Product aesthetics

representing designer intent and consumer response

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Abstract

This thesis reports on the development of a conceptual framework for product aesthetics. By adopting the theoretical perspective that products are a medium of communication between designers and consumers, the nature of consumer response and designer intent is explored. By integrating a range of disparate literature within a single coherent framework, the varieties of consumer response to product visual form are illustrated. To investigate the ways in which designers intend to evoke these responses, a qualitative research study was undertaken. This primarily involved interviews with industrial designers and consumer investigators. Analysis of these interviews led to the development of a conceptual framework for designer intent which both mirrors, and integrates with, that produced for consumer response. By representing processes beyond design that are influential in determining product form, a broader contextual framework is presented within which product aesthetics is situated. In concluding the thesis, applications for this framework are discussed and future research directions are proposed.

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Declaration

Unless otherwise stated, this thesis is the result of my own work and includes nothing that is the outcome of work done in collaboration. Any reference to the work of others is clearly indicated in the text. This thesis has not been submitted in whole or in part for consideration for any other degree or qualification at this University or any other Institute of Learning. This thesis contains fewer than 65,000 words (including appendices, bibliography, footnotes and tables) and fewer than 150 figures.

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Chapter 1

Introduction

The physical appearance of products has a profound effect upon the way in which they are perceived. Product aesthetics is therefore used to differentiate products from the competition and stimulate consumption. Particularly in mature market segments, where products are often indistinguishable from each other on a technical basis, investing in product form may increase market share and profitability. To improve understanding of this important subject, this thesis reports on the development of a conceptual framework for consumer response and designer intent. This first chapter explains the motivation for studying product aesthetics, the reasons for focusing on industrial design and the benefits of graphically representing the research findings. The objectives of the work are then presented as a list of questions that must be addressed and the outputs that are required. There next follows a description of the research paradigm within which these questions are considered and the methodology used to answer them. Finally, an outline structure of the thesis is provided by briefly describing the contents of each subsequent chapter.

1.1 Motivation

A communicative perspective on industrial design views the product as a text that is 'written' by designers and 'read' by consumers (see Figure 1-a). In the realm of product aesthetics, considerable effort has been focused on studying how products are interpreted by consumers and what factors influence that interpretation (see reviews by Crozier, 1994; Bloch, 1995; Crilly *et al.*, 2004a; Creusen & Schoormans, 2005). In contrast, the designers' role in shaping those products, and other factors that contribute to its eventual appearance, have been relatively ignored. Therefore, whilst the 'reading' of products has been examined in some detail, the 'writing' of

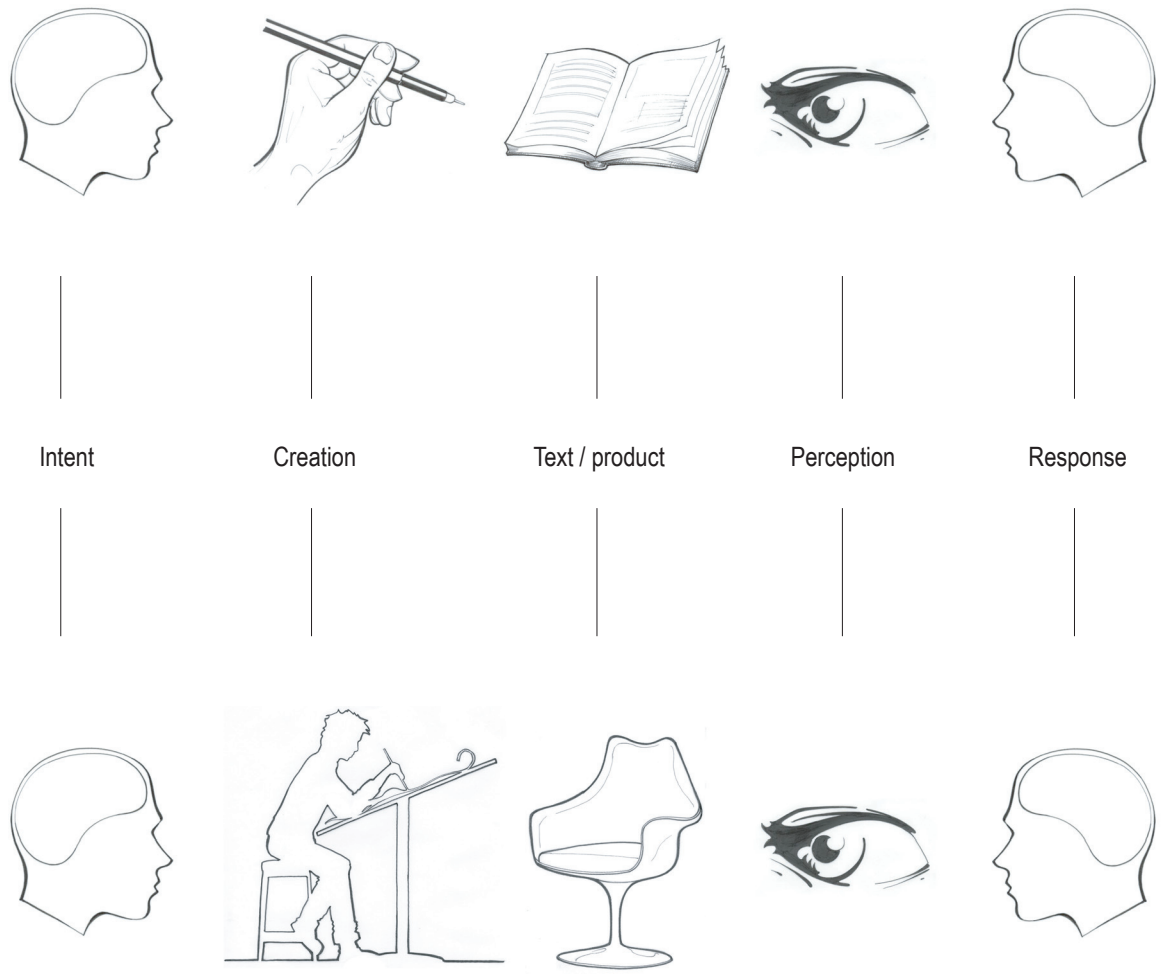

Figure 1-a: *Simple illustration of the analogous relationship between texts and products. (Art credit: Carlos Cardoso).*

products has been granted far less consideration. In particular, little attention has been devoted to the designers' intentions for how the product's form should be interpreted by consumers.

Although consumer response to product aesthetics has been studied by a variety of different disciplines, the findings of these studies have never been presented within a single coherent perspective. Therefore, the literature for consumer response is copious but unintegrated whilst the subject of designer intent is comparatively unexplored. This thesis resolves these issues by making two distinct, but related, contributions. Firstly, it integrates a variety of disparate literature to form a coherent framework for consumer response to product aesthetics. Secondly, it presents an interpretation of current industrial design practice that considers designer intent within the context of the other determinants of product form. The outcome of these literature- and fieldwork-based studies is a unified perspective on designer intent and consumer response. This provides a strong conceptual foundation upon which future work might be based and from which industrial applications might be developed.

1.1.1 Product aesthetics

Alexander Baumgarten coined the term "aesthetics" in 1735 in his *Reflections on Poetry* (Baumgarten, 1954). The meaning he assigned to the word was "the science of perceptual cognition" (in Pepper & Munro, 1977: 150). Indeed, from its Greek origins, *aisthētikos*, the word broadly pertains to perception. Although this perception need not be pleasant and need not be visual, aesthetics is now most commonly used to imply visual appearance and is often restricted to the discussion of perceived attractiveness.[1] Therefore, the word *aesthetic* may either refer to the qualities of the object or the qualities of perception. In this thesis, the term *product aesthetics* refers to the visual form of designed goods (see Lewalski, 1988), whereas, *aesthetic impression* relates to the perception of how pleasing (or otherwise) the process of regarding an object is (see Csikszentmihalyi & Robinson, 1990).

[1] The definitions supplied in modern dictionaries confirm this: "*Aesthetic*: [adjective] 1) concerned with beauty or the appreciation of beauty. 2) of pleasing appearance. [noun] A set of principles underlying the work of a particular artist or artistic movement. *Aesthetics*: [adjective] 1) a set of principals concerned with the nature of beauty, especially in art. 2) the branch of philosophy which deals with questions of beauty and artistic taste." From OED (Soanes, 2002).

When people engage with products, it is not just the product's visual form that is of relevance. Product use is typically a multi-sensory experience and tactile and auditory product qualities are often especially important. In some product categories the olfactory and gustatory characteristics are also critical in determining response. It is therefore important that a product's appearance is congruent with other sensory aspects of design (Smets *et al.*, 1994; Smets & Overbeeke, 1995), as "the product form that the eye sees creates in the observer expectation of what the other senses will perceive" (Monö, 1997: 62). Furthermore, beyond the purely sensory aspects of product interaction, the product's ergonomics, ease-of-use and cognitive demands all affect the user's experience. Despite all this, the product's visual form is considered particularly important for the following four reasons:

1. For the majority of people, vision is the dominant sense (Parret, 1995: 335).

2. The visual characteristics of products are used to infer qualities that cannot otherwise be assessed, such as function, performance and value (Borja de Mozota, 2003: 83).

3. Many purchasing decisions are made based on the visual form of the product or a representation of that form (such as photographic marketing material) (Woolley, 1992: 77).

4. Because vision is a sense that is effective over distance, products are typically seen before they are touched (Ludden *et al.*, 2004). Thus, when consumers approach a product to explore its non-visual qualities, it is often because that product's visual form initially attracted them (Borja de Mozota, 2003: 82).

Perhaps because of these reasons, relative to the other senses, the majority of research literature focuses on visual form. Whilst acknowledging the importance of all the senses and the interaction between them, this thesis focuses exclusively on 'the visual'. However, the concepts discussed are believed to be relevant to other aspects of product interaction. Furthermore, although physical products are referred to throughout, it is hoped that the arguments presented will be considered applicable to a broader range of media.

Although focusing on product aesthetics, this thesis does not concentrate on the product itself, but rather on the ways in which consumers respond to product form

and on the ways in which designers intend to evoke those responses. With reference to *consumer response*, this thesis is largely concerned with the evaluation of subjective product qualities (such as style) and the inference of objective product qualities (such as performance). With reference to *designer intent*, this thesis is concerned with the designer's conscious objectives to evoke response through the creative manipulation of product form.

Consumer response

The visual appearance of products is a critical determinant of consumer response and product success (Bloch, 1995). Judgements are often made on the elegance (Coates, 2003), functionality (Monö, 1997) and social significance (Dittmar, 1992) 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 needs (Lewalski, 1988).

Users' requirements of designed products have frequently been compared to Maslow's (1987) hierarchy of needs (Lewalski, 1988; Yalch & Brunel, 1996; Rutter & Agne, 1998; Gotzsch, 2000; Jordan, 2000; Viemeister, 2001). 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 (Postrel, 2003), and "consumers don't just buy a product, they buy value in the form of entertainment, experience and identity" (Hartmut Esslinger in Sweet, 1999: 8).

The potential for product form to satisfy many of the unarticulated requirements of consumers makes it a critical determinant of perceived value (Cooper, 2001; Goldenberg & Mazursky, 2002). Designing products so as to present this value visually may provide the opportunity to command a higher product price and enjoy increased unit sales (Ulrich & Eppinger, 2000: 217-218; Cagan & Vogel, 2002: 35). 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

(Tovey, 1992: 24).[2] In such markets, "attention to a product's appearance promises the manufacturer one of the highest returns on investment" (Lewalski, 1988: 1).

Whilst there is a great wealth of literature related to consumer response to product aesthetics, each field has approached it from a very different perspective. Attempts to understand the subject range from the philosophical to the experimental and explanations for the observed phenomena include psychological, cultural and situational factors. The subject is consequently difficult to communicate on and there can be problems in understanding how accepted ideas fit together or where new work lies relative to existing studies.[3]

Designer intent

That consumers 'respond' to the visual form of products has been established in the published literature, and an integrated framework for these responses is presented in the literature study that follows (see section 2.1). However, there is a lack of discussion related to the generation of product form, and product aesthetics is often discussed out of context. In particular, consumer response is discussed in isolation from the activities of the designer and the constraints within which they operate. For the purpose of this thesis, *designer intent* relates to the designer's motivation and objectives when generating product form, particularly their intentions to evoke consumer response. The central question is thus, from a designer's perspective, why do products look as they do?

The majority of design literature related to product aesthetics assumes that designers consciously intend to evoke specific kinds of consumer response and that this intention is influential in determining product form.[4] It is often implied, therefore, that the more understanding we have of consumer response, the more effective designers can be in defining the product's required visual qualities. A lack of

[2] It is interesting to note that the requirements for design registration in the United Kingdom are principally based on visual qualities achieving "novelty and individual character" (The Patent Office, 2003a: §1B). That is, through the lines, contours, colours, shape, texture or materials, the "overall impression the design gives someone must be different from the impression any previous design gives them" (The Patent Office, 2003b: 3).

[3] This is addressed in detail in section 2.1.

[4] This need not necessarily be the case however. As this study shows, designers may design for themselves, for the client, or even 'for the product itself' in addition to, or instead, of designing for the consumer (see *Chapter 6*).

information on how product form determines consumer response is thus assumed to be a limiting factor in designing visually successful products. These assumptions are presumably based on personal experience, anecdotal evidence or preconceived notions of design practice. However, such foundations are not often stated and are not available for examination by other researchers. This acts as a barrier to design research truly gaining the interdisciplinary focus that it requires because it prevents non-designers from understanding the field.

Whilst exploring the relationship between product form and consumer response is of interest, it has not been established how such knowledge would be used. Furthermore, even if designers *do intend* to evoke consumer response, a number of factors remain unexamined. Firstly, from where do these intentions originate, how might they be categorised and how are these abstract intentions translated into tangible product form? Secondly, beyond designer intent, what other factors are influential in determining product form? For example, what is the effect of the constraints that must be accommodated and to what extent are intentions preserved through the processes of negotiation, manufacture, distribution and retail? Thirdly, how were the designers' intentions influenced by their knowledge of the consumer groups for whom they design? In particular, what is the nature of this knowledge, how is it gained and how is it utilised in the design process?

These unanswered questions suggest the need for a study examining the relationships that designers have with the aesthetics of their products and, more specifically, the role of intent in design practice. Such a study would thus test the implicit assumptions of existing work and suggest new directions for future work. In addition to the absence of published literature on the subject, recent developments in the design field also demand a new study. In particular, the continued rise of 'the brand' as a central design issue and the advent of formal consumer research as an input to the design process have changed the nature of design practice (see *Chapter 6*). Literature published before these factors attained such prominence may be somewhat dated in their treatment of the requirements, constraints and sources of inspiration that influence design practice.

1.1.2 Industrial design

The profession of industrial design is variously defined, but for this thesis it might be described as the activity that "determines the form of a manufactured product,

shaping it to fit the people who use it and the industrial processes that produce it" (IDSA, 2004a).[5] Industrial design is characterised not only by the importance of the visual element of the end product (Archer, 1984: 59), but also by the visual output from every phase of the design process (Borja de Mozota, 2003: 14). However, in addition to considering matters of aesthetics, industrial designers must also accommodate economic, ergonomic, technological and commercial constraints and arrive at a synthesis (Borja de Mozota, 2003: 4).[6]

For the purposes of this thesis, the products of interest are physical goods that exhibit significant visual form. The definition of 'product' was purposely kept open to allow industrial design in its widest sense to be explored. However, although this thesis considers a variety of products, and the study included products ranging from domestic kettles to industrial inkjet printers, some limitations were imposed. Most notably, buildings, clothing and vehicles were not included in the study.[7] Thus, whilst the findings of the study might be relevant to these product categories, no specific claims can be made for including them in the research. The extent to which the findings of this thesis might relate to these product categories and non-physical designs such as software and services is considered in section 7.3.

Describing design

When answering the question "*why describe design?*" Zeisel suggests that such descriptions of industrial practice "may help designers and teachers of design understand their own behaviour and thereby improve their design ability" (Zeisel, 1984: 5).[8] However, Lawson claims that designers have been unable to make explicit and record their knowledge and that it is thus incredibly difficult for others to access (Lawson, 1997: 308). Despite the apparent benefits of describing design, some designers may resist investigating the process, claiming that analysis will stifle

[5] Or, more formally, "Industrial design is the professional service of creating and developing concepts and specifications that optimize the function, value and appearance of products and systems for the mutual benefit of both user and manufacturer" (IDSA, 2004a).

[6] As discussed in section 6.1.2, the constraints under which designers operate are not limited to these few examples.

[7] This is partly because such items are often designed by specialist organisations rather than general consultancies (see section 7.3.3).

[8] Zeisel also claims that such analysis "may also be useful for researchers and designers who want to work together" (Zeisel, 1984: 5).

creativity (Choueiri, 2003). Whilst Alexander agrees that intuition is of central importance to design, he argues that resistance to the analysis of design comes from those who "make a fetish of it" excluding the possibility of asking reasonable, progressive questions (Alexander, 1964: 9).

In addition to possible reluctance from designers, the creative nature of design (and especially form generation) present additional challenges to descriptive studies. For example, Tovey writes, "there are significant characteristics of the styling process which make it difficult to analyse and to give external form to its detailed processes [...] because it is intuitive and holistic, with a strongly non-verbal culture" (Tovey, 1997: 10). Therefore, whilst researchers may strive for theory that captures the essence of designing, it is impossible to completely understand or model the process (Dorst, 2003: 66). However, whilst codifying the creative process may seem paradoxical or contradictory, attempting to do so is valuable because it tests the (often held) assumption that the designers' central task cannot be studied or understood (Archer, 1984: 75).

In combination with textual or verbal descriptions, one possible approach to representing design is to produce diagrams of the factors involved. Further to the numerous benefits of employing diagrams in qualitative studies, they are particularly valuable when engaging with designers whose preferred modes of communication are often highly visual.

1.1.3 Diagrams

A diagram is a visual representation that shares the properties of written text and representational images, but cannot be reduced to either (Blackwell, 2001: 1). Familiar examples include public transport 'maps' such as the London Underground diagram, economic graphs and charts, or the assembly drawings and flowcharts included in instruction manuals. Diagrams are unlike text in that we cannot 'speak' them, but are also unlike images because that they do not correspond to our sense perceptions of any physical objects (Ittelson, 1996). Thus, rather than imitating the appearance of things, "diagrams are most suitable for visualisations of conceptual knowledge [...,] modelling reality *as we understand it*" (Kazmierczak, 2001: 177).

The value of diagrams

Effective graphic representations are capable of providing concise visual summaries of data, concepts and relationships (Enrick, 1972: 1). Consequently, communications on many subjects are clarified by presenting diagrams of the subject matter involved (Dondis, 1973; Lowe, 1993). As such they may allow one to "see relationships, whether of influence, cause or control, in a situation that can be disordered, capricious and non-procedural [and this] can greatly enhance our understanding of what is going on" (Craig, 2000: 11). This may be especially the case where diagrams allow one to gain an overview of the topic, so that interactions may be observed that might otherwise be overlooked.

These general benefits of graphic representation are particularly relevant to design. For example, Zeisel states that research findings should be presented so that they illustrate an idea, allowing the design team to build on, develop and transform the information so that it is relevant to the problem at hand (Zeisel, 1984: 39-40). To achieve this, Archer suggests that the factors of interest might be presented in a diagrammatic, hierarchical or checklist format (Archer, 1984: 71). Such outputs may then be used by designers themselves. In particular, employing diagrams for communication between designers and their clients builds trust between the two parties. This is because diagrams may illustrate that designers understand their clients' problems and that they can "provide a solution with some objective justification" (Lenk & Kahn, 2003). As Lawson writes, such visual representations should not be read too literally, "since any visually understandable diagram is probably far too much of a simplification of what is clearly a highly complex mental process" (Lawson, 1997: 47).

The value of the diagramming process

In addition to these benefits of diagrammatic presentation, the actual process of generating the diagram is also beneficial in itself. In particular, complex, intangible and non-linear concepts may often be thought about more rigorously through the application of diagramming (McKim, 1980). Such a process is rarely the mere formality of setting down in graphic form what is already understood. On the contrary, the iterative process of structuring ideas and developing representations for those ideas triggers previously unconsidered notions (Albarn & Smith, 1977: 7). As such, drawing diagrams may lead to an improved understanding of the subject and conceptualisations that would not otherwise have been entertained.

Thus, diagrams are effective instruments of thought and a valuable tool in conveying those thoughts to others. Further to this, they can also be used as elicitation stimuli in interviews. This involves presenting interviewees with a diagrammatic representation of a domain with which they are involved, thus provoking comment on the details of the diagram and the conceptualisation inferred from it, in addition to prompting further discussion of the domain in general (Crilly *et al.*, 2006). Compared to many other professions (or social groups), designers have a special relationship to sketches, diagrams and other visual material. This is because in their 'world' these are the basic components of communication and they often express a preference for receiving visual information over the purely textual or verbal (Henderson, 1999: 1).

In this research, diagrammatic representations served three distinct purposes. Firstly, graphic ideation (thinking with diagrams) was used to explore the concepts emerging from the study and provided an analytic tool for the integration and evaluation of these concepts. Secondly, graphic communication was used throughout the study to communicate the researcher's conceptualisations to research colleagues and informants. Thirdly, graphic elicitation was used to encourage contributions from informants that were otherwise relatively inaccessible and to gain their appraisal of the work.

1.1.4 Research objectives

The overall objective of this thesis is to provide a conceptual framework for product aesthetics. This requires the representation of consumer response, designer intent and the broader context within which these notions are situated. In order to achieve this objective, a number of research questions must be addressed:

Consumer response

- What is the nature of consumer response?
- How might the different aspects of response be categorised?
- What factors are influential in determining response?

Designer intent

- What is the nature of designer intent?

- What range of responses are intended?
- What other factors are influential in determining product form?

To adequately convey the answers to these questions within a unified conceptual framework, the relevant parties, processes and relationships must all be depicted. Therefore, one of the required outputs from this research is a coherent graphical representation of product aesthetics that accommodates each of these factors.

1.2 Research paradigm

The research questions posed in the preceding section demand the conceptualisation of a domain and the integration of these concepts into a coherent form. These requirements suggest a *qualitative* research approach, focussing on developing new understanding of the subject rather than the quantitative verification of existing hypotheses. This is because when developing descriptions, interpretations or theories, "qualitative research is often the most 'adequate' and 'efficient' way to obtain the type of information required and to contend with the difficulties of an empirical situation" (Glaser & Strauss, 1967: 18).

1.2.1 Qualitative research

Qualitative research is necessarily subjective, and depends on the personal qualities of the researcher. Consequently, the researcher themselves is generally considered to be the pre-eminent instrument of research (Strauss & Corbin, 1998: 6; Goulding, 2002; Robson, 2002: 167). This raises the question of how such a flawed instrument can be trusted, as each individual carries their own prejudices or preconceptions that have the potential to bias the research process. As such, it has been suggested that "the human factor is the great strength and fundamental weakness of qualitative inquiry and analysis" (Patton, 1990: 372). To address this, qualitative researchers are required to recognise their role as a research instrument, reflect upon their influence on the process and achieve some level of transparency when reporting on their work. Thus, the reader may be furnished with the appropriate information upon which to assess the value of the study.

Researcher as instrument

In qualitative research, the subject of study is not left unaffected by the presence of the researcher. For example, in interviews, it is important for the researcher to develop a constructive relationship with the interviewee (Robson, 2002: 383). The researcher's empathy, sensitivity, humour and sincerity are important for successful interviews, and thus remaining neutral, distant or uninvolved are not viable options. In asking for openness from the interviewees, the researcher must offer openness in return and thus their own mood, experiences and preconceptions enter into the interview (Rubin & Rubin, 1995: 12). Consequently, the researcher should strive to build rapport with the *person* being interviewed whilst remaining neutral to the *content* of what they say (Patton, 1990: 317).

Self-reflexivity

Qualitative researchers unavoidably bring their own backgrounds to their studies and this can act as both a source of bias and a useful analytic perspective (Robson, 2002: 49-50). Researchers are thus encouraged to take note of their own characteristics and consider how these may influence the work (Fielding & Thomas, 2001: 139). This helps researchers in acknowledging their own assumptions, and recognising bias during the research design, data collection, data analysis, and reporting phases of the study (Bringer *et al.*, 2004: 256). Such self-reflexivity is considered important because the researcher's awareness of themselves is the first step towards recognising the influence of their personal characteristics (Robson, 2002: 172).

Transparency

In qualitative research reports, there is a strong emphasis on method and process; by describing what was done and how conclusions were reached, the credibility of the findings are supported (Goulding, 2002: 19). In particular, Patton states that "graduate students will be expected to report in detail on all aspects of methodology, including analytical procedures, problems, and limitations" (Patton, 1990). This is especially important for interpretive studies where the systematic and principled nature of the inquiry provides an argument for the validity of the interpretation. For example, in relation to theory building, Strauss & Corbin argue that "one cannon for judging the usefulness of the theory is how it was generated" (Strauss & Corbin, 1998: 5). Thus, the output of the work may be assessed on a detailed description of the process of theory generation rather than its verification (Goulding, 1999: 251).

When considering the trustworthiness of a study, issues of validity and reliability are often considered. These notions originate from fixed (rather than flexible) research designs, such as those often associated with quantitative studies (Robson, 2002: 93). However, as discussed above, the personal qualities of the researcher are central to qualitative research, and thus replication by an independent investigator is not often possible (Robson, 2002: 168). Instead, Robson argues that elegance, coherence and consistency may be more appropriate standards against which to judge qualitative research, just as is done in the fields of history and literature (Robson, 2002: 168).

1.2.2 Epistemology

All research seeks to make contributions to knowledge through philosophical or scientific inquiry. Therefore, as the philosophy of knowledge, epistemology has an important role to play in all research. Defining the epistemological assumptions upon which a research study is based establishes the way in which the researcher views knowledge and thus the way in which the contributions should be interpreted.

Epistemology is commonly divided into two competing schools of thought. Whilst these epistemological stances are variously defined, they are often referred to as *positivism* and *anti-positivism* (Johnson & Duberley, 2000: 78). Positivism, is the stance traditionally adopted by the *physical* sciences and holds to the view that there is an objective reality 'out there' which can be interrogated and reported on. Positivistic research seeks to reveal the truth about the world in some objective sense. In contrast, anti-positivism (or relativism) is the stance more often adopted by the *social* sciences and holds to the view that reality is subjective and is constructed by the individuals or groups who perceive it. Relativistic investigations seek to explain how people interpret their world whilst accepting that other interpretations are not only possible but also valid (Robson, 2002: 20-25). Whilst these epistemological stances are often presented as polar philosophical positions, there also exists a continuum running between them upon which many alternative epistemologies lie (Johnson & Duberley, 2000: 180). Thus, there is a spectrum of possible epistemologies that might be chosen from depending on the research topic, the research objectives and the researcher's own philosophical standpoint.

For the research questions posed in this thesis, the epistemologies located at the positivist end of the spectrum are of limited relevance. Their focus on the observable, measurable and repeatable aspects of phenomenon are more suited to purely

quantitative inquiries (Rubin & Rubin, 1995: 32). Instead, the epistemologies located towards the relativist end of the spectrum are more appropriate. Their emphasis on experience, interpretation and meaning are suited to a qualitative research approach aimed at uncovering attitudes and beliefs (Rubin & Rubin, 1995: 35). Specifically, this thesis is written from a pragmatist standpoint; contributions are presented as useful conceptual positions rather than as discoveries that can be objectively assessed.

1.3 Research methodology

Within qualitative research, the term *methodology* may be defined as "a way of thinking about and studying social reality" (Strauss & Corbin, 1998: 3). This often leads to the adoption of a set of principles that guide the research. Such a focus on the framework within which research methods are applied is important because it assists researchers in avoiding philosophically conflicting approaches (Goulding, 2002: 19-20). Adopting (or adapting) an established research methodology thus provides guidance on a range of research procedures such as sampling, data collection and data analysis. This guidance assists researchers in avoiding 'methodological transgressions' that might result from using data analysis techniques that are incompatible with the sampling methods used, or collecting data in a way that will not allow the research questions to be answered. Thus, whilst researchers may apply a number of research methods in a study (*e.g.* interviews, questionnaires, observation, etc.) these methods should be applied in a manner consistent with a single research methodology, or a very carefully selected blend of methodologies (Goulding, 2002: 19-20).

1.3.1 Design research methodology

Writing specifically about the PhD research process in design, Newbury states that "awareness of methodological issues is important because it draws attention to the implications of the decisions made during a research project" (Newbury, 2000). Despite this, when compared to other disciples, few significant publications on design research methodology exist, and design research papers do not often describe the methodological issues involved (Blessing *et al.*, 1995; Blessing & Chakrabarti, 2002). This is not necessarily problematic however as most design research should be grounded in the procedures of more well-established academic fields (Eckert *et al.*, 2003). This allows researchers in the relatively immature field of design research to

adopt the conventions of research disciplines which have "very sophisticated views of what are effective research procedures, what constitutes adequate methodological rigour, and what is the epistemological status of their findings" (Eckert *et al.*, 2003).

For the research questions posed in this thesis, the most relevant fields to approach for methodological guidance are those that examine the social world, with their aim of uncovering attitudes and behaviours.

1.3.2 Social research methodology

To investigate design practice and reveal the ways in which designers generate product form, it is often necessary to visit design companies, observe their activities and speak with designers. For these kinds of "complex, messy and poorly controlled 'field' settings", Robson suggests that a flexible research approach is required (Robson, 2002: xv). For example, qualitative interview studies often use an iterative and continuous design, because the design changes as the researcher learns from each interview (Rubin & Rubin, 1995: 43). Despite this apparently haphazard approach, a scientific grounding may be maintained if the work is conducted in a systematic and principled fashion (Robson, 2002: 5). To achieve this, Robson suggests three research designs that are particularly relevant to real-world settings: case-studies, ethnographic studies and grounded theory studies (Robson, 2002: 87).

Case-studies

Case studies require in-depth investigation of a single case or a well-defined set of cases (Yin, 1993: 3). What constitutes a case is variously defined, but they are often focused on a location that contains a community or organisation.(Bryman, 2004: 49) Case studies are well suited to broadly defined topics where contextual conditions are important and multiple sources of data are relevant (Yin, 1993: xi). In most instances, a range of data collection techniques are used including observation, interviews and document examination (Robson, 2002: 89).

Ethnography

Ethnography is a set of data collection methods which involve the researcher participating in people's daily lives for an extended period (Hammersley & Atkinson, 2002). There is thus an emphasis on the researcher's direct personal involvement in the community being studied. This requires interactions in a range of contexts

including the home, workplace and recreational environments (Agar, 1996: 119). Ethnography seeks to satisfy three particular requirements of qualitative research: the need for an empirical approach, the need to ground phenomenon in field observations and the need to remain open to themes that cannot be identified at the outset of the study (Baszanger & Dodier, 2004: 10)

Grounded theory

Grounded theory seeks to develop *new* theories rather than test the validity of *existing* theories (Glaser & Strauss, 1967). Typically, the data is collected by conducting interviews, and the researcher immediately analyses each interview to develop initial categories, interpretations and theories. From this preliminary analysis, potential interviewees are identified who might prove useful in expanding, modify or refuting the researcher's emerging conceptualisations. By constantly comparing one case to the other and rigorously analysing the emerging data, the researcher may propose a theory that both *explains* the data and is supported *by* the data (Strauss & Corbin, 1998).

For the research presented in this thesis, the grounded theory approach was adopted because it is a well-established means of developing new interpretations of a domain for which no existing hypotheses exist. However, the three research designs described above are not mutually exclusive and the application of one may be informed by the others. Thus, in this study, elements of the case-study approach may be identified in how multiple data sources were used for each case and elements of ethnographic practice may be identified in the observational aspects of data collection (see section 4.3).

As described above, adopting an established methodological framework provides guidance on issues such as sampling, data collection and data analysis. Thus, grounded theory is described in more detail below, as the rigour dictated by the methodology informed every stage of the research.

1.3.3 Grounded theory

In 1967, Barney Glaser and Anselm Strauss published *The Discovery of Grounded Theory*, in which they presented a methodology for building theory that was 'grounded' in observation (Glaser & Strauss, 1967). This was to counter what, in their view, was the dominant attitude at the time, which held that all the great theories of

sociology had already been discovered. Grounded theory offers guidance as to how sampling, data collection and data analysis could be integrated to allow the development of theory that is "derived *from* data and then illustrated by characteristic examples *of* data" (Glaser & Strauss, 1967: 5).[9] Consequently, grounded theory is often adopted by researchers when the topic of interest has been relatively ignored in the published literature (Goulding, 1999: 8).

Following the publication of *Discovery* in 1967, the original authors' interpretations of grounded theory diverged. This has resulted in two separate streams of the methodology: 'Glaserian' and 'Straussarian' (Goulding, 2002: 2, 38, 47). From an outside perspective, the distinctions between these streams can seem quite subtle, however, one key difference in emphasis is important. Glaserian grounded theory focuses on the researcher developing 'theoretical sensitivity' to assist them in capturing theory that emerges from the data (Glaser, 1992). Conversely, Straussarian grounded theory has an increased focus on the coding procedures that researchers may use to 'force' theory from the data (Strauss & Corbin, 1998).

Staussarian grounded theory

Although originating in sociology, grounded theory has been adopted by a range of disciplines and, in particular, it is growing in popularity for organisational and consumer research (Goulding, 2002: 1, 38). Despite this, Goulding suggests that researchers from all disciplines should adopt the best practices of those researchers working in the fields that are most familiar with grounded theory (*i.e.* the sociology of health care). This entails selecting and specifying one stream of grounded theory (either Glaserian or Straussarian) rather than combining aspects of each one to form a potentially conflicting hybrid (Goulding, 2002: 47, 48, 160). For the research reported in this thesis, Straussarian grounded theory was adopted. In particular, the researcher followed the methodology as set out in Strauss and Corbin's *The Basics of Qualitative Research* (1998).[10]

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[9] Italics not in original.

[10] Although the title implies that the text is a general resource for qualitative research, this is misleading; the subtitle, *Techniques and procedures for developing Grounded Theory,* provides a more accurate description of the contents. The first edition of this book was published in 1990 and it is typically referred to as *Strauss & Corbin (1990)*.

Straussarian grounded theory was adopted for three reasons. Firstly, in comparison to Glaserian grounded theory it offers more complete and more sophisticated guidance on how the collected data should be analysed so as to arrive at useful and rigorous interpretations. Secondly, Straussarian grounded theory places far more emphasis on diagramming as an analytic tool than does Glaserian grounded theory and this approach was well aligned with the research topic, the research questions and the researcher's preferences. Thirdly, whilst Glaser recommends striving for 'substantive theory', which only explains the phenomenon under study, Strauss argues for 'formal theory', conceptualising beyond the initial field of study (Goulding, 2002: 45-46). Such an approach was considered more useful for a topic such as product aesthetics that naturally has closely related areas to which one might draw parallels.

In order to generate theory grounded in data, grounded theory studies often pass through the stages of description and interpretation. It is therefore perfectly valid to use a grounded theory approach to simply achieve either of these stages as the final objective of a study (Strauss & Corbin, 1998: 9). Such 'partial grounded theory' approaches can thus be used to develop conceptual orderings or discover categories in the data (Strauss & Corbin, 1998: 288). This was the approach adopted in this study where the grounded theory methodology was used to generate a conceptual framework rather than full-blown theory.

Grounded theory procedures

For the research reported in this thesis, there are four procedural aspects of grounded theory practice that are particularly important. These are, sampling, data collection, data analysis and diagramming.

- *Sampling*: The sampling method adopted in grounded theory is termed 'theoretical sampling' because the cases selected for the study are defined by the emerging theories. The researcher selects cases that allow comparison with existing ones so as to improve the comprehensiveness and parsimony of the theory (Strauss & Corbin, 1998: C13).

- *Data collection*: Grounded theory can accommodate multiple data sources but the most usual data collection technique is the qualitative interview. Thus, typically, the majority of data is

collected by unstructured or semi-structured interviews and the information collected from other sources such as observations, documentation and published literature are considered to be supplementary (Strauss & Corbin, 1998: 52).

- *Data analysis*: The principal data analysis method adopted in grounded theory is 'coding' (Strauss & Corbin, 1998: 55). This refers to the practice of attaching a coded interpretation to segments of the interview transcripts (or other data sources). The ongoing process of coding and re-coding the transcripts reveals structure in the data and allows the researcher to conceptualise the domain.

- *Diagramming*: Diagrams are used in grounded theory to record and stimulate thought. These activities are encouraged throughout the study, from the representation of initial ideas to the graphic expression of the final theory (Strauss & Corbin, 1998: 238). In conjunction with memos that the researcher makes during the study, these diagrams provide an 'audit trail' of the researcher's conceptual activities during the study (Strauss & Corbin, 1998: 241; Goulding, 1999: 18).

These procedures are not applied in a strict sequence; as concepts and relationships emerge from the data, the researcher can use this information to gather new data to further the evolution of the theory (Strauss & Corbin, 1998: 33).

Methodological guidance

The use of Strauss & Corbin's widely quoted work was informed by reference to the original grounded theory text (Glaser & Strauss, 1967) and Goulding's description of grounded theory in organisational settings (Goulding, 1999; Goulding, 2002). To avoid confusion in this thesis, no further reference is made to Glaserian grounded theory. Texts focusing on specific research techniques were consulted for detailed support in specific matters such as interview elicitation techniques, computer-aided data analysis and diagrammatic theory building. The guidance offered in these texts is used to justify selection of the research methods used. As such, rather than reviewing them here, they are briefly summarised throughout the methods chapters as required.

1.4 Thesis structure

As discussed, grounded theory studies require that the activities of sampling, data collection and data analysis be employed in an integrated and iterative manner. A chronological report of the study is therefore not always appropriate as separating the study into distinct sequential research activities is often impossible. This issue of reducing an organic process of cyclically inductive and deductive reasoning down to a linear textual description is well-documented (see Bringer *et al.*, 2004). To address these problems, this thesis describes each of the research activities in detail separately before presenting the analytic output. Thus, emphasis is placed on the methods employed in the study as this provides a basis upon which the resulting interpretation might be judged.

Following this introductory chapter, the remaining six chapters are arranged as follows: *Chapter 2* presents a detailed review of the literature related to consumer response to product aesthetics and develops an integrated conceptual framework from which to approach the subject. Furthermore, in the absence of literature specifically focused on designer intent, literature that surrounds, or supports, this concept is reviewed. *Chapter 3* describes the sampling activities that were undertaken to identify and recruit participants into the study. The population from which the sample was drawn is described and the distribution of the sample across the different phases of the study is presented. *Chapter 4* describes the data collection methods used in the study. This includes not only interviews, but also observation and document analysis. *Chapter 5* describes the data analysis methods used in the study. This ranges from the transcription of recorded interviews to diagramming techniques and computer-based coding activities. Having described the sampling, data collection and data analysis methods, the researcher's interpretation of current industrial design practice is presented in *Chapter 6*. This involves discussion of the role of designer intent within the context of the other determinants of product form. *Chapter 7* concludes the thesis by re-addressing the research questions and reviewing the contributions that have been made. Suggested applications for the work are provided along with discussion of what further work in the area might involve.[11]

[11] This structure permits those readers less interested in the details of research methodology to omit chapters 3, 4 and 5. For such readers a brief methodological overview is provided in *Appendix A*.

Chapter 2

Literature study

This chapter is divided into two main sections. Firstly, the literature related to consumer response is reviewed and integrated within a single conceptual framework (section 2.1). Secondly, to demonstrate the existing 'literature gap', the role of designer intent in determining product form is explored (section 2.2).[12] However, before these main sections are presented, brief descriptions are provided of the role that literature plays in grounded theory and the literature search activities that were conducted for this study.

Literature in grounded theory

In interpretative studies, one of the main threats to validity is "imposing a framework or meaning on what is happening rather than this occurring or emerging from what you learn during your involvement with the setting" (Robson, 2002: 171). As such, in grounded theory, when the researcher enters the field, they should have no preconceived concepts, frameworks or hypotheses that they are seeking to prove or disprove (Strauss & Corbin, 1998: 34). However, this is not to say that published literature is ignored, as it may be used for formulating initial questions and sensitising the researcher to relevant themes (Strauss & Corbin, 1998: 49, 51). A comprehensive literature search was thus undertaken so as to identify what work needed to be done and to establish a perspective from which that work could be approached.

[12] Although not reviewed in this chapter, detailed literature searches were also performed for the following topics: visual elicitation stimuli (section 4.2.4), member validation (section 6.4), computer-aided qualitative data analysis (section 5.3) and visual representation (section 5.4).

Literature search

Hart claims that "the originality of a research topic often depends on a critical reading of a wide-ranging literature" (Hart, 2003: 26). This is certainly the case when considering product aesthetics, which falls within the bounds of multiple fields *and* into the gaps between those fields. Thus, a number of literature search strategies were employed in an attempt to adequately cover the domain. This included searching electronic databases, browsing physical libraries and following the 'reference trail' provided by published materials (see Hart, 2001). In addition to these desk research activities, active involvement in the relevant research communities led the researcher to the recommendations of his peers (see Robson, 2002: 53). The researcher was thus exposed to a wide range of the available literature related to product aesthetics.

2.1 Consumer response

This first part of the chapter provides a literature review on the subject of consumer response 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.

2.1.1 The need for a review

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" (Taylor *et al.*, 1999: 219). In addition to design research, fields of interest typically include aesthetics, psychology, consumer research, sociology, marketing and semiotics. Crozier (1994) and Bloch (1995) 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, Monö (1997) and Coates (2003) 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

Figure 2-a: *Basic model of communication (adapted from Shannon (1948)).*

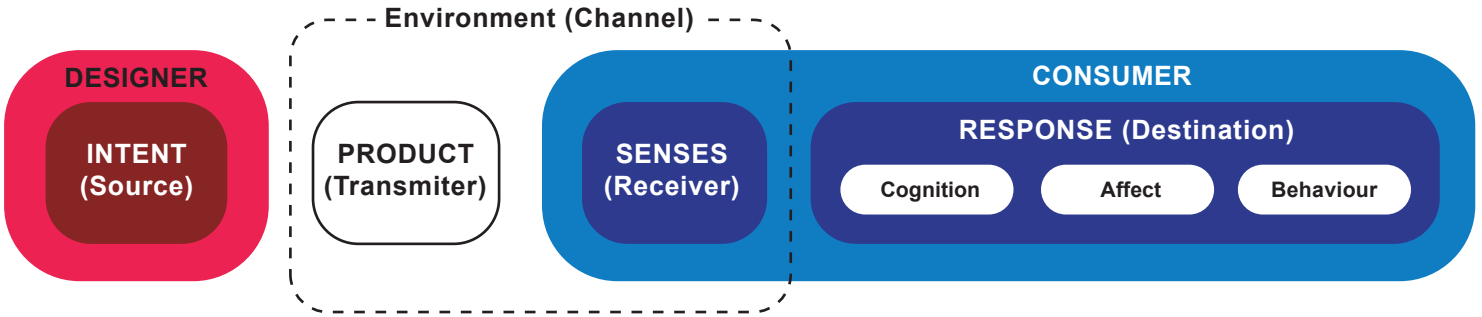

Figure 2-b: *Basic framework for design as a process of communication with emphasis given to consumer response to product aesthetics. The colour scheme adopted here (shades of red for production and shades of blue for consumption) is retained throughout this thesis.*

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. Furthermore, 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" (Veryzer, 1993: 224).

2.1.2 Products as media

In general, consumers have no access to the designers of the products they engage with. Thus, the consumers' interpretation of the design is based predominantly on their interaction with the product (Norman, 1988). Designers only communicate attributes such as elegance, functionality, mode-of-use and social significance through the medium of the product. This perspective on product design often encourages researchers to view products as signs capable of representation (Vihma, 1995). 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 (Krippendorff & Butter, 1984; Monö, 1997; Coates, 2003).

In 1948, Lasswell described the study of communication as involving consideration of "w*ho* says *what* in *which channel* to *whom* with *what effect*?" (reproduced in Fiske, 1982: 30). This was formalised and graphically represented by Shannon (1948) who presented a basic system of communication that comprised 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 destination (see Figure 2-a). In collaboration with Shannon, Weaver proposed that this mechanistic and technical perspective (originally developed for electronic communication) reflected some of the complexities of human communication (Shannon & Weaver, 1949).

Taking Shannon's basic model of communication as a starting-point, Monö has applied communication theory to the study of product design (Monö, 1997: 43-45). Here, the designer (or the design team) may be viewed as the source of the message, as defined by their intentions. 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.[13]

The orthodox view of consumer behaviour presents response to products as comprising *cognition* and *affect*, which are followed by *behaviour* (O'Shaughnessy, 1992; Bloch, 1995). 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-b). Each of these elements of the communications model are discussed below.

Designer (source)

The design message is generated during the product development process (Monö, 1997). Here, the designer makes decisions that determine what the product form should visually convey (Gotzsch, 2000). The designer may be characterised by the individuals involved in the project, the design activities they employ and the organisation or management of these activities (Simon, 1981; Bloch, 1995).[14]

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[13] The model adopted here belongs to the 'process school' of communication theory. Whilst such models are well suited to studies of communicative acts, they are often criticised for suggesting that meaning is *transmitted between* people rather than *constructed by* people (Fiske, 1982: 2, 6). However, as the model is developed throughout this thesis, emphasis is given to the contexts within which production and consumption occur. Therefore, despite the apparently mechanistic (and reductionist) framework initially adopted, the notion that products are a medium of communication does not necessarily imply that meaning resides within the product itself. Whilst designers may intend products to convey certain qualities, such qualities will only be perceived by the consumer if they interpret the product in accordance with the same set of codes that the designer anticipates. This *anti-formalist* position views meaning as an attribute of intention and interpretation rather than as a formal quality of the product (see Fish, 1989).

[14] The role of the designer in determining product form is discussed in section 2.2 and greatly elaborated on in *Chapter 6*.

Product (transmitter)

The physical product may be characterised by its geometry, dimensions, textures, materials, colours, graphics and detailing (Scott, 1951; De Sausmarez, 1983; Hannah, 2002). 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.

Environment (channel)

The environment within which the product is to be perceived may be characterised by the physical environment of interaction. Of particular interest when considering the visual perception of products are issues of illumination intensity and colour cast (Mayall, 1967: 47). If relevant, consideration must also be given to the media with which the product is to be represented; this includes photographic marketing material and packaging.[15]

Senses (receiver)

The signal transmitted by the product is received by the physiological senses (Monö, 1997). 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 tactile, auditory, olfactory and gustatory senses might 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 state (Arnheim, 1974; Hoffman, 1998; Goldstein, 1999).

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 Crozier (1994), Cupchik (1999), Lewalski (1988), Baxter (1995) and Norman (2004) strong precedent emerges for using the following three

categories to describe cognitive response to product appearance: *aesthetic impression*, *semantic interpretation* and *symbolic association*.[16]

- *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.[17]

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.

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[15] Later in this section, the context within which the consumer operates is more fully represented; this context includes both physical and cultural factors and thus replaces the channel.

[16] Similarly, Hauffe mentions three basic *functions of objects*: the 'aesthetic', 'practical' and 'symbolic' (Hauffe, 1996: 16-17).

[17] Baxter also describes a fourth attractive quality, 'prior knowledge attractiveness'. Baxter defines prior knowledge attractiveness as evoking the desire to obtain an object because it bears similarity to a design that the consumer is already familiar with. Thus, the designer must be considerate of the visual attributes of product predecessors and other products in the company's range (Baxter, 1995). The issues of identifying a product as belonging to a certain range or family of products is considered here to be a component of other factors and is dealt with in more detail later in this thesis (see section 2.1.4).

Although often convenient to do so, it is not entirely accurate to describe products as *being* aesthetic, *having* semantic attributes or *suggesting* 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 judgements (Forty, 1986).

Affective response (destination)

It has been well established that products elicit emotional responses (Frijda, 1986; Desmet, 2003a). The word *affect* is commonly used as an umbrella term to describe these emotions, moods and feelings (O'Shaughnessy, 1992; Norman, 2002: 38). Affect has been described as part of "the consumer's psychological response to the semiotic content of the product" (Demirbilek & Sener, 2003: 1347). Consumers may experience a variety of potentially contradictory feelings towards an object, such as admiration, disappointment, amusement and disgust (Desmet *et al.*, 2000; Desmet, 2003b). However, these feelings are often relatively mild when compared to the possible spectrum of human emotions (Desmet, 1999).

Desmet has proposed five categories for the emotional responses that products may elicit: *instrumental*, *aesthetic*, *social*, *surprise* and *interest* (Desmet, 2003a). 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" (Desmet, 2003a: 10). 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" (Desmet, 2003a: 11).

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

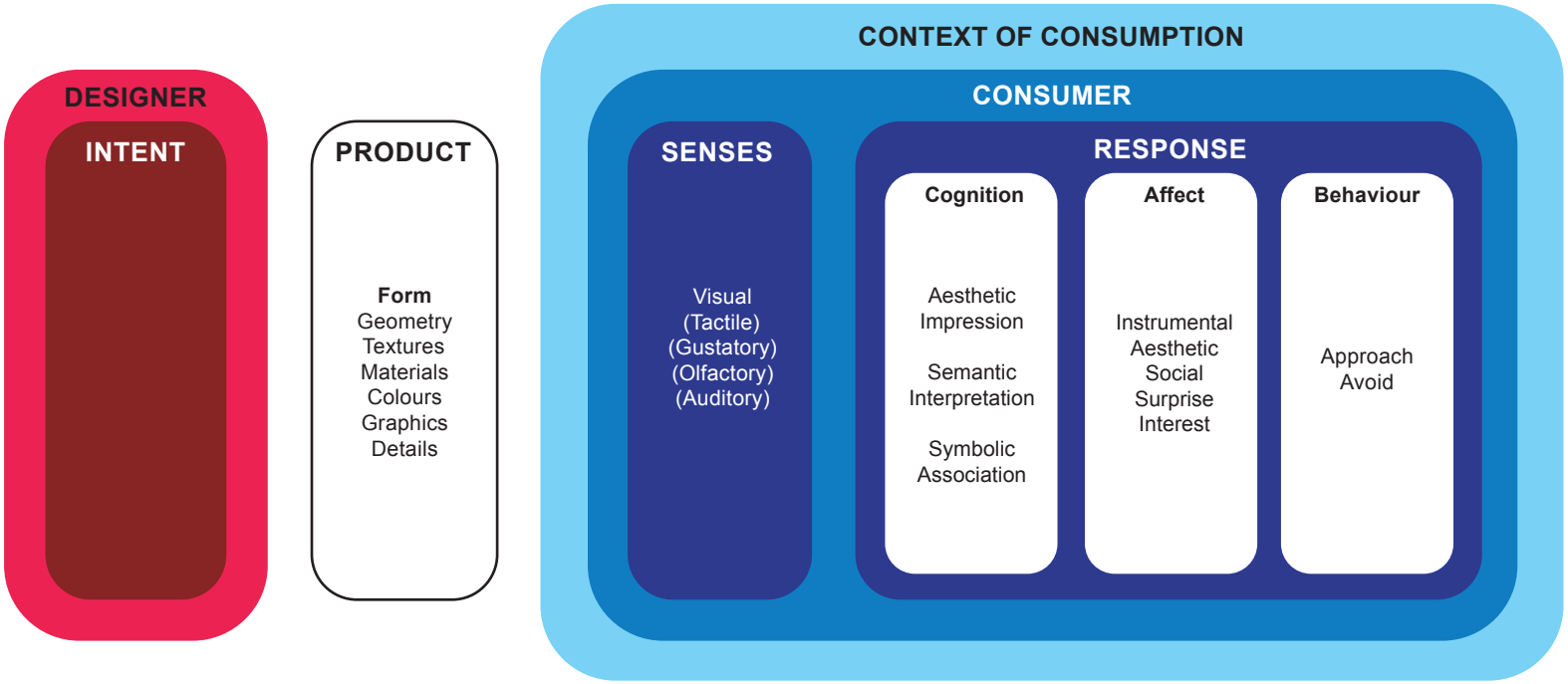

Figure 2-c: *Expanded framework for consumer response to product aesthetics.*

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 judgmental (Norman, 2002). Each system influences the other, with cognition leading to affect, and affect influencing cognition (Ashby *et al.*, 1999; Norman, 2002; Coates, 2003). Thus, whilst the division between the cognitive and affective phases presented in the framework is convenient, considerable interdependence exists.

Behavioural response (destination)

A consumer's psychological response (comprising cognition and affect) (Bloch, 1995) influences the way in which they behave towards the product (O'Shaughnessy, 1992). 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 and even product abuse (Bloch, 1995).

The consumer's cultural context

The culture, background and experiences of the consumer are influential in determining their response to products (Dittmar, 1992; Bloch, 1995; Monö, 1997; Coates, 2003). The designers and consumers of a given product are often (but not always) separated by time, place or social position. 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 2-c).

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 thesis 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.

2.1.3 Aesthetic impression

People may look at objects and find them visually attractive, elegant or beautiful (Coates, 2003). Often the activity of perceiving the object is pleasurable in itself, irrespective of other value judgements that might be made (Berlyne, 1974: 8). This positive aesthetic impression has interested design researchers for decades (Pye, 1978; Palmer, 1996) and art theorists and philosophers for centuries before them (Crawford, 1974; Csikszentmihalyi & Robinson, 1990).

Although the subject of beauty has been studied for centuries there is no scientifically comprehensive theory that explains what constitutes aesthetic experiences (Leder *et al.*, 2004: 489). Furthermore, there has been little progress in the formulation of a "coherent theory with respect to the aesthetic aspect of design" (Veryzer, 1995: 641). 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 words (Pye, 1978). As such, Baxter describes the inherent attractiveness of visual form as "that most illusive and intangible quality" (Baxter, 1995: 57). 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.

Objective and subjective attractiveness

Most early scholars of beauty held the perspective that attractive features resided in the object itself (Routio, 2002). Beauty was considered to be an objective property of the stimuli under consideration. Certain lines, proportions, shapes and colours were believed to be inherently attractive (Arnheim, 1992). This approach suggests that each object will have an ideal form, which once attained will tend to be considered attractive by everyone.

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 (Elam, 2001; Hannah, 2002).[18] The Bauhaus school pioneered the application of this approach to product design in the 1920s and 30s (Itten, 1997). 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 present (Köhler, 1930; Ellis, 1938). 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 (Scott, 1951; Lewalski, 1988; Baxter, 1995).

Despite these formal rules, 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' (Crozier, 1994: 46-47, 74). 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 group 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 attractiveness (Crozier, 1994). The consumers' subjective experiences are also important and contribute to aesthetic impressions. For example, prior experience will influence the perception of product typicality and novelty (Coates, 2003), and these two factors have been shown to strongly affect aesthetic preference (Hekkert *et al.*, 2003).

Aesthetic balance

When considering aesthetic impression, Gombrich proposed that "delight lies somewhere between boredom and confusion" (Gombrich, 1984: 9). That is, 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 presented (Berlyne, 1974: 10). Berlyne suggests that the hedonic value (pleasure) associated with perception of a stimulus will peak when there is an optimum level of

[18] The *golden section* can be expressed as a rectangle where the ratio of the short side to the long side is equal to the ratio of the longer side to the sum of both sides. Thus, the ratio of the sides is 1: 1.618 (Boselie, 1984).

psychological arousal; too little arousal will result in indifference whilst too much will result in displeasure.

More recently, Coates has united these perspectives by suggesting that aesthetic impression is based not only on a balance of interest and understanding but that it is also influenced by a combination of objective and subjective factors (Coates 2003). He 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. Thus, the information and concinnity perceived in a product may be divided into their objective and subjective components.

- *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 comply with current trends 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.

2.1.4 Semantic interpretation

Unlike purely artistic creations, designed objects are often functional devices that operate in some way to perform the task for which they are used (Avital, 1992). 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 owner. 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" (Krippendorff & Butter,

1984: 4).[19] Instead, a treatment of product semantics is explored which is more congruent with Monö's *semantic functions* (Monö, 1997) and Norman's *affordances*, *constraints* and *mappings* (Norman, 1988).

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* (Monö, 1997).

- *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

[19] A good review of the different approaches to product semantics is given in Jan Michl's critical analysis of two product semantics conferences held in 1989 (Michl, 1992).

> 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.[20]

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 graphics (Monö, 1997).

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* (Norman, 1988).

- *Affordances* were described by Gibson as "what [physical objects] furnish for good or ill" (Gibson, 1968: 285). Norman reinterpreted affordances as the "perceived [...] properties of the thing [...] that determine just how the thing could possibly be used" (Norman, 1988).[21] 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

[20] Using Monö's definitions, a design can identify itself as belonging to a family of products. Its physical form may evoke the product that it replaces, or the products that it complements. This is similar to Baxter's concept of 'prior knowledge attractiveness'.

[21] For an analysis of the differences between Norman's and Gibson's use of 'affordances' see McGrenere & Ho (2000).

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 actions (Norman, 1988).

- *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 design (Rheinfrank, 1984). 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 understood (Norman, 1988). Visually presenting product functionality assists consumers in understanding how a product may be operated (Djajadiningrat *et al.*, 2000).

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 and may be considered as sub-divisions of *description* (of mode-of-use).

2.1.5 Symbolic association

In addition to their apparent decorative and practical qualities almost all products are seen to hold some socially determined symbolic meaning (Levy, 1959; Mayall, 1979; Doyle, 1999). As such, products may evoke "thoughts, feelings [and] associations which one links to the commodity, or assumes that others must associate with it" (Haug, 1986: 97). 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" (Dittmar, 1992: 89). Thus, products contribute to the *expressive equipment* with which people present themselves (Goffman, 1990).

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 use (Gotzsch, 2000). As such, the social

value assigned to products determines the symbolic associations that are made. For example, whilst a chair *denotes* (or affords) sitting, a throne *connotes* (or implies) status and power (Muller, 2001: 302, 316).

The social value of products

Products are used by people to communicate their identity not only to others, but also to themselves (Dittmar, 1992). 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" (Belk, 1988: 139). 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* meanings (Dittmar, 1992).

- The *self-expressive* symbolism associated with products allows the expression of unique aspects of one's personality. This includes individual qualities, values and attributes (Dittmar, 1992). These self-expressive meanings serve to *differentiate* the consumer from those that surround them (Csikszentmihalyi & Rochberg-Halton, 1981). 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" (Snyder & Fromkin, 1980).

- The *categorical* symbolism associated with products allows the expression of group membership, including social position and status (Dittmar, 1992). These categorical meanings serve to *integrate* the consumer with those that surround them (Csikszentmihalyi & Rochberg-Halton, 1981). Indeed, one of the principal approaches to expressing membership of a social group is through shared consumption symbols (Belk, 1988).

The symbolic meanings attached to products are culturally defined (Dittmar, 1992). 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. This is because "no design works unless it embodies ideas that are held in common by the people for whom the object is intended" (Forty, 1986: 245). The meanings attached to products are thus often determined by factors external to the product's appearance

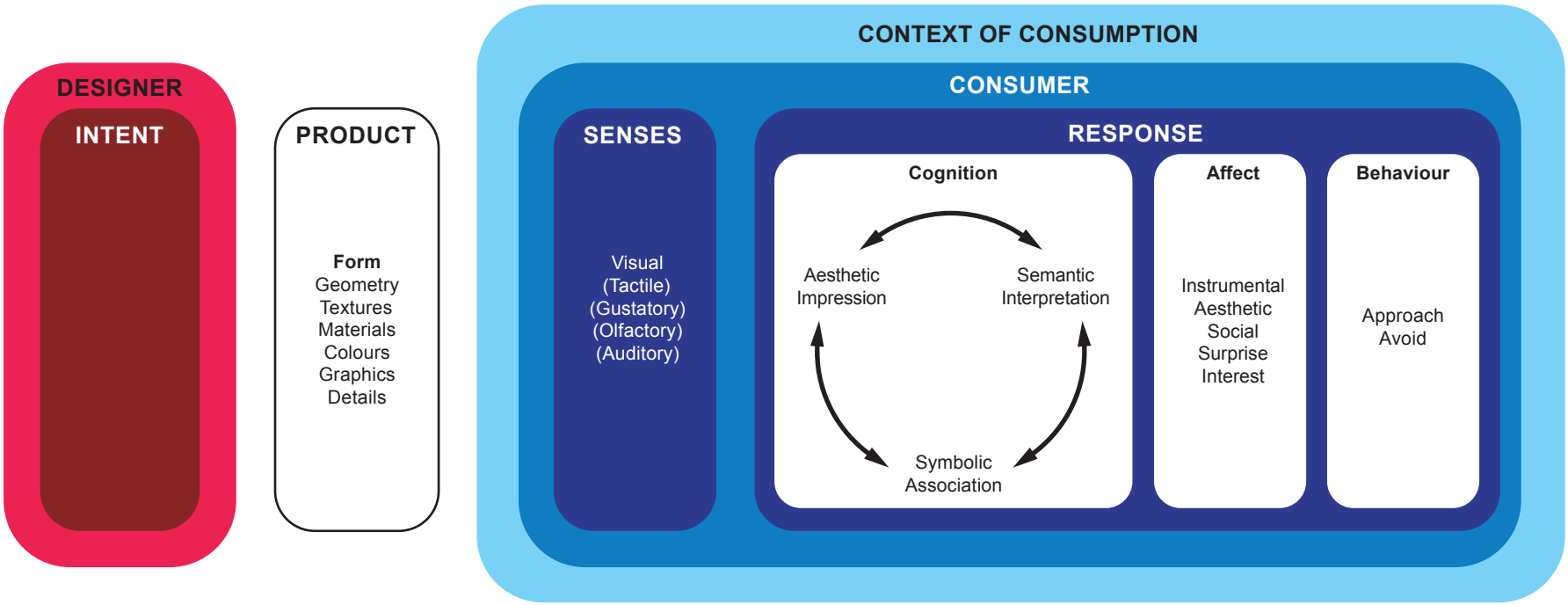

Figure 2-d: *Framework for consumer response to product aesthetics with expanded 'cognition'.*

(Haug, 1986). Historical precedents, social conventions and marketing programmes all influence the perceived symbolism of products (Forty, 1986).

Although, the symbolic associations evoked by a product may be less dependent on product appearance than aesthetic impressions and semantic interpretations are, symbolic associations are not unrelated to product appearance. For example, 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]" (Ashby & Johnson, 2002: 75). The projection of these qualities can extend beyond the product to contaminate the owner or user (Belk, 1988; Dittmar, 1992). 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.

2.1.6 Interaction of responses

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 2-d). Furthermore, the *relative importance* that the consumer places on their aesthetic, semantic and symbolic responses may vary depending upon the situation.

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 object (Coates, 2003). 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.

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) (Dittmar, 1992). 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 (as discussed above).

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 (Jones, 1991). Thus, products hold a symbolic value in reflecting the social groups to which consumers belong (Bourdieu, 1984). Cultural tastes are often characterised by agreements on what looks good, what is worth aspiring towards and how these aspirations can be reinforced with material goods (Dormer, 1990). Thus, when products are consumed, expressions of "I like that" may be implicitly converted to "I'm like that" (Postrel, 2003: 101-103); taste is not only a matter of aesthetic preference, but also of social discrimination (Bayley, 2000).

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 response (Baxter, 1995). As such, branding and promotion activities often focus on investing mass manufactured products with meaning through the creation and communication of associated qualities (Kotler *et al.*, 2002; Schroeder, 2002; Wee & Ming, 2003).

2.1.7 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

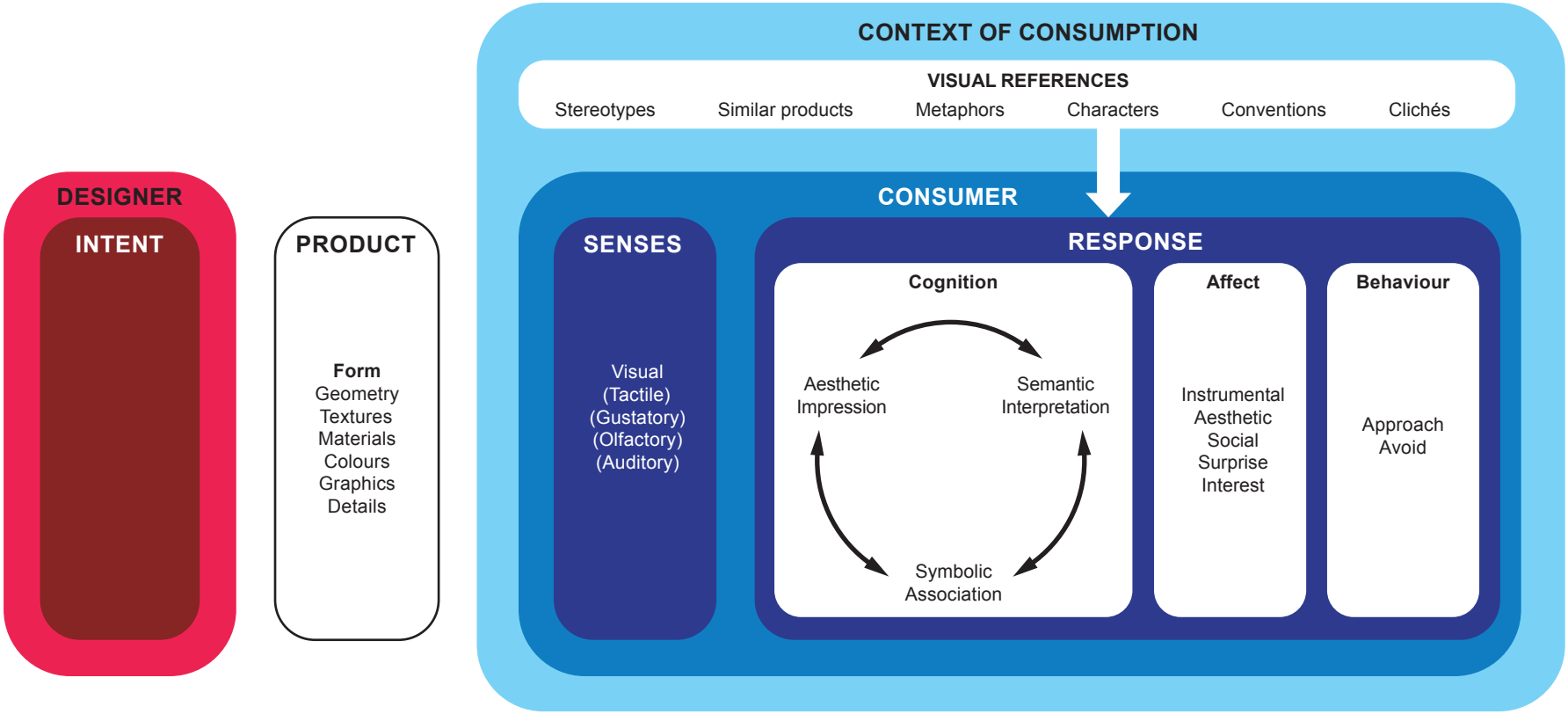

Figure 2-e: *Framework for consumer response to product aesthetics (with 'visual references' shown).*

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 presents (Coates, 2003). 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 familiar (McCoy, 1984). 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 meaning (Postrel, 2003). 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 attachments (Baxter, 1995).

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 2-e).

Stereotypes

Stereotypes (or 'prototypes') are mental images of generic exemplars of a product class (Muller, 2001: 60; Hekkert *et al.*, 2003). They present constant forms of a conventional character that suggests the familiar usage associated with the product category. 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 stereotype. 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 information (Coates, 2003). 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 form (Coates, 2003). 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 aspects (Hekkert *et al.*, 2003).

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 (O'Shaughnessy, 1992; Bloch, 1995; Underhill, 2000). 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 attractiveness (Baxter, 1995). 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" (Coates, 2003).

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" (McCoy, 1984: 16). 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 familiar (Muller, 2001: 300).[22] In particular, product metaphors may assist the consumer in interpreting how the product should be approached or how it might be used (McCoy, 1989). 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 precedent (Julier, 2000). Drawing upon imagery from external sources may give the product a more descriptive

[22] For criticisms of this approach see Dunne (1999: 35).

appearance and assist the user in their process of interpretation (Blaich, 1989; Braarud, 2002), thus facilitating intuitive use (Blackler *et al.*, 2003).

Characters

In addition to metaphors that relate to how products operate, non-functional metaphors may be detected that relate to product character (Janlert & Stolterman, 1997). In particular, designs may often evoke comparison with living things as consumers empathise with objects and engage in a process of personification (Crozier & Greenhalgh, 1992). This assists consumers in understanding designs by allowing them to treat products like humans and use their interpersonal skills to interact with them (Janlert & Stolterman, 1997: 301). Different people often assign the same personalities to products (Jordan, 2000) and relationships between shape characteristics and perceived character have been suggested (Baxter, 1995: 218-220; van Breemen *et al.*, 1999).

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 feeling (Ornstein, 1992: 98-100), and many designers exploit this through the use of facial arrangements in products (Roberts & Roberts, 2000). 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 (Rawson, 1988: 20; van Rompay & Hekkert, 2001).

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 them (Norman, 1988).

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

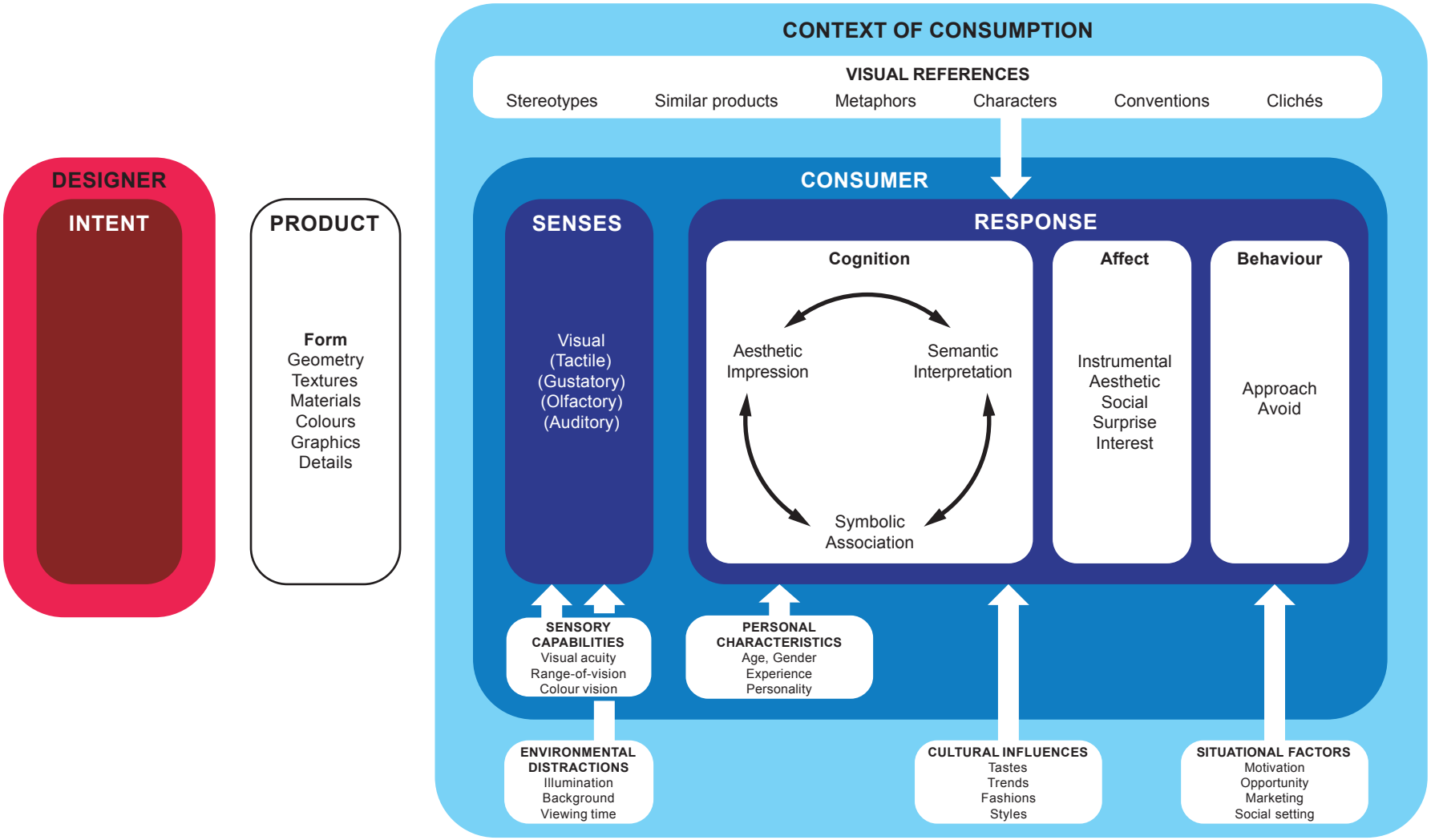

Figure 2-f: *Framework for consumer response to product aesthetics showing the moderating influences that affect response. Moderating influences acting on the designer and the manufacturing process are represented in* Chapter 6 *(where these issues are more fully considered).*

virtually everything in between [...] transparent color had become a cliché" (Coates, 2003: 239).

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 sources outside of this context but these references will not necessarily be perceived by the consumer and are not presented here (see section 6.1.3). Visual references are thus presented in the framework as being drawn from the context of consumption, influencing response.

2.1.8 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 (Shannon, 1948; Shannon, 1949; Ellis & Beattie, 1986). With regard to product design, these 'disturbances' (Monö, 1997: 44), or 'moderating influences' (Bloch, 1995), 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 2-f).

Moderating influences on product form

Moderating influences operating on the designer 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 finish (Monö, 1997). 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 products (Schmitt & Simonson, 1997). This may restrict the range of design solutions available to the designer (see section 6.1).

Beyond the designers' intentions, Monö states that "technical flaws in construction and manufacture can affect [...] the design's physical gestalt" (Monö, 1997: 45). Examples of these flaws may include failure to meet design tolerances and poor surface finish (Ashford, 1969). 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 (Ashby & Johnson, 2002; 2003). 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 attachments (Gotzsch, 2000).

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 (Rheinfrank, 1984; Julier, 2000: 87). 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" (Monö, 1997: 107-108).

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 complex design cannot be perceived instantaneously, but take time to be explored (Moles, 1966). 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 available (Creusen & Shoormans, 1998).

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 way (Monö, 1997). Of particular interest when considering the visual domain in design are conditions that affect visual acuity, range-of-vision and colour vision (Mayall, 1967: 46). For example, deterioration of the senses is especially prevalent amongst older adults (Pirkl & Babic, 1988; Pirkl, 1994; Keates & Clarkson, 2003), and this may result in products being perceived in a way other than that anticipated by the designers.

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 2-f).

Response to design is often described as involving *innate*, *personal* and *cultural* factors (Lewalski, 1988; Crozier, 1994; Bloch, 1995; Macdonald, 1997; Coates, 2003). 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* (Bloch, 1995), may vary considerably between consumers.

Personal characteristics

A number of consumer research studies have investigated the influence of personal characteristics on design preference. These studies have included consideration of age (Eckman & Wagner, 1994), gender (Bell *et al.*, 1991; Eckman & Wagner, 1994; Holbrook & Schindler, 1994), experience (Berkowitz, 1987) and personality (Bell *et al.*, 1991; Holbrook & Schindler, 1994). With regard to personality, variation in the goals, attitudes and standards held by different people characterise their concerns (Desmet, 2003a). Thus, the consumer's self-confidence, social aspirations and personal ideologies will influence response (Jordan, 2000).

The interpersonal differences between consumers results not only in 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 do (Bloch *et al.*, 2003). 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 (Pirkl & Babic, 1988; Pirkl, 1994; Keates & Clarkson, 2003).

Cultural influences

In addition to personal and situational factors, consumer response is moderated by cultural influences. These include conventions of taste (Bourdieu, 1984; Jones, 1991), general trends (Chang & Van, 2003) and transient fashions (Carrington, 1945; Bayley, 2000), which may all influence response. In particular, the *zeitgeist* (or cultural preconceptions) contribute to how designs are interpreted and the extent to which they are accepted by society (Coates, 2003: 69). This may influence the *current*

product sign, the market's conception of how a product should look (Monö, 1997: 66) and the styles which are acceptable (Chen & Owen, 1997).

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 groups (Hsu *et al.*, 2000). 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]" (Friendlaender, 1984: 14-15). Even the tendency to group tones into particular colours or to attach special significance to orthogonal structures may be culturally determined (Csikszentmihalyi, 1991). 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 (see *Chapter 6*).

Situational factors

The consumer's motivation in viewing an object has the potential to influence their response (Veryzer, 1995). 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 interpretations (Hassenzahl *et al.*, 2002). 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 and 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 possessions (Forty, 1986). This notion of *aesthetic complimentarity* indicates that ensemble effects will moderate design preference (Bell *et al.*, 1991).

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 exhibit (Underhill, 2000). Furthermore, the marketing programme that surrounds a product may also moderate consumer response (Bloch, 1995). In particular, product branding may strongly influence perceptions of quality (Page & Herr, 2002) and social value (Shavitt, 1989). Products may appear to visually identify themselves as belonging to a particular brand by the addition of brand markings and the adoption

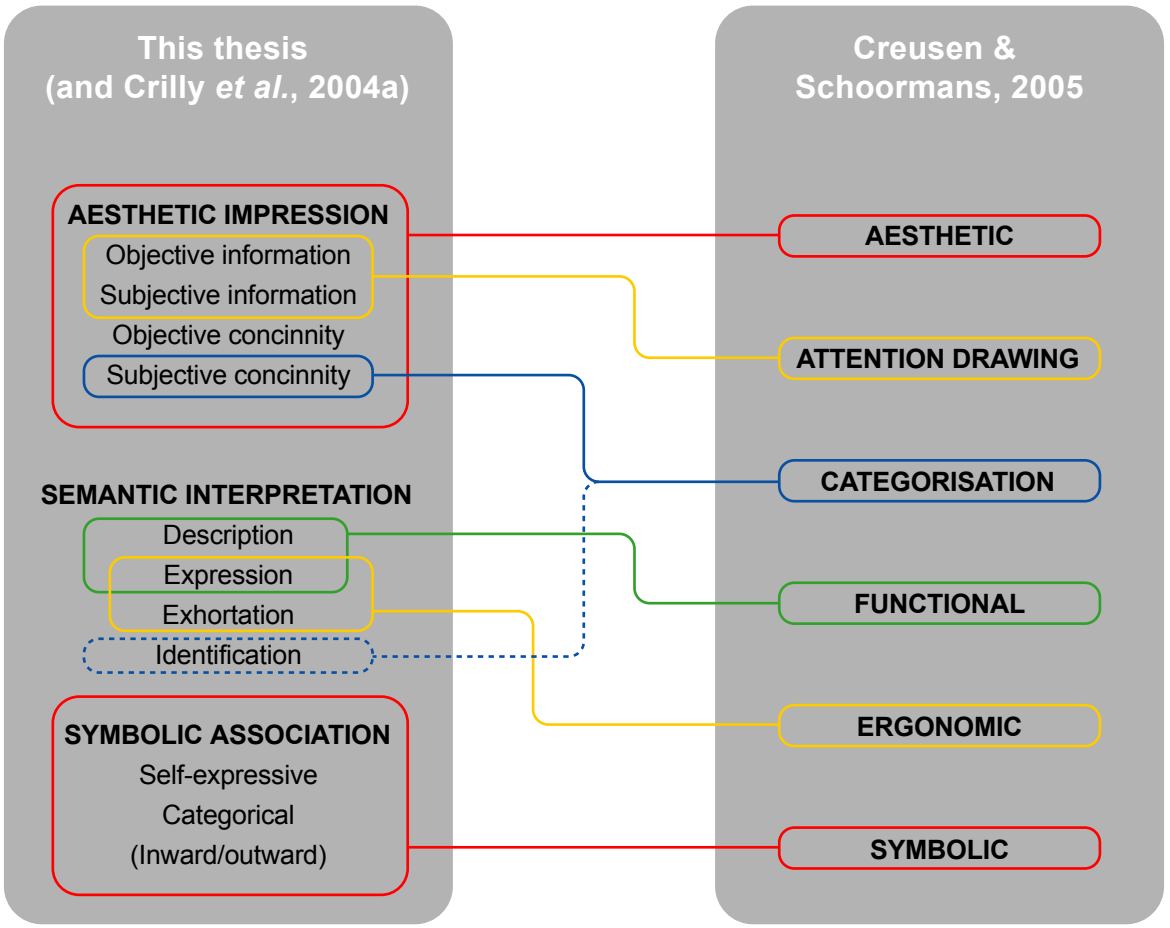

Figure 2-g: *Illustration of how the concepts used in this thesis (left-hand side) map to those proposed by Creusen & Schoormans (right-hand side). The dashed line that links 'identification' to 'categorisation' indicates a partial mapping.*

of a specific design language (Monö, 1997). Other market factors, such as product price, point-of-sale, competition and product predecessors also affect perceptions (Underhill, 2000).

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 2-f).

2.1.9 Summary

Response to the visual domain in product design has been presented as the final stage in a process of communication. The designer 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 this 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.

Following publication of the journal article upon which this section is based (Crilly *et al.*, 2004a), Creusen and Schoormans (2005) published their own categorisation of "*The different roles of product appearance in consumer choice*". Their paper is briefly reviewed here as it provides some independent support for the core conceptualisation (aesthetic, semantic and symbolic responses) outlined in the preceding section.

Creusen and Schoormans identified six different 'appearance roles' that influence consumer response to product aesthetics. These six roles are presented in Figure 2-g, along with suggestions for how they relate to the concepts used in this thesis. Creusen and Schoormans' use of 'aesthetic' and 'symbolic' roles maps directly to the terms

used in this thesis, but it is noteworthy that they have isolated 'attention drawing' and 'categorisation' from aesthetic and have defined these as categories in their own right. Whilst Creusen and Schoormans' six roles do not include semantic interpretation, their 'functional' and 'ergonomic' roles include approximations of Monö's semantic *description*, *expression* and *exhortation*. However, Creusen and Schoormans' six roles contain no direct equivalent of Monö's semantic *identification*. Instead, such a concept is partially included in their 'categorisation' role (which helps identify brands) and partially excluded because they state that "textual information drawn from the appearance, such as brand name [...] did not fit into the six categories of appearance roles" (Creusen & Schoormans, 2005: 71).[23]

To establish whether the six roles they describe are in fact influential in determining consumer response, Creusen and Schoormans' conducted an extensive qualitative study into product preference. Representative consumers were presented with example products (domestic telephone answering machines) and asked to select one product in preference to the alternatives. Interviews with the participants were then conducted to ascertain the influence of the six visual roles in determining consumer response. Of relevance to the categorisations used in this thesis, was that their 'aesthetic' and 'symbolic' roles were most frequently mentioned by the subjects (65% and 40% respectively). This was followed by the 'ergonomic' and 'functional' roles (36% and 13% respectively). The remaining 'attention drawing' and 'categorisation' roles were seldom mentioned by the subjects (10% and 8% respectively).

Whilst a detailed analysis of these results within a different framework is not possible, viewing the different roles in the manner suggested in Figure 2-g provides a valuable reinterpretation. Combining the ergonomic and functional roles into a single *semantic* role results in a total of 49% and incorporating both the 'attention drawing' and 'categorisation' roles into the *aesthetic* role increases its total to 83%. The order of roles, in order of decreasing influence, then becomes aesthetic, semantic and symbolic. Creusen and Schoormans acknowledge that their qualitative study only focused on a single product category and "only gave insight into the conscious use of information by consumers" (Creusen & Schoormans, 2005: 79). However, within the context of this thesis, it is reassuring that the aesthetic, semantic and symbolic

[23] When compared with the foundations upon which this thesis is based, notable exceptions from Creusen & Schoormans' extensive reference list include: Coates (2003), Crozier (1994), Cupchik (1999), Lewalski (1988), Baxter (1995), Monö (1997) and Dittmar (1992).

aspects of consumer response (or their constituent components) have been independently shown to significantly influence product choice.

This section of the literature study has shown that there is a broad range of existing work that offers insight into the subject of consumer response to product aesthetics. 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. Remaining cognizant of these different elements of response, and conceptualising them as part of the framework presented, will assist any further attempts to understand the visual domain in product design. In particular, this section of the literature study provides a conceptual foundation from which the topic of designer intent might be approached.

2.2 Designer intent

The previous section presented a framework for consumer response where the product served as a medium of communication between the designer and the consumer. However, the designer was only developed as a simple placeholder for the source of the message and no processes of message formation were explored. This section of the literature study is now concerned with the designers' motivation and objectives in generating product form. In particular, it focuses on the designers' intention to evoke consumer response. The central question is thus: from a designer's perspective, why do products look as they do? In terms of the Shannonian communication model presented in the previous section, this question may be restated in the following four ways:

1. What is the source of the design message?
2. How is this message encoded for transmission?
3. What sources of reference are utilised in message formation and message transmission?

4. What sources of noise may disturb message formation and message transmission?

Whereas the literature related to consumer response is copious but (previously) unintegrated, the area of designer intent is comparatively unexplored. However, when approaching the scant literature that does exist, there are some peripheral issues that illuminate the central subject. Thus, in this section, the notion that designers intend to evoke consumer response is considered after examining the argument that product form is determined by product function. There then follows a review of previous attempts to model design practice and a study of how the notion of intent is treated outside design (specifically in literary theory).

2.2.1 Determinants of product form

Before the role of designer intent can be considered, the idea that product form is primarily determined by other factors must be addressed. In particular, the modernist design movement decreed that the outward appearance of a design should be determined by the practical necessity of the object's utility. This belief is often summarised by Sullivan's (1896) doctrine, 'form follows function'.[24] Adherents to modernism held to the view that analysis of a device's required functions would logically yield the most appropriate form for that object. However, this viewpoint has been attacked on the grounds that function is not absolute but is often personally defined depending on context (Palmer, 1996: 13). Pye further argues that 'choice' and 'chance' lead to the form of a design but that "it is never actually entailed by anything whatever" (Pye, 1978).

If the form of a product is not in any way imposed on the designer then the approach taken to the creative process may influence product from and subsequent response (Pye, 1978). As such, Zeisel states that designers "want to control the behavioural effects of the design decisions they make" and that they want their products to "meet the social and psychological needs of those who use them" (Zeisel, 1984: 34). It follows that consideration of product appearance should be integral to the product

[24] Although most commonly quoted as "form follows function" the original phrase reads "form ever follows function" (Sullivan, 1896). Also, whilst this phrase is often used to undermine the importance of aesthetics, Sullivan himself included aesthetic presence as one aspect of an object's 'function' (see Macrone, 1995).

concept. Thus, Monö claims that "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 [of] what the product's aesthetic should express" (Monö, 1997: 160). Whilst this objective for the product's appearance should be considered throughout the design process (Hollins, 1990; Dieter, 1991; Baxter, 1995). However, the visual form of products is often determined by designers' intuitive judgements and 'educated guesses' (Liu, 2003).

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 information (Schmitt & Simonson, 1997). This is because designers are often not representative of the consumers of the products that they create (Norman, 1988; Cooper, 2001; Keates & Clarkson, 2003). In addition, it is claimed that "designers frequently consider their aesthetic judgement to be independent of consumer taste" (Margolin, 1997: 231) and there is little communication between designers and consumers on this subject.

2.2.2 Intention to evoke response

As stated in the introduction to this thesis, there has been a lack of discussion relating to whether designers intend product form to evoke specific responses. Certainly, no clear system of categorisation for these intentions emerges from studying the literature. However, by combining a number of authors' views some support can be found for the aesthetic, semantic and symbolic categories defined in the preceding section.

Aesthetic

Designers' tacit understanding of perception and visual composition often guide their intuitive judgements (Schmitt & Simonson, 1997; Liu, 2003). Designers thus use their skill, training and experience to produce products that induce a positive aesthetic impression. 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 design (Crozier, 1994). However, designers and consumers often interpret products differently and express different aesthetic preferences (Hsu *et al.*, 2000). Thus, although styling is the 'artistic' part of product design, it must still be directed towards opportunities and held within constraints (Baxter, 1995). As such, Coates suggests that correlating consumer perceptions with product features may offer the opportunity to more closely align product designs with consumers' aesthetic preferences (Coates, 2003).

Semantic

A semantic approach to design places emphasis on the opportunity for consumers to interpret a product's utility and associated qualities. Krippendorff (1989) thus proposes that "design is making sense (of things)" and that designers should help the user in correctly interpreting the product. To assist designers in this task, Butter (1989) has suggested a sequence of activities that integrate semantic considerations into the design process. The key stages of the process are: firstly, to establish the overall semantic character that the product should communicate; secondly, to list the desired attributes which should be expressed; and thirdly, to search for tangible manifestations capable of projecting the desired attributes through the use of shape, material, texture and colour (Butter, 1989). Not only has knowledge of semantic principles been shown to improve the clarity of students' designs (Langrish & Lin, 1992; Huang, 1996), but commercially successful products have also been produced with explicit consideration given to their semantic character (Blaich, 1989).

Symbolic

Opperud states that "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" (Opperud, 2002: 137). 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 (Julier, 2000; McDonagh & Storer, 2004). To achieve this, Baxter (1995) describes three distinct forms of image board. First, A *lifestyle board* is created that contains images reflecting the personal values, social values and 'idealistic lifestyle' of the target customers. Drawing from the images presented in the lifestyle board a *mood board* is created which contains images that reflect the sentiments, feelings and emotions engendered by product appearance. This results in a single expression of values to appeal to customers with the identified lifestyle.

Finally, the mood board is used as inspiration for a *theme board* that contains images of example products that visually convey the required mood (Baxter, 1995: 221-227). Whilst image boards may be constructed with a specific target audience in mind (Molotch, 2003: 45), the criteria for selecting images may also be quite arbitrary and such boards "are often compiled from image material that designers may have at hand" (Karjalainen, 2004: 239).

2.2.3 Models of design

Despite the lack of literature focused on designer intent (as defined in this thesis), there is some discussion of the context within which this intent might fit. Looking beyond the immediate field of industrial design, a number of models can be found that attempt to describe the practice of design in general. These account for the processes, relationships and constraints that influence design and provide frameworks within which designer intent might be considered. Rather than combining these models and descriptions into an integrated whole, their complementary or competing perspectives are reviewed here individually. This is because the research presented in the following chapters of this thesis is set against the background of these writings rather than founded on them.

The design process

Approaching the subject of industrial design is difficult because many designers do not feel that learning about the design process, or even being conscious of it, is beneficial to their work. It is thus claimed that few designers have attempted to understand the design process and that many fear such analysis will have "a deathly effect" on their intuition (Alexander, 1964: 6). Where designers have attempted to describe the design process, Lawson claims that their writings are notoriously misleading for three reasons. Firstly, designers are often not natural writers; secondly, they may actually be trying to impress rather than to explain; and thirdly, designers are used to selling their designs and conveniently post-rationalising the design process for their clients (Lawson, 1997: 307). Similarly, whilst most industrial design firms communicate their 'design process' through their marketing material, this might often be more accurately described as a sanitised list of deliverables owed to the client rather than a true design process (Fry, 2004). Thus, it is often the

writings of design educators, design researchers and design theorists that provide the clearest conceptualisations of industrial design.[25]

When considering the analysis of design activities, Jones (1992: 49) presents two possible approaches to the problem. Firstly, researchers might consider designers to be like 'black boxes' where the processes are inscrutable but the inputs and outputs are observable (Jones, 1992: 46). Alternatively, researchers might consider designers to be like 'glass boxes' where processes are explicable even though designers may not be able to accurately account for them (Jones, 1992: 49).[26] The black box theories of design consider that the most valuable part of the design process is "that which goes on inside the designer's head" (Jones, 1992: 46). However, some of this is beyond designers' conscious control and whilst the outputs of design might often succeed, this does not necessarily mean that designers are able to say how these outputs were obtained. In contrast, the glass box theories of design present a vision of designers who possess full knowledge of what they are doing and why. Design is thus seen as a systematic process where information is taken in and an optimum solution is produced (Jones, 1992: 50).

The simplest and most consensual representation of the design process involves the three stages of *analysis*, *synthesis* and *evaluation* (Archer, 1984: 64; Jones, 1992: 63; Lawson, 1997: 38; Tovey, 1997: 7). Jones describes the analysis stage as 'divergent' (the problem is broken into pieces), the subsequent synthesis stage as 'transformative' (the pieces are put back together in a new way) and the evaluative stage as 'convergent' (the new arrangement is tested). These three stages of design are often presented as iterative with the evaluation stage prompting renewed analysis (Archer, 1984: 64; Jones, 1992: 50, 63-64). Alternatively, designers might be seen as freely moving between one stage and the other with no predetermined order (Lawson, 1997: 38; Tovey, 1997: 7).

Archer's analysis of design presents the early phases of a project as requiring objective observation and inductive reasoning. Conversely, the central, creative phase involves subjective judgements and deductive reasoning. Finally, the design execution phases once again require the objective and descriptive skills that were

[25] Of course, these writers often are, or have previously been, designers too.

[26] Jones also describes designers in terms of 'self-organising systems', but this is not considered here.

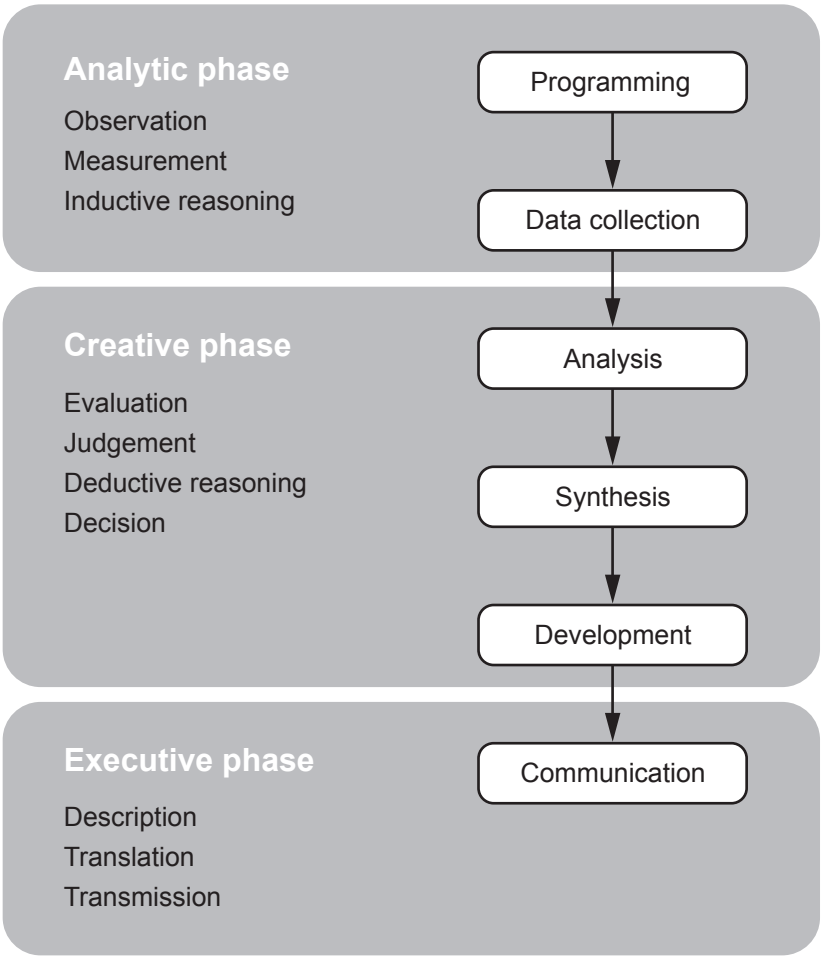

Figure 2-h: *Archer's (1984:64) representation of the design process.*

initially demanded by the early stages (see Figure 2-h). Archer thus describes the design process as a 'creative sandwich', saying that "the bread of objective and systematic analysis and may be thick or thin but the creative act is always there in the middle" (Archer, 1984: 64). Characterising this 'creative act' remains problematic to researchers, who might be charged with producing "dry, abstract descriptions of a very exciting occupation" (Dorst, 2003: 67). However, as Dorst acknowledges, this is not easy to avoid because any general statement (including theories, models and methods) must sacrifice some realism to achieve clarity.

Design constraints

Despite any intentions that they may have, designers are not free to generate any form that they please. Instead, they operate within the limitations imposed by various constraints. Archer provides a graphical representation of design constraints that illustrates the boundaries of the 'field of manoeuvre' (Archer, 1984: 68). This involves three possible extremes of solution space. Firstly, the constraints may provide an open field; secondly, the constraints may limit the designer to a single solution; or, thirdly, a number of broken-up fields of freedom might be available, suggesting two or more *kinds* of design solution.

In a different approach, Lawson (1997: 107) establishes a three-dimensional matrix of design constraints (see Figure 2-i). These are ordered according to their *source* (designer, client, user, legislator), their *domain* (internal, external) and their *nature* (radical, practical, formal, symbolic). In this thesis, it is the nature of the constraints that is of the most interest. Lawson defines these as (Lawson, 1997: 103-105):

- *Radical constraints*: the requirement for the design to satisfy its fundamental purpose.
- *Practical constraints*: the requirement for the design to be produced using certain materials and manufacturing processes.
- *Formal constraints*: the requirements for visual organisation of the object, through proportion, geometry, colour and texture.
- *Symbolic constraints*: the requirement for the design to express appropriate qualities.

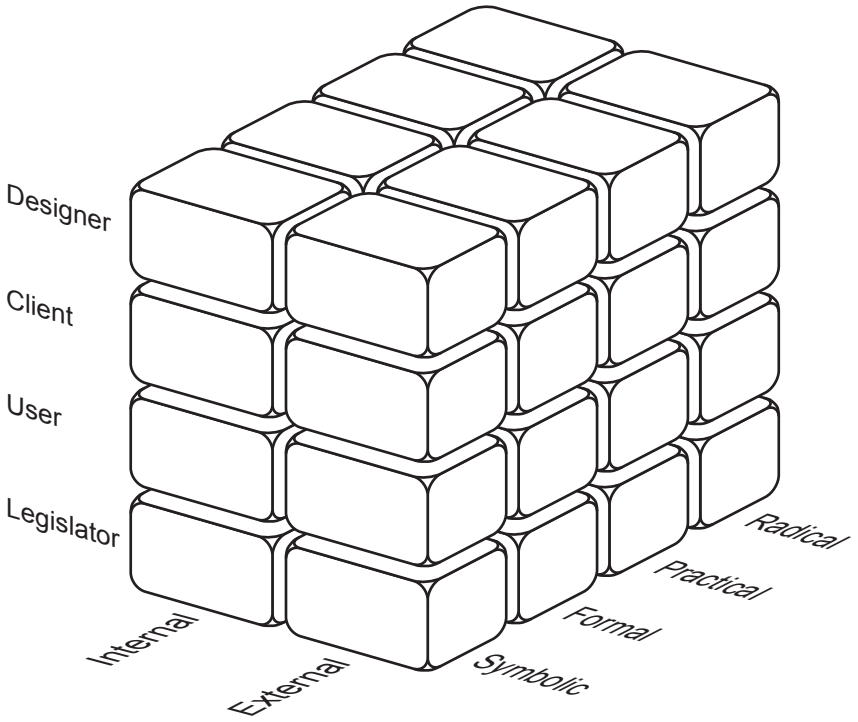

Figure 2-i: *Lawson's (1997:107) representation of design constraints.*

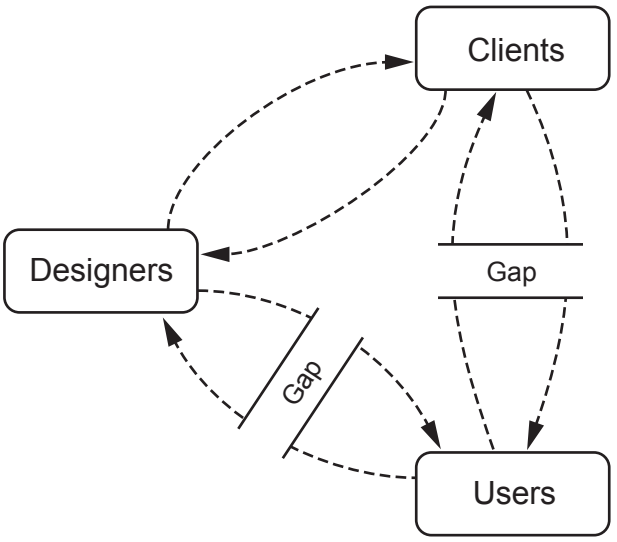

Figure 2-j: *Zeisel's (1984:34) representation of the relationships between designers, their clients and users.*

Whilst Lawson's model is reported to be useful for conceptualising design constraints (Lawson, 1997: 305), it is inappropriate for exploring product aesthetics for two reasons. Firstly, within the context of this thesis, the formal and symbolic *constraints* might better be referred to as aesthetic and symbolic *intentions*.[27] Thus, whilst these two 'constraints' provide some indication of what designer intent might involve, they are not exhaustive because semantic attributes have been omitted. Secondly, the (remaining) radical and practical constraints appear to offer a very incomplete list of the limiting factors that must be accommodated. For example, constraints such as limited resources, client appeasement and brand congruency are not represented.[28]

It is not surprising that this general model of design constraints (which was developed with a specific focus on Architecture) is not well suited to studying product aesthetics. However, these comments are not intended as a criticism of the model itself, but as an illustration of why the study reported in this thesis approached the subject in a different manner.

Design relationships

Zeisel claims that in an increasingly complex society designers are often producing products "for strangers and strange groups" and that, the personal perspective of designers is insufficient to overcome this 'gap' (Zeisel, 1984: 34). Consequently, Zeisel constructs a graphic representation of the relationship between designers, their paying clients and users (see Figure 2-j). Whilst Zeisel depicts the existence of cultural gaps between the designer and the user and also between the client and the user, he claims that the designer and the client share a common 'image of life'. In *How Designers Think,* Lawson imports Zeisel's model without modification and states that "designers and [their] paying clients, both have gaps in their communications with user[s]" (Lawson, 1997: 86). Lawson thus describes communication between designers and their users as either indirect, filtered or non-existent (Lawson, 1997: 85-87).[29]

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[27] Clearly, the distinction between *constraints* and *intentions* is dependent on the precise definitions used and the perspective that is adopted.

[28] Whilst these latter two issues are not well documented in the literature, these are some of the factors that were identified as important constraints in this study (see *Chapter 6*).

[29] Lawson also acknowledges that clients may bring their own institutional or personal prejudices to the design negotiations.

Throop describes designers as visual connoisseurs, "who make their livings through aesthetic judgement [and who] are socially isolated from those with less cultural capital" (Throop, 2004). It has thus been stressed that designers require a variety of tools to expand their empathic skills beyond the user groups to which they belong (Lebbon & McDonagh-Philp, 2000) and that "consultations with experts, will corroborate [designers'] intuition" (Kristensen, 1999). However, it is also reported that designers are frequently sceptical of consumer research activities, claiming that such studies only lead to mediocre solutions (Schmitt & Simonson, 1997).[30]

Although these authors focus on the cultural distance between designers and consumers, the designer-client relationships may also be difficult (Moody, 1980) In particular, designers and their clients are often described as operating within different contexts and exhibiting different behaviours (Buchanan, 2003). Specifically, clients may not be as visually literate, and their sensibilities may differ greatly from those of designers (Hsu *et al.*, 2000). Consequently, communication between designers and clients on subjective product qualities may be challenging (Crilly *et al.*, 2004b).

2.2.4 Authorial intent

Despite the work discussed above, there is clearly still a paucity of design literature directly related to visual intent. It is thus productive to look beyond the field of design to examine how intent is treated in other realms. In many of the visual arts there is recognition of how response to artefacts might be categorised and how creatives in these fields might strive to evoke these specific responses in the 'reader'. For example, the way in which intentions are embodied in visual media has been explored in studies of film (Boorstin, 1991), photography (Sontag, 1977) painting (Rynck, 2004) and comics (McCloud, 1993). However, it is within the field of literary theory that the most comprehensive consideration of intent is to be found. Thus, although literature is not an essentially visual medium, its critical theories are discussed here with particular reference to *authorial intent*. This provides useful theoretical perspectives that may inform the study of intent in general. Attention is then turned back to the field of design to consider the influence of literary theory on design thinking.

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[30] As discussed in section 6.2, whilst this attitude certainly exists, it is not universal and many designers

The medium of text

In a manner similar to the intuitive processes of design, Richards (2001) depicts authors as striving to make their writing 'work' almost independent of the potential audience. However, writing can be considered as an essentially communicative act which is reliant upon past similarities in experience between the writer, as the source of the message, and the reader, as its recipient (Richards, 2001: 163). Richards thus states that "although it is as a communicator that it is most profitable to consider the artist, it is by no means true that he commonly looks upon himself in this light" (Richards, 2001: 21). A semiotic perspective on this communicative process emphasises the role of signs (or codes) from which people construct meaning. For example, authors may employ metaphor, irony, juxtaposition and allusion to control the manner in which readers interpret their work (Montgomery *et al.*, 2000). However, whilst writers attempt to limit how such codes function, "no author or work can rein in all the codes and limit the expansiveness or free play of meanings that exceed intention" (Macrone, 1995: 186-187).

The death of the author

Traditional literary criticism considered that the author's declared (or assumed) intention for writing a work was a proper basis for deciding upon the work's value (Drabble & Stringer, 2003). The author's intention for how a work should be interpreted by the reader was thus considered an indispensable guide in determining the meaning of the text (Montgomery *et al.*, 2000: 283). However, it has more recently been claimed that "the design or intention of the author is neither available nor desirable as a standard for judging the success of a work of literary art" (Wimsatt & Beardsley, 1972: 334). These views have led some critics to advocate 'the death of the author' as an authoritative figure and the rise of the reader as the ultimate interpreter of an objective work (Barthes, 1977). Such views form the basis of deconstruction, which states that "in so far as the text outlasts its author and the particular context in which it was created, its meanings transcend those that may have been originally intended; in this sense, the reader brings as much to the work as the author" (Rohmann, 2001: 92).[31] Whilst this perspective has not been universally

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embrace the benefits that consumer research offers.

[31] Here, a 'text' is taken to mean any subject to which critical analysis can be applied.

embraced, the issues it raises continue to inform critical debate (Coyle & Peck, 2002; Bennet, 2005).

The death of the designer

This brief excursion beyond the boundaries of design to explore the notion of intent in other disciplines actually leads back to design itself. For example, in his essay, *The death of the designer*, Richardson considers the designer to have suffered a similar death to that of the author and thus emphasises the consumers' free interpretation of the product. Richardson claims that: "The newly invigorated user 'reads' the form and function of a product using an interpretation that is independent of the one the designer intended" (Richardson, 1993: 36).

Lloyd and Snelders also draw upon modern literary theory when they too consider the 'death of the designer' (Lloyd & Snelders, 2003: 244). Whilst they suggest that the intentions of the designer might be inferred from examining the product, they acknowledge that this is problematic. That a product exists, they argue, tells us more about its consumers, and the identity they wish to appropriate, than it reveals about the original intentions of the designer (Lloyd & Snelders, 2003). They thus conclude that the designer's creativity is a necessary but insufficient characteristic for design success because both intention *and* response determine the value of products. Molotch (2003) expresses a similar view, arguing that products succeed, and therefore survive in the marketplace, due to a complex 'lash up' of economic, cultural and political factors. Thus, whilst designers' backgrounds, intentions and activities all influence product design, even the humble toaster, "does not just sear bread, but presupposes a pricing mechanism for home amperage, government standards for electric devices [...] and people's various sentiments about the safety of electrical current and what a breakfast, nutritionally and socially, ought to be" (Molotch, 2003: 1).

These theories of criticism thus view intention as an inaccessible, unreliable or incomplete foundation for assessing the value of creative work. However this thesis does not seek to establish a framework for criticising products but rather, a framework for conceptualising design. Thus, an understanding of designer intent (within the confines of visual aesthetics) is sought, not for the purpose of studying products but to illuminate current industrial design practice. Karjalainen (2004) describes a similar objective in his study of branding and industrial design. He states that in addition to analysing products, "it is important to find complementary means

of understanding *the intentions* of the designers who created the analysed products" (Karjalainen, 2004: 72).[32] This prompts Karjalainen to adopt a qualitative case-study approach employing personal interviews (among other methods) to generate knowledge *about* design rather than *judgements on* design. As such, he "attempt[s] to construct a framework that would help companies consider the possibilities of message coding within their own specific contexts". However, Karjalainen's exclusive focus on the designers' intentions to visually communicate brand values differentiates his work from the more general objectives of this thesis which seeks to examine the broader context of product aesthetics (of which branding is a single, though important, element).

2.2.5 Summary

For the purposes of this thesis, 'designer intent' has been defined as: "the designer's motivation and objectives when generating product form, especially their intention to evoke consumer response". Whilst the literature reviewed in this section relates (in various ways) to this issue, the primary question of "why do products look as they do?" has not been adequately addressed. Thus, rather than providing a supportive structure for approaching the subject of designer intent, this section of the literature study simply illustrates that there is an insufficient volume of relevant published material.[33] Therefore, whilst the first part of this chapter provided an integrated conceptual framework for consumer response, no similar framework could be constructed for designer intent. This suggests the need for an in-depth qualitative research study to investigate the nature of designer intent within the context of the other determinants of product form.

[32] Italics not in original.

[33] Literature search activities did uncover superficially relevant material such as Ganeshan *et al.*'s (1994) paper entitled *A framework for representing design intent* and Xu & Galloway's (2005) paper entitled *Using behavioural modeling technnology to capture designer's intent*. However, such works could not be exploited in this study because they focused exclusively on the technical objectives of designers.

Chapter 3

Sampling

Having developed a sensitising framework for consumer response and reviewed the literature relevant to designer intent, a qualitative inquiry into professional design practice was undertaken. Before the activities of data collection (*e.g.* interviewing) and data analysis (*e.g.* coding) can be discussed, attention must first be turned to the sampling methods used in this study. Therefore, following an overview of the design population, this short chapter considers the way in which potential cases were identified and the way in which these cases were recruited into the study. The studied sample is then characterised and the potential sources of bias in the sample are considered.

3.1 Population overview

For the purposes of this study it was decided to focus on industrial design within the consultancy practices. Such design consultants provide a range of professional design services to their clients and those clients are typically the brand owners for the product (*e.g.* Nokia, etc.). No studies were made of in-house design activities, such as those performed by design departments within the organisations responsible for the brand (*e.g.* Nokia's own designers, etc.).[34] Whilst some design consultancies specialise in providing design services to particular brands or to specific industries, the majority are 'generalist' practices; that is, they perform a great variety of work for

[34] In-house design has unique attributes relating to designer experience, communication issues and information usage. However, studies of such organisations must be left to future work and this is discussed in section 7.3.3.

a broad range of clients. Such extreme variety of projects is generally embraced by the design consultants as each new project presents a fresh challenge, allowing them to learn something new whilst applying existing knowledge in a different domain. Such characteristics prompted Molotch to suggest that "in terms of innovation, technique, and product leadership [...] these outside offices are where the action is" (Molotch, 2003: 24).

In addition to the designers themselves, also of interest in this study were the supporting activities of consumer investigators.[35] Consumer investigators are defined here as professionals who conduct consumer research in such a way that their findings may influence design practice. The output of their investigations is typically qualitative in nature and offers insights into the behaviour, lifestyle and aspirations of consumers. Consumer investigators are thus distinct from market researchers who typically seek to produce quantitative data that is primarily of value in making financial decisions. Consumer investigators may be associated with design consultancies and their services may comprise part of that consultancy's commercial offering. Alternatively, such investigators may be associated with external agencies that provide their services to either the brand, the design consultancy, or both.

3.2 Identifying cases

In grounded theory, there is no attempt to generate a representative sample such as those used in large-scale, statistical studies. Instead, the sampling method is purposive; cases are sought out for their relevance to the emerging theory (see section 3.2.2). The objective is to obtain a set of cases that saturates the categories and dimensions identified in the theory building activities. Therefore, whilst exact representativeness is not necessary, a good spread of cases is useful (Oppenheim, 2000: 68).

Especially in the early stages of this study, where initial concepts of interest were being identified, efforts were made to cover a broad cross-section of the professionals that comprise the design community. Following this, the objective was to pursue cases that would facilitate the development of theory. Thus, more than one approach

[35] In this thesis, the term *investigator* is used to differentiate these professional consumer researchers from the author of this thesis (who is referred to throughout as *the researcher*).

to sampling was employed. Firstly, *open sampling* was used to identify initial cases. Secondly, *theoretical sampling* was used to identify cases relevant to the researcher's emerging interpretations. Thirdly, *chain sampling* was used to identify further open and theoretical cases by exploiting each interviewee's professional and social network.

Irrespective of the specific sampling methods used in selecting cases, a number of constraints were imposed on the sampling process. These constraints related to the professional practices of the potential interviewees, their location, their availability and their characteristics relevant to theory. Whilst some of these constraints related to the research questions, what was practical within the limitations of the study must also be acknowledged (see Robson, 2002: 378). Therefore, in the sections that follow, the three sampling strategies are discussed with reference made to both the research objectives and the project constraints.

3.2.1 Open sampling

In grounded theory studies, the initial cases to be examined (the initial subjects to be interviewed) are often identified by 'open sampling'; that is, they are selected at random or chosen from lists (Strauss & Corbin, 1998: 206). Although the domain of interest has often been established, and some basic research questions defined, the cases that will help drive theory development forward are only determined when the study is in progress. There may be a strong element of convenience to this initial sample as researchers 'take who they can get' assuming there will be natural variation within the situation (Strauss & Corbin, 1998: 208)

'Open sampling' (or, 'convenience sampling') was employed during the early stages of the study to explore the domain, establish concepts of interest and construct a preliminary graphical framework for the designers' activities. These initial interviews also achieved two further objectives: firstly, designers opinions were elicited on the consumer response framework (discussed in section 4.2.4); and secondly, these designers comprised an initial network that could advise on what other cases (who else) would be relevant to the study (further discussed in section 3.2.3).

For the efficient use of time and financial resources, the interviewees were initially selected from the Cambridge area, and later from London. The convenience of Cambridge-based design companies (due to their proximity to the researcher's institution) allowed exploratory data to be collected quickly in the early stages of the

study. Cambridge-based design consultancies tend towards the industrial (rather than consumer) end of the product spectrum, perhaps supporting the widely reported 'Cambridge phenomenon' of successful technology companies. In contrast, London is one of the world's 'design capitals' and hosts larger and more prestigious design consultancies. Especially in the later stages of the study, when the theoretical and chain sampling strategies were used, the closed nature of the London design community resulted in the majority of referrals leading to London-based cases.

The UK design community (especially that of London) attracts designers from all over the world. consequently, the designers interviewed in this study included those educated in Germany and Israel and those with professional experience in Japan and the Netherlands. Thus, although studying current design practice in a wider geographic region would be of interest, the data presented here is not based on an obscure or insignificant geographical region but on an important and respected design centre.

In addition to satisfying the criteria of practice and location outlined above, it was also necessary for the interviewees to be available during the time frame of the study. In the reportedly cyclic nature of the industry's workflow, the study coincided with a 'busy period' and a number of potential interviewees were unable to participate during the available window (despite expressing an interest in participating at a later date). In addition to the requirement for the interviewees to be available within the data collection stage of the study, they were also required to have at least one hour available for the interview.

3.2.2 Theoretical sampling

One of the cornerstones of the grounded theory methodology is the application of 'theoretical sampling'. Here, cases are selected based on their potential for furthering the researcher's emerging theories (Strauss & Corbin, 1998: 201). Thus, the concepts of interest are explored by identifying cases that will populate relevant areas of the domain that have not yet been fully investigated. As the study progresses, the researcher establishes the 'categories' which are felt to be of relevance and the 'dimensions' along which things in that category vary. The researcher may stop the data collection process once they reach 'theoretical saturation'. That is, when they have cases that represent all the relevant categories and they have data that saturates each of the dimensions (Strauss & Corbin, 1998: C13).

The principles of theoretical sampling dictate that the required sample size for a study be determined by the specific requirements of that study. Unfortunately, there are no formal guidelines as to when enough cases have been studied and no clear indications for when saturation has occurred (Goulding, 1999: 15). However, theoretical sampling does allow researchers to document the sampling design and therefore it is an improvement over purely opportunistic open sampling (Agar, 1996: 172).

In addition to the considerations of profession and location that characterised open sampling, less accessible, more subjective parameters were used as selection criteria when applying theoretical sampling. As concepts emerged, new theoretical sampling criteria were employed to pursue cases that would allow exploration of those concepts and further the researcher's understanding. Some of these parameters only emerged during the study, when interviewees would emphasise the importance of achieving a balanced view and urge the researcher to pursue particular contrasting cases. For example, some of the early interviewees suggested that 'famous' designers were freed from certain constraints and would thus operate in a different manner. The researcher then identified, approached and interviewed such designers to verify the claims and investigate a different area of the domain (see section 6.1.4).

In this study, theoretical sampling was employed in the pursuit of cases that varied according to the characteristics of the organisation, the individual and the product. The definition of these characteristics, and the identification of cases that would allow their exploration, was often achieved by adopting 'chain sampling'.

3.2.3 Chain sampling

In studying groups were the culture is relatively closed (*e.g.* prostitution, drug addiction, street gangs, etc.) it is common practice to adopt a policy of 'chain sampling', or 'snowball sampling' (Rubin & Rubin, 1995: 67; Bryman, 2004: 100). Here, the members of the group to which the researcher already has access make suggestions as to who else the researcher should contact and sometimes make such arrangements for the researcher (Rubin & Rubin, 1995: 265). Grounded theory studies may adopt such an approach as the researcher 'networks' through the potential population often relying on referrals from previous cases (Strauss & Corbin, 1998: 281; Goulding, 2002: 67).

Although the design community is not as closed as the social groups mentioned above, chain sampling was employed in this study to identify prospective cases that would help with the development of theory. Interviewees often referred to the design industry as a 'a small world' and as a community where 'everyone knows everyone'. Because of these educational, professional or social connections, many interviewees were able to offer suggestions for other individuals who they believed could provide information of use to the researcher. This information was either provided voluntarily (without prompting), or requested by the researcher at the end of each interview.

Identifying potential interviewees by chain sampling offered a number of specific benefits. Firstly, approaching potential interviewees by referral increased the likelihood that the invitation to participate in the research would be accepted. Secondly, as might be expected, members of the design community have a detailed knowledge of the other individuals that comprise that community. This led the researcher to individuals who held specific viewpoints or had experiences that were of interest (expanding upon or countering those already gained). Such characteristics were not apparent from design directories or from published marketing material and thus chain sampling facilitated theoretical sampling by revealing otherwise inaccessible characteristics. Thirdly, chain sampling also alerted the researcher to the presence of organisations of which he was previously unaware. For example interviewees were able to recommend individuals that did not show up in directory searches and who performed services to the design industry that had not been anticipated. Thus, chain sampling techniques led to a broader range of potential interviewees than would have been possible without exploiting the informants' contacts.

Beyond the recommendations of specific interviewees, potential sources of data were identified through informal (social) networking activities. During the course of the study, the researcher naturally developed professional relationships with some of the interviewees. Whilst never adopting the role of an 'insider', the researcher *was* taken to lunch, and invited to parties or gallery events associated with design. Attendance at such events allowed new contacts to be formed that were subsequently used to arrange interview sessions.

Although described here as separate sampling strategies, there was, in practice, some overlap between open, chain and theoretical sampling. Furthermore, whilst they were

broadly applied in the sequence in which they are described above, each of the strategies figured to some degree throughout the study.

3.3 Recruitment

When a potential case had been identified (by convenience, theoretical or chain sampling), a standard process of recruitment was adopted with each interviewee. This involved an email message of invitation to participate in the study followed by arrangement of the meeting details.[36] The interviews were followed by the supply of any information promised by either party (often design materials from the interviewee or published papers from the researcher). In total, 29 individuals were recruited during the course of the study, and these individuals were associated with 21 different organisations. This represents approximately one-third of the total number of organisations that were invited to participate.[37] Most of the declined invitations were experienced during the early stages of the study, where speculative open sampling was the predominant sampling method. As the study progressed, and the sampling methods tended towards theoretical and chain sampling, a higher proportion of accepted invitations was experienced.

3.3.1 Sample groups

Having described how the cases were identified and recruited, the sample itself can now be characterised.[38] As indicated in section 3.1, the sample can be divided into two groups: industrial designers and consumer investigators. Details of these sample groups are now provided before their distribution across the different phases of the study is presented.

[36] If the invitation was declined a message of acknowledgement for the reply was sent.

[37] Over a period of nine months (between January and October 2004), 66 organisations were invited to participate in the study.

[38] Full details of the sample are provided in *Appendix B*.

Industrial designers

Throughout the course of the study, 21 industrial designers were recruited into the study. The designers in the sample had all been educated at university level and most held bachelor's or master's degrees in industrial design. Additional qualifications included degrees in other design disciplines (*e.g.* Graphic, Transport, Furniture), Engineering, Film, Art and Architecture. All of the designers had significant professional experience ranging from 7 to 28 years and within their organisations, each designer held a senior design position. These positions were variously described by titles such as 'Design Director', or 'Head of Industrial Design'. In some of the smaller organisations, the designers were also described by titles such as 'Partner', or 'Director'.

The 21 designers recruited into the study were associated with 19 different design consultancies. Although these consultancies all offered industrial design services, within this discipline, different specialisations were apparent. For example, some organisations focused on defining the conceptual specification for the product whilst others focused on the relationship between branding and design. These consultancies can also be distinguished by the breath of services they offered; this included those providing a single core competency right through to those providing total solutions for new product development. Such variation was partly a reflection on the size of the organisations in the sample, which ranged from single-person freelancers to multinational consultancies with hundreds of employees.

Consumer investigators

Eight consumer investigators were recruited into the study. Whilst industrial design qualifications were also prevalent amongst this group, other degrees included Psychology and Design Strategy. All of the investigators had at least moderate professional experience, ranging from 4 to 18 years. However, consumer research is a relatively new activity and thus each of the investigators held senior research positions (*e.g.* 'Head of Global Trends'). Again, in small organisations, these investigators were also partners in, or directors of, the organisations with which they were associated.

Of the eight consumer investigators recruited into the study, five were associated with design consultancies. These consultancies were amongst the largest organisations in the sample and consumer research constituted one of their many offerings. The remaining three investigators were associated with external agencies. These agencies

were smaller in size, ranging from individual investigators to teams of four people. This corresponds closely with the size of the consumer research groups within the larger consultancies. Whether as external agencies or consultancy-based research groups, these organisations collected and interpreted qualitative data relating to specific market segments. This included information on the lifestyle, behaviours and aspirations of consumers and the wider social, political and technological trends that impact upon them.[39]

3.3.2 Sample distribution

As discussed in section 1.3.3, grounded theory studies employ a flexible research design that allows the work to evolve in an organic yet coherent manner. However, to facilitate the readers' comprehension of the study, it is described here as comprising four linked phases: *Phases I, II, III* and *IV*. The different phases of the study were distinguished not only by the participants involved, but also by the data collection and data analysis activities employed. However, here it is sufficient to illustrate what sample groups were associated with each phase. In the two methods chapters that follow (chapters 4 and 5), the different phases of the study are characterised further.

The sample groups associated with each phase were as follows:

- *Phase I*, eight industrial designers representing seven design consultancies.
- *Phase II*, six industrial designers representing six design consultancies.
- *Phase III*, seven industrial designers representing six design consultancies.
- *Phase IV*, eight consumer investigators representing three design consultancies and four external agencies.

[39] Whilst four of the design consultancies in the total sample were Cambridgeshire-based, all of the organisations with which the consumer investigators were associated operated out of London.

In phases I, II and III, the designers and consultancies in each phase were unique; that is, no designer or consultancy participated in more than one of these phases. However, the three design consultancies in phase IV had already been involved in the study, one from phase II and two from phase III.

This description of the different study phases corresponds closely to the actual sequence of the research activities. However, for the purpose of clarity, some licence has been taken in grouping the interviews into logical sets and describing these in a strictly sequential manner. In particular, for reasons of procedural convenience and efficiency, some of the phase IV interviews were conducted before the completion of phase III (see *Appendix B*).

3.4 Sample bias

Bias is an important consideration in qualitative research and researchers should explicitly state possible forms of sample bias (Agar, 1996: 169).[40] This is because acknowledging sources of bias in how cases were selected and recruited allows researchers to demonstrate the critical awareness that they maintained during the study and furnishes readers with an understanding of the works' limitations. Thus, biases of which the researcher was aware are outlined here and grouped according to whether the bias originates from the sampling procedure or from the informants themselves.

Procedure generated bias

The researcher's educational and professional experience was grounded in the technical domains of engineering and computing. Thus, his approach to the domain of industrial design was that of someone attempting to understand a new field. This 'outsider' status of the researcher affected the way in which the sample was generated. With few existing contacts to draw upon and no detailed industry knowledge, the initial sampling methods were based on design directories and other forms of desk research.

[40] This section only considers bias in the sample and not bias in the data or bias in the analysis. Bias in the data is considered in *Chapter 4* and bias in the analysis is considered in *Chapter 5*.

The design directory used in the study is run by European design innovations Ltd (EDI) who were formed in 1995 with the aim of providing a comprehensive directory of design consultants (European Design Innovations, 2004). Although EDI charges for organisations requiring highlighted listings, basic entries are free-of-charge, and the directory lists over 6,000 organisations. It thus provides listings for a broad selection of design consultants ranging from large prestigious multi-national organisations to individual freelancers.

The directory is divided into different design disciplines and different geographic regions (world-wide). The search terms used for this study were for the design skill "Industrial design: all categories" and the "London" and "Cambridgeshire" regions of the UK. The sub-categories of industrial design that were included in the search range from "children's toys" to "military equipment" and this was considered to be sufficiently broad for this study. However, the directory could have been used differently and other design skills might have been searched against. Those likely to yield relevant potential cases include: "Architectural products", "Engineering design: automotive" and "Ergonomics: product design". Changing the search terms in this manner may have changed the balance of specialisation in the companies that were invited to participate in the study.

In addition to searching the EDI directory in a different manner, completely different methods of identifying potential cases might have been used. These include using different design directories, using general business directories, web searches for design organisations, or using centres such as the Design Council to offer guidance on possible cases.[41] Despite the availability of alternative methods for identifying cases, the EDI directory was considered to be a valuable sampling tool. This was because it is widely used, represents a broad range of industrial design practices and was an information source that could be acknowledged in communications with candidate interviewees. Thus, although other open sampling methods could have been used, the EDI directory was believed to offer an effective starting point from which theoretical and chain sampling could proceed.

[41] The Design Council is a UK government funded body that seeks to "enhance prosperity and well-being in the UK by demonstrating and promoting the vital role of design in a modern economy" (The Design Council, 2005).

Informant generated bias

The initial approach to all candidate interviewees was an e-mail message describing the nature of the research and inviting them to participate in the study. This communication clearly defined the topic of interest as "product visual form" and indeed, the subject header read "Product aesthetics". Thus, in each instance, the subject's decision as to whether the invitation was accepted or declined was presumably informed by this knowledge of the research topic. The interviewees were therefore somewhat 'self-selecting' and those who participated in the study may be expected to exhibit a greater than average interest in the topic, or in academic research (or even in academic research on the topic). Whilst this might be seen to bias the sample towards those with a particular interest in product visual form, it also correspondingly led to interviewees who were able to offer their opinions on a potentially difficult topic and produce a wealth of useful data during the relatively short meetings.

In addition to the research topic, the institution with which the researcher was affiliated may also have influenced the informants' decision as to whether they participated in the study (see Oppenheim, 2000: 65). The University of Cambridge is an internationally acclaimed academic institution praised for the quality of its teaching and research. However, at the time of writing, this institution offers no taught courses in industrial design and might be regarded as an outsider in the design education community. The 'outsider' status of Cambridge University might therefore have led some of the informants to disregard the invitation on the grounds that the institution has no established presence in the design world. Conversely, the high academic standing of the institution, and its distance from the traditional design schools, may have led some informants to participate in the study. Therefore, potential interviewees may either have considered the institution an irrelevancy to industrial design, or, alternatively, as an institution with which industrial design *should* be associated. For example, one interviewee (in conversation after the interview) revealed that they had participated in the study because the researcher was "not from the RCA, which is where everyone else is from [...] and, until institutions such as Cambridge take industrial design seriously, no one else will".[42] Unfortunately, the attitude of those who declined to participate in the study remains unknown and it

[42] The Royal College of Art is the world's only entirely postgraduate college of art and design (RCA, 2004: 4), and an institution with which many London-based designers have been associated.

is thus impossible to determine the overall effect of the researcher's institutional affiliation.

3.5 Summary

By adopting a variety of sampling techniques, the researcher identified and recruited a broad spectrum of the industrial design community into the study. This included not only industrial designers, but also the consumer investigators whose work feeds into design practice. Although the research was necessarily conducted in a continuous and flexible manner, to ease the readers' comprehension, the study has been divided into four distinct phases. The distribution of the sample across these phases has been described, with phases I, II and III involving industrial designers and phase IV involving consumer investigators. The data collection activities employed with each of these sample groups is discussed in the next chapter.

Chapter 4

Data collection

Having considered the identification of cases, their recruitment into the study and the potential sources of bias in the sample, attention is now turned to the ways in which data was collected from that sample. As is often the case with grounded theory, interviews were chosen as the primary data collection method for the study. This was because interviews were believed to offer the researcher insights into the attitudes of the informants and allow understanding of the motivations and beliefs that underlie their behaviour. To complement the use of interviews, informal observation and document analysis techniques were also employed.

One of the (often implicit) assumptions of interview-based research is that the language people use reflects their attitudes, and that this in turn reflects their actions. Whilst some strong relationship might exist between language, attitudes and actions, studying one cannot truly give an account of the others (Fielding & Thomas, 2001: 139). Thus, interviews do not necessarily account for people's actions but only indicate the language they use to express their attitudes. Furthermore, interviewees may not reveal their attitudes for any number of conscious or unconscious reasons. Because of these potential limitations, the researcher considered other data collection methods for the primary approach used in this study. However, as orthodox grounded theory primarily employs interviews, these alternative methods were always considered in relation to interviews and compared against them. This process of method selection is briefly discussed below before the interviews are described in detail.

4.1 Method selection

Lawson suggests that there are five main methods for investigating the design process: philosophical reasoning, protocol studies, field observation, interviews and computer-based simulation (Lawson, 1997: 306). For this study, philosophical reasoning was discounted for being too vulnerable to the (ungrounded) personal perceptions of the investigator and simulation was discounted for being unsuited to the joint domains of intent and aesthetics.[43] However, field observation and protocol analysis were both considered to be viable candidate methods for the study.

Observation

Of the possible non-interview methods, observation was the most promising candidate to replace interviews. In the context of this study, observation might involve the researcher studying the designers as they conducted their work. This would lead more directly to data on their behaviour and might reveal phenomena of which they themselves were unaware, considered unimportant or which they were not prepared to discuss. However, interviews were selected over observation for the following three reasons. Firstly, interviews offer insights into attitudes and experiences which might not be apparent from the behaviour, or residual evidence, of the subject in their daily work. Secondly, during a 'live' project, the constraints of confidentiality would not permit the researcher free access to the subjects and their activities. Thirdly, the typical length of the product design process would, in many cases, prevent adequate design progress from occurring during the data collection phase of the study.

During the study, three further reasons became apparent for continuing primarily with interviews rather than complementing these with extensive observation. Firstly, determining the visual aspects of the product is only one of the industrial designer's many roles and it is achieved concurrently with various other design activities (see *Chapter 6*). Thus, in comparison to interviews, observing the entire design process for a particular product would be very inefficient in yielding visual-specific data in relation to the total data collected and the total research time expended. Secondly, observation of design practice would constrain the study to the design project (or

[43] These methods would also have been unsympathetic with a grounded theory approach.

small range of projects) with which the participants were currently engaged. By contrast, with interviews the researcher and interviewee could select from a range of recent products around which to base discussion. Thus, interesting products with a significant visual aspect could be chosen. Thirdly, observation of design practice would limit the study to 'live' projects that are necessarily unfinished. In contrast, conducting interviews based on past projects allowed a more complete 'story' of the product to be explored. Issues such as sales performance, customer feedback and effect on the industry were only relevant after the product had been launched.

This decision to avoid in-depth observational studies in favour of interviews is echoed in the writings of established design researchers. For example, Lawson states that whilst the technique of field observation offers the most realism, "it seldom offers that much useful data! [...] the really interesting things [...] are hidden in designers heads rather than visible" (Lawson, 1997: 306-307). Similarly, Zeisel states that although observation can provide information on the "behavioural and representational parts of designing, [researchers] cannot directly observe cognitive design processes taking place inside someone's head" (Zeisel, 1984: 5).

Protocol studies

To overcome some of the problems with observational studies, an artificial research context might have been constructed allowing design activities to be observed in a more controlled setting. This could, for example, involve giving designers a one-hour styling exercise and asking them to 'think aloud' explaining their actions. Such protocol studies often involve design students because access to such participants is easily arranged (Lawson, 1997: 44). However, in this study protocol sessions were not adopted for the following two reasons. Firstly, the objective of the study was to understand the domain. Designing a protocol analysis session would have risked imposing the researcher's naïve preconceptions on the informants and would have limited the breadth of data collected. Secondly, protocol study sessions would have been difficult to arrange with the informants due to the time constraints that they were operating under. In contrast, interviews are a relatively undemanding and convenient data collection method from the perspective of the interviewees.

During the study, one further reason became apparent for continuing with interviews rather than protocol studies. That is, employing interviews allowed exploration of the broad range of moderating influences acting on the designer. This included factors such as financial and temporal constraints, client preferences, manufacturing

limitations and communication issues. Such factors would not have been naturally present in protocol sessions and would have been difficult to simulate.

Again, the decision to reject protocol studies in favour of interviews is echoed in the writings of established design researchers. For example, as Lawson notes, “one of the advantages of interviews is that we can sometimes persuade very good designers to allow us to interview them” (Lawson, 1997: 44) and such access may be less likely if protocol analysis sessions are requested. Furthermore, discussing design as it occurs in the ‘real world’ of industrial practice, involves a number of relevant factors that are non-existent in experimental or educational contexts (Dorst, 2003: 130).

To answer the research questions posed in this thesis, within the constraints imposed on the project, interviews were chosen as the primary data collection method. In addition to this primary method, the techniques of observation and document examination were employed to supplement the interview data. Therefore, although observation was not selected as the primary data collection method, each of the interviews involved some degree of informal observation and a separate formal observation session was also conducted (see section 4.3.1).

4.2 Interviews

Research interviews are essentially a controlled conversation between the researcher and the informant. These interviews may take many different forms, varying according to how they are structured, where they are conducted and how many individuals are involved. However, before a detailed description is given of the type of interviews used in this study, attention is first turned to the ethical and practical implications that were addressed.

Ethical considerations

Interviews are necessarily an imposition or intervention into someone else’s life. As such, the researcher has a certain duty of care to the interviewee. In the social science literature, the ethical guidelines for interviewing cover a range of topics suited to the often highly sensitive nature of social research. These texts include consideration of how the participants might be subjected to psychological stress, ostracism for participated, and other political repercussions (Patton, 1990: 356). Whilst the interviews in this study related to topics that were not particularly delicate or

inflammatory, a number of ethical considerations were still pertinent. In particular, issues of honesty, reciprocity and confidentiality were addressed.

- *Honesty*: from the initial contact, the researcher explained who he was, what he wanted to discuss, and why (see Robson, 2002: 281). Where the researcher made promises (such as offers to supply information or published papers), these promises were noted and adhered to.

- *Reciprocity*: People generally appreciate the opportunity to talk about themselves (Robson, 2002: 378), and often experience a vague feeling of pleasure at having been of help to researchers (Oppenheim, 2000: 69). Thus, as with much research, the benefits to the interviewees who participated in this study stems from the opportunity to discuss a topic of direct interest and importance to them.

- *Confidentiality*: Subject to the requirements of legislation (including the Data Protection Act, 1998), information obtained from the participants was treated as confidential.[44] Where material from the interviews was published (such as in this thesis), contributions associated with the informants were not identifiable as theirs (see British Psychological Society, 2005).

Practical considerations

One of the key principles of research interviews is that questions should be posed in an open and non-leading manner (Patton, 1990; Fielding & Thomas, 2001; Robson, 2002). This can, in fact, prove to be a deceptively difficult objective, as it requires the researcher to overcome a range of social conventions. However, despite the apparent complexity of interviews, Rubin and Rubin suggest that they are just "modifications or extensions of ordinary conversations" (Rubin & Rubin, 1995: 6). The interviewees may thus be treated as a partner, collaborator or participant in the process rather

[44] The eight guiding principals of the UK's *Data Protection Act* (1998) are "that data must be: 1. fairly and lawfully processed; 2. processed for limited purposes; 3. adequate, relevant and not excessive; 4. accurate; 5. not kept for longer than is necessary; 6. processed in line with your rights; 7. secure; 8. not transferred to countries without adequate protection" (ICO, 2005).

than purely as a source of data (Rubin & Rubin, 1995: 10; Robson, 2002: 50-51). This is in line with feminist research practice, which establishes a more equal relationship between the researcher and researched (Robson, 2002: 29). Such a perspective is particularly relevant to this study because in the later stages of each interview, the researcher shared his emerging interpretation with the interviewees and the session consequently became more open and collaborative (see sections 4.2.4 and 6.4).

There is one particular limitation of the data collection methods used in this study that should be acknowledged. Each of the interviews was 'retrospective' in so far as the interviewees were asked to comment on their previous experience of design practice. Consequently, their responses may have been influenced by the fidelity of their recollection of 'historic' projects and their understanding of how others subsequently perceived the product. In particular, when discussing their intentions for how the product should be perceived there is the possibility that the interviewees might have been influenced by their knowledge of how consumers responded to the product.[45] However, as discussed in section 6.2.2, the interviewees were mostly unaware of how the products were actually perceived by consumers; due to the nature of consultancy practice the designers had typically 'moved on' to the next project by the time the product was released to the market. Furthermore, the commercial focus of the client meant that whilst they knew (and passed on) information related to *which* products had sold well and *to whom* they had sold, they tended to not know (or not pass on) information related to *why* these products had sold. Therefore, although in some cases the designers may have been post-rationalising the design process, it appears unlikely that their recollections would be significantly influenced by their knowledge of consumer response.

4.2.1 Interview paradigm

Research interviews vary widely in the extent to which the researcher imposes a pre-defined structure on the conversation. In particular, there are three well-established structural protocols by which interviews are categorised: structured, unstructured and semi-structured (Patton, 1990: 280; Rubin & Rubin, 1995: 5; Fielding & Thomas,

[45] A similar issue is confronted in art criticism; as Baxandall argues, when studying works of art, the artist's descriptions of his own state of mind, "have very limited authority for an account of intention of the object: they are matched with the relation between the object and its circumstances, and retouched or obliquely deployed or even discounted if they are inconsistent with it" (Baxandall, 1985: 42).

2001: 124; Robson, 2002: 269). In structured interviews, the wording and order of questions is fixed and follows the same schedule for each interview. In contrast, a completely unstructured interview may only have a single theme around which the researcher intends to base discussion. The semi-structured interview naturally lies somewhere between these two extremes, with the researcher using a range of questions or prompts to guide the interviewee through the topic, but the questions and their order need not be fixed.

In addition to variations in the degree of structure, interviews also vary in where (or by what means) they are conducted and how many participants are involved in each interview. For example, interviews may range, from informal, unstructured group discussions held in the interviewees' usual environment, to highly procedural, systematic telephone interviews involving just one participant at a time. From the varieties of available interview paradigms, semi-structured field interviews, conducted on an individual basis were selected as the primary data collection method for this study. The reasons for choosing this specific type of interview, and the reasons for any exceptional cases, are now discussed.

Semi-structured interviews

The semi-structured interview aims to strike a balance between structured interviews that may over-emphasise the researcher's conceptualisations, and unstructured interviews which may "cause confusion, incoherence and result in meaningless data" (Goulding, 1999: 8). For this study, the semi-structured interview protocol was chosen because whilst the researcher had a defined area of interest, there was also the requirement to flexibly adapt each interview in response to the prevailing circumstances. The researcher entered each interview session with a basic interview guide that outlined the areas of interest with a generic list of questions or prompts (see Oppenheim, 2000: 70). The guide allowed the researcher to lead the interviewee through the various areas of the domain and provided a checklist against which the researcher could monitor progress throughout the interview whilst remaining free to build a conversation (see Patton, 1990: 283). The interview guides also ensured that standard opening and closing questions (related to personal details, recording permission, future contact, etc.) were reliably covered.

The strengths of the semi-structured interview are that it allows for discussions to remain fairly conversational (and situational) whilst employing a systematic approach, and this ensures that the topic is adequately explored. However, one of the

potential weaknesses of the method is that the guided nature of the conversation may preclude the discovery of unanticipated, yet relevant, themes (Hammersley & Atkinson, 2002: 288). In this study, to counter such weaknesses, the interviewees were told at the start of the interviews that the researcher would be using a guide but that they should feel free to discuss issues not addressed by the researcher. Again in closing the interview, the interviewees were asked if they felt that there were any important issues that had not yet been discussed.

Despite this general guidance, it was both necessary and desirable to accommodate significant variation across the different interviews. For example, in each case, the precise focus of the interview, the time available and the contextual material available for reference was unique. More importantly, the interviewees' characteristics also varied and therefore they exhibited various levels of interest in the different aspects of the domain depending on their professional experience. A rigid adherence to the guide (as dictated by a highly structured interview protocol) would thus have missed information that the interviewees were prepared to discuss at length and which the researcher did not yet know were relevant to the topic.

Field interviews

In comparison to telephone-, videophone- or online-interviews, the travel required for field interviews normally incurs additional costs and thus demands additional resource. However, in grounded theory, it is considered essential that the researcher experience the "actual environments in which actions take place" (Goulding, 2002: 42). Therefore, in this study, face-to-face interviews were deemed worthy of the extra expense because they would improve opportunities to build rapport, facilitate the use of visual materials and permit informal contextual observation (see Fielding & Thomas, 2001: 130).

Wherever possible, the interviews were conducted in the interviewees' own work environment. This was often more convenient for the interviewees and offered the opportunity for an interaction rich with readily available reference material. For example, the interviewees could often illustrate their comments by collecting various visual or physical artefacts from their surroundings (see section 4.2.4). Field interviews also permitted the researcher to treat the interviews as informal observation sessions. In general, this allowed the researcher to gain some insight into the role of the interviewees environment in determining (or reflecting) their activities. Specifically, the visual materials with which the interviewees surrounded

themselves and their attitudes to visual artefacts (beyond products) were considered (see section 4.3.1).

In a small minority of cases, the interviews were conducted in environments that were not the true work places of the interviewees. Eight interviews were conducted in meeting rooms (or other 'non-active' locations) at the interviewee's workplace. These more controlled settings generally permitted a relaxed interview with fewer distractions and afforded a better quality of audio recording. However, there were also fewer surrounding materials to which the interviewee or researcher could refer, and this led to lost opportunities for informal observation. To counter this, in the case of the organisation which provided three of the 'meeting room interviews', a day of studio observation was arranged (see section 4.3.1).

Individual interviews (one-to-one)

The majority of the interviews in this study were conducted on an individual basis: a one-to-one interaction between the researcher and the participant. This allowed good rapport to be developed with each of the interviewees and allowed an uninhibited discussion on a broad range of topics (Fielding & Thomas, 2001: 125). The interviews lasted between 55 and 115 minutes with the (mean) average being 75 minutes. Given the time constraints under which many of the interviewees were operating and the resultant difficulties in organising some of the interviews, attempts by the researcher to organise multiple interviewees in one session would have been problematic.

Occasionally, two interviewees participated in a single interview and the study therefore included several one-to-two interviews. This typically occurred when an investigator and designer from one organisation were available at the same time and the participant contacted by the researcher arranged for the second interviewee to also be present. Due to the time constraints on the interviewees, such interviews did not necessarily include both parties at all times. For example, often one interviewee would arrive 'late' and the other would leave 'early'. The resulting interview sessions thus comprised a pair one-to-one interviews separated by a one-to-two interview. No interviews were conducted with more than two interviewees.

4.2.2 Interview procedure

The researcher arranged for the interviews to be held at a location convenient to the interviewee and at a mutually agreeable date and time. In accordance with a semi-

structured interview protocol, each of the interviews was unique, with personal, interpersonal and environmental factors all influencing the interaction. However, whilst this necessarily affected the detailed nature of each interview, a general procedural outline can be described that applied in all cases. This outline has three main stages: *open*, *body* and *close* (see Robson, 2002: 227).

Open

The opening to each interview involved thanking the participant for their time and answering any questions that they immediately posed. These inquiries from the interviewees often focused on the researcher's background, and the current stage of his research. Having answered these questions and explained the objectives of the interview, permission to record the session was obtained and the interview process could proceed. Basic opening questions relating to the interviewee and their organisation were then dealt with. In addition to confirming interviewee and organisation names, these questions covered topics such as:

- The core services offered by the organisation.
- The size of the organisation.
- The interviewees' position in the organisation.
- The interviewees' training and background.
- The interviewees' level of professional experience.

Body

The main body of the interview then commenced with attention focused on the question: "why do products look the way they do?" To answer this question, the researcher employed three different elicitation methods. Firstly, the verbal stimuli typically employed in interviews, such as questions and prompts, were used to capture the interviewee's views. Secondly, visual stimuli provided by the respondent, such as physical products, design documents and reports, were used to assist the researcher and the interviewee discussing the very visual topic. Thirdly, the researcher employed diagrammatic stimuli both to assess the interviewee's appraisal of the researcher's work and to elicit further contributions. The use of design

documents and diagrams as elicitation stimuli is discussed further in section 4.2.4 respectively and attention here is focused on the verbal aspects of the interview.

The nature of the questions used in the interviews varied according to the phases of the study, but in each case, sub-questions and prompts were used by the researcher to more completely explore the topic. In addition to using open questions, a number of non-questioning prompts were used to elicit further contributions from the interviewees. These ranged from expectant glances and silences through to explicit requests for expansion (see Patton, 1990: 324-326; Fielding & Thomas, 2001: 129; Robson, 2002: 274-276).

The conversations that comprised the body of each interview often provided information that was not directly related to the topic. However, in discussing seemingly distant themes, the informants often made contributions relevant to the central question that had not necessarily been offered in answer to direct inquiry. For example, in response to questions focused on 'design constraints', the interviewees often provided a very incomplete list of the factors involved. In contrast, during general discussion, a wide range of constraints would be referred to that could be used to expand upon the original answers. Thus, each interview comprised question and answer sessions focused on the research questions and periods of more general discussion.

Close

Following the main body of the interview, the meetings were closed with some standard questions. These covered issues such as whether the interviewees had any further comments to make, whether they wanted access to the output of the research, whether they would consent to further contact by the researcher and whether they could recommend any further potential interviewees. This ended the interview session and the recording was terminated. In many cases the interviewees had been sufficiently engaged by the topic that upon reflection, they would make significant comments after the interview had closed. Such contributions, and any observations made during the visit, were then noted by the researcher in an interview memo, as recommended by Robson (2002: 75) and Oppenheim (2000: 75).

4.2.3 Interviewing phases

Although all the interviews generally adhered to the procedural outline described above, they were also divided into two distinct categories. These were: *exploratory interviews* discussing the interviewees' general experiences; and, *case-based interviews* each focussing on one particular product. With reference to the different phases of the study outlined in section 3.3.2, these different categories of interview were employed in the following manner:

- *Phase I*, seven exploratory interviews with eight industrial designers.[46]
- *Phase II*, six case-based interviews with six industrial designers.
- *Phase III*, nine case-based interviews with eight industrial designers.[47]
- *Phase IV*, seven exploratory interviews with eight consumer investigators.

Each of these phases is now described in more detail to illustrate the role of exploratory and case-based interviews in the study.

Phase I

The first eight interviews with the industrial designers were conducted on an exploratory basis with discussion centred around the topic in general. These interviews were conducted so as to fulfil the following objectives:

- Exploring the domain in general and identifying relevant sub-themes (see Strauss & Corbin, 1998: 38). From this information, a preliminary graphical framework for designer intent could be constructed.

[46] One of the interviews in phase I involved two designers.

[47] One of the designers in phase II was interviewed twice.

- Familiarisation with specialised terminology (see Rubin & Rubin, 1995: 18). This included clarification of phrases such as 'visual language', 'customer profile' and 'well resolved form'.

- Eliciting feedback on the preliminary graphical framework for consumer response (shown in section 2.1). This was achieved by utilising a technique called graphic elicitation (see Crilly *et al.*, 2006 and section 4.2.4).

The central question in these preliminary interviews was "why do products looks like they do?" Whilst the conversations were relatively open and unstructured, the interview guide provided a number of sub-themes to ensure that the topic was adequately covered. The basic thematic content of the interviews was:

- The role of the client in defining constraints and determining product form.

- The nature of designer intent.

- The processes, tools and techniques used to generate form.

- The influence of design theory.

- The nature of market information and user involvement.

- The role of creativity and sources of inspiration.

- The role of manufacturing and marketing.

The interviewees typically made reference to specific products from their design experience and thus these interviews often focused on three or four recent examples. In referring to these products, the interviewees would often present associated design materials such as sketches, photographs and presentations (see section 4.2.4).

Phases II and III

In contrast to the exploratory interviews, which drew widely on products from the interviewees' professional experience, the case-based interviews in phase II and phase III each focused on a particular product. The researcher's experience of the

first exploratory phase of the study had shown that communication was improved by reference to specific examples. However, whilst discussing several examples in one interview was useful in the first phase of the study it was felt that the depth achievable by focussing on just one product in each interview would reveal more useful information.

The general criteria imposed by the researcher for product selection were that the product was designed recently and that the interviewee had been personally involved in the design process. These constraints on the selection of a case product were to ensure that the interviewees were able to offer direct experiences with some degree of accuracy. Beyond these constraints imposed by the researcher, the interviewees themselves imposed their own selection criteria for the products discussed. These criteria included observing confidentiality issues, selecting products with significant visual form and selecting products that they felt were interesting to discuss. Such criteria were often explicitly referred to by the interviewees but might still be expected to be relevant in the cases were no such criteria were mentioned. The products chosen by the interviewees may thus be expected to be biased towards the impressive, or successful. However products discussed in the case-based interviews included those that failed to find a market and products that the designers considered to be laden with compromise.

As with the preliminary interviews, the case based interviews had a central question: “why does *this* product look like it does?” The expanded range of thematic prompts included:

- Characterising the client, the product, the user and the context of consumption.
- The role of the client in determining product form.
- The nature of market information, consumer information and user involvement.
- The nature of designer intent.
- The processes, tools and techniques used to generate form.
- The effect of constraints on the design process.

- The sources of inspiration and sources of reference.
- The role of manufacturing and marketing.
- The influence of communication problems within and between stakeholders in the design process.
- The role of consumer feedback in assessing design success.

Although the case-based interviews naturally included comments about general design practice, each of the above themes was typically discussed with reference to a specific product. As such, the product and any associated design materials provided a focus around which the case-based interviews were conducted.

Phase IV

The initial interviews with the consumer investigators were planned as exploratory interviews for the same reasons as those outlined for Phase I. However, two factors led to the continued use of exploratory interviews with this group of informants. Firstly, the recorded research material that they held was of a proprietary and confidential nature and thus a detailed exploration of one case was not possible. Secondly, the research activities that they conducted were not solely aimed at offering visual guidance to designers. Thus, focusing on one case would not necessarily yield the most information relevant to the research questions posed in this thesis. Instead, discussing the relevant aspects of a number of projects provided a more complete understanding of the visual nature of their research without compromising the sensitivity of the material that they held.

The exploratory interviews with the consumer investigators were conducted in a similar manner to those conducted with designers. However, the objective now was to establish the way in which their research activities inform design. In particular, these interviews sought to determine the way in which detailed consumer information influences product appearance. As such, the following topics were addressed:

- The need for consumer investigation.
- The nature of consumer investigation.
- The outputs from consumer investigation.

- The application of these outputs in design.

Although these discussions were necessarily wide ranging, where possible they were focused on the relationship between consumer investigation and product form.

As in the interviews with the industrial designers, the interviews with the consumer investigators were often based around the materials associated with their work. However, with the consumer investigators, these materials were principally presented in the form of research reports rather than representations of the design. Such reports were employed as a form of elicitation stimuli in interviews that guided the conversation and clarified communication.

4.2.4 Visual elicitation stimuli

Visual elicitation stimuli are artefacts employed during interviews where the subject matter defies the use of a strictly verbal approach. Such stimuli might typically include physical specimens, maps, drawings, photographs and video-clips (Banks, 2001; Johnson & Weller, 2001: 510). This approach may yield contributions from informants that are difficult to achieve by verbal transactions alone. For example, allowing interviewees to sort through word-, phrase- or picture-cards may elicit ideas that would otherwise remain unarticulated and promotes general discussion (Gaskell, 2000: 50). This is because such stimuli bring factors external to the interview situation into view, prompting response to "'not now' moments, 'not here' events and 'not present' actors" (Törrönen, 2002: 348).

Despite the variety of possible stimulus materials the majority of literature on visual elicitation research has focused on the use of photography (Harper, 2002: 13). Thus, the photo elicitation literature offers the most comprehensive guidance on how other visual stimuli might be employed in interviews. Photo elicitation involves introducing photographs into research interviews to evoke comments and discussion. Such images may be created by the researcher (see Collier, 1967), created by the informant (*e.g.* Clark, 1999; Samuels, 2004), or collected from existing sources (see Banks, 2001: 87, 99). Whatever the source of the images, Harper suggests that "photo elicitation mines deeper shafts into a different part of human consciousness than do words-alone interviews" (Harper, 2002: 22).

Such benefits are clearly not confined to the use of photographs, and in this study two specific categories of visual stimuli were employed. Firstly, a selection of design

materials, or research reports, were provided by the interviewees, and secondly, diagrammatic representations of the domain were provided by the researcher. To illustrate their role in the study, the application of these stimuli types is now described.

Design materials and research reports

Many of the interviews were focused on revealing the factors that determine product form and the relationships between those factors. In discussing such matters, it was natural to refer to a range of visual materials associated with the products under discussion. Such materials were provided by the interviewee and typically included some combination of the following artefacts:

- Products and product photographs.
- Sketches, illustrations and models.
- Image boards (lifestyle, mood, theme, etc.).
- Software-based presentations (*e.g.*, PowerPoint, Flash).
- Research data (text, photographs and video-segments).
- Research reports (*e.g.*, market, consumer, lifestyle).

The interviewees often used such material to show the progression of ideas and 'tell the story' of the design. Thus, the stimuli were always available for either the interviewee or the researcher to refer to, and this aided communication on such a visual topic. For example, comparison of early sketches and the finished product (or photographs of it) facilitated discussion of the compromises that were eventually made and allowed the interviewees to suggest what the visual effect of these compromises were.

Where possible, the researcher received copies of the visual material referred to during the interviews. For example, CD Roms of design work (including sketches, photographs, image boards, etc.), paper copies of promotional documents, and a range of electronic images of products were often collected. Where such visual evidence was not obtained at the time of the interview, they were either sent by the interviewee later or the researcher collected publicly available material from various

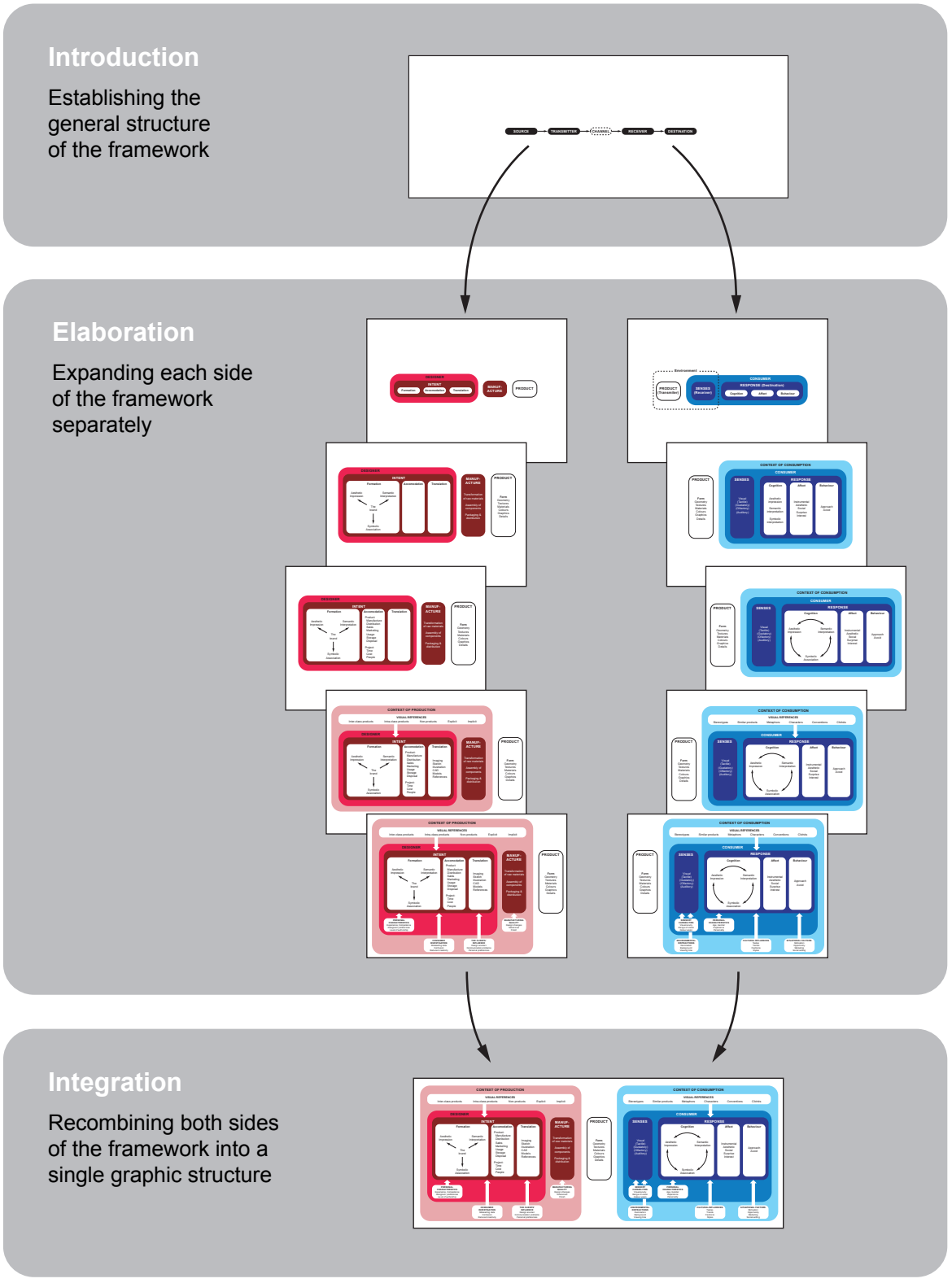

Figure 4-a: *Illustration of how the framework was presented to the interviewees in a sequence of increasing detail. The right-hand side of this framework has already been presented in* Chapter 2, *the left-hand side is presented in* Chapter 6.

electronic sources (websites and printed materials of the design consultancies, the brand, the retailers, etc.). The collected design materials were then used during many of the subsequent analysis activities (see *Chapter 5*).

Research diagrams

The development of diagrams and their use as an analytic tool is discussed in section 5.4. Here however, attention is focussed on their use as an elicitation stimuli in interviews. In comparison to photographs and other visual artefacts, the use of diagrams in interview scenarios is less well established. There are however a small number of studies in which their use is reported. Interviewing with diagrams is considered to be particularly useful where cross-cultural language barriers or illiteracy limit the effectiveness of textual and verbal communication (Mayoux, 2003). Similarly, where the topics discussed are of a sensitive nature the use of *participatory diagramming* may be especially effective in providing rich and nuanced data on subjects' experiences (Kesby, 2000). However, even without such challenges to communication, diagrams can be used to elicit knowledge from experts (Cheng, 1996), and it may be beneficial to focus discussion around the common framework that a diagram provides (Ford & Sterman, 1998).

Unlike other visual artefacts, diagrams may depict subject matter ranging from the conceptual to the physical by adopting various degrees of graphic abstraction. This affords an overview of the topic that is unavailable by other means and elicits unique contributions accordingly. However, diagrams differ from photographs not only in what they can depict but also in how they are created and how they are interpreted. Thus, employing diagrammatic representations of a domain in interviews offers a useful addition to the established array of elicitation stimuli. The use of such a technique is referred to as *graphic elicitation* (Crilly *et al.*, 2006).

In this study, each interview was divided into two parts: a conventional verbal interview session was conducted using the stimulus materials provided by the interviewee, and a graphic elicitation session was conducted using the diagrammatic stimulus materials provided by the researcher. Each diagram (or framework) was presented to the designers in a series of slides that cumulatively built up the layers of the representation (see Figure 4-a). The different aspects of the diagram were sequentially revealed so as to constrain the interviewees' attention to the area under discussion and so that their comprehension of each layer could be assessed before presenting the next.

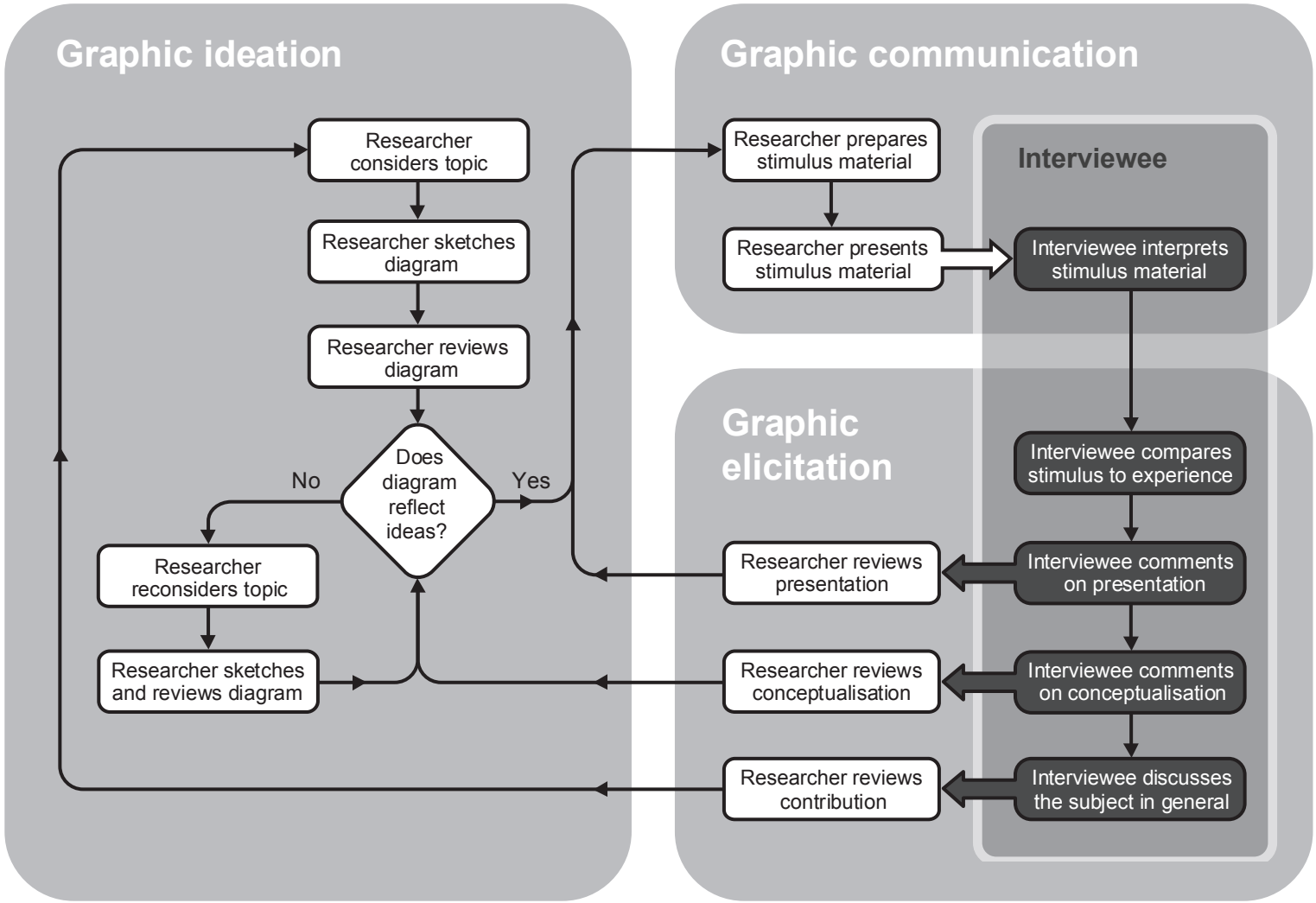

Figure 4-b: *Illustration of how the different contributions that diagrams elicit may provide information that can be used in the generation and presentation of future diagrams. Graphic ideation is further discussed in* Chapter 5.

The graphic elicitation sessions were found to evoke three different kinds of response. Firstly, presenting diagrams to the interviewees provoked comments on the details of the presentation and offered insights into how the diagram was interpreted. Unanticipated assumptions and misunderstandings noted at this stage were then accommodated in future communications. Secondly, informants were encouraged to comment on what the diagram revealed about the researcher's conceptualisation of the domain. These comments provided feedback on the underlying structure of the representation, rather than the details of its execution. Consequently, the researcher gained new perspectives on the implications of his assumptions and the limitations of the graphic language used. Thirdly, and in a broader sense, informants were encouraged to discuss the subject in general based on their interpretation of the diagram. The diagram provided a visual overview of the domain and this allowed connections to be made and scenarios to be envisaged that might otherwise have been overlooked (see Figure 4-b).

The researchers' interpretation of these three forms of response offered new insights that were used in the ongoing processes of analytic diagramming (see section 5.4). In addition to eliciting a broad range of general comments and contributions, presenting a graphical framework also prompted the interviewees to suggest possible applications for the representation.

Employing diagrammatic stimuli also assisted with other aspects of the interview process. For example, by presenting a diagram that provided a common frame of reference to both parties, complex lines of questioning were formulated more clearly. Similarly, involved answers or statements from the informant were often more easily expressed with reference to the representation. These transactions typically involved both parties interacting with the diagram, 'animating' it with gestures to convey flows, relationships or dependencies. Presenting informants with a diagram of the research domain also proved useful in communicating the limits of interest. Although focused on product aesthetics, the boundaries of the research were set widely and verbal descriptions of the topic could be confusing. Outlining the domain graphically reassured the informants that their contributions were relevant to the researcher's interests. Additionally, a clear view of the existing boundaries set by the researcher provoked the informants to challenge the validity or relevance of such constraints.

Graphic elicitation phases

The four phases of the study have already been outlined in sections 3.3.2 and 4.2.3. However, one of the key factors that distinguished one phase of the study from the next was the diagrammatic elicitation stimuli used in the interviews. These stimuli were:

- *Phase I*, the framework for consumer response (developed during the literature study).
- *Phase II*, the stimuli used in phase I, *and* a preliminary graphical framework for designer intent (developed during Phase I).
- *Phase III*, both the stimuli used in phase II, *and* a general framework of design relationships within which consumer response and designer intent might fit (developed during Phase II).
- *Phase IV*, all the stimuli used in phase III, but now with a different sample group (the consumer investigators).

The development of the stimuli from one phase to the next was a result of the amendment, expansion and restructuring of existing concepts, and also the addition of new ones. This diagrammatic evolution reflected the understanding gained within each phase and the analytic activities that are discussed in the next chapter. Therefore, a comprehensive explanation of how diagrams were employed in each phase of the study is reserved until section 5.4.3 where an integrated account of the data collection and data analysis activities is provided.

4.2.5 Audio recording

With the interviewees' permission, an audio recording was made of each interview.[48] This freed the researcher from the burden of producing copious notes and allowed him to concentrate on the interview, knowing that an accurate and comprehensive

[48] The audio recorder used was a Panasonic SJ-MR220; the microphone used was a Sony ECM-F8.

record of the conversation would be retained (see Patton, 1990: 348; Fielding & Thomas, 2001: 136; Robson, 2002: 289). Furthermore, audio recordings facilitate the production of a verbatim transcript, a document that is almost essential for the grounded theory coding approach (discussed in section 5.2.1).

Alternative methods of recording the interviews were also considered, including note taking and video recording. Note-taking was discounted because it would be impractical to record everything that was said; thus certain topics of conversation considered irrelevant at the time of the interview (and therefore not noted) would not be preserved for later analysis once such topics were considered important (see Fielding & Thomas, 2001: 135). Conversely, by documenting the subtleties of gesture and expression, video recording may offer a very complete record of the interactions that take place during an interview. However, whilst this approach may aid analysis, it also presents attendant problems relating to access, behaviour and technique.[49]

Although audio recording was selected as the preferred method of data capture, short, hand-written notes were also made during each interview. This allowed the researcher to return to topics of interest and check the meaning of phrases used by the interviewee (see Patton, 1990: 348-349, 351; Robson, 2002: 278). Also, more comprehensive memos were made of any discussions that preceded or followed the interview and of any observations that the researcher made during the visit.

Obtaining permission

At the beginning of each interview, the researcher sought permission to record the interaction that was to follow (see Patton, 1990: 348; Oppenheim, 2000: 71; Fielding & Thomas, 2001: 136). All of the informants appeared to have expected the request and offered their immediate consent without raising any objections. This may reflect their experience of qualitative research (either participating as a researcher or as an informant) or the increasing use of recording devices in business meetings (see Fielding & Thomas, 2001: 136).

[49] To elaborate: *access,* design studios are filled with visual artifacts the appearance of which are proprietary and cannot be photographed; *behaviour,* people are often more sensitive to video recording than audio recording and this significantly alters their behaviour; *technique,* whilst audio recorders may be fitted with microphones that do not require directional adjustments, even when fitted with a wide-angle lens, video cameras typically require constant supervision to control framing.

In addition to offering their consent, none of the interviewees appeared unduly concerned about providing examples of difficult client relationships or design errors, and some interviewees freely cursed. This might suggest that the interviewees were unperturbed by the recording process and were unconcerned that their confidentiality would be compromised. Although the interviewees appeared at ease in the presence of the recording equipment, the potential for this technique to modify behaviour (or discussion) cannot be discounted. However, participants may be expected to have become increasingly comfortable with the equipment (and the researcher) during course of each interview (Stanton & Young, 1999: 40).

Recording non-verbal communication

In a typical conversation, much of the communication between the participants is non-verbal. In particular, visual elicitation studies frequently promote non-verbal communication as informants may indicate elements of the stimuli by gesture as they talk. Consequently, an audio recording (and any subsequent transcript) offers only an incomplete record of the informants' contributions. For example, when responding to a diagrammatic representation, interviewees may make comments such as, 'this [indicating an element of the diagram] is sometimes also over here [indicating an area on the page], next to this one [indicating another element of the diagram]'. Although listening to the recording, or reading the transcript, may allow the researcher to recollect the meaning of such vague statements, errors in interpretation are clearly possible.

In this study, one approach to overcoming this problem was for the researcher to adopt a confirmation strategy, verbally reiterating the informants' (partially visual) messages. Thus, the recorded interactions included questions or comments from the researcher that clarified the informants' responses. As an additional approach (especially with graphic elicitation), the informants' comments were sketched out either on the original diagram or elsewhere. Thus, the essential details of the informants' visual ideas were recorded for later elaboration and analysis.

4.3 Non-interview methods

In line with grounded theory practice, interviews were the primary source of data in the study. However, whilst it is perfectly acceptable to employ a single data collection method, many studies benefit from supplementary 'micro methods' (Robson, 2002: 386). Multiple method studies are desirable in that they may, for example,

triangulate attitude data from interviews with action data from observation (Agar, 1996: 156; Fielding & Thomas, 2001: 139). Thus, in this study, three further sources of data augmented the interview material. These were: *observations*, *documentation* and *published literature*. Each of these data sources are now briefly described before the data collection methods are summarised.

4.3.1 Observations

To gain additional insight into design practice and to support the data collected from the interviews, environmental, behavioural and cultural observations were included in this study. The opportunities available for observation may be divided into two distinct categories: *informal* and *formal*. Informal observations were performed throughout the study as the majority of interviews were conducted in the work places of the interviewees. Further to these informal observations, a more formal observation day was arranged at one of the design consultancies.

Informal

As explained in section 4.2.1, field interviews exposed the researcher to the interviewees' work environment and prevailing organisational culture. Thus, informal contextual observations were conducted during the interview visits. Of particular interest were the visual artefacts with which the designers surrounded themselves and evidence of their participation in visual culture. The following list provides a representative sample of the materials considered relevant:

- The design materials from past projects.
- The designers' workstations.
- The products that the designers consume.
- Magazines, books, products, etc. (for reference and inspiration).

The observations associated with each interview visit enriched the data collected from the informants. Such observations were recorded in post-interview notes and these were consulted to inform the data analysis activities that followed (see *Chapter 5*).

Formal

To consolidate the informal observations made during the field interviews, and to clarify the interview material itself, a more formal day of observation was arranged. This occurred during phase III of the study and involved one of the larger participating companies. This larger company was chosen because it was expected that there would be a great variety of concurrent activities to observe. Also, the preceding interviews at this particular company had been conducted in meeting rooms and had thus offered very limited opportunities for informal observation.

Using Patton's *Five dimensions of variation in approaches to observation*, this observation session may be characterised as follows (Patton, 1990: 217):

1. Role of observer: *onlooker* (rather than *participant*).
2. Portrayal of observer to others: *overt* (rather than *covert*).
3. Portrayal of purpose to others: *full* (rather than *partial*).
4. Duration: *single* (rather than *multiple*).
5. Focus of observations: *broad* (rather than *narrow*).

The seven-hour visit was divided into six (approximately equal) parts: observation of a design development meeting, four desk visits to observe designers at work and lunch with the designers. During the design development meeting, the researcher was presented with the current state of design progress for a single project. The researcher was then able to observe the design decisions made in the face of commercial, technical and aesthetic constraints. The relationship between team members and the synergistic interaction of their ideas were noted by the researcher and discussed after the meeting. At each of the four desk visits, the researcher observed the designers working on their current ('live') projects. In addition, the designers frequently presented comparable work from previous projects to illustrate the similarities and differences between cases. Each of the desk visits might thus be characterised as comprising a relatively unmoderated initial phase focused on the live project, and a subsequent explanatory phase as the previously observed behaviour was clarified by reference to other projects. The lunch break was used to meet other members of the design team and to observe designers outside of the office environment. The research topic was discussed with the designers and new perspectives were offered by those whom the researcher had not yet met. This

allowed the formation of new contacts in the researcher's growing network of design professionals (see section 3.2.3).

The formal observation visit clarified many of the issues that had been discussed in the interviews, including:

- The division of work amongst the design team.
- Personal interactions and their influence on creativity.
- The role of the brand in determining form.
- Key activities employed in translating intent to form.
- The production of visual deliverables (sketches, illustrations, presentations, models, etc.)
- The role of intuition and informal methods in design.

The visit thus fulfilled the objective of lending context to the data already collected and also provided new contacts with whom chain sampling could be pursued (see section 3.2.3).

4.3.2 Document examination

In grounded theory, documentation may offer a supplementary source of data to that collected through the interviews (Strauss & Corbin, 1998: 52). The use of design materials in the interview sessions has already been discussed (see section 4.2.4). From this material, three particular classes of document were subjected to examination: design work, client presentations and research reports.

- *Design work*: In each of the interviews with designers, the interviewees presented the design materials associated with the product (or products) under discussion. This included sketches, image boards, models, photographs, brochures and advertisements in addition to the physical products themselves. This material had either already been collected into a portfolio

prior to the interview or was collected from various parts of the work environment during the interview.

- *Client presentations*: During the interviews with designers, the interviewees would often show the researcher the computer-based presentations that they gave to their clients. These presentations typically included materials such as the background to the project, the results of any research activities, the concepts developed and the refinement of the chosen concept.

- *Research reports*: Especially in interviews with the consumer investigators, the final research report would often be presented to the researcher. Such reports typically included information on the history of the brand or product, the target consumers, the social trends identified, and possible design strategies related to the key trends.

Although the researcher was seldom permitted to remove these materials from the interview location, the interviews that focused on these documents provided the opportunity for a cursory qualitative analysis of their content and form (see Bryman, 2004: 392). In addition to verbal interview data, this document analysis provided information on the design process, the designer-client relationship and the way in which research outcomes might be interpreted.

4.3.3 Literature review

In grounded theory, the researcher may use literature as stimuli for thinking or to develop frameworks that sensitise them to issues of relevance (Strauss & Corbin, 1998: 44, 48, 59). Throughout the study, as the on-going literature review process uncovered greater volumes of published literature, the researcher encountered new ideas that informed his conceptualisation of the domain. These literature-based data sources were not given higher standing than the interview-based data and the emerging theories were still grounded in the primary source evidence. However, the literature that was most influential can be categorised into two classes: theoretical models of design and published interviews with designers.

Models of design

The published literature relating to models of design has already been reviewed in the literature study chapter. In particular, design constraints, design relationships and design processes are addressed in section 2.2.3. Much of this literature was not, in fact, identified until quite late in the study, when certain previously unconsidered topics were highlighted as relevant because of their frequent recurrence in the interviews. None of the published literature's established frameworks, models and metaphors fitted well with the interview data and the lack of visual focus rendered them inadequate for describing the twin domains of designer intent and product aesthetics. However, despite their shortcomings, they were used for stimulating thought and studying the different ways in which researchers have attempted to characterise design. Thus, the published material that provided perspectives supplementary to the interviews has been acknowledged whilst maintaining that the designer intent framework developed in this thesis is founded on primary data rather than literature.

Interviews

Especially with the more well-known interviewees who participated in the study, published interview material was available that could be used to augment the primary material collected. Whilst the interviews conducted by other researchers (or journalists) did not often focus exclusively on the topics of this study, they did provide useful background material that placed the primary sources in a broader context.

Published interviews with designers whom the researcher had not met were also of interest where they related to the research questions posed in this thesis. A review of these texts highlights one of the problems with such published interviews; that is, they tend to only represent the views of 'famous' designers, who (as is shown in section 6.1.4) are freed from many of the constraints that characterise more typical design practice.

4.4 Summary

The primary data collection method used in the study was the semi-structured field interview. Within these interviews, design and research materials provided by the interviewees were used to guide the discussion, and diagrams provided by the

researcher were used to elicit further contributions. Audio recordings were made of each interview to facilitate the production of a verbatim transcript. Furthermore, environmental, behavioural and cultural observations, in combination with the document examination sessions complimented the data gained from the interviews. However, rather than providing data that was in itself analysed, these activities informed the general analysis of the interview data. In addition, confidentiality agreements between the researcher and the organisations involved forbid disclosure of detailed comments. Thus, despite the general benefits of conducting the observation and document examination sessions, in this thesis their analysis is incorporated with the findings from the interviews rather than presented separately. The methods used in this analytic process are discussed in the next chapter before the resulting interpretation is present in *Chapter 6*.

Chapter 5

Data analysis

The purpose of qualitative data analysis is to make sense of the often massive amounts of data generated from a qualitative study. The volume of data must thus be reduced, significant patterns identified and a framework constructed for "communicating the essence of what the data reveals" (Patton, 1990: 372). When reporting on grounded theory in particular, it is important to carefully describe the analytic process and provide examples (Bringer *et al.*, 2004: 251). Consequently, in this chapter, the different methods of analysing the collected data are presented in detail.

5.1 Transcription

A common observation on the qualitative analysis of interview data is that the further into the analysis process the researcher proceeds, the further removed they become from the original material. The interview is a complex interaction involving not only words, but also pauses, gestures, facial expressions and varying tones of voice. However, a transcript (no matter how detailed or sophisticated) must reduce that richness down to a purely textual interpretation. Even worse, in the analysis processes that follows, this transcript is necessarily abstracted further in an attempt to move away from specific instances and move towards general concepts. Although this process is necessary to allow the development of interpretations, hypotheses or theories, the resulting loss of data richness leads to problems in relating such concepts back to the material on which it is based. In this study, to minimise such problems, a transcription process was adopted to retain as much contextual detail as possible at each analytic stage and allow the researcher to link back to the audio recording at all times.

The raw data of interviews are quotations and thus, despite the costs involved, "full transcriptions are the most valuable data to obtain" (Patton, 1990: 349). Consequently, in this study, each of the interviews was transcribed verbatim, providing a comprehensive document that would allow the full range analysis techniques to be employed (see Fielding & Thomas, 2001: 135).

From the audio recording of each interview, an MP3 file was produced which was 'vocally labelled' with the relevant interview details.[50] In instances where the recorded audio contained multiple speakers with similar voices, the vocal label identified each speaker with a short excerpt (*e.g.* "Jack sounds like: [except of Jack speaking], John sounds like [excerpt of John speaking], etc."). This process was used to prevent any confusion arising during the transcription stage or any subsequent analysis activity requiring audio playback. Conversion to MP3 format allowed the audio files to be read by the transcription software, *Scribe Express* (NCH Swift Sound, 2004).[51]

One of the major benefits in employing the file conversion and transcription process outlined above was that audio 'time marks' could be accurately inserted into the transcript at regular intervals. These time marks corresponded to data embedded in the MP3 files and, therefore, unlike tape-recordings, they did not need regular 'zeroing' to remain accurate. The insertion of regular time marks into the transcripts (typically at five minute intervals) was essential for allowing rapid alternation between the transcript and the corresponding segment of the audio recording. This was necessary to check the accuracy of the transcript and to revisit the rich audio data, complete with pauses, shifts in emphasis and other audible features which might be lost in transcription. This process of alternating between the easily manageable transcripts and the more comprehensive audio recordings featured in every stage of the analysis. Due to the time marks, such switching between text and audio could be achieved in approximately 30 seconds, (despite collecting 2,000 minutes of audio recording and the production of 250,000 words of transcript).

Performing the process of transcription is in itself considered to be a valuable stage in the analysis process (Fielding & Thomas, 2001: 136). The precise and focused

[50] Audio recording software called *Audacity* (Sourceforge, 2003) was used for this process.

[51] This application allows audio playback at various speeds and 'steps back' a few seconds each time the stop button is pressed. These features facilitated the accurate transcription of the audio as the playback was easily controlled whilst typing.

listening that the activity demands, fosters a familiarity with the data that guides subsequent coding. However, for efficiency, whilst the initial three interviews were transcribed in full by the researcher the majority of the transcription was performed by others. By performing the first transcriptions himself, the researcher was able to establish an appropriate format and formulate the detailed instructions that the typists were given (see Fielding & Thomas, 2001: 136). Due to the need for accuracy, the specialised nature of the conversations and the benefits inherent in having conducted the interview, each transcript was fully checked by the researcher. This involved inserting additional comments and correcting any transcription errors. Thus, although the researcher did not perform the majority of the transcription for this study, he gained good familiarity with the material through repeatedly studying the audio recordings and their associated transcripts. This resulted in the commonly reported phenomenon of the researcher being able to recall the speaker's tone of voice simply by reading the transcript (see Gilbert, 2002: 215).

5.2 Data coding

When analysing qualitative interview data, a common procedure is that of 'coding' the interviews (Fielding & Thomas, 2001: 137). This involves systematic and rigorous identification of themes and concepts in the interview transcripts. These codes are then compared and contrasted with those in other transcripts leading to the identification of new codes which further the researchers' understanding of the domain (Fielding & Thomas, 2001: 137). For example, if in one paragraph an interviewee is discussing the visualisation activities that they use in the design process, the researcher may assign that paragraph the code 'visualisation'. As the research progresses, the list (or hierarchy) of codes is expanded and refined to accommodate the full range of concepts emerging for the data. Therefore, to elaborate on the example above, if many interviewees discussed the visualisation activities that they use, codes might be developed for each of the different visualisation activities mentioned (such as, 'sketching', 'clay modelling' and 'image boards'). In addition to coding the procedures, activities or deliverables described by the interviewees, the researcher may also code attitudes (such as, 'consumers don't know what they want'), causal factors (such as, a 'budget constraints'), consequential effects (such as, 'market success') or any other pertinent categories of information. A number of established code libraries exist (*e.g.* Patton, 1990: 437) to which researchers may refer, or entirely new code-sets may be developed for a particular study.

Coding procedures assist analysis because they force the researcher to continually look for meaning in the data and to submit the previously identified categories of meaning to increased scrutiny with each new case. Furthermore, transcribed passages assigned the same code might thus be compared to identify sub-codes that only become apparent when all these passages are examined together. Alternatively, collections of passages with different codes might be compared to reveal the possible reasons for any discrepancy. Coding thus presents two challenges to the researcher: *analytically*, how should thematically related passages be identified within and between cases; and *practically*, how should the documents be labelled with these codes and how might the coded segments be retrieved (Fielding & Thomas, 2001: 137). In this study, the analytical challenge was addressed by utilising the grounded theory coding schemes (described below) and the practical challenge was addressed by adopting certain manual and software-based methods (described in the sections that follow).

5.2.1 Coding in grounded theory

Straussarian grounded theory emphasises a rigorous coding procedure that assists researchers in generating useful interpretations. In particular, three distinct coding activities are described: *open coding*, *axial coding* and *selective coding*. Whilst these three coding activities are presented as distinct, sequential activities, the general progression from open, through axial, to selective coding involves interplay, overlap and iteration between the methods (Robson, 2002: 194).

Open coding

During the open coding process, the researcher identifies initial categories of information from the available data (Strauss & Corbin, 1998: C8; Robson, 2002: 194). From these categories, further sub-categories are identified and such categories are typically assigned to the appropriate sentences or paragraphs of the transcripts (Strauss & Corbin, 1998: 119-120). A further stage of open coding is identifying the properties of a category (its characteristics or attributes) and the dimensions along which these properties vary (Strauss & Corbin, 1998: 117).

Axial coding

The process of axial coding involves exploring the relationships between the concepts identified during the open coding stage of the analysis (Strauss & Corbin, 1998: C9).

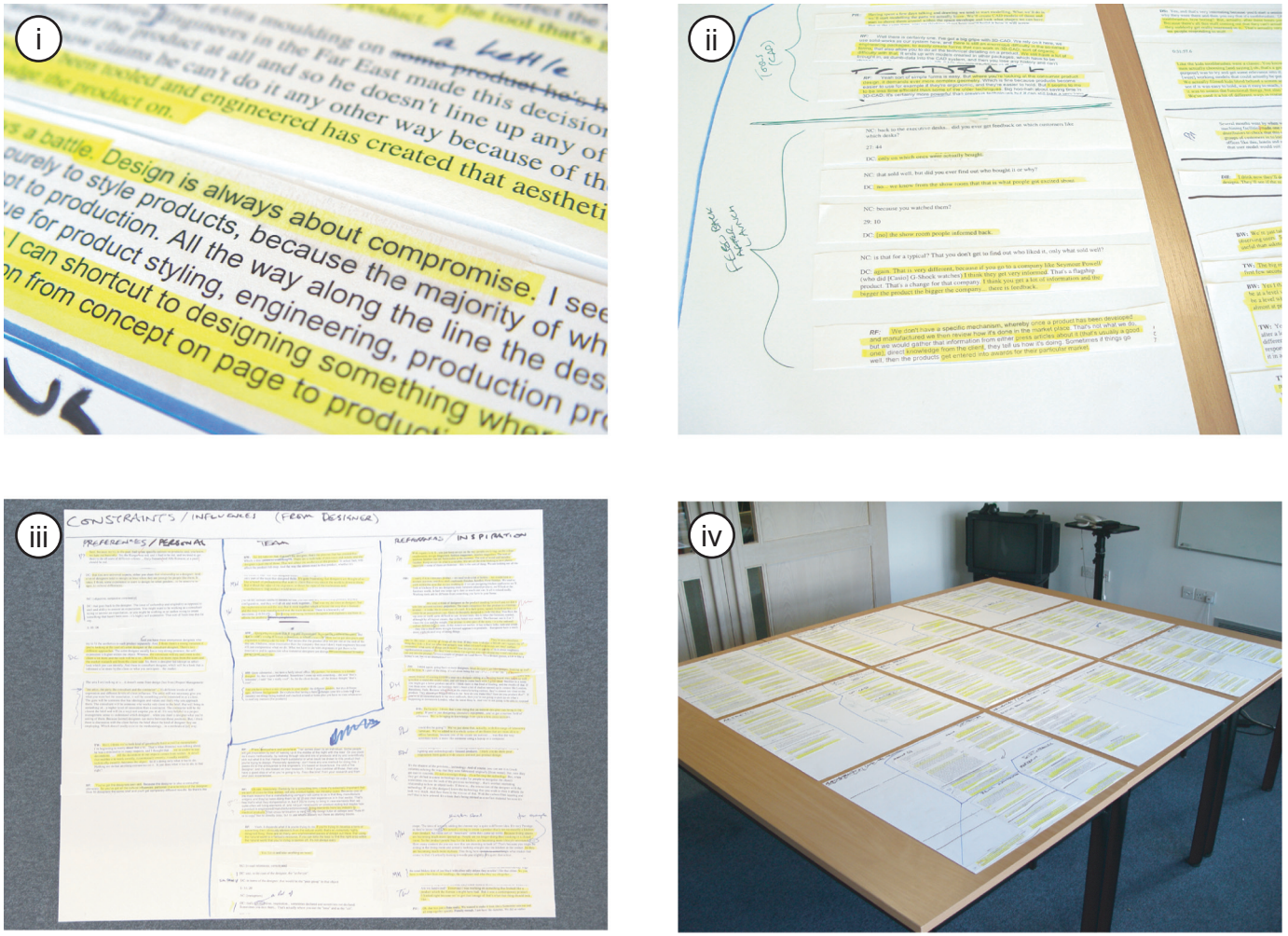

Figure 5-a: *Photographs of different stages in the manual coding procedure. i) Marking-up the transcripts to indicate relevant passages. ii) Collating related passages from multiple interviews on the same code sheets. iii) Dividing the code sheets into sub-themes. iv) Examining the code sheets to explore the connections between different themes and sub-themes (in total, 13 code sheets were produced).*

Thus, during axial coding, the researcher often seeks to understand how codes are connected to each other by employing diagrams as an analytic tool (Strauss & Corbin, 1998: 235). Such an approach may help identify a central category of interest and explore the causal, contextual and consequential issues related to this category (Robson, 2002: 194).

Selective coding

Whilst open coding identifies relevant concepts, and axial coding establishes relationships between these concepts, selective coding works towards integrating these concepts into theory (Strauss & Corbin, 1998: C10). Here, the researcher constructs "relational statements" out of data to "explain, in a general sense, what is going on" (Strauss & Corbin, 1998: 145).

The coding process has thus far been described in abstract terms concentrating on the conceptual procedures and analytic benefits associated with the technique. However, to the uninitiated, coding is perhaps more easily understood by reference to the practical (and sometimes physical) implications of coding large volumes of data. Thus, a brief description is given of the 'manual coding' procedure initially used followed by a comprehensive description of the software-based approach that was subsequently adopted for the remainder of the study.

5.2.2 Manual coding

As transcripts from the first few cases were reviewed, initial coded themes of interest were identified and the relevant segments of text were marked up by hand. Large (A1) sheets of paper, called 'code sheets', were then headed with each of the thematic codes, and the appropriate segments of text were cut from the transcripts and collated on the relevant sheet (see Figure 5-a). Thus, segments of text that were previously separated by many pages of transcript were all brought together under the appropriate thematic headings. This activity of sorting through the data and physically rearranging it to form sheets of meaning was a valuable tool in increasing the researcher's familiarity with the data. The process encouraged the identification of sub-themes and the comparison of connected passages within and between cases. From this method of interrogating the data, categorisations of, and relationships between, the emerging concepts were defined.

Despite the analytic benefits outlined above, the process of manually coding the data presented a number of problems. Firstly, even with the relatively small quantities of data collected in the first phase of the study (approximately 25,000 words of transcript), the code sheets became physically unwieldy. Examination of the connections and contrasts within the data was thus hampered by the physical geography of the numerous code sheets. Secondly, when segments of text related to more than one code it was necessary to duplicate the segment to allow it to be placed on the appropriate sheets (see Fielding & Thomas, 2001: 138). Notes or corrections that were subsequently added to any one segment often had to be added to each additional duplicate; this process was time-consuming, irritating and prone to error. Thirdly, when sub-themes were identified it was necessary to create new code sheets for the sub-themes and transfer all the relevant segments of text to the new sheet. This was also time-consuming, exposed the text segments to damage and consequently discouraged experimentation with alternative coding schemes. Therefore, despite the initial benefits of the manual coding process, as more interviews were conducted, a more sophisticated coding system was required.

Although the manual coding procedures were superseded by a software-based approach (see below), the influence of the manual methods persisted throughout the study. In fact when considering the question “should new researchers start off doing analysis by hand?”, Weitzman suggests that “students benefit from having some experience with manual methods, if only a few coding exercises, so that they get the feel of what is happening analytically” (Weitzman, 2003: 334). In this study, the analytic basis provided by the manual methods informed the subsequent use of the software and in fact, the manual methods were never entirely discarded; instead, a combination of manual and software-based methods was eventually adopted (see section 5.3.3).

5.3 Data analysis software

Qualitative data analysis was traditionally (prior to 1980) performed in a manner much like that described in the previous section. The advent of Computer Aided Qualitative Data Analysis Software (CAQDAS) packages offered the opportunity for some of the physical aspects of such methods to be replaced by computers (Weitzman, 2003: 311). It is important to note however, that such software does not perform any of the analysis for the researcher; it simply facilitates the organisation of data and concepts, and the exploration of any relationships between them. Thus,

CAQDAS does not reduce the time required to adequately read, conceptualise and analyse the data, but it does allow more time for these activities by reducing the burden of the mundane clerical tasks associated with manual coding (Bringer *et al.*, 2004: 250). By exploiting the qualities typically associated with software, CAQDAS can improve analysis by offering *consistent* retrieval of data, *rapid* access to the required data, convenient *representations* of the data and *consolidation* of many data types within a single environment (Weitzman, 2003: 316-317). Consequently, CAQDAS usage can "help competent researchers do more rigorous, consistent, and thorough analysis than they otherwise might" (Weitzman, 2003: 335).

Despite the potential benefits that CAQDAS offers, the approach still has its detractors, with some considering it to the antithesis of effective qualitative research. One of the concerns voiced by those sceptical of CAQDAS is that the methodological assumptions of the software developers and the resulting features and limitations of the software will constrain the researcher's approach (Weitzman, 2003: 334).[52] In this study, such problems were avoided by adopting two strategies. Firstly, the software was selected to be sympathetic with the research objectives and the methodology adopted. Secondly, where the software did not provide the functionality required by the researcher, such needs were met by other methods (see section 5.3.3).

When reporting on the analysis of qualitative data, the use of CAQDAS actually increases the importance of methodological description (Bringer *et al.*, 2004: 248). For the author to establish trustworthiness, the procedures used in the analysis must be described, and "'analyzed with programme x' does not constitute a description" (Gilbert, 2002: 226). Furthermore, there is a lack of published grounded theory studies using CAQDAS within the field of design research. Thus, readers of this thesis cannot be expected to have familiarity with CAQDAS or the methodological implications of its use. It is therefore important to provide a transparent account of CAQDAS selection and usage so that the reader may assess whether the software was used in a way appropriate to the methodology and research questions (see Bringer *et al.*, 2004: 252). Consequently, in this chapter, the selection and use of CAQDAS is now described in detail.

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[52] Despite these potential misuses, the UK's Economic and Social Research Council now recommends that postgraduate students should be trained in the use of qualitative software (ESRC, 2001: E4.3), and this is widely seen as significant institutional acceptance of the benefits offered (Crowley *et al.*, 2002: 196; Bringer *et al.*, 2004: 250)

5.3.1 Software selection

Somewhat unlike quantitative data analysis packages, the differences between competing CAQDAS packages is quite fundamental and there is no clearly established market leader (Bryman, 2004: 418). Each program is designed around different ways of interrogating data and although they typically offer flexible working methods, some are more suited to particular research objectives than others (Crowley *et al.*, 2002: 194). For example, whilst some packages are suited to exploring themes and developing concepts, others are more appropriate for systematically coding transcripts with a pre-defined coding scheme. Thus, it is important to demonstrate both that the software selected is appropriate to the research objectives and that the software was used appropriately (Weitzman, 2003: 310, 322).

CAQDAS requirements

From a combination of the manual coding exercise discussed above and the relevant literature, a brief requirements list was constructed to guide the selection of CAQDAS packages. These requirements related to the manner in which coding could be performed, the way in which data could be organised and the variety of media that the software supported:

- *Coding*: the software was required to be well suited to exploratory fine-grained analysis of the transcribed interviews. Thus, the ability to code documents and retrieve all instances of a code was essential, along with the facility to merge, split and restructure the evolving code set as the study progressed.

- *Organisation*: document control tools were required to organise the transcripts and memos associated with the study. The facility to edit coded text without 'breaking' the code links was also important so that the transcripts would not be reduced to static documents that the researcher was unable to modify during the study.

- *Multi-media*: beyond the textual basis of the research material, the facility to link, embed, or structure images was considered

beneficial. Furthermore, some facility for recording and exploring ideas in diagrammatic form was sought.

Finally, in addition to these specific feature requirements, there was a more general requirement that the software be 'flexible in use'. This was because it was anticipated that many of the more sophisticated tools offered by the packages would not be needed in this study due to the nature of the investigation.[53]

Existing guides

There are number of published critiques comparing existing CAQDAS packages (*e.g.* Barry, 1998; Weitzman, 2003), and these were consulted for an overview of the available options. Such texts were particularly useful in defining the range of available features and the variety of working methods that might be supported. For example, the range of possible procedures for retrieving coded text segments were reviewed and the researcher could thus make decisions as to whether these previously unconsidered tools would be of use in the study.

Despite the benefits offered by these publications, there were three main limitations to their relevance: *currency*, *bias* and *focus*. Firstly, the currency of these written reports was reduced by the rapid pace of software development activities and this limited the confidence with which their comparative assessments could be interpreted. Secondly, some of the reviews appeared somewhat biased either through the selection of packages that were discussed or by the authors' association with the software companies involved. Thirdly, the majority of the literature was focused on applying the software to traditional fields of sociological inquiry and did not place as much emphasis on the role of diagramming as was to be used in this study. Due to these limitations, it was necessary for the researcher to conduct small-scale trials of different available CAQDAS packages.

The Selection of QSR NVivo

To make a final selection for the CAQDAS package to be used in the study, the following software packages were explored: *HyperRESEARCH 2.6* (Researchware, 2004), *QDA Miner 1.0* (Provalis Research, 2004) and *NVivo 2.0* (QSR, 2002). Each

[53] For example, many packages are capable of performing statistical operations on the data and provide interactive visualisations of the resultant summaries.

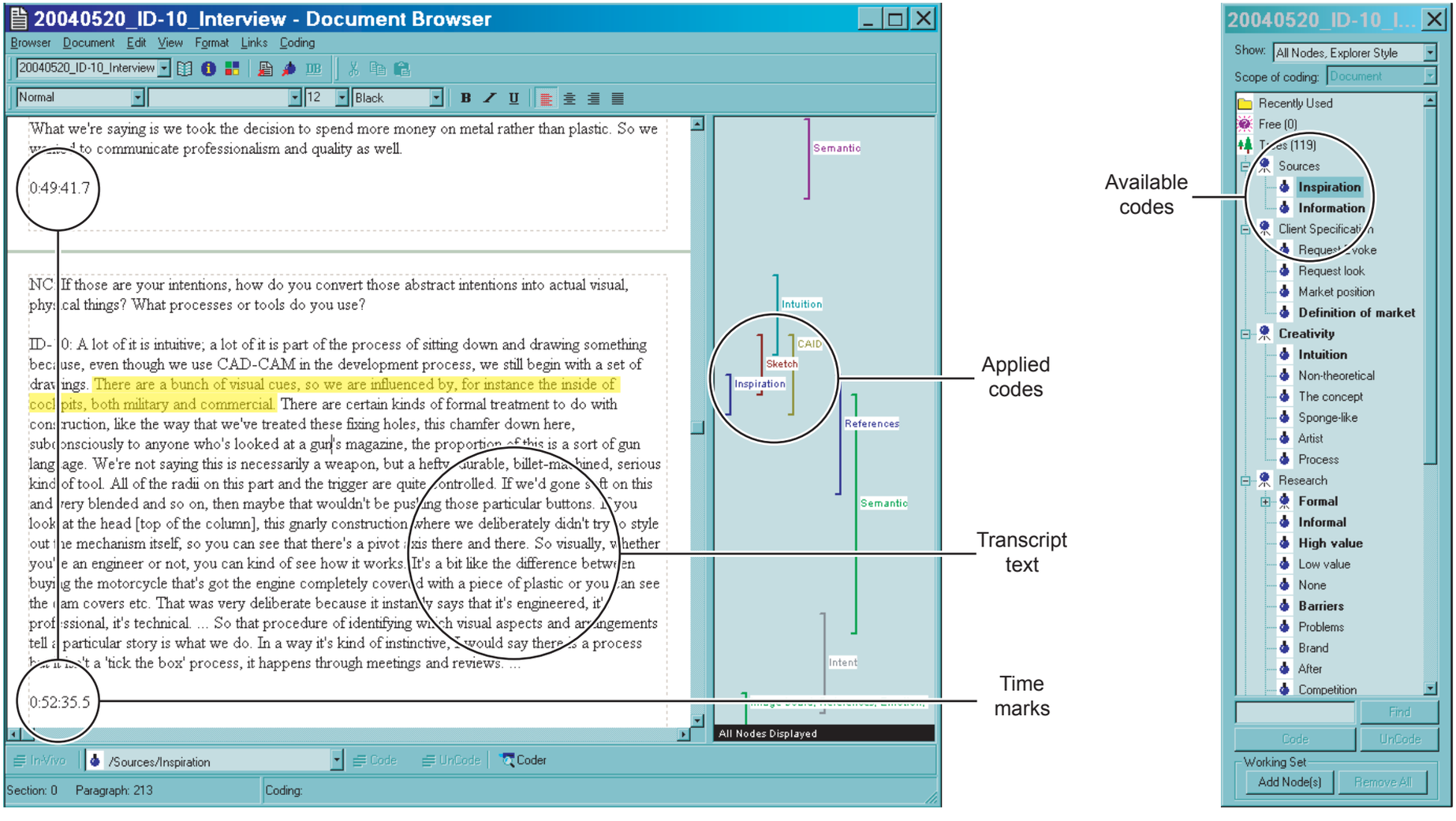

Figure 5-b: *Screen shot from NVivo showing the document browser window (left) and the coding window (right). In this particular view, the code 'Inspiration' has been applied to the highlighted text; the relevant coding stripe is shown on the right-hand side of this portion of the transcript.*

package was tested with example interviews from the study which were coded in the software to allow exploration of the available software features.

Based on these trials and further reading of the CAQDAS literature, QSR NVivo was selected for the study. The following factors (each related to the above requirements) were instrumental in determining this selection.

- *Coding*: in contrast to the other packages, NVivo offered a hierarchical coding structure that allowed codes to have siblings, children and parents. This suited the emerging nature of the codes because high-level codes (such as 'practical constraints') had sub-codes (such as 'cost' and 'time'). NVivo provided adequate facilities for splitting, merging, re-naming and re-organising the codes (see Figure 5-b).

- *Organisation*: in comparison to the other packages, NVivo offered the most sophisticated document control facilities. Documents could be grouped into 'sets' (such as 'interviews with designers' and 'interviews with investigators') with the facility to place documents in more than one group (such as when an interview involved both a designer and an investigator). Research memos could also be associated with the transcripts and these could be coded like any other document. NVivo supports rich text documents which can be continuously edited irrespective of any coding applied to them (see Figure 5-c).

- *Multi-media*: NVivo permits the linking of all other file types (audio, images, web pages, etc.) to allow some of the richness of the original data to be preserved. Of particular interest was the facility to construct visual representations of the data (codes, documents, memos) linked *to* the data, providing an alternative interface to the collected material. This was considered (and found to be) a particularly useful feature for developing an abstracted interpretative view of the domain (see Figure 5-d).

In addition to these specific feature benefits, NVivo also complied with the more general requirement that it be 'flexible in use'. Furthermore, NVivo is considered to be particularly well suited to grounded theory studies (Crowley *et al.*, 2002: 195;

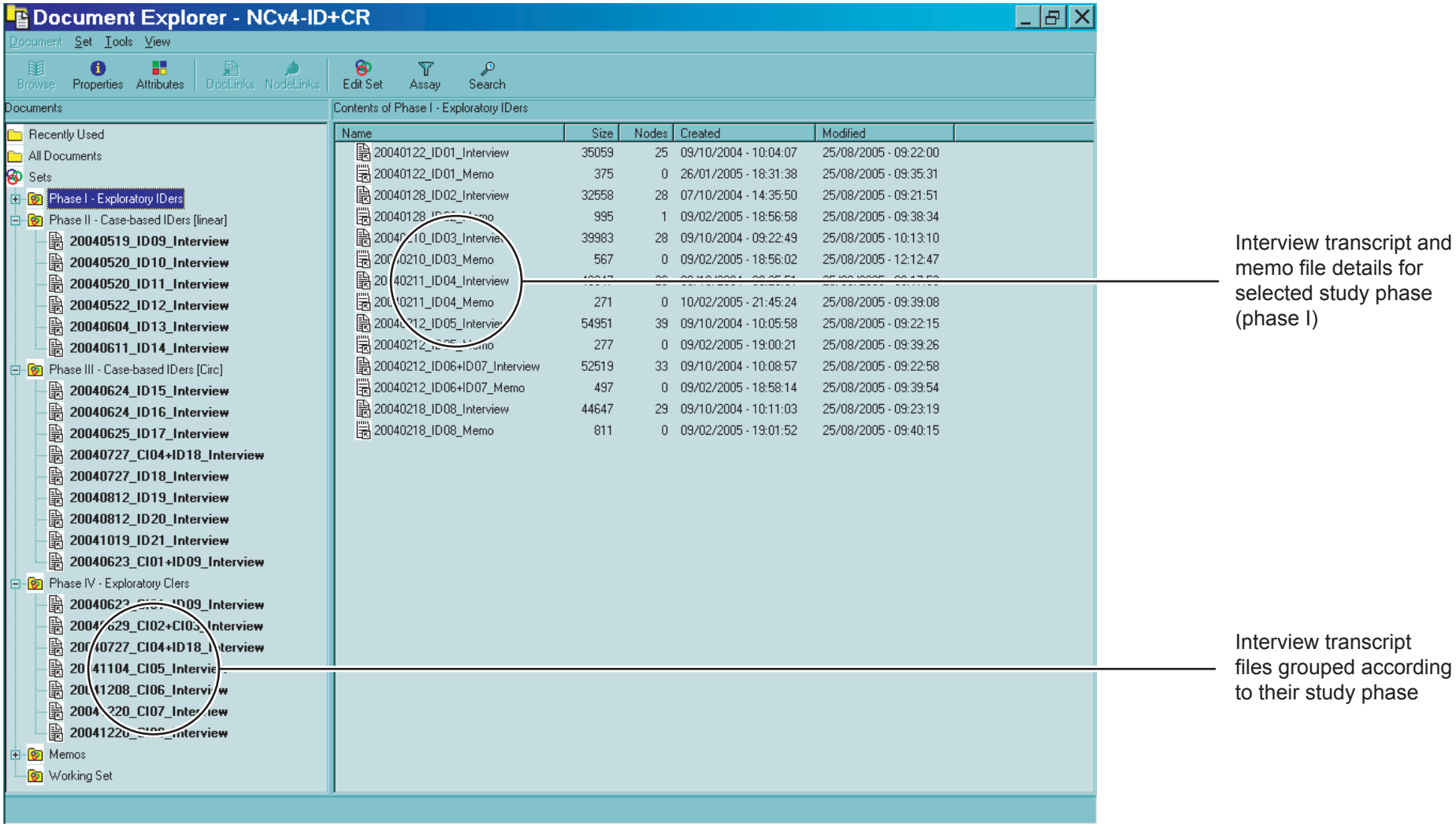

Figure 5-c: *Screen shot from NVivo showing the document explorer window. The left-hand pane shows the interview transcripts grouped under their respective study phase sets; the right-hand pane shows all the documents associated with phase I (including interview transcripts and memos).*

Bringer *et al.*, 2004: 259), is appropriate for PhD level research (Weitzman, 2003: 320), and is mature, stable, well-supported and well-documented. Beyond the considerations of the immediate study reported in this thesis, NVivo also provided a rich feature set that could be of significant benefit in future studies that might use the same data.[54]

5.3.2 Software usage

In order to demonstrate that the software was used appropriately, it is necessary to report the way in which it was employed during the study. Thus, the reader might judge the validity of how the software features were applied to the research objectives. Despite the many sophisticated ways in which NVivo allows data to be developed and interrogated, in this study only four main processes were used: *document control*, *document coding*, *code retrieval* and *graphic modelling*. Each of these processes is now described in detail, identifying what software features were used and why.

Document control

NVivo was used to organise two distinct forms of data: the research documents associated with the interviews (transcripts and memos) and the coded interpretations that were assigned to these documents. Twenty-seven interview transcripts were produced in the study, and each of these were related to other documents according to factors such as: the phase of the study, the interviewees' profession and the organisations they were involved with. Furthermore, each interview transcript was accompanied by at least one memo (see section 4.2.2) and these memos were linked to the appropriate transcript.

As the study progressed, the initial set of 12 codes that had been developed for the exploratory study was expanded to more than 100 codes. This was due to the sub-division of existing top-level codes and the addition of entirely new ones. These codes were arranged in a hierarchical structure with 19 top-level codes and up to two levels of sub-codes beneath each of these (see Figures 5-c and 5-e). During the data

[54] This did in fact happen *during* the study; NVivo's sophisticated search facilities allowed other researchers to access the data in a way that facilitated exploration of different aspects of industrial design practice.

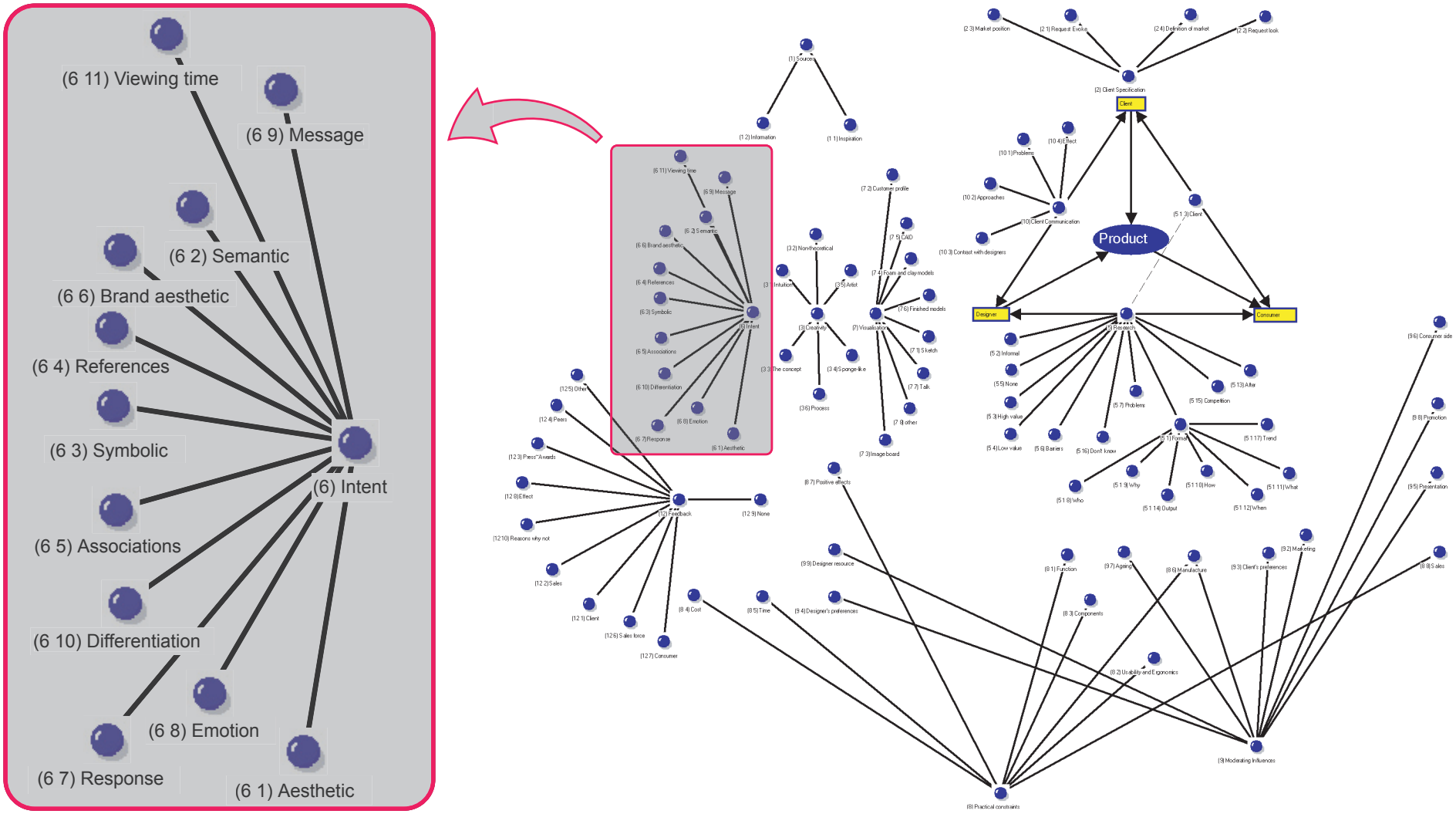

Figure 5-d: *Graphic model constructed in NVivo to represent and explore the relationship between codes. The triangular structure surrounding 'product' in the top right-hand corner corresponds with those presented in section 6.3.3.*

collection and analysis processes, these codes were continuously merged, divided, renamed and redefined to reflect the emerging conceptualisation of the domain.

Document coding and code retrieval

Writing specifically about using CAQDAS for open, axial and selective coding, Fielding describes the three analytic CAQDAS coding steps that were employed in this study (Fielding, 2001: 246-248):

- In open coding, codes are developed to create a code set and these are then applied to the text. Passages may be assigned more than one code.

- In axial coding, the relationship between categories and sub-categories are explored involving code splitting, merging and grouping activities.

- Selective coding occurs when the main themes and concepts have been identified and illustrative examples are extracted to provide quotable material.

The 27 interview transcripts were the principal documents to be analysed in the study. In addition to these long passages of text (approximately 10,000 words each), smaller memos were also produced (as described in section 4.2.2). Both these document types were coded (and re-coded) in NVivo with the most recent code sets available. The codes assigned to the interview material were partly suggested by the structure of the diagrams used in the interviews and partly based on post-interview analysis. Also coded in the software was visual material such as product photographs, pages from websites and sketches produced by the informants.

In this study, extensive use was made of the facility to retrieve all the segments of text assigned to a particular code. Regularly reviewing related passages from the various interviews encouraged the development of the emerging codes through a process of ‘constant comparison’. That is, the coded abstractions of the data were subjected to scrutiny and compared against the data itself (both old and new). Such analysis led to the refinement of code definitions, the identification of sub-codes and the discovery of connections between codes that had not previously been observed.

Graphic modelling

Because diagrams fulfilled a number of roles in this study, the facility to graphically model the coded material was particularly helpful. For example, the researcher could display the codes so that the connections between the code's parents, children and siblings could be viewed. The code structures were also overlaid on basic frameworks that reflected the then current conceptualisations of the domain (see Figure 5-d). As each element of the diagram (codes, documents, memos, etc.) was linked to the related data, the researcher could rapidly alternate between an abstract representation and textual evidence that would either support or refute that conception. Thus, the graphic models offered an alternative method by which the data could be interrogated and provided a link between the computer-based data and the predominantly hand-sketched diagrams used for analysis purposes.

Using the software, alternating between views of the model (emergent theory) and the transcripts (interview data) was a simple procedure. As compared to sorting through paper-based transcripts and sketches, this allowed the researcher to connect the abstract representation to supporting or refuting evidence at a "speed much closer to that with which the brain is likely to be processing the information" (Bringer *et al.*, 2004: 254). This facility for continual and efficient comparison of the diagram against the case-based material allowed continual appraisal of the diagrams' validity as representations of the domain.

Although the processes of document control, coding, code retrieval and graphic modelling have been described here separately, they were not employed in a purely sequential manner. Instead, each activity was dependent on the others, resulting in an iterative process of discovery and evaluation throughout the study. For example, the process of code retrieval and review resulted in modified code sets which would, in turn, lead to document re-coding and renewed exploration of the graphic model.

5.3.3 Combining methods

When engaged in the processes of qualitative analysis, researchers require both *closeness to* the data and also *distance from* it. Closeness refers to the need for the researcher to absorb themselves in the rich data through the processes of conducting the interviews, reading the transcripts, coding, re-reading and, re-coding in an iterative analytic process (Weitzman, 2003: 332). Conversely, researchers are also

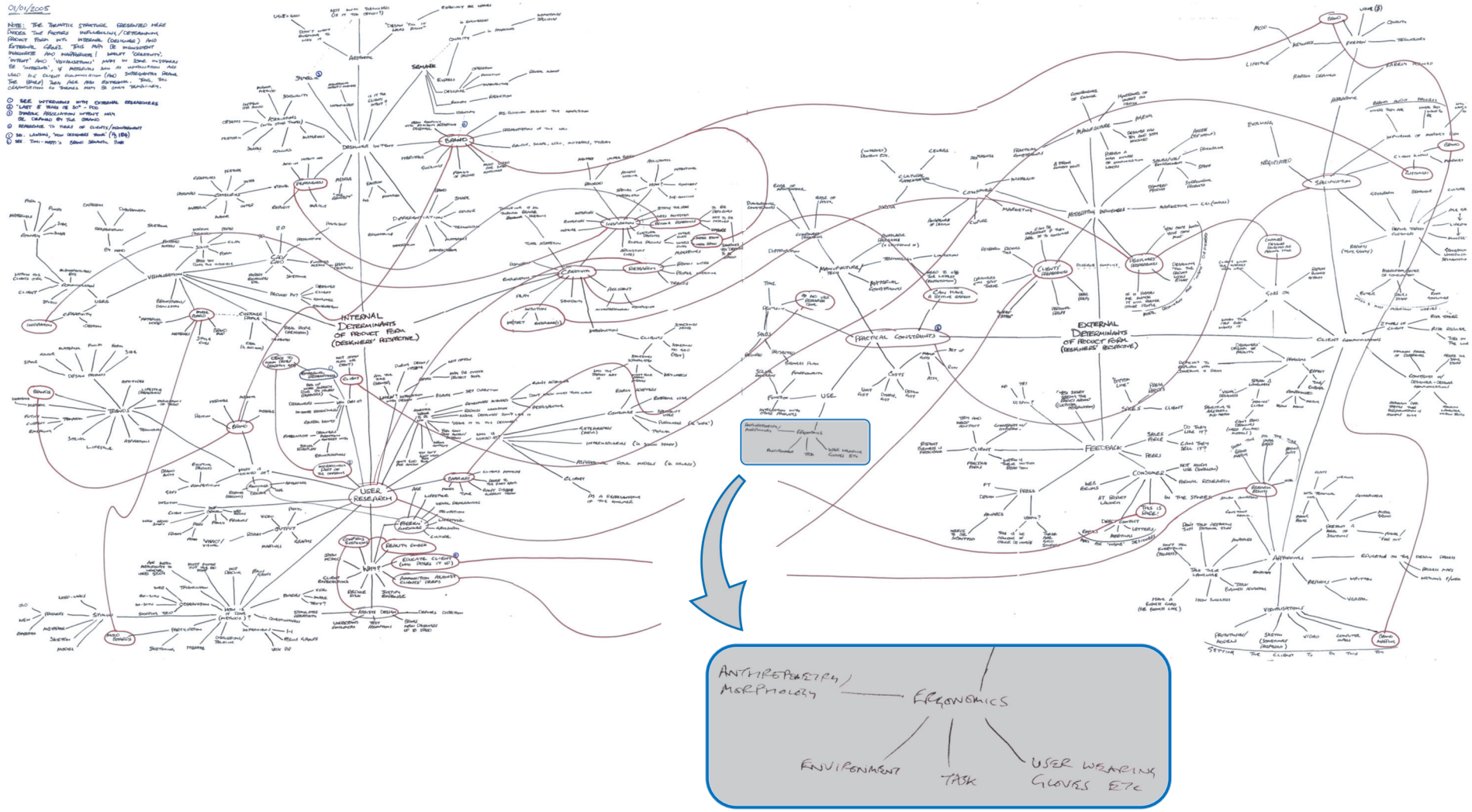

Figure 5-e: *Illustration of how manual (diagrammatic) analysis techniques were employed in the study to represent and explore the relationships between different codes. The red (curved) lines indicate connections between disparate parts of the code set.*

required to draw back from the details of the data to see the concepts and connections within it by processes of abstraction (Gilbert, 2002).

There is the risk with CAQDAS, that the facility to neatly code and re-code documents at increasingly finer detail may lead researchers to continue this procedure beyond the point of any analytic benefit. In particular, experienced CAQDAS users report that there is the danger of becoming too 'bogged down' in coding, with a resulting failure to abstract from the data (Gilbert, 2002: 218). However, just because a CAQDAS package does not support a particular approach, this does not preclude the researcher from pursuing this approach by other means: "the researcher is not a hostage to qualitative software" (Crowley *et al.*, 2002: 195). Thus, many experienced researchers use a combination of paper-based and screen-based methods to code and review the data (Gilbert, 2002: 217).

In this study, NVivo assisted the researcher in achieving closeness to the data by providing an environment for interrogating the interview data in detail. The predominantly manual methods of diagramming were used for achieving analytic distance from the data, as the relationships between concepts could more easily be explored on paper (see Figure 5-e).

5.4 Diagramming

Many qualitative research texts advocate the use of visual representations in the analysis process (see Dey, 1993; Miles & Huberman, 1994; Ryan & Bernard, 2003). In this capacity, diagrams are often regarded as a useful tool for generating, exploring and recording ideas. In relation to grounded theory, diagrams may be defined as "visual devices that depict the relationships among concepts", and drawing diagrams may help the researcher gain analytic distance (Strauss & Corbin, 1998: 217). Consequently, diagramming is especially useful in the axial coding stage of analysis, and, in conjunction with writing memos, it helps keep a record the analytic process (Strauss & Corbin, 1998: 235, 241).

There are two functions of diagramming relevant to the data analysis processes used in this study. Firstly, diagrams were used as tools for idea generation, *graphic ideation*; and secondly, diagrams were used as tools for developing theory, *diagrammatic theory building*. These two functions are briefly reviewed here before their integrated application in the different phases of the study are presented.

5.4.1 Graphic ideation

Graphic ideation offers the opportunity to thoroughly examine a problem from a number of perspectives using visual representations to both record and stimulate thought (McKim, 1980: 124). Graphic ideation involves both exploratory and developmental phases. The exploratory phase is formative and requires the imagery of a new idea to be visualised and recorded. The subsequent developmental phase requires the evolution of these 'promising, though initially embryonic, concept[s] into mature form' (McKim, 1980: 122). Graphic ideation is described by both Enrick (1972: 4) and McKim (1980: 124) as an iterative process in which ideas are visually expressed, tested, and then fed back to the expressive stage. The output of this initially cyclic activity is the eventual convergence on a graphic solution that is considered appropriate.

One possible consequence of the new-found clarity that diagrams provide is that the originator of the diagram is 'tempted to treat [these] simplified constructs as though they were reality itself' (Arnheim, 1969: 307). However, diagrams are necessarily a radical simplification that presents a domain from a single perspective leading to an emphasis of some aspects at the expense of de-emphasising others (Green *et al.*, 1991). In this study, visual thinking was enhanced by actively moving between different graphic languages (see Cox & Brna, 1995). This included exploration of different modes of presentation and experimenting with various degrees of abstraction.[55] The ongoing process of searching for different visual solutions helped in the refinement of conceptualisations as every time the researcher changed graphic languages, he submitted his ideas to a new set of logical operations (see McKim, 1980: 132).[56]

The opportunities presented by graphic ideation for continually re-examining the problem led to expansion and refinement of the entire thought process surrounding the problem. Thus, the inconsistencies and imprecision of early ideas were revealed and graphic representations were available for theory building activities.

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[55] For examples of the different styles of diagram used in the study see Figures 2-f, 5-e, 6-m and 6-q.

[56] For valuable guidance in exploring the available modes of presentation Bertin (1967), Lockwood (1969), Harris (1999) and Engelhardt (2002) provide visual summaries of the varieties of diagrammatic possibility.

5.4.2 Diagrammatic theory building

The objective of theory building is to 'find order in the booming, bustling confusion that is the realm of experience' (Dubin, 1978: 5). To achieve this there are four essential questions that Dubin suggests a theory must answer: What is the domain of interest and what factors should be considered? How are these factors related? Why have these factors been selected and what justification is there for the proposed relationships? Finally, to whom, where and when are the propositions limited (what are the boundaries of the theory)? Generating analytic diagrams (and employing these diagrams in graphic elicitation studies) can aid researchers in establishing answers to these four questions (see Crilly *et al.*, 2006).[57]

Focusing on case-based research, Eisenhardt describes theory building as a process of constantly juxtaposing the emergent theories with the case data (Eisenhardt, 1989: 546). Diagramming facilitates this process by providing a visual summary of the concepts and relationships under consideration. Comparing the evidence of each case to visual representations encourages an ongoing appraisal of the accuracy of the concepts and relationships depicted. Thus, in relation to the 'what' and 'how' elements of a theory, Whetten suggests that '"visual representation often clarifies the author's thinking and increases the reader's comprehension" (Whetten, 1989: 491). In this study, diagrams for exploring and 'testing' the possible relationships between concepts principally took the form of inclusion diagrams (see Figure 2-f) and spider diagrams (see Figure 5-e).

By producing diagrams that clearly depicted the factors of interest and the relationships between them, the researcher illustrated his conception of the domain. When presented to the interviewees, this elicited comments from the interviewees on the importance of not only that which had been represented, but also that which had been omitted. This served to strengthen the researcher's justification for the factors and relationships that had been selected and clarified the 'why' elements of the emerging interpretation. Finally, in attempting to generate diagrams that reflect observation, the researcher strove to reveal a general structure that was applicable to

[57] As discussed in section 1.3.3, the objective of this study was not to develop full-blown theory, but rather, by adopting a partial grounded theory approach, to construct an integrated conceptual framework. However, whilst the guidelines for theory building are particularly stringent, their structured nature provided a useful guide to diagramming.

a variety of specific cases. When interviewees responded to these generic representations they offered clues to the possible limits of generality which helped determine the 'who, where and when' elements of the framework.

5.4.3 Diagramming phases

Irrespective of the diagramming approach adopted, diagrams performed three distinct roles during the study. Firstly, they acted as a framework to sensitise the researcher to issues of relevance; secondly, they were employed as stimulus materials to elicit contributions from informants; and thirdly, they were used as an analytic tool to stimulate thinking and record the researcher's emerging conceptualisations. Thus, each phase of the study might be viewed as having a diagrammatic input (the initial representation), diagrammatic operations (graphic elicitation, graphic ideation, diagrammatic theory building) and a diagrammatic output (the resulting representation). As the study progressed, the diagrammatic output from one phase became the diagrammatic input to the phase that followed.

Further to the diagramming activities associated with constructing the literature-based framework presented in section 2.1, each phase of the study involved the following diagramming activities:

- *Phase I*, developing a preliminary conceptual framework for designer intent.
- *Phase II*, developing a general framework of design relationships within which designer intent might be placed.
- *Phase III*, exploring the framework developed in phase II.
- *Phase IV*, developing a framework for consumer research.

Now that the data collection and data analysis methods employed in the study have been reviewed, their integrated application can be presented. The role of diagramming in the separate phases of the study is thus described below, finalising the characterisation of each phase.

Phase I

In the first phase of the study, seven exploratory interviews with industrial designers were conducted. The interviews were divided into two parts: firstly, the interviewees were asked to describe the determinants of product form. Secondly, to elicit contributions from the interviewees and to gain their appraisal of the work, the researcher presented the graphical framework for consumer response developed during the literature study (section 2.1). Seeing the conceptual framework prompted the designers to offer their own ideas about consumer response and to make further comments about design in general.

Following the interviews, the transcripts were reviewed and coded to establish themes, connections and contrasts within the data. From this information sketches were made in an attempt to capture the essence of the subject in diagrammatic form. Iterating through the graphic ideation process permitted the development of a preliminary graphical framework that was felt to adequately depict the factors involved. This representation was refined and a presentation was generated suitable for communication to the next round of interviewees. An interview script for the second phase of the study was produced based on transcript analysis and the diagramming process.

Phase II

The second phase of the study involved six case-based interviews with industrial designers. The diagrammatic stimuli employed in this phase included the original framework for consumer response (*used* in phase I) and the new framework for designer intent (*developed* in phase I). Through a series of interjections, or at the end of the presentation, the designers commented on the diagrams and offered further opinions on the subject in general. Consideration of these comments, in conjunction with preliminary analysis of the interviews, resulted in the creation of a more general framework that represented the relationships between the main product stakeholders. This provided a contextual overview within which consumer response and designer intent might fit (see section 6.3.3).

Phase III

In the third phase of the study, nine further case-based interviews were conducted in a similar manner to those in phase II. Following the initial product-focussed discussion the original presentation slides were shown and the designers made comments and contributions as before. However, as described above, no specific

diagramming activities were associated with phase III. This was because some form of saturation had been reached with the industrial designers and whilst the researcher's conceptualisation evolved in valuable ways, no revolutionary changes were made. However, in phase IV, focus was shifted to the sample group of consumer investigators. This resulted in a new set of data to analyse and new concepts to which diagramming activities could be applied.

Phase IV

In the fourth phase of the study, seven exploratory interviews were conducted with consumer researchers. The stimuli presented to the consumer investigators were the same as those that had been employed in phase III. Now though, the stimuli did not represent the activities of the interviewees, but rather, those of the consumers whom they studied, the designers with whom they collaborated and the brand owners who were often their clients. Thus, much of the graphic elicitation sessions in each interview focused on the general framework of design relationships (developed in phase II), with the interviewees describing their position in relation to this contextual overview. This included consideration of why their services were requested, how their investigations were conducted and what form the output from their research took. The diagramming activities associated with phase IV primarily involved the integration of such concepts with the existing frameworks produced earlier in the study.

5.5 Summary

The data analysis activities in this study began with the preparation of detailed interview transcripts. This allowed the application of grounded theory coding procedures that were initially performed manually and later supported by software. The software facilitated the control of numerous large documents, iterative revisions of the code set and visualisation of the data. When combined with manual diagramming techniques, this allowed the researcher to gain an overview of the domain and construct graphical frameworks that represented his conceptualisations.

In this chapter, for the purposes of clarity, the different analysis activities have been described separately. However, in application, the methods were employed in an integrated manner to synergistic effect. For example, the coding activities often revealed new ways in which data could be categorised and this influenced the diagramming process that followed. Similarly, the diagramming process often

indicated relationships between the codes that were not apparent from the software's hierarchical presentation of the data. This interplay between the different analysis methods led to inextricable links between the coding and diagramming activities. Specifically, the structures implied by hand-drawn diagrams were transposed into NVivo's modelling environment and used as a means to navigate the coded transcripts.

Just as these individual analysis activities were applied within a single, coherent approach, so too were the different research stages (sampling, data collection and data analysis). Thus, whilst these activities have been delineated in separate chapters of this thesis, in practice they were applied in an iterative and integrated manner. For example, the graphic elicitation technique used in the interviews (data collection) was dependent upon the diagramming activities associated with review of the coded transcripts (data analysis). Thus, diagrams were both an instrument and product of the research, with data analysis activities informing the data collection methods that followed.

Chapter 6

Interpretation

Having now outlined the way in which the study was conducted, this chapter presents a detailed account of the researcher's interpretation.[58] This involves describing the nature of designer intent and explaining how translating that intention into physical product form is influenced by a range of competing factors. This interpretation leads to the construction of a conceptual framework for designer intent that mirrors and integrates with that developed for consumer response (see Figure 2-f). The role of consumer investigation and the designers' interaction with the client is then explored to place product aesthetics within its broader context and complete the framework. As in the literature study chapter, the framework is built up in several stages as the argument unfolds, but now, the supporting evidence is drawn exclusively (and extensively) from the interview material rather than from published literature.[59]

6.1 Designer intent

As previously defined in this thesis, the concept of designer intent relates to "the designer's motivations and objectives when generating product form, particularly their intention to evoke consumer response". Before the different aspects of designer intent are defined, it is worth establishing that such intent does in fact exist: that

[58] A brief methodological overview is provided in *Appendix A*.

[59] The quotations from designers are reproduced here based on the verbatim transcripts; where necessary, they have been edited (shown with square brackets) to clarify meanings that are obscured by lack of context and to preserve the anonymity of the interviewees. Each quotation is followed by an identification code that corresponds with those provided in the table of interviewees in *Appendix B*.

designers do consciously strive to communicate with consumers through the products' aesthetic.

Most designers do not explicitly define themselves as communicators, but are aware that their designs have communicative potential. Therefore, with varying degrees of self-reflection, they generate their designs under the assumption that their 'message' will be interpreted by others. However obliquely this idea of message formation is understood, designers often strive to affect consumers with a positive experience: one that makes the product desirable and encourages consumption.

> *"Purely in visual terms… there needed to be something about it that made people go, 'yeah, that's pretty cool: I didn't know I wanted one of those, but I want one of those. I certainly don't need one of those, but I want one.'"* ID-11(II)

Not only do designers acknowledge the communicative potential of products, but also in many cases the consumers' response to the message is explicitly defined during the early stages of design. This may take the form of image collections that represent the desired response or even written descriptions of the perceptions, feelings and associations that are intended.[60] With these visual objectives defined, product forms are then sought that appropriately embody the original intent.

> *"We get images that summarise that emotion and begin to discuss why that image makes us feel a certain way. If there are any visual cues to that, or proportional cues, then that might be the starting point for a sketch"* ID-10(II)

Thus, most designers *do form* clear objectives for how their products should be perceived. However, the appearance of the resulting product is determined by a combination of the designers' intentions and the technical, commercial, personal and political pressures that they operate under. Therefore, designers must *translate* these intentions into physical form whilst *accommodating* many conflicting constraints.

[60] The use of image boards as a method of defining visual objectives is discussed in section 2.2.2.

Figure 6-a: *Basic framework for design as a process of communication with emphasis given to designer intent. The colour scheme adopted in* Chapter 2 *(shades of red for production and shades of blue for consumption) is retained here.*

Following the *manufacture* of the product, manifestations of the original intentions are then available for the consumer to perceive (see Figure 6-a).[61]

6.1.1 Formation of intent

The intentions that designers form may be divided into categories that relate to the specific responses that are intended. Here, the cognitive categories of aesthetic, semantic and symbolic response are used (as first described in sections 2.1.3, 2.1.4 and 2.1.5). Each of these intentions is now described in detail followed by consideration of how they are informed by *the brand* with which the product is associated.

Aesthetic intent

Of the different categories of intent that can be identified, it is aesthetic intent that designers appear to be least conscious of, least able, or least willing to speak about. This may be because such design objectives are implicit and the achievement of these objectives is almost entirely intuitive. Certainly, much of the aesthetic intent that is formed is attributed to the instincts, experiences and inherent creativity of designers rather than the application of aesthetic theories.

> *"You don't set out to make it a beautiful thing, you just set out with all those considerations and think 'well, how can we make it into something attractive?' It is just something we do."* ID-01(I)

Despite recognising the importance of the eventual consumers' aesthetic impressions, designers are also confident in their personal aesthetic sensibilities. They thus often strive to satisfy their own visual preferences, confident that they (and their peers) are effective arbiters of good design.

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[61] The process of manufacture is described here as involving the transformation of raw materials, the assembly of components and the packaging and distribution of the product (see Figure 6-b). However, the purpose of this study was to investigate the design of products rather than their manufacture. Therefore, although consideration is given to the influence of manufacturing on the design process, the manufacturing process itself was not studied and is only represented for completeness. This is comparable to the lack of emphasis given to the senses in *Chapter 2*; attention is focused on intent and interpretation, rather than physical or physiological factors.

> *"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."* ID-13(II)

With good reason, designers consider themselves to be sufficiently ahead of the general population's tastes that they can generate designs for which the market will be ready when the product is eventually released. This is despite lead times that often result in a significant delay between the conception of the product and its production. Designers thus believe that relying on their own perceptions is the only effective way of designing products that are aesthetically successful. This is justified by arguing that the public is, to some extent, led in their aesthetic preferences by the very presence of designed goods. Simply put, the tastes of designers shape products, and these, in turn, shape the tastes of consumers.

> *"Because of the design lead-in time, something that you think is actually quite unusual, by the time it comes to market you're quite amazed at how many other designers are actually almost thinking the same way as you. Or, you know, predicting the future aesthetics of products in exactly the same way."* ID-14(II)

Semantic intent

In anticipating the consumers' semantic interpretation of products, designers either seek to reveal or conceal the product's technical attributes. For example, designers issue subtle instructions for the way in which consumers should approach and interact with devices by choosing to display or emphasise components that would 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."* ID-10(II)

However, where products have a particularly complicated mode of operation, designers may seek to disguise the products' underlying behaviour and imply a more intuitive one. They thus encourage the consumer to interact with the product using a simple, yet valuable, mental model whilst being shielded from the product's true complexity. Similarly, the means by which a product is manufactured may also be disguised through the application of different visual treatments.

> *"All designers are trying to build products that don't have nuts and bolts all over them. Part of the work is to make it fit together in a way that is not immediately apparent."* ID-01(I)

In addition to these technical attributes (which correspond with Monö's *description* and *exhortation*), designers also seek to *express* the less tangible qualities that the product exhibits.[62] This includes the general character of the product, which suggests the manner in which consumers might relate to it. Thus, with semantic intent designers attempt to convey the value of products, both in relation to the competition and within the manufacturer's range.

Symbolic intent

When considering the symbolic associations that consumers may form with a product, designers' strive to encourage (or reinforce) positive associations whilst discouraging (or diminishing) negative associations. This may involve visually establishing credibility by implying a lifestyle that is aspirational for the group to whom the product is to be marketed or purposefully avoiding visual references 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."* ID-08(I)

The degree to which such symbolic intentions are important varies with respect to the target market for the product. Whilst domestic products are considered to require a strong symbolic presence, industrial products for specialist users often receive more of a semantic emphasis. However, designers still imbue industrial products with symbolic triggers, but the associations they strive for tend towards personal qualities (such as 'competence' or 'reliability') as compared to the lifestyle-focus of consumer goods.

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[62] That designers intend a product's organisational origins to be *identifiable* (Monö's fourth and final semantic function) is discussed below, in the section titled *The brand*.

> *"In a professional arena you tend to have an aesthetic that's saying something about the product, in the consumer world you're having a product that's saying something about you. I think that's a fundamental difference."* ID-03(I)

The symbolic intentions that designers form are often strongly influenced by the brand responsible for the product. This is because brands are typically aspirational in nature and are strongly associated with personality, culture and lifestyle. However, the brand does not only influence the designer's symbolic intent but also those intentions related to aesthetic impression and semantic interpretation.

The brand

In its basic form, branding identifies products as originating from a particular organisation. However, this identification is often symbolic in nature, as modern brands are associated with qualities that can be quite detached from those of the product. Increasingly, the brand occupies a position of central importance in the corporate sphere, and the product is often one of the main channels through which that brand is communicated.[63] Therefore, for designers, developing an appreciation of the brand often precedes much of the product-specific design work.

> *"The first thing we would do is try and understand what [the brand] means. That's a massive piece of work. To try and understand what that brand's all about [means asking:] what does it look like and what does it feel like, what's its attitude?"* ID-09(II)

Of particular influence on product form is the role of specific 'brand values' and the general 'brand aesthetic'. Brand values refer to the mostly intangible, and often aspirational, qualities that brands communicate. For example, 'freedom', 'confidence', 'rebellion' and 'creativity' exemplify many of the characteristics that brands align themselves with and which consumers seek to acquire through their association with the brand. Distilling the brand down to such keyword descriptors establishes a message that the product should visually convey. Designers then seek to translate those words into individual form elements and an overall gestalt that embodies the essence of the brand.

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[63] A detailed discussion of the brand's influence on design is provided by Karjalainen (2004).

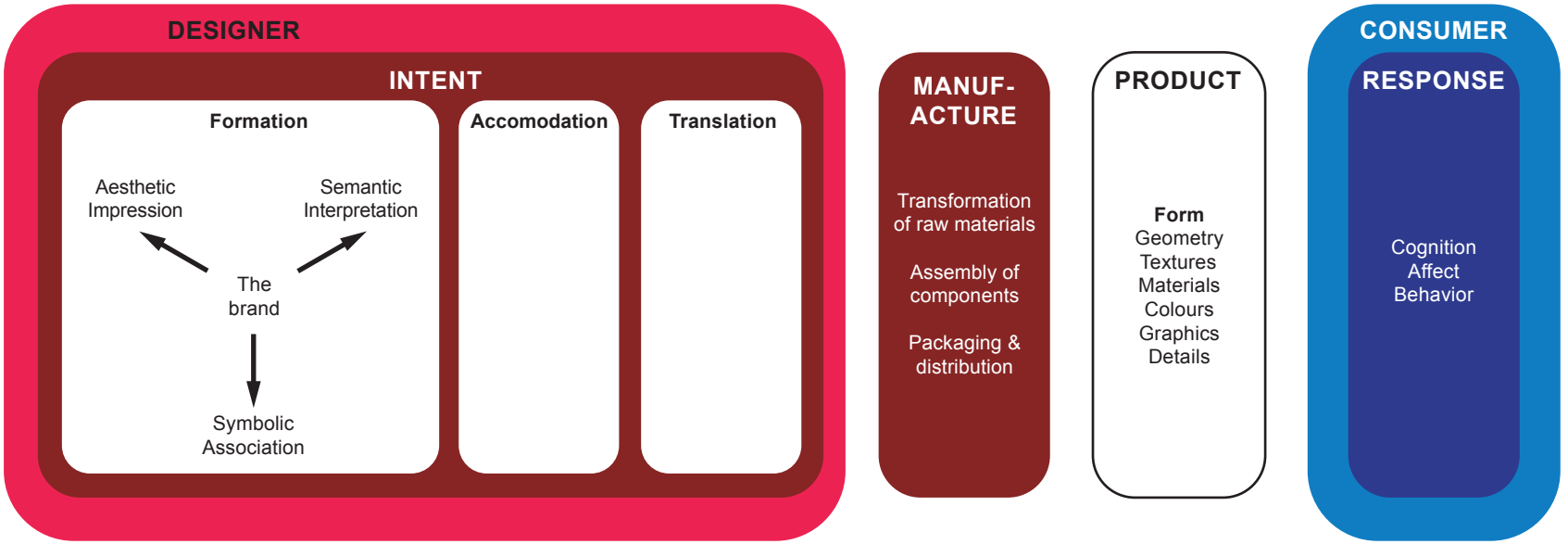

Figure 6-b: *Framework for designer intent with expanded 'formation'.*

> *"They [the client] wanted a physical brand language to be expressed through their devices… That it should be, if you like, almost a brand ambassador."* ID-14(II)

The brand aesthetic refers to the established visual language that distinguishes one brand from another. This is largely determined by a combination of the brand's heritage (the product predecessors) and the brand's current offerings (the product family). These factors not only serve to guide the designers' general stylistic palette, but also determine the treatment of functional details. Furthermore, by visually referring to the brands' commercial offerings (from both the past and present) designers seek to identify the product as belonging to that brand. Thus, the brand aesthetic influences not only the designer's aesthetic intent but also their semantic intent.

> *"The client has this particular aesthetic heritage that they are very careful about… [The product] 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."* ID-01(I)

Designers typically embrace the brand as it offers a strong foundation for symbolic intent and provides a rich source of relevant styling cues. It also encourages integration and differentiation of the product both within its familial line-up and relative to the competition. Thus, in many cases, the designers' understanding of the brand drives the formation of aesthetic, semantic and symbolic intent (see Figure 6-b).

6.1.2 Accommodation of constraints

Designers are not at liberty to freely translate their intentions into any form they choose; their designs must be directed towards objectives and held within practical constraints. However, it is not the constraints themselves that are of interest here, but rather, the influences they exert on product form. These influences may be characterised by the different stages in the product life-cycle to which they apply. That is, the manufacture, distribution, sale, marketing, usage, storage and disposal of the product all present potential compromises that designers must accommodate in their visual solutions.

> *"All the way along the line the design is about compromise. That's true for product styling, engineering, production processes [and] cost."* ID-04(I)

Manufacture and distribution

The range of manufacturing routes available to designers strongly influences the eventual product form. Limitations in the manufacturers' production capabilities, established methods of assembly and pre-defined internal components must all be incorporated within the design. In particular, the tooling budget allocated for producing a particular product acts as a major constraint on product form.

> *"You can get a very beautiful product, fantastic form, really good materials, particular split-line, for instance, that can be shot out of the water by cost… We wanted to have a little bit of movement in the split line because it softens the whole product… We spent time drawing and making lovely models and [the client said] 'can you put a straight split line through there?' So, cost really has an impact.* ID-10(II)

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. Here, the drive to increase stacking density (on pallets, shipping containers, etc.) encourages small, light products with collapsible components, and geometry that tessellates efficiently.

Sales and marketing

In a competitive commercial environment, the primary objective imposed upon the designer is simply that the product should sell. Therefore, the requirements for the product to satisfy (or stimulate) market demand, achieve the expected sales volume and return the appropriate level of profit all shape the product.

> *"I think that it's definitely a necessary component of every project, [the] consideration of it actually working commercially. I don't think that what we do is so artistic and pure that that isn't an issue. It definitely is an issue."* ID-17(III)

The role of branding in defining intent has already been described. However, in certain instances, the requirement to convey brand values and adhere to a brand aesthetic may also be viewed by designers as a constraint. In particular, expressing product qualities that are dictated by the brand may limit the range of product

characters that are available to the designer. Furthermore, the precedent for using specific form elements or corporate colours may compromise other visual objectives that the designers hold. However, although the brand must often be accommodated, its pre-eminent position in the corporate sphere generally means that the product is in the service of the brand rather than *vice-versa*. Therefore, it is more appropriate to consider (and represent) the communication of the brand as a driver of design intent rather than as a limitation that is imposed upon those intentions (as in Figure 6-b).

Usage, storage and disposal

To justify their position in the marketplace, commercial goods must offer value to consumers and often do so through the provision of some useful operation (as opposed to being purely decorative). Therefore, the designer must accommodate the requirements for the product to both function correctly and be conveniently usable (within any relevant regulations).[64] This necessarily entails consideration of ergonomic factors such as anthropometrics, environment-of-use and task demands.

> *"So this [manufacturing] process allowed us to have big raised areas which made it comfortable to interact with, but also gave it a certain look. It was partly driven by the aesthetic appeal that they wanted, or were striving to get, but it was also driven by the ergonomic angle."* ID-13(II)

That products must be stored whilst they are not in use and that they must also be disposed of when no longer required are also factors that influence product form. As with distribution constraints, this influences the size and geometry of products, whilst also moderating the range of materials that can be considered.

Project resources

In addition to the constraints imposed by the various stages in the product's anticipated life-cycle, designers must also operate within the constraints associated with the project itself. These include the financial and human resources that can be committed and the time that is allocated to creative activities. Such project constraints do not just impact the manner in which designers work, they also

[64] Clearly, the interpretation given here is 'aesthetics-centric'; a more general treatment of design practice would most likely consider the operation of the product (and many of the other factors listed in this section) to be design objectives rather than design constraints.

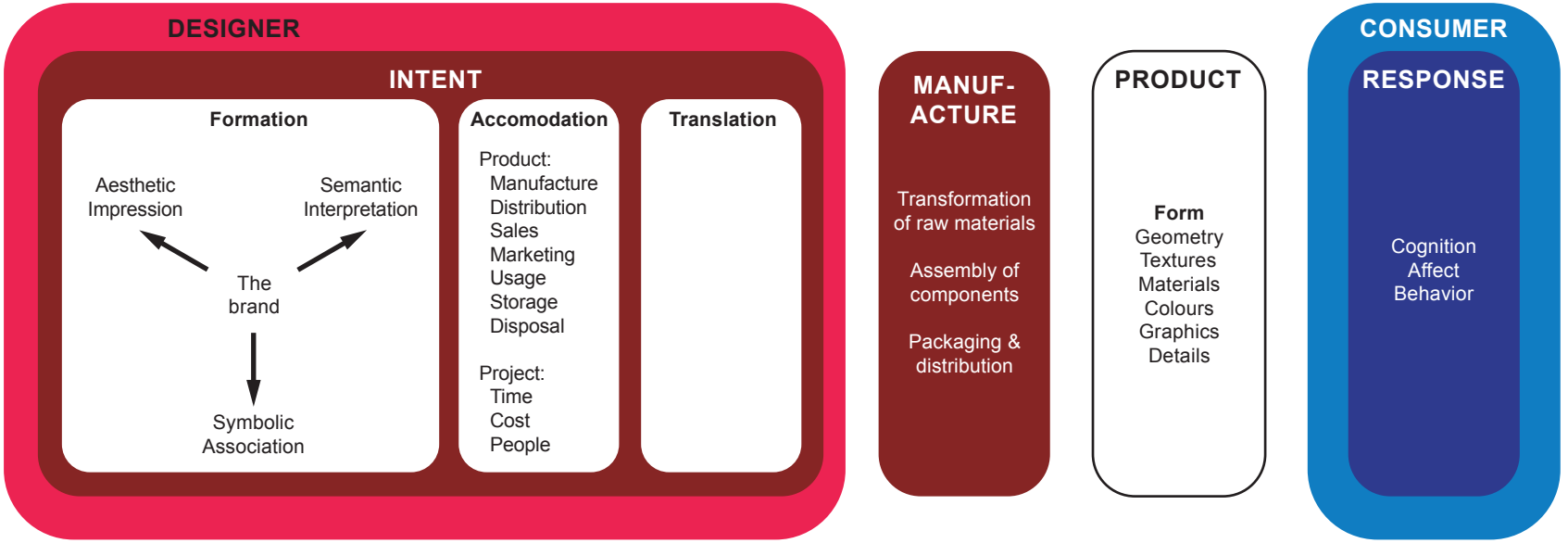

Figure 6-c: *Framework for designer intent with expanded 'accomodation'.*

influence the visual output from that work. This is because limited project resources prevent designers from fully translating their intentions into the most appropriate form (See Figure 6-c).

> *"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."* ID-10(II)

However, whilst these limitations may prevent the purest incarnations of the designer's intentions from being realised, it is not simply a matter of constraints having a detrimental effect on the design process. On the contrary, the various constraints that designers seek to accommodate in their visual solutions are generally viewed as a stimulus for developing creative solutions. Thus, constraints are often incorporated into the visual design process as welcome challenges that improve the originality of the eventual solution.

> *"There's a conception that if you put a constraint on someone it kills innovation. But that is totally wrong. It breeds innovation, it breeds creativity."* ID-03(I)

6.1.3 Translation into form

In order to translate their abstract intentions into physical form, designers engage in a variety visualisation activities. The output from these activities range from low fidelity, two-dimensional representations (*e.g.* sketches) right through to highly finished, three-dimensional models (*e.g.* prototypes). These visual artefacts are used to facilitate clear communications related to product form as they are employed in meetings within the design team, with the client and with other interested parties (*e.g.* manufacturers). However, these visualisation activities are not simply a closing stage in the design process but are instead vital in determining the intentions that are formed and in finding answers to the constraints that must be accommodated. Thus, visualisation is often the very tool by which design solutions are reached rather than just a means by which those solutions are represented.

Imaging

A number of mental, verbal and physical imaging activities are typically employed in the early stages of visualisation. These include a combination of thoughtful reflection,

open discussion and outward gesticulation that whilst not necessarily resulting in permanent physical records are nevertheless highly influential in determining the course of the visualisation activities that they precede.

> *"Before I sketch I just leave it there [in my mind] and, you know, it might do nothing for a week or three weeks and then suddenly [there'll] be some weird connection that gives it a new direction or a slightly new variation of what it was. And then I'll sketch."* ID-17(III)

Sketches and illustrations

Sketches, and other forms of hand-produced illustration, are often the key tools in developing the basic form of the product. They are used to quickly record fleeting ideas, to develop such ideas into workable solutions, and to communicate those solutions to others.

> *"Being able to draw… I think it's still the fastest, quickest way to get your ideas across. Both internally in the studio and to external people… So, the sketching is a very strong culture here with us."* ID-05(I)

As discussed below, designers may also employ software to generate product visualisations. However, this does not eliminate the need for hand-drawn representations. On the contrary, the free and expressive qualities of sketches and manual illustrations allow designers to capture and communicate the essence of their designs without necessarily establishing all the details of its execution.

> *"In some presentations we've gone back to doing watercolours… very loose and impressionistic, very much about capturing the emotion. Rather than a computer system, which forces you to define every single surface."* ID10(II)

Computer aided design software

Designers may use computer-aided design (CAD) software to assist in the problem-solving process. Importing the geometry of existing components into the software-based environment permits designers to develop their design solutions within the spatial constraints imposed. Furthermore, CAD may be used to generate photo-realistic rendered images and produce three-dimensional high fidelity models. In comparison to the often loose and expressive representations developed through sketching and illustration, CAD allows designers to work through the details of the

product's visual form with consistent and accurate results. However, the products that result from these processes are not left unaffected by the software used in their creation. Principally, each software package has its own unique feature set which both encourages the use of certain form elements and discourages the use of others. As such, the software itself strongly influences the look of the product.

> *"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.*[65] *Just because of the way the object looks."* ID-08(I)

Physical models

In addition to the three-dimensional representations that are generated from computer-based models, more traditional model-making methods are also employed. These include the shaping of paper, foam, clay and wood to variously illustrate the desired qualities of form, scale and finish. These physical models are particularly valued because they rein in the designers' imagination and focus their attentions on the practicalities of what can be made.

> *"When you're making a model, the first thing is you're dealing in reality… It's only when you make it, and you realise that it can't work that you are actually designing… models are able to move very fast to actually making it into a reality"* ID-19(III)

Whether by crude sketches or sophisticated models, visualisation activities allow the rapid synthesis of product forms. These forms are then evaluated for their fidelity to the original intent and may further act as stimuli to assess the validity of those intentions. However, translating designer intent into physical product form is not a mechanistic or formulaic process, but one that draws heavily on the designers' intuition and creativity.

> *"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."* ID-17(III)

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[65] Alias and ProEngineer are competing CAD packages (see www.alias.com and www.ptc.com respectively)

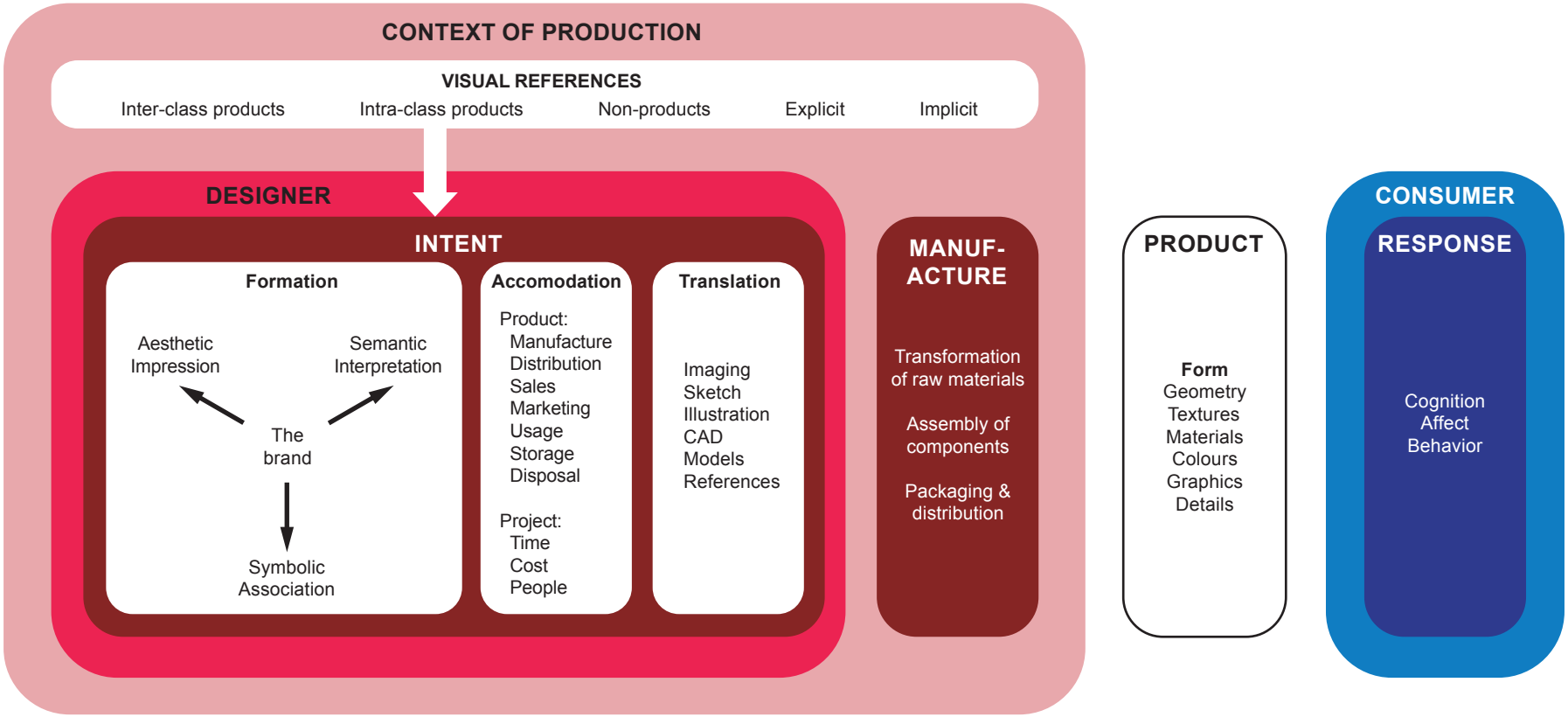

Figure 6-d: *Framework for designer intent with expanded 'translation'. The 'visual references' are shown originating from the 'context of production'.*

These intuitive processes involve elements of play, accident, exploration and inspiration as designers immerse themselves in the problem. As such, the designers' awareness of, and involvement with visual culture provides a rich source of references which they draw upon during the design process.

Visual references

Designers may draw on a broad range of visual references as a source of inspiration for the product. These references include products within the same category (intra-class), products from other categories (inter-class) and non-products (*e.g.* natural objects). Such references are often employed to aid the consumers' semantic interpretation of the design. That is, they are intended 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 or attributes that the product possesses.

> *"Subconsciously, to anyone who's looked at a gun's magazine, the proportion of this [product] 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."* ID-10(II)

Designers may consider these references as either *explicit* or *implicit*. Explicit references are those that designers intend the consumer to perceive and recognise in the product. Implicit references are those that designers do not intend the consumers to perceive but the effects of which they hope will somehow be felt. In addition to these intentional references, accidental (or unconscious) references may also be made and once these are identified, they are either embraced (if considered valuable), disguised (if considered damaging) or ignored altogether.

> *"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."* ID-14(II)

However consciously designers intend their references to be perceived, and whatever it is they are referring to, the references themselves always originate from the same source: the designers' context (see Figure 6-d). References are therefore determined by the designers' previous professional experience and the products, entities or concepts with which they are familiar. As such, designers may employ references, the true origins of which are beyond most consumers' comprehension. In these cases, the cultural divide between the two parties and disparities in their levels of visual

sophistication limit the extent to which designers intend their references to be recognised. In most cases however, designers purposefully employ references that are shared by the consumers towards whom the product is to be targeted. This, along with the formation of appropriate intent, requires an understanding of the target market's cultural context and the preferences that they exhibit. Where designers do not already possess this insight, some form of consumer investigation may be required (see section 6.2).

6.1.4 Moderating influences

As discussed in the consumer response section of the literature study, successful communication between the designer and the consumer may be compromised by a variety of moderating influences. Unlike constraints, which are purposefully accommodated during the design process, these moderating influences are typically unanticipated, unacknowledged, or beyond the designers' control. They can thus prevent the formation of an appropriate message, corrupt the translation of any such message into visual form or affect how that form is delivered to the consumer.

> *"The product gets beaten up before it's born, then it's manufactured and ends up in a rubbish shop with a rubbish salesperson. It [therefore] needs to have a core of something pretty amazing that'll make it last."* ID-10(II)

> *"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."* ID-04(I)

The designers' personal characteristics

The personal characteristics of the designer necessarily have a strong influence on the product form. Especially in consultancies, the designers' experience of previous projects influences the breadth of product domains upon which they draw and the 'cross-pollination' that occurs between different projects. The designers' competence and the effectiveness of the supportive structure within which they operate influences every stage of the design process. This includes the designers' technical knowledge of manufacturing techniques as this may influence the extent to which their intentions survive production.

> *"The less you know about how it's going to be made means that its less likely to be like you designed it."* ID-08(I)

Because designers use their own visual sensibilities and intuition in the design process, their personal preferences necessarily shape product form. The extent to which this is encouraged (or even acknowledged) depends on the level of 'authorship' ascribed to the designer. At one extreme, there are the 'artist-designers' who posses their own style and who are, in effect, their own brands. At the other extreme, are the 'contractor-designers', who perform a piece of design work for the client and adapt their style to suit the brief.[66] Products designed by the artist-designers often exhibit a distinctive set of visual characteristics and are easily identifiable as the work of that individual. Conversely, the personality of the contractor is almost invisible in the finished product as their own preferences are subsumed by the needs of the client. Between these two extremes lies the spectrum of 'consultant-designers' who collaborate with the client in defining what is required but who still produce products somewhat anonymously.

Because of their relative fame, artist-designers are freed from many of the constraints that characterise consultant design practice. Importantly, they are often approached by their clients for their distinctive aesthetic, and therefore their own visual sensibilities or preferences are expected to strongly influence the product; in many cases that is precisely what the client is paying for. Furthermore, the client's brand, which is central to the work of consultant-designers, may actually be subservient to the artist-designer's *own* brand. That is, the artist-designer's heritage, values and aesthetic may dominate or replace those of the client. This means that in the marketplace, the resulting product, or range of products, is presented as a separate brand to that of the client (or a sub-brand within it).

> *"The idiosyncrasies of [the clients'] 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*

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[66] The researcher wishes to acknowledge Daniel Charny's influence in labeling these types of design practice.

> *way, it would be hard for us to accommodate that. It wouldn't be successful."* ID-19(III)

With respect to designer intent, these privileges of the artist-designer distinguish them from their consultant counterparts by freeing them to design for their own aesthetic satisfaction rather than those of the eventual consumer. They therefore claim to be unconcerned with anticipating consumer response and do not consciously strive to evoke specific reactions. For example, in the quotations below, the consultant-designer's attitude to the consumer (illustrated in the first passage) contrasts strongly with that of the artist-designer (illustrated in the second passage).

> *"We're not putting our own individual names to things: this isn't necessarily my vision of a perfect world. [Instead] this is 'how do we create something that we think the market it's designed for is going to buy into?'"* ID-11(II)

> *"Of course, when you look at it, things have meanings…But it's not about, you're not writing, you're not doing things by market research. I mean although what you're doing is for people to use… the market itself…is almost a necessary evil."* ID-21(III)

The level of authorship attributed to the designer influences the designers' attitude to the consumer, the client and the product. It therefore acts as a moderating influence on intent: potentially diminishing it and potentially amplifying it relative to the effect of other factors (see Figure 6-e).

The consultant-artist distinction is a useful way of categorising designers by their outlook rather than by organisation size, specialisation or professional experience. However, no designer is entirely free of technical, financial or political constraints, nor are they able to design in a fully objective manner. Therefore, all designers may exhibit characteristics of each type at different times and on different projects and thus the consultant-artist distinction can be considered as a way of classifying the designers' current mode-of-working rather than their inherent type.

Influences on production

Manufacture of the product has already been considered as both an influence on intent and a constraint that must be accommodated. Further to this, manufacturing can also act as a moderating influence when production decisions are taken out of the designers hands. This means that intentions that were consciously embodied in the

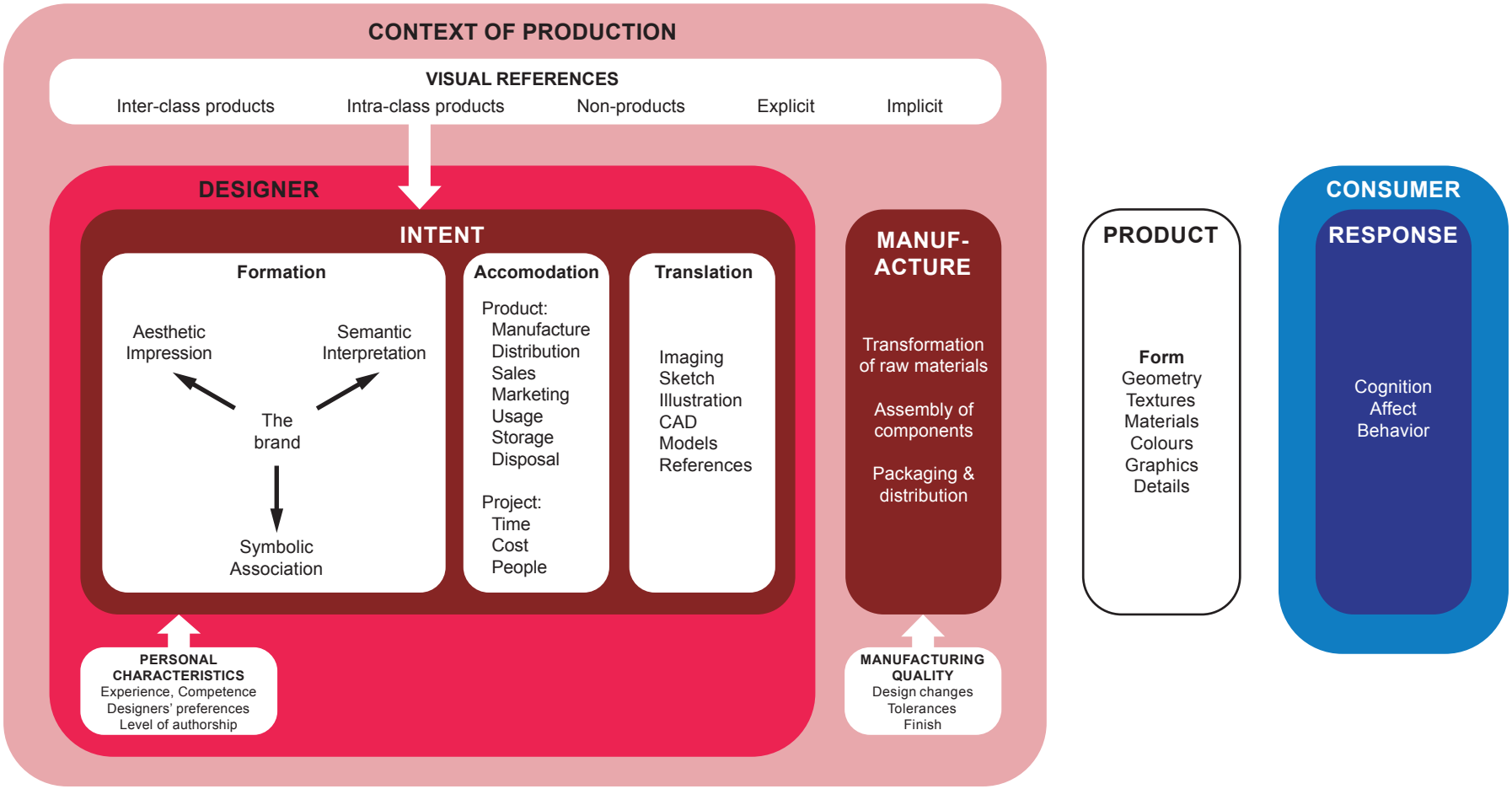

Figure 6-e: *Framework for designer intent with the moderating influences shown* originating from *the designer and* acting on *manufacture*.

product form are corrupted by unanticipated changes to the geometry, colour, materials or detailing. Whilst such changes may ease assembly, or lower costs, they are often made in ways that are needlessly unsympathetic to the design. Thus, the product aesthetic may be severely compromised by the way in which it is manufactured (see Figure 6-e).

> *"[An] engineer in Asia 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. So the way it's been tooled and engineered has created that aesthetic mismatch, which people will now judge the product on."* ID-03(I)

Further exploration of the moderating influences that act on intent requires consideration of the broader context within which that intent is situated. Therefore, attention is now focused on the relationships that designers have with the other stakeholders in design. This includes consideration of the *consumer investigation* activities that are conducted and *the role of the client* in determining product form. The effect that those relationships exert on designer intent can then be represented by adding two further moderating influences to the framework.

6.2 Consumer investigation

In considering the nature of designer intent and consumer response it is obviously important to consider the relationship between designers and the consumer groups for whom they design. Therefore, this section considers the designers' awareness of consumers and the informal or systematic inquiry that is conducted to acquire further knowledge about them. Whilst consumer investigation is seldom solely focused on defining the visual direction for the project, it does offer information on the consumers' aesthetic preferences and provides other insights that ultimately affect the form of the product. However, despite the apparent benefits that this approach promises, there are barriers to conducting consumer investigation and also difficulties in interpreting its results.

As a formal input into the design process, consumer investigation is a relatively new phenomenon and its influence on product aesthetics is not yet well reported in the literature. Therefore, the process of consumer investigation is outlined here before its influence in defining product appearance is discussed.

6.2.1 The process

The process of conducting consumer investigation normally requires that the consumer population is sampled from, a topic of interest is identified, and that some research methods are employed by investigators. This all leads to an output summarising the findings of the investigation that can be distributed amongst the relevant parties. Whilst consumer investigation may be systematically conducted in a highly formal manner, it may also be informally applied or performed somewhat intuitively.

The sample

The target market is the first immediate choice when considering those who should be studied. This includes those who purchase the product and also, in cases where there is a difference, those who use it. This naturally leads to the identification of not only typical consumers but also 'edge cases' who, whilst not truly representative of the target market, do exhibit interesting characteristics that can promote innovative thinking amongst the design team. 'Early adopters' are an example of one such group who are often studied because their progressive attitudes to technology and design are both indicative of future trends and influential in shaping those trends.[67]

> *"You are just trying to understand how this would fit into an early adopter's life or how it wouldn't… What other things do they buy, use, want, desire? How should the product be reflecting that in some way? Round edges? Sleek? Slim?"*
> CI-07(IV)

Also of interest are the intermediaries who are involved in the distribution and sale of the product; this includes the clients' sales force, the retailers and the "gatekeepers" who recommend a product, or somehow guide selection (*e.g.* journalists). Finally, consumer groups that are identified as aspirational for the target market may be studied as their association with, or endorsement of, the product can be highly influential in determining the target markets' consumption behaviour.

[67] Many designers are, themselves, early adopters (or at least self-identify as such) and this provides further support for them designing for their own sensibilities.

Designers consider themselves to be constantly absorbing cultural information and this gives them an insight into the consumers for whom they design. However, in many instances, designers conduct small-scale, informal investigations as an intuitive and routine part of the design process. This may involve quickly generating a crude sample that approximates the target market by exploiting their network of personal contacts and then seeking insight through contact with this group.

> *"We tend to use wives, and friends and things. We don't go out of our way to do [research]."* ID-03(I)

When a more formal research approach is used, the sampling method may involve separate recruitment companies providing groups that are claimed to represent a particular demographic. Studying such groups gives the designer insight into, and empathy for, the individuals to whom their designs are targeted.

The topic

With each of the groups studied, but particularly those representing the target market, the consumers' lifestyles and attitudes are the main focus of inquiry. Of particular interest are the brands with which they identify, and the 'product world' that they reside in. That is, the researchers investigate the products that these consumers surround themselves with, the products that they are aware of and the products that they aspire to own. In addition to these consumer-focused investigations, significant research effort is also dedicated to the identification and analysis of social, political and technological trends. These broad studies give an indication of the external forces that contribute to consumer tastes over both the short and longer term.

> *"Basically we've got a network of people around the globe that we use to conduct tests for us; take pictures of where they live, what they do."* CI-05(IV)

The investigators

Consumer investigation may be conducted by the designers themselves, by their in-house research colleagues, by their clients, or by some independent agency working on their behalf. Additionally, some collaborative research team comprised of representatives from these parties may be assembled for a specific project.

Where the designer conducts consumer investigations in isolation, the approach is often informal and small-scale. When a more formal research approach is required

(or requested) then designers may take recourse to the services of a research group within the same consultancy, or an external agency that provide such a service. In some instances, research may already have been conducted by the client organisation (or some agent acting on their behalf) before the designers' services have been requested. In these cases, designers may simply be provided with the research findings as presented in a formal report. However, there is strong motivation to include the designer in any investigations that are conducted, so they may gain direct experience of the consumer, their environment and their cultural context.

> *"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. If we hadn't been involved in that… it's very unlikely that we'd have realised the significance of some aspects of it."* ID-11(II)

The methods

The nature of consumer investigation activities range from informal observations that designers conduct in the natural course of their work, to more systematic multi-method research programmes. With formal consumer investigation, consumers may be asked to self-report on their own lifestyles, attitudes and consumption activities, in some form of regularly maintained diary.

> *"All these people got a pack and they kept a diary of their week. They cut things out of magazines, adverts, they took pictures of their favourite clothing items, what they had in their bedroom, where they went with their friends to give us an idea about what they're doing with their life."* CI-05(IV)

They may also be interviewed, surveyed, or asked to participate in group discussions that focus on the products that are currently commercially available. Where insights are sought that offer more situational or contextual validity, techniques such as video ethnography are preferred. This typically requires the investigator to live amongst a household or community for an extended period with the aim of revealing behaviours and attitudes that are inaccessible through direct inquiry.[68]

[68] A period of one week is not uncommon, and whilst this is very brief in relation to conventional ethnographic practice, it is relatively long in relation to most consumer investigation activities.

The output

Whether performed by, or for, the designer, the findings from consumer investigation activities are often summarised in a visually rich format. For example, designers often produce image boards that represent the lifestyle, aspirations and products with which the consumers are associated. In addition to characterising the target market, these boards often represent the designers' initial intentions and suggest directions in which the design might proceed. The more formal, structured reports that research groups produce often include similar images supported by titles, text and tables that provide additional details. These reports must often serve a variety of audiences as they should both inspire designers whilst also being able to educate different groups within the client organisation.

> *"A lot of what we do is very visual to try and bring it to life, because it goes to a number of different audiences… It goes to marketing, design, it can go to NPD,… to top level management.*[69] *So, it's giving everyone something."* CI-05(IV)

6.2.2 The application

Irrespective of how consumer investigations are conducted, or how they are reported, the ultimate objective is that the designer improves their consumer insight. This insight is acquired either through exposure to the research findings or, preferably, through experience of directly participating in the investigation. The designers' improved understanding of, and empathy with, the consumer may define the design direction, offer feedback on the effectiveness of the final product, and help manage client relations.

Design direction

In design projects where consumer investigations are conducted at the outset, the insight gained may help define the very direction in which the design proceeds. By gaining exposure to specific target markets, designers gain insight into the consumers' aesthetic preferences, their relationship to products, and the visual nature of the environments in which the product will be situated. As such, the output

[69] NPD: New Product Development.

from consumer investigation is often suggestive in nature rather than prescriptive; this allows the designers to treat the research results as a point of departure rather than as guidelines to which they must adhere.

> *"So we kind of hint at design direction, but not in a definite way because it goes to designers and that's what they do. We're just saying 'this is what people are seeing and this is what they're interested in and they expect, but what you [the designer] do with it is still quite open.'"* CI-05(IV)

Where investigations are only conducted after the design work has already commenced, it may be used to confirm or deny existing ideas and thus be simply regarded as a 'reality check'. In either case, the designers may draw inspiration from what is learned in the investigations, as they are exposed to new varieties of lifestyle, and attitude. This can take the form of breaking down preconceived notions of the target market, testing out assumptions that the designers have formed or allowing new members of the design team to rapidly assimilate the nature of the consumer needs.

> *"[By showing consumers your designs,] you can get some good responses that you can map back to particular features of those products. Like colours, simplicity of overall surface, etc. A lot of it, I guess is quite obvious, but what we're trying to do is confirm those obvious hypotheses if you like."* ID-10(II)

Feedback

If designers intend to evoke specific responses in consumers then consumer investigation activities conducted after the product has been launched provide the opportunity to ascertain whether those objectives were fulfilled. That is, eliciting feedback from consumers on their perceptions of the product may inform designers as to whether the design was successful or whether it was interpreted in some way other than that which was intended.

> *"We created that interior, for the brand's [flagship] store, and we were obviously hoping that when people walk into that store that there are certain elements of the brand that they kind of capture and recall. And there was definitely research done with that particular brand store to find out if the actual communication was happening."* ID-09(II)

Despite this opportunity to 'close the loop', designers are seldom exposed to detailed information on how consumers actually responded to products or what factors may have been influential in determining that response. This is largely because, at the time of product launch, the designers are typically engaged on a new project and additional resources are unlikely to be committed to projects that are no longer 'live'. Whilst the client organisation will, in most cases, provide information on the product's sales performance in relation to establish targets, such information will be primarily quantitative in nature. Thus, designers may discover how many units were sold, at what price, and in which regions, but will not typically know who those consumers were or why those purchase decisions were made. Thus, feedback on the product form is often limited to that offered by their colleagues, by the press or by awards committees. Whilst such responses may be gratifying, they mostly originate from other designers and thus are not necessarily representative of consumer perceptions.

> *"Design awards are useful to some degree, as a gauge of feedback of how well something's been designed, but they typically are judged by other designers, so that doesn't necessarily mean that the product's right. So design awards need to be taken with a pinch of salt."* ID-11(II)

Client relations

In addition to having direct application in the design process, consumer investigation is also a political weapon that designers employ in their negotiations with clients.[70] This manifests itself in three distinct forms. Firstly, designers use consumer investigations to demonstrate that a rigorous, methodical approach has been adopted. This not only makes the design process more comprehensible to the client, but is also used to justify the design expense. Secondly, the client often expects certain formal investigations to be conducted in an attempt to reduce the risk associated with the design project. Designers may thus seek to assuage the clients' concerns by performing (or permitting) the studies that are requested.

[70] This aggressive metaphor actually originates with the designers themselves, who frequently described the results of consumer investigation as 'ammunition against the client'.

Figure 6-f: *Illustration of how consumer investigation provides designers with information about the groups for whom they design.*

> *"What this process does is it says, 'we've spoken to all the stakeholders involved in this project - [they have] all given us what they think, and we've been interpreting that. So,… there's [probably] a higher chance of it being successful.'"* ID-09(II)

Such apparent compliance does not necessarily correspond with effective investigations however, as they are often conducted in a way that is considered unconstructive and thus the results may be dismissed by designers as an irrelevancy. The third client-oriented application of consumer investigation is the insight gained by designers during their investigations, which allows them to act as a proxy for the consumer when communicating with the client. The designers' relationship with the client is considered in detail in section 6.3, but it is sufficient to state here that the clients' own aesthetic preferences may be suppressed by effective representation of the consumers' lifestyles, tastes and aspirations (see Figure 6-f).

> *"We had to show [research findings] to the client: 'look, this is the world of our [customers]… this is what it's got to look like, and not what you think'"* ID-02(II)

6.2.3 The barriers and limitations

Despite the potential benefits that consumer investigation offers the designer, there still remain significant barriers to conducting such research and difficulty in interpreting any data that results from it.

One of the most significant barriers to conducting formal consumer investigation is the clients' perception that such activities will add little value to the final product: that it will not be cost-effective. Within the limited resources allocated to the project, committing time, money and people to the intangible benefits of insight and empathy may be perceived as a luxuriant digression. Designers are also, at times, reluctant to request extra resource for research because they fear that acknowledging their incomplete understanding of the consumer will diminish the clients' confidence in the design team. Where concessions *are* made to conducting consumer investigations but the allocated resources are limited, logistical research problems may be encountered. In particular, small-scale studies may struggle to establish a sample group that is representative of the target markets' demographic, geographic and cultural spread.

> *"We will try to gain access to consumers… if there is the budget and if there is the time."* CI-01(IV)

The competitive secrecy surrounding design projects also constrains the consumer investigation activities that can be performed. For example, exposing representative consumers to early product visualisations, or working prototypes, may compromise the confidentiality requirements associated with the project. Therefore, there is often limited scope for assessing the target markets' reaction to the design prior to product launch.

> *"Most of our clients are rather reluctant to let anyone from outside see the designs in progress. You have to be careful with user involvement."* ID-06(IV)

In addition to these barriers imposed by external factors, the designers' own attitude to the practical value of consumer investigation may also prevent such research being conducted. Designers may feel that they themselves are representative of the target market, that they already have sufficient understanding of consumers, or that, in any case, consumer investigation is of limited value in yielding useful insights. In particular, where consumers are presented with sketches, illustrations or models of the preliminary design, their inability to properly interpret such visualisations may pose severe challenges to communication. When this is combined with a research context that differs strongly from that in which the product will be consumed, the results may be even more difficult to interpret.

> *"I think when you're asking adult people about shapes and colour and so on, you get into territories which are, I think, quite difficult to get at."* ID-09(II)

> *"When they first see something new… their first reaction may not necessarily be their long-term reaction."* ID-13(II)

Designers commonly assert that consumers do not know what they want until they see it, and that they cannot articulate their needs, desires or aspirations. Therefore, designers may have little confidence in the results of consumer investigation activities that require introspection on the part of the consumer. Consumers are also often considered to be so fixated on the past that they are unable to imagine a future that is substantially different to the present. Thus, designers fear that the consumers' response to innovative product forms are not indicative of how they will respond once the product is launched.

> *"It's really the designer's job to think about how the design's going to be in two years time, after production, rather than thinking about the consumer now, because [investigators] ask the consumer to think about a future product in their*

> *current context, and it can kill an idea, because they can't think that far ahead. It is a problem with them, it's a problem with consumer testing."* CI-02(IV)

Whilst most designers acknowledge that consumer investigation is valuable in identifying and resolving ergonomic issues, it is often considered to be of less value in defining the products' aesthetic. Furthermore, the visual clues that such studies do provide may not only be misleading, but can stifle creativity and reduce innovation. Thus, whilst consumer investigators strive to inspire the designer, they are also cautious of placing limits on their visual solutions.

> *"The aesthetics of it are pretty much in the hands of the product designers, the designers who are working on the brief. To be honest, we wouldn't really want to influence that… because it can destroy a good brief. And it can destroy someone's creativity"* CI-08(IV)

Because consumer investigation may be a required component of design projects, they may be conducted despite any limitations that are perceived by the designers. This unavoidably exposes the designer to new experiences or information, and may have both positive and negative effects on the design process. Therefore, even in instances where designers do not fully endorse consumer investigation, or believe in the validity of its findings, it may still strongly influence product form.

> *"It reduces the risk of being completely unsuccessful. But also at the same time it's difficult to make huge innovations or breakthroughs… First of all, 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."* ID-19(III)

Consumer investigation offers the opportunity gain insight into the target market, to design products in collaboration with representative consumers and then to ascertain what their response to those products was. This feedback may enhance the designers' understanding of how products are perceived and lead to further consumer insights that improve future designs. Thus, in many ways, consumer investigation would appear to offer the perfect vehicle by which designers could establish their intentions and define the visual direction in which the design should proceed. However, perceived problems with the accuracy and relevance of the findings may either reduce their impact on the design process or affect that process in undesirable ways. Therefore, difficulties in collecting, interpreting and applying data relevant to

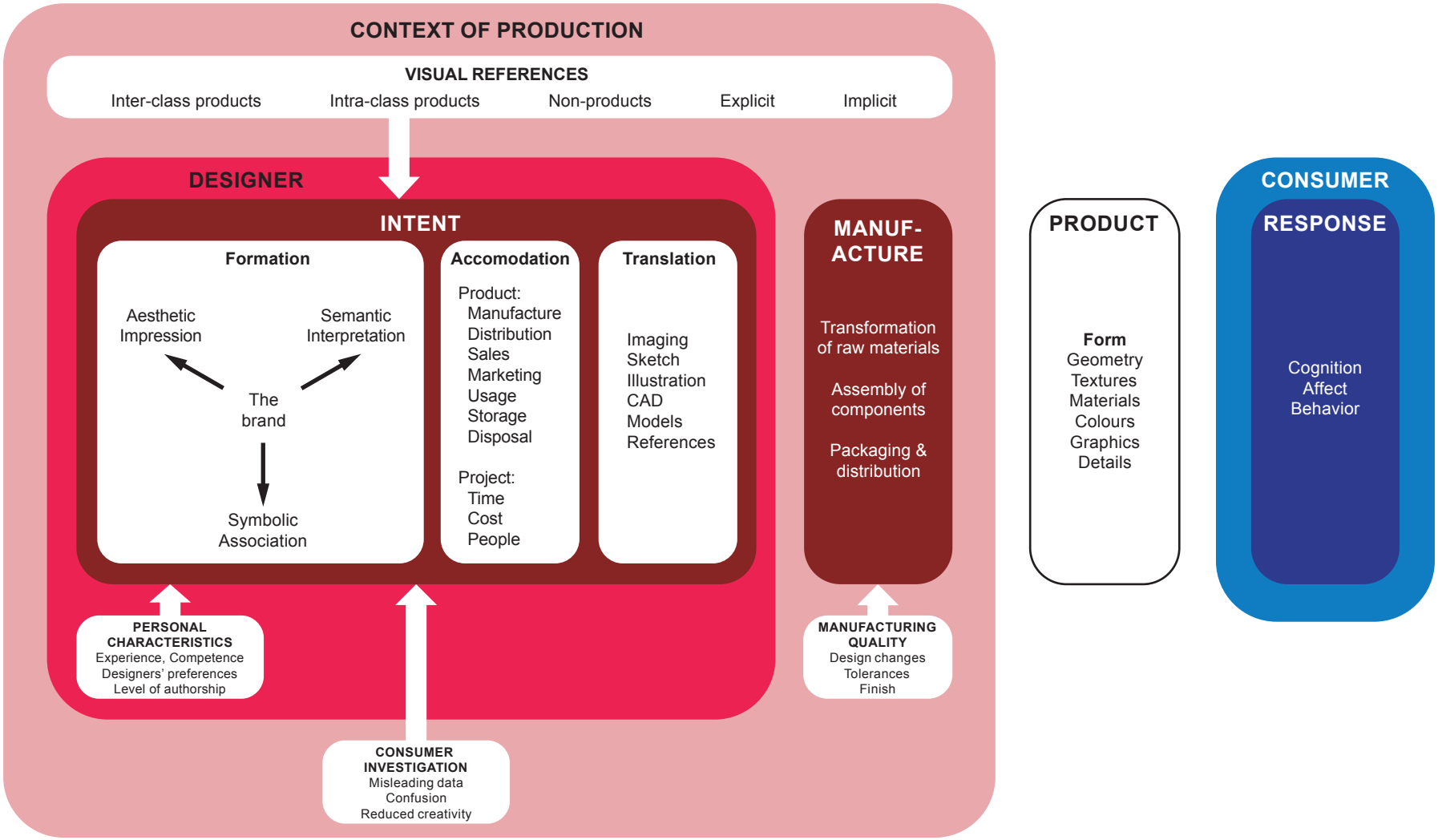

Figure 6-g: *Framework for designer intent (now showing the moderating influences that may result from consumer investigation).*

product aesthetics can lead to consumer investigation acting as a moderating influence on designer intent (see Figure 6-g).

6.3 The role of the client

So far, in this chapter the designer has been described as operating largely independently of the clients who commission their work. This is clearly not the case however and many of the interviews in this study were dominated by consideration of the client. Therefore, although this chapter is focused on the role of designer intent, to place the existing framework within a broader context, this section examines how the designer-client relationship influences product form. This necessarily involves an exploration of the nature of designer-client communication, and the effect of the clients' own aesthetic preferences.

6.3.1 Communication

The initial brief from the client seldom suggests a strong visual direction in which designers should proceed. Instead, the brief is mostly concerned with the specification of details such as space envelopes, manufacturing routes and tooling costs. However, this is not immediately problematic as designers believe that their training, experience and visual sensibilities make them more suited than the client to define the product's appearance.

> *"It's very rare for somebody to come to us with a very detailed understanding of exactly how the product is going to look"* ID-04(I)

> *"They come to you as an external consultant for that visual clarity"* ID-05(I)

It is certainly not surprising that designers are expected to take control of the visual domain of the product's specification. However, the client is the designers' immediate customer and they often have an intimate understanding of the brand. Therefore, appreciating the clients' visual expectations and understanding what they believe the product's appearance should convey is critically important. Consequently, the clients' reluctance (or inability) to express their qualitative expectations causes problems with communication.

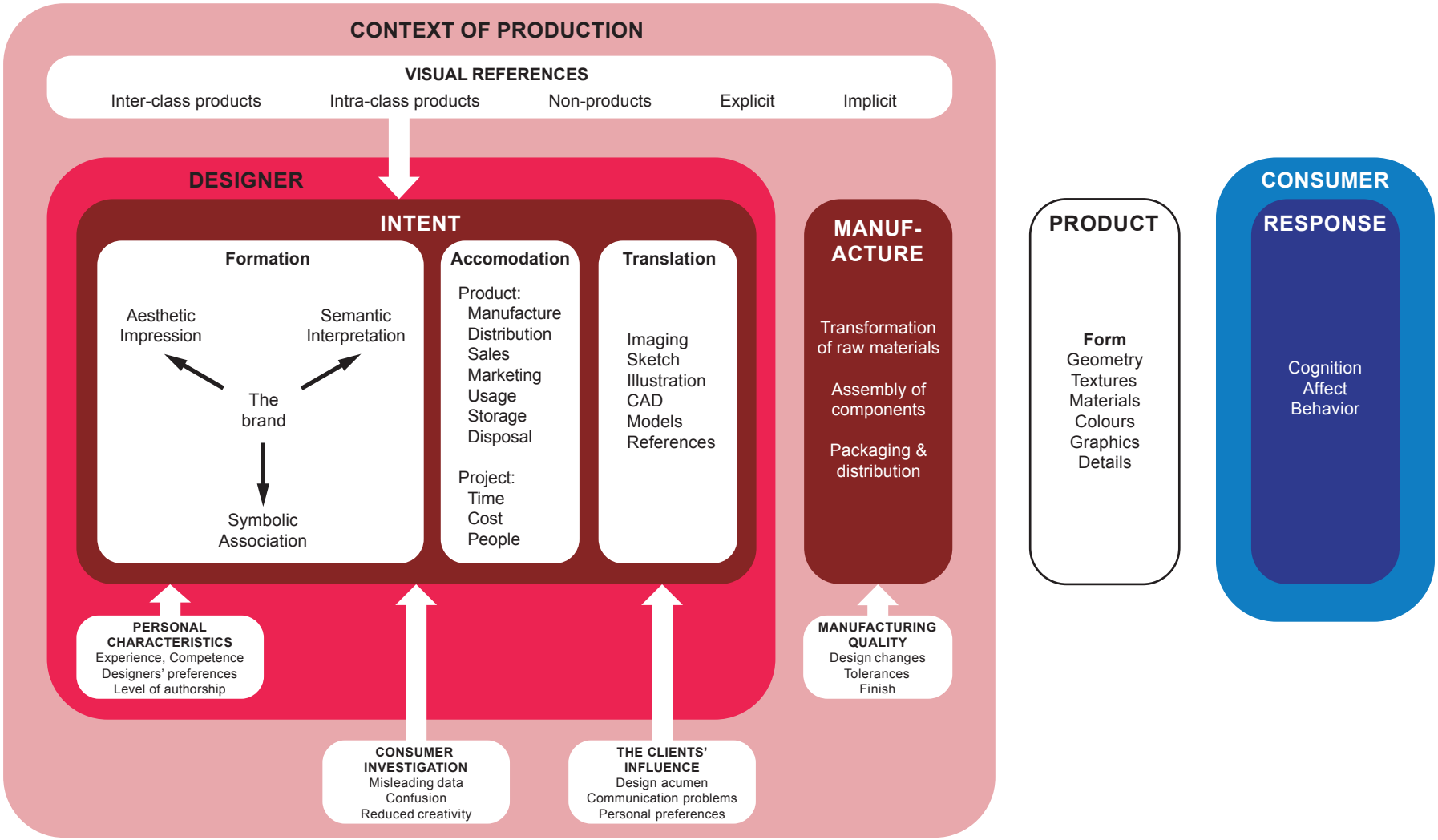

Figure 6-h: *Framework for designer intent (now showing the moderating influences that may result from the clients' influence).*

> *"The clients want to describe… the subjective specification of the product… but find it difficult… So you have to turn into an amateur psychologist to figure it out"* ID-04(I)

Designers naturally consider themselves to exhibit high levels of visual literacy and cultural awareness. They believe that these characteristics distinguish them from their more verbal, less creative clients. Designers' attitudes to their clients' perceived lack of design acumen range from that of nurturing tolerance to confusion and incredulity. In either case, this perceived cultural difference is considered to pose significant barriers to communication.

> *"They are often management people who don't understand anything about design… getting the design across to them [is] a big problem"* ID-02(I)

In addressing these difficulties, designers adopt a variety of approaches to elicit visual information from clients and to inform them of the rationale behind the design's appearance. These approaches often employ the outputs from the designers' visualisation activities as they seek to convey both the tangible and expressive qualities of the design. Especially in large design consultancies the design team may engage in a formal process of educating the client in an effort to manage their expectations. In reciprocation, large client organisations may recruit design-educated individuals (or ex-designers) to work as design managers on the project and interface with the design team. Despite these efforts, the subsequent manufacture and marketing of the product is often taken as evidence of continued misunderstanding. Therefore, the effects of poor communication are represented here as a further moderating influence on intent (see Figure 6-h).

6.3.2 The clients' preferences

Whilst the consumer is most often the stated target for the product's 'aesthetic message', this objective is commonly compromised to accommodate the clients' own preferences and those of the designer. There are therefore, three potential audiences that designers consider when generating the visual form of the product: the consumer, the client and the designer themselves.[71] The relative balance of how much

[71] The subject of designers satisfying their own aesthetic sensibilities was considered in section 6.1.4.

attention is directed towards satisfying each party's preferences is determined by the characteristics of the client, the project, the product and the designer.

With some clients, particularly smaller organisations, the design of the product can be quite a personal matter and the clients' own preferences are thus an important consideration. For example, with specialist technical products, where the client is often closely associated with the end consumer, designers may view the client as a valuable representative of the target market. In such cases, and in the absence of resource for consumer investigation, liasing with the client may be the best alternative to direct consumer involvement. However, in some projects, the personal preferences of the client are apparent even when there is an abundance of information on the target markets' tastes. In such cases, designers use research data as ammunition against the client, to promote the importance of satisfying the consumer. An alternative, less confrontational approach is to appease the client by seemingly incorporating their wishes into the design whilst only doing so in a way that is insignificant and undisruptive. The designers can then proceed in directing their efforts towards serving the consumers' tastes, having satisfied the client that their contributions have been recognised.

> *"The problem is [that] if you do a piece of design that [makes them] think they're excluded, they really try and put their foot in. [But] if you let them in and let them feel like they are part of the process, then they don't stamp [their feet] and the interference becomes less. It becomes more harmonious from that point onwards."* ID-16(III)

Of course, in some instances, the client can neither be persuaded that their opinions are irrelevant nor appeased by subtle accommodation. The clients' opinions thus act as significant determinants of product form, as designers succumb to the demands of their immediate customer.

> *"A marketing director in the [client] company, had a particular view about the shape of the handle and the thickness of the handle… And he pushed this through despite continued resistance. There comes a point where you say, 'right, you're the customer, we'll do what you say.'… 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."* ID-13(II)

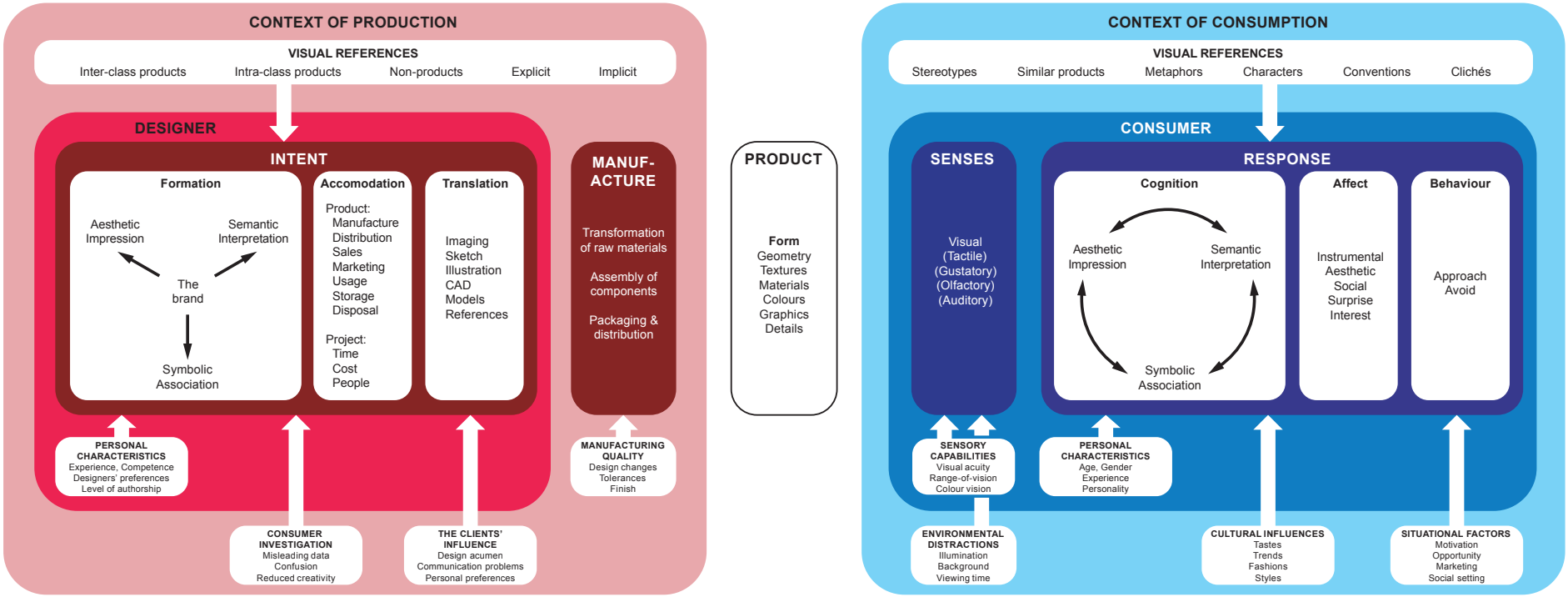

Figure 6-i: *Integrated framework for product aesthetics representing designer intent and consumer response.*

The clients' aesthetic preferences may be resisted or accommodated by the designer during the design process. In either case, the clients' preferences shape product form by diverting attention and resources away from satisfying the consumer. However, despite the influence of these preferences, they are seldom openly acknowledged and are therefore presented here as a moderating influence acting on the design, rather than as a form of intent or constraint (see Figure 6-h). This final moderating influence completes the framework, allowing it to be integrated with that developed for consumer response in *Chapter 2* (see Figure 6-i).

6.3.3 Representing the client

As discussed, the designer-client relationship is highly influential in shaping designer intent and product form. It is therefore instructive to represent the clients' position in relation to the integrated framework developed so far.

Whilst the linear format of the existing framework might be extended to include the client, such a representation either distances the client from the consumer or from the designer (see Figure 6-j). Instead, the linear representation must be disrupted to position the client 'within sight' of both the designer and the consumer, and with each party having their own relationship to the product (see Figure 6-k).[72] Communication between the designer and the client can thus be illustrated by a two-directional flow of information between the two parties. As the brief is negotiated, objectives and constraints, and visualisations that seek to resolve these issues are shuttled backwards and forwards between designer and the client.

The consumer investigation activities performed by, or on behalf of, the designer may now be represented as part of this circle of information exchange (see Figure 6-l). The outputs from such activities flow into the designer, who then communicates with the client. This is highly appropriate, as the output from consumer investigation is often used to support arguments against the clients' own opinions and in support of the designers, who ostensibly represent the needs of the consumer. There is no separate depiction of any information flow from the designer to the consumer. This is because

[72] The interviewees' role in influencing this form of representation, and their approval of it, are discussed in section 6.4.

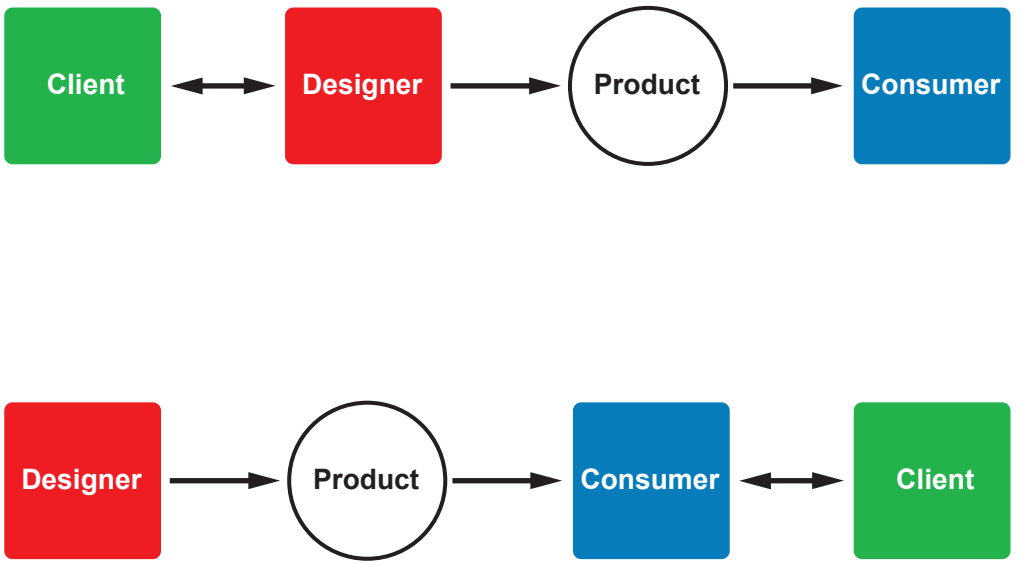

Figure 6-j: *Illustration of how adding the client to a linear representation of stakeholder relations obscures the client from either the designer or consumer (and also from the product).*

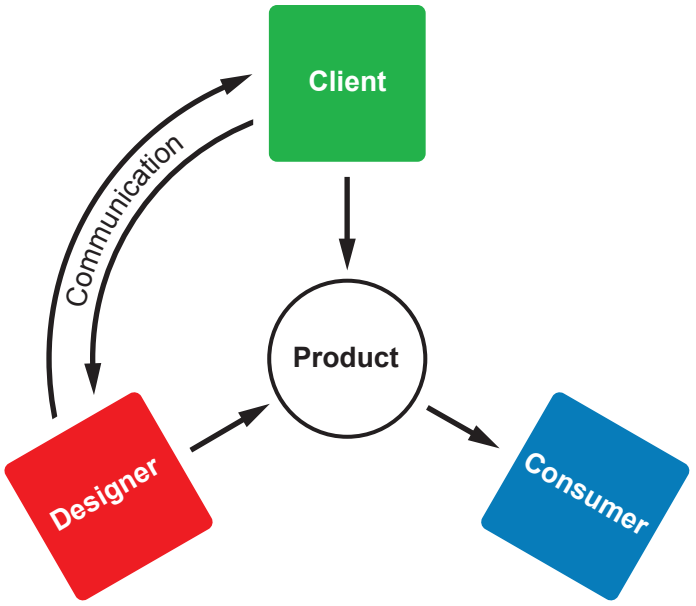

Figure 6-k: *Circular representation of stakeholder relations allowing each party's relationship to the product and the other parties to be represented.*

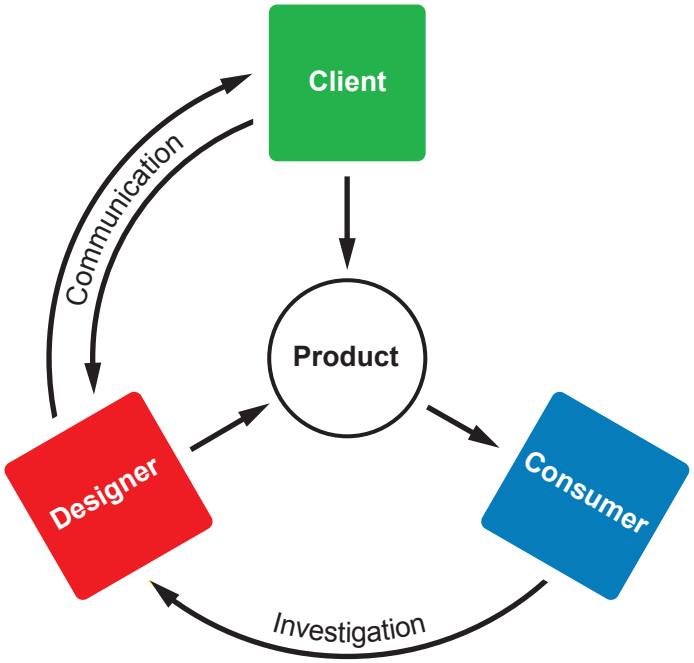

Figure 6-l: *Circular representation of stakeholder relations with consumer investigation added.*

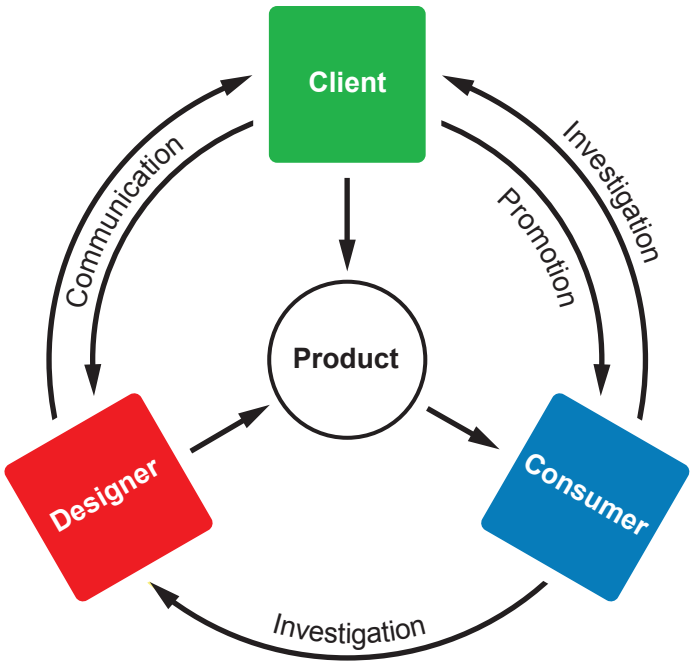

Figure 6-m: *Circular representation of stakeholder relations with the clients' activities added.*

any communication that does take place is typically conducted through the medium of the product (or representations of it).

For completeness, the relationship between the client and the consumer might also be represented with a two-directional flow of information between the two parties. From the consumer to the client flows much of the same consumer information that flows to designer (as discussed in section 6.2). From the client to the consumer, flows the promotional marketing material that often constructs a narrative around the product and suggests many of the symbolic qualities that are associated with the brand (see Figure 6-m).

This general perspective on stakeholder relations illustrates that each party is often influenced by their knowledge of the others. For example, the designers' intentions for how the product should be perceived may be informed through the processes of communicating with the client and investigating the consumer. Similarly, by acknowledging the complexity of design practice, some of the possible variation between different projects can be visualised. This includes consideration of the following questions:

- Which of the three parties drives project inception and how does the project develop (see Figure 6-n)?

- To which of the three parties' preferences is the product more closely aligned (see Figure 6-o)?

- What is the relative cultural divide between the three parties (see Figure 6-p)?

Such an adaptable general perspective on stakeholder relations illustrates the organisational context in which the product is situated. This encourages consideration of the many factors and activities that are seldom regarded as part of the design process despite their influence in determining product form. Thus, by providing such a representation, the broader context of product aesthetics can more easily be conceptualised and new research opportunities can be identified (see section 7.3).

Communication between the different parties should not be perceived as purely involving the exchange of information. In some cases, the arrows in the framework might instead represent the areas in which collaboration occurs. For example, the

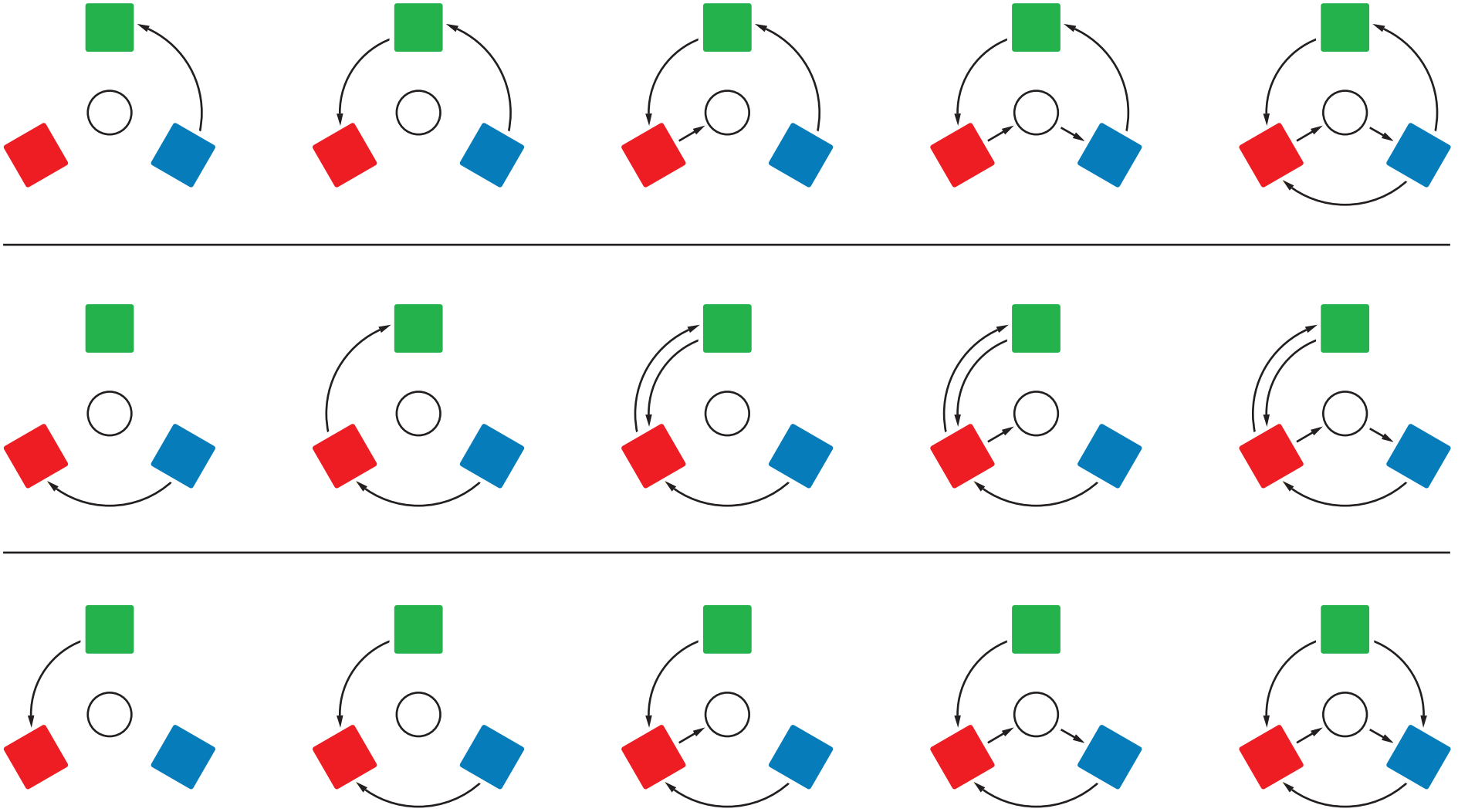

Figure 6-n: *Three simplified examples of how the origins and development of a project might be represesented.*

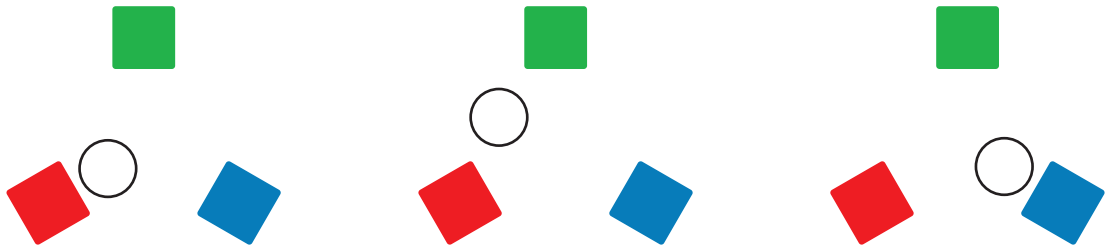

Figure 6-o: *Three simplified representations of how the products' aesthetic may be more closely aligned to the preferences of the different parties, or some compromise between those preferences.*

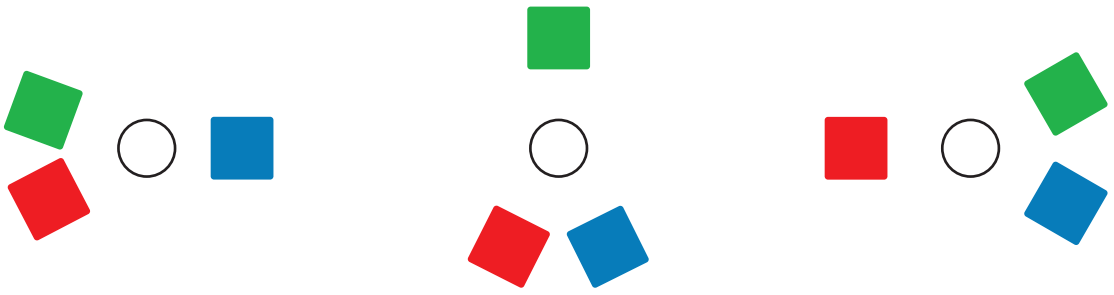

Figure 6-p: *Three simplified representations of how the relative cultural divide between the three parties may vary between projects.*

designer and the client might share information and jointly define the direction in which the design should proceed. Or, the designer and the consumer might collaborate to establish a mutual understanding of the product category and determine the consumer's true needs (see Figure 6-q). Whilst this integrated and somewhat utopian view of collaborative working is at present not truly representative of design practice, it is reportedly the ideal state and the asymptote of current trends. However, as this chapter is grounded in an interpretation of current industrial practice, the use of arrows has been retained in preference to some more 'optimistic' notation.

It is now possible to produce a synthesis of the linear and non-linear perspectives discussed in this chapter by combining a number of the existing elements. This involves inserting both the detailed framework for designer intent and consumer response (Figure 6-i) and the representation of consumer investigation activities (Figure 6-f) into the general structure of stakeholder relations (Figure 6-m). The outcome is the representation shown in Figure 6-r.

6.4 Member validation

Qualitative researchers may make use of external referees, including the informants themselves, in order to check the accuracy of their interpretation (Goulding, 2002: 19, 43). Taking Schutz's 'postulate of adequacy' (Schutz, 1970: 279) as a philosophical basis, such idea-sharing activities have conventionally involved presenting the subjects of a study with the researchers' report and seeking their appraisal (Schatzman & Strauss, 1973; Douglas, 1976). Whilst this approach offers valuable insight into how the researchers' findings are interpreted, as a method of validation it is also epistemologically problematic. This is because member validation is not free from the interpersonal and political ambiguities that characterise all qualitative investigation (Bloor, 1978; 1997). One further problem associated with member validation is that members of the studied group do not necessarily possess the skills or motivation required to analyse and comment on the documents that they are provided with (Emerson & Pollner, 1988). Such issues prompted Bloor to ask, "how does one frame and present one's analysis in such a form and in such a setting that one can be confident that one's respondents will fully understand it [...] ?" (Bloor, 1978: 550).

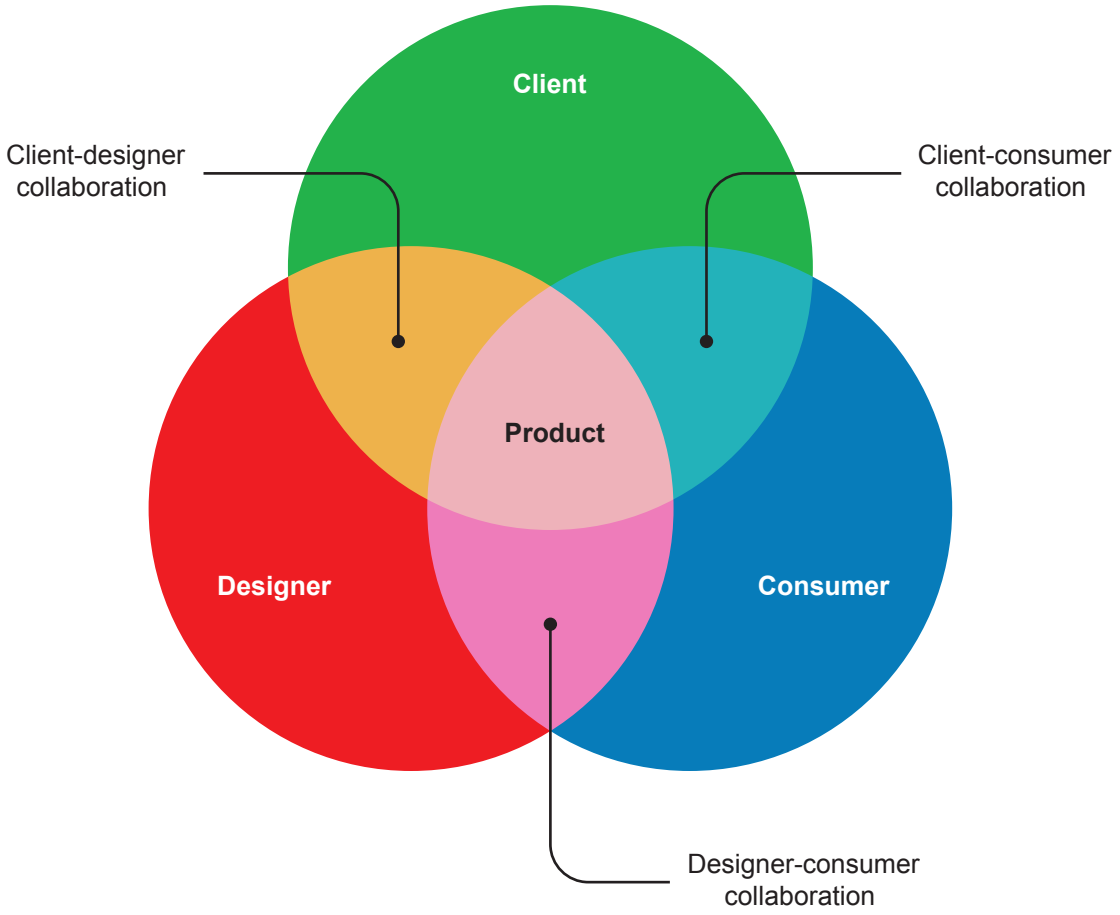

Figure 6-q: *Alternative representation of the relationship between designers, clients and consumers.*

In this study, diagrammatic representations circumvented many of the problems associated with written reports by allowing the researcher's interpretations to be presented in a simple, concise and coherent manner. Therefore, in addition to employing diagrams as elicitation stimuli in this study, they also served as a form of a member validation. That is, the interviewees' response to the researcher's emerging conceptualisations allowed the researcher to assess the extent to which the interviewees interpreted the framework as a reflection of 'their world' (see Crilly *et al.*, 2006). However, other methodological problems of using 'member validation' to actually validate results still remained, and in any case, a true validation stage would be both beyond the scope of this study and outside the boundaries of a grounded theory approach. Thus, whilst for reasons of convention this section is titled *Member validation*, the feedback from the interviewees was simply viewed as another source of data rather than as validation or refutation of the researcher's inferences (see Fielding & Fielding, 1986: 43).[73] This data is particularly valuable however, because it indicates the way in which the design community received the frameworks upon which this chapter is based.

The interviewees' response to the framework can be divided into three parts: *general appraisal, suggested improvements,* and *suggested applications*. Each of these contributions is now discussed below, and, where appropriate, considered further in the *Future work* section of the following chapter.

6.4.1 General appraisal

Many of the interviewees' responses were particularly positive, indicating their recognition of the framework as an accurate, novel and valuable interpretation of design practice. This was the case both for the industrial designers and the consumer investigators.

[73] In addition to using the diagrams as 'member validation' stimuli in interviews, they were also used in a similar manner with fellow academics. Most notably, a four-hour research meeting was held with Professor Del Coates (from San José State University) and Professor Ray Crozier (from Cardiff University), two of the principal authors referred to in the literature study (section 2.1). During this meeting and others, the diagrams presented in this thesis were used to elicit the appraisal of experts in the field.

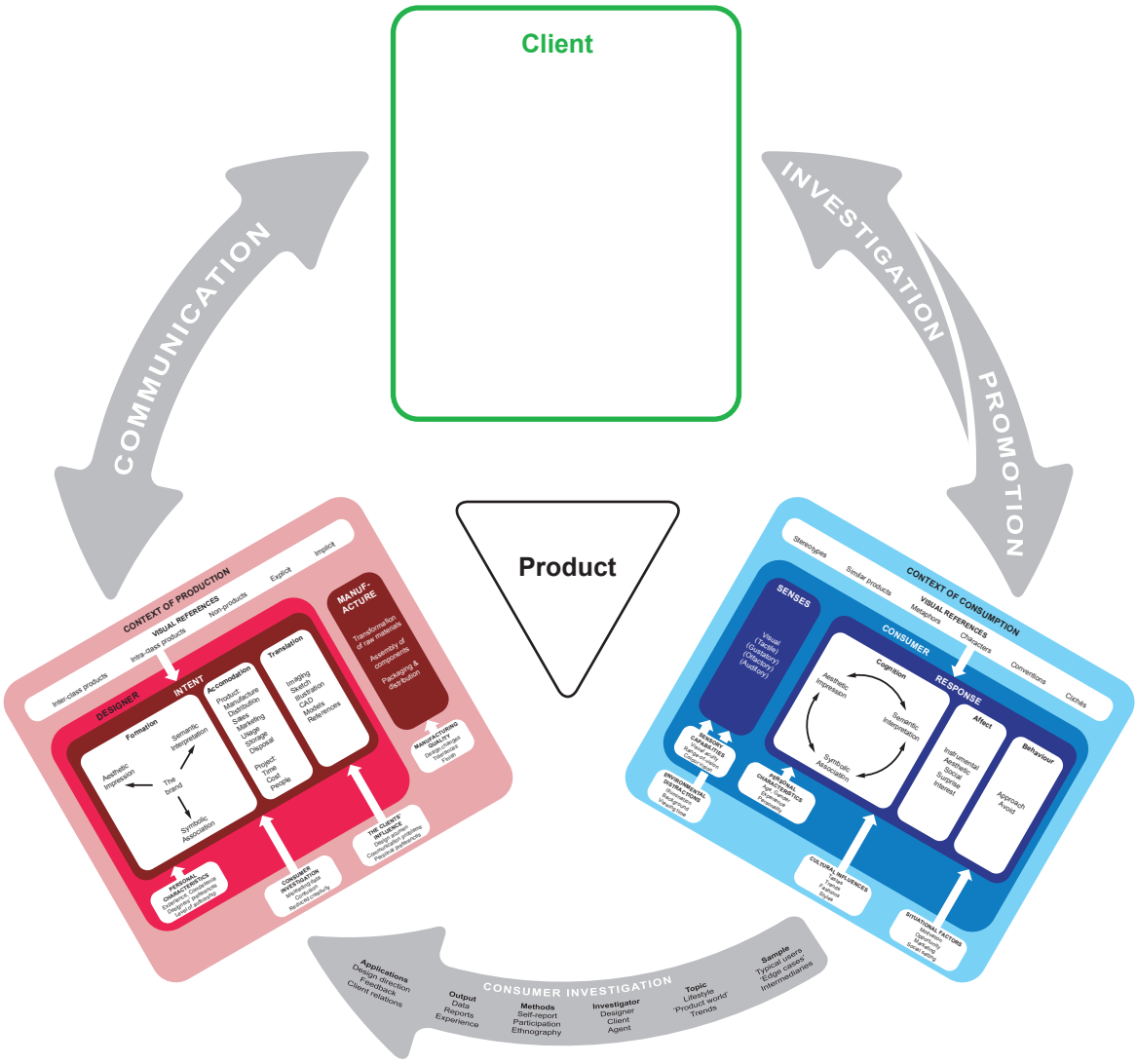

Figure 6-r: *Illustration of how the diagrammatic representations of designer intent, consumer response and consumer investigation can be combined within the general structure of stakeholder relations. The 'client' is indicated by an empty block that future research could expand to mimic the level of detail in the consumer and designer blocks. Similarly, the arrows for 'communication', 'investigation' and 'promotion' could be expanded to mimic the level of detail in the 'consumer investigation' arrow.*

> *"You actually describe what I wanted to say… Actually, I think it's quite perfect… It works like this exactly. This is an interpretation of skill and it works."* ID-12(II)

> *"You see, this is what I'm doing: this model represents what we're trying to do within research and design… and you're taking quite a neutral view. But it makes sense in terms of the elements and what you've got within the elements".* CI-04(IV)

In addition to such general comments on the frameworks' value, the interviewees also offered their opinion on the notion of product aesthetics as a research topic and on the validity of the perspective adopted. In general, product aesthetics was considered to be a critically important factor in determining product success, and research on the topic was considered to be potentially valuable to the design industry. Furthermore, conceptualising products as a medium of communication between designers and consumers was considered useful, and in some instances was claimed to have clarified the interviewees' own perspective on their work.

> *"What you are studying is desperately important. … It's what we live and die on."* ID-10(II)

> *"For me, it's actually a really useful model because a) it gets me thinking and b) I don't know if I've seen anything… I haven't seen any papers that really present this 'in one.'"* CR-04(IV)

These responses were not only gratifying but also gave some reassurance that the foundations of the emerging framework were acceptable to the interviewees. However, more useful to progression of the research were the instances in which the interviewees offered their suggestions for how the intermediate frameworks might be improved. These suggestions, in combination with review and analysis of the collected data, encouraged the development of the framework into the form in which it has been presented in this chapter.

6.4.2 Suggested improvements

Throughout the study, the interviewees made suggestions for how the framework might be improved. These suggestions were prompted by their response to individual words, their confusion over how certain concepts were related and their interpretation of the frameworks' structural arrangements. From a broad range of

contributions, the most influential was their encouragement to depart from a linear depiction of stakeholder relations in favour of the circular representation eventually adopted. Their views on the linear and non-linear perspectives are thus explored further here so as to provide some supporting rationale for the circular views presented in Figure 6-m and Figure 6-r.

During the second phase of the study a number of interviewees expressed concern over the linear structure used in the framework with which they were presented (Figure 6-j). They felt that the iterative, fluid and complex process of design was not conveyed by a representation that encouraged left-to-right reading. Furthermore, the linear arrangement of the parties involved in the process (client, designer and consumer) resulted in graphical separation that was not felt to reflect their true relationships.

> *"…you kept the client a long way from the consumer… in fact, probably [in] most cases, the client is constantly interacting with the consumer."* ID-13(II)

Consideration of comments such as this in conjunction with preliminary analysis of the interviews resulted in the creation of a non-linear (circular) representation. This new graphic structure encouraged the depiction of interactions between the parties that had not previously been shown (and not fully considered) due to the limitations imposed by the linear form of the original diagram. When, in the third phase of the study, interviewees expressed concern over the misrepresentative implications of the diagram's linear structure the new framework was presented to address these issues.

> *"I don't know quite how far you're going to go into what's driving the client's decisions and what's happening in the business and how that relates to the market. Which almost kind of brings it back in full circle really."*
>
> *[Interviewee is presented with a sketched circular framework]*
>
> *"I can see that actually. Maybe that's what I meant by it comes round full circle. I think that's the thing: each party does have a different relationship with the product."* ID-14(II)

Compared to Figure 6-j, the circular structure depicted in Figure 6-m was generally agreed to offer a more accurate representation of the factors and relationships involved. This new diagram provided a common conceptual framework upon which to base further discussion, and expansive contributions were more forthcoming now

that the initial objection to linearity had been addressed. The interviewees' acceptance of the circular representation gives some measure of confidence in its fidelity to the situation as experienced by the design community. More generally however, their objection to the linear representation with which they were first confronted indicates that as a group, they were not simply appeasing the researcher by agreeing with the framework unquestioningly. They were instead actively comparing it to their own professional experiences and their own conceptions of the relationships between the different parties involved with the product. This is an encouraging indication that their contributions were honest and well-considered, both during their general participation in the interview and in response to the framework specifically.

6.4.3 Suggested applications

Further to guiding the development of the framework, the interviewees also made suggestions for how it might be used in design practice and design education. Of these suggestions, the notion that the framework would assist in communications with the client was the most prevalent. The application of the framework in this context is pertinent to many of the issues raised in this chapter. Therefore, the framework's potential as a tool for designer-client communication is discussed here, whilst adaptation for use as an educational or marketing tool is considered in the next chapter's *Applications* section.

Many of the designers responded to the framework by expressing interest in sharing such a representation with their clients. They acknowledged that whilst the issues presented are ones with which they were familiar, these issues were often difficult to explain. Thus, the formalised and integrated presentation of the information in the framework was felt to be an appropriate vehicle for communication.

> *"I wish I had some of this stuff up my sleeve when talking to clients"* ID-01(I)

> *"I think it could be very useful for education within the relationship [between] clients and designers"* ID-08(II)

The designers perceived the framework as an opportunity to focus, and continually refocus, the clients' attentions on the consumers' perception of the product. In particular, they identified the framework as emphasising the implications of

modifying the design and corrupting the message transmitted from the designer to the consumer.

> *"I think there are some positive conclusions you can come up with there as to how to maintain the initial design intention all the way [to when] the product is finally out there being sold"* ID-06(II)

Even in large, sophisticated consultancies that dedicate significant resources to managing client relationships, the framework was considered to be a valuable representation of the wide-ranging factors that influence product form and consumer response. The framework was thus seen as a stimulus around which negotiation might be conducted when requesting additional resource or defending design decisions.

> *"We've got process maps and so on. But actually I would find this very useful, particularly for clients who haven't done this before [hired consultants]. To get them to understand what the process is about and the consequences of doing something to the designers or to the product… So this would be a useful map."* ID-10(II)

The designers expressed an interest in employing the framework in their interaction with clients because they believed it might alleviate many of the communication problems highlighted in this chapter. Such an improvement was hoped to allow the designers' intentions to be maintained during the subsequent manufacture and marketing of the product. Further development of the framework to specifically adapt it to this purpose were proposed by the interviewees and are discussed in the next chapter.

6.5 Summary

This chapter has shown that the concept of products as a medium of communication is both an appropriate and useful perspective. Principally, designers form distinct intentions for how their products should be perceived and thus strive to affect the consumer and stimulate consumption. However, designer intent is not the only determinant of product form and therefore designers must seek to maintain their intentions in spite of numerous conflicting constraints and potentially moderating influences. For ease of comprehension, these components of intent have been neatly distinguished from each other. However, as with consumer response, such factors are

often interrelated and seldom occur in a linear sequence or structured manner. For example, visualisation activities assist in the accommodation of numerous conflicting constraints whilst intuition may inform every stage of the design process. Consequently, the challenge has been to categorise and represent these factors in a way that is conceptually useful whilst remaining faithful to the complexity of the situation as described by the data.

Although the researcher strove to maintain an unbiased perspective throughout the study, he was presumably influenced by both existing literature and the sensitising framework that had been developed. It is therefore not surprising that concepts such as 'design as communication' and 'aesthetic, semantic and symbolic response' were found to be compatible with the collected data. However, although the general structure of the sensitising framework provided a valuable and appropriate lens through which to view designer intent, the details of designer intent itself arose purely from the collected data. Therefore, rather than using pre-defined low-level concepts as place-holders for the designers' intentions, the categorisations and relative emphasis that were apparent in the data have been retained. This approach was commensurate with the aim of the analysis, which was to develop a coherent representation of designer intent rather than to validate an existing model or to provide arguments for the value of one model over another. The treatment of 'member validation' offered in the previous section is also sympathetic with this objective, as it demonstrates the framework's relevance and value to the design community from whom the data was drawn. Their acceptance of the general principles, detailed elements and mode of representation does not necessarily prove the framework's fidelity but does clearly indicate its conceptual and practical utility.

Chapter 7

Conclusions

Having reviewed the researcher's interpretation of current industrial design practice, an integrated conceptual framework for designer intent and consumer response has been presented. This chapter now begins by illustrating how this framework answers the research questions posed in *Chapter 1* and by summarising the other contributions that have been made. Potential applications for the framework are then discussed along with suggestions for how future research might expand the scope of those applications. In closing the chapter, a brief summary of the thesis is provided along with conclusions for how its value might be judged.

7.1 Contributions

At the outset of this thesis two distinct, but related, contributions were sought. Firstly, the copious but unintegrated literature on consumer response was to be unified within a single conceptual framework. Secondly, an understanding of designer intent was to be gained and this was to be presented within the context of the other determinants of product form. However, in describing the manner in which this second objective was fulfilled, further contributions to knowledge have been made. Therefore, the contributions in this thesis may be categorised by those that relate specifically to product aesthetics, and those that relate to methodology.

7.1.1 Contributions to product aesthetics

By presenting a coherent conceptual framework for product aesthetics this thesis makes the subject easier to understand and easier to communicate on. Such benefits

apply to each side of the linear framework (both consumer response *and* designer intent), and the more general perspective of stakeholder relations.

Consumer response

In *Chapter 1*, it was asked, "*What is the nature of consumer response? How might the different aspects of response be categorised? What factors are influential in determining response?*". The literature study in *Chapter 2* answers these questions by describing consumer response to product form as the final stage in a process of communication between designers and consumers. Following visual perception, the principal categories of response are cognitive, affective and behavioural. Cognitive response is the primary focus of this thesis and is further sub-divided into aesthetic, semantic and symbolic components. These aspects of response are moderated by a number of influences including personal, cultural and situational factors.

By providing a comprehensive review of the relevant product aesthetics literature, this thesis provides a central point of reference for the subject and promotes little-known or recent texts that have made significant contributions to the field. Furthermore, complementary theories presented by different authors have been drawn together for the first time and presented so that their similarities may be better observed. By developing a conceptual framework within which these concepts may be positioned, a representation of the relationship between different aspects of response has been constructed. This makes the subject easier to understand, identifies gaps in the current literature and suggests directions for future work (see section 7.3).[74]

By conceptualising consumer response, the subject of designer intent is also clarified. For example, it reveals the varieties of response that might be intended along with the range of references and moderating influences that might be anticipated. Therefore, the framework of consumer response presented in this thesis might be used by other researchers to sensitise them to issues of relevance when considering the determinants of product form.

[74] In acknowledgement of the contribution that such an integrated review offers, the journal paper on which section 2.1 is based (Crilly *et al.*, 2004b) features in the *Design & Emotion Society*'s recommended reading list (see Wouters, 2004).

Designer intent

In *Chapter 1*, it was asked, "*What is the nature of designer intent? What range of responses are intended? What other factors are influential in determining product form?*". The interpretation provided in *Chapter 6* answers these questions by describing intent as the formation of a message that is transmitted to the consumer via the medium of the product. The aesthetic, semantic and symbolic categories of response were found to be congruent with designers' declared intentions and each of these aspects of intent is strongly influenced by the brand. A number of product and project constraints are accommodated before intentions are translated into product form. These intentions are moderated by the designers' personal characteristics, their interaction with the client and their knowledge of the consumer.

If industrial design research is to truly become the interdisciplinary field that it protests to be, then explicit, researched descriptions of design practice are required. This would allow researchers from a wide variety of disciplines to more easily bring their skills and perspectives to the study of industrial design. However, such descriptions are somewhat rare, and those that do exist tend be written from personal experience or anecdotal evidence rather than from a sustained research effort. In contrast, this thesis provides an interpretation of the determinants of product form along with a detailed description of how that interpretation was reached. Therefore, in addition to providing a timely and novel description of design practice, a good deal of transparency has been achieved in demonstrating the manner in which the study was conducted.

By providing a well-reasoned description, and the accompanying framework, many of the complexities of product form generation are revealed. This allows future studies in product aesthetics to take better account of such complexities and increase the relevance of their work. In particular, illustrating how product form is, at least partially, determined by factors other than designer intent may lead researchers to consider issues that are currently neglected such as brand congruency, tooling budgets and communication with multiple stakeholders.

In recent years, there has been mounting interest in studies that seek to quantify and optimise the aesthetic characteristics of products (see Hsiao & Wang, 1998; Vergeest *et al.*, 2002; Cai *et al.*, 2003). However, such studies often do so at the expense of contextual validity. For example, where such studies employ statistical interpretations of consumer response surveys to generate an optimum form, the influence of factors such as brand congruency and competitor behaviour is ignored.

Similarly, by generating synthesised forms to which consumers respond positively, the nature of their response after a suitable product lead time (say, 6 to 36 months) is not considered.

By examining the framework presented in this thesis, the range of factors that are influential in determining product form becomes apparent. Considering the results of quantitative studies in the light of such competing factors provides reason for caution in judging their current relevance. However, it also points the way towards increasing the realism of such studies and revealing potentially unanticipated applications. For example, simulating the effects of manufacturing constraints, or the effects of adhering to a brand aesthetic, may offer interesting results. Furthermore, it may be that in industrial application, such computational studies would be considered as much a tool for communication (*e.g.* as 'ammunition against the client') as they would be a method for design.

In this thesis, the perspective of products as a medium of communication has been adopted.[75] This linear framework, whilst representing the relationship that designers and consumers have with products, also fits within a broader perspective in which the influence of the client is considered. This encourages representation of the relationships that each stakeholder has with the others, in addition to those that they have with the product.

7.1.2 Contributions to methodology

Beyond the contributions made to the research topic, this thesis also makes three distinct contributions to research methodology. Firstly, in relation to design research, the adherence to established qualitative research methods, in a manner compliant with social research practice, illustrates an approach that may be relevant to other design research studies. Secondly, in relation to the broader qualitative research domain, the development of the graphic elicitation technique provides a valuable alternative to the use of more established elicitation stimuli. Thirdly, the use of graphic elicitation within a grounded theory study connects the diagramming and theory sharing procedures of grounded theory for the first time.

[75] As discussed, this follows the work of Monö (1997), who, in turn, was adopting the principles set out by Shannon (1948).

Design research

Design research often adopts (or 'borrows') qualitative research techniques from the social sciences. For example, many studies are informed by an ethnographic-, case-study- or interview-based approach. However, whilst much design research adopts the methods and conventions of social research, it often does so in a very incomplete manner. For example, many research projects utilise interviews as a data collection method and presumably employ some form of coding to analyse the resultant data. However, the details of such methods are not often stated and the reader is left to guess how the conclusions drawn for the research were extracted for the interviews. In contrast, this thesis presents design research more squarely in the established methodological rigour of social research. In particular, applying CAQDAS to large volumes of qualitative data, which is an increasingly orthodox procedure in a range of qualitative research disciplines, is a practice that is largely unreported in design research. Furthermore, whilst a general grounded theory approach is often described in design research, the requirement to align the research with one particular stream (Glaserian or Straussarian) is seldom adhered to. Thus, this thesis contributes to the field of design research by identifying, adapting and reporting on methodological procedures that may be of use to (industrial) design research as it develops.

Although design research often adopts a qualitative research approach, there are certain characteristics that distinguish it from the social sciences. Therefore, many of the research techniques that are used are adapted for application in this domain. However, it is rare for design research to 'give back' these new methods to the wider qualitative research community. By contrast, in this study, the use of the researcher's diagrams to elicit comments from the informants and to gain their appraisal of the work was identified as a novel contribution to qualitative research methodology. The details of this approach were therefore situated within the appropriate theoretical context and are to be published within the qualitative research domain (Crilly *et al.*, 2006). The development of graphic elicitation is thus a product of *adapting* social research methods to the study of industrial designers whilst *adopting* an engineering approach.

Graphic elicitation

The application of visual elicitation stimuli in interviews has traditionally focused on the use of photographs. However, whereas researchers employing photo elicitation have used images originating from a variety of sources, the use of diagrammatic stimuli has been limited to representations produced by the informant. This is

despite some implicit suggestion in the literature that diagrams produced by researchers may provide useful stimuli. For example, Padilla recommends that issues identified in preliminary interviews might be codified as a sketch; presenting this in subsequent interviews may allow discussion to be focused around an artefact that captures the essential aspects of a domain (Padilla, 1993: 156). Furthermore, Törrönen (2002: 354) has specifically described the use of 'microcosm' stimuli that imitate, illustrate or exemplify the subject of study. Interviewees are thus encouraged to "compare their own conceptions and experiences to the world constructed in the stimulus [...which may be...] a picture, map or metaphorical outline" (Törrönen, 2002: 354).

Despite these suggested applications, there is a lack of supportive structure for the use of diagrammatic stimuli in research interviews. To address this, Crilly *et al.* (2006) defined the theoretical context within which graphic elicitation is situated. In complement, this thesis presents a detailed account of the practical application of graphic elicitation within an example study. Consequently, three distinct qualities of graphic elicitation have been illustrated. Firstly the unique characteristics of diagrams in relation to other elicitation stimuli have been revealed. Secondly, the specific benefits of employing diagrammatic stimuli in interviews has been demonstrated. Thirdly, the methodological issues associated with the development and implementation of diagrams has been addressed.

Designers often think and communicate by reference to visual media and they naturally exhibit high levels of visual literacy (Henderson, 1999). Therefore, by reporting on the application of graphic elicitation in a study of the design community, the technique has been demonstrated as particularly applicable to a professional context in which visual representations are culturally privileged. A greater understanding of the potential for graphic elicitation and the practicalities of its implementation will require further studies across a range of populations, domains and interview scenarios. Such work may reveal the ways in which graphic elicitation can be adapted to a variety of applications and offer guidance as to how the practical and methodological issues raised in this thesis might be addressed in different contexts.

Grounded theory

Grounded theory studies are oriented towards the generation of new theory rather than the evaluation of existing hypotheses. Thus, validation, in the quantitative sense

can be left to future studies and instead, researchers may seek internal validation by comparing theoretical abstractions to the raw data (Strauss & Corbin, 1998: 159-161). One method of doing this is for the researcher to present their interpretations to informants and establish whether the informants recognise themselves in that interpretation (Strauss & Corbin, 1998: 159-161; Goulding, 1999: 16; Goulding, 2002). Outside of grounded theory, such an approach is often referred to as 'member validation' (see section 6.4).

Although (Straussarian) grounded theory, advocates both the production of diagrams and the discussion of theories with informants (Strauss & Corbin, 1998: 45, 217), there is no suggestion that these two activities might be connected. On the contrary, diagrams are considered to be one of the private analytic tools of the researcher and "are rarely seen by anyone but the analyst" (Strauss & Corbin, 1998: 218). Whilst this approach acknowledges that diagrams are effective instruments of thought, it fails to exploit their potential for conveying those thoughts to others. If researchers are to expend time and analytic effort producing meaningful diagrams, and diagrams are known to aid communication, employing these diagrams as a vehicle for member validation is a research technique that can be both efficient and effective. Thus, by connecting the two previously separate activities of diagramming and theory sharing, the application of graphic elicitation in this study offers an evolutionary methodological contribution to grounded theory practice.

7.2 Applications

As discussed in the *Member validation* section of the previous chapter, many of the designers considered that the framework would be a valuable tool in facilitating designer-client communication. The general overview that the representation provides, combined with a strong focus on consumer response, would allow designers to educate their clients as to the influence of their decisions. This would strengthen the designers' position in negotiations with the client and thus help preserve their intentions through the design, manufacture and delivery of the product. Whilst this was regarded as the framework's most obvious application, further potential uses include the marketing of design-related services and the provision of design education.

7.2.1 Marketing

By representing the relationship between the different stakeholders in design practice, the framework could improve the marketing of design consultancies, or other organisations associated with design. This would involve using the framework to visualise an organisation's position within the industry and illustrate the services that they offer. For example, some design consultancies could illustrate their broad coverage of the domain by employing the diagram to communicate their approach to activities such as consumer investigation and client communications in addition to design. Alternatively, firms specialising in consumer investigation might use the framework to illustrate how their services integrate with other organisations in the product development process.

> *"I think it would be interesting for us in terms of positioning, working out what we should offer and where we should position [ourselves]. Because we offer so many different things it's hard for us to say 'this is what we do'" CI-05(IV)*

Naturally, such use of the framework would be most effective if the representation was adapted so as to be consistent with the organisations' existing business and process models and with the graphic language they adopt in corporate communications (see section 7.3.5).

7.2.2 Education

Beyond the possible industrial applications already discussed, the framework might also be employed in the service of education. Visual representations are regarded as valuable tools of instruction, and the structured nature of diagrams lends itself to the structured nature of courses and lectures (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. As one designer, who is also a design educator, commented:

> *"I like the 'disturbances' [moderating influences] bit… because it exposes where a designer should actually be concentrating… I could see a course that related to the methodology of design… in a very interesting and productive way"* ID-08(I)

Alternatively, for educational subjects where industrial design is not the core discipline (such as engineering or business), the framework may provide the necessary introduction to the topic of product aesthetics in an easily digestible form.[76] This might encourage students from non-creative disciplines to recognise the importance of intangible product qualities and develop a more 'qualitative sense' (see Macdonald, 1993; 1997).

7.3 Further work

The representations used in graphic communication need not be regarded as final but may form the basis of future work. For example, diagrams of processes and organisations are likely to require modification over time and between cases if they are to retain fidelity and remain relevant. As such, Craig describes diagrams as 'tools for thought' and suggests that considering them as permanent representations should normally be avoided (Craig, 2000: 20). Thus, whilst the 'final' framework presented in this thesis is believed to be a useful representation of the domain, other representations may also be equally valid. As such, this thesis might be considered as the point of departure for further work.

By focussing this study on the visual form of products and the activities of industrial design consultants, the resulting framework presents a generic representation that is limited in its scope. Future work in this area might involve research to include other levels of product interaction (beyond the visual), other parties in the design process (beyond the designer and the client) and other design practices (beyond industrial design). Each of these potential expansions to the framework are now described in detail followed by consideration of the practical issues involved in preparing the framework for applications outside research.

7.3.1 Incorporating other levels of interaction

As described in section 1.1.1, this thesis has focused on the visual domain in product design and consumption. However, other forms of sensory, physical and cognitive

[76] This has, in fact, already been done in a lecture for 'design and manufacture' given to third-year undergraduates on the University of Cambridge MET (Manufacturing Engineering Tripos) course.

interaction are also important to both designer intent and consumer response. In particular, there are three distinct directions in which framework development might proceed. Firstly, consumers do not just encounter products once, but many times, and therefore the effects of *repeated exposure* might be included in the framework. Secondly, the framework might be adapted to incorporate *other senses*. Thirdly, beyond sensory exploration of the product, frameworks for *product use* might be investigated. With these three areas explored, framework *integration* might then be attempted, representing the interaction between all the senses and the full experience of product use.

Repeated exposure

A number of studies have described the effects of repeated exposure in determining preference for visual artefacts (see Coughlan & Mashman, 1999; Cox & Cox, 2002). To take account of repeated exposure in the framework presented in this thesis, the variety of possible visual consumption scenarios must be considered. This might include repeated exposure to advertising and product packaging in addition to the product itself. Such exposure may occur in a number of physical and social contexts whilst the available visual references and moderating influences continued to change. Accommodating these dynamic factors in the framework would require a number of modifications. In particular, the product at the centre of the framework would become a collection of stimuli ranging from photographic marketing material to a used (and possibly damaged) product. Therefore, each time the consumer perceives the stimuli its precise nature may have changed. Graphically, this may be conveyed by representing consumption as a cyclic activity; the consumer continually revisits an ever-changing product.

Other senses

Beyond the visual, the full range of senses and sensory product qualities could be incorporated into the framework. The most influential of these (after vision) might be expected to be tactile and auditory whilst for some product categories the olfactory and gustatory senses are also relevant (Schifferstein, 2004). Separate frameworks might be developed for these senses and then attempts might be made to integrate these with the one presented in this thesis. Such work would involve considering the relative importance of the different sensory contributions, and this might be expected to vary between product categories (Schifferstein, 2004). Of particular interest during this stage of framework development might be the ‘synaesthetic phenomenon’

experienced during product engagement (Parret, 1995; Rognoli & Levi, 2004). This refers to the anticipation of one set of sensory qualities (*e.g.* tactile) resulting from exposure to another set (*e.g.* visual). Investigating the effect of perceived discrepancies between the expected and experienced sensory qualities of a product might allow the framework to represent this phenomenon.

Product use

Beyond sensory exploration of the product, further research might allow product use to be included in the framework. Here, the interaction between semantic interpretation and the experience of product use might be explored. For example, judgements made on a product's perceived performance or mode-of-operation might lead to expectations that conflict with how the product actually operates. Where discrepancies exist, responses such as surprise, confusion or disappointment might result. Incorporating such potential responses into the framework would thus lead to a more comprehensive representation of consumer response to products.

Integration

The way in which designers anticipate repeated exposure, full sensory interaction and product usage all shape the design process. For example, investigations might reveal the instances in which designers intend to produce products that exhibit sensory congruence or sensory discrepancies (see Schifferstein, 2004). Therefore, in addition to investigating consumer response, the relevant attitudes and activities of the designer would also be of interest. This might lead to the construction of new or modified frameworks for designer intent that represent their objectives beyond instantaneous visual response.

Integrating frameworks that accommodate designer intent and consumer response for repeated exposure, full sensory interaction and product use would necessarily require renewed and sustained research efforts. Surveying the 'multi-modal' research literature and further studies of designers would obviously be required. However, many of the findings might be expected to fit well within the structure of the existing framework. In particular, a general communication process involving references and moderating influences might still be useful. However, the resulting conceptual framework would be capable of more fully representing the complexity of designer intent and consumer response.

7.3.2 Incorporating other parties

In addition to considering other levels of product interaction, the framework might also be modified to include other parties that are involved in the processes of product development and consumption. This principally involves other collaborators in design and the hierarchy of consumers that respond to the product.

Design collaborators

For the products studied in this research, the designer and the client (brand owner) were the most influential parties in determining product form. However, with a wider range of product categories, other parties may also be relevant. In particular, this study suggested that manufacturers, suppliers, retailers and a range of external agents might all be influential.

- *Manufacturers*: where products require truly innovative manufacturing processes the design may demand the use of techniques close to the limits of current technology. In such cases, the manufacturer necessarily becomes closely involved in the design process to ensure that the technical constraints are adhered to.

- *Suppliers*: where a design specifies that products utilise materials or components that are to be provided by a particular supplier, such suppliers may become an integral part of the design team. For example, their expertise in how a material can be coloured, formed and joined becomes a key determinant of product form.

- *Retailers*: in some product categories the sales for a particular geography are largely achieved by a single retailer, or small group of retailers. The buyers (purchasing departments) for these retailers are therefore the first line of consumers for the product and they may thus be consulted to access the information, experience and insights that they possess.

- *External agents*: the design process may necessarily involve a number of external agents to provide specialist services or information. These agents include: *brand consultancies* that specialise in advising organisations on how the brand should be maintained, protected, repositioned or redefined; *recruitment consultancies* that supply representative samples of consumers within a particular demographic; and, *trend consultancies* that specialise in the identification, interpretation and presentation of trends ranging from the technological to the sociological.

Further research into the activities of these parties and their interaction (or integration) with the design process would allow the production of a modified framework that represented more of the potential complexity of design practice. This might include the information held by each party, the processes they engage in and their communication with other parties.

A hierarchy of consumers

For simplicity, the framework presented in this thesis assumes a generic consumer involved in some stage of visual consumption. However, in many instances, that single consumer represents a hierarchy of consumers with disparate characteristics. For example, in the case of medical equipment, the device may first be ordered by the hospital purchasing department, then operated by medical staff on patients whilst periodically being cleaned and serviced by maintenance personnel. For each of these 'consumers' the product may be required to fulfil distinct visual requirements:

- The purchasing department may require reassurance of reliability and value.

- Medical staff may require clarity of function and associations of competence.

- Patients may require an impression of hygiene and non-threatening operation.

- Maintenance staff may require clear indication of parts that require attention and those that should be avoided.

With respect to modifying the framework, representing an unknown number of potential layers of consumption presents conceptual and graphic challenges. In particular, the requirements for, and relative importance of, product attributes might be expected to vary between these layers. Furthermore, it is unclear how the response of one layer might interact with the perceptions (and subsequent response) of another. Therefore, further research would be required to establish whether it is more appropriate to represent consumers as existing, for example, in a sequential chain or in a parallel array.

7.3.3 Incorporating other forms of design

As described in section 1.1.2, industrial design consultancies were targeted for this study due to the variety of projects they engage in and the organisational division between the design team and the client. To expand the framework, further research might be conducted to incorporate other forms of design practice. This could include investigating *other product categories* not typically designed by industrial designers and also investigating *in-house design* rather than simply design consultancies.

Other product categories

Whilst this study has focused on a broad range of products, there are certain product categories that were not included in the research. In particular, buildings, clothing and vehicles were not discussed in the interviews and were not explicitly considered in the analysis. These omissions partly resulted from such product categories largely being the responsibility of specialised design practices (architecture, fashion design, automotive design, etc.) rather than industrial design. However, these specialised practices have well established conventions for generating, discussing and evaluating visual form. For example, Tovey reports that automotive stylists develop an in-house culture with an idiosyncratic group language composed of both words and images (Tovey, 1997: 10). Similarly, Eckert & Stacey (2000) state that fashion designers talk in a language of references to other products and that successful communication is thus dependent on all participants enjoying access to shared cultural experiences. As such, these specialised design practices may provide fruitful areas for further research.

In addition to the physical product categories discussed in this thesis (and those outlined above), the inclusion of graphic products such as signage, posters and software might also be investigated. The design disciplines responsible for these

products have traditionally considered their work to be artefacts of visual communication (Buchanan, 1984: 91). In particular, the relatively new field of web-design has increasingly focused on understanding how the graphic qualities of websites influence all aspects of consumer response (Haig & Whitfield, 2001). Therefore, studying the pedagogy, professional practice and research literature associated with these fields might prove instructive in developing the perspective of products as a medium of communication.

In-house design

In this study, focussing on design consultants presented a number of unique opportunities as compared to in-house designers. Firstly, most consultancies have experience of a broad range of product categories and different types of product could be discussed in a single meeting. Secondly, and again because of the varied work performed by the design consultancies, the designers were able to comment on the comparative differences between different product categories. Thirdly, because the brand owners and the designers belonged to different organisations, there was a clear distinction between them; this organisational divide highlighted some of the associated communication issues. However, many organisations employ their own 'in-house' design teams. In such cases, whilst both the product managers and the designers belong to the same organisation, there remain departmental divisions between those responsible for brand management and those responsible for form generation. Although communication across departments within a single organisation might not be as strained as communication between organisations, there are still cultural, educational and personal differences (Jablin & Putnam, 2001). A more generic version of the framework could thus be produced to incorporate both in-house design and design consultancies. This might involve re-labelling 'the client' as 'the brand owner' and representing their interactions with designers as taking place within a single organisation.

More profound changes to incorporate in-house design practice in the framework would require further research. This could involve collecting new primary data, collecting existing data produced in other studies or further surveys of the existing literature.[77] Any of these approaches, or a combination of them, would reveal the

[77] Professional contacts have already been formed with researchers who hold data related to in-house practice and with whom data comparison or collaboration might be possible.

differences between in-house and consultancy design practices pertinent to the research questions posed in *Chapter 1*. Such distinctions might then be accommodated in the framework by producing a more generic representation or by producing an alternative (but expectedly similar) representation for each form of design practice.

7.3.4 Practical considerations

The framework presented in this thesis should be regarded as a research diagram that strives to accurately and concisely convey the concepts and relationships of interest. It is the result of the researcher's analysis of the collected data *and* collaboration with the informants. Any lack of graphic sophistication in the representation results from limitations imposed by the researcher's background, training and capabilities. Thus, for the representation to achieve its full potential in non-research applications, the services of a graphic designer should be employed. This is because researchers should allow individuals trained in form development and visual perception to translate research findings into comprehensive visual models. This is to counteract "the mistaken conviction that the same force that leads to the development of an idea also facilitates its best visual display" (Kazmierczak, 2001: 186). Thus, the expertise of a graphic designer could allow the diagram to be more intuitively read and increase the fidelity with which it represents the domain.

Much of the further work discussed above would require extensive literature research to uncover the existing bodies of knowledge relevant to each piece of work, however, for those areas that relate to design practice, the existing interview data also holds much material of relevance. Although each interview was focused on product visual form, the discussions naturally included a wider range of topics than the central theme. For example, the full range of sensory interactions with products were often discussed. Although not directly relevant to the study, the coding efficiency that CAQDAS offers allowed such material to be assigned the appropriate codes during the study. Therefore, for some topics coded transcript segments are already available and others might be generated through applying the appropriate search parameters and reviewing the transcripts. Thus, because of the data treatments applied in this study, information is readily available that could be utilised in conducting much of the further work outlined above.

7.3.5 Mapping products to the framework

In addition to future work centred on framework development, further research might be focussed on offering some form of validation for the ideas presented in this thesis. Such validation requires evidence of conceptual utility, and this could be demonstrated by mapping particular product examples to the generic framework.

Product mapping involves conducting case studies to explore the relationship between intent and response.[78] This requires the collection of a wide range of publishable[79] materials to document the progression of each design and represent the spectrum of consumer response to each product. The collected and analysed materials could then be synthesised into coherent stories of the evolution of the visual form of those products. These narratives would trace the products' aesthetic as the designs progress from verbal intentions to physical manifestations and from objective forms to visual stimuli that drive subjective response.

As the framework suggests, such a study might be divided into two main phases: designer intent mapped to the left-hand side of the framework and consumer response mapped to the right-hand side. This would allow examination of the correspondence between intent and response.

Mapping designer intent

Designer intent might be identified (prior to market launch) through observation, interview and document analysis. This might involve defining the aesthetic, semantic and symbolic objectives of the design team and examining how those intentions are modified or maintained during the design process. Whilst interviews with designers would allow the design process to be quickly summarised, comprehensively documenting the origins of the products' aesthetic would require evidence of the following aspects of intention:

[78] See section 1.3.2 for a brief discussion of the case study approach.

[79] Much of the material assembled for this thesis was subject to confidentiality agreements.

- *Formation*: The genesis and evolution of the design brief including the visual or linguistic devices used to define the intended consumer response.

- *Accommodation*: The full range of product and project constraints that are accommodated in the design process and the effect of those constraints on the product.

- *Translation*: The evolution of the design through the visualisation processes that convert intentions into product form.

- *References*: The explicit and implicit references employed by designers and the tangible influence of those references on the product.

Evidence for these aspects of intention would be manifest in collected briefing documents, image boards, consumer research reports and the relevant communications between members of the design team and other stakeholders. To identify the influence of intent on the visual evolution of the product all the design materials associated with a project would also be required, including: image boards, sketches, illustrations, models and prototypes.

In addition to these intentional factors, complete mapping of the determinants of product form would also require a range moderating influences to be identified. These would include:

- *Personal influences*: The influence of the designers' personal characteristics in determining product form. This might involve examining the history of the designers' work to identify any recurring motifs and assess the role of their experience, competence and preferences.

- *Consumer investigation*: The specific details of consumer research and their influence on the design process in defining direction, providing feedback or mediating communication with the client. Such materials might include video clips, photographs and transcripts from interview and focus groups sessions.

- *Client relations*: The way in which the clients' personal preferences influence the design process and the product form. This might include independently identifying the clients' and the designers' intentions and then tracking the divergence of conversions of those potentially disparate intentions throughout the project.

Beyond the design process, the actual product (as manufactured) must also be examined. Comparing the proposed design to the eventual product would allow characterisation of how the physical manifestation deviates from the visual specification. Attention might also be turned to how packaging processes determine which aspects of the product are visable, and how distribution of the product influences its condition when finally presented to the consumer.

Mapping consumer response

Following market launch, consumer response to the product could be identified through experiment, survey and interview. This involves definition of the aesthetic, semantic and symbolic aspects of response and identification of the personal, cultural and situational factors that are most influential. Comprehensively documenting consumer response would require evidence of:

- *Cognition*: The consumers' intrinsic appreciation of the product along with their understanding of how it might satisfy their extrinsic goals.

- *Affect*: The consumer's emotional response to the product including the combination emotions they experience and the intensity of those emotions.

- *Behaviour*: The consumer's reaction to the product including how they select, purchase, use, store and dispose of the product.

- *References*: The references that the consumers perceive in the product along with their interpretation of those references as metaphors, characters, conventions and clichés.

Techniques for monitoring and recording behavioural response are well established in the fields of consumer research and consumer investigation. The cognitive and

affective responses that drive this behaviour are less readily accessible. However, for cognition, the concepts of aesthetic, semantic and symbolic response could be integrated with existing tools for recording consumer perceptions. For example, a semantic differential[80] might be used with adjective pairs selected so as to provide information specifically related to the aesthetic impressions, semantic interpretations and symbolic associations that are formed.

Whilst the semantic differential is appropriate for recording consumers' understanding of the product, it is not well suited to assessing emotional response. Instead, an instrument capable of measuring the mixed, low-intensity emotions typically elicited by product appearance would be required (Desmet *et al.*, 2000); a software-based tool such as PrEmo[81] would be a good candidate. Combining these techniques with conventional interview or focus groups sessions would allow a broad range of unanticipated responses to be elicited. Such a mixed method approach would be designed to provide systematically collected data that could be compared across samples *and* unstructured data that would add depth and richness to the participants' accounts.

Surveying response in this way would ideally be repeated under various conditions and with various samples to assess the effect of moderating influences. These would include:

- *Sensory capabilities*: Investigations might be conducted into the effect of variations in the consumers' sensory capabilities. For example, sample groups might be selected to allow researchers to

[80] The semantic differential scale was developed by Charles Osgood (1990) to 'measure' the meaning that people assign to stimuli. The technique requires participants to indicate a point on a continuum between two polar adjectives (*e.g.* "hot-cold", "fast-slow", etc.) that corresponds with their perception of the stimuli. Several adjective pairs are typically used in each test to provide a linguistic profile of interpretation. The use of the semantic differential in measuring consumer response to design can be seen in Gombrich (1984), Shavitt (1989), Holbrook (1994) and Coates (2003) amongst others.

[81] "Emotions elicited by product design are typically of low intensity and mixed character. To measure these typical product emotions, a non-verbal self-report tool was developed: Product Emotion Measurement Tool (PrEmo)" (Desmet, 2003b). The PrEmo interface presents nine positive and nine negative emotions ('amusement', 'surprise', 'disgust' , etc.). They are represented by full-bodied cartoon characters, which are animated to reinforce and clarify their expression. Participants select the combination of emotions that most closely correspond with their own feelings about the product. The emotions (and intensity ratings) selected by the participants provides a profile of their emotional response to the products (Desmet, 2003b).

evaluate the effect of colour vision anomalies in determining response to the products.

- *Environment*: The role of the physical environment in determining response to the products might also be considered. For example, experiments could be conducted to assess the effect of illumination, background distractions and available viewing time.

- *Personal characteristics*: Surveys might be repeated across and beyond the target market to assess the influence of age, gender, experience and personality in determining response. Such studies might include individuals that represent the full spectrum of stakeholders in the design.

- *Cultural influences*: Studies might be conducted to investigate the influence of the consumers' cultural context on response. In particular, researchers might identify where the products are situated relative to prevailing tastes, trends and fashions within the context of consumption.

- *Situational factors*: The influence of situational factors such as motivation, opportunity and social setting might be assessed by conducting (post-purchase) interviews with consumers. Where marketers experiment with different promotional strategies in different regions, the influence of branding on consumer response might also be assessed.

In addition to these direct studies of consumer response, attention might also be turned to the design, technology and lifestyle publications that review these products. Instances in which products enter into language are particularly important as they contribute to the products' place in cultural discourse.

Comparing intent to response

With a set of rich illustrative case studies mapped to the framework, the notion of 'design as communication' could be critically examined, asking:

- What relationship exists between designers' visual intentions and consumers' responses?

- When do discrepancies occur between intent and response?

- What specific moderating influences are responsible for these discrepancies and how might they be accommodated or avoided?

For the example products selected, the mapping activities described above would provide the necessary evidence to answer these questions. In particular, researchers could study the evolution of intent in the design process, the correspondence between specification and manifestation, and the various determinants of consumer response. Employing the framework in defining, designing or conducting this research would demonstrate its conceptual utility and provide clear examples of its application.

7.4 Summary

Through the study of existing literature and a qualitative investigation of design practice, an integrated conceptual framework for product aesthetics has been produced. By adopting the perspective of 'products as a medium of communication', this framework focuses on the role of designer intent in determining product form and the nature of consumer response to those forms. A notoriously intangible subject is thus rendered more comprehensible and communications on the topic are greatly clarified. This has potential applications within the areas of design research, design practice and design education. Whilst future work to develop and refine the framework would expand its utility, its efficacy within its present form has already been demonstrated.

The 'reality' of product aesthetics may be that both product form and consumer response are determined by a limitless spectrum of transient factors and that each of these factors interact in a complex and unpredictable way. Whilst quite accurate, this perspective is not conceptually useful because it renders the subject impenetrable to reasoned investigation. Instead, this study has asked: *What are the most influential factors? How are these factors typically related? And, what general framework do they fit within?* The challenge therefore was to conceptualise the subject and represent it in an integrated and coherent manner. This necessarily dictated that some fidelity be sacrificed for the benefits of simplicity and parsimony. However,

such an abstraction has been shown to be a valuable tool for thought and communication rather than a ‘proven’ or ‘correct’ model. Further studies may well scrutinise this conceptualisation and subject it to tests of validity. However, in producing a framework that could be tested at all, this present study would already have been successful in providing a clear perspective within which, or against which, other researchers may position themselves.

Appendices

This section contains two appendices. Firstly, *Appendix A* provides a methodological overview of the study (briefly summarising chapters 3, 4 and 5). Secondly, *Appendix B* provides a table of interviewees that details the organisations and individuals that participated in the study; the 'interviewee identifiers' correspond with those used in chapters 6 and 7).

A: Methodological overview

By adopting a grounded theory approach (see Glaser & Strauss, 1967), a qualitative research study was undertaken to examine the issue of designer intent in industrial design. The study focused on consultant design practice, sampling from the London and Cambridge areas of the UK. The sample was complemented by including professional consumer investigators whose findings feed into the design process. Over the course of one calendar year, 27 interviews were conducted with a total of 29 interviewees representing 23 different organisations.

The study included an initial series of eight exploratory interviews, with industrial designers discussing the topic in relation to their general professional experience. This was followed by a further series of 13 case-based interviews with designers, each interview focused on one particular product. Finally, seven exploratory interviews were conducted with consumer researchers in a manner similar to the initial interviews with designers. The majority of the interviews were conducted on a one-to-one basis and set in the context of the interviewees' places of work; the mean duration of each interview was 75 minutes. At the end of each interview, the interviewees were presented with diagrammatic representations of the researcher's current conceptualisations of the domain. This allowed the researcher to gain the interviewees' appraisal of the work and also elicited further contributions on the research topic (Crilly *et al.*, 2006).

With the interviewees' permission, all the interviews were recorded and later transcribed to produce over 250,000 words of text-based data. Themes of relevance were identified and sections of the transcripts were labelled (coded) with these themes for easy identification. As new themes and sub-themes were identified in the

data, the transcripts were continually coded and re-coded as necessary. Reviewing all the transcript segments that had been assigned the same codes facilitated the identification of connections and contrasts within the data. Computer-aided qualitative data analysis software, QSR NVivo (2002) was used to assist in this task and to provide interactive visualisations of the emerging themes. Based on this analytic procedure, an interpretation of current industrial design practice was obtained which places the role of designer intent within the context of other factors that are influential in determining product form.

B: Table of interviewees

INTERVIEW NUMBER	INTERVIEWEE IDENTIFIER	ORGANISATION			INDIVIDUAL		
		Specialisation	Employees	Location	Position	Education or training	Experience
01	ID-01(I)	Industrial design, engineering	2	Cambs.	Director	Product Design	28 years
02	ID-02(I)	Industrial design	5	London	Managing director	Engineering degree; MA, Industrial design	10 years
03	ID-03(I)	Industrial design	6	Cambs.	Director	BA(Hons), Three dimensional design	22 years
04	ID-04(I)	Industrial design, engineering	15	Cambs.	Head of Industrial Design	Industrial Design	8 years
05	ID-05(I)	Industrial design	5	London	Director, Design Director	BA, Industrial Design; MA, Design	25 years
06	ID-06(I)	Industrial design (for specifiers)[1]	3	London	Partner	MEng, MA	n/a
	ID-07(I)	Industrial design (for specifiers)[1]	3	London	Partner	BA, MA	26 years
07	ID-08(I)	Industrial design	1	London	Self-employed	BA & MA, Industrial design	12 years
08	ID-09(II)	Brand consultancy[2]	120	London	Design director[A]	BA, Product Design	15 years
09	ID-10(II)	Industrial design[3]	48	London	Director, Design Director	BSc, Industrial design; MDes, Transport Design	20 years
10	ID-11(II)	Industrial design ('front end')	11	London	Creative Director	BA, Industrial Design	10 years
11	ID-12(II)	Industrial design	1	London	Self-employed	BA & MA, Industrial design	7 years
12	ID-13(II)	Industrial design (vehicle seating)	6	Cambs.	Partner, director	BSc, Mechanical Engineering	25 years
13	ID-14(II)	Industrial design ('product direction')	2 (+4)	London	Co-founder, partner	BA, Graphic Design; MA, Film	14 years
14	CI-01(IV)	Brand consultancy[2]	120 (/4)	London	Associate planning director (Research)	n/a	n/a
	ID-09(III)	Brand consultancy[2]	120	London	Design director[A]	BA, Product design	15 years
15	ID-15(III)	Product innovation[4]	80	London	Head of Industrial Design	BA, Furniture & Product Design	15 years
16	ID-16(III)	Architecture, products	2	London	Director	Architecture BA, MA (RCA)	7 years
17	ID-17(III)	Furniture, Lighting, Product Design	5	London	Head	BA & MA, Design	19 years
18	CI-02(IV)	Industrial design (User research)[3]	48 (/4)	London	Head of global trends	BA(Hons). Three dimensional design	7 years
	CI-03(IV)	Industrial design (User research)[3]	48 (/4)	London	Research manager	BA(Hons), Three dimensional design	5 years
19	CI-04(IV)	Product innovation (User research)[4]	80 (/4)	London	Head of user research	n/a	n/a
	ID-18(III)	Product innovation[4]	80	London	Project manager[B]	BA, Industrial design	9 years
20	ID-18(III)	Product innovation[4]	80	London	Project manager[B]	BA, Industrial design	9 years
21	ID-19(III)	Industrial design	4	London	Co-founder, Partner	MA, Industrial design	n/a
22	ID-20(III)	3D Design	10	London	Director	MA, Furniture	10 years
23	ID-21(III)	Furniture/industrial design	13	London	Director	Art & Architecture	25 years
24	CI-05(IV)	Trends research	8 (+4)	London	Researcher	BEng; MA Design, Strategy & Innovation	4 years
25	CI-06(IV)	Industrial design (User research)[3]	4	London	Senior researcher	BA & MA, Industrial Design	4 years
26	CI-07(IV)	Consumer ethnography	7	London	Founding partner, director	BA, Industrial Design	17 years
27	CI-08(IV)	Ethnographic user research	1 (+3)	London	Director	BA, Psychology; MA, Ergonomics	5 years

Number of employees: (+X) = number of additional freelancers; (/X) = number of consumer investigators

Interviewee identifier (listed in order interviewed): ID = industrial designer; CI = consumer investigator (X) = phase number

Level of professional experience within the industry

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