

Pre-press draft. Article published as:

Crilly, N., Moultrie, J., & Clarkson, P. J. (2004). Seeing things: consumer response to the visual domain in product design. *Design Studies*, 25(6), 547–577.

Seeing things: consumer response to the visual domain in product design

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This paper discusses consumer response to product visual form within the context of an integrated conceptual framework. Emphasis is placed on the aesthetic, semantic and symbolic aspects of cognitive response to design. The accompanying affective and behavioural responses are also discussed and the interaction between cognitive and affective response is considered. All aspects of response are presented as the final stage in a process of communication between the design team and the consumer. The role of external visual references is examined and the effects of moderating influences at each stage in the process of communication are discussed. In particular, the personal, situational and cultural factors that moderate response are considered. In concluding the paper, implications for design practice and design research are presented.

Keywords: aesthetics, product design, styling, perception, user behaviour.

The visual appearance of products is a critical determinant of consumer response and product success¹. Judgements are often made on the elegance², functionality³ and social significance⁴ of products based largely on visual information. These judgements relate to the *perceived* attributes of products and frequently centre on the satisfaction of consumer wants and desires, rather than their needs⁵.

Users' requirements of designed products have frequently been compared to Maslow's⁶ hierarchy of needs^{5,7-11}. This suggests that once issues of utility, safety and comfort have been satisfied, emphasis may shift towards the decorative, emotional and symbolic attributes of design. Thus, depending on motivation and context, a product's perceived attributes may be of greater importance than its tangible properties. This is because appearances are important^{11,12}, and "consumers don't just buy a product, they buy value in the form of entertainment, experience and identity"¹³.

1. Introduction

1.1. The need for a review and framework

There is a wide variety of literature related to response to product appearance. When surveying this literature, boundaries can be difficult to establish as “almost everything encountered [is] found to have some potential relevance to human perception of products”¹⁴. In addition to design research, fields of interest typically include aesthetics, psychology, consumer research, sociology, marketing and semiotics.

Crozier¹⁵ and Bloch¹ have drawn together ideas from many of these fields and presented excellent overviews of response to design. Subsequently, there have been a number of significant contributions to understanding how product design influences response. In particular, Monö³ and Coates² have offered new theories on product design that expand upon specific areas described by Bloch and Crozier. To date, the theories presented by these authors have not been reviewed and considered against the context of other work. Consequently, many of the ideas presented in the literature have not been connected even when they are complementary. Work is often presented without reference to that which precedes it and new language is developed for concepts that have already been described. To some extent this may be accounted for by (even excellent) texts being out-of-print, difficult to locate or generally not well known.

In addition to the absence of a comprehensive literature review, the existing models and frameworks have not previously been integrated to form a general and coherent perspective. The detailed frameworks related to specific aspects of product appearance are not set within the context of a more general theoretical framework. Consequently, there is little support available for categorising and structuring the relevant literature. This hinders the development of a proper understanding of the subject and may lead to failure in appreciating the relevance of each contribution. Indeed, when considering the subject of consumer response to product design Veryzer commented that “progress has been greatly impeded by the lack of a conceptual framework”¹⁶.

1.2. Scope

This paper provides a literature review on the subject of product appearance that is structured around the development of an integrated conceptual framework. The framework is built up as the concepts are discussed and the terminology introduced in the text is carried over to the framework. By

reviewing existing work and presenting it within a unified structure it is hoped that the following benefits will be realised:

- Listing and reviewing the existing texts will provide a point of reference for the subject.
- Little-known or recent texts that offer significant contributions to the field will achieve wider recognition, increasing their influence.
- Complementary theories presented by different authors will be drawn together and presented so that their commonalities may be observed.
- Presenting a general framework integrating the perspectives of a number of authors will provide a structure by which the subject may be better understood.

Although visual information frequently dominates our culture and environment^{12,17} it is accepted that the full range of human senses influence response to design¹⁸. It is important that a product's appearance is congruent with other sensory aspects of design^{19,20}, as "the product form that the eye sees creates in the observer expectation of what the other senses will perceive"³. This paper focuses solely on the visual form of products. However, the concepts discussed are believed to be relevant to other sensory aspects of product interaction. Furthermore, although physical products are referred to throughout, it is hoped that the information presented will be considered applicable to a broader range of media.

1.3. Notes on language

When discussing product appearance, it is important to establish precise definitions, as the language used can be confusing and inconsistent²¹. In particular the term *aesthetic* is commonly used to refer to two different concepts. Firstly, in the context of *product aesthetics* it may relate to what the product presents to the senses (especially vision)⁵. Secondly, in the context of *aesthetic experience* it may relate to one particular aspect of cognitive response: the perception of how pleasing (or otherwise) the process of regarding an object is²². For clarity, in this paper the term *aesthetic* is only used to refer to aesthetic response and not product appearance in general. In addition, the term *consumer* is used throughout this paper not only to refer to those involved in purchase decisions but also to include those involved in the ongoing process of *visual consumption*¹⁷. Other terms such as *semiotic*, *semantic* and *symbolic* are defined in the text

as they are introduced. Attempts have been made to adhere to the definitions found in the existing literature.

2. Communication through design

In general, consumers have no access to the designers of the products they interact with. Thus, the consumers' interpretation of the design is based predominantly on their interaction with the product²³. Designers only communicate attributes such as elegance, functionality, mode-of-use and social significance through the medium of the product. This *semiotic* perspective on product design focuses on viewing products as signs capable of representation²⁴. If products are to be considered as signs that are interpreted by users it is useful to consider consumer response to product appearance as one stage in a process of communication^{2,3,25}.

Shannon described a basic system of communication as comprising five elements: *source*, *transmitter*, *channel*, *receiver* and *destination*. The information source produces a message which is encoded into a signal and transmitted across a channel. The receiver decodes the signal and the message arrives at the destination²⁶ (see Figure 1).



Figure 1 Basic model of communication (adapted from Shannon²⁶)

Monō has applied this basic model of communication to the study of product design³. Here, the producer of the product is responsible for design and manufacture. The designer, or the design team, may be viewed as the source of the message. The product itself may be regarded as the transmitter of the message, and the environment in which the consumer interacts with the product may be regarded as the channel. The consumer is involved in both the perception of products and subsequent response. Consequently, the consumer's perceptual senses may be regarded as the receiver of the design message and their faculty for response may be regarded as the destination.

The orthodox view of consumer behaviour presents response to products as comprising *cognition* and *affect*, which are followed by *behaviour*^{1,27}. Thus, the destination may be divided into these three aspects of response. This suggests a representation of the design communication process where

designers have intentions for how a product should appear, the product is manufactured, placed in an environment, perceived by the consumer and finally responded to (see Figure 2). Each of these elements of the communications model will be discussed below.

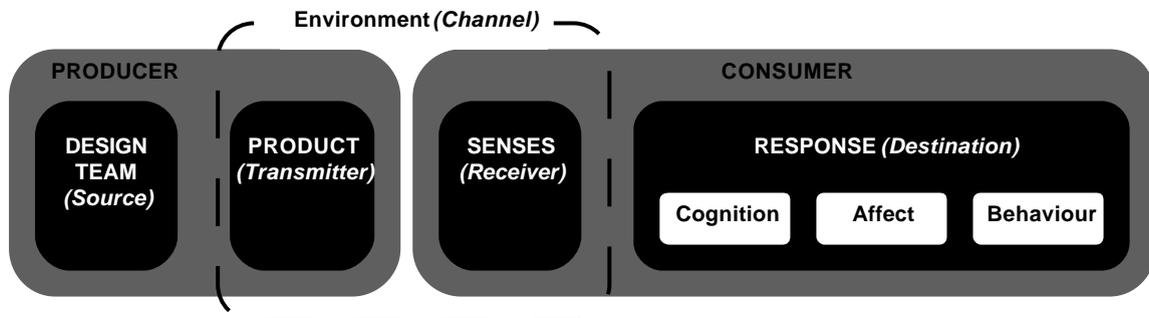


Figure 2 Basic framework for design as a process of communication

2.1. Design Team (source)

The design message is generated during the product development process³. Here, the design team makes decisions that determine what the product form should visually convey¹⁰. The design team may be characterised by the individuals involved in the project, the design activities they employ and the organisation or management of these activities^{1,28}.

2.2. Product (transmitter)

The physical product may be characterised by its geometry, dimensions, textures, materials, colours, graphics and detailing²⁹⁻³¹. Aspects such as the perceived novelty, style and personality of products are not considered here to be characteristics of the product because they are not objective qualities of the design. Instead, they are presented as aspects of the consumers' psychological response to the product.

2.3. Environment (channel)

The environment within which the product is to be perceived may be characterised by the physical conditions of the context of interaction. Of particular interest when considering the visual perception of products are issues of illumination³². If relevant, consideration must be given to the

media with which the product is to be represented, for example, photographic marketing material and packaging.

2.4. Senses (receiver)

The signal transmitted by the product is received by the physiological senses³. With regard to the perception of product form, vision is of primary importance. If consideration is to be given to other sensory aspects of design then touch, taste, smell and hearing all become significant. The complexities of perceptual psychology are not presented here; it is sufficient to state that our visual perception of objects may not be an accurate reflection of their physical state³³⁻³⁵.

2.5. Cognitive response (destination)

Cognitive response refers to the judgements that the user or consumer makes about the product based on the information perceived by the senses. These judgements include evaluation of the products' perceived qualities. In the existing literature, a number of different approaches are taken to describe response to design. However, when reviewing the work of Crozier¹⁵, Cupchik³⁶, Lewalski³, Baxter³⁷ and Norman³⁸ strong precedent emerges for using the following three categories to describe cognitive response to product appearance: *aesthetic impression*, *semantic interpretation* and *symbolic association*.

- *Aesthetic Impression* may be defined as the sensation that results from the perception of attractiveness (or unattractiveness) in products. This is related to Crozier's "response to form", Cupchik's "sensory/aesthetic response", Lewalski's visual "X-values" (which express "the order of visual forms"), Baxter's "intrinsic attractiveness" and Norman's "visceral level" in design.
- *Semantic Interpretation* may be defined as what a product is seen to say about its function, mode-of-use and qualities. This is related to Crozier's "response to function", Cupchik's "cognitive/behavioural response", Lewalski's visual "Y-values" (which are "conducive to purposefulness and functionality"), Baxter's "semantic attractiveness" and Norman's "behavioural level" in design.
- *Symbolic Association* may be defined as the perception of what a product says about its owner or user: the personal and social significance attached to the design. This is related to Crozier's "response to meaning",

Cupchik's "personal/symbolic response", Lewalski's visual "Z-values" (which "fulfil the need to belong and for self esteem"), Baxter's "symbolic attractiveness" and Norman's "reflective level" in design.

These elements of response are not presented as objective qualities of the product. They are classifications for different aspects of cognitive response to product form. Although often convenient to do so, it is not entirely accurate to describe products as *being* aesthetic, *having* semantic attributes or *possessing* symbolic qualities. Instead, these are all aspects of cognition driven by both the perception of tangible stimuli and pre-existing knowledge. Although there is often consensus amongst groups and within eras, viewers in different circumstances may make different judgements³⁹.

2.6. *Affective response (destination)*

It has been well established that products elicit emotional responses^{40,41}. The word *affect* is commonly used as an umbrella term to describe these emotions, moods and feelings^{27,42}. Affect has been described as part of "the consumer's psychological response to the semiotic content of the product"⁴³. Consumers may experience a variety of potentially contradictory feelings towards an object, such as admiration, disappointment, amusement and disgust^{44,45}. Typically, these feelings will be relatively mild when compared to the possible spectrum of human emotions⁴⁶.

Desmet has proposed five categories for the emotional responses that products may elicit: *instrumental*, *aesthetic*, *social*, *surprise* and *interest*⁴¹. Instrumental emotions (such as disappointment or satisfaction) stem from perceptions of whether a product will assist the user in achieving their objectives. Aesthetic emotions (such as disgust or attraction) relate to the potential for products to "delight and offend our senses"⁴¹. Social emotions (such as indignation or admiration) result from the extent to which products are seen to comply with socially determined standards. Surprise emotions (such as amazement) are driven by the perception of novelty in a design. Finally, interest emotions (such as boredom or fascination) are elicited by the perception of "challenge combined with promise"⁴¹.

Each of these categories of emotion result from an appraisal of the product. With regard to visual perception, this appraisal is based on the aesthetic impressions, semantic interpretations and symbolic associations that comprise cognitive response. However, whilst aesthetic emotions are directly related to aesthetic impressions, in general, the full range of cognitive responses may contribute to the full range of affective responses. For example, instrumental emotions may result from aesthetic impressions,

semantic interpretations and symbolic associations if the product is seen to promise the satisfaction of decorative, practical and social objectives.

Norman describes both affect and cognition as information processing systems, where the cognitive system makes sense of the world and the affective system is judgmental⁴². Each system influences the other, with cognition leading to affect, and affect influencing cognition^{2,42,47}. Thus, whilst the division between the cognitive and affective phases presented in the framework is convenient, considerable interdependence exists.

2.7. *Behavioural response (destination)*

A consumer's psychological response (comprising cognition and affect)¹ influences the way in which they behave towards the product²⁷. Marketers frequently use the terms *approach* or *avoid* to distinguish between the behavioural responses of an interested and disinterested consumer.

Approach responses may be associated with further investigation of the product, product purchase and product use. Avoid responses may be associated with ignoring the product, failure to purchase, product abuse and even hiding the product¹.

2.8. *The consumer's cultural context*

The culture, background and experiences of the consumer are influential in determining their response to products¹⁻⁴. The designers and consumers of a given product are often (but not always) separated by time, place or social group. As such, the *context of consumption* within which the consumer operates is an important consideration. It is within this context that the design message is interpreted and from which influences on this interpretation originate (see Figure 3).

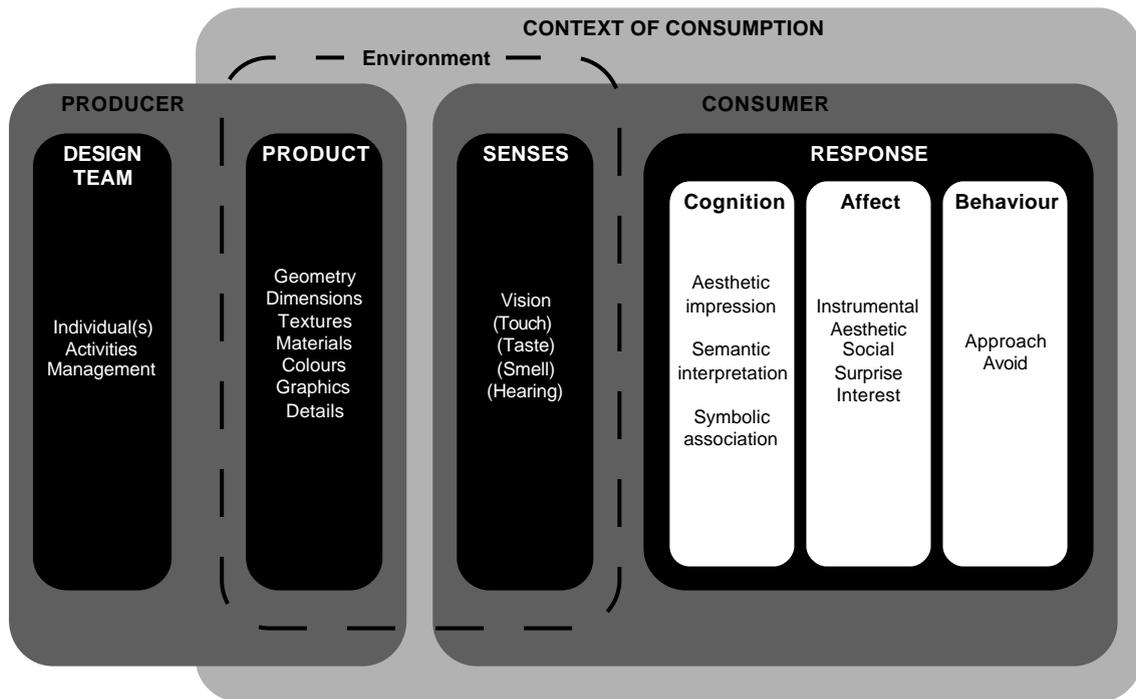


Figure 3 Expanded framework for design as a process of communication

The cognitive response phase in the design communication framework has been presented as comprising aesthetic, semantic and symbolic elements. These aspects of response are central to this paper and are discussed in detail below. This discussion is accompanied by consideration of the way in which these elements interact. Following this, the *visual references* that may be perceived in a design are presented and the *moderating influences* which may disturb the process of communication are discussed.

3. Aesthetic impression

People may look at objects and find them visually attractive, elegant or beautiful². Often the activity of perceiving the object is pleasurable in itself, irrespective of other value judgements that might be made⁴⁸. This positive aesthetic impression has interested design researchers for decades^{49,50} and art theorists and philosophers for centuries before them^{22,51}.

Although the subject of beauty has been studied for centuries there is still no unanimous consensus on what is beautiful or what comprises beautiful artefacts⁵². Furthermore, there has been little progress in the formulation of a “coherent theory with respect to the aesthetic aspect of design”¹⁶. Many of the theories proposed have resulted in disagreement amongst creative

individuals, suggesting that general principles either do not exist or are not easily communicated in words⁵⁰. As such, Baxter describes the inherent attractiveness of visual form as “that most illusive and intangible quality”³⁷. Despite this, there are aesthetic principles and theories that provide a useful conceptual foundation. In particular, considering the perception of attractiveness as comprising objective and subjective components, and as a balance between opposing factors provides a basis upon which the subject of aesthetic impression might be approached.

3.1. *Objective and subjective attractiveness*

Most early scholars of beauty held the perspective that attractive features resided in the object itself⁵². Beauty was considered to be an objective property of the stimuli under consideration. Certain lines, proportions, shapes and colours were believed to be inherently attractive⁵³. This approach suggests that each object will have an ideal form, which once attained will tend to be considered attractive by everyone².

A great deal of historical art and architecture is based upon the notion of inherently pleasing proportions (such as the Golden Section), and the adherence to strict geometric rules^{29,54}. The Bauhaus school pioneered the application of this approach to product design in the 1920s and 30s⁵⁵. Products from the Bauhaus school were highly rational, and reflected the work of the Gestalt psychologists, who identified the tendency to perceive or construct symmetry, regularity and harmony even when it is not actually present⁵⁶⁻⁵⁸. This innate desire for order in visual stimuli resulted in a number of aesthetic principles, which were developed to aid the production of pleasing designs. These principles are commonly referred to as the Gestalt Rules. There are a large number of these rules, which include an emphasis on symmetry, proximity, similarity, continuance, repetition and closure^{5,31,37}.

Crozier suggests that “the presence of demonstrable differences between peoples’ judgements makes it difficult to believe in universal aesthetic principles [and that] inherent responses [may be] a mirage”¹⁵. He suggests that the visual appeal of objects is also influenced by socio-cultural, socio-economic, historical and technological factors. As such, the ideals and standards to which one culture aspires may not be appreciated by other cultures. This issue of cultural taste indicates that the objective properties of a design are insufficient, in themselves, to explain judgements of attractiveness¹⁵. The consumers’ subjective experiences are also important and contribute to aesthetic impressions. For example, prior experience will influence the perception of product typicality and novelty², two factors that have been shown to strongly affect aesthetic preference⁵⁹.

3.2. *Aesthetic balance*

When considering aesthetic impression, Gombrich proposed that “delight lies somewhere between boredom and confusion”⁶⁰. For stimuli to be considered attractive, the extent to which they make sense to the viewer must be balanced by the extent to which they present something of interest. In Berlyne’s reinterpretation of the Wundt curve, a similar concept is presented⁴⁸. Berlyne suggests that the hedonic value (pleasure) associated with perception of a stimulus will peak when there is an optimum level of psychological arousal; too little arousal will result in indifference whilst too much will result in displeasure.

More recently, Coates has advanced his own theories on the perception of product attractiveness². He also describes positive aesthetic impression as the result of a balance between two opposing factors: *information* and *concinnity*. Information relates to both *novelty* and *contrast*, which may serve to arouse a consumer’s interest. Conversely, concinnity relates to the *order* and *sense* perceived in a design, which may assist the consumer in understanding the product.

Coates suggests that the information and concinnity perceived in a product stem from not only the *objective* qualities of the product itself, but also from the *subjective* experiences of the consumer. In addition to the combination of lines, colours, textures and details that comprise the product’s visual form, the consumer’s familiarity with other products, entities and concepts also influence aesthetic impression. Thus, the information and concinnity perceived in a product may be divided into their objective and subjective components (see Figure 4).

- *Objective information* may be regarded as the amount of contrast that a design presents against its background and within itself. This is determined by the way in which certain design elements are combined. For example, products which are of a strikingly different colour to the environment in which they are perceived and which utilise a variety of lines, shapes and textures will exhibit a high degree of contrast.
- *Subjective information* may be regarded as the novelty perceived in the design. This is largely determined by the extent to which the product deviates from forms with which the consumer is already familiar. For example, products utilising shapes and lines that are a radical departure from those normally encountered arouse interest due to their novelty.

- *Objective concinnity* may be regarded as the order perceived in the design. This is determined by the application of design principles such as the Gestalt Rules. For example, products exhibiting a high degree of symmetry and orthogonality appear simple, rational and ordered.
- *Subjective concinnity* may be regarded as the extent to which the design appears to make sense to the viewer. This is determined by the consumer's personal, cultural and visual experiences that assist them in understanding the product. For example, products that use design cues from other products, or exhibit a good degree of commonality with existing designs are often easy to comprehend.

Coates conceptualises these four *aesthetic ingredients* as items on a weighing scale. The total information (comprising objective and subjective components) is on one side and the total concinnity (also comprising objective and subjective components) is on the other. If information outweighs concinnity the product will be considered confusing, meaningless and ugly. Alternatively, if concinnity outweighs information, the product will be considered simple, dull and boring. Coates suggests that only when information and concinnity balance, and the product is at once engaging and comprehensible, will it be considered attractive.

3.3. *Design for aesthetic impression*

Designers use their skill, training and experience to produce products that induce a positive aesthetic impression. Designers' tacit understanding of perception and visual composition often guide their intuitive judgements^{61,62}. Indeed, there are those who feel that intuitive creativity is all that is required for the production of visually attractive products and that a scientific approach is not relevant to an understanding of the problem. This view may be reinforced by the discovery that very few of the scientific studies have led to generalisations which are useful for students or practitioners of design¹⁵. However, designers and consumers often interpret products differently and express different aesthetic preferences⁶³. Thus, although "styling is the 'artistic' part of product design [it must still be] directed towards opportunities and held within constraints"³⁷. Measuring consumer response to products and correlating perceptions with product features may offer the opportunity to modify designs and closer align them with consumers' aesthetic preferences².

4. Semantic interpretation

Designed objects are often functional devices that operate in some way to perform the task for which they are used⁶⁴. Consequently, a significant portion of the value assigned to products may be attributed to their utility. This may comprise practical qualities such as function, performance, efficiency and ergonomics. These aspects of utility can be conveyed to some extent by the visual form of the product. This evaluation of a design's *apparent* utility and *perceived* qualities is described here as *semantic interpretation*.

The definition of *product semantics* relevant to this interpretation is limited to what the product appears to communicate about itself. The extent to which products are seen to reflect the identity of their owners is discussed separately in the section on *symbolic association*. A distinction is made here between what the product is seen to indicate about itself and what it is seen to symbolise about its owner¹⁰. Consequently, a narrower definition of product semantics is adopted than that proposed by Krippendorff and Butter, who included symbolic qualities such as “the personalities a [car] driver seeks to acquire by owning a particular model”²⁵. Instead, a treatment of product semantics is explored which is more congruent with Monö's *semantic functions*³ and Norman's *affordances, constraints and mappings*²³.

4.1. Semantic functions

Monö's book, *Design for Product Understanding*, presents a comprehensive guide to semantic interpretation from a semiotic perspective. Monö states that a product's visual form may appear to communicate its practical qualities through four semantic functions: *description*, *expression*, *exhortation* and *identification*³ (see Figure 4):

- *Description* refers to the way in which the outward appearance of a product presents its purpose, mode-of-operation and mode-of-use. For example, a grooved handle may suggest the direction in which it is to be turned and indicate how much force will be required. From a product's description, consumers may infer the practical benefits the product will offer and how they must interact with it.
- *Expression* refers to the properties that the product appears to exhibit. For example, modifications to a product's visual form may alter the consumer's interpretation of qualities such as density, stability or fragility. The properties that a design expresses may assist the consumer in understanding how the object should be treated.

- *Exhortation* refers to the requests or demands that a product appears to make of those perceiving it. For example, flashing switches may request that they be switched off. Through exhortation the product may elicit the appropriate actions from the user for correct and safe operation.
- *Identification* principally refers to the extent that the origin and affiliation of a product are conveyed. For example, the manufacturer, product type, product range and specific model may be communicated by text, graphics and design cues. The identification of a product assists the user in understanding the category to which the product belongs.

Monö suggests that, in application, the distinction between these semantic functions may not always be clear. The communication of a specific attribute may be shared across semantic functions. For example, the product's purpose may be *described* by the physical form and *identified* by the addition of text labels and graphics³.

4.2. *Affordances, constraints and mappings*

Norman's book, *The Design of Everyday Things*, describes how the visual presentation of products may assist the user in assessing how products should be used. Norman refers to three clues in the visible structure of products that can improve the ease with which they may be understood: *affordances, constraints and mappings*²³.

- *Affordances* were described by Gibson as "what [physical objects] furnish for good or ill"⁶⁵. Norman reinterpreted⁶⁶ affordances as the "perceived ... properties of the thing ... that determine just how the thing could possibly be used"²³. With respect to product design the affordances of objects allow certain actions and operations by the user. An example commonly cited is that of a chair, which through the provision of a flat, stable, adequately sized surface at a suitable height *affords* sitting.
- *Constraints* place limits on what actions can be performed. The propensity to perform certain activities may be limited by the perception of obstacles and barriers to those activities. For example, with a pair of scissors the holes in the handle *afford* the use of fingers and the limited size of the holes place *constraints* upon the number of fingers that can be used in each handle. Thus affordances and constraints may work together to suggest what actions are possible and what limits are placed on those actions²³.

- *Mappings* refers to the relationships between a user's actions and the corresponding behaviour of the system. Even without operating a device, congruence with mental models may be perceived in the design⁶⁷. Norman uses the example of an electric car-seat-control-panel where the levers required to move the seat are arranged so as to represent the seat itself; purely from visual inspection, the mode of operation may be understood²³. Visually presenting product functionality assists consumers in understanding how a product may be operated⁶⁸.

Norman relates each of these terms to the physical use of products. However, they are also relevant to the perceived use of products based on visual inspection. Furthermore, they may be considered as sub-divisions of *description* (of mode-of-use) and as such they are not shown on the framework.

4.3. *Design for semantic interpretation*

A semantic approach to design places emphasis on the opportunity for consumers to interpret a product's utility and associated qualities. Krippendorff proposes that "design is making sense (of things)"⁶⁹ and that designers should help the user in correctly interpreting the product. To assist designers in this task, Butter has suggested a sequence of activities that integrate semantic considerations into the design process⁷⁰. The key stages of the process are: 1, establish the overall semantic character that the product should communicate; 2, list the desired attributes which should be expressed; and 3, search for tangible manifestations capable of projecting the desired attributes through the use of shape, material, texture and colour⁷⁰.

Knowledge of semantic principles has been shown to improve the clarity of students' designs^{71,72}. Furthermore, commercially successful products have been produced with explicit consideration given to their semantic character⁷³. In conjunction with Norman and Butter, Monö's explanation of product semantics provides a practical guide to the communicative capabilities of product form. Thus, a useful theoretical basis exists for designers looking to foster an appropriate semantic interpretation of their products.

5. *Symbolic association*

In addition to their apparent decorative and practical qualities almost all products are seen to hold some socially determined symbolic meaning⁷⁴⁻⁷⁶. As such, products may evoke "thoughts, feelings [and] associations which

one links to the commodity, or assumes that others must associate with it”⁷⁷. This culturally agreed meaning of objects allows a person to communicate their identity through products; it allows them to “project a desirable image to others, to express social status and to make visible their personal characteristics”⁷⁴. Thus, products contribute to the *expressive equipment* with which people present themselves⁷⁸.

Whereas semantic interpretation relates to what the product is seen to indicate about itself, symbolic association is determined by what the product is seen to symbolise about its user, or the socio-cultural context of use¹⁰. For example, whilst a chair *denotes* (or affords) sitting, a throne *connotes* (or implies) status and power⁷⁹. As such, the social value assigned to products determines the symbolic associations that are made.

5.1. *The social value of products*

Products are used by people to communicate their identity not only to others, but also to themselves⁴. The objects we consume both reflect *and* contribute to who we are: “possessions may impose their identities on us” and as such, “we regard possessions as parts of ourselves”⁸⁰. In addition to this distinction between an inward and outward expression of identity, Dittmar divides the symbolic qualities associated with products into *self-expressive* and *categorical* meanings⁴ (see Figure 4).

- The *self-expressive* symbolism associated with products allows the expression of unique aspects of one's personality. This includes individual qualities, values and attributes⁴. These self-expressive meanings serve to *differentiate* the consumer from those that surround them⁸¹. As such, products are used to reflect the owner's distinction from others, they “represent a means of defining one's self as unique [and] may symbolise the person's unique identity”⁸².
- The *categorical* symbolism associated with products allows the expression of group membership, including social position and status⁴. These categorical meanings serve to *integrate* the consumer with those that surround them⁸¹. Indeed, one of the principal approaches to expressing membership of a social group is through shared consumption symbols⁸⁰.

The symbolic meanings attached to products are culturally defined⁴. Therefore, the extent to which a product is seen to reflect or support identity will be determined by the cultural context within which the product is consumed.

5.2. *Design for symbolic association*

The meanings attached to products are often determined by factors external to the product's appearance⁷⁷. Historical precedents, social conventions and marketing programmes all influence the perceived symbolism of products³⁹. Consequently, the symbolic associations evoked by a product may be less dependent on product appearance than aesthetic impressions and semantic interpretations are. Still, symbolic associations are not unrelated to product appearance, and "it is the designer's job to decode the common values and opinions that exist in the culture, and reproduce them into forms that embody the appropriate symbolic meaning"⁸³. Thus, the meaning of designs should be considered from the beginning of the design process. Here, image boards may be of use in capturing and communicating the lifestyle, moods and themes that are of interest^{37,84}.

The materials used in products are one aspect of visual form that may be associated with specific qualities. The use of wood may evoke images of craftsmanship, metals may be associated with precision and products utilising polymers are often regarded as "cheap plastic imitation[s]"⁸⁵. The projection of these qualities can extend beyond the product to contaminate the owner or user^{4,80}. For example, those involved in the consumption of goods constructed of wood and metal may be seen not only to appreciate craftsmanship, but also to *be* traditional, skilled and precise themselves.

6. *Aesthetic, semantic and symbolic interaction*

Cognitive response to product visual form has been described as comprising aesthetic impressions, semantic interpretations and symbolic associations. However these aspects of response do not operate independently, but are highly inter-related; each one influences the others. For example, assessment of what a product is (semantic interpretation), may influence judgements on the elegance of a design (aesthetic impression) and the social values it may connote (symbolic association). These interactions are indicated on the framework by double-headed arrows connecting each aspect of cognitive response (see Figure 4). Furthermore, the *relative importance* that the consumer places on their aesthetic, semantic and symbolic responses may vary depending upon the situation.

6.1. *Aesthetic-semantic interaction*

The visual appeal of a design is influenced by the extent to which it makes sense to the viewer. One contributor to this concinnity is the apparent agency (or usefulness) of the object². Thus, a consumer's aesthetic impression is influenced by their semantic interpretation of the product. In addition, there is a great deal of overlap between Monö's semantic function of expression and Coates' aesthetic principle of *daimon* (or character). The character perceived in a design affects consumers' understanding of that product and consequently influences both their aesthetic *and* semantic judgements.

6.2. *Semantic-symbolic interaction*

There is not necessarily a clear distinction between the symbolic value associated with a product and semantic interpretation of its instrumental (or utilitarian) value. For example, qualities such as the apparent power of a machine (semantic interpretation) may be transferred to its user, who may be perceived as being strong and capable themselves (symbolic association)⁴. Thus, the semantic expression interpreted in a design, which defines its character, may also be of symbolic significance in reflecting the character of its owner or user.

6.3. *Symbolic-aesthetic interaction*

Connections may be observed between the perceived aesthetic and symbolic qualities of objects. The aesthetic judgements that consumers make often reflect their taste. Thus, products hold a symbolic value in reflecting the social groups to which consumers belong⁸⁶. Cultural tastes are often characterised by agreements on "what looks good ... what materials are to be valued ... what is worth aspiring towards and how aspirations can be reinforced with material goods"⁸⁷. Thus, when products are consumed, expressions of "I like that" may be implicitly converted to "I'm like that"¹²; taste is not only a matter of aesthetic preference, but also of social discrimination⁸⁸.

6.4. *Relative importance*

Almost all products elicit aesthetic, semantic and symbolic responses to various extents. The relative strength and importance of each aspect of response may vary depending upon context, motivation and product type. For example, the symbolic meaning associated with products often has the

potential to dominate the aesthetic and semantic aspects of cognitive response³⁷. As such, branding and promotion activities often focus on investing mass manufactured products with meaning through the creation and communication of associated qualities^{17,89,90}.

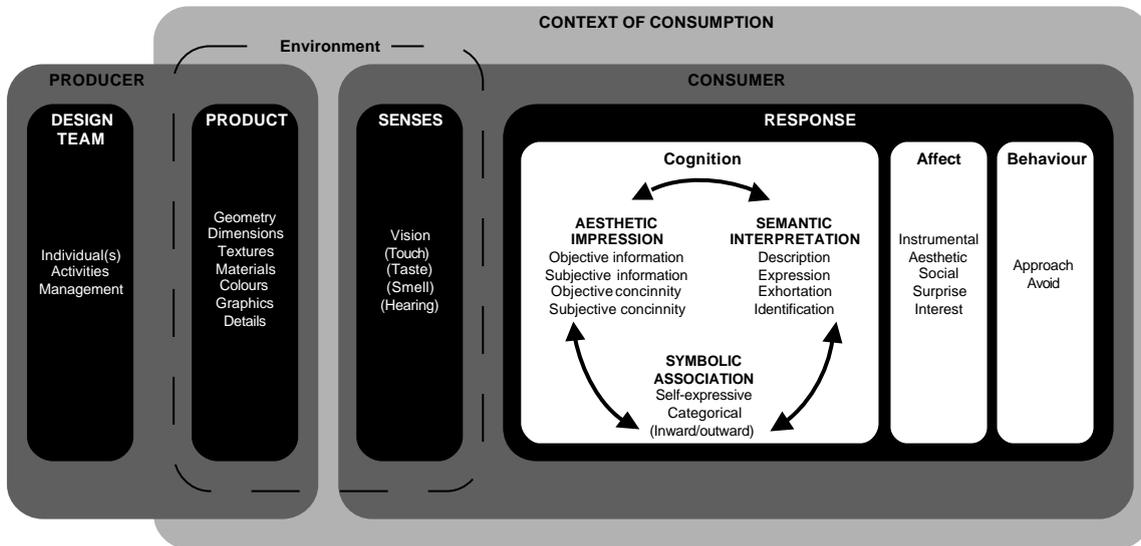


Figure 4 Framework for design as a process as communication with expanded cognitive response

7. Visual references

When interpreting a product's visual appearance, consumers draw upon sources external to the perceived object as points of reference. These *visual references* help the consumer to understand the product by reflecting generic designs, alluding to other concepts or evoking comparison with living things. As such, consumer response to design may be influenced by the visual references that are perceived, whether or not the designers intended these references.

Visual references may affect aesthetic impression by increasing subjective concinnity. This assists the viewer in making sense of the information which the product presents². Semantic interpretation may be assisted by allowing the viewer to categorise the product with greater ease and compare it to artefacts or concepts with which they are already familiar⁹¹. Visual references may also influence the symbolic associations a product evokes by connecting it with other entities that are already seen to hold some social meaning¹². Beyond moderating these aspects of cognitive response, visual references may also influence affective response. For example, recognising allusions to other product types or living things may result in the perception of unexpected humour and the formation of emotional attachments³⁷.

Visual comparisons may be drawn between the product itself and the consumer's *stereotypes* of the product category. Furthermore, products may be compared to *similar products* that exist within the same category. Beyond exhibiting typicality with the class to which it belongs, a product may also be seen to make reference to other products, other entities and other styles. These references are described here as *metaphors*, *characters*, *conventions* and *clichés* (see Figure 5).

7.1. *Stereotypes*

Stereotypes (or prototypes^{59,79}) are mental images of generic exemplars of a product class. They present constant forms of a conventional character that suggests the familiar usage associated with the product category⁷⁹. For example, a stereotypical chair may be thought of as having four legs, a flat base and a straight back (which affords sitting). Stereotypes may typify many designs without necessarily being coincident with any of them.

Coates proposes that when a specific design example is observed it is implicitly compared to the stereotype². If there is a high degree of conformity the design will appear to make sense, increasing subjective concinnity. Conversely, if the design varies considerably from the stereotype it may be interpreted as exhibiting novelty, increasing subjective information². Thus, the perception of novelty, which is one ingredient on the balance of aesthetic impression, is influenced by stereotypes.

Both typicality and novelty contribute to the formation of a positive aesthetic impression. Novelty arouses the viewer by presenting something new whereas typicality assists the consumer in categorising the product and understanding its form². Whilst typicality and novelty might appear to be mutually exclusive qualities, consumers often express a preference for products that appear to offer an optimal combination of both aspects⁵⁹.

7.2. *Similar products*

In addition to a conceptual stereotype, reference may also be made to similar products within the same product category. Products may be explicitly compared to competing products. This informs purchase decisions because product form is often used to differentiate products within the marketplace^{1,27,92}. The perceived similarity between a particular product and previous generations of products may also moderate response. In particular, when consumers seek to replace existing purchases, prior knowledge may be used to make judgements on attractiveness³⁷. Beyond reference to recent designs, products may evoke recollections of historic or iconic designs. For

example, within the automotive industry, new products frequently utilise nostalgic design cues that “remind viewers fondly of revered cars of the past”².

7.3. *Metaphors*

Products may be compared, not only to other examples from the same product category, but also to other types of product and natural forms. These metaphors may suggest “evocative connections between the [product] and memories from our experience”⁹¹. This can allow people to more easily understand a new concept by presenting it in such a way as to suggest analogy with concepts that are already familiar⁷⁹. In particular, product metaphors may assist the consumer in interpreting how the product should be approached or how it might be used⁹³. Metaphors are particularly common in electronic products where the form of the outer casing need not closely reflect its constituent components and products may have no existing precedent⁸⁴. Drawing upon imagery from external sources may give the product a more descriptive appearance and assist the user in their process of interpretation^{73,94}, thus facilitating intuitive use⁹⁵.

7.4. *Characters*

In addition to metaphors that relate to how products operate, non-functional metaphors may be detected that relate to product character⁹⁶. In particular, designs may often evoke comparison with living things as consumers empathise with objects and engage in a “process of personification”⁹⁷. This assists consumers in understanding designs by allowing them to treat products like humans and use their interpersonal skills to interact with them⁹⁶. Different people often assign the same personalities to products⁹ and relationships between shape characteristics and perceived character have been suggested^{37,98}.

In order to indicate character, products may be proportioned or arranged so as to evoke associations with animate creatures. In particular, facial expressions have great power in conveying feeling⁹⁹, and many designers exploit this through the use of facial arrangements in products¹⁰⁰. Other aspects of the body are also referred to in products. For example, a pronounced waist may hint at femininity, wide legs may indicate stability and broad shoulders may suggest strength^{101,102}.

7.5. *Conventions*

Repeated use of analogies can result in the establishment of culturally accepted conventions. For example, the traffic light colour sequence is frequently used, on a wide range of products, to indicate safe and unsafe states. As such, it is rarely considered as an explicit comparison, but as a conventional use of colour. Such conventions can be useful in visually communicating correct operation and confusion may arise if designers do not adhere to them²³.

7.6. *Clichés*

When too many products are seen to use the same visual references, such products may be interpreted as clichés. This may particularly be the case where designs appear to lack significant original thought and merely utilise hackneyed design cues. For example, following the success of the original iMac, “many other colorful, transparent products quickly appeared as well, ranging from cellular phones to office chairs and virtually everything in between ... transparent color had become a cliché”².

7.7. *The source of visual references*

The visual references upon which the consumer may draw are defined by their personal experiences. Clearly, designers may draw upon references outside of the consumer’s experience. However, these references will not necessarily be perceived by the consumer and are not presented here. Visual references are presented in the framework as being drawn from the context of consumption, influencing response (see Figure 5).

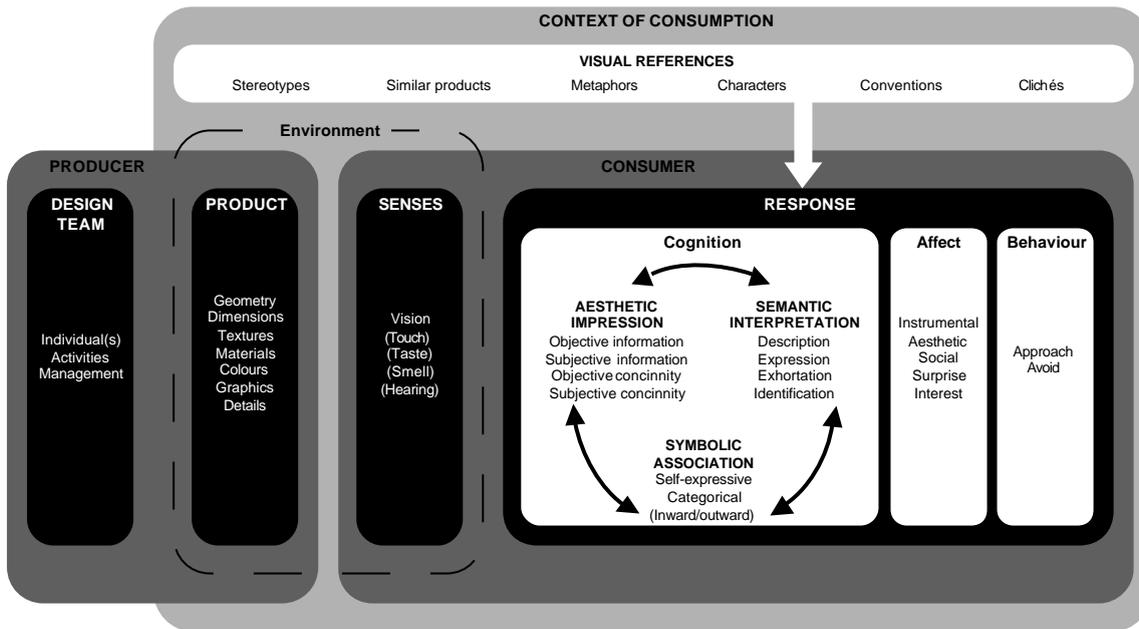


Figure 5 Framework for design as a process of communication with visual references

8. Moderating influences

Consumer response to product design has been presented as one stage in a process of communication. However, processes of communication are subject to disturbance in the presence of noise^{26,103,104}. With regard to product design, these disturbances³ or moderating influences¹ may operate at any phase in the design communication process, thereby affecting consumer response to the product. A huge variety of factors can influence response to design. Thus, a range of representative (rather than exhaustive) moderating influences is presented (see Figure 6).

8.1. Organisational issues influencing the design team

Moderating influences operating on the design team may affect the creation of the design message. In addition to designer competence, organisational issues such as communication and resources will influence the design process. This may lead to difficulties in logically converting the required message into product form and finish³. An important aspect of product design in a corporate environment may be the requirement to adhere to a brand style, or reflect the design of previous products⁶¹. This may restrict the range of design solutions available to the design team.

8.2. *Production quality influencing the product*

Monö states that “technical flaws in construction and manufacture can affect ... the design’s physical gestalt”³. Examples of these flaws may include failure to meet design tolerances and poor surface finish¹⁰⁵. Additionally, the ageing of products over time may influence the way they are perceived. For example, whilst some metals and woods acquire an attractive patina over time, in general, polymers do not age gracefully^{85,106}. This may lead to a disparity between the way a product appears and the appearance intended by the designers. It is worth noting here that although high standards of production are often appreciated, the inconsistencies indicative of hand finishing are also valued by consumers and may encourage the formation of emotional attachments¹⁰.

8.3. *Distractions in the environment*

The visual information received by the senses is moderated by the manner in which the product is presented and distractions that detract from that presentation^{67,84}. For example, when considering the use of colour in identifying brands, care should be taken as, “when one colour is used it is always seen against random background colours and is affected by them ... a combination of colours is better able to preserve colour identity intact in different environments”³.

The time available to view an object within its environment may also be a moderating influence. The amount of time the consumer has to observe a design determines the amount of information they receive. The full details of a design may not be perceived instantaneously, but take time to be explored¹⁰⁷. For example, it has been suggested that whilst aesthetic impressions may be formed almost immediately, semantic interpretations are more likely to be made when an extended observation time is available¹⁰⁸.

8.4. *Sensory capabilities influencing perception*

Unanticipated physiological characteristics of the consumer, which influence sensory perception, may result in the transmitted design message being received in an unexpected way³. Of particular interest when considering the visual domain in design are conditions that affect visual acuity, range-of-vision and colour vision³². For example, deterioration of the senses is especially prevalent amongst older adults¹⁰⁹⁻¹¹¹ and this may result in products being perceived in a way other than that anticipated by the designers.

8.5. *Moderating influences on response*

There are a number of factors that influence cognition, affect and behaviour. These influences may act on all three aspects of response and, as discussed, these aspects of response have considerable interdependence. As such, these moderating influences are not presented as moderators to specific aspects of response, but to response in general (see Figure 6).

Response to design is often described as involving *innate, personal* and *cultural* factors^{1,2,5,15,112}. The innate (or deep-seated) preferences have been discussed previously (for example, the gestalt principles) and are relatively universal and constant. However, the personal and cultural, to which Bloch adds *situational*¹ may vary considerably between consumers.

8.5.1. *Personal characteristics*

A number of consumer research studies have investigated the influence of personal characteristics on design preference. These studies have included consideration of age¹¹³, gender¹¹³⁻¹¹⁵, experience¹¹⁶ and personality^{114,115}. With regard to personality, variation in the goals, attitudes and standards held by different people characterise their concerns⁴¹. Thus, the consumer's self-confidence, social aspirations and personal ideologies will influence response⁹.

The interpersonal differences between consumers result in not only variations in the preferences they express, but also variation in the importance of those preferences. Some people simply place more emphasis on the appearance of products than others do¹¹⁷. In certain cases, the psychological condition of the consumer may also influence response. Any reduction in mental faculties, whether temporary or permanent, has the potential to influence interpretation of the design message^{3,109-111}.

8.5.2. *Cultural influences*

In addition to personal and situational factors, consumer response is moderated by cultural influences. Design preferences may be largely defined by cultural agreements on “what looks good ... what materials are to be valued ... what is worth aspiring towards and how aspirations can be reinforced with material goods”⁸⁷. It is not just these established conventions of taste⁸⁶, but also general trends¹¹⁸ and transient fashions^{88,119}, which may influence response. In particular, the *zeitgeist* (or cultural preconceptions) contribute to how designs are interpreted and the extent to

which they are accepted by society². This may influence the *current product sign* (the market's conception of how a product should look)³ and the styles which are acceptable¹²⁰.

The cultural contexts within which designers and consumers operate may differ greatly from each other. Design acumen, product perceptions and taste may all contrast strongly between the two groups⁶³. Thus, when consumers interpret products, there may be a “completely different relationship between user and object from that intended by the designer ... depending on the cultural and sociological background of the ‘reader’ [consumer]”¹²¹. Even the tendency to group tones into particular colours or to attach special significance to orthogonal structures may be culturally determined¹²². As such, designers may have access to different visual references than those available to consumers and a wide range of moderating influences may be difficult to anticipate.

8.5.3. *Situational factors*

The consumer's motivation in viewing an object has the potential to influence their response¹²³. For example, intrinsically motivated (activity-rather than goal-oriented) consumers may prize a product's hedonic quality over its pragmatic quality and thus be more focused on aesthetic impressions than semantic interpretations¹²⁴. Beyond motivation, the opportunity to continue the consumption process may be influential. In particular, financial constraints determine whether or not a product may be purchased. This has the potential to moderate not only consumer behaviour, but also cognitive and affective response. In addition, products are often acquired because they are believed to visually compliment existing possessions³⁹. This notion of *aesthetic complementarity* indicates that ensemble effects will moderate design preference¹¹⁵.

The immediate social setting within which products are consumed may moderate consumer response. Those who surround the consumer during their interaction with the product may influence the preferences they express and the behaviour they exhibit⁹². Furthermore, the marketing programme that surrounds a product may also moderate consumer response¹. In particular, product branding may strongly influence perceptions of quality¹²⁵ and social value¹²⁶. Products may appear to visually identify themselves as belonging to a particular brand by the addition of brand markings and the adoption of specific design language³. Other market factors, such as product price, point-of-sale, competition and product predecessors also affect perceptions⁹².

8.6. The source of moderating influences

Moderating influences on the design message have been described as (potentially) operating at any phase in the design communication process. Influences such as organisational issues and production quality originate from the producer, whilst environmental distractions, cultural influences and situational factors all originate from the context of consumption. Finally, the sensory capabilities and personal characteristics are attributes of the consumer themselves (see Figure 6).

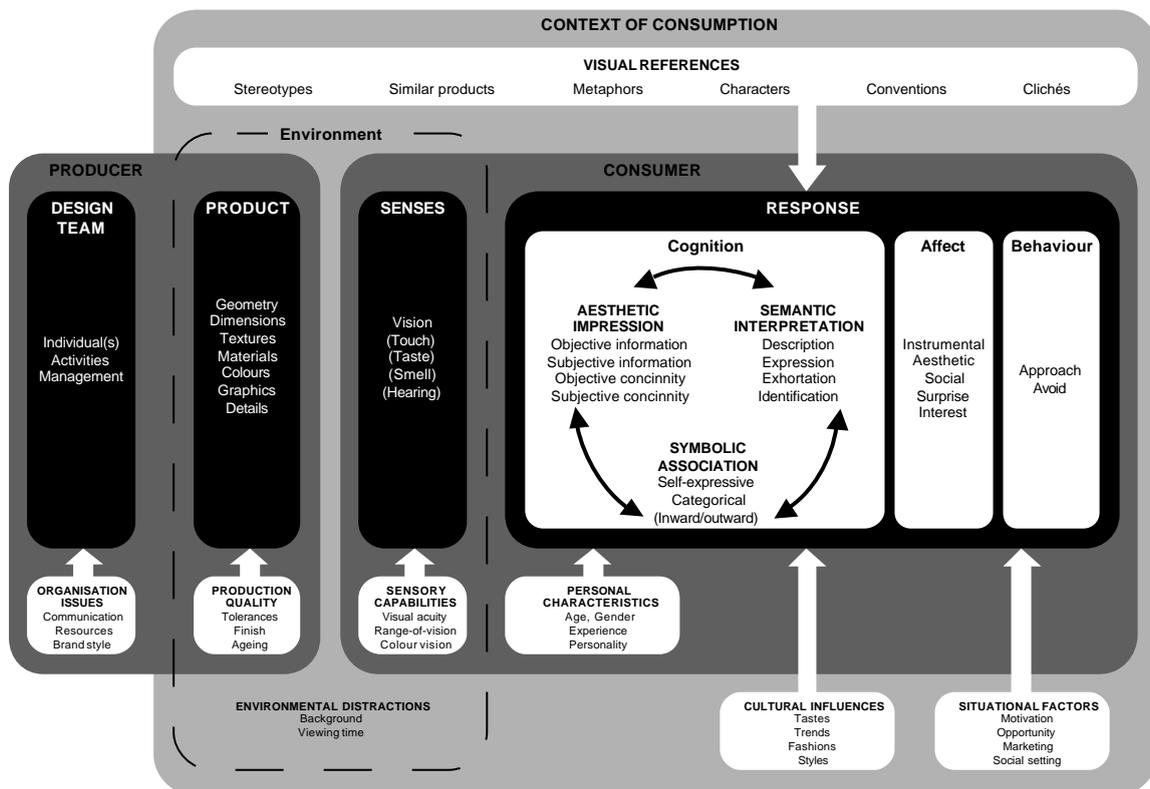


Figure 6 Framework for consumer response to the visual domain in product design

9. Discussion

Response to the visual domain in product design has been presented as part of a process of communication. The design team creates a message that is encoded in a product and the product is perceived by the consumer within an environment. This perception leads to cognitive, affective and behavioural responses, where cognitive response is composed of aesthetic, semantic and symbolic aspects. Interpretation of product appearance may be assisted by reference to other products, concepts or entities. In addition to

these visual references, moderating influences may operate at each stage of the communication process. These moderating influences may affect the consumer's perception of, and response to, the design message. Response to the design message takes place within the consumer's cultural context and it is within this context that the visual references and many of the moderating influences originate.

This paper provides a foundation upon which the subject of product visual form may be better understood. There is a broad range of literature available offering insight into the subject of response to the visual domain in product design. This literature has been reviewed including contributions from significant texts that are seldom referenced. Thus, the theories and concepts from a variety of fields have been discussed and presented within a unified structure. In particular, aesthetic, semantic and symbolic responses (which are usually discussed separately) have been drawn together. This provides an opportunity to consider the way in which these aspects of response influence each other and how their relative importance might vary depending on context. This framework suggests a number of implications for design practice and future research.

9.1. Implications for design practice

Product appearance is a key component in defining product-person relationships and as such, it significantly affects commercial success¹. The potential for product form to satisfy many of the unarticulated requirements of users makes it a critical determinant of perceived value^{127,128}. Designing products so as to present this value visually may provide the opportunity to command a higher product price and enjoy increased unit sales^{129,130}. In mature markets, where the functionality and performance of products are often taken for granted, attention is increasingly focused on the visual characteristics of products. In such markets, "attention to a product's appearance promises the manufacturer one of the highest returns on investment"⁵.

It follows that consideration of product appearance should be integral to the product concept, and "it is vital that right from the moment when the product brief is being discussed with the client, the designer gets a clear answer to the question what the product's [visual form] should express"³. This objective for the product's appearance should be considered throughout the design process^{37,131,132}. However, design is a creative activity that "seems not to be understood except by designers, and they have not formulated what they know"⁵⁰. Thus, the visual form of products is often determined by designers' "intuitive judgements and 'educated guesses'"⁶².

Although the importance of design skill, training and experience in visual design activities is widely acknowledged, there are dangers inherent in relying solely on intuition and anecdotal evidence to justify a product's visual appearance. Basing design decisions on the invocation of personal experience risks drawing on highly subjective and unrepresentative information⁶¹. This is because designers are often not representative of the consumers of the products that they create^{23,111,127}. In addition, it is claimed that “designers frequently consider their aesthetic judgement to be independent of consumer taste”¹³³ and there is little communication between designers and consumers on this subject.

Awareness of the aesthetic, semantic and symbolic aspects of consumer response provides a basis upon which the subject of product visual form might be better understood and communicated. Furthermore, conceptualising design as a process of communication highlights the possibility for discrepancies to exist between designer intent and consumer response. Thus, a framework has been presented which fosters understanding of the potential for products to be misinterpreted. In particular, consumer characteristics, cultural contexts and the limited range of visual references upon which the consumer may draw must be appreciated. This is because these factors influence response to products and “no design works unless it embodies ideas that are held in common by the people for whom the object is intended”³⁹.

9.2. Implications for further research

The framework presented clarifies the subject of consumer response to product appearance and suggests a number of promising future research directions.

Firstly, insight might be gained into the nature of designer intent. How conscious are designers of the concepts discussed in this paper? Can their visual objectives be categorised into aesthetic, semantic and symbolic aspects or is such categorisation inaccurate and inappropriate? In addition, it would be valuable to understand how the visual objectives for a design are converted into physical form. What processes are used and what checks are employed to determine if the objectives have been achieved? With regard to the framework, this would result in a significant expansion of the *producer* side of the diagram. A *context of production* might be included along with an indication of how information from the *context of consumption* is used by designers.

Secondly, if design is to be considered as a process of communication, it would be valuable to determine how successful that process is. When do

discrepancies occur between designers' visual intentions and consumers' responses? Furthermore, are there specific moderating influences responsible for these discrepancies and how might they be foreseen or avoided?

Thirdly, it would be beneficial to understand how designers incorporate visual references into their products. To what extent is this a conscious process and how are the visual references selected? Also, developing an understanding of the role of visual references in consumer response would be valuable. What is the range of references upon which consumers may draw and how might these best be categorised? To what extent are users aware of the references that are suggested by product form, and do they perceive the same references as those intended by designers?

In addition to these three main research areas, specific parts of the framework suggest other topics that may be fruitful. For example, the influence of manufacturing quality on consumer response might be investigated. How are specific manufacturing defects related to consumer judgements on products, and how do different types of defects interact? Also, investigations might be conducted into the effect of variations in sensory capabilities. How do colour vision anomalies and conditions resulting in partial vision influence the beliefs that are formed about a product. Can these influences be anticipated to allow designers to successfully evoke the responses they intend across a wider range of consumers? Finally, studies might be conducted to investigate the influence of cultural context on consumer response to product design. How does response to a given product vary between different cultures or different generations? Is it possible to better predict the response of specific sections of the population?

9.3. Conclusions

The visual appearance of products plays a significant role in determining consumer response. Product form may provide for unarticulated consumer requirements and suggest product qualities that are otherwise difficult to ascertain. Judgements on whether a product is attractive include not only consideration of whether the product looks good, but also whether it appears functional and says the right things about the owner. As such, product appearance influences commercial success and consumer quality-of-life. Remaining cognizant of these different elements of response, and conceptualising them as part of the framework presented will assist any further attempts to understand consumer response to the visual domain in product design.

Acknowledgements

The authors wish to thank the following people for stimulating discussions during the writing of this paper: Professor Mike Ashby and Dr. Saeema Ahmed of the University of Cambridge; Marianne Gulbrandsen of Cranfield University; Professor John Drane of the Royal College of Art; and Professor Alastair Macdonald of The Glasgow School of Art.

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