Modelling perceptual product experience – Towards a cohesive framework of presentation and representation in design

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Abstract

This paper proposes a cohesive and comprehensive framework for perceptual product experience (PPE). The framework aims at bringing together the variety of perceptual experiences that we may have when encountering products and objects. Apart from the core sensorial, cognitive and affective modes, the framework takes into account that any experience has dimensions of presentation and representation, which are distinctively different in nature. The framework is useful for understanding the totality of perceptual experiences arising from non-instrumental interaction with products, and to inform the design of products with respect to how the product is experienced.

Conference theme: Modelling Experience

Keywords: Perceptual, experience, framework, modelling, presentation, representation

Introduction

An emerging trend in design research has shifted the focus of attention from what is designed, to what is experienced. Through processes of sensory stimulation, cognitive processing and affective response, we experience products in a wide variety of ways. We become aware, we enjoy, we feel, we remember, we understand and we value things around us. This is true for natural as well as designed objects and environments.

Contributions from a variety of fields highlight and scrutinise various aspects of the phenomenon of experiencing designed objects. The variety of viewpoints, theoretical underpinnings, and objectives, however, create a plethora of approaches surrounding the multi-facetted topic of product experience.

This paper presents a framework that attempts to offer a more holistic understanding of the product experience. The objective of the framework is to provide a useful and useable model of the perceptual experience, and to propose a possible way of structuring, thinking and reasoning about the nature of the product experience, which is relevant for design and has the ability to support design work.

Focussing on the perceptual, the framework does not explicitly consider the practical, instrumental or goal oriented interaction with the product, such as functionality, fit for use or performance. Rather, it focuses on the perceived, non-instrumental aspects of product interaction – how users, customers, or colloquial observers experience the product based on what is observed, judged, and inferred from the product manifestation; its sensory appearance.

Models of Product Experience – A Brief Overview

A variety of aspects of product experience, as well as other frameworks, has been proposed by other authors. Desmet and Hekkert (2007, p. 58) use the term product experience to denote "all possible affective experiences involved in human-product interaction". Hekkert (2006, p.158) defines the product experience as consisting of three components; aesthetic pleasure, attribution of meaning, and emotional response. Jordan (2002) defines pleasure as "the emotional, hedonic and practical benefits associated with products and services". While not limiting pleasure to sensory aesthetics as does Hekkert, Jordan includes emotional and instrumental benefits of product interaction in the concept of pleasure.

Other authors have suggested similar typologies of experience. Lewalski (1988) proposes three classes of X-, Y- and Z-values to differentiate between aesthetic values that express visual order, simplicity and clarity in form; values conducive to purposefulness, functionality and intentionality; and values conducive to fashion, prevailing taste, and visual culture. Heufner (2004) proposes three levels of the design experience; the *observer level*, which includes aesthetic functions based on sensory experience; the *user level*, which concerns practical functions based on physical experience; and the *owner level*, denoting symbol functions based on social experience.

Proposing three 'aspects of emotional design', Norman (2004) differentiates between *visceral design*, which concerns the look and appearance of the product; *behavioural design*, which relates to pleasure and effectiveness of use; and *reflective design*, which considers reputation, rationalisation and intellectualisation of design. While Norman's model takes its standpoint in the experience related to instrumental as well non-instrumental product use, Lewalski focuses specifically on aesthetic and semantic complexity.

Based on the work by, e.g., Lewalski and Norman, Crilly et al. (2004, p.552) propose three categories of cognitive response to describe the experience of product appearance; *aesthetic impression*, the sensation that results from the perception of attractiveness (or unattractiveness) in products; *semantic interpretation*, what a product is seen to say about its function, mode-of-use and qualities; and *symbolic association*, the personal and social significance attached to the design. Note that Crilly et al. regard all these categories of experience to be cognitive in nature, that is, "dependent on judgements that the user or consumer makes about the product based on the information perceived by the senses". This is in contrast to the view of Hekkert (2006, p. 158), who regards only the attribution of meaning to be a cognitive process, which should be conceptually separated from both aesthetic experience and emotional involvement.

The Framework of Perceptual Product Experience

The perceptual product experience (PPE) framework treats perceptual experiences involving any or all senses. The experience is subjective and specific to each perceiver, and depends on personal factors (experiences, background, cultural values and motives), product related factors (type of product, properties and characteristics, brand), and external factors (environmental, social and economic context).

In this work, the term 'perceptual' refers to an experience that relies of perception; "the process of becoming aware of physical objects, phenomena, etc., through the senses, and the mental product or result of perceiving something" (Oxford English Dictionary, 2008).

In contrast to Desmet and Hekkert (2007, p. 58), the PPE framework recognises that the experience, apart from affective components, consists of parts that are not valenced (i.e. include an assessment or judgment as to the positive or negative, beneficial or unfavourable nature of the experience). Not all experiences lead to a judgement; however, assessment may be a result of a pleasurable or meaningful experience.

Core Modes of the Perceptual Experience

The framework regards perceptual product experience as composed of three core modes; the sensorial, the cognitive, and the affective modes of experience (See Figure 1). The three core modalities recognise all possible types of perceptual experience; including (1) initial impression and recognition of product existence and specific perceptual characteristics, (2) making sense of the product, its manifestation, structure, use, origin and purpose, and (3) the affective response, attribution of value to, and judgement of the product.

Figure 1. The core modes of perceptual product experience (PPE) with sensorial, cognitive, and affective experiences.

In the following sections, the core modes of the PPE framework are described in more detail.

The sensorial mode

The sensorial experience is often described as the first point of interaction with our perceivable environment. Sensory perception of the product leads to a range of experiences, including

aesthetic, emotional (see, e.g., Desmet 2002, Norman 2004) and pleasurable (see, e.g., Jordan 2000) experiences.

We experience products with all our senses – for example, we see the unusual looking grille of the car, we hear the sound of the approaching motorcycle, and we feel the delicate balance and weight of the TV remote control.

The sensorial mode includes perceptions of stimuli experienced with any of the senses; vision, hearing, smell/taste, touch, or balance (Mather, 2006). Physiologically, vision can be regarded as the most highly prioritised sense. Alone consuming over half of the neurons in the cortex (Mather, 2006, p.3), vision is the most prominent sensory system in perception research (Hekkert, 2006, p. 162) and the most efficient organ of human cognition (Arnheim, 1970).

Smell has a unique characteristic compared to the other senses. As olfactory signals do not go through the series of successive transformations on the way through the brain, but pass directly from olfactory bulb to cortex (Mather 2006, p.13), olfactory stimuli result in strong associations with past experiences, memory, places, situations, and emotions. Through touch we sense texture, temperature, pressure, pain and vibration. According to Mather (2006) "touch mediates our most intimate contact with the external world".

Unlike vision, the sense of hearing allow us to sense sound in all directions and through opaque occluded objects (Mather 2006, p.81). Product semantics can generate expectations of what the product will sound like, and evaluation of a product can include whether there is dissonance with these expectations. Balance dictates how we physically manage the product with which we interact. With smaller products such as mobile phones, the distribution of mass within the product itself is critical to the handling of the product and to the development of usability, utility and playfulness.

The cognitive mode

The cognitive part of the product experience processes and categorises sensory input, stores, creates and retrieves information and knowledge from memory, and supports in decision making, judgement and inferences (see Reisberg, 1996). Modern cognitive science does not exclude the activity of the senses from cognition, but recognises the close relation between sensory perception and knowledge – between what we 'see' and 'understand' (see, e.g., Arnheim 1974, and Solso 1999)

In the cognitive mode, we understand, organise, and interpret and make sense of what we perceive. For example, we are impressed by the softness and loft of the insulation in the new down parka and understand that the thick insulation will keep us warm on cold winter's days.

The affective mode

The affective mode concerns itself with experiences that are affective in nature, i.e. the give rise to feelings, emotions, and mood states, based on product perceptions (see e.g. Crilly et al. 2004, Visser 2006, Schütte 2005). As the affective system is judgemental (Norman, 2002), the affective mode includes associations and notions that people attribute to products, such as brand associations based on personal beliefs, values and emotions (Abbot et al., 2006).

In the affective mode, the old chest of drawers may evoke joyful and pleasant memories of your grandparents, and may make you think of the happy childhood days when lollies were hidden in the top drawer. The excessive dimensions of a Hummer SUV may make you feel intimidated and poignant, while you wonder what a military vehicle is doing on your narrow side street.

Presentational and representational dimensions of perceptual experience

Apart from the core modes, the PPE framework recognises that the experience has a dual nature; that is, that the experience can be presentational as well as representational, as suggested by Vihma (1995).

In the PPE model, this inherent duality of the experience is made explicit in the two dimensions of presentation and representation. The dimension of presentation is related to the direct, non-interpretative experience, i.e. experiencing the product for 'what it is', while the dimension of representation is related to the interpretational, meaningful side of the experience, i.e. 'what it stands for'. In short, presentation may be seen as the 'pleasurable' side of the experience, while representation is the 'meaningful' side.

The idea of the dual dimensionality is supported by work of Goldman (1990), who distinguishes between the modes of experiencing based on sense perception and those that are representational or expressive, and by Visser (2006, p.106), who states that "Indeed, not all processing requires conscious, semantic, interpretational activities". Moreover, Greeno and Moore (1993) make a distinction between 'recognition' as a symbolic process on one hand, and 'direct perception' as a

non-symbolic process on the other hand, which furthermore according to Gibson is unmediated by mental activity (Visser, 2006, p.106).

Figure 2. Framework of perceptual product experience (PPE), with core modes (centre) and the two dimensions of presentation (left) and representation (right) with submodes.

In the PPE model, the two dimensions 'map' to the sensorial, cognitive and affective core modes such that each of these modes are manifested in the presentation as well as the representation dimension (see Figure 2). Thus, each core mode has a 'pleasurable' as well as a 'meaningful' dimension. Hence, the sensorial experience is manifested in the presentation dimension as impression and in the representation dimension as recognition. Correspondingly, the cognitive experience is manifested as appreciation and comprehension, while the affective experience is manifested as emotion and association in the dimensions of presentation and representation, respectively. The core modes, dimensions and submodes of the PPE framework are illustrated in Table 1.

	Dimensions	
Core modes 'types of experience'	**Presentation** 'pleasurable experience'	**Representation** 'meaningful experience'
Sensorial	Impression	Recognition
Cognitive	Appreciation	Comprehension
Affective	Emotion	Association

Table 1. Core modes, dimensions and submodes of the Perceptual Product Experience framework.

Other frameworks (e.g., Lewalski 1988, Jordan 2002, Heufner 2004, Norman 2004, Crilly et al. 2004, Desmet and Hekkert 2007) also acknowledge experiences containing pleasurable and meaningful elements. The PPE framework, however, recognises that each of the core modes of sensorial, cognitive and affective experience inherently have a presentational as well as a representational part. As the two dimensions are ubiquitous aspects of the core modes and

indistinguishably and intrinsically part of the entirety of the perceptual product experience, they can be seen as ‘two sides of the same coin’.

In the following sections, the dimensions and related submodes of the PPE framework are described in more detail.

Presentation dimension and submodes

The dimension of ‘presentation’ is the ‘pleasurable’, non-interpretative side of the perceptual product experience. This dimension acknowledges the modes in which the product presents itself; how it may be experienced ‘for what it is’.

Thus, the presentation dimension is concerned with the direct, ‘pure’ sensual stimuli related side of the experience. However, as we ‘think with our senses’ in a reasoning process where “perceiving and thinking are indivisibly intertwined” (Arnheim, 1970), the process of making sense of what we perceive, including the categorisation and ordering of stimuli, is part of the presentation dimension. In line with Jordan (2002), the emotional response evoked by sensory stimuli as a result of cognitive and often automatic and unconscious processes (Desmet and Hekkert 2007) is also part of the presentation dimension of the experience.

The three submodes of the presentation dimension; impression, appreciation and emotion (see Figure 3), are described in the following sections.

Figure 3. The presentation dimension of the PPE framework, with impression, appreciation, and emotion submodes.

Impression

Impression is the essential and first part of the experience, which in turn can lead to any, or all, of the other experiences. In the PPE framework, impression is the purely sensorial experience of becoming aware of a product as a result of it being sufficiently 'different' to stand out, be noticed and attended to, referred to as 'active selectivity' by Arnheim (1970, p.20).

For example, we may notice a product we have seen many times before and make nothing more of it, such as the coffee grinder on our kitchen bench top. Or, we may discover a product which is new to us because it is different. For example, when looking for a new mp3 player, the one with the unusual shape and bright green colour may stand out among the blander, similar looking ones.

Appreciation

Appreciation is about "recognition of aesthetic values" (Merriam-Webster, 2008). In the PPE framework, appreciation engages cognitive processing of what we perceive through our senses. Arnheim (1970, p.13) argues that the cognitive operations are "essential ingredients of perception itself".

Gestalt psychology focussed on understanding patterns of visual perception, the 'organizational essence' (McKim, 1980), of fundamental forms, related to similarity, repetition, continuity, etc., all properties which contribute to an accurate and economical interpretation of the outside world (Hekkert 2006, p.162; see also Monö 1997, Solso 1999). The perception of gestalts is however not limited to the visual sense, but everything we perceive which can be discerned as a whole constitutes a gestalt, including colours and olfactory sensations (Monö, 1997).

Part of the appreciation is the composition and order of perceived stimuli (Muller 2001), such as the enjoyment of a pleasing visual composition of a piece of visual art, the harmonious and complex auditory structures in music, or the composition of tastes in gastronomy (see Hekkert 2006 for an overview). In the visual domain, hierarchy and layering of visual structures determines which features are seen as belonging together and which are incommensurate (Arnheim 1970, p.57). The pleasurable experience of visual composition of detail and unity in product design can be enhanced by the creation of coherence and resemblance between elements within each structural level of the visual composition, as well as between the hierarchical levels of holistic and atomistic structure of form (Warell, 2001).

Emotion

Emotion is the affective response evoked by the combination of product stimuli, subjective concerns and an appraisal (Desmet, 2002). Desmet states that emotions are a result of our assessment or appraisal of the product in light of our experience and concerns related to it. According to Visser (2006, p.7), emotion is involved in the control of activity and thus influences decision making (Tversky & Kahnemann, 1981).

Sensory stimuli give rise to emotions and indirectly also inform psycho-pleasure (Jordan 2002), relating to cognitive demands and emotional reactions associated with sensory perception. Understanding the sensory experience of products is a critical factor in being able to understand the subsequent appraisals that lead to emotions, and subsequently, to types of pleasurable response.

Thus, emotional response may be evoked from appraisals based on any of the other perceptual modes, such as appreciation, recognition, comprehension or association.

Representation dimension and submodes

Representation is complimentary to the presentation dimension in the PPE framework – both are inherent to product perception, and have to be regarded and attended to in the process of product design. The process of representation can be considered a perceptual process (Vera and Simon 1993, p.9). The 'perceptual' experience is thus not restricted only to the reception of stimuli (the impression mode), but to all processes involved in the experience, whether presentational or representational.

The dimension of representation regards the product experience as a meaning-making phenomenon that can be described by the three submodes of 'recognition', 'comprehension', and 'association' (see Figure 4).

The process of meaning making is socio-culturally contextualised and can be seen from the perspective of the producer (e.g., the designer or company) and the perceiver (e.g., the customer or user). Meaning can be created and formed from both these perspectives – as intended and perceived meanings. The three modes of the representation dimension are related to the three types of semiotic signs; icon, index and symbol (Pierce, 1931-1966), however, there is no absolute mapping between the type of sign and the form of representation (Warell et *al.*, 2006).

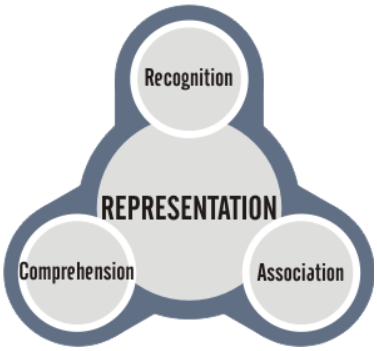

Figure 4. The representation dimension of the PPE framework, with recognition, comprehension, and association submodes.

Recognition

Recognition is based on direct, instantaneous processing of perceived stimuli – perception and recognition are inseparably intertwined (Arnheim 1970, p.90). Recognition is based on familiarity, resemblance or similarity, and requires previous precedents to compare with. Thus it is dependent on the existence of pre-established references stored in long term memory (Simon 1992, p.132; Solso, 1999, p.78).

In semiotic terms, recognition is dependent on the presence of iconic signs, a visual likeness between one thing (the icon) and another (the object). A classical example of an iconic reference is the metaphor, e.g., the form of the beetle is a metaphor of the form of the car (Vihma 1995, p.68).

Recognition can encompass several levels of identification, e.g., product type – a pair of scissors are identified through the sharpness of the cutting edges, an iron is identified by the flat, polished metal base, the electrical cord and an appropriately placed handle (see Muller 2001, and Monö, 1997)

Similarly, recognition of product brand requires resemblance to other products of a certain brand through similar sensorial elements. In the visual domain, such elements are known as ‘signifiers’ (Warell et al. 2006), or ‘design cues’. Arnheim (1970, p.166) referred to these types of items as ‘fieldmarks’. For example, recognition of an Apple computer or music player is often achieved through consistent use of colour schemes, materiality and logotype, and the characteristic shape and size of the grille is a common feature for all Audi cars. Recognition is equally applicable to the other sensory domains; e.g., the characteristic sound is typical for all Harley Davidson

motorcycles, and the solid tactile quality and well balanced weight is what I'd expect to find in any Bang & Olufsen product.

Comprehension

Comprehension is about making 'sense of things', such that products are "understandable to their users" (Krippendorff, 2006, p.xv). This is an area where product semantics has largely contributed to the understanding of design (see, e.g., Monö 1997, Krippendorff and Butter 1984, Krippendorff 2006).

Through comprehension, we understand characteristics such as level of quality and the nature of the product; the product describes its operation, expresses its properties, and exhorts certain types of action or even non-action; it informs and advises about itself. In comprehension, perceivable references in the product point towards the product itself, providing meaning related to the nature, behaviour, properties and essential characteristics of the product as such.

The first form of reference operates through a physical connection or a causal relation between the signifier and the object; as such, this form of comprehension depends on the presence of an indexical sign. An example of this is an old classic type of table top telephone that looks stable, because it has a wide and large base surface area. There is thus a causal relation – 'it is what it seems to be'; there is an indexical motivation (Joslyn, 1997).

The second form of reference operates through symbolic signs and is thus dependent on the interpretation of meaning (Chandler, 1994). As a symbolic sign, the relationship between the signifier and the meaning is completely arbitrary – i.e., it is subjective or at best dictated by social convention or habit. For producers, it is importance that established symbolic features are used in an honest manner, or the product may be interpreted as 'fake' (Monö 1997).

For example, a product may be interpreted as 'reliable' if components are generously dimensioned and made of solid materials (indexical reference), or if switches operate with the right tactility and have the right sound (symbolic reference).

Association

The third mode, 'association', is about communication of, e.g., values, origin and heritage, and works solely through the creation and interpretation of symbolic signs.

Association is dependent on subjective and socio-culturally conditioned processes of coding, which determine how we associate references with meaning through symbolic signs within target market groups with similar values and aspirations; interpretative communities (Chandler 1994). In association, meaning is created (encoded) and interpreted (decoded) from two perspectives; from the point of view of the manufacturer, who uses the product to convey strategic brand messages and build brand values (see Karjalainen, 2004); and from the point of view of the customer or user, who communicates personal values and preferences through ownership or use of the product.

For example, while for some, a Mercedes Benz is a symbol of success and social status, for others it represents excess and ostentatiousness (value based judgements). Or, someone wearing a koru spiral bracelet may do so because it symbolises new beginnings, growth and harmony and communicates his or her Maori origin.

Conclusion

Products are perceived with all senses. They create experiences, and are understood and valued in a context of previous experiences, personal expectations and preferences, socio-cultural environments and use situations. The PPE framework acknowledges that we experience products with all senses, and that the experience of pleasure, understanding, emotional response and value judgements are inherently part of any perceptual experience.

The framework recognises the various modes of the perceptual experience of the product, albeit to various degrees depending on product, perceiver and context. Acknowledging the complex and multi-layered nature of the perceptual experience, the experiential modes of the framework are inherently interrelated in a bi-directional manner, such that the cognitive part of the experience may follow from the sensory, or the affective experience being the response to an initial visual stimulus.

The framework clarifies, positions and relates the various experiences for the purpose of creating and examining design, and provides essential insights for purposes of designing product form and understanding product experiences. Understanding what possible perceptions that may arise from the experience of products is of value for design and for marketing activities. Being more informed as to how the product may be experienced, design work may be more effectively directed, and design concepts may be more easily assessed and evaluated. Experiences of users

may be more accurately predicted and more effectively researched such that new products may be designed that create desirable, pleasurable and meaningful experiences.

Acknowledgement

This work was supported by Affect – the Centre for Affective Design Research at Massey University through the Design for Desirability project. This support is gratefully acknowledged.

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