

Shaping things: intended consumer response and the other determinants of product form

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This paper reports on a qualitative investigation of the factors that influence the visual form of products during the design process. Based on a series of interviews with practicing industrial designers, a framework is developed that categorises and relates the various determinants of product form. This framework represents designers as holding multiple and potentially conflicting intentions for how products should be interpreted by consumers (e.g. perceived qualities). These intentions are driven by various motivating factors (e.g. the brand) and constrained by other factors (e.g. production costs). Designers seek to resolve these competing factors by constructing visual representations (e.g. sketches) that describe the planned form for the product. In constructing such representations, reference is often made to visual sources (e.g. existing products) that are considered to exemplify how the intended responses can be evoked. Despite designers' efforts to specify a plan for the product's form, the eventual form may be outside their control because still other factors (e.g. manufacturing tolerances) modify the design in unanticipated ways or otherwise affect how the resulting product is experienced by the consumer.

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

1. Introduction

The visual appearance of products has a profound effect upon the way in which they are interpreted, approached and used. To improve understanding of this important subject, considerable effort has been devoted to studying how the visual form of products is interpreted by consumers and to characterising the factors that influence those interpretations (see Bloch, 1995 for a classic review, and section 5.1 for a discussion of recent work). However, in comparison to the attention that researchers

have devoted to studying consumer response, the designers' role in shaping products and other factors that contribute to product form have been relatively neglected (Sener and Wormald, 2008: 13). In particular, accounts of how designers intend product form to be experienced (hereafter referred to simply as *intent* or *intentions*) is absent from the research literature. This present article seeks to redress this imbalance by reporting on a series of interviews with practicing industrial designers and developing a conceptual framework that situates designer intent within the context of the other determinants of product form.

In a previous article, the authors sought to develop a conceptual framework for consumer response to product visual form (Crilly *et al.*, 2004). 'Consumer' was defined broadly to include anyone involved in the visual consumption of the product, and 'product' was used to refer to the output from industrial design activities. The framework represented consumers responding to product form, and designers intending those forms to be experienced in particular ways. When conceptualising the varieties and determinants of consumer response a vast range of literature was available for reference but no comparable body of work was found to assist in conceptualising the intentions that designers hold. Consequently, whilst consumer response and its influences were categorised and related, the designer was simply included as a placeholder in the framework. That placeholder is here developed into a more comprehensive representation of the intentions that designers hold, the factors that influence those intentions, and the influence of those intentions on the product. In so doing, it is hoped that accounts of consumer response to product form can be contextualised with respect to the many factors that shape the products to which consumers are responding. This has implications for how research into consumer response is conducted and presented, how designers communicate their work to others, and how certain aspects of design education are delivered.

1.1 Background

Through manipulating product form, industrial designers seek to attract, inform and influence consumers (Person *et al.*, 2008). Accounts of these design activities are scarce, and this may either be because of designers' reported reluctance to make their knowledge explicit (Lawson, 1997: 308; Choueiri, 2003), or because they perceive form generation to be an inherently intuitive activity that is difficult to verbalise (Tovey, 1997: 10; Coates, 2003: 23-24). Despite such challenges, some researchers have offered perspectives on design that conceptualise the factors that influence

product form. For example, by building on Lawson's (1980/1997: 107) work, Bloch (1995: 18-19) identifies six categories of constraint that must be accommodated during form development: functional and aesthetic; ergonomic; production and cost; regulatory and legal; designer-generated; and marketing (a category within which Bloch includes storage, handling, transportation, branding and promotion). With such a variety of influencing factors – all originating from different sources and assigned different priorities – the designers' task can be viewed as the planning of forms that appropriately reconcile many competing and conflicting constraints (see Alexander, 1964; Pugh, 1996).

Whilst designers' intentions for how products should be experienced can be considered as one of the many constraints that influence a design project, these intentions can also be viewed as overarching objectives that are distinct from other influencing factors. For example, studies of industrial practice have shown that strategic brand identity can define the visual intentions of designers (Karjalainen, 2004), and that other constraints must often be accommodated with respect to those intentions (Hestad, 2007). In such instances, the form development process is driven by the designers' efforts to guide or constrain the way in which the product will be experienced, and the success of the final design may be determined by the degree of correspondence between designer intent and consumer response. Beyond those factors that influence what intentions are held and what constraints are most prominent, there are also other factors that influence the extent to which the final product corresponds with the specified design (Forslund *et al.*, 2006). Therefore, to understand the determinants of product form, we require accounts not just of intentions, but also of the various factors that influence those intentions and of the other factors that shape products (see Tovey, 1997: 8).

1.2 Methodology

By adopting a research approach that iteratively alternated between sampling, data collection and interpretation, (see Eisenhardt, 1989; Strauss and Corbin, 1998), a qualitative investigation was conducted into the determinants of product visual form (Crilly, 2005). Exposure to a broad range of industrial design practice was sought, and over the course of one calendar year 21 UK-based industrial designers were recruited into the study. Suitable candidates were initially identified by searching a comprehensive design directory (European Design Innovations, 2004) and later by using referrals from previous participants (see Rubin and Rubin, 1995: 67; Bryman,

2004: 100). All of the designers had significant professional experience (ranging from seven to 28 years) and they held correspondingly senior design positions (variously described by titles such as ‘Design Director’, or ‘Head of Industrial Design’). In total, the participants were associated with 19 different design consultancies ranging from single-person freelancers specialising in specific product categories to multi-national consultancies offering a suite of creative services.

In total, 23 semi-structured interviews were conducted (two participants were interviewed twice), with a mean duration of approximately 75 minutes. The majority of the interviews were conducted on a one-to-one basis in the participants’ place of everyday work (typically studio space). This allowed for easy reference to many available design materials and for informal observation of the designers’ working culture and practices. Each interview was motivated by a single overarching question: from the designers’ perspective, *why do products look as they do?* Towards the end of each discussion, the designers were presented with diagrammatic representations of the researchers’ emerging framework to gain their appraisal of the work and to elicit further contributions on the research topic in general (Crilly *et al.*, 2006). With the interviewees’ permission, each of the interviews were recorded and later transcribed to produce over 200,000 words of text-based data.

Computer-aided qualitative data analysis software, QSR NVivo (2002) was used to store, structure and analyse the interview data. This allowed passages of interest to be thematically tagged and related to each other, facilitating the exploration of connections and contrasts within the data (see Bringer *et al.*, 2004). By constantly comparing the researchers’ emerging interpretations with the source material, a number of different concepts and categories were trialled. During the course of the interviews and their analysis, many competing frameworks were produced in an attempt to fit those concepts and categories together. The framework considered to be the most faithful and coherent representation of the collected data is presented and described in this article.

1.3 Framework

To aid orientation with respect to the research findings, the framework that resulted from the study is presented here first (see Figure 1) before the phenomena it represents are described in detail.

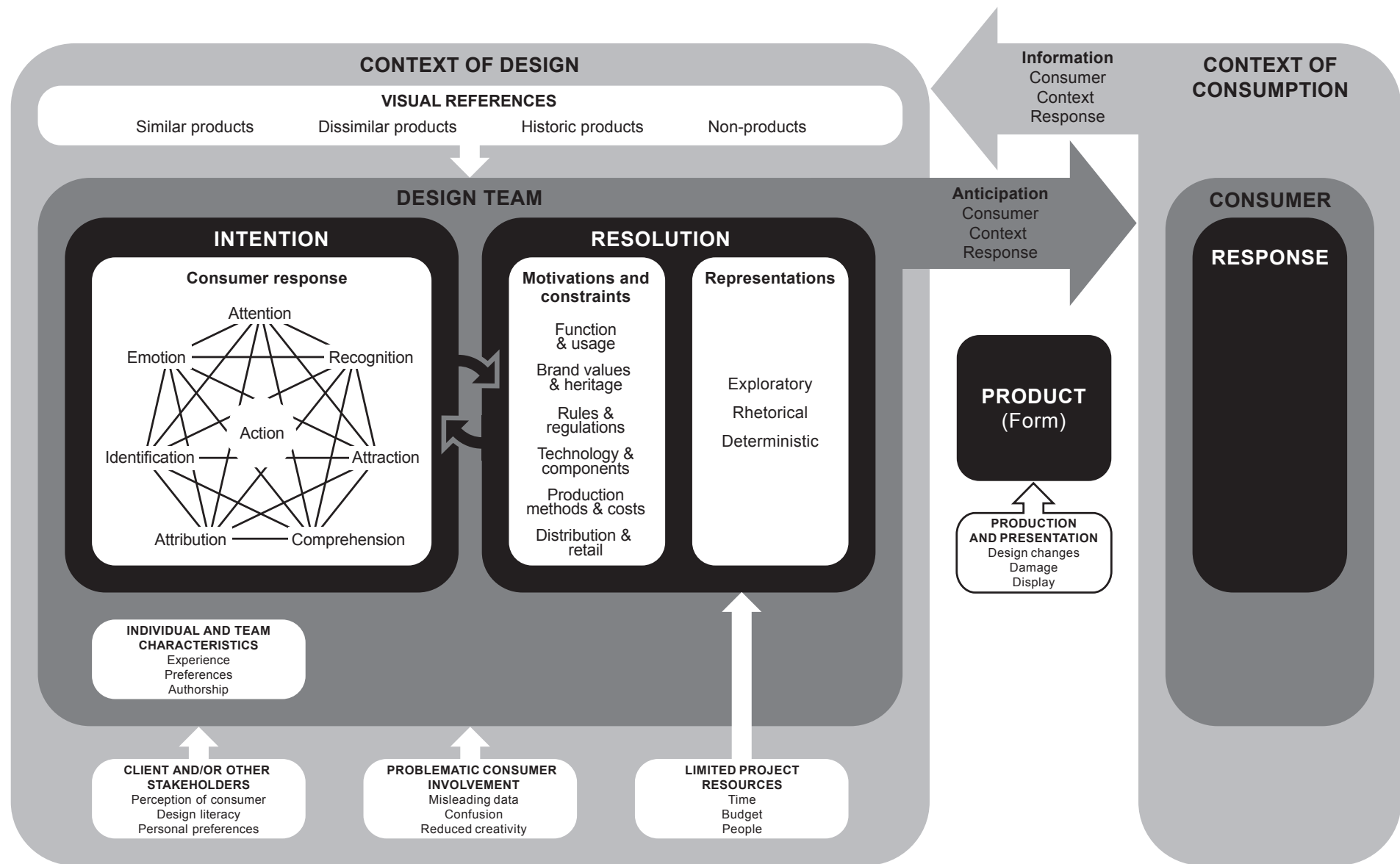


Figure 1 – Conceptual framework situating designer intent within the context of the other determinants of product form

The design team is depicted as holding intentions for how consumers should respond to the product being designed. Those intentions are broadly divided into seven categories of psychological response, each of which is related to the others and also to the behavioural responses that they engender. These intentions need not spontaneously occur to the designer, but are often motivated by other design requirements that are specified in some initial or emergent brief. Such design requirements do not just motivate designers to hold certain intentions; they also place constraints on the product forms that can be proposed. Through the representation of the planned form of the product, some resolution is sought between motivations, constraints and the intentions that are defined or discovered. These representations are often constructed with reference to visual sources that either communicate what intentions are held or suggest how those intentions can be realised. The product is nominally manufactured in accordance with some representation that is appropriately specific, and the product is then distributed for consumption.

The design activities described above are conducted in anticipation of consumers experiencing the product and are therefore influenced by the information that designers' have about those consumers. However, design activities are also influenced by a range of factors that moderate how effectively intentions are defined and then how effectively they are translated into the products that consumers experience. Defining the intended response and resolving the product form are both processes that are influenced by the personal characteristics of the designers that constitute the team and of the clients (and other stakeholders) involved with the project. Form generation is further influenced by the unintended consequences of consumer involvement and the limited availability of project resources. These influences originate from various sources, including the organisational or cultural contexts within which designers operate. Whilst all these factors affect the planned form of the product as specified by the designer, the form of the product that the consumer actually encounters is further influenced by the processes of production and distribution which may be beyond the designer's control.

The framework described above is intended to represent the various determinants of product form in a coherent way whilst remaining faithful to the data collected in the study. However, it is neither a model of the design process, nor a generalised account

of form generation. Instead, it simply categorises and relates the different factors that influence product form whilst taking intended response as its focus. Therefore, even though intentions themselves do not occupy a large proportion of the framework or the accompanying account, the other determinants of product form are all considered in relation to those intentions. For example, whilst design requirements such as the provision of functionality and adherence to regulatory guidelines might normally be regarded as design objectives, they are here considered as factors that either motivate or constrain the responses that are intended. With those caveats in place, and with the framework now presented, intentions and the factors that surround them are elaborated in the sections that follow. Where helpful, quotations are drawn from the interview transcripts to illustrate, clarify or support the account that is offered. Each quotation is followed by an anonymized interviewee identifier, and, as specifically as possible, an indication of the product category to which their comments refer.

2. *Intention*

Designers may hold many practice- and project-related intentions that do not necessarily bear upon the product form. These intentions might include general corporate objectives to sustain or extend the design firm, or more specific goals of satisfying a particular client so as to maximise the possibility of repeat business. Whilst such broad intentions might influence the designers' behaviour during a project, we are concerned here with the intentions they hold for how consumers will experience the product. In particular, we focus on the designers' declared intentions to elicit specific psychological and behavioural responses from consumers. Such intentions are often explicitly defined during the negotiation of the design brief but might also only be discovered later during the design process.

2.1 *Intended consumer response*

When defined from the designers' perspective, and using terms in line with the language of the interviews, the consumer responses that designers intend to elicit can be categorised as: draw *attention* to the product; foster *recognition* of product type; generate *attraction*; support *comprehension* of function; encourage *attribution* of qualities; promote personal *identification*; stimulate *emotion*; and provoke *action*. These eight categories are not necessarily internally consistent, mutually exclusive or collectively exhaustive, and they therefore lack the formal coherency of ideal

classificatory systems. However, whilst no single interviewee necessarily made comments that correspond to all eight of these categories, they do represent the range of intentional concerns most frequently mentioned by the interviewees as a whole. In some accounts these intentions were described individually, whilst in other accounts one intention was run into another. Therefore, although described separately here for the purpose of definition, they should be considered as either inter-related or overlapping.

2.1.1 Attention

When designing for mature markets that are already crowded with similar products, designers must draw consumer attention away from distractions and towards the products for which they are responsible. This is manifest either as an intention to make the product noticeable and noteworthy in its own right, or to differentiate the product from the competition.

“To be noticed as a small supplier in this big world, our products have to be different and the visual difference is the thing that instantly grabs people’s attention.” (ID05, household goods)

2.1.2 Recognition

Not only must designers draw the consumers’ attention to the product, they also seek to make that product recognisable. In this sense, designers intend to generate forms that consumers will recognise as belonging to a particular product category or as originating from a particular source (*e.g.* brand).

“The thing about customers is that, for anything, you’ve got that couple of nanoseconds, when somebody’s browsing a store, to get them to understand what it is they’re looking at. If they don’t understand it, [they think] “it’s got no relevance to me”, there’s a shutter that comes down and they move on.” (ID10, consumer products)

2.1.3 Attraction

Designers often intend consumers to find their products attractive, elegant or refined. However, the achievement of such objectives seldom relies on the application of formal aesthetic theories, but is instead almost entirely intuitive. Consequently, much of the ability to render products visually attractive is attributed to the creativity, experiences and inherent creativity of designers.

“So, [the function dictated the basic form and then it was] just a question of making it as simple and as clean and aesthetic as possible... But a lot of hard work has to go into that to keep the image clean.” (ID06, architectural fitting)

2.1.4 Comprehension

Many products operate or function in some way, and designers may try to reveal how a product works or how it has been made so that those technical characteristics will be comprehended by consumers. For example, designers issue subtle instructions for the way in which consumers should approach and interact with products by emphasising functional components that might otherwise be hidden.

“It’s quite a smart piece of kit and rather than hiding that [adjustability] we wanted to show that off. That’s part of the aesthetics. That’s why these little gears in here can be seen.” (ID10, computer joystick)

2.1.5 Attribution

In many projects, designers intend consumers to attribute specific characteristics to the product. These may relate to technical qualities that the product actually or ostensibly exhibits (*e.g.* reliability) or to more abstract qualities that relate to some perceived animate character (*e.g.* friendliness). By encouraging the attribution of these qualities, designers attempt to convey the relative value of products, and the manner in which consumers might relate to them.

“What’s coming out as quite a key feature is that there’s a perception of ergonomics..., So that’s a classic case where the aesthetics have to convey a message... They’ve got to see that [the product is] going to be ergonomic.” (ID18, consumer electronics)

2.1.6 Identification

Aware that people use products to explore, expand and express their identity, designers’ strive to encourage (or reinforce) positive associations whilst discouraging (or diminishing) negative associations. This may involve attempts to imply a lifestyle that is aspirational for the group to whom the product is to be marketed whilst purposefully avoiding visual references to products that are already associated with a negatively perceived lifestyle.

“I was working on a [product] for people that have post-stroke [conditions, people with]... limited mobility in their fingers. The look of these things is usually very medical... uninviting. People don’t want to be seen using all these... very cumbersome, mechanisms. We did something which was very clean... [and] people suddenly thought ‘that looks cool’.” (ID08, page turning device)

2.1.7 Emotion

Designers intend to elicit emotional responses in consumers by designing products that will surprise, satisfy or delight. Just as with the other categories of psychological response described above, this often involves the verbal definition of an intention that can translated into some appropriate form.

“If we wanted to design something right now, and we knew what emotional response we wanted... [we could arrive at some appropriate word descriptions]. If we had all those words listed down right now and we said “within this context, what do we think those words mean visually?”... [by way of answering, the interviewee indicates a collage of images]. And once you’ve got that, [it can] then become a kind of blueprint

to how you then start to design something.” (ID09, cosmetics packaging)

2.1.8 Action

Whilst the seven categories of response described above are all psychological (in that they relate to the consumers’ thoughts, feelings and associations), those intended responses may all be determined by a desire to provoke action. Such actions may include preferred purchase and usage behaviours for the purpose of promoting both consumer satisfaction and commercial success.

“[The handle of the product] could be updated and it could be refreshed and changed... They would all have a different character on them... So, every six months, the idea was that they updated them, whether it was a teddy bear or a racing car... That was the idea, to get the kids interested [so] that they wanted the latest one [and bought it].” (ID05, children’s toothbrush)

2.2 Conception of consumer

Implicit in the account of intentions provided above is that designers hold conceptions of the consumers they design for and that product form is influenced by those conceptions. It is therefore important to consider how designers’ anticipate consumers experiencing the product and also how they acquire information about those consumers.

2.2.1 Anticipation of consumers

Designers anticipate that the products they design will be experienced, and this anticipation focuses attention on the eventual consumers, the psychological or behavioural responses that might be elicited and contexts within which those responses are relevant.

“You should always think about the end-user, the one who goes to the shop, when you design something... the way that you influence the buyer

is not just [through] the way it looks but [through] how it's displayed, and how it's commercialised, and how a thousand [of them would look together]." (ID12, consumer products)

Although designers anticipate consumers during the design process, the routine practices of form generation are often performed in the absence of those consumers. Therefore, even though there are instances of participatory design and consumer testing, designers themselves often constitute the most immediate audience for the design work. They therefore use their own response as a guide to how others will respond.

"I think we probably have a perception of whether we think the product looks good or not... I guess we're using that as a judge of how we think the rest of the world is going to view the product." (ID13, public transport seating)

2.2.2 *Information about consumers*

Consumer research offers designers the opportunity to gain insight into the characteristics of the target market, the contexts within which they operate and their response to design. This research may be systematically conducted in a highly formal manner (*e.g.* controlled focus groups), or performed somewhat intuitively throughout the course of the designers' everyday life. In either case, information from consumer research can either help to establish the direction of future design projects or provide feedback on completed ones. Whether formal or informal, prospective or retrospective, research allows designers to gain useful information on the consumers' attitudes and behaviours.

"through actually the designer being involved in gathering the research data, there are bits that you pick up along the way that are actually invaluable to the design process." (ID11, consumer products)

Consumer research can provide information on many aspects of product experience and is often focussed on issues such as functionality, usability and satisfaction. Whilst not necessarily directed towards defining product visual form, such general research exposes designers to consumers' visual preferences and the visual characteristics of

the contexts within which the product will be situated. Where studies are conducted specifically for the purpose of understanding response to product form, consumers might be asked to comment on existing products or to indicate forms that they associate with specific qualities. Consumer research of this kind allows designers to gain some insight into how product forms are interpreted and therefore to define what forms are likely to elicit the desired response.

“[By saying to consumers] ‘name some products that you consider to be modern/old-fashioned, feminine/masculine’... you can get some good responses that you can map back to particular features of those products, like colours, simplicity of overall surface, etcetera.” (ID10, consumer electronics)

3. *Resolution*

Designers are not at liberty to freely translate their intentions into any form they choose because form generation is motivated and constrained by many factors. The designers’ task therefore, is to construct representations of possible product forms that offer some resolution of these potentially conflicting design requirements. The influence of these requirements is discussed first before the role of representations is addressed.

3.1 *Motivations and constraints*

There are design requirements that motivate the intentions that are held and also those that constrain the forms that can be realised. Which requirements are considered to be motivating or constraining varies between different projects, between different stages of any one project and between different stakeholders. In the sections that follow, requirements are categorised according to the sources from which they originate: function and usage; brand values and heritage; rules and regulations; technology and components; production processes and costs; distribution and retail.

3.1.1 Function and usage

To justify their position in the marketplace, products often offer value to consumers through the provision of some useful function. Therefore in addition to holding intentions that product users understand what a product is, how it works and how they work it (see section 2.1), designers must account for the practicalities of what the product can do. In many electronic devices the provision of function may have only limited influence on product form, but in mechanical devices its influence may be clearly evident.

“The look came from the functionality more than anything else... So, the aesthetics really were driven out of the functionality of the product.”

(ID16, micro ‘pod’ hotel)

Products must not only offer the appropriate functionality, but must be designed to allow for suitable access, operation and maintenance. This directs design attention towards ergonomic factors such as anthropometrics, environment-of-use and task demands. In considering such issues, designers must prioritise and reconcile many conflicting objectives, often compromising their visual intentions for practical advantages.

“They [the users] have to come along and maintain these things. So, the lid has to hinge up, and that’s why it overlaps, so you can seal it. Again, ideally, it would’ve been nice to have one form that was sealed, but it has to have an overhang... This is just so that they can inspect... all that internal stuff...” (ID18, industrial inkjet printer)

3.1.2 Brand values and heritage

Issues of brand and corporate identity occupy a position of central importance in business, and the product is often one of the main channels through which corporate identity is expressed. Consequently, designers are charged with developing products that will define, support or extend the brand. Of particular influence on product form are the mostly intangible, and often aspirational, values with which the brand is associated. For example, ‘freedom’, ‘confidence’, ‘rebellion’ and ‘creativity’ exemplify

the types of characteristic that brands align themselves with and which consumers seek to acquire through their association with the product. Distilling the brand down to such keyword descriptors establishes a message that the product should visually convey.

“They [the client] wanted a physical brand language to be expressed through their devices... [the product] should be, if you like, almost a ‘brand ambassador’.” (ID14, mobile phone)

Brands are not just defined by a collection of abstract values, but also by the range of current and historic artefacts that constitute the brand’s heritage. By visually referring to this heritage, designers seek to make the product recognisable as an instance of the brand. This suggests a general stylistic palette, but also determines the treatment of specific functional elements. Consequently, whilst reference to this source of design cues may inspire the designer, it can also be imposed as a requirement that either motivates or constrains form generation.

“The client has this particular aesthetic heritage that they are very careful about... It had to have features that would identify it at one-hundred paces as one of theirs. That is not just colour, it is also the treatment of tiny details, such as this bevel here... It was made clear to us at the beginning that that would be one of the requirements on us.” (ID01, electrician’s tool)

3.1.3 Rules and regulations

In addition to satisfying the requirements of the brand, products must often comply with a range of legal and regulatory guidelines. Of particular relevance here, are those guidelines that either directly or indirectly influence the visual characteristics of the product. For example, much industrial equipment is controlled by product standards that ensure usage and maintenance can be conducted safely. On the one hand such standards may explicitly define physical properties such as the size, colour and positioning of components, whilst on the other hand they can encourage designers to emphasise that the product exhibits characteristics relevant to compliance.

One of the aspects of this is that it's 'IP rated' [IP55 - ingress protection from dust and water], so you can hose it down, and the water just drips off. So the idea is that it looks quite fluid and everything can run off it"
(ID18, industrial inkjet printer)

In addition to those guidelines that specify the physical, and therefore visual, characteristics of products, there are also those that specify which appearances must be avoided. For example, the requirements for legally registering a design in the UK are principally based on the product visually achieving novelty and individual character. There is therefore a requirement for the product to be visually distinguished from its competitors, either for the purposes of having a design that can be protected, or to avoid infringement of designs that are already protected.

"They [the client] want to sell something that doesn't look like anybody else's. [...] You're not allowed to copy the competition because... You get into trouble... if you use a similar principle that someone else has patented already." (ID02, communications headset)

3.1.4 Technology and components

Especially in markets driven by functionality, products often compete on the basis of their technological sophistication. Designers must therefore emphasise the products' underlying technology as this is likely to be a key determinant of consumer appraisal.

"[The original product needed to be very large,] but, the new product can be technically so much smaller. So the design imperative is to reflect that in the product itself... There is obviously a huge push to show off the technology." (ID01, electrician's tool)

The functional requirements of a product often demand that it must interface satisfactorily with existing products and technologies. In particular, a number of physical constraints are imposed by the components which the product must house or by those which it must connect to. This leads the designer into a packaging exercise where product form is partially determined by the characteristics of existing systems, including not only their shape and size, but also properties such as mass, heat output and connectivity requirements. With these technical constraints in mind,

designers can proceed with their exploration of the subset of forms that are realistically feasible.

Quotation continued from above: *“On this there is a transformer in there, so the design had to be centred; it gives us the basic dimensions... What we’ll do is we’ll start modelling the parts we actually know. We’ll create CAD models of those and start to shove them around within the space envelope and look at what shapes we can have.”*

3.1.5 Production methods and costs

The range of manufacturing routes available to designers strongly influences the eventual product form. Designers must therefore take account of factors such as limitations in the manufacturers’ production capabilities, the use of preferred suppliers and established methods of assembly. Such considerations influence product form because the selection of certain methods promotes the design of certain forms.

“We look at a number of alternative manufacturing methods, we might look at, say, six to ten different ones, and we whittle that down... And then we make three manufacturing processes work with three designs... that’s actually part of the selection process of which of the designs we’re going to use.” (ID13, public transport seating)

It is not just the technicalities of production methods that influence product form, but also the costs associated with those methods. Therefore, the number, size and complexity of production tools required can act as a major constraint on the forms that are feasible.

“There may be certain processes that look visually attractive... [but] you’re always balancing the visual appearance versus cost.” (ID04, medical products)

3.1.6 Distribution and retail

In products where the distribution costs contribute significantly to the unit price at retail, the manner in which products can be transported becomes another influential factor in the design of the product. For example, the drive to increase stacking density on transport containers encourages the design of compact products with collapsible components, and geometry that tessellates efficiently.

“One of the significant cost drivers for this client is the cost of getting it from the factory in China to retail in Europe or the States. You want as big a footprint as possible [when the product’s in use], but if you put that in a box, you can pack only so many in a container. So we said alright, to drive costs down, we’ll find an affordable way of folding the [product’s] legs up.” (ID10, consumer electronics)

Because products are often sold through a variety of third party vendors, designers must consider the practical demands of the retailer’s display system, whether that is a shelf, catalogue or webpage. Such issues impose additional constraints on product form because they influence how the product must be packaged and presented, and what features or qualities can be emphasised.

“You have to evoke the product through the packaging and the point of sale. Then you start getting into advertising and it gets bigger and bigger. For a product designer, in terms of aesthetics, it’s not solely about the product these days; there are wider issues to be thinking about.” (ID15, electric razor)

3.2 Representations

In order to translate their abstract intentions into plans for the product’s visual form, designers engage in a variety of visualisation activities. These include the collection of various materials that represent aspects of context, character and style (*e.g.* mood boards), and the production of two-dimensional drawings (*e.g.* pencil sketches) and three-dimensional objects (*e.g.* foam models). In addition to these tangible artefacts, there are also transient representations (*e.g.* gestures) that offer a visual description

of possible forms whilst leaving no physical record of the proposed shape, scale or finish of the product.

“We will have internal brainstorming... to start growing up almost like a list of words, or little sketches if you like... so that’ll come after these [image] boards, and then we’ll start to take key points from those brainstorming, put them in categories and start sketching,... translating those thoughts...” (ID18, drinks packaging)

Regardless of their dimensionality, fidelity or permanence, designers use visual representations to record their ideas, develop those ideas into proposed forms, and convey those proposals to other people. In so doing, activities of representation influence the resulting product form in three distinct ways. Firstly, representation allows designers to explore the relationship between their intentions and the forms that might achieve them. Secondly, designers use representations to persuade others that their intentions are appropriate and that the proposed forms express those intentions effectively. Thirdly, different modes of representation do themselves determine what product forms are most likely to be proposed. Each of these effects of representation is now discussed further before attention is turned to the visual sources that designers draw upon when such representations are constructed.

3.2.1 Exploratory

Throughout the design process, provisional exploratory representations allow designers to quickly record their ideas and to develop those ideas into workable solutions. The forms proposed in such representations are judged against their ability to evoke the responses that are intended whilst accommodating the various constraints that are imposed. Activities of representation therefore shape the product by providing a space within which designers can discover the product forms that they believe will best satisfy their intentions.

“I think it’s more of a feeling of when a product’s right that I’m aiming for. We design it to a point where it looks finished... It’s a mixture of proportions and just the object seeming like a whole, complete, tidy, well done thing.” (ID17, household goods)

In constructing visual representations, designers are not just exploring the form's potential to elicit the intended response, but also exploring the validity of those intentions. Consequently, intentions are formed and reformed during activities of representation as designers reflect upon their own response to the representations they construct. Activities of representation therefore further influence product form through promoting the revision of intentions and the renewed exploration of forms that might satisfy those intentions.

3.2.2 *Rhetorical*

The design process is constituted by many communications within the design team and between the design team and other interested parties, including clients, manufacturers, retailers and marketers. Visual representations are used to facilitate these communications, especially with respect to negotiating the design directions that should be pursued. In this context, visual representations serve a rhetorical function, as designers use them to persuade others of what responses should be intended and what product forms will most effectively evoke those responses. Consequently, the designers' ability to justify their proposals and defend their intentions depends upon their ability to construct appropriate representations. What form of representation is most appropriate depends on what aspect of the design is to be emphasised and what level of engagement is sought from others.

"If you present [a design] in different ways, people [including clients] respond to it in different ways. So, if you want them to think about it, paint it white. If you want them to respond to your materials, make it in the right materials. If you want them to think about it in an abstract sense, make a cartoon of it." (ID07, architectural fittings)

It is not just designers that construct representations; they may also be introduced by other stakeholders (*e.g.* clients) or produced in collaboration with them. This gives those stakeholders a more prominent voice in the negotiation of visual form by allowing them to contribute opinions or preferences that they might otherwise struggle to articulate. However, although such representations are not necessarily produced by designers, they are still used rhetorically in ways that influence product form. In particular, demonstrating that other stakeholders' views have been captured

or incorporated, allows designers to appease those stakeholders without significantly influencing the end consumers' experience.

"[When collecting images] you always put them [the clients' images] in because it makes the client feel like the product was generated from them... They always feel like 'wow, that's my [idea]' and it makes the client happy. The end-user doesn't necessarily have to understand why that's there; as long as it's well designed and well worked into the overall design of the project they don't see it." (ID16, consumer products)

3.2.3 Deterministic

Designers use a wide variety of visualisation techniques when constructing representations of product form. These include activities of paper-based sketching, free-hand illustration and traditional methods of shaping foam, clay and wood. In addition to such manual practices, designers also use computer-aided design software (CAD) to model the product and generate physical mock-ups directly from digital files. Whether free-hand or computer-based, the different visualisation methods that designers employ all assist in the definition of product shape, scale or finish. However, these methods are not neutral with respect to product form and the products that result are not left unaffected by the methods used in their production. This is because the different methods, especially those that are software based, each have their own unique limitations and these both promote the use of certain form treatments and discourage the use of others. Consequently, product form is determined not just by the content of the representations that are constructed, but also by the methods used in the construction of those representations.

"You can always recognise a lot of products by the [CAD] programme that was used to generate them. You can say "OK, that was done in 'Alias' or 'ProEngineer', just because of the way the object looks." (ID08, physical products)

3.3 Visual references

In defining intentions, and constructing representations of forms that will satisfy those intentions, designers may refer to a broad range of visual sources that guide their work. These sources may be drawn from almost any sphere, but commonly include similar products (*e.g.* from within the same category), dissimilar products (*e.g.* from other categories), historic products (*e.g.* cultural artefacts) and non-products (*e.g.* natural objects). The features of these different sources are, to varying degrees, incorporated within the design, and product form is therefore influenced by visual references.

“It does refer to and it is influenced by... this kind of slightly nostalgic scooter look [Vespa moped], the kind of domestic porcelain product look [tea cup], and the pebble. So it refers to other products and organic forms.”
(ID14, mobile phone)

In some instances, visual references are made with the expectation that those references will be clearly recognised in the final product. For example, designers might employ the explicit metaphor of a traffic-light sequence to indicate the changing safety status of a device or the implications of a test result. Alternatively, and more commonly, they may intend to subconsciously influence consumer response by subtly invoking the chosen references. In such cases, visual references are intended to influence the way in which product form is experienced, but recognition of those references is not intended.

Quotation continued from above: *“I wouldn’t expect the consumers to perceive the intention in terms of ‘what was the inspiration for the design?’... I would hope that intuitively they ‘got it’ without consciously realising what it was that went into it.”*

By identifying forms that elicit the intended response, either in specific detail or overall impression, designers can adopt or adapt existing solutions. This can help to clarify what the product is and what it does, how it should be used and from where (or whom) it originates. Further to these quite practical cues, references are also employed to emphasise the qualities that the product possesses or the qualities that those who are identified with it might possess. In particular, referring to products that

are already associated with particular qualities can help to design forms to which those same qualities will be attributed.

“Subconsciously, to anyone who’s looked at a gun’s magazine, the proportion of this is a sort of gun language. We’re not saying this is necessarily a weapon, but a hefty, durable, billet-machined, serious kind of tool.” (ID10, computer joystick)

4. Moderating influences

As discussed above, designers have a conception of the consumers for whom they design, they hold intentions for how those consumers should respond to the product and they construct representations that specify forms that are expected to elicit those responses. However, there are many factors that decrease the likelihood that the response intended by designers will correspond with the consumers’ actual response. These influences act on many different activities of form generation, affecting the intentions that are held, the translation of those intentions into planned forms and how those forms are realised and delivered to the consumer. However, unlike motivations and constraints, which are purposefully accommodated during the design process, these moderating influences are typically unanticipated, unnoticed, unacknowledged, or otherwise beyond the designers’ control.

“We always get frustrated to what happens to products once they leave our door. As soon as it leaves, the intent of the product that you built in can get lost.” (ID04, industrial and consumer products)

In the sections that follow, different kinds of moderating influence are classified according to their origins: the characteristics of the designers that constitute the design team; the characteristics of the client and other stakeholders who are involved in the project; the unintended consequences of consumer involvement; limited project resources; and the production and presentation of the product.

4.1 *Characteristics of designers and design teams*

The personal characteristics of designers have a strong influence on every stage of the design process and consequently have a strong influence on product form. These characteristics include the designers' exposure to previous projects and their knowledge of all the processes that stand between intentions and interpretations. In addition to these matters of experience, the design process is also influenced by the designers' personal preferences. The extent to which this is encouraged (or even acknowledged) depends on the degree of 'authorship' attributed to the designer. At one level are the 'artist-designers' who possess their own style and whose work often exhibits a distinctive set of visual characteristics. At another level are the 'contractor-designers', who adopt whatever style is necessary and whose own preferences have limited influence on the final product. Although all designers may exhibit characteristics of each type, on any given project, the level of authorship attributed to the designer influences the designers' attitude to the consumer, the client and the product.

"The idiosyncrasies of brand, we don't really involve [get involved with], because we're the kind of company where we don't switch our morals or preferences or directions of design. I mean we have a very clear, rational approach to our work. So if a brand is perhaps a lot more flippant, or gregarious in any way, it would be hard for us to accommodate that. It wouldn't be successful." (ID19, consumer products)

4.2 *Characteristics of the client (and other stakeholders)*

Whilst designers direct many of their design activities towards the consumer, their most immediate customers are the clients who commission their work. Clients (and other stakeholders) often have an intimate understanding of the brand, the target market, and the behaviour of marketplace competitors. Consequently, developing an appreciation of the clients' visual expectations for the product is an important stage in negotiating the brief. However, beyond legitimately defining many of the factors that motivate the designer, clients further influence product form by introducing their personal preferences into negotiations about the design.

“Sometimes [there’s] a little bit of a conflict between what the client wants and what we think the consumer needs, [and between] what we know intuitively and what the client knows intuitively as well.” (ID06, consumer products)

When clients seek to exert their influence, designers may refer to their own research data, design training or experience to promote the importance of satisfying the consumer’s tastes. Such tactics are not always successful however, and in some instances the client can neither be persuaded that their opinions are irrelevant nor appeased by subtle accommodation. Consequently, designers may succumb to the clients’ wishes and thus satisfy their immediate ‘customer’ (i.e. the client) at the expense of serving the eventual consumer.

“A marketing director in the [client] company had a particular view about the shape of the handle... And he pushed this through despite continued resistance... So yes, quite often, I guess, we are skewing a design towards what our client wants, as opposed to what we think is the best design for the product.” (ID13, public transport seating)

4.3 Consumer involvement

As discussed earlier, researching consumers or involving them in the design process allows designers to gain insight into people’s lives, to design products in collaboration with them and to ascertain how they respond to designs (see section 2.2.2).

Therefore, in many ways, consumer research would appear to offer the perfect mechanism by which designers can both establish their intentions and also define the product forms that will be most effective in fulfilling those intentions. However, designers may have limited confidence in people’s ability to reflect on and express their visual preferences within a research context.

“I think when you’re asking people about shapes and colour and so on, you get into territories which are, I think, quite difficult to get at.” (ID09, consumer products)

Although there can be severe difficulties in collecting, interpreting and applying data relevant to product form, consumer research may still be a required component of

design projects. Research may therefore be conducted in instances where designers do not fully endorse it or believe in the validity of its findings. This may introduce problems into activities of form generation and act as a moderating influence on product form.

“Generally, the public don’t really know what they want... If you’re involving them in your process as you’re going along it can completely confuse you, and the end result is not really strong.” (ID19, consumer electronics)

4.4 Limited project resources

In addition to the constraints imposed by the product’s various requirements (see section 3.1), designers must also operate within the constraints associated with the project itself. These include the limitations placed upon the financial and human resources that can be committed to design work and also the timeframe within which that work must be completed. By influencing the manner in which activities of form generation are conducted, these project constraints inevitably influence the forms that result from such activities. In particular, the limited time available for design work necessitates the acceptance of compromised solutions as it prevents designers from fully exploring the range of possible product forms.

“There is a feeling, aesthetically, that there is a bit of mismatch between what’s going on in here [at the top of the product]... and visually what’s happening at the base. I might tend to agree with that but, you know, you run out of project time.” (ID10, computer joystick)

4.5 Production and presentation

Manufacture of the product has already been considered as a constraint that must be accommodated, but it can also act as a moderating influence when production decisions are made without the designers’ consent. Whilst such decisions may, for example, ease assembly or reduce the number of product parts, they also result in unanticipated changes to the products’ geometry, colour, materials and detailing.

“[An engineer in the country of manufacture] made this decision, but had no appreciation of the aesthetics of the product at all and so he didn’t line up any of the break lines. And the engineer now claims he can’t do it any other way because of the way it’s got to be tooled [for manufacture]. So the way it’s been tooled and engineered has created that aesthetic mismatch, which people will now judge the product on.” (ID03, electric kettle)

It is not just design and manufacture that influences how consumers experience products, but also how those products are presented. This includes aspects of product packaging, press coverage, promotional activities, retail environments and the sales and support staff who surround the product. Designers often have limited control over these factors even though they each may have a significant influence on how product form is interpreted. The extent to which the designers’ intentions survive those influences ultimately depends upon the strength of their original ideas, and the resilience of those ideas to all the influences that lie beyond the designers’ control.

“It’s always a battle. Design is always about compromise... All the way along the line the design is about compromise. That’s true for product styling, engineering, production processes, cost. The more I do this, the more I can shortcut to designing something where we know it’s going to be a fairly smooth transition from concept on page to production.” (ID04, industrial and consumer products)

5. Discussion

By reporting on a qualitative investigation of industrial design practice, this paper has developed a conceptual framework that situates designer intent within the context of other determinants of product form. The implications of such a framework are now discussed before the limitations of the study are addressed and opportunities for further work are suggested.

5.1 *Implications for design research, practice and education*

As stated in the introduction, many researchers have attempted to conceptualise consumer response to designed products. Although these researchers belong to different disciplines, employ different methods, and have different objectives, much of their work achieves a similar result by proposing distinct categories into which response might be divided. It is therefore evident that systems of categorisation are thought to be useful in conceptualising response, and that such a system might usefully be employed in categorising the responses that designers intend. However, this paper has proposed a new categorisation of response that can be used to either challenge or support prior work in this area. A brief review of this work is now provided below so that the system of categorisation proposed in this present article can be related to those that precede it and so that some justification can be offered for developing yet another new system.

In reviewing the work of Lewalski (1988), Crozier (1994), Baxter (1995), Cupchik (1999) and Norman (2004), Crilly *et al.* (2004) described categories of ‘aesthetic’, ‘semantic’ and ‘symbolic’ response. Aesthetic response is defined as the impression that results from the perception of attractiveness (or unattractiveness) in products; semantic response as the interpretation of a product’s function, mode-of-use and other qualities; and symbolic response as the associations that are made between the characteristics of a product and the identity of its owner or user. Such categories have precedence in both the Offenbach ‘product language’ approach, where ‘formal aesthetic’, ‘indication’ and ‘symbolic’ functions are identified (Gros, 1973; Steffen, 1997; see reviews in Muller, 2001: 299; Bürdek, 2005: 295), and Lefkoff-Hagius and Mason’s (1993: 101) review of several classificatory systems of consumer judgement. More recently, similar categories of ‘aesthetic’, ‘instrumental’, and ‘symbolic’ can be found in Rafaeli and Vilnai-Yavetz’s (2004) exploration of the relationship between physical artefacts and emotions, and Mahlke *et al.*’s (2007) studies of human-computer interaction.

Whilst the above systems of categorisation can (but needn’t) be viewed as essentially expressing the same tripartite distinction, the literature also contains other categorisations of response. These include Desmet and Hekkert’s (2007) division of the antecedents of emotion into categories of ‘aesthetic experience’ and ‘experience of meaning’ (where ‘meaning’ here relates to the aforementioned categories of semantic and symbolic response), and Creusen and Schoormans’ (2005) roles of product

appearance: ‘aesthetic’, ‘attention drawing’, ‘categorisation’, ‘functional’, ‘ergonomic’ and ‘symbolic’ (each of which relates to the categorisations described above in some complex way (Crilly, 2005: 46-47)). There are also other categorisations of response for which no real correspondence to those described above could be found, and these include Jordan’s (2000) categories of ‘physiological’, ‘sociological’, ‘psychological’ and ‘ideological’ product pleasures, and Hassenzahl’s (2003) categories of ‘pragmatic’, ‘hedonic’ and ‘consequential’ attributes of (perceived) product character.

In analysing the interviews reported on here, it was found that the collected data could be manipulated to persuasively support many of the existing categorisations of consumer response. This was because the designers’ declared intentions could be logically grouped in a variety of different ways and the existing work offered coherent and compelling categorical systems within which to sort them. However, although the designers often reported sophisticated intentions for how their products should be experienced, they did not betray any sophisticated categorisation of those intentions. Therefore, instead of imposing some pre-defined categorisation of response on the data, a new categorisation of *intended* response was proposed (see section 2.1). This categorisation is considered to be a more faithful representation of the collected data and has been presented here in the language used by the interviewees.

Developing a well-grounded categorisation of intended response has two distinct implications for how research into consumer response is framed. Firstly, many researchers interested in product experience seek to produce design guidelines with a view to increasing the likelihood that product interactions will lead to the intended response (Schifferstein and Hekkert, 2008: 7-8). Developing some understanding of how designers might tend to classify and describe those responses can provide some foundation for establishing how that design guidance is presented. Secondly, many of the existing models of consumer response have been developed either from theory or from studies of consumers. Introducing the voice of relevant experts who are concerned with eliciting those responses (*i.e.* designers) has provided a categorisation of response that can be used to either challenge or support many of those existing models.

Much research into product form has recently centred on the relationship between objective product features and the subjective responses that are thought to be associated with them. Whilst studies of this relationship differ in the details of their approach, they often involve presenting consumers with a range of product forms that vary in some measurable way, and then measuring how consumers respond to

those forms. By establishing a correlation between form attributes and response types, guidance is offered for producing forms that are optimised for eliciting particular responses. Where such forms are produced as part of the study, measuring response to those new forms is used to validate the correlation and support the proposal that the experimental method can be implemented as a design tool (for examples of different approaches see Chen and Owen, 1997; Hsiao and Wang, 1998; Nagamachi, 2002; Vergeest *et al.*, 2002; Cai *et al.*, 2003). To establish experimental control, such studies not only isolate the visual form of products from many of the contextual factors that influence consumer response (*e.g.* motivation, peer appraisal and ensemble effects), they also isolate form production from many of the factors that are influential in industrial practice. In contrast, this paper has emphasised that intentions alone do not determine product form and that a variety of other influences must be considered. Attending to such influences might provide interesting directions for future experimental studies and increase the relevance of their findings. In particular, acknowledging that product form is, at least partially, determined by factors such as brand congruency, manufacturing constraints and techniques of visual representation might promote greater consideration of the contexts within which products are produced and consumed.

Beyond contributing to the research discipline at which it is targeted, the study reported here might also offer something back to the design community from which the data was drawn. As stated in the introduction, the emerging framework was shown to the interviewees towards the end of each interview session to gain their appraisal of the work and to elicit further contributions on the relevant themes. Beyond simply guiding development of the framework, the designers also often made unprompted suggestions for how such representations might be usefully employed in design practice. Although a variety of suggestions were put forward, they most commonly centered on how a framework that relates intention to interpretation could help to inform designer-client communications. In particular, the designers anticipated that such a framework would emphasise the implications of modifying the design in ways that decrease the likelihood that the product's form will elicit the intended response. The framework was thus seen as a stimulus around which negotiations might be conducted when requesting additional resources or defending the rationale behind design decisions. Any improvements in such communications might better allow the preservation of intention through the design, manufacture and delivery of the product (see Tomes *et al.*, 1998; Armstrong, 2000).

In addition to holding possible implications for design research and practice, the framework presented here might also be employed in the service of education. Diagrams are regarded as valuable tools of instruction, and their emphasis on dividing and relating subject matter makes them useful for the structuring and delivery of courses and classes (Lowe, 1993). As such, the framework could assist in design education by providing a foundation upon which more in-depth educational activities could be built. Alternatively, for educational subjects where design is not the core discipline (such as engineering or business), it provides a necessary introduction to the topic of form generation in a succinct and rational way. This might encourage students from more analytic disciplines to recognise the importance of intangible product qualities and develop a more 'qualitative sense' (Macdonald, 1998)

5.2 Limitations of the study and opportunities for further work

The purpose of this study was to provide an overview of the factors that influence form development from project inception through to market launch. To achieve this, each of the designer interviews was conducted with respect to previously completed design projects. This allowed the interviewees to comment in detail on specific products for which they had been responsible and to give an account of any factors that influenced consumer response after their own involvement had ended (*e.g.* manufacturing, marketing and retailing operations). Despite the benefits of retrospective interviews, they also present potential problems. In particular, interviewees' accounts may be adversely influenced by the fidelity with which they recall prior events and also by their attempts to post-rationalise those events to render them more intelligible. Therefore in this study, when the interviewees discussed their intentions for how a particular product was to be perceived there is the possibility that they were influenced by their knowledge of how consumers actually responded to the product once launched. In fact, this does not appear to be especially likely because in most cases the interviewees expressed regret that they were unaware of how their designs were actually perceived by consumers. Despite this, there remains the risk that the designers' accounts of their own intentions were compromised by their exposure to peer critique, and their knowledge of client satisfaction or market performance. To address such issues, future studies might adopt a more balanced mixed-method approach by, for example, attempting to triangulate data from interviews, observations, documentation and participation (see Agar, 1996: 156). This might be particularly effective in longitudinal studies where

specific design projects are followed throughout, tracking the intentions, motivations, constraints, representations and moderating influences that collectively determine the form of specific products.

As described in the introduction, the scope of this study was limited in terms of the senses considered, the participants involved, and the design practices studied. Future work seeking to offer greater understanding of product form development could address each of these limitations and seek to overcome them. For example, whilst this study has focused solely on the visual aspects of product design, other forms of engagement are clearly important to consumer response (see Schifferstein, 2006). To address this, further research might be conducted to expand the framework presented here to incorporate other forms of intended sensory, physical and cognitive interaction. In addition to considering more levels of product engagement, the framework might also be modified to incorporate other parties that are involved in the processes of product development and consumption. This might include clients, manufacturers and the variety of individuals or institutions involved in the specification, distribution and retailing of products. Finally, whilst this study focussed on the work of industrial design consultants, other forms of design practice might also be considered. This could include investigating other varieties of designed product (*e.g.* architectural, automotive, software) and also investigating *in-house designers* who repeatedly or exclusively design products for a single manufacturer.

5.3 Conclusion

The ‘reality’ of product design is that both product form and consumer response are determined by a vast array of factors and that these factors interact with one another in a complex and unpredictable way. Although perhaps accurate, such a view is not useful because it renders the subject impenetrable to reasoned investigation. Instead, this article has sought to categorise and represent those factors that are most influential, whilst remaining faithful to the complexity of the situation as described by the data. This necessarily dictates that some fidelity be sacrificed for the benefits of simplicity, but the framework is presented here as an instrument for thought and communication rather than as a validated model. In general, the interviewees’ positive response to the framework indicates its relevance and value to the design community from whom the data was drawn, and it is the authors’ contention that it offers useful concepts for design researchers and educators. Should future studies either expand upon this representation or subject it to tests of validity, then the

present work would have fulfilled its objective in providing a framework within which or against which other research may be positioned.

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