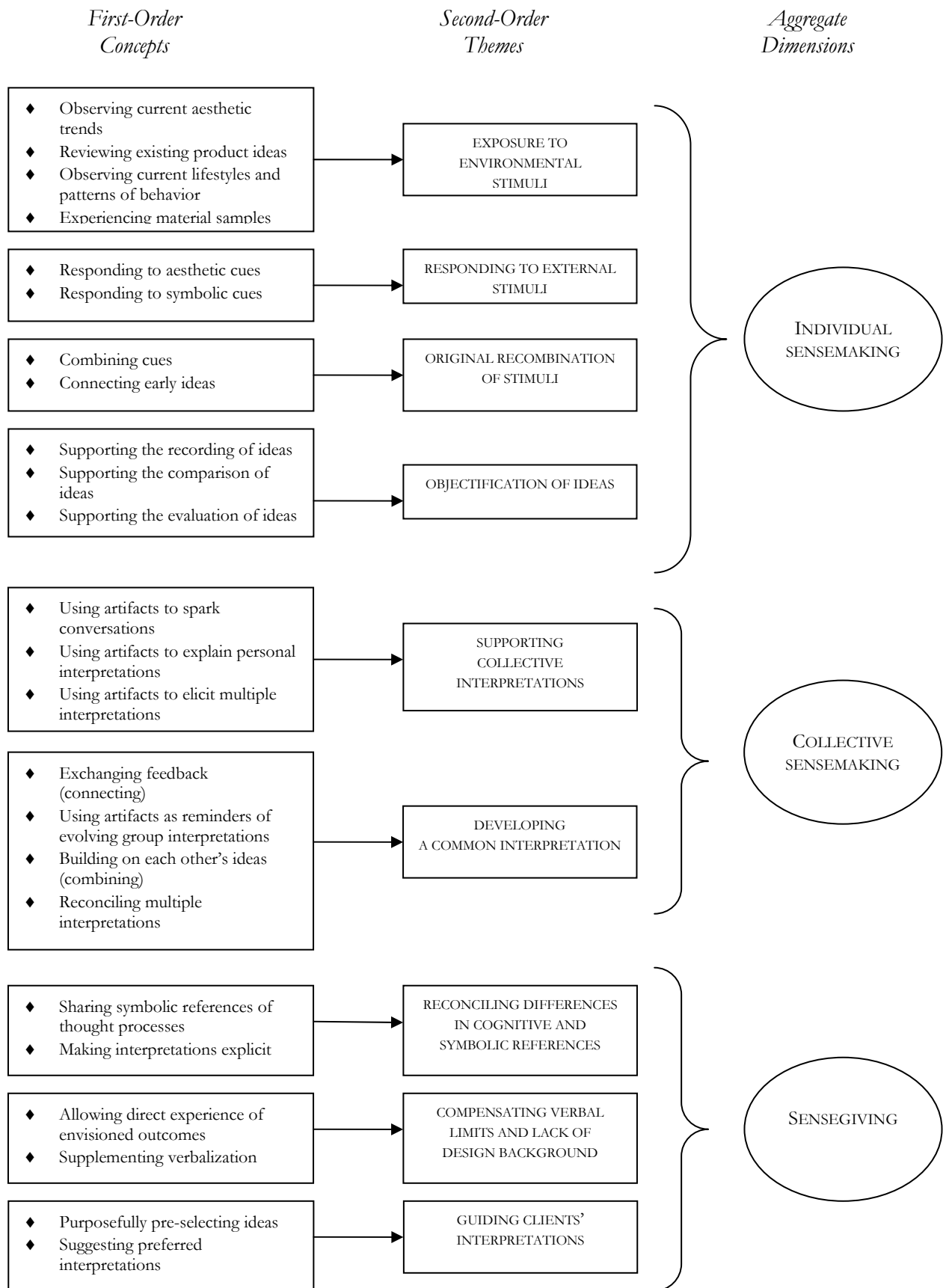
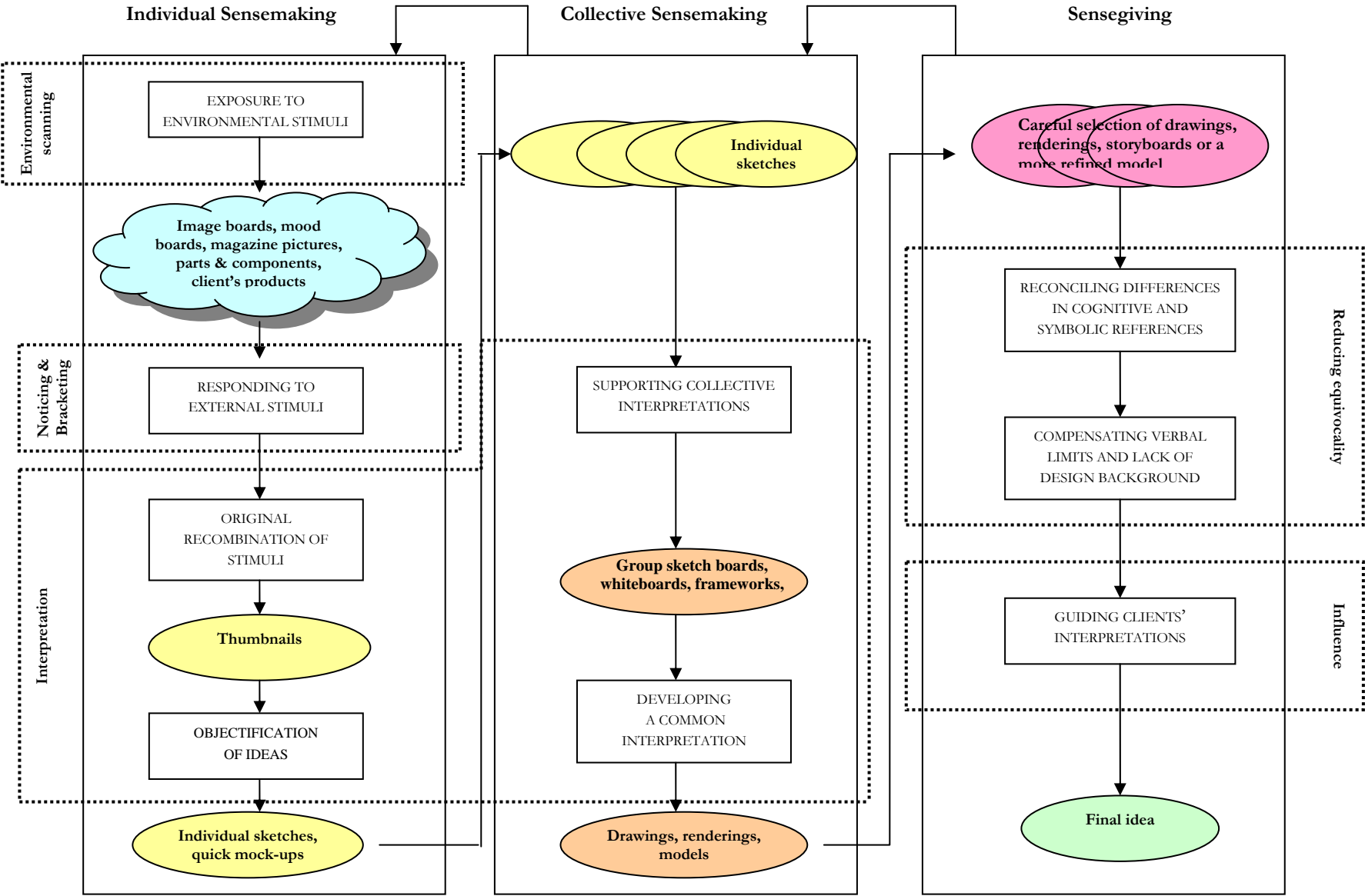


Figure 2. The emerging conceptual framework



Appendix 1. Interview Protocol On Objects Used Along The Creative Process

- ✓ Which kind of objects do you usually use during a project?
- ✓ When (in which phase of the process) do you use them?
- ✓ Why do you use them?
- ✓ Do these objects affect the accomplishment of your tasks and goals?
- ✓ How do they affect them? Particularly, do they increase or decrease the possibility to accomplish them?
- ✓ Can you tell some examples of how these objects have influenced the accomplishment of your tasks and goals?

- ✓ Do these objects have particular meanings and/or associations for you?
- ✓ If yes, which kind of meanings?
- ✓ Do you think that these meanings are the same for:
 - ✓ The other members of the team?
 - ✓ Your clients?
 - ✓ Other people in the organization (not involved in the project)
- ✓ Do these objects and/or the interactions with them elicit particular experiences? In other words, which kind of thoughts, emotions, and reactions do they provoke in you?
- ✓ If you couldn't use any of these objects, how different you think your work would be?
- ✓ Do you think that these objects facilitate or hinder the interactions between the members of the team?

- ✓ How do you store these objects?
- ✓ Which way do you try to keep track of past projects and to preserve what you have learnt during past projects?