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An investigation into the relationship between product form and perceived meanings

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ABSTRACT

The product form is more than an enclosure of a product. Some studies suggest that product form, as a physical quality, informs the user of the meanings of functionality and utilitarian features (a bottom-up approach); however, some suggest product form is a communication medium dependent on the context. Others suggest form is a construction of meanings by evoking pleasure and emotion (a top-down approach). The purpose of this study is to investigate the relationships between perceived meanings (e.g., safety, elegance) and product form (roundness in multiple dimensions) in an experimental setting. Participants in the experiment interacted with nine hard drive and nine soap dispenser prototypes and provided Likert scale scores about meaning (similar to semantic differential method) for each prototype. The edge and/or corner roundness of these prototypes was manipulated from crisp 90° edges to round edges along two and three dimensions. Results suggest that physical quality of the form and the perceived meaning follow a pattern akin to Fechner's law of perception – mostly non-linear relationships. A small change in product form resulted in a large impact on meaning, and moderate manipulations in product form was more likely to confuse participants. Thus, this investigation underscores that product form should be managed carefully by product designers and companies.

Relevance to industry: This study provides an empirical data which presents the relationship between product from and perceived meanings. The proposed approach reveals that this relationship is mostly non-linear; therefore, it is delicate and requires extra attention. Knowledge gained from the study is beneficial for product designers when communicating clearly with users via product forms, and as a result achieve commercial success. The study also provides evidence to support interactionist theoretical framework when describing meaning attribution process to product forms.

1. Introduction

Each year companies release new product lines with new form factors. The intention is that the new form factor delivers their brand value and reflects their achievement in technology and crafting. However, the product form is more than a product enclosure. It not only signifies functionality and utility but also evokes emotions and becomes a communication medium in social context (Gibson, 1986, 1977; Krippendorff, 1989; Norman, 1990, 2004; You and Chen, 2007; Sanders, 1992; Jordan, 2000; Desmet, 2003; Hekkert, 2006). Users presume that products should already function as they ought to and provide high usability (Jordan, 2000). Products fail in the market when they don't meet these expectations. However, only functionality and usability are not guarantees of success (Kuniavsky, 2003). Thus, designers develop products that are not only functional, usable, attractive, and engaging but also are meaningful for the users. The challenge is then to match the meanings assigned by the designer and those attributed by the user. Although there are many studies focusing on the topic the nature of the relationship between product forms and meaning is not completely understood. There are two principal theoretical approaches describing perception and meaning attribution processes to products forms. Bottom-up approaches claims that the core of perception is the physical qualities of the product whereas top-down approaches declares the importance of the human-mind on perception. The third approach that is hold by the current study is the hybrid of those both and can be entitled as interactionist view. It is claimed that some product meanings may be a result of only physical qualities of the product (accounted for by bottom-up theories and mostly related to functionality) while other product meanings may be a result of only mental constructs (accounted for by top-down theories and mostly related to emotions) and that there may be meanings revealed due to physical qualities and mental constructions simultaneously (Kapkın,

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2016). The notion of demonstrating a relationship between the physical intensity of stimulus and the change in perception has been investigated. The Fechner law (Coren et al., 2004; Goldstein, 2009), which addresses many sensorial modalities such as brightness, loudness etc., suggests that subjective perception is proportional to the logarithm of the actual physical intensity of stimulus. The basis of the current study is that incremental physical manipulation (edge and/or corner roundness) on a product form may change perceived meanings of a product, and the relationship between physical features of the form and meaning may be described by the Fechner law.

2. Background

2.1. Theoretical positioning

The definition of form has been debated in theoretical discussions of both aesthetics and perception. The essence of the discussion is whether the product form is a physical quality or a mental construct. When form is considered as a physical quality, it is sets of surfaces spatially organized and establishes a boundary for matter (Muller, 2001). This boundary defines the contrasts between the matter and the environment. A form cannot be visually identified without the existence of light and it depends on the structure and order of surfaces and materials from which it is made (Muller, 2001). The components of form consists of point, line, plane (surface), volume (positive or negative space), value (light and dark), texture, and color (Hannah, 2002). A designer organizes these components to define a form in space (Porter, 1974). The complexity of a form occurs when designing interrelationships between these components (Hannah, 2002). The form, however, is also defined as a mental construct. It is the representation of the content and context of the product. Form is "a very particular class of configurations, namely those that are visualized thought … (it) is precisely not the actual concretization—that is, materialization—of a concept or notion, but rather its dematerialized conceptual sibling … It is a mental-visual structure" (Erlhoff and Marshall, 2007, p.169). Similarly, the form is "first, something about the object itself; second, something about the larger context of its use; and both to the user who interacts with it and develops the conceptual connection" (Krippendorff and Butter, 1984).

The debate can be accommodated in three theoretical approaches. First, the bottom-up theories, which value the physical qualities of objects as a source of the perception (Sternberg, 2008), should be highlighted. Suggestions relying on bottom-up theories such as Affordance Theory (Gibson, 1986, 1977; Krippendorff, 1989; Norman, 1990; You and Chen, 2007) assume that the perception is a pattern recognition process of matching received information with that stored or categorized according to their typicality or relation to other objects in the environment. Bottom-up theories underscore the physical qualities of products to guide certain behaviors that can be actualized through the application of ergonomic principles or the use of anthropometric data to provide expected utility (You and Chen, 2007). However, bottom-up theories provide limited explanation about the involvement of expectations, knowledge, and prior experience in perception. Second, the top-down theories emerge and they suggest that perception requires high-level cognitive processes, in which sensorial information triggers stored information to construct perception (Sternberg, 2008). Top-down theories in design disciplines concentrate on emotional elicitation (Sanders, 1992; Jordan, 2000; Desmet, 2003; Norman, 2004; Hekkert, 2006) and cognitive aspects of user-product interaction (Khalid and Helander, 2004; Cupchik and Hilscher, 2007; Desmet and Hekkert, 2007; Crilly et al., 2009; Karapanos et al., 2009; Locher et al., 2010; Schifferstein and Hekkert, 2007; Schifferstein, 2010; Pucillo and Cascini, 2014). Correspondingly, there have been comprehensive studies on the significance of Product Semantics, which is "a study of the symbolic qualities of man-made forms in the cognitive and social contexts of their use (Krippendorff, 1989, 2006; Krippendorff and Butter, 1984). Product Semantics covers both physical and symbolic (perceived) qualities and it suggests the third theoretical approach, an interactionist approach to this debate. The benefits of this approach have been discussed (Crozier, 1994; Kapkın, 2015, 2016; Van Rompay, 2008) and regarded as a bridge that connects the gap between physical qualities of product and perceived meanings.

2.2. Product form and meaning

The relationship between product form and meaning has been studied extensively The meaning of products can be based on its form, material, function, color, context, and users' characteristics (Karana et al., 2007a,b). There is evidence that organic forms and those with small or large rounded corners are not associated with a high-tech, efficient look and should be avoided to create elegance when designing electronics (Chuang and Ma, 2001). Another study investigating diverse forms of telephone samples found that rectangular and solid forms have a negative impact on users and designers whereas curvilinear forms are found acceptable (Hsu et al., 2000). Product form is also found to provide explanations for the emotional reactions in a study that used a kettle, a seat, and a car as stimuli. Overall, sharp corners, corners with large arcs, straight lines, and flat surfaces are found to be important form factors influencing emotional reaction to these products (Hsiao and Chen, 2006). Moreover, product form has significant influence on the perception of the taste when designing packages. Bitter and salty tastes are visualized as angular and thin forms within sharp angular packages whereas sweet tastes are illustrated in rounded packages (Velasco et al., 2016). Form is also found related to purchase preference of the packages. Packages with rounded contours are more likely to be purchased than those with angular contours, and rounded forms are found more appealing than angular forms (Westerman et al., 2013).

Materials of product forms carry meanings only when they are in context (Karana, 2010). One study reveals that form and function have major effects whereas gender and culture present minor effects on attributing meanings to materials of products (Karana and Hekkert, 2010). Product forms may infer certain materials and meanings. Rounded forms refer to plastics, whereas sharps may be assumed to be metals (Karana et al., 2007a,b). Considering findings of previous studies, product forms used in the current study were generated carefully to minimize the effects of material, color, and function. Previous studies allocated images and photos of products, however this is found anomalous when investigating the nature of product forms. The current study allocates three-dimensional prototypes with which participants can interact in the real world. Previous studies support that the manipulations on the edges of the product forms are acceptable and has effects on preferences and meaning. However, the nature of the relationship between form and meaning is not completely understood. It is hypothesized that meanings revealed by products with sharp and rounded corners might be opposite of each other, however when incremental changes are applied to product form, perceived meaning scores may change as a logarithmic function so as to fit in Fechner law.

3. Experiment

3.1. Methods

After participants were welcomed and the study described, informed consent was collected. Participants were first shown a presentation regarding the ways people verbally describe products because participants often have difficulty articulating their thoughts during experimental environments (Dagman et al., 2010; Ericsson and Simon, 1993). This presentation was based on the findings of previous studies that also used the think aloud method. A printed summary (including a list of trigger words) of the presentation was provided for the participants to serve as a reference during the experiment. This was intended to prime participants prior to the viewing the study prototypes, encourage them to think aloud, and use triggers when they felt stuck.

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