Engineering the Brand:

Automotive attribute management based on the cognitive categorisation of the branded product

Marcus Abbott M.Des. RCA

Brunel University

School of Engineering & Design

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‘Physical concepts are free creations of the human mind,

and are not, however it may seem,

uniquely determined by the external world’

Albert Einstein, 1938

Abstract

In mature product markets competitive advantage is increasingly realised by the careful design and engineering of product attributes that emphasise a brand's values. In the high-luxury automotive segment, user satisfaction appears to be particularly influenced by products that are perceived to be typical to the brand's lineage. This research aims to explore the links between product specifications and the categorisation of the product as belonging to the brand, by studying the effect with the Bentley brand's interiors.

The research uses cognitive categorisation theory and related methodologies as a basis for understanding the cognitive processes that operate between the input of specific multi-sensory stimuli and assessments of typicality and therefore satisfaction. These processes are interpreted through Semantic Differentiation techniques in a number of studies of Bentley products and competitor vehicles. The results suggest that by identifying and defining a number of product properties, of varying importance, and measuring subject's responses to them, brand-based categorisation effects can be visualised and quantified. The research investigates if these effects have been stable over time and finds that some patterns exist that might be used to predict how future products might be categorised.

The benefits of the resulting assessment and measurement tool to the product development process appear to be at least two-fold; firstly, by informing the process, product specifications may be set and designs developed, that are considered more accurate, good and right for the brand, resulting in controlled development time and costs and increased consumer satisfaction. Secondly, by enabling the process, property strengths, weakness and competitive threats may be understood that facilitate experimental and actual design modifications to optimise brand distinctiveness.

Contents

Preface

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List of Abbreviations

BPC Branded Product Category – a category of products belonging to a single brand.

CPE Concept Property Element – a discrete defining property of a concept.

FMC Ford Motor Company

HLS High Luxury Segment – automotive market segment with purchase price >€150,000

MY Model Year – annual introduction point of a new vehicle type.

PALS Product Attribute Leadership Strategy – A process adopted by Ford, Land Rover and others to identify a balanced set of vehicle attributes.

SD Semantic Differentiation – Osgood, Suci & Tannenbaum (1957) theory of concept affective meaning.

SDS Semantic Differentiation Scales – Osgood, Suci & Tannenbaum (1957) tool to measure concept affective meaning.

1. The Customer, Cultural and Commercial Research Context and Motivations

1.1. The Automotive Context

1.1.1. Automotive Product Uniformity

Product uniformity (or product 'commoditisation'; the development of the product as commodity) is a contemporary trend pervading many areas of commerce in the developed world. It is, therefore, widely reflected in the literature (Gobe, 2001; Hekkert, Snelders & Van Wieringen, 2003; Karjalainen, 2005; Snelders & Hekkert, 1999; Karjalainen & Warell, 2005); Simonetta Carbonaro & Christain Votava describe it as *'a vicious cycle of innovation pressure, information food and shorter product life cycles'* (Carbonaro & Votava, 2005, p.74) that inevitably influences the relationship between product development and product usage. This is especially significant in the automotive marketplace, where product differentiation has narrowed over recent decades as companies have consolidated and the technologies employed have matured. Product performance (for example; power, acceleration, ride, handling, braking), quality levels (see Figure 1.1), reliability, durability (Figure 1.2) and safety levels (Figure 1.3), are no longer a competitive influence exclusive to the more expensive and luxurious marques. They have reached a level of general equality to become a minimum requirement of the now experienced and sophisticatedly minded customer visiting any showroom. (Accenture, 2005; Antlitz et al., 2004; Cornet & Krieger, 2005; Di Riso, Ghislanzoni & Scalabrini, 2005; Gruntegs et al., 2005; Jacoby, 2006).

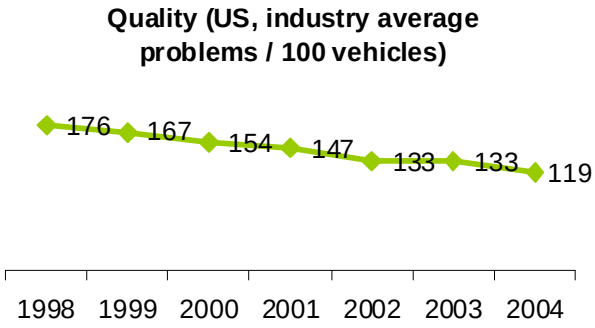


Figure 1.1. Quality indicator; average vehicle problems / 100 vehicles, US market.
Source: Accenture, 2005.

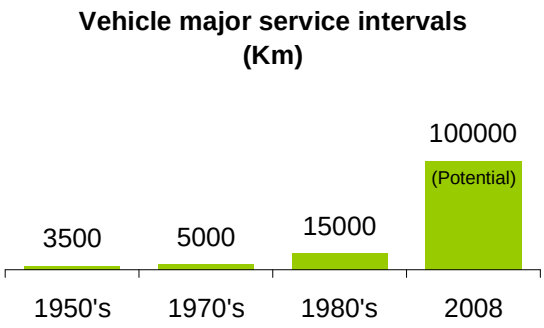


Figure 1.2. Durability indicator; vehicle major service intervals in Km.
Source: Volkswagen, 2006.

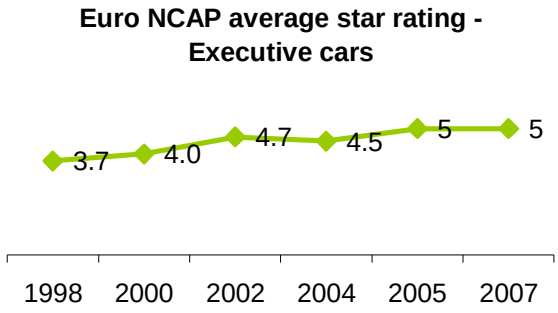


Figure 1.3. Safety indicator; Euro NCAP average safety star rating, executive cars.
Source: Euro NCAP, 2007.

Kano et al. (1984) suggested that which is expected from a product can be defined in terms of product quality, being on the one hand objective; *'expressed by a state of physical fulfilment'* or on the other, subjective; *'expressed by user satisfaction'*. Kano's model has been adapted more recently (e.g.: Schutte, 2005), to provide an insight into the cycle of technology diffusion experienced by automotive customers (and those participating in many other mature product segments) (de Chernatony & McDonald, 2003). Many objective benefits were once attractive when they were unexpected and rarely obtainable (see Figure 1.4). During the past 25 years, however, they have become

somewhat ubiquitous, obtainable and therefore largely expected, moving them from attractive to must-be qualities in customers' expectations (Figure 1.5).

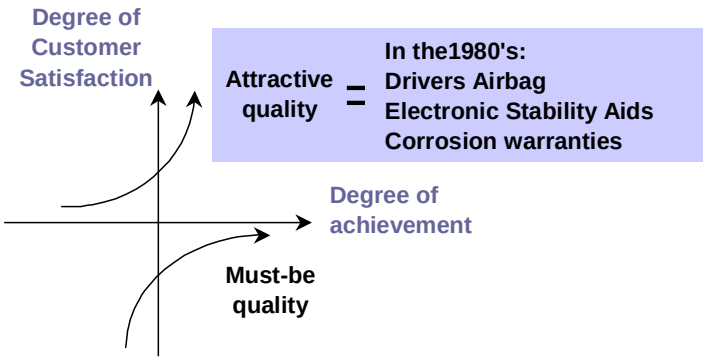


Figure 1.4. Kano Model (Kano et al., 1984) with examples of attractive qualities in automotive products in the 1980's.

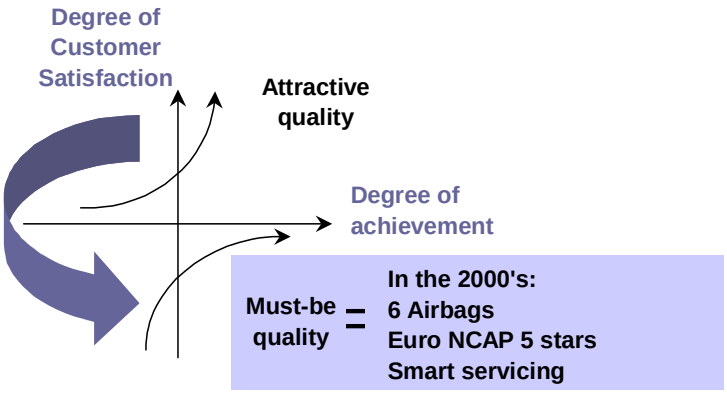


Figure 1.5. Kano Model (following the adaptation by Schutte [2005]) with examples of must-be qualities in automotive products in 2008.

Concurrently, greater manufacturing efficiency and improvements in design and development effectiveness have occurred through automakers' acquisitions and consolidation. For example, the global number of independent producers reduced from 52 in the 1960's to 30 in 1980 to 12 recently (Accenture, 2005) (Figure 1.6), although inclinations to de-merge to capitalise on brand value (e.g.: Aston Martin, Jaguar and Land Rover's break-up from Ford, the DaimlerChrysler split [Green, 2007]) are appearing to slow this trend. Nevertheless, efficiencies delivered through consolidation have enabled automakers to respond faster to evolving demands for products that satisfy ever-smaller market niches. For example, in the US between 1994 and 2004 there was a 69% increase

in major variants of car models; the average number of models per brand increased from 20 to 34 (Accenture, 2005).

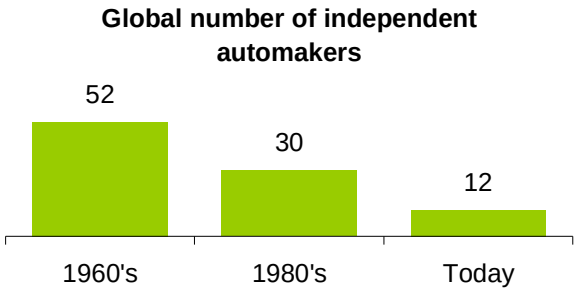


Figure 1.6. Industry consolidation represented by the decline in the number of independent automakers 1960's to 2005.
Source: Accenture, 2005.

1.1.2. The Rise of the Brand

The question can be posed, therefore; what are the new attractive qualities in the automotive marketplace? Without expanding upon underlying causes, significant evidence exists to suggest that the brand and brand-design (the explicit manipulation of brand specific properties within the product) are the new product differentiators and the battle-ground upon which commercial advantage is now being fought (Figure 1.7) (Barroff, 2006; Gonzalez, 2006; Simms & Trott, 2006). For example, Di Riso, Ghislanzoni & Scalabrini (2005, p3) observe; *'the things that really make a difference in the customers purchasing decision are the emotional attributes of the brand'* whilst Gruntegs et al. (2005, p.1) comment on the importance of the brand rising *'in direct proportion to the decline in other differentiating* [product] *attributes'*.

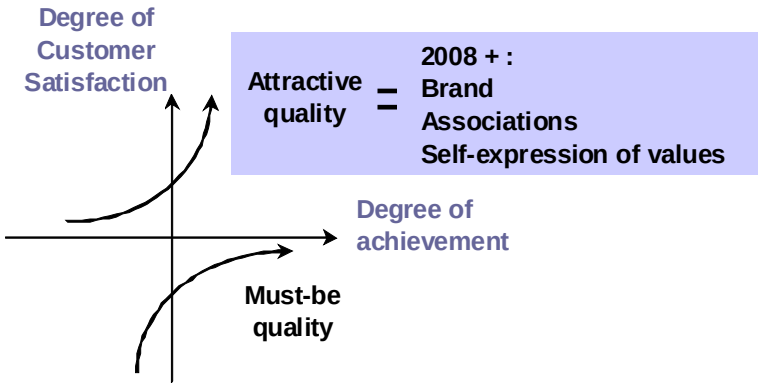


Figure 1.7. Kano Model (Kano et al., 1984) with examples of attractive qualities and must-be qualities for automotive products in 2008.

Indeed, profitability, and even survival, appears to increasingly depend on the potency of a company's brand image and the corresponding distinguishability of that message contained in the product (Carbon & Leder, 2005). Companies with strong brands have found that competitive advantage and market protection can be earned by carefully aligning key product qualities to the brand (Rowland & Evans, 1994) and that the credibility of competitors' propositions can suffer if superiority is claimed against recognised and salient brand dimensions (Aaker, 1991), whilst, for example, automakers focusing on the historical attractive qualities of safety, in their marketing campaigns, have found their market share correspondingly decline (Cornet & Krieger, 2005). By way of an indication of some cultural influence, Martin (1998) identified the top attributes (emotions, values and thoughts which are attributed to a product) consistently held by high-involvement products to include positive cognitive association links (of people, places, life-styles), uniqueness (or novelty), nostalgic value and sensory appeal.

Market research and other commentary, therefore, suggests that emotional, brand referenced attributes are attractive qualities in today's automotive product (e.g.: Zhang & Shen, 1999) For example, one customer comment from Bentley's Customer Quality Tracking System (CQTS) enthuses about an objective product attribute, in relationship to both the brand and an emotional association;

> *'It was good. It just pulls like a steam train. It feels very much like a Bentley engine. That's good. It feels like a Bentley engine, that's important to say'*
>
> (personal communication).

Globally, the shift toward the fulfilment of abstract, emotional benefits is notable; the market researchers McKinsey established that criteria like pleasure to drive, trendy, exterior styling and interior styling are all included in the top 10 most important purchasing criteria for mid-sized sedans in Japan, Germany and the US (Cornet & Krieger, 2005) (Figure 1.8)

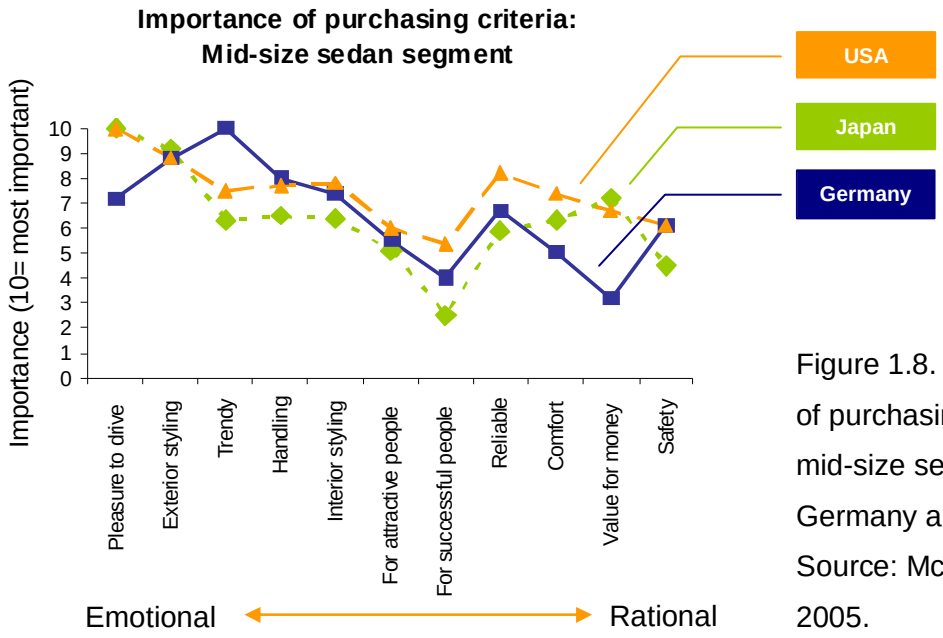


Figure 1.8. Importance of purchasing criteria, mid-size sedans, US, Germany and Japan. Source: McKinsey, 2005.

In response to the rise of the brand, companies have shifted their focus from a singular approach to brand development (traditionally, advertising communications) to broad and diverse brand focused design, development, manufacturing, product and marketing strategies. Brand strength has turned into a key business health-check (Haug et al., 2006; Phillips, 2005; Reynolds & Phillips, 2005; Valentine & Gordon, 2000). In many businesses employees are promoted as brand ambassadors (Heaton & Gizzo, 2005), and in automotive R&D divisions, developing products that possess properties that support and enhance the brand are at the heart of some product development processes (see section 1.3.10). Concurrently, the manufacturing centre of gravity has moved to a few mega-suppliers, who provide high-value standardised modules to assembly plants, allowing automakers to *'focus on the technologies…most critical to enhancing their brands'* (Dannenberg & Kleinhans, 2004. p.89).

1.1.3. High-luxury and 'Pinnacle' Brands

The automotive high-luxury segment (HLS), (purchase price >€150,000), and 'pinnacle' automotive segment (purchase price >€220,000) are markets where the importance of the brand, in relationship to corporate value creation, is distinct. For automakers, luxury brands are their flagships and centres of core competence (Dannenberg & Kleinhans, 2004); *'for a manufacturer, possession of evocative brands is now an asset more valuable than ownership of industrial real estate or even access to technology'* (Bayley, 2005, p.120, describing Aston Martin). Here luxury is framed in a traditional sense, of exclusive and somewhat conspicuous products like cars, clothing, furniture etc., as opposed to the emerging new luxury described by Bayley, Müller-Pietralla and others of rare qualities like time, exploration and authenticity (Pearlfisher, 2005; Müller-Pietralla, 2005; Ellison, 2007).

However, the cultural context behind the HLS mirrors a general observation in other evolving luxury markets;

> *'Customers are no longer 'consumers'* [they are] *no longer impressed by something as simple as superlatives...Rather, they are much more seeking intuitively understood reference points, which are in harmony with their own value system and their individual life themes'*
> (Carbonaro & Votava, 2005, p.77).

In other words, customers '*are looking for a brand that suggests the universe to which they aspire'* (Dejean, 2006, p.3), or that they inhabit; utilising the product or artefact as an extension of their self-image, values and beliefs (Belk, 1988). Transport needs, then, become a reflection of these self-expressions and values rather than the utility of getting from 'A to B' (Taylor, 2003). Instead, customers will typically own a collection of occasional cars and when considering another will exercise their facility to opt between, maybe, a car, or as easily, a boat, a painting or new holiday home (Hallmark, in Autoweb, 2002).

Within these segments, there is a select group of established brands that operate exclusively within it; for example Aston Martin, Ferrari, Lamborghini, Rolls-Royce, Bentley, and more recently, the re-launch of Bugatti. Common to these marques are rich, clearly recognisable brand identities built on decades of luxury and sporting heritage. Automakers attempting to break into these segments can quickly hit customer acceptance barriers if

they do not possess established, recognisable and congruent brand identities to support their proposition (Eisenstein, 2004; Shulinder, 2005; Taylor, 2003). Bentley's recent accomplishment is, in part, based on new products that embody a continued lineage of attributes supporting the brand's five values or 'pillars'; Racing, Driving, Power, Design and Craftsmanship (Feast, 2004; McCormick, 2005). These values have long established foundations stretching from five LeMans wins in the 1930's (and more recently a sixth in 2003) through the propositions of the romance of touring, torque (more salient, perhaps, than power) and style, to luxury and bespoke coachwork for British Royalty. As far back as 1933, Autocar described how influential the character of the Bentley brand is in the product experience. The passage is worth including here in its entirety because of its insight and remarkable suitability to the current topic;

> *'One of the most interesting and at the same time most curious things in connection with motoring is the way in which certain cars acquire what can only be termed a personality, odd though the term may seem in connection with machinery. Once achieve this point and a firm has every prospect of success, since the owners of the car in question hold stoutly the opinion that there is no better machine to be had, and take, as it were, a personal pride in any success the marque may attain. So it is with the Bentley'*
>
> (Autocar, October 6th. 1933, p.632)

Evidence suggests that products that inspire such authentic, emotional, brand values have assisted Bentley's successful expansion into the HLS (Feast, 2004; McCormick, 2005), whilst in a wider context, these themes are increasingly areas of discourse for contemporary product and brand theorists and practitioners concerned with evolving luxury cultures and product-user relationships (Carbonaro & Votava, 2005; Cheliotis, 2007; Gobe, 2001; Muller-Pietralla, 2005; Pearlfisher, 2005; Karjalainen & Warell, 2005).

1.1.4 Conclusions and Consequences

The literature identifies a clear movement in the cultural and commercial backdrop to the automotive market recently, and particularly in the high-luxury and ‘pinnacle’ segments. Mass attainment of certain product attributes, now considered must-be qualities, have encouraged the rise of the brand, and brand-design as the new attractive qualities in this market. Products that embody authentic and emotionally evocative attributes that are harmonious with the brand’s values, and resonate with customer values are most successful. However, to ensure this success, automakers need to understand how their products stimulate these cognitive associations, which are recognized by the customer as being authentic to the brand, and appropriately manage them through the product development process. Thus, it first appears important for designers, engineers and marketers to have an understanding of the mechanisms through which specific brand concepts are cognitively processed by the receipt of specific product attributes and properties. Section 1.2 therefore explores some general theories of concepts, and their cognitive processing, with particular reference to the brand as a cognitive concept, before methodologies are reviewed and proposed for their measurement and management within automotive product development activities.

1.2 Concepts, Categories and Memes

1.2.1. Background

Figure 1.9. 'Ceci n'est pas une pipe', Rene Magritte, 1928 –1929

Rene Magritte's interest in the cognitive processing of concepts is exemplified in his painting 'Ceci n'est pas une pipe' ('This is not a pipe') from the series 'La trahison des images' ('The treachery of images'; 1928-1929) (Figure 1.9). His work forms part of a tradition developed by diverse groups that have explored notions of concept recognition, categorisation, meaning and transference across a spectrum of human cognitive and physiological disciplines. The class includes, but is not exclusively limited to; philosophy (Berlin, 1980; Kenny, 1994; Margolis & Lawrence, 1999), linguistics (Chandler, 2002; Eco, 1976; Fisher, 2003), anthropology (Levi-Strauss, 1963), art (Gablik, 1985), memetics (Blackmore, 2000; Dawkins, 1976), marketing (Aaker, 1991; Basunti, 2004; Keller, 1993), cognitive psychology (Fodor, 1998; Lakoff, 1987), product design (Kreuzbauer & Malter, 2005, Shackleton, 1996), robotics and artificial intelligence (Barnes & Zhi-Qiang, 2004; Castelfranchi, 2003). Theories proposed by practitioners in these disciplines appear complementary, overlapping, or occasionally isolationist, often approaching the same

subject from different perspectives. Two of these, cognitive psychology and semiotics are examples where some common themes of discrete stimuli and higher-level constructs are explored, in similar terminologies, but with some differentiation; cognitive psychology being concerned with concept recognition processes, and semiotics concerned with the concepts relationship between its form and its content within a context. A third, memetics, a theoretical proposition of similar structure (see Figure 1.10), explores the transmission and evolution of culturally based concepts between and across cultures. This section therefore consolidates theories presented in the literature and explores their relationship to branding and design, drawing principally from cognitive psychology (Aaker, 1991), semiotics (Harvey & Evans, 2001; Hodgkinson, 1993; Valentine & Evans, 1993) and memetics (Marsden, 2002; Spring & Wood, 2005). Above other theories, all three are of particular interest as their individual relationships to commerce; marketing and product development have been well documented. However, this section also aims to discuss some potential synergies, interactions and models of these theories that could be later applied, through a product attribute management process, to the branded automotive product.

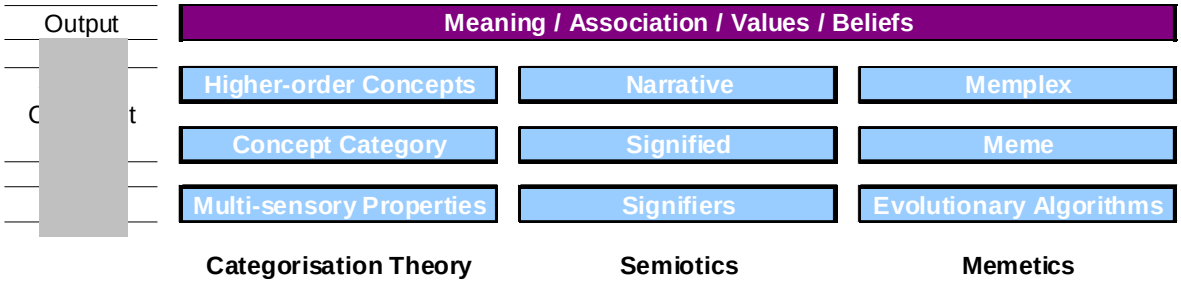


Figure 1.10. Cognitive categorisation, semiotic and memetic theory structures.

1.2.2. Concept Theory

Before discussing cognitive concept theories, what is generally meant by a concept should be defined. To summarise the literature; a concept is an abstract entity of infinitely variable forms that can be understood by humans, and possibly other creatures, endowed with the capacity for sensing and cognitive processing (e.g.: Fodor, 1998). A concept, therefore, could be; *'a person, place, thing, feeling, state of affairs, sense of foreboding, fantasy, hallucination, hope or idea'* (Eco 1976, p.67). Equally, then, it can be a product and a brand. To be a concept that is manifested in the physical world, the entity should have a content that can be defined by properties that can be sensed and to which further (often variable) meanings and associations can be attributed (Eco, 1976). Knowing a concept involves a structured cognitive activity through two distinctive processes; either physio-psychological journeys of sensing, understanding and learning, what Kant calls *a posteriori* knowledge; or purely psychological or philosophical journeys to *a priori* knowledge (Körner, 1955). *A posteriori* concepts, like the branded product, are locked into memory through causal / historical experiences (Fodor, 1998); understanding these concepts requires them (Simon, 1996) and beliefs and attitudes about them result (Mason & Bequette, 1998).

Because brands and products exist culturally and their products are experienced, the physio-psychological process to *a posteriori* knowledge is of most interest to this research, rather than *a priori* knowledge, which a product or brand can only be, at most, fleetingly, in the mind of the creator, before it becomes a concept that is universally acknowledged. The mechanisms of sensing stimuli (seeing, touching, tasting etc.) are assumed to be significantly explained and understood in other research. Instead, this Thesis explores

what concept stimuli might consist of and what might condition them in the branded product concept recognition / output process.

For the purposes of this research, concept awareness, recognition and knowledge is obtained through the receipt of information about a physical object's constituent properties and performance (distinguishing features, characteristics, dimensions, etc.) presented within a contextual framework that has become, at least in part, embedded in memory through experience. The neurological procedure that processes this information has been described (e.g.: Pinker, 1997) in the form of a computational model, consisting of cerebral nodes (or neurons) sensitive to specific mutli-sensory stimuli, sweeping for concept properties (or Concept Property Elements [CPE's] following Solomon & Barsalou, 2001, but also referred to in the literature as features or primitives [Ratneshwar & Shocker, 1991], or atoms [Berlin, 1980; Fodor, 1998), like colour, form, aroma, auditory notes, performance, etc. The model suggests neurons form stimuli comparisons to learnt, pre-determined weighted thresholds, which when exceeded cause neurological activity. For complex properties with multiple stimuli (like the colour, smell, texture and taste of a food) neurons join in a controlled network, and when property networks combine, with *a posteriori* weightings, within an expected contextual framework, concept identification can be established (Keller, 1993; Kleine & Kernan, 1991; Pinker, 1997; Wiedermann & Beran, 2003), affordances derived (Quester & Smart, 1998) and authenticity judged (Grayson & Martinec, 2004). It is noted, however, that property neural-networks do not need to be complete; probability or cue validity can exist, where limited stimuli indicators infer the presence of others (Rosch, 1999); cognitive economy in cognitive categorisation mechanisms, influenced by familiarity and experience, then prompts predictions about the nature of what has been encountered (Pinker, 1997).

Whilst the computational model presents an organised neurological theory for concept stimulation, recognition, meaning and knowledge, structuralists like Ferdinand de

Saussure relate to the same theory in alternative terms; here the content of the concept consists of a signifier (the form of the concept sign; like the painting of a pipe) which is equivalent to its meaning, and a signified (the content of the concept; an implement used to smoke tobacco) (Figure 1.11) (Chandler, 2002). At a basic level it can be proposed that a single signifier exists like a single property, as it performs a mediation process leading to associative meaning equivalent to that of the signified (Osgood, Suci & Tannenbaum, 1957), for example; a fire alarm with properties of certain pitch and tone is a signifier of the concept ‘fire’ which evokes understanding of ‘emergency’ and operates an associative behaviour of ‘evacuation’ (ibid), whereas a sound with different pitch and tone may be a signifier of door bell, provoking understanding of ‘visitor’ and the behaviour ‘open the front door’. Complex concepts with multiple definitional properties have multiple signifiers (and corresponding signifieds) that combine in a chain-like network, also sometimes described as a code (Harvey & Evans, 2001; Lacan, 1985). The central manifestation of this code, in semiotics and cognitive psychology (Pinker, 2007), is language, where the basic linguistic structure of phonemes and morphemes forms together in a higher-level narrative, or discourse, that can be understood by reference to the signified (Levi-Strauss, 1963), when presented within an appropriate context. In semiotic theory, the socio-cultural contextual dimension dominates; Levi-Strauss (in Chandler, 2002) stressed a universal code can only provide accurate meaning if it is received in a context that is also *‘familiar to the sign-users culture’* (Chandler, 2002, p.31). For example, the colour blue, having a spectrum between 480mμ and 460mμ, has two different cultural units in Russia, whereas in Hindu, the red to orange spectrum 590mμ to 800mμ, has a single term (Eco, 1976).

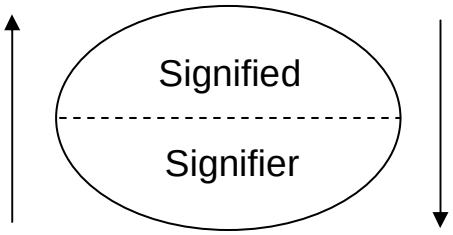


Figure 1.11. Saussure's diagram of concept signifier and signified; the arrows represent the signification process, and the dotted line the bar segmenting the two elements (Chandler, 2002).

1.2.3. Categorisation Mechanisms

Beyond the receipt of salient, contextual properties, the information acquired against *a posteriori* concept knowledge is organised into cognitive categories to aid concept meaning (Barnes & Zhi-Qiang, 2004), followed, usually, by physical or psychological outputs like thoughts, activity or emotions (Pinker, 1997). Cognitive categories can be taxonomic, biological (e.g.: plant, animal), goal-derived (e.g.: drinking vessels – the designation of most product categories) or ad-hoc (e.g.: *'things to take from one's home during a fire'* [Barsalou, 1983 p.214], which tend not to be ubiquitous) (Ratneshwar & Shocker, 1991). Later, the hypothesis provided by Bouch (1993) and (Kreuzbauer & Malter, 2005) that some brands exist as taxonomic categories is explored.

Overall, categorisation theory is a complex and diverse field of research and hypothesis. The historically dominant Classical Theory suggests that concept categories are defined by structures of necessary and sufficient conditions (Margolis & Lawrence, 1999), perhaps equivalent to strictly bounded and definitive sets of properties, which can be analytically identified and explained. In the classical theory, all examples belonging to the concept category are said to exist on an equal footing and a check of category membership is

therefore a check of the subjects defining properties according to pre-defined necessary and sufficient conditions (ibid). A popular example is the concept ‘bachelor’, where the necessary and sufficient conditions are, for example, unmarried, male and adult; the collection of these properties exclusively infers bachelor and defines it (Pinker, 1997). However, as could be imagined, some problems exist with the classical theory. Three are most usually explored:

(a). Not all concepts have definitions that have necessary and sufficient conditions.

(b). Category members can be more or less typical of the concept category.

(c). Concepts can emerge and their categories evolve.

These problems are subsequently discussed.

The problem with definitions (problem (a)) is that there are many concepts for which they are not necessary and sufficient, for example: in lie, knowledge, goodness, or game varieties of definitional properties are plausible (Margolis & Lawrence, 1999). Without a defined list of a concept’s constituent properties, classical theory struggles to accommodate such examples. Indeed, most people cannot recall most necessary and sufficient conditions to describe concepts any more complex than the most basic (Rey, 1999). Reflecting on the complex nature of many concepts, Wittgenstein alternatively proposed that category members shared ‘family resemblances’ and these define concept categories, like fuzzy sets, in a *‘complicated network of similarities overlapping and criss-crossing: sometimes overall similarities, sometimes similarities of detail'* (Kenny, 1994, p.44).

For many, the previous example of the concept ‘bachelor’ will also produce a variety of examples (Cliff Richard and The Pope could be two). Eleanor Rosch (1999) noted that

many category members can be more or less typical of the concept category and therefore do not exist on equal footings (problem (b)); some members have properties that are shared with other members more than some others and are therefore more or less typical of the concept (Barsalou, 1983; Lakoff 1987; Ratneshwar & Shocker, 1991). By way of example, Pinker (1997) cites work by Sharon Armstrong, Henry and Lila Glieitman, who proposed that the number 13 was a better example of the concept 'odd number' than 23 (Figure 1.12) and that mother was a better example of the concept 'female' than a comedienne, despite these being apparently crisply bounded categories with necessary and sufficient definitions.

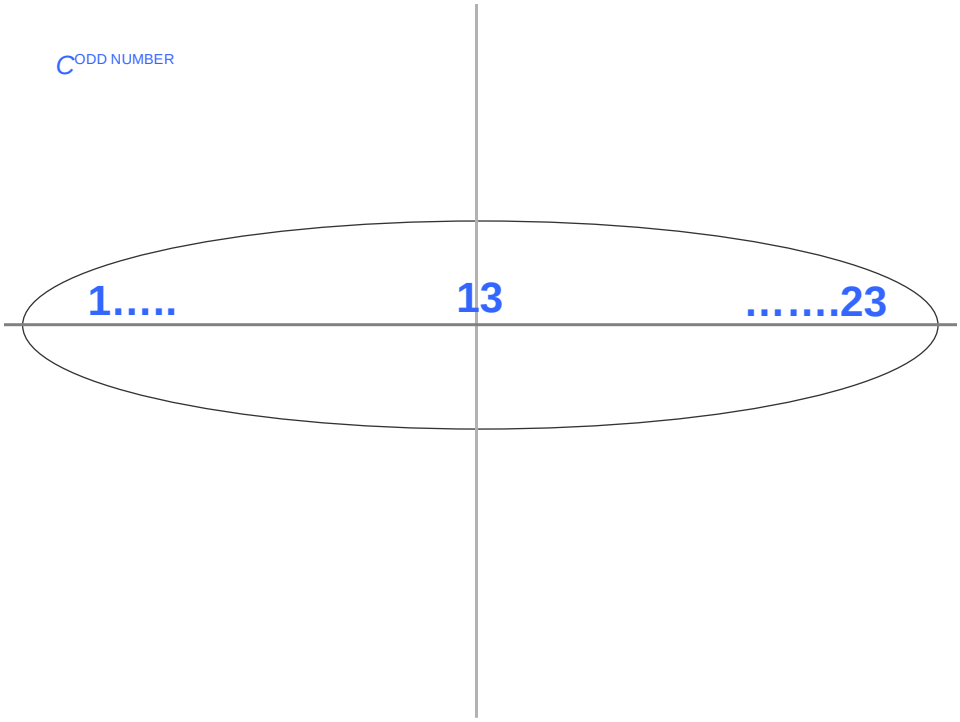


Figure 1.12. The Odd Number category. Adapted from Pinker (1997).

In response to problem (b), Prototype Theory developed as a new theory of category structure in the 1970's. Prototype theory recognised that a category usually contains members of scaled typicality and that it may have unclear boundaries and sit within a hierarchical structure of related entities. Rosch, Lakoff, Fodor and others proposed that this structure could be drawn on two perpendicular axes; '*x*' representing category

segmentation or taxonomy, at a given level of inclusiveness, mapped along a continuum from prototypical centre through unclear cases to non-prototypical (an 'is like' association) (Barsalou, 1983 & 1985), and '*y*' representing levels of inclusiveness, or a hierarchy of dominance (a 'belongs to' association) (Fodor, 1998; Lakoff, 1987). For example, in the concept 'chair'; '*x*' possibly reads, 'is like…kitchen chair, dining room chair, office chair…', and '*y*' reads 'belongs to…man-made object ➔ furniture ➔ chair' (Margolis & Lawrence, 1999). Lakoff (1987) suggests the vertical hierarchy has six levels, in descending order of specificity; Unique Beginner (e.g.: plant, animal); Life-form (tree, bush, bird, fish); Intermediate (leaf-bearing tree, needle bearing tree); Genus (oak, maple); Species (sugar maple, white oak) and Variety (cutleaf staghorn sumac) (Figure 1.13). Basic level concepts are those at the genus level, where the most properties common to examples within the category are found (Fodor, 1998; Lakoff, 1987; Ratneshwar & Shocker, 1991). The genus is the crossing point of the axes of category segmentation and inclusiveness, where a zone of prototypicality, or ostension appears (Eco, 1985). Some benefits of this theory to cognitive efficiency are offered to support its legitimacy; for example, prototypicality appears to influence the speed of mental processing of a concept (a new information chunk takes about eight seconds to process, whereas a previously stored template takes one or two seconds [Simon, 1996]), as well improving the speed of learning of alternative categories, and the probability accuracy of an member's output (what it does) and performance (how it does it) (Rosch, 1999).

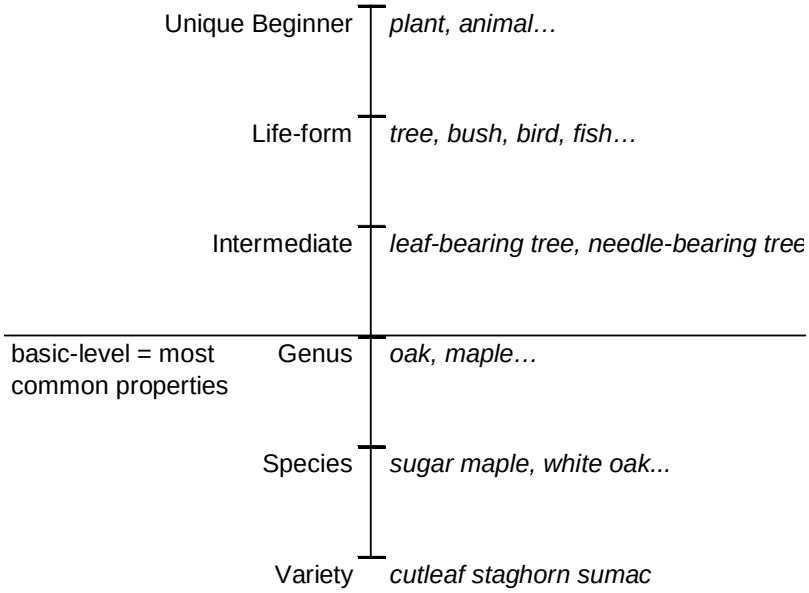


Figure 1.13. Concept hierarchy structure (Lakoff, 1987).

Within the literature, two principal methodologies have emerged for measuring the typicality of category members; Tversky's Contrast Principle (Barsalou, 1983; St. Jacques & Barriere, 2006), and Smith et al.'s (1988) Selective Modification Model. Both assess similarity between members and similarity of a member to a prototype based on its property count (see also section 1.3.7., for a detailed review). Property quantity has been used in the contrast principle to demonstrate, for example, that Robin is a more prototypical bird than Chicken (Figure 1.14). However, some difficulties have been generally recognised when attempting to quantify typicality in a category; firstly, for different individuals dissimilar prototypical representations may be recalled; for example, for the concept 'president', no agreement can be reached on the defining set of its prototypical properties (Fodor, 1998). Secondly, members can inhabit multiple categories with variable typicality. For example, Goldfish is a poor prototype for pet and a poor prototype for fish but a good prototype for pet fish (ibid), or garlic and onions share the same natural taxonomy, but in cooking they are differently categorised (Barnes & Zhi-

Qiang, 2004). Thirdly, prototypical properties cannot be the sole defining properties of a category; consider ‘has four legs’ and ‘is made of wood’; neither are defining properties of the category ‘chair’, but may be properties that one or more members have, including, potentially, the prototype (Rey, 1999). Barsalou (1985) recognises such complexities, identifying further active determinants of typicality, including, ideals; the associated affordance of the member, for example; *the ‘ideal… foods to eat on a diet’* (Barsalou, 1985, p.630) and frequency of instantiation; the frequency of experience of an entity as a category member; all considerations Hampton (2006) noted in his review of the selective modification model, but did not resolve. Tversky & Smith et al’s (1988) offerings therefore remain the only typicality quantification methodologies consistently employed.

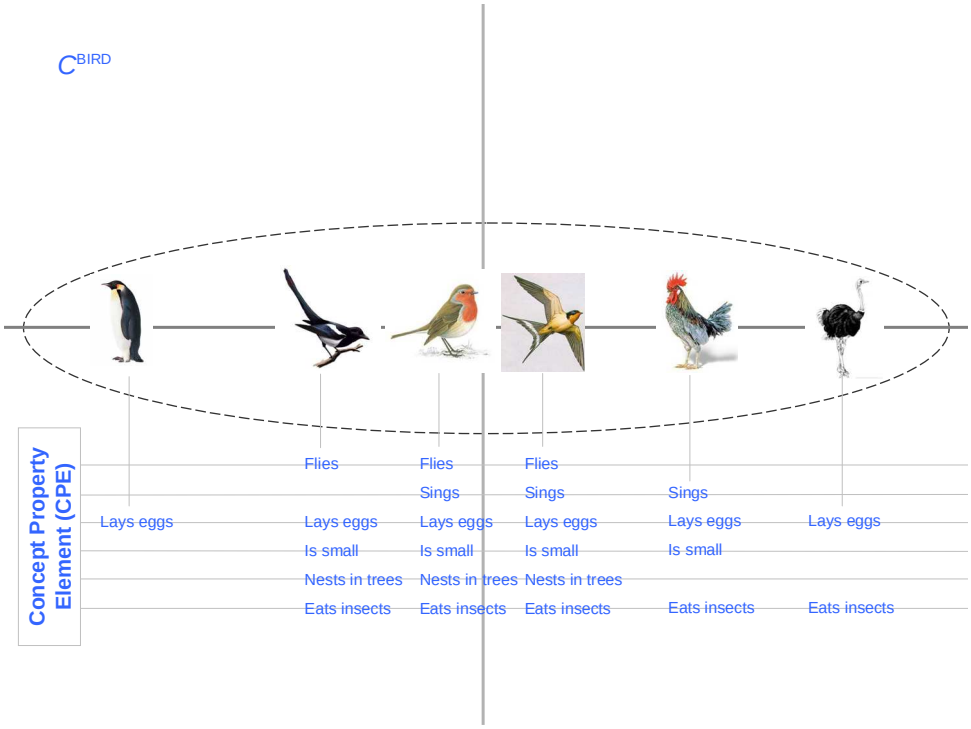


Figure 1.14. The bird category, with example properties. Adapted from Smith et al. (1988).

Saussure’s use of paradigmatic and syntagmatic axes in semiotic concept theory, indicates that similar category structures exist within other fields, for example; in Figure

1.13, '*x*' could be described as consisting of *x* or *y* or *z* members of increasing typicality (an is like, paradigmatic construct), whilst '*y*' could be alternatively described as consisting of *a* and *b* and *c* inclusive, associative, contextual relationships (a belongs to syntagmatic construct) (Chandler, 2002; Valentine & Evans, 1993) (Figure 1.15). The typicality relationship (*x*) is often described by semioticians as dualism, also referred to as 'what something is not'; why one thing is chosen against another (as knowing what something is, by first knowing what it is not, appears to be a central mechanism in cognitive categorisation [Pinker, 2007]). Aristotle's Metaphysics first identified the important role of dualism in concept identification with primary opposites like natural and unnatural; *'opposites* [antonyms] *clearly have a very practical function compared with synonyms: that of sorting'* (Chandler, 2002, p102). It is conceivable, therefore, that along the *x* continuum, opposites might perform a role of defining category membership, boundaries and member typicality. Osgood, Suci and Tannenbaum's (1957) seminal methodology of concept measurement; semantic differentiation (discussed in detail in section 1.3.2.), was based largely on this proposition.

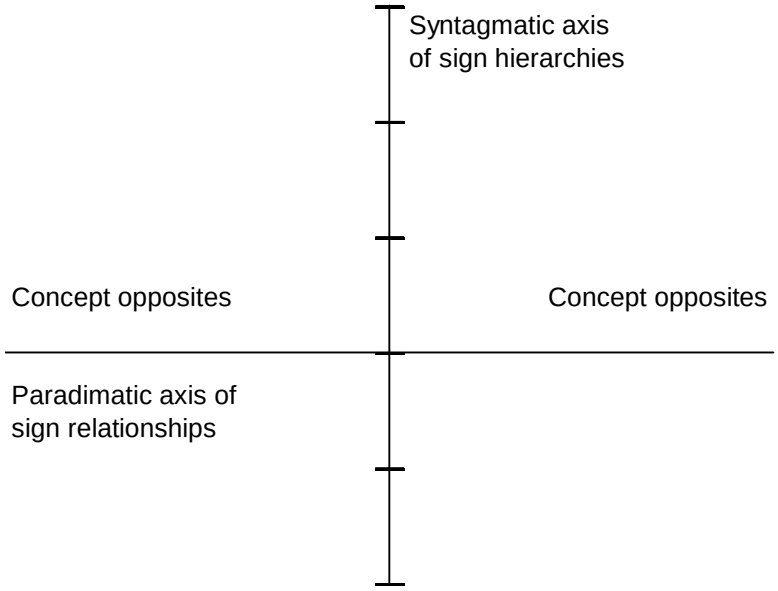


Figure 1.15. Semiotic concept structure.

Chandler (2002) also noted that in Structural Linguistics, metaphor (associative relationships) and metonym (related relationships) correspond like paradigm and syntagm. Significant discussion has been given to the role of language in mentation (e.g.: Pinker, 2007) and therefore also to the relationship between the linguistic constructs of metaphor and metonym, which appears to be a key component to understanding, that work by performing a referencing mechanism, either to associated entities (is like) or to related entities (belongs to) (Chandler, 2002). The importance of the metaphoric / metonymic relationship was likened to that of latitude (*x*) and longitude (*y*) by Valentine (2002) when describing conceptual location. Various marketing agencies (e.g.: www.semioticsolutions.com), have explored these relationships in marketing-based processes, like semantic differentiation scales, and the purpose of the two in establishing concept myths (Levi-Strauss, 1963); the reconciliation of propositional contradictions, through the analysis of opposites, built along metaphoric and metonymic axes (for example, in branding; 'home-cooked convenience foods' [Marks and Spencer] or 'caring efficiency' [Persil], or 'emotional safety' [Volvo] (Alexander, 1996; Karjalainen, 2005; MacFarquhar, 1994; Valentine & Evans, 1993). However, the concept hierarchy structure model deconstructs somewhat here, without defined metonymic structure levels and with an emphasis on category opposites, or infinite boundaries, rather than centrality inferred by prototype theory. Nevertheless, semiotics explores concept signifiers and their meaning along apparently complementary axes to prototype theory. Its concern with language reflecting the significance of the role that it appears to take as a medium through which thought and meaning is facilitated (Osgood, Suci & Tannenbaum, 1957; Osgood, May & Miron, 1975; Pinker, 1997; Pinker, 2007), communicated and habituated (Gentilucci & Corballis, 2007).

Returning to the criticisms of classical theory, problem (c) stated that in opposition to the stable necessary and sufficient conditions that describe category members, concepts can emerge and their categories can evolve. It is clear that concepts do emerge and evolve;

evolution is a natural process that modifies species, whilst cultural concepts are adapted across generations when new technology develops, innovation or lifestyles are conceived, spawning new products or other artefacts (Blackmore, 2000; Blackmore, 2001; Dawkins, 1976; Wood, 2003). In this context, it is important, therefore, to explore the theory somewhat to understand how established concept categories and their prototypes might shift and evolve and what causes them to do so.

Wittgenstien, Lakoff and Fodor all argued that some concept categories have fuzzy boundaries and that category boundaries move to accommodate new examples that possess properties that resemble them (Pan & Lehmann, 1993). As this happens, prototypes also shift and change; consider the category ‘personal music machine’ (Figure 1.16), a category explored further in chapter 2. The prototype, in the 1980’s, was probably the Sony Walkman; it was the first, most successful and most recognisable example. Today, the prototype is probably the Apple i-Pod, (Naughton, 2006), although some emerging evidence suggests its ubiquity is leading to its decline in popularity (Smith, 2006) and therefore to a potential shift in the category prototype. This has been perhaps, in part, due to changes in technology (e.g.: miniaturisation of components, new recording formats, interface design and data exchange methods) but some influence can also be attributed to the laws of novelty (Martindale, 1990); a force that balances against typicality in attractiveness assessments in a number of artistic fields like music, art, poetry, architecture and product design (e.g.: Martindale & Uemura, 1983; Martindale, 1986). Here stylistic habituation and the desire for cognitive arousal forces novelty to occur as each design practitioner searches for more novel concepts than their predecessor or peer, but where attractiveness and prototypicality is kept in check by concept familiarity and relevance (Batra, Lenk & Wedel, 2006; Carbon & Leder, 2005; Carbon, Hutzler & Minge, 2006; Hekkert, Snelders & Van Wieringen 2003; Martin, 1998; Snelders & Hekkert, 1999). This theoretical relationship is discussed in more detail in chapter 5.

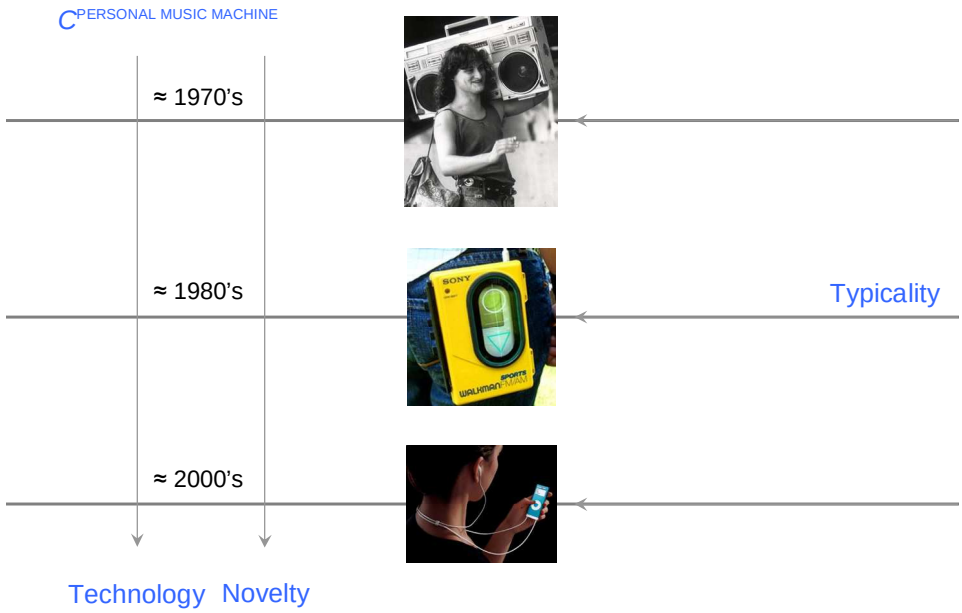


Figure 1.16. The personal music machine category evolution, with technology and novelty acting in balance with typicality.

An alternative explanation of the motivation behind the evolution of concepts across epoch's, cultures and continents is given by the more recent theory of memetics (although the theory has some similarities to the 1920's Purist theory of 'object-types' in art and design [Jencks, 1987]). Memetics proposes that there are two evolutionary components now present in the human species; genes (the Darwinian biological code, which have existed for millennia and are relatively stable) and memes (the cultural, concept code, which are more recent additions to humanity and are [relatively] immature) (Blackmore, 2001; Downes, 1999; Pech, 2003; Spring & Wood, 2008; Wood, 2003). Like genes, memes replicate, evolve and transcend the vessel through which they are carried between (the human brain); for example, Blackmore (2000) notes that human activities like farming are concepts which transfer and adapt from generation to generation through imitation rather than controlled manipulation. The heredity, variation and modification of the meme appear, instead, to be governed by laws similar to genetic evolution; selection

is made through the survival fitness of the concept, to serve the needs of the meme rather than some other controlling force (Dawkins, 1976; DeJong, 1999). Akin to the genetic component DNA, meme's contain a deconstructable algorithm (Blackmore, 2001) that when present within the artefact, for example, appears to condition meaning in a similar manner to the stimuli of object properties or the relationship between signifier and signified. Wood (2003) uses memetics to explain the flow in the evolution of this algorithm through the design of successful objects, arguing that the logic of categories has historically suggested an inherently static set of ideal prototypes (problem (c)), whereas (and as previously observed), memetics leads toward shifting concept prototypes and changing and flexing category boundaries in response to technological or cultural influence:

> *'This factor* [successful memetic evolution] *is increasingly visible in an age when both technological innovation and the spread of mass production and distribution continue to accelerate. In such a world, relations are paramount. Indeed, it is the relationship between form, novelty, function, style, price and replicability that will determine the net effects of a given design'*
>
> Wood, 2003.

1.2.4. The Brand Concept

Cognitive psychology, semiotics and memetics all deal with concept recognition, categorisation, meaning and transference and have all applied their theories to branding and the branded product at some point (e.g.; cognitive psychology: Franzen & Bouwman,

2001; semiotics: Valentine & Evans, 1993; memetics: Marsden, 2002; Wu & Ardley, 2001). Interest in the relationship between these theoretical models and brand behaviour has been encouraged by the apparently strong cognitive benefits that branding promotes and the relationship that has to customer satisfaction (Aaker, 1991; de Chernatony & McDonald, 2003; Czellar, 2003; Keller, 1993; Lindstrom, 2005). The Oxford English Dictionary therefore recognises that brand means not only *'the type of product manufactured by a company under a particular name'* (www.askoxford.com) but that it is also related to what is described as 'mindshare'; *'consumer awareness of a product or brand'* (ibid). The success of a brand concept appears to be obtained primarily through the communication of associated affordances from the cognitive categorisation process manifested in a variety of possible rational or emotional effects like understanding, recognition and agreement, delight or esteem (Kreuzbauer & Malter, 2005). When the customer has favourable, strong or unique cognitive associations, they are said to have customer-based brand equity (Keller, 1993) creating value for the brand through purchase loyalty, peer recommendations and brand extension opportunities. Sometimes the associational effects appear to out-weigh objective reason (the whole concept becomes something more than a collection of its individual properties); for example, preference for a sample of the breakfast cereal Corn Flakes increases from 47% to 59% when the brand (Kellogg's) is known (Figure 1.17) (Lindstrom, 2005).

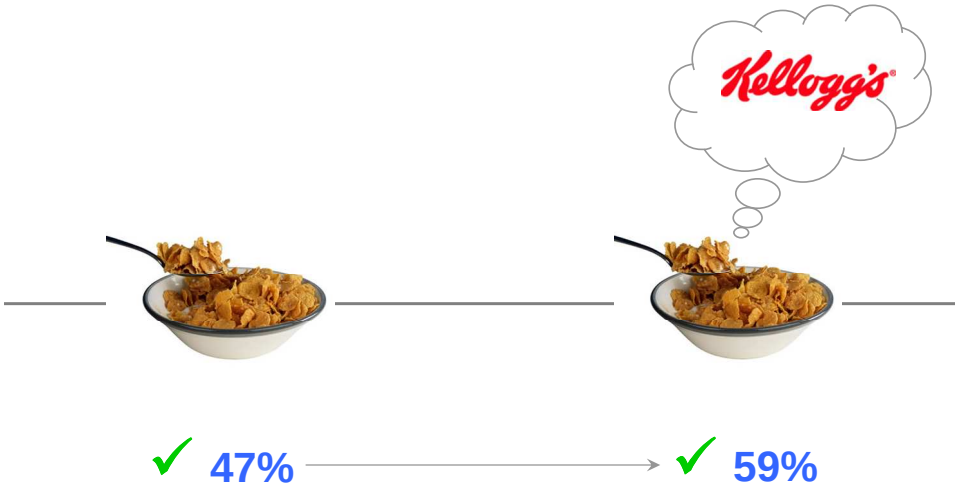


Figure 1.17. Breakfast cereal approval pre and post brand revelation. Adapted from Lindstrom (2005)

One of the most salient brand associations conceivable from the cognitive categorisation process, discussed by many authors including Carbonaro and Votava and Lindstrom, is authenticity; relating to both the 'is like' (paradigmatic, typicality assessment) and the 'belongs to' (syntagmatic, relationship assessment) axis, the latter construct being particularly important for brands like Volvo or BMW Mini that aim to evoke specific authenticity perceptions as part of their appeal (Karjalainen, 2005; Simms & Trott, 2006). Lindstrom therefore advises brand custodians (designers, engineers and marketers); *'Your primary objective…should be to ensure that all the historical links and associations connected to your brand are supported,* [they are] *the strongest competitive advantage of* [the] *brand' (*Lindstrom, 2005, p.182), where support can be defined as the proactive inclusion of appropriate, multi-sensory product properties. He further encourages, 'Smash your Brand!', to examine the strength of the associative concept links through to the constituent units that stimulated it, emulating the brief for the designer of the Coke bottle;

create a design which could be instantly recognised (as belonging to) from a single piece, if it were smashed on the floor (ibid).

The authenticity example is one of many (e.g.: prototypicality, transference, cultural context, *a posteriori* knowledge) where the literature suggests the brand behaves as a cognitive concept (Franzen & Bouwman, 2001 includes an extensive review, aptly titled The Brand in Their Minds). Accordingly, de Chernatony & McDonald (2003) propose branding not as an input process, devised and applied by marketers to a product, but as an evaluation of meaning made in users' minds, such that the brand is their view of the product, not the producers (an argument supported by the brand commentator Peter York [York, 2006] and in Valentine & Evans, 2000). However, the dominant hypotheses relating to categorisation argue that the brand is a property of a product that is subject to cognitive categorisation (in a goal-derived category) and to prototype effects; for example, Romaniuk and Sharp (2000) (cited in de Chernatony and McDonald, 2003) identified prototypical brands of a product category based on member property quantity, demonstrating such processes enable customers to predict the performance of unknown brands based on common product category properties. They accompany others, where discussions explore the influences of brand properties on the product category segmentation axis (for example, Henderson, Iacobucci & Calder, 1998; Karjalainen & Warell, 2005; Kreuzbauer & Malter, 2005; Meyvis & Janiszewski, 2002; Warlop, Ratneshwar & van Osselaer, 2006; Warell, 2006) (see Figure 1.18), or the reciprocal influence of the product category on the character of the brand (e.g.: Batra, Lenk & Wedel, 2006).

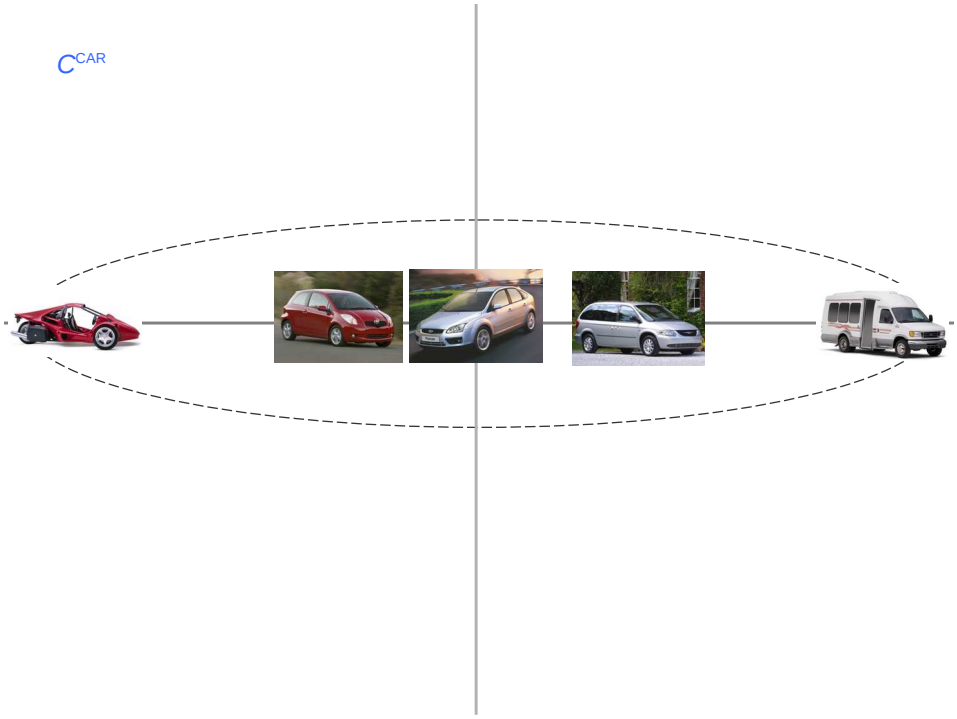


Figure 1.18. The Car category, whereby product and brand properties define inclusion and prototypicality.

Whilst this is the case, emerging hypotheses also suggest that some brands are taxonomic categories in themselves; they adhere to the horizontal and vertical concept structure within our mental constructs, their constituent members being the products of the brand category (Boush, 1993; Joiner & Loken, 1998; Loken, Joiner & Peck, 2002) (Figure 1.19). It follows from the suggestion that notness is significant in concept identification (Millikan, 1984; Pinker, 2007), that dissimilarity of brand properties, or brand cue distinctiveness, within a product category might aid brand identification, recall and preference (Warlop, Ratneshwar & van Osselaer, 2006). This interestingly suggests that prototypicality may not be the sole measure of likeliness of recall when considering brands in the dominant hypothesis of brand as a property of a product within a product category, but that distinction also has a role. However, this can also be read as support for the second hypothesis, that when brands are considered as categories, the distinctiveness of the brand category (sharpness of category boundary, or intermediate category space) aids differentiation between brands; a potentially significant alternative view for brand

management, as brand differentiation and distinctiveness appear to be one hallmark of commercial success. However, limited evidence to support this view exists in the literature reviewed, as explicitly acknowledged in Boush (1993).

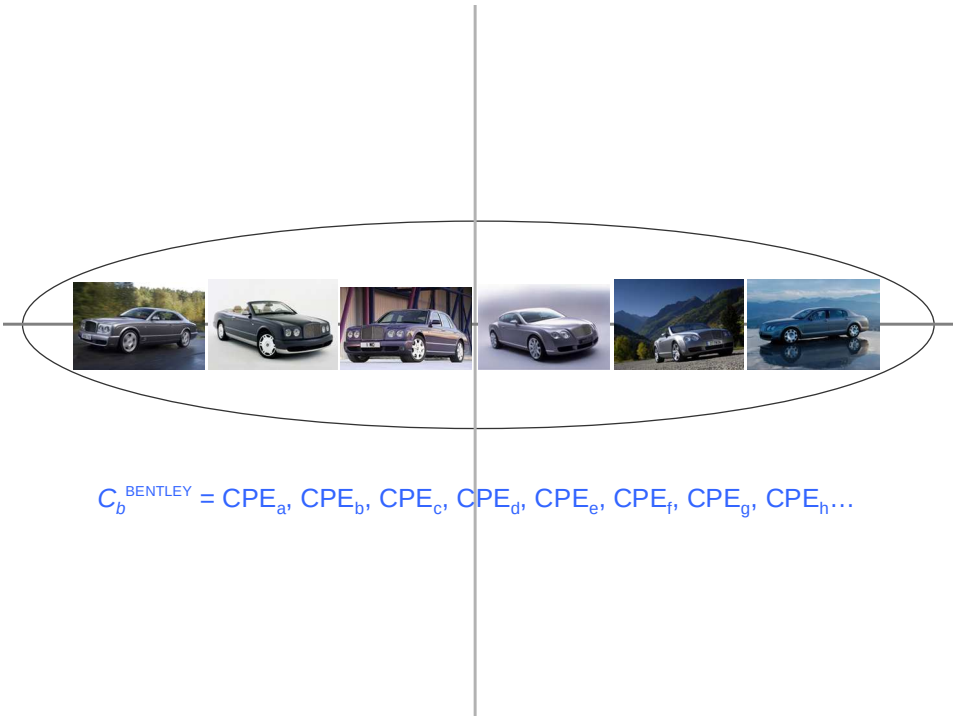


Figure 1.19. The Bentley category, whereby brand properties define inclusion and prototypicality.

In either view, it is suggested that successful brand recognition relies on prior brand exposure (*a posteriori* knowledge) and the ability to correctly link distinctive product property values and contexts to the concept (Romaniuk & Sharp, 2004). The designer, engineer or marketer can apply influence to this process at a number of points, with the latest thinking focused on drawing out multi-sensory properties that may provide some clarity in today's overcrowded mono (visual), or at most, duo dimension (visual + auditory) communication stream (Lindstrom, 2005). Although the visual sense is dominant, branded concept recognition can be evoked by many senses; for example, research claims that 28% of US customers and 38% of Japanese can identify the difference between car brands by the sound of the door shut alone (ibid).

As a mirror to concept category fuzzy boundaries, segmentation and evolutionary influence, brand extensions exist. These are products that move beyond their established category boundaries in response to opportunities for synergistic products (Baumuller, Cornet & Erbenich, 2005). Customers perceive brand extensions based on apparent category fit, along two concurrently assessed dimensions; firstly, product category fit – the product is accepted into to the new brand category, and secondly, brand level fit – the brand is accepted into the new product category, and the reciprocal effect of the extension to attitudes to the parent brand category (Czellar, 2003). The cognitive condition of the brand in these cases, however, appears finely balanced; for example, the inclusion effect (Joiner & Loken, 1998) suggests that there is a stronger cognitive link between a category member and its higher-level concept (e.g.: in Figure 1.13, Genus ➔ Intermediate) than between members suggesting attribute transference travels up the '*y*' axis in preference to the '*x*' axis (see Figure 1.20). However, Keller warns *'if a brand becomes associated with a disparate set of products, product category identification and the corresponding product associations may become less strong'* (Keller, 1993, p.16) indicating that a dilution of the vertical preference occurs when multiple extensions are present. In such cases, tension builds within the established category, ultimately leading to the parent category segmenting, like splitting of cell nuclei (Shackleton, 1996) and to associational uncertainty within customers' minds; for example, Caterpillar; Digger or Boots? (Aaker, 1991).

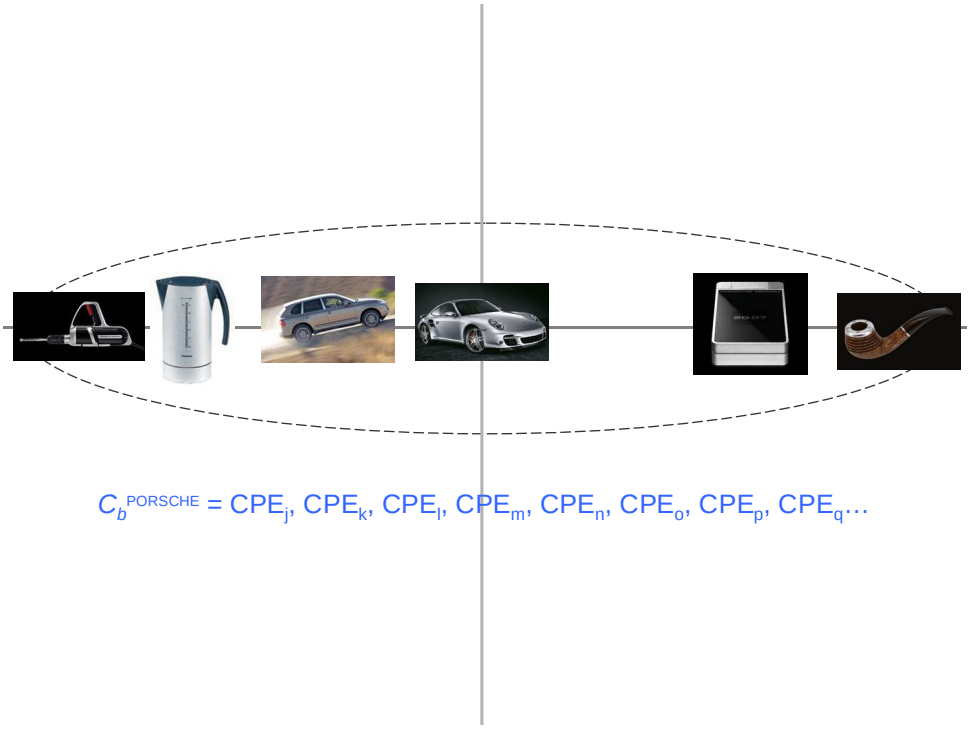


Figure 1.20. The Porsche category, whereby brand property links define inclusion and prototypicality across product types.

1.2.5. Conclusions and Consequences

In section 1.1 the significance of product concepts that evoke satisfactory emotional feelings in the high-luxury automotive market were discussed. Section 1.2 reviews the cognitive mechanisms that create such reactions by presenting some philosophical and empirical research in cognitive psychology, semiotics and memetics to support a generally agreed theory of concept processing, whether for a branded product or not. The mechanisms involved; property stimuli, context, knowledge, categorisation, prototypicality, association and transference; the semiotic code; language as a mediator; the evolutionary algorithm of concept replication and survival, all suggest that discrete concept properties might not only influence concept recognition and understanding, but also help build a construct that provides user satisfaction in branded products. One theory was identified that offers some significant potential for advantageous brand management; that of the brand as category, but requires further evidence to make it useful. From this starting point, however, it appears plausible that designers, engineers and marketers might manipulate specific product properties to influence this cognitive process that might lead, in turn, to the emergence of new product variations that are recognisable as authentic to the brand through their possession of salient multi-sensory stimuli and the resulting recall of strong affective associations. However, one of the requirements of the effective deployment of that idea to automotive design and engineering would be the development of a suitable cognitive categorisation based product property assessment and measurement tool. Some of the various methodologies that might be available for this are reviewed in section 1.3.

1.3. Concept and Category Measurement Methodologies

1.3.1. Background

The Literature Review has so far discussed the motivations evident in high-luxury vehicle markets and the cognitive processes that stimulate users' satisfactions within it. Now, in order to understand how these cognitive stimuli might be qualified, quantified and specified, in order that they could be understood and managed for advantage within an automotive attribute management process, available alternative methodologies are explored. It is important to note here that the Research Objective stated in section 1.4. will show that it is not intended that this Thesis defines a novel methodology for measuring typicality, cognitive categorisation, product attributes, or what is right for the brand, but rather applies one or more existing cognitive categorisation assessment and measurement tools to the branded product and in particular the automotive interior, for the first time. Therefore, the following review sections are significant and necessary within that context.

There is a large body of established knowledge from cognitive psychology and marketing in the assessment and measurement of our affective reaction to concepts, including brands and the branded product. This section, however, is focused on research closely related to product attribute management; that which has recently become known as Affective Engineering (see: www.engage-design.org), and that which originates in branding research, in order that useful conclusions toward the Research Objective can be drawn. The following general areas are therefore discussed; the analysis of qualitative concept properties through semantic differentiation techniques (Heise, 1970; Osgood, Suci & Tannenbaum, 1957) and grounded theory (Corbin & Strauss, 1990; Goulding,

1998); property preference through conjoint analysis (Keller, 1993); linking specific property performance to technology delivery through Quality Function Deployment (Zairi, 1993) and the related Kansei Engineering (Schutte, 2005); measurement of concept typicality through the selective modification model (Smith et al., 1988) and the contrast principle (Margolis & Lawrence, 2002), and other methods (Shackleton, 1996; St-Jacques & Barrière, 2006); evolution of categorisation and typicality (Martindale, 1990), and general industry product attribute management processes from Ford, Land Rover and Jaguar, where little published work is available.

In selecting these areas for discussion, the following criteria were used;

1. Methods previously used, or with potential to be used, within branding and product development for measuring affective response to cognitive concepts and their categorisation.

OR

2. Methods previously used, or with potential to be used, within branding and product development for measuring preference resulting from affective response to cognitive concepts and their categorisation.

OR

3. Methods previously used to measure member typicality within a cognitive category.

Each methodology will be discussed briefly and compared for usefulness considering the Research Objective (section 1.4). For readers familiar with the methodologies, attention is drawn directly to the summary in section 1.3.11 and Table 1.

1.3.2. Semantic Differentiation

Concepts are a mental construct; cognitive outputs from their receipt can be measured physio-psychologically by heart-rate, eye movement and pupil dilation (Carbon, Hutzler & Minge, 2006) or galvanic skin response (Franzen & Bouwman 2001). However, language's apparent role as a primary cognitive mediator (Pinker, 1997) suggests that concepts may be most comprehensively, consistently and efficiently interpreted and captured by language. One such methodology built upon this premise is Semantic Differentiation (SD); a process that obtains affective measures of human reactions to concepts, first developed in the study of metaphorical relationships between music and colour in the US in the 1930's and 40's (Osgood, Suci & Tannenbaum, 1957). Subsequently psychologists, market researchers and others have extensively adopted SD due to its correlation reliability and recording and retrieval economy (Franzen & Bouwman, 2001; Gatty, 1972; Heise, 1970; Martindale, 1990; Mindak, 1961; St-Jacques & Barrière, 2006).

Osgood's SD techniques develops a representation of the concept's semantic interpretation of a feeling towards a concept (Osgood, May & Miron, 1975), by employing specific, multiple, dualistic, bi-polar synonym – antonym adjectives that have the necessary sensitivities to adequately and consistently describe a concept across cultures (ibid). The method uses *'concept x scale interaction'* (Batra, Lenk & Wedel, 2006. p5) Semantic Differentiation Scales (SDS); ordinal Likert-type scales of uneven indices, that are assumed to be discrete numeric (Shackleton, 1996), to indicate the strength of one synonym versus its antonym (Figure 1.21). Scales are usually set at seven indices, balancing scale sensitivity and recording economy (Schutte, 2005; Zhang & Shen, 1999),

but five (e.g.: Bhise et al., 2005), nine (e.g.: Batra, Lenk & Wedel, 2006) and eleven (e.g.: Ratneshwar, Shocker & Stewart, 1987) are also common in the literature.

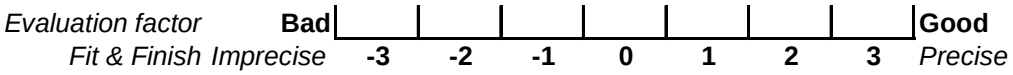


Figure 1.21. 7-point SDS; example, Bentley Interior Attribute Management Study (See chapter 4)

In the course of a number of large studies of concepts, and in particular the seminal Thesaurus Study (Osgood, Suci & Tannenbaum, 1957, p53-61), three emerging principal factors have been identified in general semantic assessments; Evaluation (good vs. bad), an attitudinal factor based on achieved and anticipated reward, Potency (strong vs. weak), based on power and size, and Activity (active vs. passive), based on speed or warmth etc. (commonly known as the EPA factors). Although factor composition can vary, with up to 70% being Evaluative, the Thesaurus Study (ibid) identifies five further factors, with E, P & A accounting for 65.76% of the total variance. The literature concludes that EPA generally accounts for well over 50% of normal variance, with E, P & A appearing in a consistent ratio, where Ex2 : P, A (Heise, 1970). This assignment *'reflects a real tendency in human thinking to place a high priority on the evaluative significance of things'* (Osgood, Suci & Tannenbaum, 1957, p. 47).

The Thesaurus Study (ibid) also identified that concepts may load against multiple factors (e.g.: the concept clean ➔ dirty loads primarily on Evaluation [0.45] but also on Stability [0.18]). In practice, Heise (1970) advises that (as much as possible) pure scales be chosen, allocated to E, P & A in roughly the expected proportion. Good judgement in scale composition is appropriate (ibid), but single meanings and unfamiliar concepts should be avoided as unfamiliarity tends towards neutrality and to some variability in EPA

proportion (Osgood, May & Miron, 1975). However, SDS rating repeatability appears to be high; the average deviation for Evaluation scales being ≈ 0.5 units, with Potency and Activity deviating between 0.7 to 1 units (Heise, 1970).

Analysis of EPA data provides an opportunity to describe the concept's semantic space; a multidimensional visual representation or interpretation of a concept's affective direction and intensity. Spatial location is obtained by collapsing data in scale (*k*) x concept (*m*) x subject (*n*) matrices to their mean, usually along the *n* axis, as this provides a view of cultural aspects, and along each factor of *k* (providing *k'*) to arrive at a *k'* x *m* matrix (Osgood, Suci & Tannenbaum, 1957). The resulting three-dimensional picture can be an effective analytical and communication tool for interpreted concept positions and is highly stable (Heise, 1970). However, few SD studies appear to have taken the opportunity to exploit it (Gatty, 1972). Semantic distances can be quantified to demonstrate the intensity of feeling or emotionality of the concept (the distance between entities and the neutral centre) and semantic similarity relationships to other concepts (the distance between entities) (ibid). Semantic Difference (*D*) for multiple entities is calculated by;

$$D = \sqrt{(e_1 - e_2)^2+(p_1 - p_2)^2+(a_1 - a_2)^2}$$

Where e = Evaluation, p = Potency and a = Activity (ibid). As difference is contrary to similarity, and similarity relates to typicality (Smith et al., 1988), the calculation effectively describes concept category relationships of prototypicality and categorisation, and therefore the semantic space also effectively interprets the cognitive category in a visual manner. For example, in Heise' (1970) research, the concepts home, office and work are discussed; where *D* for home and work = 3.8 and office and work = 0.8 (along different vectors), suggesting that work is more similar to office than home (Figure 1.22).

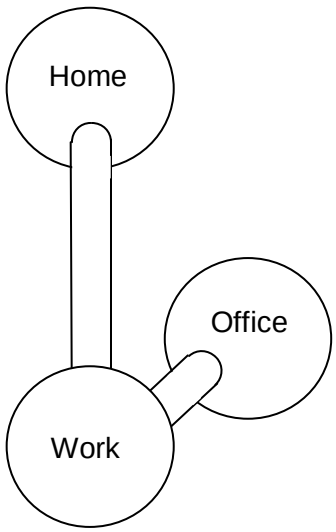


Figure 1.22. Method to describe the semantic space adapted from Osgood Suci & Tannenbaum (1957) & Heise (1970). Positioning of concepts arbitrary.

Osgood, however, noted some potential problems with SD as a concept evaluation technique. Two are prominent; firstly, the assumption that distances between scale increments are equal for every subject, and secondly, that they correlate between one scale and another. For example, how is it ensured that a +3 score for Precise (Figure 1.21) is the same for every subject?; the intensity of precision is highly subjective. Collapsing scores across subjects, as described, provides an appropriate and commonly adopted solution. Alternatively, in Kansei Engineering, scale intensities are more accurately controlled by adopting true Likert scales, with a biased pole of full content verses full absence, set against a single concept statement (Figure 1.23) (Gatty, 1972; Schutte, 2005). In both principles, central tendency bias is a risk. However, the major disadvantages of the Kansei approach appear to be two-fold; that specific meaning vectors cannot be explored (for example, Wordnet 2.1 [http://wordnet.princeton.edu], identifies seven senses for the word solid with antonyms liquid, hollow and soft, listed amongst others) and that opposing properties for concepts that are multi-directional towards different prototypes, along common factors, cannot be measured. For example,

the concept trim panel softness with the bi-polar Potency factor adjectives hard ➔ soft, along a single SDS, may simultaneously measure one brand prototype of soft and another brand prototype of hard.

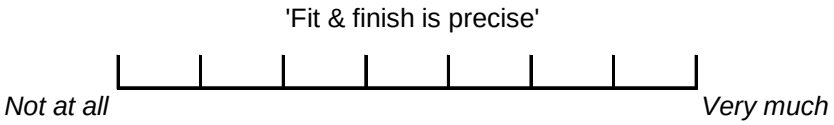


Figure 1.23. 7-point Likert Scale, typically used in Kansei Engineering

The second issue of scale equality suggests distances between precise and imprecise and, for example, rough and smooth may not correlate. Recognising this, Osgood (1957) proposes most value may be extracted from the methodology when scales are standardised across multiple subjects, concepts and entities, when semantic difference (*D*) is of interest, and when trends are important. Maintaining constant measurement criteria can also eliminate scaling problems; by ensuring the statistical character of the test, statistical significance has often been obtained for both individual and group assessments (ibid).

In conclusion, the literature suggests that SD methodology might be highly attractive to the objectives of this research by translating the affective response to concept stimuli through language, in a reliable and economical manner, and by providing easily understood visual representations of the concept semantic space and quantitative representations of typicality.

1.3.3. Grounded Theory

Grounded Theory is a qualitative, theoretical methodology that interprets and establishes patterns of underlying human behavioural categorical constructs, their constituent concepts and properties, from multiple observed situations (Corbin & Strauss, 1990; Glaser, 2002; Goulding, 1998). Developed initially by Glaser and Strauss in the late 1960's, it has been most extensively applied in medical sociology and more recently in marketing (e.g.: Gummesson, 2001). Although grounded theory does not exactly fit with the selection criteria given in section 1.3.1, as a cognitive categorisation assessment or measurement tool, it is included because it explores categorical constructs and their member's properties through phenomenological, inductive reasoning from qualitative data (mainly linguistically based, like narrative text, interviews and inter-subject discussions) and because it argues for a contextual and structuralist construction of the emerging categories. The methodology, therefore, identifies the hypothetical category by 'reverse engineering' it from available data rather than interpreting individual or collective cognitive categorisation responses from stimuli. However, it may have applicability to this research because the cognitive category in this case is an affective construct that requires detailed definition before it can be used to check stimuli effects. It is also of note because it provides some support for adopting some qualitative techniques.

Although two approaches have emerged to grounded theory; one based upon the Straussian constructivist methodology, which is rigidly structured and systematic, and one based on Glasian objectivist methodology, that proposes 'all is data' (Glaser, 2002) and recognises Wittgenstein traditions of overlapping categories or fuzzy boundaries (Kenny, 1994), the general technique explores multiple data sources (sampling data that is 'grounded in reality' [Corbin & Strauss, 1990]) for emerging concepts. These concepts

(taken in grounded theory to be basic units of information) are arranged into properties and then categories and interrogated repeatedly by comparison to alternative data sources until no new theory about them emerges from any new data source (ibid). The Staussian approach emphasises the process of coding during this analysis. Coding takes three forms; firstly, Open Coding, which analyses similarity / dissimilarity relationships in conceptual constructs, akin to the paradigmatic is like relationship (*x* axis) in category structures. Secondly, Axial Coding, which analyses hierarchical relationships between categories and sub-categories, akin to the syntagmatic belongs to relationship (*y* axis) in category structures. And thirdly, Selective Coding, which looks for multi-layered relationships between categories to a definitive core category of concern.

Because of its qualitative nature, grounded theory has prompted significant argument about the precision of the technique and therefore the validity of any possible results (e.g.: Goulding, 1998). This is answered in many cases by the researcher *'staying in the field until no further evidence emerges'* (ibid, p52) to 'saturate' the category with observed data. Further, collaborative validation through group discussion reduces bias, although Glaser (2002) argues that bias is irrelevant when the patterns that emerge are the true individual interpretations of the observation, which cannot be denied.

Nevertheless, grounded theory proposes an interesting approach that may be applicable to this research in the detailed understanding and construction of the cognitive category before assessment against it can take place. It also provides some appropriate arguments for a pluralist (qualitative and quantitative) methodology in the research activity.

1.3.4. Conjoint Analysis

Conjoint analysis enables the designer, engineer or marketer to understand customer preference by forcing a trade-off between concept properties (usually product, service or brand) (Aaker, 1991; Dean, 2004), thereby also effectively establishing property weightings (Koslow, 1999). For example, a laundry detergent product may have four packaging design variables; a box with a window, a plain box, red printing and blue printing. By force ranking in a *variable x variable* matrix the significance of window or colour can be established (ibid). However, Quester & Smart (1998) observed at least two limitations of the methodology; more than five or six properties *'diminishes reliability'* (ibid, p.226) and large sample sizes are necessary for statistical significance. In response, a number of modifications have developed to help resolve complex choice problems. For example; Full-profile and Choice Conjoint analysis (Koslow, 1999). Further restrictions relating to contextual influence are identified in reviews of Multi Attribute Utility Theory (MAUT) of which conjoint forms part (Nelson, 1999).

Nevertheless, conjoint is a significant methodology in the literature; for example, Kolvenbach, Krieg and Felten (2003) employed conjoint as a measure of brand value for two similar multi-purpose vehicles; the Volkswagen Sharan and Ford Galaxy. As both shared an architectural platform, produced in a joint-venture facility, both were identical products other than in some detail properties (trim and engine specifications) and the brand name under which they were sold. In 2000, the former vehicle sold 25,000 units at €24,500 and the latter 19,000 units at €23,500 (cost-control model). In this case, the researchers propose that brand value has two components; price and quantity, and therefore argue that the Sharan is more successful. By analysing twelve technical and brand related properties in paired, mixed comparisons, the study concludes that technical

related properties are equalised and that brand properties become the influencing factors in price premium and quantity positions.

Within the scope of this research, conjoint analysis' benefit may lie in the augmentation of SD, as SD generally assumes all concept properties are of equal importance, whereas it appears plausible that for some HLS car brands carpet execution, for example, may not be as important as veneer handcraftedness. By applying conjoint, or its variations, it may be possible to explore relative property importance and thereby some finer sensitivities in the attribute management process.

1.3.5. Quality Function Deployment

Quality Function Deployment (QFD) is an approach to product design that aims to manage user needs and wants through the application of appropriate and available technologies. It is not, therefore, a process for measuring cognitive concepts or their categories, but a tool to enable the definition of concept quality characteristics (Zairi, 1993). QFD is included here, however, as a preface to its sister theory, Kansei Engineering, which explores affective user requirements and matched technologies, which is an appropriate consideration within the scope of the Thesis because of its relevance to the emotive response to concept stimuli (see section 1.3.5). The literal translation of QFD in Japanese is 'Hin Shitsu Ki No Ten Kai' (Hin Shitsu = **Q**ualities, features, attributes; Ki No = **F**unction, mechanisation; Ten Kai = **D**eployment, diffusion, development, evolution) (ibid), thereby emphasising the development of functional properties in the product through design and manufacturing activity.

The four stages to the QFD process; Product Planning, Design, Planning and Operational activities are mapped in the House of Quality matrix (ibid). Technology weightings and synergies can be described here, concluding with a calculated design priority list. In some variations, four houses are built in a chain relationship whereby engineering characteristics are translated into part characteristics, process operations and plant equipment requirements (Schutte, 2005). The literature is deficient, however, in how affective user needs, for example mood or emotion, and the closely related attributes of brand preferences are captured through the standard QFD process (ibid). It appears reasonable to propose that a substitution of functions with brand properties might work, as QFD effectively maps any required input to enablers, although no evidence exists to support this hypothesis.

1.3.6. Kansei Engineering

Kansei Engineering attempts to answer some of the problems of QFD concerned with users' affective needs and their responses to products. It therefore forms part of growing discourse concerned with user emotions; their effect to commerce and the effect that that environment has on them. The importance of the largely neglected affective effects of products, and specifically the branded product, is increasingly being recognised by companies (e.g.: Mazda, Boeing), organisations (e.g.: www.designandemotion.org) and academia (e.g.: Linkopings [Sweden], Leeds [UK] and Delft [Holland] Universities). Kansei Engineering sits amongst this as a methodology for establishing affective relationships between the user and the product, and whilst incorporating other tools to QFD, appears to be amongst the wider applied.

Developed initially in Japan (like QFD) by Dr. Mitsuo Nagamashi, it's first and to now most notable application, was at Mazda, in the development of the Miata (MX5) (Guerin, 2004;

Lee, Harada & Stappers, 2004). Dr. Nagamashi adopted the term Kansei; the Japanese translation of the German word sinnlichkeit (English; sensuousness), used originally by Kant to describe perceptions elicited by senses which cannot be rationally analysed alone (Schutte, 2005), and built it into a collection of available tools (e.g.: fish-bone charts; affinity diagrams; QFD's House of Quality; SDS) to convert 'the Kansei' into engineering solutions (ibid).

Although Kansei Engineering is engaged in the world of affective user experience, its relationship to branding and branded products is, surprisingly, not widely explored. In Kansei studies reviewed, users' emotional needs are related to the general product category, being markedly divorced from any brand category effects. As discussed, brands satisfy emotional needs too, and therefore it appears necessary to consider them as a source in Kansei Engineering methodology. This could be reasonably reconciled in a number of the adopted tools, substituting or complementing affective product needs with affective brand needs. However, like QFD, Kansei Engineering is more an approach to a limited collection of concept development tools rather than a cognitive concept or category assessment or measurement methodology. It is therefore rejected as a possible methodology for use in this research, although its sentiment makes it an appropriate background reference for general concept measurement.

1.3.7. The Selective Modification Model and the Contrast Principle

Inspired by Lakoff, Rosch and others, the 1970's and 80's witnessed significant discourse into prototype theory as a theory for concept structures and cognitive categorisation (see section 1.2.3). Smith, Osherson, Rips & Keane (1988) were major contributors with their Selective Modification Model; a method that measures typicality in cognitive judgements by identifying member similarity / dissimilarity to a category set, based upon two elements;

concept property diagnosticity (the usefulness of the property in discriminating the concept) and property saliency (the strength of the property in discriminating the concept). The selective modification model's central benefit is to offer a solution to the operation of prototypicality in combined concepts (like pet bird). It also provides a weighting of prototype properties for typicality assessments, whether the concepts are complex, familiar, combined, or not. The model first establishes all the possible properties of a concept by listing its descriptors (typically adjectives), followed by distribution into constructs (collectors of similar meaning). Property saliency is taken as a count of mentions of a descriptor, equal to 1 mention = 1 vote. Property diagnosticity, the measure of discrimination of the property versus other properties, is obtained by an *n* by *x* table, whereby *n* is the number of constructs and *x* the number of features assessed. Diagnosticity values (*v*) are then calculated through the formula;

$$v=(x^2/N \min (A-1), (B-1)) 1/2$$

Where x^2 = chi-square, *N* the total number of constructs, *A* the number of rows and *B* the number of columns.

Diagnosticity values are useful in assessments of prototypicality because property weighting reflects the probability of relative levels of importance likely to be seen in the prototype. Typicality comparisons can then be made according to Tversky's model (Abbott et al., 2006; Barsalou, 1983; Hampton, 2006; Margolis & Lawrence, 1999; Smith et al., 1988; St-Jacques & Barrière, 2006), which measures similarity / dissimilarity between weighted properties and features from members within a category (Smith & Medin, 1999). Most applications use a slightly modified Tversky formula later proposed by Smith et al. (1988);

$$Sim(I,J) = E;[afi(I \cap J)-bf(I-J)-cf(J-I)$$

Where *i* is the index of properties, $I \cap J$ the set of common property votes, *I-J* the set of distinct prototype votes and *J-I* the set of distinct example votes. Constants *a, b* and *c* are equal to the relative contribution of the sets and *f* multiply's the property *i* by its prototype diagnosticity value, or weighting (Margolis and Lawrence, 1999).

Hampton (2006) suggests the selective modification model is not a model for categorisation (for example, in defining the boundary of the set), but can be successful in identifying typicality relationships (how alike entities are). Despite both being subject to similarity, categorisation is determined by the presence of properties which when perceived above a threshold trigger category membership. The selective modification model and the contrast principle, however, do not define these thresholds, but relative values of similarity (Hampton, 2006; Smith et al., 1988). Further, the quite coarse weighting sensitivity levels of the technique can be problematic; further research is invited by the model authors following poor correlation between some predicted values and obtained values. Interest in these methods here, however, is in their potential to identify the relative importance of properties for branded products to complement other models, like SDS.

1.3.8. Other methods

The main theories reviewed so far constitute an approximate rank of the application and dispersion of available concept and category assessment and measurement methodologies according to the criteria set in section 1.3.1. There are, however, further methodologies within the literature that are of note, and more discourse still, without substantive models, which will not be discussed further.

St-Jacques & Barrière's (2006) review of linguistic classification based *'word sense disambiguation (WSD)'* (St-Jacques & Barrière, 2006. p 9), takes in SDS and the contrast principle but also subjective scaling; a somewhat simplistic assessment method of property similarities amongst *n* concepts observed by distances between them in an *n* x *n* matrix. Clusters of similar concepts, against given properties, can then be mapped multi-dimensionally. The process assumes distances between concepts are symmetric; the similarity of *a* to *b* is equal to *b* to *a*, ignoring the inclusion effect that suggests similarity can also be asymmetric (Joiner & Loken, 1998). St-Jacques & Barrière (2006) proceed to review further mathematical models, of which some thirty are listed, the choice between which being based upon intended application and the example group property composition (for example, distances between concepts, symmetrical concept relationships and transitivity relationships).

John Shackleton's (1996) work explores concept categorisation and typicality in the Japanese 4x4 and SUV automotive market through mathematical models like factor analysis. In each step, complementary methodologies are chosen to the specific objective of the test; for example, regression, homogeneity analysis and logistic regression. Like QFD, Kansei Engineering and other attribute management processes discussed below, the multiple steps in this methodology reflect the multi-factorial cognitive processing associated with complex concepts, like a vehicle product type, as in this case.

Anders Warell (2006) follows a similar multi-step approach; he proposes a Visual Product Identity (VPI) model as his posit on concept typicality theory, to complement two other models of aesthetic preference and experience. Warell explores visual identity and the role that specific properties, either product category elements or brand elements, have in object recognition processing (what it is), comprehension (how it does it) and association (what it symbolises). The model uses established procedures like pair-wise conjoint type

assessments for property weighting and the frequency of occurrence of properties in a set of examples to derive typicality values.

Warell's further research also looks closely at branded products within the automotive industry. In two experiments (Karjalainen & Warell, 2005 & Warell, Fjellner & Stridsman-Dahlstrom, 2006), automotive brands are extended into other product categories (first reference) and used to assess new products within an established brand category (e.g.: Saab) (second reference). In the first instance, a product design task took salient brand properties (e.g.: from Jaguar, Alfa Romeo and VW) and applied them to other products like sunglasses, MP3 players and wristwatches. Although a qualitative study, the results agree with the predominant theories of product recognition and association previously discussed, and the role that concept properties have in that process.

In the second instance, the VPI model is applied to test the equality of the three modes of identity. Products from the auto brand Saab, including current models, new market extension models (SUV's) and non-production concept cars, were assessed by focus groups using brand-based Kansei type scales (like Progressive, Balanced). Although somewhat unquantified, the study suggests that identity is perceived through multi-modal paths with a dominance of associative values over recognition and comprehension.

The value of these studies to the current research, however, appear in some general background theories (e.g.: the use of linguistic models), application fields (e.g.: automotive) and assessment and measurement methodologies (e.g.: SDS); particularly, the potential benefits of descriptive scales that provide a profile or rule to assess and measure the branded product built from discrete properties, which, when naturally combined with Osgood's (1957) work appear to be potentially both appropriate and novel.

1.3.9. Measuring Concept and Category Evolution

In section 1.1.1. and 1.2.3 the evolution of product attraction was introduced using the Kano model (Kano et al., 1984; Schutte, 2005). The model demonstrates that over time, novel things become familiar and therefore more expected and hence dull, uninteresting and unattractive (Carbon & Leder, 2005; Carbon, Hutzler & Minge, 2006; Hekkert, Snelders & Van Wieringen, 2003; Snelders & Hekkert, 1999). It is highly plausible that this process is one component of memetic evolution in concept categorisation and prototypicality. Research into this phenomenon has been largely based on Colin Martindale's (1990) pioneering studies of the shift in prevalent artistic styles like music, poetry, art and architecture. In that work he identified a measurable state of an authors primordial thought (free thinking, novel and irrational) and conceptual thought (logical and rational), expressed as a concept's Affective Content, that changes in a non-linear but predictable fashion as artistic styles evolve, due to hedonic selection. A detailed discussion of the techniques employed is included in chapter 5.

Although Martindale's work contributes no novel techniques, his innovative application of SDS further demonstrates the methodology's potential to identify underlying and historical trends within concepts and categories. These trends, by their nature, are retrospective but could also be forward-projected if sufficient patterns exist within historical positions. Therefore, it appears sensible, and indeed necessary, that when designing and engineering prototypical branded products that the model be explored, whilst respecting heritage cues previously identified as significant for historically founded brands like Bentley.

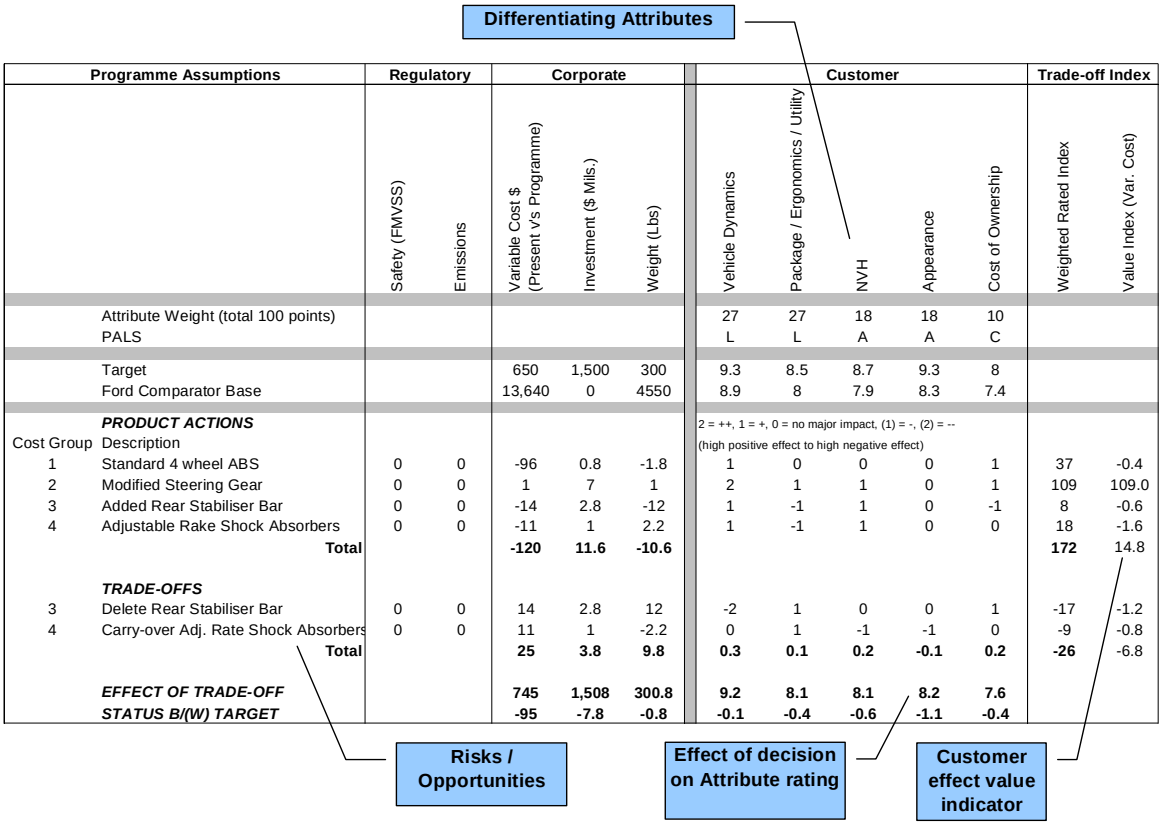
Despite memetics being a significant evolutionary theory, it appears from the literature that no attempts have been made to measure the phenomena so far.

1.3.10. Automotive Attribute Management Processes

References to automotive attribute management processes are compiled from personal experience or other primary sources, as no published work appears to exist. In all cases, these examples form different sets of isolated initiatives without apparent rigorous scientific or philosophical foundations. However, in at least one example, such processes have been used to establish clear product propositions within the marketplace, with some marked commercial success. In another, brand positioning is considered an important factor in specific product attribute target setting, although in neither are branded product category structures explicitly recognised.

Ford Motor Company's (FMC) Product Attribute Leadership Strategy (PALS) is based upon the identification of product category attributes (≈ concept properties) that align with competitive positions for the brand. The process can also enable the allocation of appropriate project expenditures against attributes based upon analysis of the company's products and those of the competition, within the product category. In so doing, it is intended that new products will offer a unique proposition, as proportionally more emphasis (resource and / or investment) is placed on leadership attributes (those that the company wishes to lead within the market in).

Balancing financial or technical conflicts can be conducted by trading technical solutions and costs. The Trading Matrix (Figure 1.24) factors the PALS position against the focus metric, for example component piece price or weight.



Programme Assumptions		Regulatory		Corporate			Customer					Trade-off Index	
		Safety (FMVSS)	Emissions	Variable Cost $ (Present v's Programme)	Investment ($ Mils.)	Weight (Lbs)	Vehicle Dynamics	Package / Ergonomics / Utility	NVH	Appearance	Cost of Ownership	Weighted Rated Index	Value Index (Var. Cost)
	Attribute Weight (total 100 points)						27	27	18	18	10		
	PALS						L	L	A	A	C		
	Target			650	1,500	300	9.3	8.5	8.7	9.3	8		
	Ford Comparator Base			13,640	0	4550	8.9	8	7.9	8.3	7.4		
	PRODUCT ACTIONS						2 = ++, 1 = +, 0 = no major impact, (1) = -, (2) = --						
Cost Group	Description						(high positive effect to high negative effect)						
1	Standard 4 wheel ABS	0	0	-96	0.8	-1.8	1	0	0	0	1	37	-0.4
2	Modified Steering Gear	0	0	1	7	1	2	1	1	0	1	109	109.0
3	Added Rear Stabiliser Bar	0	0	-14	2.8	-12	1	-1	1	0	-1	8	-0.6
4	Adjustable Rake Shock Absorbers	0	0	-11	1	2.2	1	-1	1	0	0	18	-1.6
	Total			**-120**	**11.6**	**-10.6**						**172**	14.8
	TRADE-OFFS												
3	Delete Rear Stabiliser Bar	0	0	14	2.8	12	-2	1	0	0	1	-17	-1.2
4	Carry-over Adj. Rate Shock Absorbers	0	0	11	1	-2.2	0	1	-1	-1	0	-9	-0.8
	Total			**25**	**3.8**	**9.8**	**0.3**	**0.1**	**0.2**	**-0.1**	**0.2**	**-26**	-6.8
	EFFECT OF TRADE-OFF			**745**	**1,508**	**300.8**	**9.2**	**8.1**	**8.1**	**8.2**	**7.6**		
	STATUS B/(W) TARGET			**-95**	**-7.8**	**-0.8**	**-0.1**	**-0.4**	**-0.6**	**-1.1**	**-0.4**		

Figure 1.24. Ford Motor Company Attribute Trading Matrix (personal communication).

The matrix in Figure 1.24, also illustrates one application of the industry standard 10-point subjective rating index, the use of which is problematic for two reasons; firstly, due to subjectivity, test reliability is rarely established. Secondly, central tendency principles (in this case skewed-central tendency) tend in reality to restrict fine judgments to a very limited 4-point section (6-9 points). In Figure 1.24, the attribute effect is also a coarse 5-point discrete numeric scale that does not correlate to the 10-point index. The overall attribute effect therefore appears to be somewhat insensitive and open to misinterpretation. The status of the development of the matrix is, therefore, immature, but does, however, add some value as a guide to the assessment of consumer impact of alternative engineering solutions.

The FMC PALS process works along the product category segmentation axis and effectively ignores brand values as an influencing factor. At Land Rover and Jaguar,

however, attribute sets have been directly linked to brand values through a hierarchy expressed in a Target Pyramid that identifies those attributes, or concept properties, that differentiate the brand and those that are foundation to it (the must-be qualities; Kano et al., 1984). Product Profiles are established through a type of QFD that maps relationships between both differentiating and foundation attributes (*a*) and technical areas (*b*) of the car in an *a* x *b* matrix and weights those relationships strong (score 9), medium (3) and weak (1). Summing scores (*c*), and plotting on a *c* x *a* chart, pictures those that have a strong correlation to consumer value.

There are clear benefits to the principle adopted by Land Rover and Jaguar, in that it promotes appropriate emphasis on the emotive associations that the brand evokes when specifying technical areas of the product. It does not, however, go deeper into the necessary process of identification, target setting and the assessment and measurement of specific properties that support those values.

1.3.11. Conclusions and Consequences

Section 1 identified that emotive cognitive associations related to the branded product are a significant source of customer satisfaction within the high-luxury automotive market. The significant consequence of this appears to be, that to develop successful products within this market, designers, engineers and marketers might benefit from exploring and understanding such processes. Section 2 discussed the scientific and cultural theories of the cognitive processing of a concept, concluding that a link appears to exist between authentic multi-sensory concept properties through categorization and typicality to emotive associative cognitive constructs, and that the cognitive output is not stable, but is perhaps transferable and evolutionary. Consequently a premise exists that product properties might be manipulated to benefit user satisfaction. Section 3 then discussed some of the available concept analysis and measurement methodologies, with an emphasis on exploring cognitive categorisation. Table 1 describes some potential hypothetical advantages and disadvantages of these methodologies to the Research Objective (section 1.4), supported with an applicability rating (high, medium, low) based upon validity in the measurement of cognitive conditions, including categorisation, typicality, affectivity and other anticipated benefits.

Methodology	Hypothetical benefits to the Research Objective	Hypothetical problems to the Research Objective	App. Rating
1. Semantic Differentiation Scales (SDS)	• Operates through language; possibly converts cognitive categorisation through a single operational media. • Measures bi-directionally; for multiple products, single scales can measure prototypical properties towards dual prototype positions. • Facilitates measurement of multiple sensory stimuli. • EPA factors enable a visual representation of direction and intensity of affectivity (rightness and goodness). Can possibly visualise and quantify the interpretation of categorisation and prototypicality. • Methodology is economical and efficient in anticipated test conditions, which may include dynamic driving. • Good general reliability and repeatability. • Is culturally stable.	• Problematic construction of an efficient set of property scales that adequately describe the concept. • All property scales have equal weighting when discriminating the concept (see Conjoint analysis). • Some explanation of scale meaning may be required; construction of lead-in question important.	H
2. Grounded Theory	• Contextual, language based methodology to emerging category and property identification from multiple observed situations. • Proposes a structuralist approach to categories. • Adopts qualitative enquiry techniques and inductive reasoning.	• Deals in the emerging category rather than cognitive categorisation.	M
3. Conjoint analysis	• May add richness and sensitivity to SDS by enabling the weighting of properties.	• Is generally a method of measuring preference rather than categorisation.	M
4. Quality Function Deployment (QFD) / Kansei Engineering	• Kansei touches affective cognition inputs and outputs.	• Is a method of linking functional and affective requirements to product specifications rather than categorisation. • No evidence of an application to branding.	L
5. Selective Modification Model / Contrast Principle	• Only empirical methodologies proven in a number of studies to adequately establish property or entity typicality values. • Have been used to describe complex concepts.	• Measures typicality not categorisation.	H

Methodology	Hypothetical benefits to the Research Objective	Hypothetical problems to the Research Objective	App. Rating
6. Visual Product Identity (VPI)	• Describes the typicality of product properties to a brand category.	• Limited to visual stimuli only.	M
7. Martindale's models of artistic change in Affective Content	• Describes historical cognitive affective response trends; may be useful in the understanding of branded product authenticity, identity and heredity. • Trends may be predictable and therefore may be useful to describe the future condition of the cognitive category.	• Not widely applied to product design; no evidence of an application to branding.	H
8. Commercial Attribute Management models	• Sensitive to brand positioning when defining attribute hierarchies. • Combines subjective measures and objective specifications.	• Do not generally link cognitive categorisation effects or affective influence to product specifications. • Subjective rating scales are compromised.	M

Table 1. Hypothetical advantages and disadvantages of available methodologies to the Research Objective.

Table 1. suggests a number of methodologies might benefit the Research Objective. However, semantic differentiation techniques appear to provide some compelling arguments for adoption, particularly considering the background theories presented by cognitive psychology, semiotics and memetics for the cognitive processing of concepts and categories and the role that language appears to play within that process. Further, considering the affective nature of customer motivations and satisfactions within the high-luxury and 'pinnacle' automotive marketplace, SD appears to be one of the only methodologies available that efficiently and reliably captures and translates the qualitative nature of the affective response to multi-sensory stimuli into an explicable and clear measure. Whilst some of the other methodologies discussed will be further explored within the Thesis (e.g.: selective modification model, as a method for identifying typicality; grounded theory principles in the construction of the category and the identification of

properties; conjoint analysis, as a tool for establishing relative weightings between concept properties; and Martindale's models of artistic change in affective content, as a model to which the branded product category is checked), these will be presented in support of the role that semantic differentiation takes as the core methodology employed.

1.4. Research Objective

The literature review undertaken has established the background motivations to the research. The central Research Objective is therefore defined from this as;

> *The development of a design measure that enables the identification of typical multi-sensory brand-based product properties, their specification, measurement, visualisation and predicted condition, based on cognitive categorisation theory and related methodology, applied to the vehicle interior. As a hypothetical basis, the research considers that brands act as cognitive categories in some circumstances* [H_1].

The application model will be the sponsoring company (Bentley Motors Limited) core product interiors ('standard' production products and not personalised products, such that the more widely applied and homogenous product stimuli are considered).

In order to fulfil the Research Objective, the following questions will be addressed;

1. Do brands act as cognitive categories as hypothesised by Boush (1993) and in H_1?
2. If H_1 is true, what is the specification of typicality for the Bentley Interior cognitive category (the typical properties that define it)?
3. Do Bentley Interior entities populate this interpretation of the cognitive category semantic space in support of the hypothesis?

4. Has this cognitive category semantic space been stable over time or does Martindale's (1990) hypothesis also applies to the brand in such a way that predictions about it can be made?
5. If it does, can we also consider the concept to be an evolutionary meme?
6. What are the potential benefits of the unique contribution to the body of knowledge, and design, engineering and marketing practice, firstly in the automotive application and secondly in wider product applications?

1.5 Thesis Structure and Methodology

The Thesis is organised into six chapters; In chapter 1, the Literature Review explored the Customer, Cultural and Commercial Research Context, taking in prevalent themes within the high-luxury automotive segment, including the significance of branding as a source of customer satisfaction; the cognitive processing, understanding and manipulation of concepts, specifically the branded product, where discourse is limited to the related fields identified in the fish-bone diagram in Figure 1.25; and finally concluding with a review of available tools to aid the assessment, measurement and visualisation of affective response to the cognitive categorisation of a branded product.

The Thesis then aims to establish an empirical foundation to H_1 (the brand as category). Chapter 2 will provide some novel evidence that some brands act as cognitive categories through a factor analysis of responses to visual stimuli of products in the mobile telephone, personal music machine, vacuum cleaner and car product categories (study 1). This is necessary as a preface to the main body of the Thesis where the cognitive category for the Bentley Interior, will be identified, built, populated, validated and predicted. The main tool employed for this task will be taken from semantic differentiation principles (Osgood, Suci & Tannenbaum, 1957).

Building towards this, chapter 3 will explore what the specification of typicality for the Bentley Interior category might consist of by identifying its concept properties and their core constructs through a four-stage process. This process takes a pluralist approach using multiple qualitative and quantitative data sources so that knowledge of the category becomes 'saturated' (Gummesson, 2001). Stage 1 of this process segments the higher-order concept Bentley into the Bentley Interior level by reference to the company's pre-defined attribute management structure. Stage 2 then describes a theory for the Bentley Interior category by identifying what its typical core constructs and properties might be in studies 2, 3 & 4. In this stage some construct and property typicality is identified from the results of a large–scale interactive study of product examples using the selective modification model (Smith et al., 1988). Other typical constructs and properties are identified from expert discussion groups and a review of Bentley customer verbatim responses in 1:1 telephone interviews. Stage 3 then explores the brand's positive and negative bipolar semantic differentiation scales that might describe the properties and constructs identified, by referring to a large body of adjectives collected in stage 2. Chapter 3 concludes in stage 4 by identifying property weightings through a pair-wise conjoint type analysis (study 5).

Chapter 4 then populates and validates the category semantic space, by measuring multiple product examples against the Bentley Interior bi-polar scales in five large-scale studies (studies 6 – 10). Chapter 5 explores the potential to predict the future condition of the category through a novel application of Martindale's (1990) methodology for the measurement of affective content (studies 11 & 12). Chapter 6 concludes the Thesis by discussing the how the Research Objective may have been met, how the principal Research Questions were answered and summarising the key findings, whilst acknowledging any limitations. The potential benefits of the research to product development disciplines, within the application field, will be identified and some

speculation given to wider implications. Recommendations for future research will also be summarised.

It is important to note that the subjects participating in studies 2, 3, 5, 6, 7, 8, 9 and 10 were employees of Bentley Motors Limited and as such the outcomes of these studies may not reflect the outcomes if these studies had been conducted with Bentley customers or other subject groups. Concerns over the access to a wide selection of customers under controlled test conditions were a principal consideration in this decision. A number of researchers have found, however, that expert and expert-peer (company wide) subject group judgments may not be too dissimilar to non-expert judgements (e.g.: Cho et al., 2008; Reece, Matthews & Bergraff, 1998; Snow et al., 2008). Although there is some research available that suggests expert-novice categorisation processes are different (for example, the speed of categorisation and elaboration of underlying structures) (Chi, Feltovich & Glaser, 1981), there is no evidence to suggest that Bentley customers are novices in their knowledge or appreciation of the Bentley Interior. Therefore, the use of internal subject sets is not considered to imply bias or loss of value to the Research Objective, especially as they are aimed at obtaining a reliable methodology and not necessarily specific outcomes which can be used for commercial advantage. However, study 1, 4 and 11 do use alternative data sources (undergraduate design students, customer verbatim reports and motoring press articles respectively) which provide some external validity to the internal subject set findings. A list of the practical experiments conducted as part of this research is given in Table 2. Although the author took part in some of these studies to gain test experience, his results were omitted from the analysis to avoid any bias. Further, any dialogue within tests between the author and the subjects was restricted as far as possible.

A number of the chapters will also draw upon conference and journal articles published by the author, and key-note speeches made by the author during the course of the research. These will be identified at the start of each chapter.

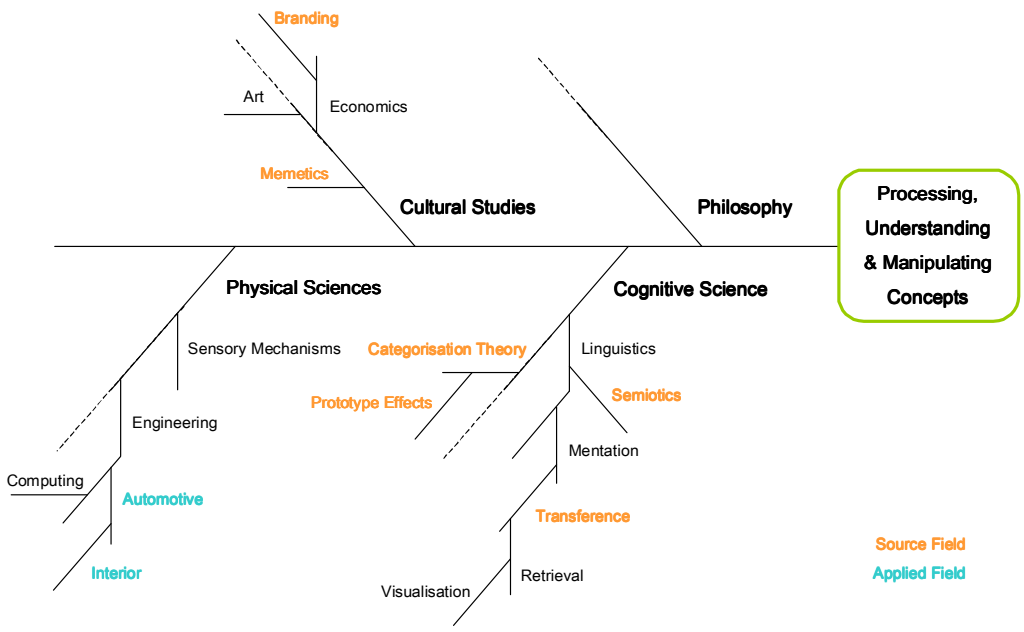


Figure 1.25. Research source and application fields

Study	Description	Chapter	Date
1	Brand categorisation test	2	June 2006
2	Bentley heritage study	3	July 2005
3	Bentley Interior current properties study	3	November 2005
4	Bentley CQTS study	3	January 2006
5	Bentley Interior property weighting study	3	June 2006
6	Bentley Interior SD database development	4	January 2006
7	Bentley Interior SD database development – additional vehicles	4	June 2007
8	Bentley Interior SD database development – additional vehicles	4	May 2008
9	Bentley Interior SD database development – new design 1	4	December 2006
10	Bentley Interior SD database development – new design 2	4	April 2008
11	Bentley Interior affective content study	5	August 2007

Table 2. Practical experiments conducted during the research.

2. The Brand as Category[1]

1. Content in this chapter was presented in ABBOTT, M.; SHACKLETON, J.P.; and HOLLAND, R, (2007), 'Brand' as Category: An Analysis of Categorisation and Branded Product Concepts, Proceedings from IASDR07, Hong Kong, 12th. – 15th. November 2007. The paper was published under joint affiliation to Bentley Motors Limited and Brunel University.

2.2. Introduction

Following Bouch (1993), Joiner & Loken (1998) and Loken, Joiner & Peck (2002), the Thesis central hypothesis proposes that some brands behave as cognitive categories (H_1). For example, the cognitive construct of the brand can be mapped on both the *x* axis of basic level, paradigmatic, metaphoric associations of 'is like' products and the *y* axis of hierarchical, syntagmatic, metonymic, 'belongs to' relationships. In this case, prototype effects, stimulated by the multi-sensory properties of category members and the cognitive, associative values, beliefs and emotions that result, may be highly attractive to product development disciplines; viewing the branded product in this way may draw out a stronger link between the manipulation of product properties by the designer, engineer or marketer and accurate categorisation by the customer. However, although some authors have argued that some brands may behave as cognitive categories, the majority of the published research has been focused on understanding the relationship between the branded product and the product category (e.g.: Figure 1.18) rather than the alternative (e.g.: Figure 1.19 and 2.1, where Lakoff's [1987] concept structure model indicates that the Genus, basic level is where we might find the brand category Bentley, for example, or other luxury vehicle brands). Indeed, no empirical evidence appears to exist for H_1, even though it looks highly plausible. Therefore, in order that this research has validity, an empirical foundation for H_1 is required. Chapter 2 sets out to meet this objective and to answer question 1 in the Research Objective.

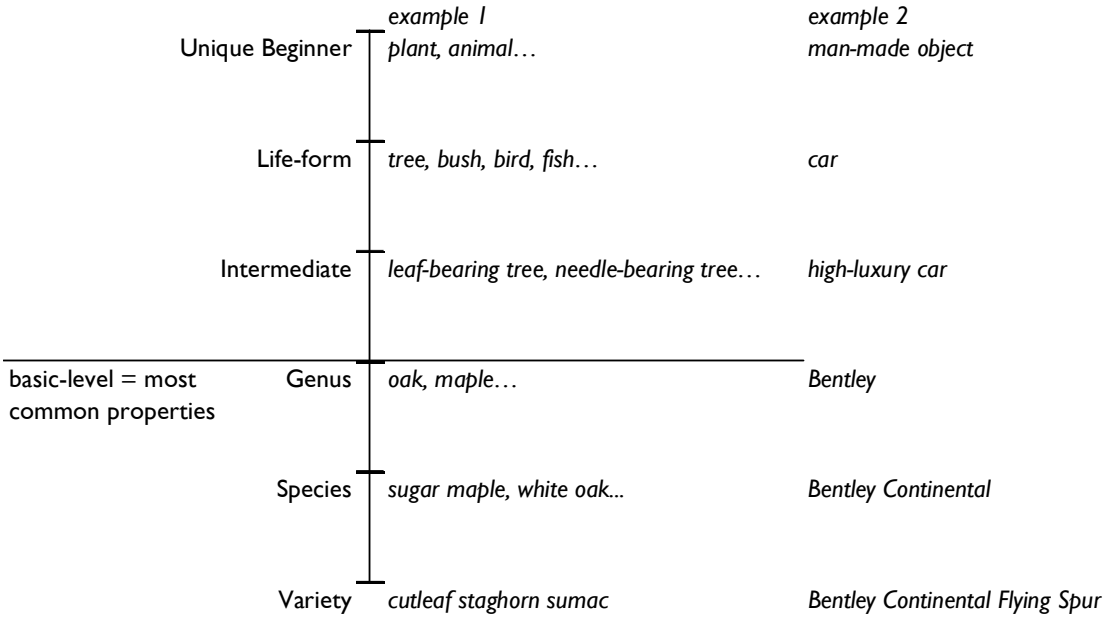


Figure 2.1. Concept hierarchy structure for the brand category (example 2) (following Lakoff, 1987).

2.3. Brand Categorisation Test (Study 1)

One output of the cognitive categorisation process could be the accurate identification of the object observed (e.g.: Franzen & Bouwman, 2001; Simon, 1996). If H_1 is true, and as language appears to be a significant mechanism of intellectualisation and the ultimate communication of that identification process (e.g.: Pinker, 2007), it appears predictable that, if asked: 'What is this?' when encountering a product, cognitive processing might lead to a response classified by brand rather than product type, in some cases. A test was therefore designed to confirm the null hypothesis that when subjects are asked 'What is this?', when presented with products from a number of brands and from a number of product categories, they will always be classified as the product type.

Some secondary objectives of the test were also defined to add richness to the understanding of the Literature Review and in support of H_1; specifically, consideration is given to brand categorisation in the automotive product, and that in alternative product segments like mobile telephones and vacuum cleaners. For example, the following are explored; brand extensions (as discussed in section 1.2.4.), brands as verbs (e.g.: Hoover) and brand identity in product segments where brand identities appear immature (e.g.: mobile telephones) and finally, the significance of stimuli distinction between brand names or logo's and visual form identification in the cognitive categorisation of the branded product. To expand upon these themes, the following questions were posed in the test design and results analysis;

a). How do brand extensions like the Volkswagen Phaeton affect brand categorisation?

b). Does identification of all products as Hoovers in the category vacuum cleaners still exist?

c). What are the brand categorisation effects within a saturated market like mobile telephones?

d). Does a visible brand name or logo affect the brand categorisation effect?

2.3.1. Methodology

The test material consisted of a selection of 65 pictures of products from 4 product categories; cars, mobile telephones, personal music machines (e.g.: MP3 players) and vacuum cleaners, pre-selected by the author to satisfy H_1 and questions a) to d) (examples, Table 3). The pictures were sourced randomly from the Internet (e.g.: Google Images), with consideration given to picture clarity, variety of position and colour and minimum contextual identification or distraction. A number of established and ostensibly well-known brands were included in the categories collected; Volkswagen (also for

question a).), BMW, Nokia (for question c).), Apple i-Pod, Dyson and Hoover (for question b).), for example, as well as products from the categories that may be less familiar to the viewer. Within some brand categories, sub-brands were also included; for example, Volkswagen Beetle and BMW Mini. Images were compiled onto individual PowerPoint slides and projected in a timed (10 seconds per image) random order to 59 subjects who were asked to provide written responses to the question 'What is this?' on a pre-designed response form (Appendix A1.1.). The picture choice and order were selected to minimise possible learning effects. The subjects were allowed to discuss their response during the test, but were encouraged to submit their first answer to the question. The subject group consisted of undergraduate design students; 83% male, 88% British, mean age 22.2 years (standard deviation; 1.19). Due to the groups' predominant socio-demographic background, it was expected that most would have high brand awareness for cars, telephones and MP3 players, but not for vacuum cleaners. It was also recognised that product properties were limited in this test to visual stimuli as a single variable.

What is this ?	1 	2 	3 	4 	image unavailable
6 	7 	8 	9 	10 	11 
12 	13 	14 	15 	16 	17 
18 	19 	image unavailable	21 	22 	23 
24 	25 	26 	27 	28 	29 
30 	31 	32 	33 	image unavailable	35 
36 	image unavailable	38 	image unavailable	40 	41 
42 	image unavailable	44 	45 	46 	47
48	49	50	51	52	53
54	55	image unavailable	57	58	59
image unavailable	image unavailable	62	63	64	65

Table 3. Brand categorisation test images.

Title Slide	**1. Music Machine – Sansa**	2. Vacuum – Dyson	**3. Telephone – Nokia**	4. Car – Nissan Z350	5. Music Machine – Apple I-Pod
6. Music Machine – Toshiba	7. Car – BMW 3 Series	8. Vacuum – Bosch	**9. Telephone – Motorola**	10. Music Machine – Sony	11. Car – Cadillac (concept car)
12. Car – VW Beetle	**13. Telephone – Motorola**	**14. Music Machine – Creative**	15. Car – Hyundai	16. Music Machine – unknown brand 1	**17. Telephone – Siemens**
18. Vacuum – Miele	**19. Telephone – Sony Ericsson**	20. Car – BMW Mini	21. Music Machine – unknown brand 2	22. Vacuum – Gisowatt	**23. Car – Audi TT**
24. Vacuum – Dyson	**25. Telephone – Nokia**	**26. Music Machine – Sanyo**	27. Car – Ferrari F350	**28. Telephone – Nokia**	**29. Music Machine – Samsung Yepp**
30. Music Machine – Sony Walkman	**31. Telephone – Samsung**	32. Car – Toyota Prius	**33. Vacuum – George**	34. Car – Ford Mondeo	**35. Telephone – Nokia**
36. Music Machine – Apple i-Pod	37. Car – VW Golf	38. Vacuum – Hoover	39. Car – Ford Focus	40. Vacuum – Panasonic	41. Car – Toyota Yaris
42. Telephone – Samsung	43. Vacuum – unknown brand 3	44. Music Machine – Apple I-Pod	**45. Telephone – Nokia**	46. Vacuum – Sebo	**47. Car – Suzuki Swift**
48. Vacuum – Dyson	**49. Telephone – Samsung**	50. Car – VW Phaeton	**51. Car – Opel Vectra**	**52. Vacuum – Miele**	53. Car – Bentley Continental GT
54. Telephone – Siemens	55. Music Machine – Apple i-Pod	56. Telephone – unknown brand 4	57. Car – Chrysler	58. Vacuum – Dyson	**59. Car – Audi A8**
60. Music Machine – unknown brand 5	61. Music Machine – Apple i-Pod	**62. Car – Volkswagen Jetta**	63. Vacuum – Dyson	64. Vacuum – Hoover	**65. Telephone – Siemens**

Table 4. Brand categorisation test product and brand categories. Products in bold indicate images with visible brand names or logo's.

2.3.2. Results

Initially, the questionnaire responses were organised into 4 sets by the author: i) those products identified by the correct brand (for example; Apple or i-Pod or Nano, or any combination, for image 36; the Apple i-Pod Nano); ii) those products identified by another brand (either in error or by use of the brand name in reference a generic product type (for example; i-Pod for image 30; the Sony MP3 player, or Hoover for image 40; the Panasonic vacuum cleaner); iii) those identified by product type (for example; car for image 39; the Ford Focus), and iv) no response. These sets were considered to be syntagmatic, belongs to, constructs in concept recognition. However, during the organisation process, a fifth construct emerged; one that is a paradigmatic, is like construct; where the entity is identified by either a brand or product association, for example, responses like cool, engineering quality and expensive were recorded for image 53, the Bentley Continental GT. These sets were organised into an entity x subject matrix, whereby set i) = 1; ii) = 2; iii) = 3 and iv) = 4 (see Appendix A1.2).

The set responses in the entity x subject matrix were analysed using homogeneity analysis (Gifi, 1990). The output produced is a scatter-plot on factor-like axes, in which items that are consistently similarly categorised are closest together, and those that are consistently categorised differently are furthest apart. Although the technique can produce higher dimension output, a satisfactory distribution in two dimensions was found in this case. The factors were rotated to make them more parsimonious. The first of these two factors appears to correspond to Branded Product Categorisation (BPC) strength (*y-axis*); a bi-polar measure of the degree to which an example is consistently categorised by brand (at one extreme; *y*+) or by product type (at the other extreme; *y*-). The second factor (*x-axis*) appears to correspond to BPC accuracy; the degree to which an example is

identified by its correct category (either correct brand; *x*+, or correct product type; *x*-) (Figure 2.2).

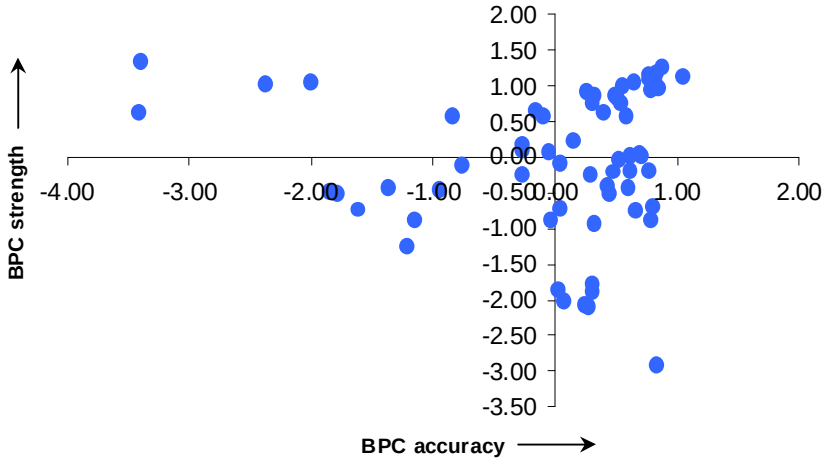


Figure 2.2. Branded Product Categorisation strength and accuracy factors, all products.

A number of interesting outputs from the analysis can be identified. Segment [a], (Figure 2.3 and Table 4), includes 20 points that demonstrate high BPC strength and accuracy, with high inter-subject reliability (Cronbach's α 0.958). This group is noteworthy because it suggests that the categorisation of these products is based upon the brand category and not the product category. The categorisation of these products therefore indicates H_1 is true, rejects the null hypothesis and affirmatively answers question 1 in the Research Objective. Segment [b] includes 4 points that demonstrate low BPC with low accuracy, interpreted as a strong inverse product type categorisation (or miss-branding categorisation). For example, Bosch (Vacuum Cleaner), Cadillac (Concept Car) and Chrysler were repeatedly identified as other brands. Segment [b] demonstrates partial brand categorisation, as the examples are categorised by brand, although inaccurately. Inter-subject reliability in this set was good (Cronbach's α 0.817). Segment [c] includes 7 points that demonstrate low BPC and low accurately but high product type categorisation,

with good inter-subject reliability (Cronbach's α 0.848). Of note, all of the members of the group come from the personal music machine category with 3 of the 5 products of unknown origin (brand). Significantly, the general scatter indicates that as BPC strength increases so does accuracy (Figure 2.4), peaking in a zone of high brand saliency, where the brand concept is apparently cognitively efficient.

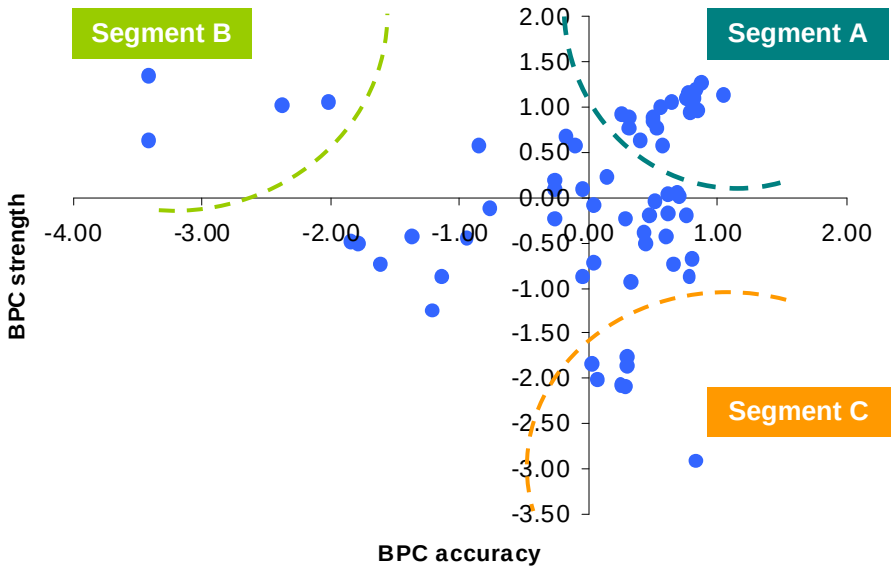


Figure 2.3. Brand categorisation test significant clusters.

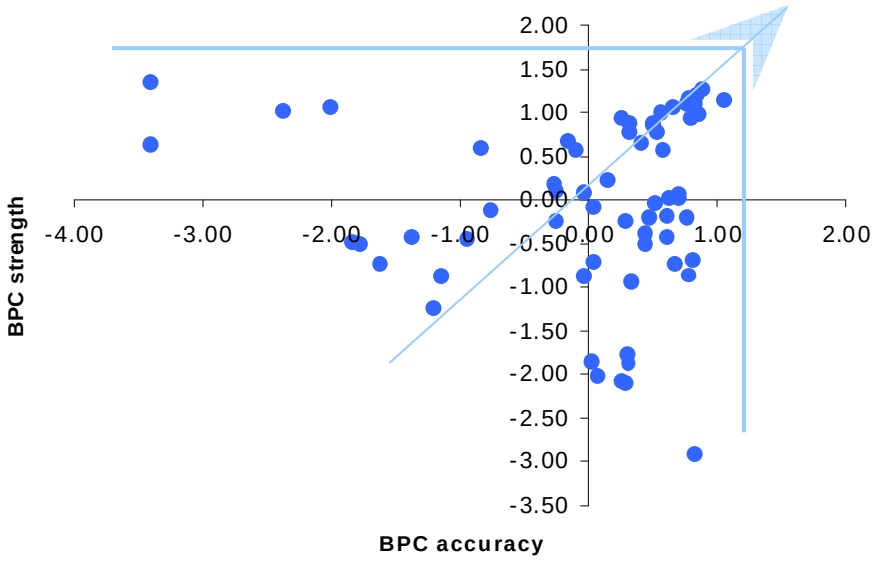


Figure 2.4. Branded Product Categorisation saliency vector.

Zone	Brand	Sub-brand (image #)	Factor 1. BPC accuracy	Factor 2. BPC strength	Brand	Sub-brand (image #)	Factor 1. BPC accuracy	Factor 2. BPC strength
A	Apple	i-Pod (5)	1.05	1.14	Dyson	(24)	0.65	1.07
A	VW	Beetle	0.88	1.27	Ford	Focus	0.58	0.59
A	BMW	3 Series	0.85	0.98	Audi	A8	0.55	1.02
A	Apple	i-Pod Shuffle	0.83	1.20	VW	Golf	0.53	0.78
A	Apple	i-Pod (44)	0.81	1.17	Dyson	(48)	0.50	0.89
A	Apple	i-Pod (61)	0.81	1.11	VW	Jetta	0.50	0.86
A	Audi	TT	0.78	1.10	Dyson	(63)	0.40	0.65
A	Dyson	(58)	0.78	0.95	Ferrari	F350	0.32	0.89
A	BMW	Mini	0.77	1.17	Dyson	(2)	0.31	0.78
A	Apple	i-Pod Nano	0.76	1.11	Bentley	Continental GT	0.25	0.94
B	Bosch	(8)	-3.42	0.64	VW	Phaeton	-2.37	1.03
B	Cadillac	(11)	-3.41	1.36	Chrysler	(57)	-2.01	1.07
C	Sansa	(1)	0.82	-2.90	Sony	(10)	0.30	-1.86
C	Music Machine	(Unknown brand 60)	0.28	-2.09	Music Machine	(Unknown brand 21)	0.02	-1.84
C	Music Machine	(Unknown brand 16)	0.25	-2.07	Samsung	Yepp	0.30	-1.76
C	Toshiba	(6)	0.07	-2.00				

Table 5. Cluster [a], [b] & [c] BPC strength and accuracy values.

Figures 2.5 – 2.8 depict some conclusions to questions a). to d). respectively. Figure 2.5 illustrates the possible effects of brand extensions on Branded Product Categorisation. For the branded product Volkswagen there is a group of strong and accurate exemplars (Beetle [P_1: 0.88, 1.27], Jetta [P_2: 0.50, 0.86], Golf [P_3: 0.53, 0.78]), but Phaeton [P_4: -2.37, 1.03] appears not to be perceived to be among them, nor is it accurately identified; here it apparently stretches the boundary of the Volkswagen category, being associated more

closely with other luxury brands, and outside the alternative product type category; car. Figure 2.6 explores the Hoover effect; where members of the product category vacuum cleaner, and the activity involved in their use, have become colloquially known by the brand name, at least within the UK. The scatter illustrates, however, that Dyson and George products scored consistently highly in BPC strength and accuracy, the former also being members of segment [a]. Hoover products appear more strongly inclined to product type categorisation (vacuum cleaner). Figure 2.7 explores the mobile telephone set and finds minimal clustering, but a syntagmatic bias towards product type categorisation. BPC strength is highest, however, with Nokia, with other brands randomly arrayed. Finally, Figure 2.8 identifies the spread of the 27 examples that contained either a brand name or logo in the image. These originated from all 4-product sets. Two effects are evident that suggest the presence of identifiers did not influence categorisation in this study. Firstly, in segment [a], the group with strong and accurate BPC effects included only 3 examples that were identified. Secondly, there appears to be a trend towards a syntagmatic vector, with some examples categorised inaccurately against their brand, preferring product type categorisation.

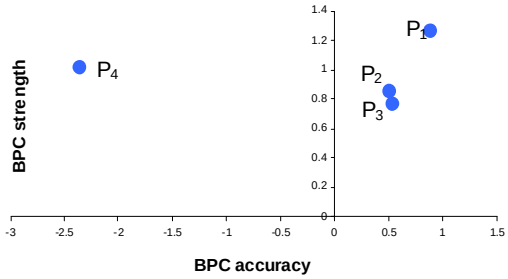


Figure 2.5. The Volkswagen category.

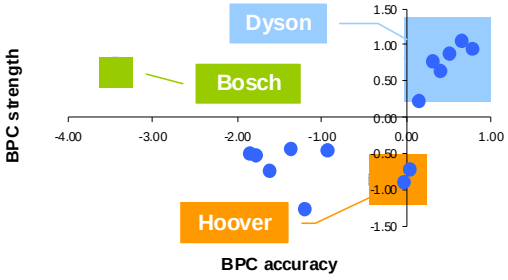


Figure 2.6. The vacuum cleaner category.

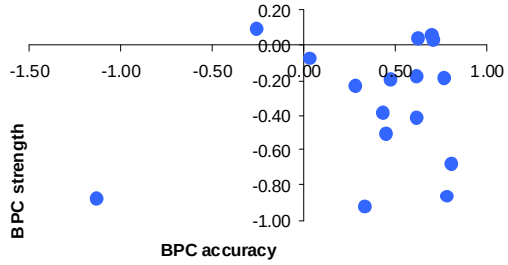


Figure 2.7. Mobile telephone category.

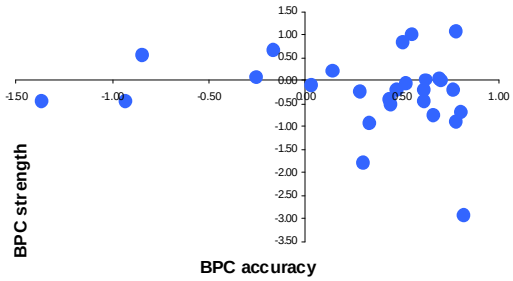


Figure 2.8. Identified images.

2.3.3. Discussion

The test results indicate that in correctly identifying a product by its brand, cognitive categorisation effects may be present that suggest the brand acts as a cognitive category in some instances. In so doing, the brand may also behave like other taxonomic, biological, goal derived or ad-hoc categories in building cognitive constructs from its members that possess more or less specific properties that are more or less typical of a prototype. The twenty members that inhabit segment [a] appear to be those in the set with strong visual-form identities (specific property stimuli, and distinctive brand values, e.g.: Apple i-Pod; Dyson; BMW; Audi; Bentley); perhaps especially so in the minds of the subject demographic (which may correspondingly, also be a limitation of the test). Where visual-form identity homogeneity is apparently weak or perhaps *a posteriori* knowledge is weak within the subject set, or brand values indistinct, objects are either categorised by

the product type (e.g.: Sansa; Samsung; Toshiba; 3 of the 5 entities with unknown pedigree) or by associative, paradigmatic constructs like office, long-and-fast, executive (e.g.: Volkswagen Phaeton). Therefore, results appear to support H_1 and suggest that some brands do act as cognitive categories (question 1 in the Research Objective).

Further, questions a). to d). pose some problems that may be involved with the brand as category effect; question a). asked whether brand extensions like the Volkswagen Phaeton affect brand categorisation. This topic was interesting because some evidence exists that Volkswagen specifically introduced the product to stretch the brand category (e.g.: Hjorth & Pelzer, 2007); its traditional products being more utilitarian, generally smaller and aimed at higher volume segments. If the Phaeton were perceived close to prototypical Volkswagen positions in this sense, it may be unsuccessful in that objective (Rust, Zeithaml & Lemon, 2004). In fact, its position against BPC strength and accuracy factors (P_4, Figure 2.5) appears to support H_1, maybe because the subject group's established expectations of the brand category Volkswagen were not congruent with this example (being further away from P_1, P_2 & P_3, which themselves demonstrate good BPC homogeneity). Some associational benefits appear to be present, however, as stretching categorisation in this case appeared to successfully connect the example to other luxury saloons in a syntagmatic relationship (subject responses included, for example; Audi, Saab), and also in a paradigmatic relationship as previously discussed. This effect appears reasonably strong, in BPC strength value (1.03) and in low BPC accuracy value (-2.37).

Some brands have become well established as a cultural concept, or meme. One effect of the permeation of the brand meme is that it can become a synonym for tasks that the branded product may involve with (Low & Blois, 2002). Examples like Sellotape, Xerox and Hoover have evolved to become generic terms in some cultures, where the cognitive brand category appears to accept members from other brands. Question b). explores this

phenomenon and asks if the identification of all products as Hoovers in the category vacuum cleaners exists. It could be predicted that if this effect were strong, all examples of vacuum cleaners that were not Hoovers would have low BPC categorisation values with low accuracy, being analysed as being incorrectly identified by both brand and product type. Conversely, those that were Hoovers would predictably have strong and accurate BPC values. However, in this subject group, this effect appears to be weak; strong and accurate examples being categorised by their own brands (Dyson, George [Figure 2.6]) and Hoover products unexpectedly biased further towards product type categorisation accuracy (vacuum cleaner) than any other examples. Only one example was miss-categorised repeatedly as a Hoover: a cleaner by Bosch. It appears from these results, therefore, that the Hoover effect is dying within this socio-demographic group.

Within the branded product categories studied there are categories with more or less heredity and therefore more or less memetic maturity; cars have been relatively well established (even commoditised [see Section 1.1.1]), with some brands included in this test enjoying a lineage of over 70 years, whereas mobile phones are genetically immature without clear and distinct brand visual-form identities. In fact, the most salient branded product property within the mobile telephones set is probably the adopted Nokia ring-tone (original; ‘Gran Vals’ written by Francisco Tàrrega in 1902) (Lindstrom, 2005). In examination of the categorisation of products in immature segments, question c). asked; what are the brand categorisation effects within a saturated market like mobile telephones? It is apparent within the set of examples chosen that visual themes within and across brands are difficult to identify. It is perhaps unsurprising, therefore, for the scatter in Figure 2.7 to be generally inclined towards accurate product categorisation, suggesting that insufficient distinct visual brand properties exist with these examples to stimulate strong brand categorisation.

It could be argued that subject responses might be influenced by identification of the branded product by logos or trade names in the images, rather than other discrete visual characteristics. Question d)., therefore, asked; does a visible brand name or logo affect the brand categorisation effect? Figure 2.8 illustrates a dispersed scatter of the products given in Table 4 that included visual identification. Three effects are evident in the figure that suggests the presence of names did not influence categorisation in this study. Firstly, the scatter is dispersed along the BPC accuracy factor, indicating that identification did not help with accurate brand categorisation. Secondly, in segment [a], the group with strong and accurate BPC values included only 3 examples (of the 20) that were named and finally, there appears to be a trend towards a syntagmatic vector, with many examples categorised strongly towards product categorisation.

Some limitations of the study need to be discussed. Firstly, as previously noted, the demographics of the study group were somewhat limited. Such categorisation effects may not be present within groups or cultures where the products and brands presented are less ubiquitous. Nevertheless, the objective was to support H_1 and to answer question 1 in the Research Objective whereby brands can be said to act as cognitive categories as suggested by Boush (1993). Some evidence, therefore, is collected against this objective, at least within this demographic, thereby satisfying the question. Further, there may have been some learning activity induced by the order and type of image shown. If this had been the case, it could be reasonable to conclude that subject's first responses to the images might set up subsequent responses to similar images. However, this effect would not change the initial categorisation response, thereby providing some validity to the interpretation of results.

2.4. Conclusions and Consequences

This chapter set out to establish if some brands behave as cognitive categories, as a foundation for the later research presented in the Thesis. The test finds that the hypothesis (H_1) is supported and further, that the brand categorisation characteristic appears to reflect general cognitive categorisation theory in that it is subject to typicality, prototype effects, authenticity, *a posteriori* knowledge, and stimuli that may exclude explicit identification (brand names or logo's). Therefore, the results suggest that viewing the brand as a category may be an alternative and possibly advantageous approach to product development activities because it places emphasis on the specification of typicality within the brand category; the brand specific product attributes, or properties, which guide accurate cognitive categorisation.

However, in order that the brand category may be explored and understood in depth, the multi-sensory properties that are signifiers of the products within it need to be identified. Chapter 3 therefore explores the Bentley Interior to identify the salient properties that stimulates that concept's cognitive categorisation, which may later be useful in constructing the brand category semantic space.

3. The Specification of Typicality within the Branded Product Category[1]

1. Content in this chapter was presented in ABBOTT, M.; SHACKLETON, J.P.; HOLLAND, R.; GUEST, P.; JENKINS, M-J., 2006. Engineering Emotional Identities in High-Luxury Vehicles, Proceedings from 5th. International Conference on Design and Emotion, Götenburg, Sweden, 27th-29th. September 2006.

   and at 'Automotive Comfort', IMechE Seminar, London, 25th. September 2007.

   A revised version of the above paper is also included as a chapter in the book DESMET, P.; van ERP, J. and KARLSSON, M., 2008. Design & Emotion Moves, Cambridge Scholars Publishing.

   These papers were published under joint affiliation to Bentley Motors Limited and Brunel University.

3.1. Introduction

The high-luxury automotive product appears to be highly complex; the cognitive processing of the complete concept involves the receipt of stimuli that are multiple and variable, concept meanings can be detailed and emotive associations multifaceted. Within automotive product development, multiple design and engineering disciplines are employed, drawing upon diverse specialism and resource. Recognising this complexity, and to clarify that the specification of typicality to be explored will not take in the complete product, this chapter first provides some definition, clarity and theory to the specific branded product category of interest to this research; the Bentley Interior. This will consider a number of background factors; firstly, it is noted that previous studies of product categorisation maximised research efficiency by either dealing with single stimuli (e.g.: vision in Karjalainen & Warell, 2005 and Shackleton, 1996) or very simple concepts (e.g.: 'apple' in Smith et al., 1988). Secondly, reflecting that Barnes & Zhi-Quang (2004), Pinker (1997) and Simon (1996) recognised that in the computational model of the processing of complex concepts, compound neural activity takes place that involves multiple single categorisation tasks for the multiple aspects of the concept, it appears appropriate to concentrate on only a few of those tasks undertaken with the automotive product. Thirdly, cognitive science, semiotics and memetics all deal with complex concepts in structuralist-type definitions (e.g.: Fodor, 1998; Eco, 1976; Dawkins, 1976, respectively) (see also Figure 1.10), reducing higher-order constructs into basic elements (Berlin, 1980), or 'chunks' that by themselves act as valuable meaning building blocks. Finally, in order that the research provides some meaningful and useful outputs to the automotive profession, and in particular the sponsoring company, some segmentation of the overall concept is necessary. These four factors lead to a compact and focused

definition of the boundaries of the category under study within which the specification of typicality will be explored.

However, despite study 1 concluding that some brands act as cognitive categories, it is plausible that no such effects will be found within these boundaries. Therefore the null hypothesis that multiple brands will inhabit the cognitive category randomly will be tested later in chapter 4. Some further evidence to support H_1 is also expected then. First, however, a rule to measure the typical Bentley Interior properties that may be present in this category needs to be identified. Because it is widely observed that concept recognition and cognitive categorisation is based upon attained and experiential knowledge of the concept (e.g.: Fodor, 1998; Simon, 1996), and that the authenticity perception is an important cognitive association mechanism, particularly with some automotive brands (Karjalainen, 2005; Simms & Trott, 2006), the creation of this rule necessarily involves a multiple (in this case, 3 studies), pluralistic (Gummesson, 2001), approach that draws upon established knowledge of the branded product. Firstly, historical conditions are explored by reference to a lineage of Derby and Crewe (UK) built products in a large-scale study, to identify property heredity. Secondly, contemporary conditions are explored through an expert group discussion forum to check the relevance of the first set of properties to present-day brand categorisation and thirdly, both are validated against an analysis of current Bentley customer verbatim taken from a database of 1:1 interviews.

By analysing this categorical-type data from these multiple sources, it may be possible to collect a large number of adjectives for allocation to this rule's positive and negative bi-polar scales according to Osgood, Suci & Tannenbaum (1957) Semantic Differentiation principles of concept affectivity (see section 1.3.2 and Table 1). The objective of SD's use, in chapter 4, is in the subsequent construction of the category semantic space as an

assessment, measurement and visualisation tool to test the null hypothesis presented above.

Further, the background research also leads to some expectations of the condition of the Bentley Interior properties expressed as hypotheses H_2 and H_3.

> Some product properties are more or less important in the stimulation of the identification of the cognitive category Bentley Interior [H_2].
>
> Further, if certain properties are more or less important for stimulation, their descriptors will also be differently important (scaled). [H_3].

Smith et al. (1988) Selective Modification Model and a pair-wise conjoint type rating study (study 5) (Warell, 2006) are used to reject the additional, related, null hypothesis that all properties have equal status in the Bentley Interior category.

Figure 3.1 summarises the four process steps and the four studies undertaken in this chapter to answer question 2 in the Research Objective; the definition of the Bentley Interior category and the specification of typicality within it. These process steps are, however, not prescriptive to the identification of the specification of typicality within general cognitive categories. Other research may employ other empirical methodologies like factor analysis or phenomenological methodologies like grounded theory alone. This Thesis takes a pluralistic approach, combining empiricism and interpretivist theory, believing that the resulting understanding of the properties that stimulate categorisation are best obtained by combining the rigours of statistical analysis and the richness provided by the insight of phenomenological data. Nevertheless, the objective is to arrive

at an exhaustive identification of the category's properties and their bi-polar descriptors which can be applied to the core SD methodology employed in later in the Thesis.

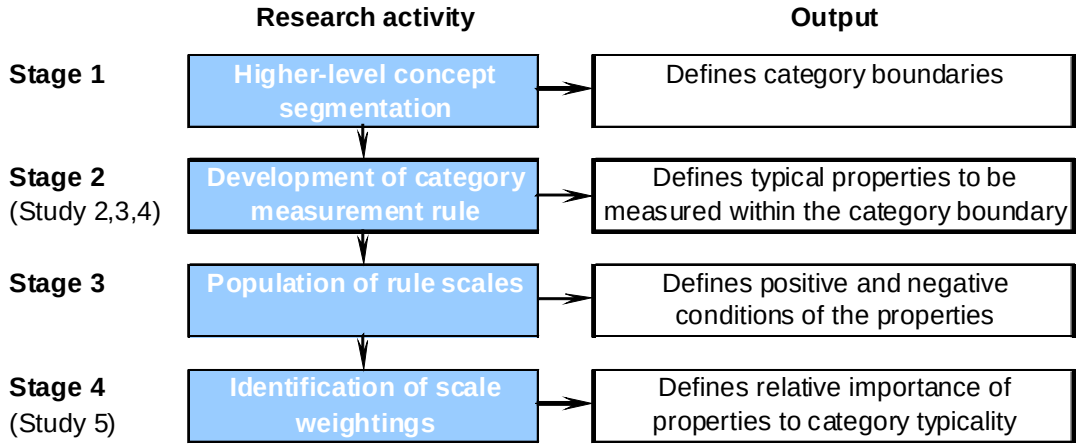


Figure 3.1. The Bentley Interior category definition and specification of typicality process steps and studies.

3.2. Stage 1: Higher-level concept segmentation

Segmenting, or reducing, the higher-level brand concept Bentley was obtained by reference to the sponsoring company's pre-defined Attribute Management structure, in order that the resulting category boundaries were relevant to the designers and engineers' functional organisation. It is intended, therefore, that the research have direct applicable benefit to the business as well as the wider field.

From this structure, the Bentley Interior category (known as Interior Execution within this arrangement) is proposed to exist at a secondary attribute level within the Luxury and Craftsmanship primary attribute. This segmentation leads to the exclusion of some attributes such as ergonomics and electronic functions, which are measured separately. The boundaries of the Bentley Interior category, in this case, are interpreted as

incorporating some distinct brand related attributes including veneer, brightware, and leatherwork, which may also help to maximise potential brand dissimilarities within the category semantic space.

Whilst it is recognised that this structure was defined in alternative intra-company research that is outside the scope of this Thesis, its validity may be given through the reliability of a test in this research (Clarke, 1993). Therefore, the validity of these category boundaries will be tested during the course of the studies described in chapter 4.

3.3. Stage 2: Development of the Branded Product Category Measurement Rule (Studies 2, 3, 4)

Lindstrom (2005) stressed the significance of brand heritage to competitive advantage. Karjalainen (2005) and Simms & Trott (2006) further explored the effect of branded product authenticity to customers' perceptions of satisfaction (see section 1.2.4). It is clear also that the heritage and lineage of the Bentley brand is particularly important both for cognitive typicality assessments and the associations they evoke (see section 1.1.3). Therefore, it appears appropriate that when exploring 'the rules according to which the properties that stimulate the cognitive categorisation of products as typical Bentley Interior's are defined and operate', that examples from the company's past product portfolio are employed as test stimuli. It is worth noting that the Bentley brands' development between 1932 and 2002 was inter-woven with its then sister brand Rolls-Royce (Feast, 2004) and that, particularly with the interior, differences in product properties during this time were restricted at best. This Thesis considers, therefore, that the cognitive categorisation of Bentley Interior approximates Rolls-Royce Interior between

these dates and that the test stimuli in this section (and also in chapter 5) may include Rolls-Royce products built whilst both brands were linked.

A first study was planned and conducted, lead by the author, in July 2005 to identify some of the properties that define the Bentley category. According to the guiding principles set out above, the study referenced products from the company's past product portfolio. As a sub-set of this study, the Bentley Interior category was explored.

3.3.1. Methodology – Study 2

A group of 160 associates of the company, with a design and engineering bias, were randomly selected to review, in groups of 40, a collection of five vehicles and over 400 photographs categorised by discrete properties, that included, for example, exterior and interior lighting, glazing, exterior and interior handles, colours, veneers and seat styles (Figure 3.2). The photographs were pre-selected by a panel of intra-company experts, lead by the author, from a database of over 3000 examples taken from products made by the company between the early 1920's and 2002 and grouped into 36 sets of property examples (18 interior only sets) with 12 different examples of the property in each set (see Table 7 for examples from the property sets). These were displayed on A0 size boards. The collection of vehicles were also sourced by this panel from the Bentley Lineage collection, with examples from the 1930's through to the 1990's, including four previous production cars and one bespoke Royal vehicle. The list of vehicles presented is given in Table 6. The test set-up was as described in Figure 3.2, with the 36 property boards arranged around the periphery of the room with the vehicles displayed in the centre. The individual assessment groups were given a short introductory presentation by the author outlining the aims of the study before they were asked to review the photographs and vehicles. Reviews were limited to 1-hour duration and discussion between the participants

was not restricted. Participants were also encouraged to assess the product through visual cues, in the case of the photographs, or other sensory stimuli, in the case of the vehicles, which could be sat in, but not driven, thereby limiting stimuli to non-dynamic properties.

Figure 3.2. Bentley heritage study set-up.

Participants were asked to identify their top 10 examples, in no specific order, which to them most typified a construct of the higher-level concept Bentley, seven from the photographic collection and three from the vehicle collection. Participants were also asked to identify which of the five vehicles was most typical of the brand overall. In asking for an explanatory note about each of the chosen examples, significant quantities of free-form elaborative, qualitative descriptions were also collected, consisting predominantly of adjectives or nouns with adjectival relationships (for example; jewellery → jewelled). Responses were collected on individual feedback forms.

Vehicle	Year of manufacture	Image
1. Bentley 3.5 Litre Saloon-Thrupp and Maberley	1933	
2. Rolls-Royce Phantom IV-Mulliner	1950	
3. Bentley R-Type Continental-Mulliner	1953	
4. Bentley S1 Continental-Mulliner (‘Flying Spur’)	1957	
5. Rolls-Royce Corniche (last Crewe built Rolls-Royce)	2002	

Table 6. Bentley heritage study vehicles.

3.3.2. Results – Study 2

Analysis of the data collected on the individual feedback forms took two forms; firstly a sum of ‘votes’ for specific properties and secondly, a detailed analysis of the adjectives attached to those votes with diagnosticity calculations according to the Selective Modification Model (Smith et al., 1988), focused on the Bentley Interior category. The aim of conducting the first analysis was to identify which properties were exemplars of the category and which, if any, properties could be identified as having perceptions of prototypicality. The aim of the second analysis was to identify how the attributed descriptions of the properties were most useful in stimulating cognitive categorisation. Both of these objectives were to support stage 2 output (Figure 3.1); the definition of typical properties to be measured within the boundaries of the Bentley Interior category. Appendix A1.3 includes the full data set collected.

By summing individual scores, the results of the analysis of photographic sets identified that there were distinct groups of typical properties; those appearing more frequently in participants’ identifications of examples that most represented their perceptions of the category, supporting H_2. For example, votes for typical properties were not evenly distributed (Table 7).

Property (ranked by typicality)		Total votes (as % of total)	Top 4 exemplar votes (as % of total)	Inter-property reliability	Property (ranked by typicality)		Total votes (as % of total)	Top 4 exemplar votes (as % of total)	Inter-property reliability
1. Veneer		12.5	76.9	0.6	10. Lighting		5.3	100	0.69
2. Tool Kits		9.1	100	0.74	11. Airvents		5.2	85.5	0.58
3. Luxury Items		8.6	86	0.61	12. Trimming		4.5	73.3	0.44
4. Luggage		8.5	84	0.61	13. Switches		3.0	70	0.55
5. Seating		7.7	74.5	0.54	14. Cantrail		2.4	94	0.64
6. Door Trim		6.9	65	0.53	15. Colours		2.1	64.2	0.67
7. Materials		6.8	77.8	0.57	16. Ashtrays		2.0	92	0.63
8. Handles		6.2	70.8	0.58	17. Piping		1.9	100	0.51
9. Instruments		5.4	86	0.67	18. Storage		1.9	91	0.64
Total							**100**	**-**	**-**

Table 7. Rank of typical category properties.

Further, within those properties, there appears to be distinct exemplars present. For example, the top property (1: veneers) attracted 12.5% of all votes with 76.9% of those assigned to four examples from the 12 available. Note also, in Table 6, how some properties presented included examples with stronger or weaker prototypicality effects; property 2: tool kits had all of its responses determined by four of the 12 possible (inter-property reliability = 0.74 [Hayes, 1998]). A similar analysis of the vehicle collection showed that the examples were also distinctly ranked, with the most popular receiving 10% more responses that the next highest.

This analysis also performed a function of ranking the prototypical properties in preparation for exploration of the usefulness of specific lower-order properties in the stimulation of typicality. At this point also, properties that sat outside the boundaries of the category, as defined in section 3.2, were excluded from further analysis, reducing the properties to nine. Following Selective Modification Model principles (Smith et al., 1988), the subject's free-form explanations of the properties identified as being typical of the Bentley Interior were analysed by the author for elaborative descriptors. For example, adjectives detailed, intricate and hand-crafted were extracted from individual response forms and listed. Many of these were emotionally based reactions attributed to the properties encountered (for example; beautiful; stylish), some were more rational (for example; clean; metallic). To enable diagnosticity calculations for each property, each descriptor extracted from the responses was allocated a vote towards a defining descriptive construct; a higher-level synonym-type concept (see Table 8). For example, the property tool kits included descriptors ordered, simplicity, clean and precise, that were allocated to the descriptive construct Precision with the aid of Wordnet 2.1 (http://wordnet.princeton.edu), a linguistics tool that identifies synonyms ranked by likeliness of instantiation within common dialogue. Descriptors with total votes below five were further collected into sub-constructs, or were eliminated from the analysis if synonym relationships could not be identified.

Diagnosticity value	Construct	Construct total Observed	Descriptor Observed	Descriptor	Property: Veneer	Seat styles	Luggage	Toolkits	Door Trim	Interior Handles	Materials	Airvents	Trimming
9.298	Precision	61	14	ordered	1	1	2	8			2		
			32	simplicity	1	7	3	1	4	5	3	5	3
			6	clean			2	1	1				2
			9	precise				4			4	1	
2.681	Hand crafted	44	22	like furniture	21								1
			15	craftsmanship	9	1	2	1	1				1
			7	care	4				2				1
2.315	Refined	59	11	beautiful	3		1	1	1	2	3		
			21	elegant	4	4	4		3	2	2		2
			27	stylish		4	13		4	2	1	1	2
1.673	Comfort	30	21	comfortable		20					1		
			9	armchair		9							
1.046	Character	25	5	expressive		1	2			2			
			10	sporty		3	4				2		1
			5	potency				5					
			5	character	2	1	1			1			
0.743	Quality	23	15	quality			2	8	1			2	2
			8	appealing	6			1		1			
0.697	Luxurious	19	9	luxury	3	4			2				
			6	rich	1	1		1				1	2
			4	jewellery	1			1		1		1	
0.398	Structure	14	5	solid	2		1			1		1	
			9	strong	1	1				3		2	2
0.385	Form	39	11	size	7	2			2				
			7	form	7								
			11	flowing	6				1	3		1	
			10	graphic	2				2		3	1	2
0.188	Practicality	26	9	functional		4	2			2		1	
			7	practical			3	1		2	1		
			10	utility				5			1	4	
0.175	Bespoke	28	9	branding	2		2	4	1				
			11	individual	3		2	3	1	1			1
			8	distinct	1	1		1	2	1	1	1	
0.165	Lineage	19	11	class		1	4			2	1		3
			8	pedigree		4	3					1	
0.044	Sensory	16	6	soft		1	2		1		1	1	
			5	tactile		1		1		1		2	
			5	metallic							4	1	
0.010	Detailing	33	17	detailed				7	4	2		1	3
			16	intricate	14				2				
					101	71	55	54	35	34	30	28	28

Table 8. Analysis of adjectival descriptors collected for Bentley Interior properties and the calculation of diagnosticity values.

Table 8 shows the diagnosticity values resulting for the nine properties remaining. Within these, the descriptive constructs Precision, Hand-crafted, Refined and Comfort produced statistically significant chi square values of less than 0.05 (p<0.0001; 0.0214; 0.0362 and 0.0285 respectively). Diagnosticity values identified according to the Selective Modification Model suggest that these descriptive constructs are not equally important when describing cognitive categorisation, thereby supporting H_3; for example, Precision (9.298) has a higher diagnosticity value than Comfort (1.673) or Practicality (0.188).

3.3.3. Discussion – Study 2

The results of study 2 suggest that H_2 and H_3 are true by identifying that some properties are more or less important in the stimulation of typicality within the category boundaries defined, and that constructs which describe them are also differentially scaled. The study therefore potentially selected some of the properties and their descriptive constructs that may be necessary to exhaust the specification of typicality and the interpretation of the Bentley Interior category semantic space. However, a number of interesting effects are also evident. For example, firstly, the descriptive construct Potency, for tool kits, has a high diagnosticity value for the property, perhaps hinting at least two potential underlying phenomena; i)., that such elaborative constructs, which express capabilities beyond some basic requirements (or 'must-be' qualities) of the modern automotive product, maybe significant when assessing typicality within the category. Or, ii)., that some fondly thought of features that were once important were being artificially elevated through nostalgic cognitive judgements. Categorisation theory generally supports ii)., (recalling problem (c), section 1.2.3), whereby categories and prototypicality can be unstable and evolutionary. Secondly, the same descriptive construct (Potency), exhibits a high diagnosticity value due to the influence of its component descriptor, simplicity, which tended to be used by reviewers to describe degrees of restraint and lack of complication involved in the exact

execution of many of the properties assessed, this possibly has an elevated importance due to the demographics of the study participants; it is plausible that engineers and designers will find such constructs particularly attractive.

To augment study 2 in its objective to identify some of the typical properties that are involved with the Bentley Interior and to address the points above concerning nostalgia and potential engineering bias and reliability, two further studies were undertaken in stage 2; study 3 involved the exploration of contemporary properties for the Bentley Interior and was conducted in the Autumn of 2005 and study 4 involved a check of customers' opinion of Bentley products categorical accuracy and acceptability in the Spring of 2006. Additionally, in chapter 5, the Thesis will explore contemporary views of historical features, which may provide some clarity to these proposals and add further validity to the study 1 findings.

3.3.4. Methodology – Study 3

Study 3 consisted of a series of 8-10 discussion group meetings lead by the author with a pre-defined set of 16 cross-functional peers from Product Development, Procurement, Marketing and Manufacturing departments within the sponsoring company's organisation. These members had varying degrees of expertise in the area, although all had experience of the product. Discussion was focused towards identifying, debating and agreeing the Bentley Interior properties that might typify distinct cognitive categorisation by assigning highly positive, positive or neutral indicators to three questions; 1). 'Is it unique' (indication of a defining property that may not be present within competitors branded product categories); 2). 'Is it memorable' (the saliency of the stimuli); 3). 'Is it differentiated' (the effect of prototypicality of properties between exemplars). These questions were set across the sponsoring company as a constant set within a number of the attribute areas

previously discussed in section 3.2 in order that comparable results could be obtained across the vehicle. They also appear to qualitatively satisfy categorisation mechanisms and so were used within this research for that purpose. Through questions 1 and 3 respectively, associative, contextual, syntagmatic 'belongs to' relationship and paradigmatic 'is like' relationships within the category were explored. Effectively, therefore, coding in a grounded theory-type took place (Corbin & Strauss, 1990) within question 1 (Axial Coding of inclusion) and question 3 (Open Coding of similarity / dissimilarity). Qualitative discussion centred on the current Bentley product range, using pictures and vehicles as stimuli, and agreements were recorded on a central spreadsheet (Appendix A1.4). Further, notes were taken from the group discussion of two bi-polar questions about the property; 'What it is' and 'What it isn't', to explore any potential metaphoric, paradigmatic sensitivities (Chandler, 2002; Valentine, 2002) that might be useful in the elaboration of the positive and negative conditions of the properties in stage 3.

3.3.5. Results – Study 3

The discussion group concluded that the lineage of some properties continued out of study 2 into the current product examples. Particularly, the veneer property was agreed as a distinct characteristic of the current Bentley Interior. Other study 2 properties; seat styles, door trim, and trimming, also continued but were considered to be more parsimonious if combined into a higher-level property Leather Trimming, as that property appeared as a consistent and exhaustive factor of all three in the qualitative discussion. The study 2 property Materials was segmented into carpets and brightware as veneer and leather trimming was separately identified and no other materials were considered to currently have significant presence as a differentiated property in the Interior. Interior handles and airvents were combined and expanded to include other properties that

involve mechanisms (moving parts like cupholders, which is a more contemporary ‘must-be quality’ of the automotive interior and stowage, like gloveboxes) under the title Control Functionality in recognition of human-product interaction that is connected with such features. Finally, study 2 property tool kits and luggage were considered to have less significant influence in the categorisation of the contemporary Bentley Interior due, in the first instance, to a combination of modern automotive product reliability and the probability of use of the tool kit by the customer, and in the second instance, because for some while branded luggage had not been offered by the company and therefore it was felt that categorisation stimuli had evolved to reduce its current levels of importance relative to others.

Further, the discussion group considered that study 2 potentially omitted some properties that may be important in the contemporary categorisation effect, albeit in a less tangible manner than some others; for example, a property called Design for Material, which describes the apparent sympathy between the design image of the interior and the materials chosen for its construction. In this case, the group felt that a unique, memorable and differentiated characteristic of the Bentley Interior was the application of the leather panel stitch-lines, which are necessary to make trimming of the interior feasible to manufacture in that material, to sympathetically highlight general form lines described by the designer. Similarly colour harmony was also considered to be a typical Bentley property because of consideration of the application of colour within the design (similar to design for material), which in itself appeared as a property in study 2, within the design of form. Smell was considered to be a significant multi-sensory property, especially considering the unique and particularly memorable use of natural leathers and woods within the interior. These properties were added to a higher-level property construct of Interior Execution overall, because of their universal application within the product.

Finally, the group concluded by identifying five other core categorical constructs for the Bentley Interior (selective coding-type analysis [Corbin & Strauss, 1990]) within which the properties identified clustered; Leather Trimming, Veneer, Brightware, Carpets and Control Functionality. Figures 3.3 – 3.7 inclusive show picture boards created to visualise these properties.

3.3.6. Discussion – Study 3

Study 2 appeared to identify a number of the Bentley Interior properties and their descriptive constructs that may define the specification of typicality within this cognitive category. However, the stimuli presented deliberately explored historical products in order that the concept's heredity may be understood, given its importance to customer satisfaction (Karjalainen, 2005; Lindstrom, 2005; Simms & Trott, 2006). In so doing something akin to the brand memetic evolutionary algorithm (Blackmore, 2001) may have been identified. The qualitative conclusions of study 3 suggest that a number of the properties identified in study 2 still discriminate the Bentley Interior and some perhaps not, having either become irrelevant or reduced in importance as stimuli in the opinions of the expert discussion group. Modifying the properties generally reflects principles posited in cognitive science (e.g.: Fodor, 1998; Lakoff, 1987), memetics (e.g.: Blackmore, 2001; Dawkins, 1976; Wood, 2003) and others (e.g.: Martindale, 1990) whereby the conditions of the category adapt and evolve to reflect prevalent cultural influence, technology developments, the laws of novelty and the survival of the fittest concepts. Therefore, it is perhaps unsurprising that the contemporary view of Bentley Interior properties might be modified from a historic view. An exploration of these phenomena will be presented in chapter 5 to establish any patterns that might then be used to predict the future condition of the category. Further, grounded theory (Corbin & Strauss, 1990; Glaser, 2002; Goulding, 1998) suggests that multiple data sources be explored in order that categorical

saturation (and therefore validity) is achieved. It is plausible, therefore, that property modification also takes place on this basis.

Figure 3.3. Leather Trimming.

Figure 3.4. Veneer.

Figure 3.5. Brightware.

Figure 3.6. Carpets.

Figure 3.7. Control Functionality.

It is a limitation of both study 2 and 3 that data was taken from intra-company sources. Cho et al. (2008) identified that peer-group based judgements tend to be equally reliable as non-expert based judgements, suggesting that the results of study 3 may correlate to external views. However, to fully ground in the subject, study 4 validates the outcomes of study 2 and 3 against Bentley customer interpretations of the brand category.

3.3.7. Methodology – Study 4

In many industries, customer expectations of a product and the way that the product meets (or does not meet) those expectations are well recorded. Methodologies can include interviews, questionnaires and group discussion forums amongst others. Gummesson (2001) calls the resulting databases 'data warehouses', where narrative discourse can be richly elaborative and insightful. Bentley Motors Customer Quality Tracking System (CQTS) contains text transcripts from 1:1 telephone interviews with customers in many markets. Although these interviews focus on structured questions about product features, one verbatim example (quoted previously in section 1.1.2) contains evidence of brand categorical cognition in both a metonymic, associative, syntagmatic 'belongs to' relationship ('like a Bentley') and a metaphorical, paradigmatic 'is like' relationship ('like a steam train');

> *'It was good. It just pulls like a steam train. It feels very much like a Bentley engine. That's good. It feels like a Bentley engine, that's important to say'*
>
> (personal communication).

The author therefore interrogated this database for further statements that might suggest cognitive categorisation (positive and negative) along both axes, but set against the categorical boundaries given in stage 1. Emerging properties were collected, recorded and compared against the content in studies 2 and 3. Further elaborative, qualitative descriptors were noted against the properties identified.

3.3.8. Results – Study 4

Some new properties emerged from this analysis and others were confirmed. Statements within the database appeared to include properties like handcraftedness (overall) and veneers specifically (positive categorisation). Elements of what could be described as comfort, in terms of softness of the trim (trim panel softness) and smoothness of the applied leather were also areas of comment. Further, a significant amount of narrative was evident concerning customers' perceptions of what might be described as the 'must-be' qualities (Kano et al., 1984) of the product, where comments were found about minimum satisfactions rather than elaborative, expressive content. Properties like Fit & Finish, Part Stiffness / Robustness and Control Functionality Refinement and Harmony were present here. The emergence of the property Fit & Finish also suggested that the descriptive construct Precise, which may have been subject to some influence by the intra-company study demographic in study 2, was valid due to its instantiation within the external data. During the analysis, as in study 2 and 3, elaborative descriptors were added to the notes.

3.3.9. Discussion – Study 2, 3 and 4

The three studies conducted so far took the research towards the definition of the branded product category measurement rule, through a pluralist quantitative and qualitative approach that resulted with an apparent set of properties, some higher-level core properties, and their descriptive constructs, that might define the Bentley Interior. Table 9 illustrates this theoretical structure 'bonded to' the attribute management structure discussed in section 3.2. By full emersion in the data available, it could be argued that this resulting rule could be valid as a precise representation of the boundaries of the category and the properties that operate within it (Corbin & Strauss, 1990; Goulding, 1998). Limitations in terms of a selective intra-company view of the data were discussed in section 1.5 and addressed with study 4 and potential bias interpretation in study 2 and 4 were addressed with the group-discussions in study 3. Clarke (1993) further posits that reliability (of the stimuli in categorisation) can be derived from the discriminatability of the stimuli (the probability that discrimination occurs beyond chance levels). Therefore, the validity of the rule proposed, might be given by the reliability of the resulting tests in chapter 4, if it produces a discriminated categorical representation of the Bentley Interior.

Attribute Management Structure			Concept Property Elements				
Primary	Secondary	Tertiary	Core property	Property	Study 2	Study 3	Study 4
Luxury & Craftsmanship	Interior Execution	Materials & Appearance	Materials & Appearance overall	Design for Material		✓	
				Smell		✓	
				Colour harmony		✓	
				Fit and finish	✓		✓
				Hand-crafted	✓	✓	✓
			Leather Trimming	Trim panel softness	✓	✓	✓
				Softness harmony		✓	
				Part stiffness / robustness			✓
				Leather grade / grain		✓	✓
			Carpets	Carpet quality		✓	
				Carpet execution		✓	
			Brightware	Brightware Harmony		✓	
				Brightware Solidity	✓	✓	
				Brightware Authenticity	✓	✓	
			Veneer	Veneer Solidity	✓	✓	
				Veneer Hand-crafted	✓	✓	✓
				Veneer Detailing	✓	✓	
		Control Functionality		CF Refinement	✓	✓	✓
				CF Part stiffness / robustness		✓	
				CF Function harmony		✓	✓

Table 9. The Bentley Interior property structure. Occurrences of properties identified within studies indicated.

Study 2 also suggests that H_2; some product properties are more or less important in the stimulation of the identification of the cognitive category, is true as not all property votes are evenly distributed. H_3; if certain properties are more or less important for stimulation, their descriptors will also be differently important (scaled), also appears to be true by the diagnosticity values presented in study 2. Both hypotheses suggest that the 20 properties finally identified in Table 9 are not equally important as cognitive categorisation stimuli. A weighting between properties appears necessary that prompts study 5 in section 3.5.

As stated in the Research Objective, the central methodology of the main body of the Thesis is semantic differentiation; the application of Semantic Differentiation Scales (SDS) as a measure of member typicality relationships to the category's defining properties, and their resulting factor interpretation within the semantic space. One of the central advantages of SDS, discussed previously in section 1.3.2., is that bi-directional positions can be measured against a single property. When considering cognitive categorisation, it

is conceivable that typicality measurements cannot only be positive / negative (in other words, goodness of fit, or likeness) but also prototypical (rightness of fit, or belonging) in both directions. Section 3.4. therefore, considers and allocates some bi-polar descriptive constructs to the properties from the data captured in studies 2, 3 and 4.

3.4. Development of Property Rule Scales

Stage 3 is concerned with the identification, refinement and allocation of semantic differentiation measurement scales to the properties that may act as stimuli in the cognitive categorisation of the Bentley Interior. The process undertaken considered a number of factors; firstly, Osgood, Suci & Tannenbaum's (1957) seminal work on SD techniques, argued that affective semantic response to conceptual stimuli generally involved three principle factors; Evaluation, Potency & Activity (EPA) (see section 1.3.2). Osgood, and later Heise (1970), advised SD practitioners play close attention to the development of scales that satisfy these factors and an EPA ratio of 2:1:1 in order that the semantic output is close to the internalised cognitive assessment. However, in the review of published research, few SD studies appeared to do so. Nevertheless, to be true to the original work, the selection of bi-polar adjectives for the Bentley Interior properties considered EP&A factors from actual scales, or synonyms, presented in Osgood, Suci & Tannenbaum's Thesaurus Study (1957, p53-61). Secondly, in order that inter-concept semantic difference values (*D*) be maximised between Bentley Interior examples and alternative brand examples, so that any cognitive categorisation effects are distinctly interpreted within the semantic space, the positive polar descriptor were set at the Bentley brand value. Antonym (negative pole) descriptors therefore fall naturally, but at the same time may represent an alternative brand's positive value. Thirdly, the database created during stage 2 contained a significant number of individual instantiations of affectively based adjectives (>700) that were associated to the properties by the study participants.

By comparing these to the Thesaurus Study (ibid) (for EPA), the perceived Bentley brand value (for the positive pole), and Wordnet 2.1 (http://wordnet.princeton.edu) (for the antonym), the bi-polar descriptive constructs in Table 10 were identified. EPA classifications for the positive descriptor are also shown (ratio; 1.5:1:0.8). A seven-point, ordinal Likert-type scale (Schutte, 2005; Zhang & Shen, 1999) was chosen to separate the poles.

Concept Property Elements		Semantic Differentiation poles									
Core property	Property	Antonym	-3	-2	-1	0	1	2	3	Positive descriptor	EPA
Materials & Appearance overall	Design for Material	incompatible								sympathetic	E
	Smell	artificial								natural	E
	Colour harmony	unintegrated								co-ordinated	E
	Fit and finish	imprecise								precise	E
	Hand-crafted	machine-made								hand-crafted	A
Leather Trimming	Trim panel softness	hard								soft	P
	Softness harmony	dissimilar								similar	E
	Part stiffness / robustness	flexible								rigid	P
	Leather grade / grain	rough								smooth	A
Carpets	Carpet quality	poor								luxurious	E
	Carpet execution	machine-made								hand-crafted	A
Brightware	Brightware Harmony	unintegrated								co-ordinated	E
	Brightware Solidity	hollow								solid	P
	Brightware Authenticity	false								genuine	E
Veneer	Veneer Solidity	hollow								solid	P
	Veneer Hand-crafted	machine-made								hand-crafted	A
	Veneer Detailing	simple								intricate	A
Control Functionality	CF Refinement	unrefined								refined	E
	CF Part stiffness / robustness	flexible								rigid	P
	CF Function harmony	dissimilar								similar	E

Table 10. Bentley Interior property bi-polar descriptors.

As the positive descriptive construct for the property defines characteristics of probable (or ideal) prototypicality, it is expected that any measured prototypical example should describe a straight line along right side of the scale. Examples that are not prototypical may describe an alternative line thereby presenting a specific semantic difference (*D*) to the Bentley prototype. Translating the scales into mean E, P & A values, may allow the cognitive category ‘zone of prototypicality’ to be visualised in three-dimensions as extreme positive E, P & A values with a theoretical prototype (tp) located at 3.0, 3.0, 3.0 (Figure 3.8) (Osgood, Suci & Tannenbaum, 1957).

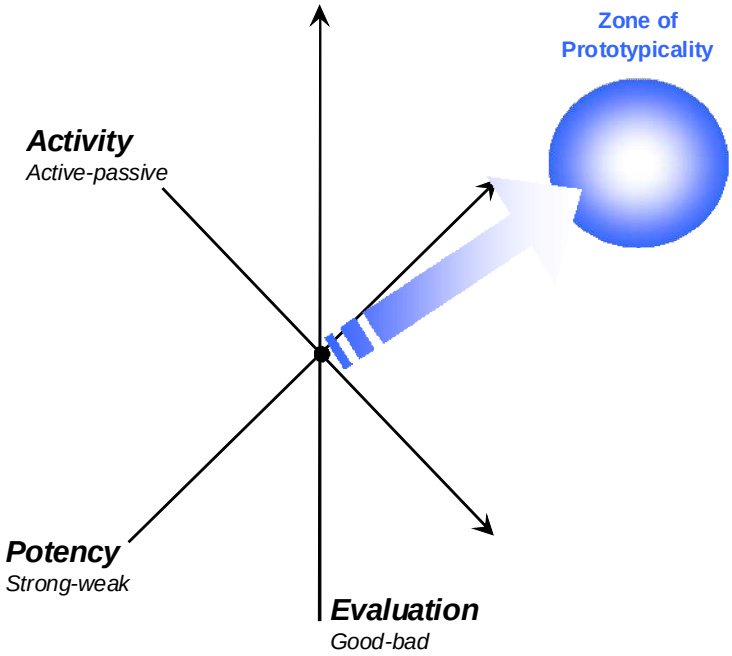


Figure 3.8. A three-dimensional framework for the representation of the cognitive category based upon semantic differentiation EPA values (adapted from Osgood, Suci & Tannenbaum, 1957).

Three pre-test studies were concluded during this stage to explore if the property rule scales developed were parsimonious, logical and repeatable and in order to understand possible test methodology and response form layout, before adoption in the large-scale studies described in chapter 4. With these, and all subsequent tests, attention was paid to assessments of actual product examples (vehicles), rather than substitute media, to avoid problems with stimuli restriction (Nordgren & Ayonama 2006) and to make assessment ratings as rich as possible.

Four pairs of assessors (eight in total) performed pre-test 1 on a single vehicle from current Bentley production using the rating form contained in Appendix A1.5. Assessors were familiar with the commodities rated but were not provided with pre-instructions or

help during the assessment. Individual pairs conducted ratings at different times. Pre-test 2 examined potential differences between two further Bentley current products, and the repeatability of the test over time, with two pairs of assessors who were familiar with the commodities, rating each vehicle four weeks apart. Pre-test 3 observed a wider vehicle set, one from Bentley and three competitor examples, by three assessor pairs (six in total), two pairs familiar with the commodities and one pair who were unfamiliar.

Summarising all pre-tests, overall rating repeatability appeared to be strong, especially for the Bentley products studied. Rating spread was greater for competitor vehicles, however, perhaps providing some first evidence of brand categorisation effects by confirming the property mix and bi-polar scales were more accurately interpreted for Bentley products, but were inconsistently interpreted for examples falling outside the category. Generally, individual property values recorded for the Bentley Interiors assessed suggested cognitive categorisation based upon the brand. From these pre-tests, the properties and their descriptive constructs appeared to satisfy the Research Objective and answer question 3; what is the specification of typicality for the Bentley Interior cognitive category?, suggesting the measurement rule might be adequately defined for the subsequent large-scale tests.

However, as study 2 suggested H_2 was true, weightings for the final properties set are required for calculating locations within the category semantic space. Study 2 obtained weightings for properties by simple ranking from individual votes. However, because the latter studies drew upon multiple data sources and types at different times and from varying sample sizes, this approach alone was considered to be unsatisfactory for the final set identified. Instead, a concluding study (5) was conducted using a pair-wise conjoint type analysis (see section 1.3.4 and 1.3.8) (Warell, 2006) to concurrently force rank between the final property set and assign a weighting value.

3.5. Identification of Scale Weightings (Study 5)

Warrel (2006) adopted a pair-wise conjoint type analysis to identify typicality between visual concept elements to a product example. This approach lists all elements in a *k* x *k* matrix whereby properties (k^1, k^2, k^3,…..k^n) are listed in both rows and columns and compensated one against another (Koslow, 1999). Ranking typicality to a prototype of one pair member over another, and continuing this until all elements have been compared to all others, can obtain an ordinal rank of properties with values that may reasonably represent their relative importance in the cognitive categorisation process. Values obtained may then be used to modify mean group property scores collected from the semantic differentiation tests that may result in a more accurate position of the product example within the three-dimensions of the category semantic space (Figure 3.9.)

3.5.1. Methodology

Whilst Warrel (2006) doesn't describe how his analysis was conducted, for the purposes of this research it was arranged in a live session with five expert assessors, from the sponsoring company's engineering department, actively debating and agreeing scores. In this respect, the approach was qualitatively similar to study 3. Each of the 20 properties were displayed on the matrix and compared horizontally. A score of 1 is attributed if the property in column (*x*) is more dominant than row (*y*) (e.g.: $xk^1 > yk^2$), 0 if $xk^1 = yk^2$, and –1 if $yk^2 > xk^1$. Scores were set against the question 'Which property is more important in the stimulation of the brand concept Bentley Interior; xk^n or yk^n?'. Following dominance agreement, each column is summed and a relative sum calculated (e.g.: $\sum k^a$, n*k*), with weightings (*w*) given by;

$$w = \frac{\sum k^n, nk\text{-}1}{nk\text{-}1, nk\text{-}1}$$

The full matrix and results are presented in Appendix A1.6.

3.5.2. Results

The results of study 5 gave the property ranking and weighting values (*w*) shown in Table 11.

Concept Property Elements		Semantic Differentiation poles				
Core property	Property	Antonym	Positive descriptor	EPA	Rank	Weighting (*w*)
Materials & Appearance overall	Design for Material	incompatible	sympathetic	E	11	0.47
	Smell	artificial	natural	E	20	0.00
	Colour harmony	unintegrated	co-ordinated	E	6	0.63
	Fit and finish	imprecise	precise	E	1	0.92
	Hand-crafted	machine-made	hand-crafted	A	3	0.82
Leather Trimming	Trim panel softness	hard	soft	P	9	0.61
	Softness harmony	dissimilar	similar	E	16	0.24
	Part stiffness / robustness	flexible	rigid	P	2	0.87
	Leather grade / grain	rough	smooth	A	15	0.29
Carpets	Carpet quality	poor	luxurious	E	12	0.45
	Carpet execution	machine-made	hand-crafted	A	16	0.24
Brightware	Brightware Harmony	unintegrated	co-ordinated	E	14	0.37
	Brightware Solidity	hollow	solid	P	18	0.18
	Brightware Authenticity	false	genuine	E	6	0.63
Veneer	Veneer Solidity	hollow	solid	P	9	0.61
	Veneer Hand-crafted	machine-made	hand-crafted	A	6	0.63
	Veneer Detailing	simple	intricate	A	19	0.08
Control Functionality	CF Refinement	unrefined	refined	E	4	0.79
	CF Part stiffness / robustness	flexible	rigid	P	4	0.79
	CF Function harmony	dissimilar	similar	E	13	0.39

Table 11. Bentley Interior property ranking and weighting values (*w*).

3.5.3. Discussion

A number of interesting observations can be made from study 5. Firstly, the highest ranking properties; Fit & Finish (*w* = 0.92) and Leather Trimming Part Stiffness (*w* = 0.87)

were properties that were confirmed in the category largely from study 4. As discussed previously, in this study, there appeared to be some significant discourse evident around the ‘must-be’ qualities of the product, to which both these properties are associated suggesting, perhaps, that if these qualities are not present first, then the more attractive, emotive, associational qualities will not succeed in stimulating accurate cognitive categorisation. Secondly, the property Smell did not acquire any weighting value as it was ranked second to any other property in the pair-wise assessment. This is a limitation of this methodological approach that was not apparent in Warrel’s (2006) research, as all the elements in his test had at least one other element that was less typical. The consequence is that in an EPA calculation for the Bentley Interior that includes weighting values (*w*), this property will be irrelevant. However, it clearly does have some significance in cognitive categorisation in this case, as identified in study 3. Therefore, it is proposed that EPA calculations be made with and without weightings to understand any significant effects within the category semantic space, either resulting from Bentley examples or alternatives. Thirdly, it is noteworthy that property ranking suggests a more-or-less homogeneous mix of E, P & A, ranking without a general predisposition toward a single factor being more important, supporting Osgood (1957) and Heise (1970) observations about the influence of these factors within cognitive assessments. Nevertheless, if the weighting calculation is considered, E, P & A ratio modifies slightly to 8.8:7:4.2. Further, the theoretical prototype location in the category semantic space modifies to 1.47, 1.76, 1.24.

3.6. Conclusions and Consequences

This chapter set out to explore the specification of typicality that might define the specific brand category of interest, the Bentley Interior, by answering question 2 in the Research Objective; what is the specification of typicality for the Bentley Interior cognitive category (the typical properties that define it)? It aimed to establish the boundaries of this category within which the measurement of cognitive categorisation effects can be explored, and proposed that the properties that may stimulate categorisation will be demonstrably more-or-less important in that stimulation, in hypotheses H_2 and H_3. The research chose to take a pluralist approach to quantitative and qualitative 'saturation' in the category through a 4-stage process that took in theories presented in chapter 1 from cognitive science, semiotics and memetics, specifically; the lineage, heredity and authenticity of the brand and the branded product as a structured, *a posteriori*, evolutionary, associational concept that can be described efficiently by language. As acknowledged in the introduction to the chapter, other methodologies are available that may arrive at similar solutions for other researchers.

As presented in Table 10, the resulting specification of typicality within the proposed boundaries of this category is described by six high-level core concepts; Materials and Appearance Overall, Leather Trimming, Carpets, Brightware, Veneer and Control Functionality, segmented into 20, weighted properties, that can be measured by adjectives set in bi-polar semantic differentiation scales characterised by Evaluation, Potency or Activity (EPA) factors, with the positive pole set at the theoretical Bentley prototype (tp). The resulting three-dimensional semantic space may provide an effective interpretation and visualisation of the cognitive category. Degrees of typicality between products can be quantified by semantic difference (*D* and *wD*). Some pre-tests indicated this structure and measurement rule allows construction of the affective response to the

cognitive categorisation of the brand, population of the semantic space, and validation of the hypotheses with some efficiency and reliability.

4. Building and Populating the Branded Product Category Semantic Space[1]

1. Content in this chapter was presented in ABBOTT, M.; SHACKLETON, J.P.; and HOLLAND, R, (2008), Measuring the Brand Category through Semantic Differentiation. *Journal of Product & Brand Management,* 17(4) pp. 223-233. The paper was published under single affiliation with Brunel University to protect Bentley confidentiality. All references to Bentley, specific attributes or properties, or any other brand were removed from the paper.

4.1. Introduction

The Thesis has so far produced new evidence to suggest some brands act as cognitive categories in some circumstances. Background theories also suggest that the affective interpretation of categorisation may be most consistently and reliably captured by language. For the Bentley Interior cognitive category, the specifications of typicality for the multi-sensory properties that stimulate this categorisation effect, and the Semantic Differentiation Scales (SDS) by which this phenomenon may be measured, have been identified. Further, it has been proposed that these properties may be characterised by Evaluation, Potency or Activity (EPA) factors that may allow categorisation and typicality relationships to be represented and visualised in a three-dimensional semantic space. It is expected that such measures, analyses and representations, may be beneficial to product development activities in order that product heredity, authenticity and satisfaction may be optimised through the design, engineering and marketing process.

This chapter explores semantic differentiation as the core cognitive categorisation assessment and measurement methodology presented in the Literature Review. It describes five separate large-scale studies (studies 6 – 10), conducted between January 2006 and May 2008, that explore the cognitive categorisation of the Bentley Interior by assessing affective response to the property stimuli against Bentley product examples and contrastingly, those from other brands. The objective is to support the Research Objective and to answer question 3; Do Bentley Interior entities populate this cognitive category semantic space in support of the hypothesis (H_1)?, by building and populating it with product examples. In three of the five studies, current production vehicles are assessed to build a database. In two, new design proposals are assessed. In total, nine Bentley products and 15 products from alternative brands are systematically assessed, measured and located within the semantic space. In all studies, inter-member semantic difference

(*D*) (Osgood, Suci & Tannenbaum, 1957) and EPA reliability (Heise, 1970) are calculated to validate the affective measure of categorisation and typicality response. Finally, for each study, test repeatability will be established.

4.2. Study 6

4.2.1. Methodology

Study 6 was designed to establish Bentley whole-vehicle attribute management targets (see Section 3.2) set against seven competitor vehicles (m^1 – m^7) from six alternative brands in advance of a new model programme. Three examples of the Bentley product range were included (m^a, m^b and m^c) providing ten assessed vehicles in total. Table 12 illustrates the vehicles studied. Appendices A2.1 and A2.2 detail the interiors of the vehicles and part of the study set-up. Within the higher-level attribute management assessments, the 14 pairs of assessors (28 subjects in total), all employees of the company, rated the interior of each vehicle using the SDS form described in Appendix A1.5, thereby contributing an assessment of all products against the Bentley property stimuli. Following a short standardised brief by the event organiser, assessments were made over a period of three days, with each assessor-pair spending an average of 1½ hours in each vehicle, which were rotated in an order that fairly mixed the Bentley product within the set. Assessments were made in the vehicles whilst static, and whilst being dynamically driven, partly on a pre-defined test-track route and partly on a pre-defined public road route in the east of England, mixing town and country driving. Weather conditions were dry, sunny and cold (<10°C).

4.2.2. Results

Results from the SDS assessment were summarised into a property (*k*) x concept (*m*) matrix whereby subject (*n*) mean observed property scores (μ) (e.g.: μ = +2) were calculated for each property against each concept (each vehicle interior). For each vehicle, property scores were plotted on spider diagrams (Figure 4.1). Previously, section 3.4 discussed the location of the positive bi-polar descriptive constructs as defining probable (or ideal) prototypicality, therefore, a large regular diameter trace may indicate this characteristic on these charts.

Non weighted Evaluation, Potency and Activity positions for each vehicle were calculated for each factor by;

$$(\sum \mu\ (E, P, A)) / 9(E); 6(P); 5(A)$$

and weighted EPA values by;

$$(\sum \mu w\ (E, P, A)) / 9(E); 6(P); 5(A)$$

producing two, three digit spatial coordinates that represent the vehicles location within the collective semantic space described in section 3.4 (Table 13). Reliability calculations conducted according to Hayes (1998) suggest that weighted EPA positions produce more reliable spatial coordinates. Both non-weighted and weighted EPA positions for each vehicle are illustrated in the semantic spaces in Figures 4.2 and 4.3 and semantic differences (see section 1.3.2) between them and the theoretical prototype (tp), for weighted positions and non-weighted positions (*D* and *wD* respectively), were calculated.

Vehicle	Image	Vehicle	Image
m^a : 07MY Bentley Continental Flying Spur + Mulliner Driving Specification		m^b : 07MY Bentley Continental GT	
m^c : 08MY Bentley Continental GT + Mulliner Driving Specification		m^1 : Porsche 911 Turbo	
m^2 : Ferrari 612 Scagletti		m^3 : BMW M6	
m^4 : Mercedes S600L		m^5 : Mercedes CL500	
m^6 : Aston Martin DB9		m^7 : Jaguar XKR	

Table 12. Study 6 vehicles.

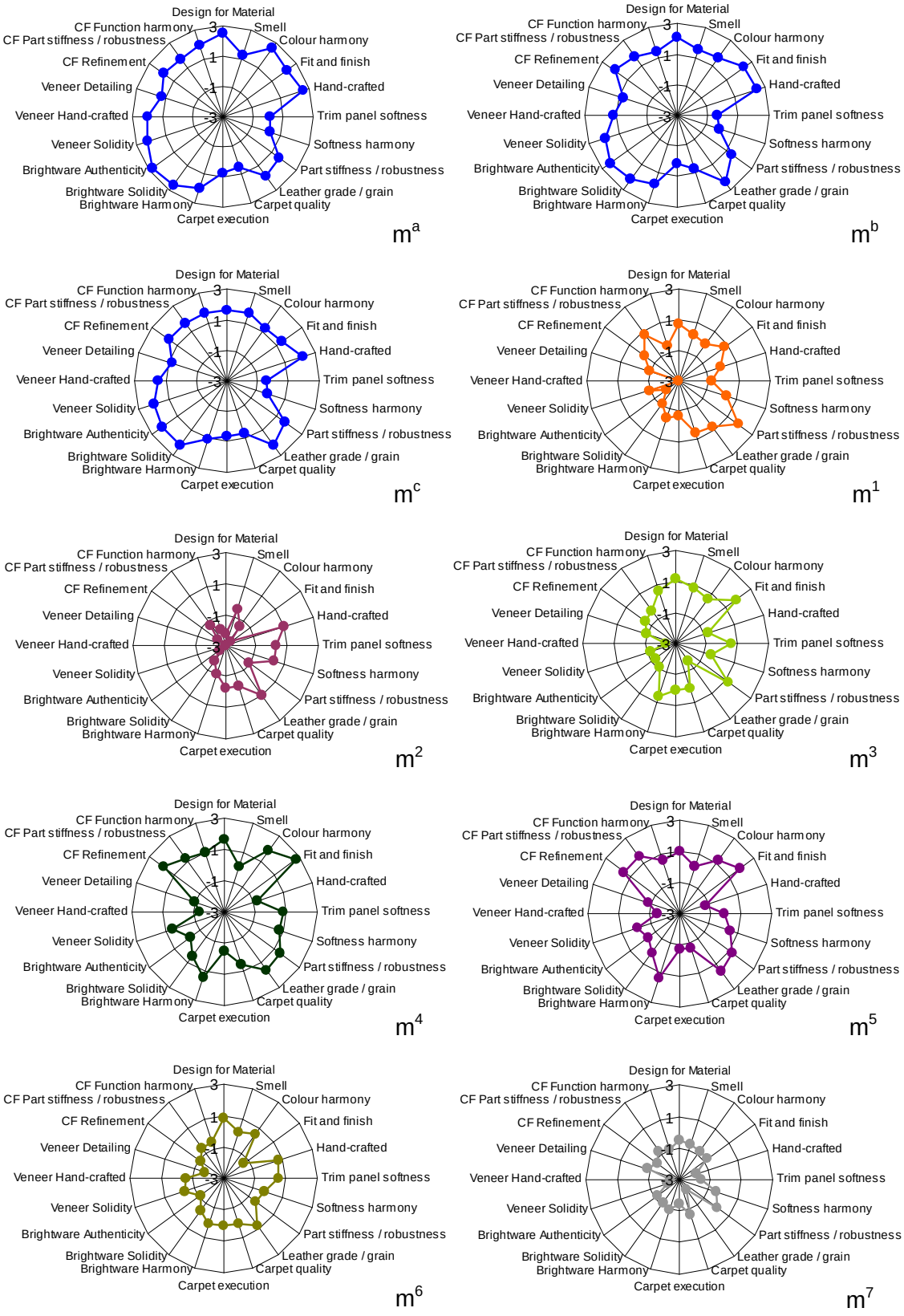


Figure 4.1. Study 6 mean property scores.

		D to *tp*	*w*D to *tp*	E	P	A	*w*E	*w*P	*w*A
m^a		**5.06**	**1.16**	**1.95**	**1.49**	**1.71**	**1.07**	**0.83**	**0.85**
	r			*0.65*	*0.56*	*0.64*	*0.62*	*0.64*	*0.59*
m^b		**7.48**	**1.67**	**1.64**	**1.26**	**1.38**	**0.92**	**0.71**	**0.72**
	r			*0.67*	*0.58*	*0.54*	*0.63*	*0.65*	*0.65*
m^c		**8.18**	**1.78**	**1.33**	**1.27**	**1.45**	**0.7**	**0.72**	**0.89**
	r			*0.69*	*0.56*	*0.62*	*0.7*	*0.63*	*0.66*
m^1		**33.49**	**7.61**	**-0.16**	**0.02**	**-0.83**	**-0.09**	**0.18**	**-0.41**
	r			*0.63*	*0.49*	*0.52*	*0.75*	*0.61*	*0.63*
m^2		**53.79**	**14.16**	**-1.61**	**-1.21**	**-0.85**	**-0.99**	**-0.7**	**-0.22**
	r			*0.56*	*0.55*	*0.37*	*0.6*	*0.62*	*0.6*
m^3		**34.47**	**7.86**	**0.33**	**-0.19**	**-1.15**	**0.17**	**0.01**	**-0.53**
	r			*0.56*	*0.56*	*0.6*	*0.67*	*0.68*	*0.7*
m^4		**19.14**	**4.07**	**1.21**	**0.85**	**-0.36**	**0.76**	**0.57**	**-0.23**
	r			*0.57*	*0.74*	*0.56*	*0.61*	*0.73*	*0.72*
m^5		**24.25**	**5.48**	**0.87**	**0.33**	**-0.55**	**0.53**	**0.31**	**-0.35**
	r			*0.63*	*0.59*	*0.54*	*0.68*	*0.65*	*0.66*
m^6		**31.8**	**8.09**	**-0.34**	**-0.25**	**-0.17**	**-0.28**	**-0.16**	**0.06**
	r			*0.61*	*0.75*	*0.56*	*0.68*	*0.81*	*0.79*
m^7		**54.08**	**13.32**	**-0.85**	**-1.06**	**-1.77**	**-0.45**	**-0.56**	**-0.82**
	r			*0.81*	*0.63*	*0.68*	*0.79*	*0.72*	*0.64*

Table 13. Study 6 EPA & *w*EPA spatial coordinates, reliability values and semantic difference to tp values.

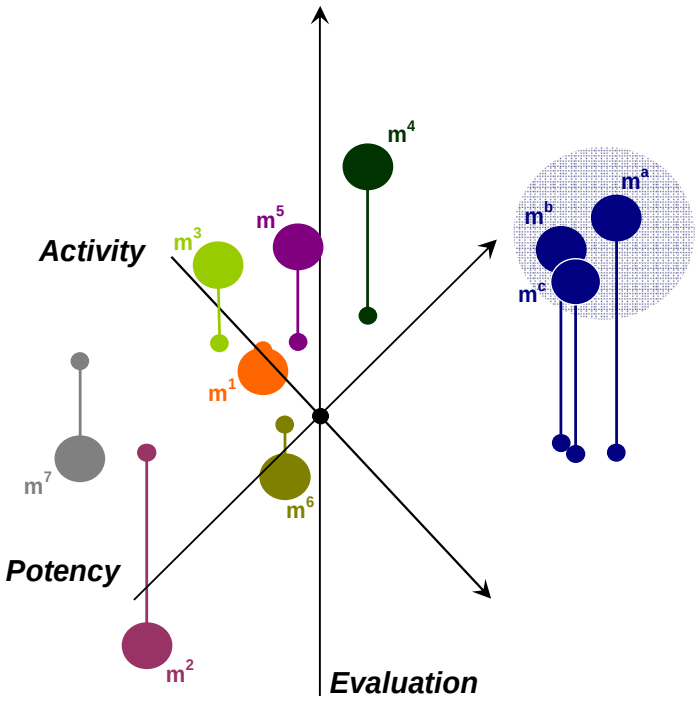


Figure 4.2. Study 6 semantic space. Non-weighted EPA positions.

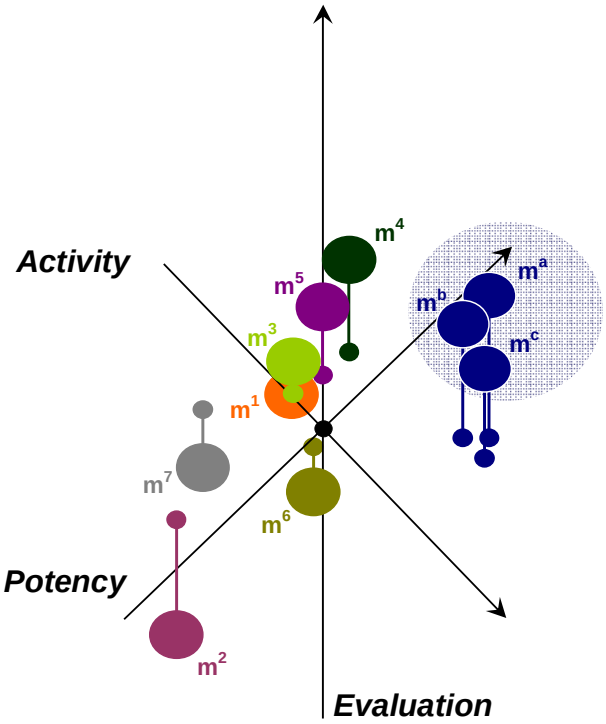


Figure 4.3. Study 6 semantic space. Weighted EPA positions.

4.2.3. Discussion

Study 6 suggests brand based cognitive categorisation (H_1) can be interpreted from this test. This is apparent by two observations, and their contrary effects; firstly, the 20 property positions illustrated in Figure 4.1, describe distinct, but homogeneous patterns for Bentley products (m^a, m^b, m^c) compared to alternative branded products (m^1 to m^7 inclusive), with the Bentley products producing more of the large diameter regular circle expected of the theoretical prototype (tp). The contrary effect is that m^1 - m^7 produce irregular and heterogeneous patterns which suggest non-prototypicality and therefore, possibly, non-categorisation, depending on where category boundaries may be drawn. Secondly, product to tp semantic difference values (*D* and *wD*, Table 13) suggest that within the semantic space, m^a, m^b and m^c are closely related to tp ($wD \leq 1.78$) whilst m^1 –

m^7 proximity to tp ranged between 4.07 (m^4) – 14.16 (m^2). This effect is distinguishable from the semantic spaces illustrated in Figures 4.2 and 4.3, where Bentley Interiors are closely clustered within the anticipated zone of prototypicality and alternative brands differently positioned.

The spider charts may provide some further useful information for product development; where property scores are not strongly prototypical, product change (specification, feature or design change) might modify both property and EPA values thereby benefiting both categorisation and distinctiveness (the syntagmatic, belongs to, relationship and the paradigmatic, is like, association respectively). Both of these might reasonably be expected to improve brand value and therefore commercial advantage (Aaker, 1991; de Chernatony & McDonald, 2003; Czellar, 2003; Keller, 1993; Lindstrom, 2005). Similarly, where property scores indicate strong prototypicality, it could be assumed the product specifications need to be maintained to preserve accurate cognitive categorization, although the laws of novelty may be modifiers of these positions in future products (Carbon & Leder, 2005; Carbon, Hutzler & Minge, 2006; Hekkert, Snelders & Van Wieringen, 2003; Snelders & Hekkert, 1999). This effect will be explored further in chapter 5.

Validity of the 20 properties as definitions of the multi-sensory stimuli that affect Bentley Interior cognitive categorisation, and validity of the bi-polar SDS set, as representatives of the typicality relationships within that category, may be obtained by two measures. Firstly, Heise (1970) suggested that repeatability of general E,P & A factors is given by scale deviations of ≈ 0.5 units for Evaluation, and 0.7 to 1 units for Potency and Activity (see section 1.3.2.). Because the scales are set against the expected Bentley Interior positions, deviations for m^a, m^b and m^c are of most interest where reliability of this test is concerned. Although antonym positions may be typical of alternative brands, they have not been explicitly set so. Standard deviation (σ) for *w*E, wP & *w*A for m^a is 0.7, 0.6 and 0.9, m^b; 0.7, 0.6 and 0.8 and m^c; 0.5, 0.7 and 0.7 suggesting good overall repeatability, especially

for Potency and Activity. Secondly, reliability calculated according to Hayes (1998) of all exemplar positions within the weighted semantic space appeared to be good (Table 12), suggesting their given positions within the space to be reasonably accurate representations of a cognitive categorisation effect within, around or outside the boundaries of this category.

Some limitations of the SD procedure were observed during the study, however. A number of assessors requested further explanation of the meaning of some of the properties during the assessment. For example, the property Softness Harmony, was considered to be some distance from the theoretical prototype position of 'similar' in examples m^a (mean observed score [μ] = 0.3), m^b (μ = -0.1) and m^c (μ = -0.2) with a large standard deviation (σ = 1.5; 1.6 and 1.5 respectively), and during the test was found to require some clarification of meaning and of feature inclusion / exclusion (scope). The results and test experience suggest some disagreement within the assessment population in this case, which might be improved in subsequent studies. Some previous SD based studies (e.g.: Schutte, 2005) adopt a clarifying concept statement or question, set against the bi-polar scale to aid understanding (see section 1.3.2.). Therefore, the feedback form was modified by the author and another company expert post study 6, to include a lead-in question for each property. For example; Softness Harmony was introduced with the question 'Are all the trim panels similar in softness?' At the same time, the form design was revised in response to other comments made during the study about layout clarity. The revised response form is included in Appendix A1.7.

4.3. Study 7

4.3.1. Methodology

Study 7 followed a similar methodology to Study 6 in that it involved the dynamic assessment of multiple vehicle examples by sets of assessors looking at both whole-vehicle attributes, and as a subset, the affective response to multi-sensory stimuli in Bentley and non-Bentley product interiors. Study 7 added additional vehicles to the data-base that were not assessed in study 6. The vehicle set included Bentley products m^a (designated m^a7 to distinguish results between tests), m^d and m^e and non-Bentley products m^4 (m^47), m^8, m^9 and m^{10}; 7 in total (Table 14). Note m^a and m^4 were included from study 6 to further understand test repeatability. Fourteen pairs of assessors (28 in total), all employees of the company, spent a total of 3 hours in the vehicles in two sessions. During the assessment, the vehicles were driven on a pre-defined public road route in north Wales mixing country, town and motorway driving with periodic stops to rotate drivers and cars so that all assessor pairs experienced all vehicles. The assessors were provided with the revised SDS form in Appendix A1.7 and were given a short brief at the start of the test by the author. During the test no further communication between the author and the assessors took place.

Bentley vehicle	Non-Bentley vehicle
m^a7: 07MY Bentley Continental Flying Spur + Mulliner Driving Specification	m^47: Mercedes S600L
m^d : 07MY Bentley Continental GTC	m^8 : Lexus LS460
m^e : Bentley Azure	m^9 : Range Rover
	m^{10} : Jaguar XJ

Table 14. Study 7 vehicles.

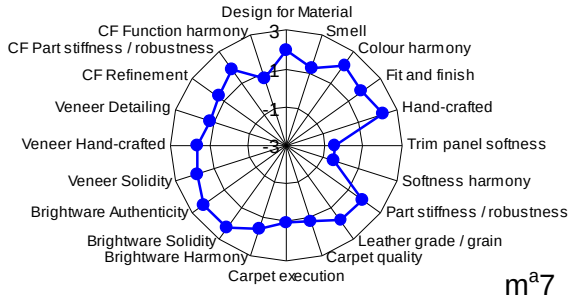
4.3.2. Results

Data recording, formatting and analyses followed study 6 in that SDS values were summarised into the *k* x *m* x *n* matrix with mean observed property scores (μ) calculated for each property against each *m* and represented on spider charts (Figure 4.4).

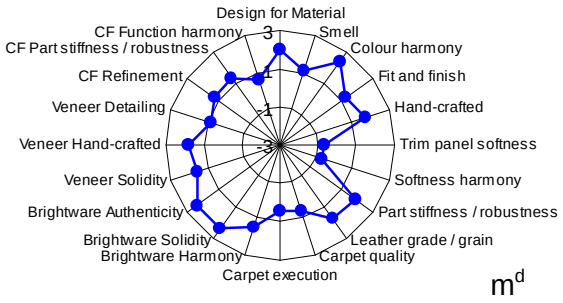
Similarly, EPA and *w*EPA positions and product to tp semantic differences (*D* and *wD*) were calculated to facilitate the representation of cognitive categorisation effects within the semantic space (Table 15, Figure 4.20 [EPA] and Figure 4.21 [*w*EPA]), populated with examples from study 7 only at this stage.

		D to *tp*	*wD* to *tp*	E	P	A	*w*E	*w*P	*w*A
m^a7		**7.1**	**1.6**	**1.39**	**1.43**	**1.58**	**0.79**	**0.81**	**0.75**
	r			*0.63*	*0.58*	*0.72*	*0.65*	*0.62*	*0.64*
m^d		**9.11**	**2.11**	**1.3**	**1.18**	**1.29**	**0.74**	**0.66**	**0.64**
	r			*0.6*	*0.55*	*0.65*	*0.66*	*0.64*	*0.67*
m^e		**5.86**	**1.61**	**1.31**	**1.6**	**1.98**	**0.57**	**0.91**	**0.96**
	r			*0.58*	*0.54*	*0.77*	*0.7*	*0.62*	*0.63*
m^47		**17.06**	**3.39**	**0.97**	**0.85**	**0.11**	**0.61**	**0.63**	**0.07**
	r			*0.62*	*0.62*	*0.55*	*0.66*	*0.64*	*0.76*
m^8		**36.83**	**7.46**	**0.21**	**0.06**	**-1.51**	**0.24**	**0.24**	**-0.67**
	r			*0.54*	*0.51*	*0.64*	*0.64*	*0.63*	*0.64*
m^9		**34.3**	**7.46**	**0.32**	**-0.11**	**-1.18**	**0.21**	**0.03**	**-0.46**
	r			*0.59*	*0.64*	*0.57*	*0.72*	*0.74*	*0.71*
m^{10}		**32.32**	**8.15**	**-0.01**	**-0.23**	**-0.58**	**0.03**	**-0.13**	**-0.34**
	r			*0.65*	*0.68*	*0.60*	*0.81*	*0.77*	*0.70*

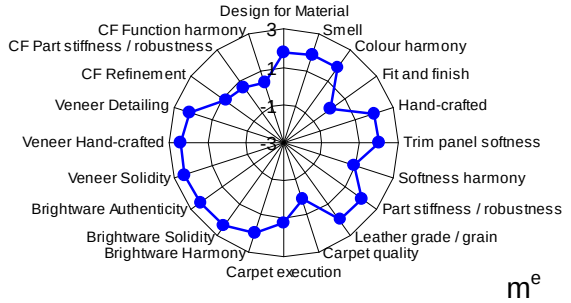
Table 15. Study 7 EPA & *w*EPA spatial coordinates, reliability values and semantic difference to tp values.



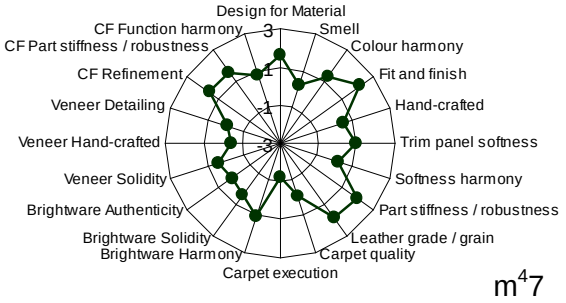
m^a7



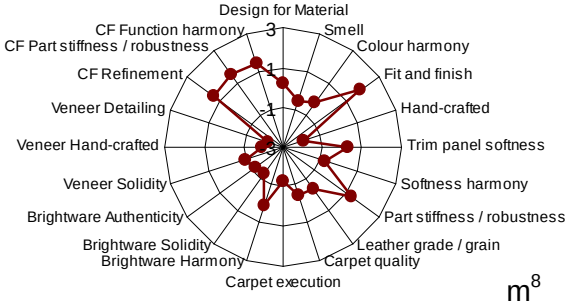
m^d



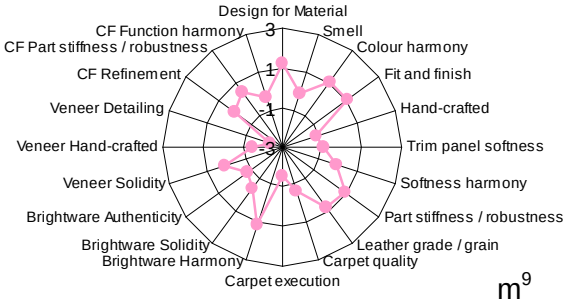
m^e



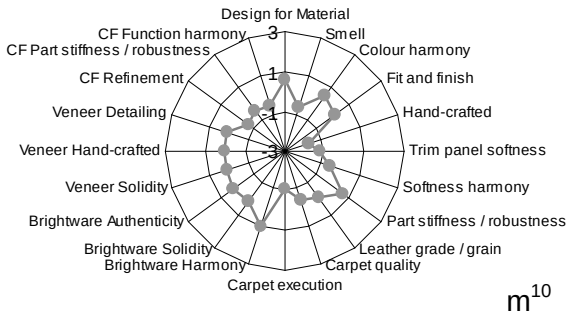
m^47



m^8



m^9



m^{10}

Figure 4.4. Study 7 mean property scores.

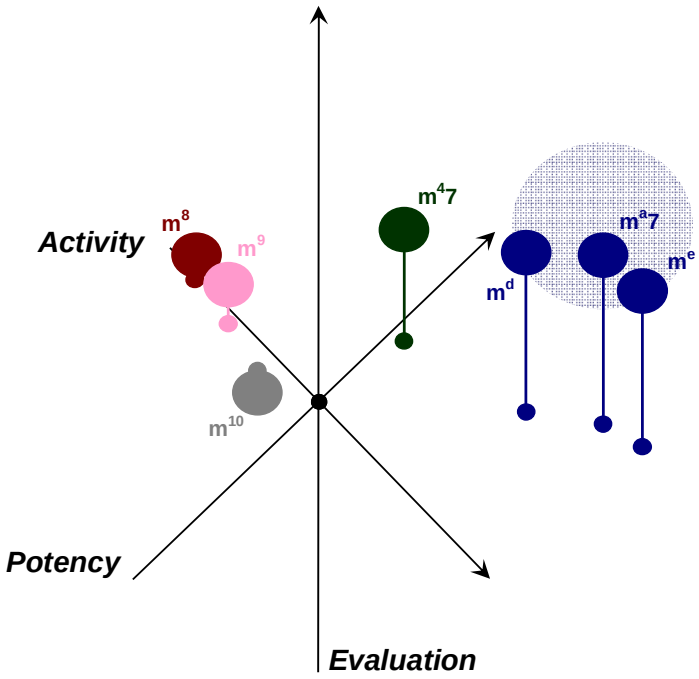


Figure 4.5. Study 7 semantic space. Non-weighted EPA positions.

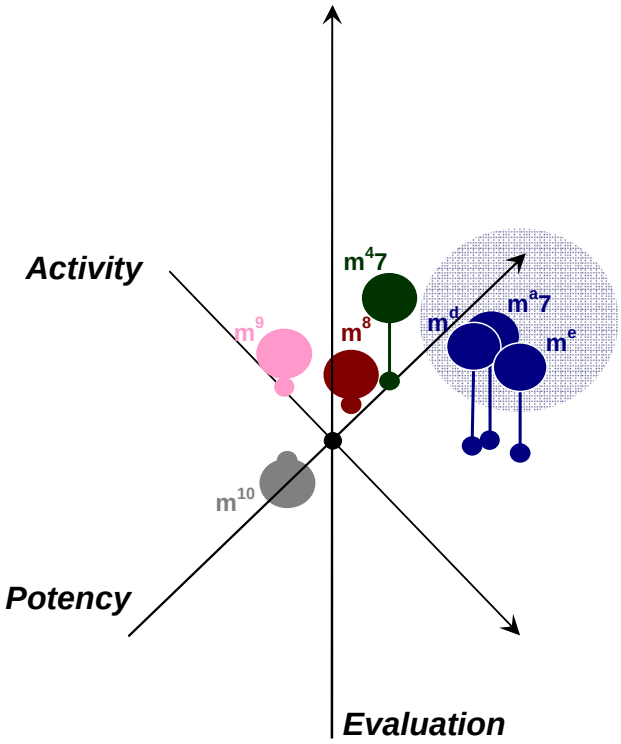


Figure 4.6. Study 7 semantic space. Weighted EPA positions.

4.3.3. Discussion

Study 7 follows study 6 in that it suggests brand based cognitive categorisation effects are present both within the property values and semantic space locations; m^a7, m^d and m^e, produce the larger diameter, regular circular patterns of the theoretical prototype on the property spider charts than other non-Bentley products and cluster toward tp within both weighted and non-weighted semantic spaces. Reliability calculations continue to suggest validity of the stimuli and the measurement scales, whilst σ for *w*E, wP & *w*A for m^a7 at 0.6, 0.7 and 0.7, m^d; 0.6, 0.7 and 0.6 and m^e; 0.5, 0.7 and 0.7 suggest a small change in repeatability, especially in E, within the expected SD values posited by Heise (1970).

Comparing study 7 to 6 for the two products assessed in both tests; m^a and m^4, provides some further insight into the validity of this test procedure and measurement tool and possible category boundaries. Because *w*EPA proves more reliable, semantic difference is calculated for *wD* only, giving values 0.09 between m^a and m^a7 and 0.12 between m^4 and m^47 suggesting that relative assessments to tp are quite tightly controlled within the studies conducted so far. By using these products as non-variable control models within all tests may further the definition of probable semantic space location tolerance, and therefore help describe where the category boundary may be. As semantic difference is a measure of affective linguistic association (similarity; 'is like' [see section 1.3.2.]) between entities (Smith et al., 1988), such values may help characterise the category *x* axis of paradigmatic, metaphoric associations illustrated in Figure 1.19.

The revision of the assessment form between studies 6 and 7 (A1.6 and A1.7) was designed to improve understanding of the scope of the property stimuli and clarification of affective response scores. Although anecdotal evidence suggests that A1.7 did not induce the concerns within the assessment community that A1.5 prompted, no discernable

improvement in reliability was evident in the data. However, one trend is notable; evaluation scores tended to be devalued between study 6 and 7 for the two constant products. Comparing individual evaluative mean observed scores for m^a / m^a7, all values were within Heise's (1970) repeatability value ≈ 0.5 scale units, but negatively so (-0.1 to -0.5 scale units) except for Control Functionality Harmony which deviated by -1.3 scale units. For m^4 / m^47 all evaluative mean observed scores fell within expected variability but with 6 of the 9 properties negatively valued. Study 8 values for m^a8 will be reviewed to help explain the particular variance for Control Functionality Harmony in study 6 and 7.

4.4. Study 8

4.4.1. Methodology

Study 8 objectives, set-up and process were similar to studies 6 and 7. Study 8, however, added a further two Bentley products (m^f and m^g) to the database and a further 5 non-Bentley products (m^{11} to m^{15} inclusive), which were unavailable for study 6 or 7 (Table 17). Additionally products m^a (m^a8), m^4 (m^48) and m^8 (m^88) were re-tested from studies 6 and 7 (6 only in the case of m^8). Fourteen pairs of assessors (28 in total), all employees of the company, spent approximately 2½ days assessing the vehicles both statically and dynamically in the north-east of England on a mixture of pre-defined country, town and motorway roads. Each vehicle was driven by each pair for one circuit of the route, which took approximately 1 hour to complete. Static appraisals took a further 30 minutes approximately. Weather conditions were partly sunny with light showers, temperature <15℃. During the assessment of whole-vehicle attri butes, the SDS form in Appendix A1.7 was used by the assessor pairs, following a short standardized brief from the event organizer.

4.4.2. Results

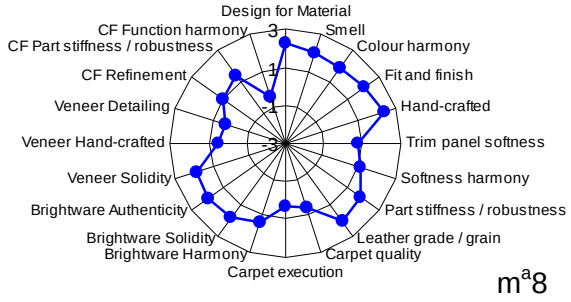
Results from study 8 were collated in the *k* x *m* x *n* matrix and analysed according to study 6 and 7; property mean observed scores (μ) plotted in individual vehicle spider charts (Figure 4.7) and EPA and *w*EPA values calculated to give locations within the semantic space (Figures 4.8 and 4.9). EPA and *w*EPA coordinates and reliability values are given in Table 16. Further, comparison between m^a, m^a7 and m^a8, m^4, m^47 and m^48 and m^8 and m^88 in studies 6, 7 and 8 were made to understand test repeatability and to help explain particular variance for Control Functionality Harmony between study 6 and 7.

	D to *tp*	*wD* to *tp*	E	P	A	*w*E	*w*P	*w*A
m^a7	**8.61**	**1.83**	**1.45**	**1.38**	**1.11**	**0.74**	**0.82**	**0.60**
r			*0.61*	*0.68*	*0.52*	*0.65*	*0.68*	*0.64*
m^f	**6.45**	**1.35**	**1.85**	**1.45**	**1.35**	**0.98**	**0.87**	**0.68**
r			*0.67*	*0.49*	*0.53*	*0.63*	*0.56*	*0.66*
m^g	**6.28**	**1.64**	**1.20**	**1.56**	**2.01**	**0.64**	**0.85**	**0.90**
r			*0.58*	*0.67*	*0.71*	*0.7*	*0.74*	*0.62*
m^47	**19.97**	**4.19**	**1.12**	**0.79**	**-0.40**	**0.67**	**0.56**	**-0.21**
r			*0.66*	*0.63*	*0.59*	*0.66*	*0.64*	*0.77*
m^87	**29.52**	**6.23**	**0.50**	**0.25**	**-0.96**	**0.39**	**0.28**	**-0.46**
r			*0.57*	*0.58*	*0.53*	*0.69*	*0.65*	*0.66*
m^{11}	**33.22**	**6.82**	**0.04**	**0.57**	**-1.31**	**0.04**	**0.49**	**-0.54**
r			*0.62*	*0.57*	*0.69*	*0.76*	*0.65*	*0.75*
m^{12}	**36.21**	**8.88**	**-0.35**	**-0.43**	**-0.63**	**-0.34**	**-0.23**	**-0.04**
r			*0.49*	*0.56*	*0.54*	*0.62*	*0.69*	*0.73*
m^{13}	**28.29**	**6.34**	**0.53**	**0.07**	**-0.69**	**0.34**	**0.14**	**-0.32**
r			*0.62*	*0.65*	*0.74*	*0.74*	*0.73*	*0.82*
m^{14}	**26.6**	**6.53**	**1.03**	**0.01**	**-0.72**	**0.61**	**0.06**	**-0.46**
r			*0.62*	*0.55*	*0.5*	*0.72*	*0.65*	*0.65*
m^{15}	**33.24**	**7.49**	**-0.31**	**0.04**	**-0.68**	**-0.1**	**0.09**	**-0.26**
r			*0.68*	*0.53*	*0.65*	*0.78*	*0.65*	*0.83*

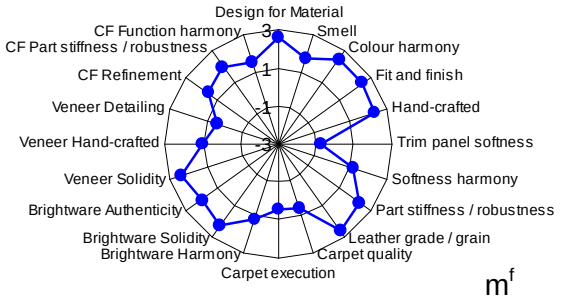
Table 16. Study 8 EPA & *w*EPA spatial coordinates, reliability values and semantic difference to tp values.

Vehicle	Image	Vehicle	Image
m^a8 : 09MY Bentley Continental Flying Spur + Mulliner Driving Specification		m^f : 09MY Bentley Continental Flying Spur	
m^g : 08MY Bentley Arnage T		$m^4$8 : Mercedes S600L	
$m^8$8: Lexus LS460		m^{11} : BMW 760Li	
m^{12} : Maserati Quattroporte		m^{13} : Mercedes CLS63 AMG	
m^{14} : Audi S8		m^{15} : BMW M5	

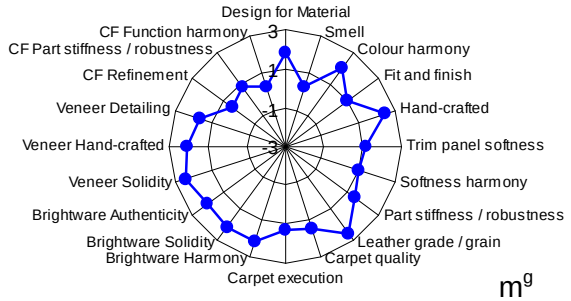
Table 17. Study 8 vehicles.



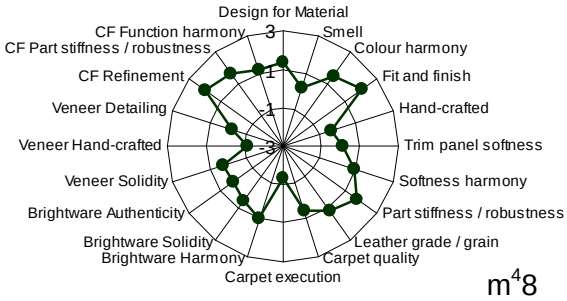
m^a8



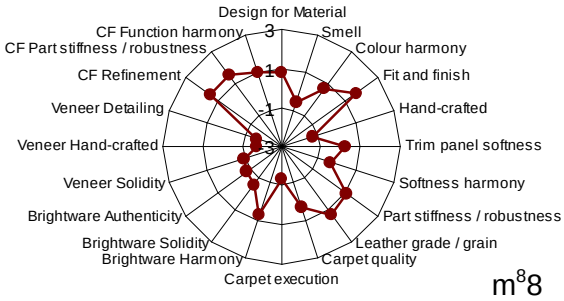
m^f



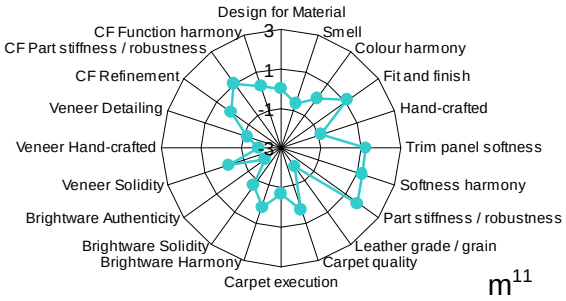
m^g



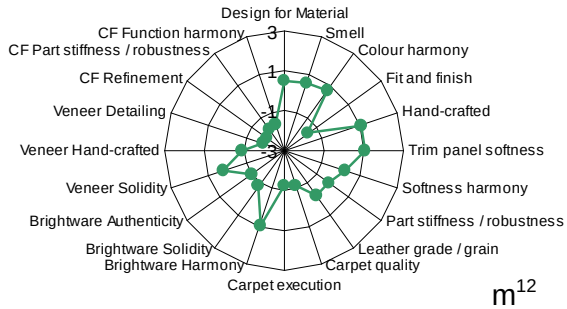
m^48



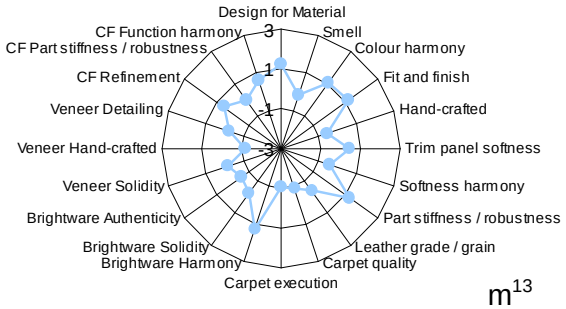
m^88



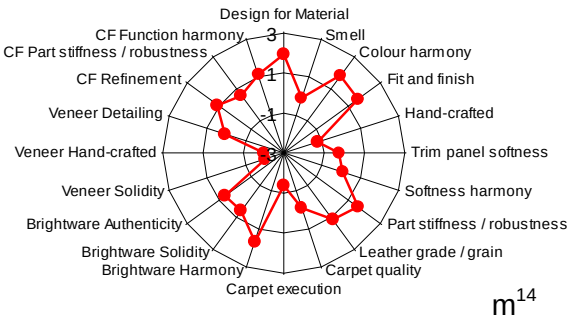
m^{11}



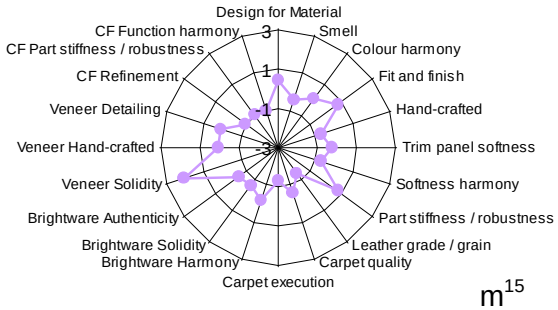
m^{12}



m^{13}



m^{14}



m^{15}

Figure 4.7. Study 8 mean property scores.

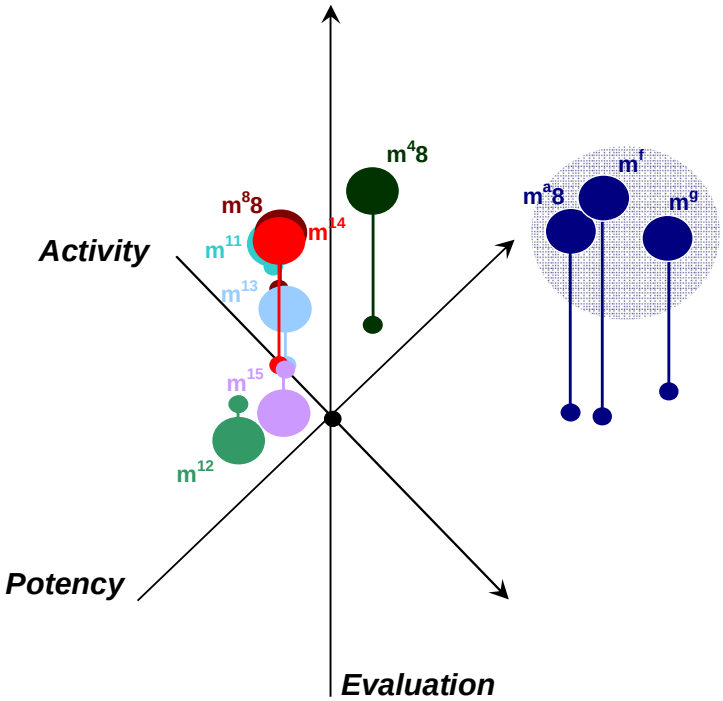


Figure 4.8. Study 8 semantic space. Non-weighted EPA positions.

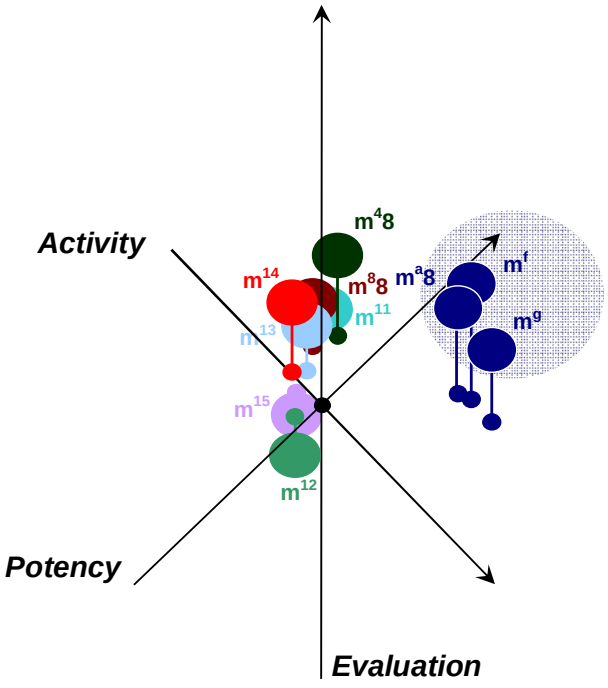


Figure 4.9. Study 8 semantic space. Weighted EPA positions.

4.4.3. Discussion

Study 8 correlates study 6 and 7 claims of brand based cognitive categorisation effects evident in both property values and semantic space locations. Figure 4.7 shows that the Bentley products m^a8, m^f and m^g continue to describe the large diameter, regular circular pattern of the theoretical prototype (tp), whilst both the control non-Bentley products m^48 and m^88, and new products m^{11} – m^{15}, describe irregular heterogeneous shapes. In both non-weighted and weighted semantic spaces, clustered locations within the zone of prototypicality are found for m^a8, m^f and m^g, whilst all non-Bentley products are distinctly located elsewhere. Property, scale and weighting validity continues to be suggested by reliability calculations with σ for the control models m^a8 *w*E, *w*P and *w*A of 0.7, 0.5 and 0.8 respectively and m^47 of 0.7, 0.7 and 0.4, providing similar deviations to studies 6 and 7 which fall within expected SD variance (Heise, 1970).

Semantic difference (*w*D) between study 6 and 8 for m^a (m^a8) is 0.17 and for m^4 (m^48) 1.36, suggesting that final semantic space locations were closer between study 6 and 7, but nevertheless still tightly controlled in study 8, especially for m^ax. Figure 4.10 shows the *w*EPA individual study co-ordinate values for the test control models in studies 6, 7 and 8. Mean across-study values are also indicated. This illustration suggests that between-test agreement of individual study EPA values is improved the closer the semantic space location is considered to be to tp, or in other words, the more alike an example is to a prototype, the categorisation effect is likely to be more widely shared and more accurately defined. This provides some further support for validity of the defining brand category properties and bi-polar measurement scales, as well as illustrating the effect that product typicality can possibly make to homogeneous and concurred cognitive judgement; the strength of the meme (Marsden, 2002) and therefore product attractiveness (Veryzer & Hutchinson, 1998) and brand equity (Keller, 1993).

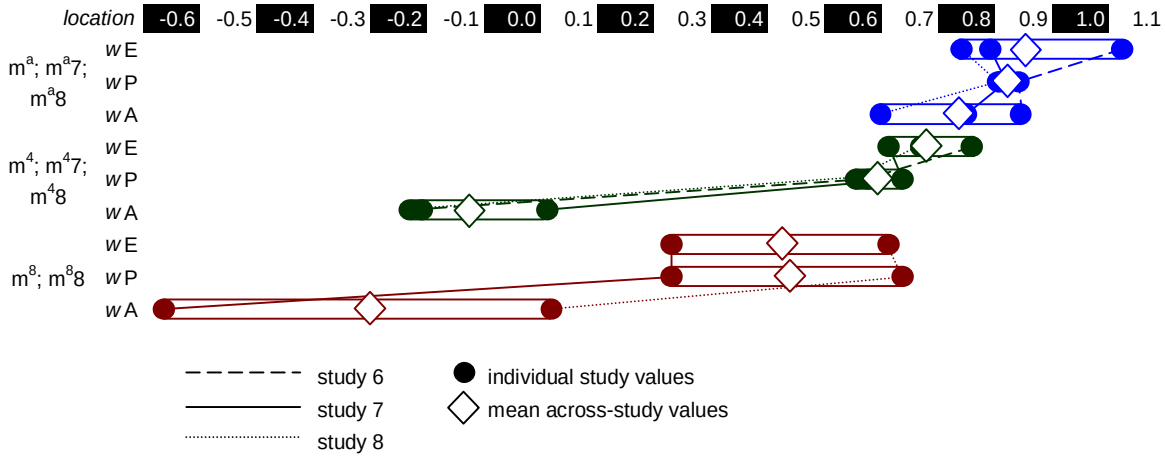


Figure 4.10. Study 6, 7 and 8 control model *w*EPA co-ordinate values and mean across-study values.

Comparing between control models and across tests provides an opportunity to further understand the repeatability of individual mean observed scores and the consequences that has for test design and scale definition. As identified in study 7, other than general agreement, no discernable pattern of repeatability emerges between tests. Two evaluative property values did fall outside the cross-study boundaries posited by Heise (1970); for the Bentley product m^a, Control Functionality Harmony, as discussed in section 4.3.3, deviated by -1.3 scale units between study 6 to 7, and Softness Harmony deviated by 1.5 scale units between study 7 and 8. Comparing affective responses for Control Functionality Harmony between Bentley products in studies 6 and 7 suggests no false data is present; mean observed scores are consistent and within expected boundaries. Similarly, for Softness Harmony, values between Bentley products in studies 7 and 8 are regular and within expected boundaries, or can be explained in terms of product specification variances (for example, with m^e). It is possible, however, that both of these properties require some interpretation and are not immediately meaningful. For example, section 4.2.3 discussed how Softness Harmony required some clarification during study 6, and it may be that further refinement of either the lead-in question or the bi-polar scale is

required to control the repeatability of these specific cross-study SD values within the limits suggested by other research.

Studies 6, 7 and 8 conclude the exploration of the Bentley Interior category for product examples in production at the time of writing. By consolidating the semantic spaces from each study, a picture of the affective interpretation of brand based categorisation within the automotive HLS product category emerges that supports H_1 (some brands act as cognitive categories in some circumstances) and question 3 in the Research Objective (Do Bentley Interior entities populate this interpretation of the cognitive category semantic space in support of the hypothesis?). Figure 4.11 illustrates the consolidated semantic space for *w*EPA, visually demonstrating semantic difference between Bentley products and other brands and the clustering of the Bentley products within the theoretical zone of prototypicality. Semantic difference (*wD*) to tp suggests the category boundary in this case might exist somewhere between 2.21 and 3.39 (Figure 4.12).

One of the possible benefits of the model developed so far, according to the central Research Objective, is that it could be utilised within the product development process as a measure of possible affective responses to the design of new products against expected or anticipated typicality and categorisation constructs. Studies 6, 7 and 8 have identified the current state of the category. Studies 9 and 10 therefore test and measure new Bentley Interior product designs against this model, to develop the semantic space and help quantify the benefits to product development generally.

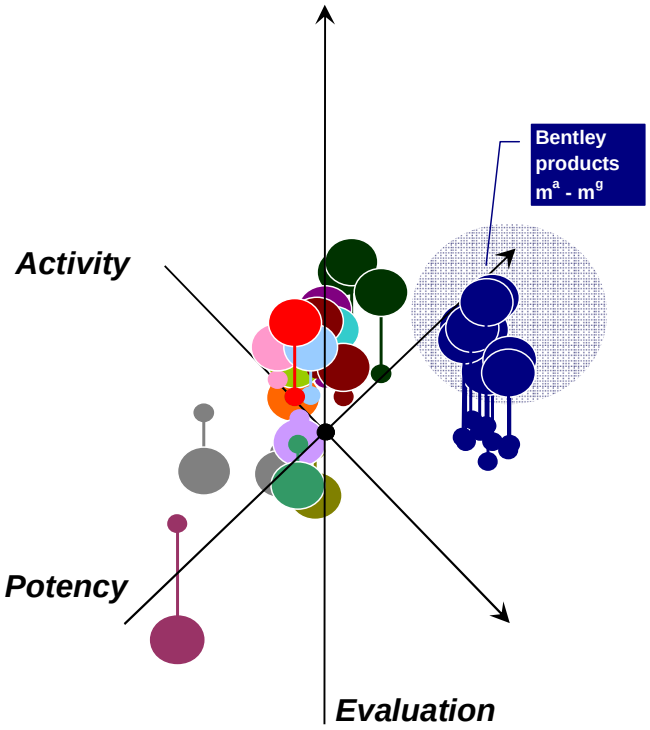


Figure 4.11. Consolidated semantic space. Weighted EPA positions.

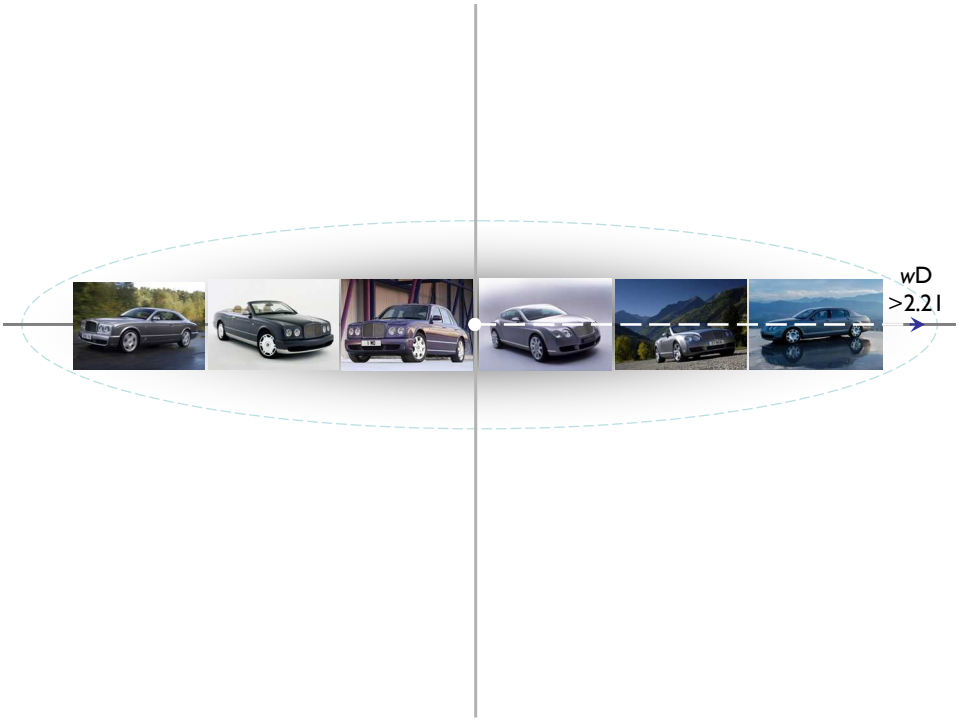


Figure 4.12. The Bentley Interior category with boundary definition according to studies 6, 7 and 8.

4.5. Study 9

4.5.1. Methodology

Study 9 involved the assessment of a full-size design model of the interior of a proposed new Bentley product (m^h), using the general methodology and SDS from studies 7 and 8. The model was presented without a roof or trunk and therefore only the design below vehicle 'waist-line' was assessed. The assessment group comprised seven product experts from the sponsoring company who were asked to rate the model using visual stimuli only. None of the assessors had experienced the SD measurement methodology before the test. The study lasted twenty minutes and took place in the company's design studio.

The limitation of stimuli in this test was necessary because the model simulated other sensory and material properties like Trim Panel Softness and Part Stiffness / Robustness, being constructed from modeller's clay and other rapid prototype materials and was painted to represent various surface finishes. Consequently, the SD scales were also limited, with Smell, Trim Panel Softness, Softness Harmony, Part Stiffness / Robustness, Leather Grade / Grain, CF Refinement, CF Part Stiffness / Robustness and CF Harmony removed from the assessment form. Scores for these properties were later given an estimate, concurred by the assessment group, based upon values obtained from studies 6, 7 and 8 compared to known product specification change in the new design.

4.5.2. Results

Mean observed property scores (μ) from study 9 were collated in the *k* x *m* x *n* matrix and plotted on a spider chart (Figure 4.13). EPA and *w*EPA values were calculated along with the estimated values from the non-measured properties. The resulting position of m^h was located within the consolidated semantic space (here *w*EPA only illustrated in Figure 4.14). Table 18 shows the EPA and wEPA coordinates and reliability values obtained.

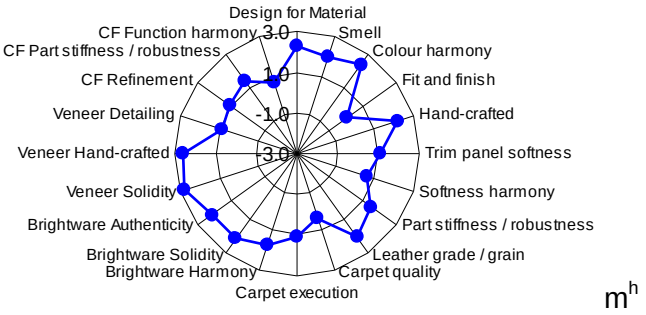


Figure 4.13. Study 9 mean property scores.

	D to *tp*	*wD* to *tp*	E	P	A	*w*E	*w*P	*w*A
m^h	**4.89**	**1.98**	**1.37**	**1.55**	**1.82**	**0.73**	**0.89**	**0.89**
r			*0.57*	*0.61*	*0.6*	*0.68*	*0.67*	*0.6*

Table 18. Study 9 EPA & *w*EPA spatial coordinates, reliability values and semantic difference to tp values.

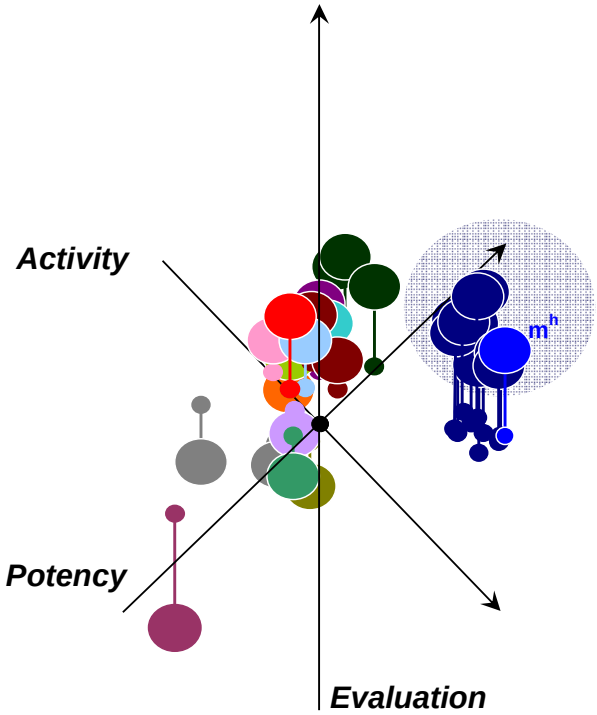


Figure 4.14. Consolidated semantic space with m^h. Weighted EPA positions.

4.5.3. Discussion

Study 9 is limited by the exclusion of multi-sensory property stimuli and therefore the necessary estimation of property scores and semantic space location. Nevertheless, the property spider chart describes a similar pattern to previous vehicles with m^h *w*EPA position closely aligned to the other Bentley products. Semantic difference (*wD*) to tp = 1.98. Therefore, study 9 appears to confirm arguments made from studies 6, 7 and 8 on apparent brand categorisation effects.

However, the property spider chart reveals some further limitations of the model that may emerge when measuring affective responses to artificial representations of the product. For example, visual property stimuli like Fit and Finish (the accuracy of fit of components)

is assessed significantly lower in m^h than in the average observed in m^a – m^g (0.0 vs. 1.6). It is possible that the hand-made model in this case artificially modified the score from that expected from a manufactured product (an effect noted in Nordgren & Aoyama [2006]). Therefore, deviations from tp need careful analysis to ensure that differences between stimuli presentation and design manipulation are distinguishable. The spider chart does, however, reveal properties where progress toward tp is being made by design modification (for example, with Veneer Solidity and Handcraftedness). This is also reflected in an overall *w*EPA location that is strongly inclined, particularly in Potency, toward tp. Therefore, study 9 suggests the new design might be considered to be categorised as an authentic representation of the Bentley product with some heredity and evolutionary effects observable, which may be appropriate for the new product in order that the balance between novelty and typicality be optimised to ensure product attractiveness (Batra, Lenk & Wedel, 2006; Carbon & Leder, 2005; Carbon, Hutzler & Minge, 2006; Hekkert, Snelders & Van Wieringen, 2003; Martin, 1998; Snelders & Hekkert, 1999).

4.6. Study 10

4.6.1. Methodology

Study 10 explored an alternative new Bentley Interior product design (m^j), using the established methodology and SDS. This design was presented in a studio as a full-size model, similar in construction and material to that of study 9, to a group of ten company experts, none of whom took part in the previous study. Again, the model simulated some materials and finishes and stimuli was restricted to visual input only, but this time was complete with roof and could be sat in (the seats were trimmed in representative materials). The assessment lasted 30 minutes and excluded property judgements for the

excluded stimuli which were later estimated and concurred by the group compared to studies 6, 7, 8 and 9, and known specification change within the design.

It is important to note that the design examined was a solution for a different model to that of study 9; both products are aimed to satisfy subtly different market positions within the automotive HLS. Therefore, both had deliberately discrete forms of vehicle package and interior execution, but importantly both needed to be inclusively categorised as a Bentley Interior, allbeit at possibly different locations, as the similarity ('is like') association may reasonably be stretched by the brand extension.

4.6.2. Results

Results were collated and analysed according to the previous studies with mean observed property scores (μ) recorded in the *k* x *m* x *n* matrix and plotted on a spider chart (Figure 4.15). EPA and *w*EPA values with estimated values from the non-measured properties were calculated and the affective interpretation of this example's categorisation located within the consolidated semantic space in Figure 4.16 (*w*EPA only). Table 19 describes the semantic space location coordinates and their reliability values.

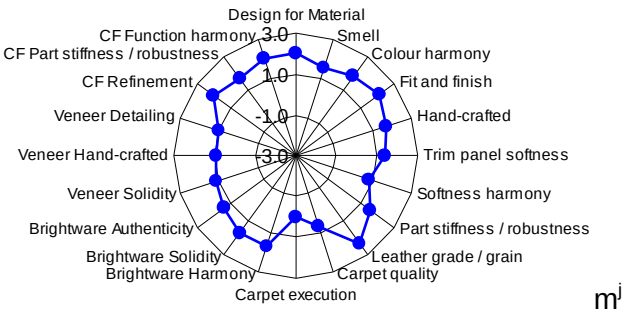


Figure 4.15. Study 10 mean property scores.

	D to *tp*	*wD* to *tp*	E	P	A	*w*E	*w*P	*w*A
m^j	**7.70**	**1.74**	**1.71**	**1.34**	**1.19**	**0.89**	**0.93**	**0.48**
r			*0.76*	*0.76*	*0.61*	*0.69*	*0.73*	*0.71*

Table 19. Study 10 EPA & *w*EPA spatial coordinates, reliability values and semantic difference to tp values.

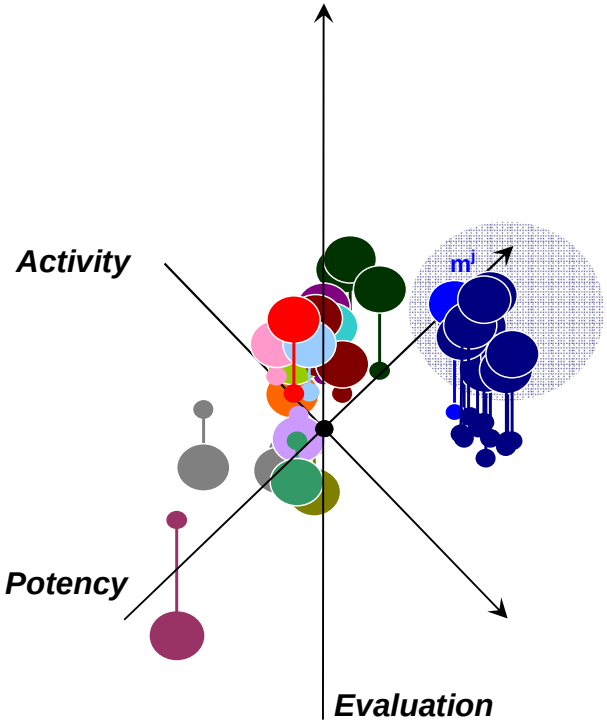


Figure 4.16. Consolidated semantic space with m^j. Weighted EPA positions.

4.6.3. Discussion

Study 10 apparently confirms the brand categorisation effects present in all other studies described in this chapter; the property spider chart for m^j describes the similar large diameter regular circle expected of the theoretical prototype (tp) and the *w*EPA location for m^j falls within the zone of prototypicality, being closely related to other Bentley products with a semantic difference (*wD*) to tp of 1.74. What is notable, however, is twofold; firstly the reliability of both EPA and *w*EPA values obtained in this test appear to be generally

good, indicating that the semantic space location is agreed and providing further validity to the methodology adopted. Secondly, despite m^j being somewhat differently positioned to m^h, primarily due to lower Activity values in m^j, both have close semantic difference values to tp (m^h = 1.98; m^j = 1.74). This lends some further support to the brand as category hypothesis (H_1) and the work by Boush (1993), Joiner & Loken (1998) and Loken, Joiner & Peck (2002) that suggested the cognitive brand category is tolerant to variations in product examples that share common sets of characteristics within some defined limits, as well as general categorisation theories posited by Pinker (1997), Fodor (1988) and others.

4.7. Conclusions and Consequences

Chapter 4 set out to populate and validate the semantic interpretation of the branded product category proposed in chapter 3. It also aimed to provide some further evidence to support H_1 and to answer question 3 in the Research Objective; Do Bentley Interior products populate this interpretation of the cognitive category semantic space in support of the hypothesis? Through five large-scale studies of nine Bentley product examples and 15 non Bentley product examples, affective responses to the 20 property stimuli were measured by bi-polar Semantic Differentiation Scales producing results that suggest a positive answer can be given to this question. Further, the developed individual and consolidated semantic spaces imply a brand based categorisation effect, both qualitatively (visually) and empirically by the measure of semantic difference (*D* and *wD*); employed here to identify proximity to the theoretical prototype and the possible boundary locations of this category by reference to the *D* values of the non-Bentley products assessed, thereby supporting H_1 and rejecting the null hypothesis that multiple brands will inhabit the category randomly.

In all studies, general reliability and repeatability of the SDS and test methodology suggest the specification of typicality of the Bentley Interior, as represented by the 20 properties, to be valid within the limits of other SD techniques established over the past 50 years. However, despite SDS theory being well developed, the application of scales that are characterised by the given core factors of affective meaning; Evaluation, Potency and Activity, to product and brand positioning within the semantic space, appear to be somewhat novel. Indeed, it is possible that through immersion in the semantic interpretation of tangible qualities of the products assessed in these studies, the EPA factors in this case might be qualitatively reinterpreted as corresponding to constructs of Quality (attractiveness), Elaboration (strength of content) and Character (type of content).

Such interpretations may provide useful sources for brand and marketing development specifically.

However, for designers, engineers and marketers, the semantic space, semantic difference and property scores, visualised by spider charts, also provides some rich insights into the effect of design and engineering specifications and solutions on the categorisation effect. Consequently, modifying very specific properties to maintain categorisation, or to respond to the unwelcome proximity of competitors to ensure brand distinctiveness, can be tested, assessed or predicted. This appears particularly advantageous to emotionally associated branded products as authenticity and distinction appear to be important influencing factors in customer satisfaction and competitive advantage. Further, the methodology provides an opportunity to consistently and reliably explore and understand multi-sensory design qualities that are somewhat esoteric and therefore maybe difficult to describe in other ways.

The inclusion within these studies of two new product designs provides an opportunity to assess how these techniques can be applied within the product development process and to the wider understanding of the condition of the cognitive category as it may evolve. Firstly, while the research emphasised the importance of multi-sensory stimuli in the categorisation process, limiting that stimuli whilst drawing upon the categorical knowledge-base for those missing, did not appear to diminish the effect of the SD methodology in interpreting categorisation. Secondly, the positioning of m^h and m^j within the semantic space suggests a stretching of the boundaries of the category as defined by m^a to m^g inclusive, but at the same time, semantic difference (*wD*) suggests these examples are categorically close to each other, to other examples and to the theoretical prototype, and are therefore inclusive. It may be that this is a tangible effect of the evolutionary process described in memetic theory that exerts some influence on categorisation over time and ultimately the survival of the concept. However, it is not clear

if the positioning of m^h and m^j within the semantic space is an appropriate response to the future condition of the category, or if they are influencing factors themselves. Therefore, to conclude if these designs are good and right for the future state of the brand, the predicted state of the category needs to be understood somewhat. To help answer this question, chapter 5 explores the affective condition of the branded product category over the past 90 years in order that predictions may be made about its forthcoming definition and content.

5. Refining the Branded Product Category[1]

1. Content in this chapter was published in; ABBOTT, M.; HOLLAND, R., GIACOMIN, J.; and SHACKLETON, J.P., (2009), 'Changing Affective Content in Brand and Product Attributes' *Journal of Product and Brand Management* 18(1) pp.17-26. The paper was published under sole affiliation to Brunel University and has all references to Bentley Motors and other brands removed to protect Bentley confidentiality.

5.1. Introduction

Branding theory, philosophy and memetics all propose that concept categories are usually unstable and are usually changing, albeit constrained by constructs of typicality and inclusion. In the brand as category hypothesis, brand extensions can influence the categorisation process to affect customer satisfaction and the reciprocal definition and understanding of the meaning of the brand. From philosophy and cognitive science come the theories of fuzzy category boundaries that see members excluded to different degrees, and the laws of novelty that act on the varying attractiveness perceptions of category members and therefore likely category recall or entity inclusion. In memetics, the evolutionary algorithm proposal reflects possible ongoing cultural modifications of a concept that imply, in the long term, that only the fittest concepts survive. In this Thesis, some evolutionary effects have also been observed; chapter 3 indicated some possible modifications, or re-interpreting, of category typicality provided by modern-day assessments of historically presented properties in product examples and chapter 4 suggested the semantic space representation of the present brand category may be stretched by new product examples that are also semantically close to the theoretical prototype.

As a background to these phenomenon, the Literature Review spent some time discussing Martindale's (1990) theory of artistic change, identifying it as an important body of work contributing to the understanding of one of the possible influencing factors in concept evolution; that of the quest for novelty balanced by typicality which stimulates maximum attractiveness, or cognitive arousal (complementing other factors like technology, see section 1.2.3 and Figure 1.16) (also Martindale & Uemura, 1983; Martindale, 1986). Martindale provided a model that suggested that the evolutionary

effects of attraction (in these cases to artistic styles in art, music, poetry, literature and architecture) is predictable, as it can be shown historical changes follow a regular pattern of cycling 'primordial thought' present within the concept with a monotonously increasing potential to arouse the viewer, expressed in this Thesis as the overall affective content of the style (Figure 5.1). The Literature Review also discussed how attraction and typicality appear to be both linked and important in emotionally evocative products like high-luxury vehicles (and possibly other product categories). It may be possible, therefore, to use Martindale's model to understand the construction and content of the brand category, in the past, present and future to understand how new product designs are perceived to be categorically included, typical, attractive and satisfying.

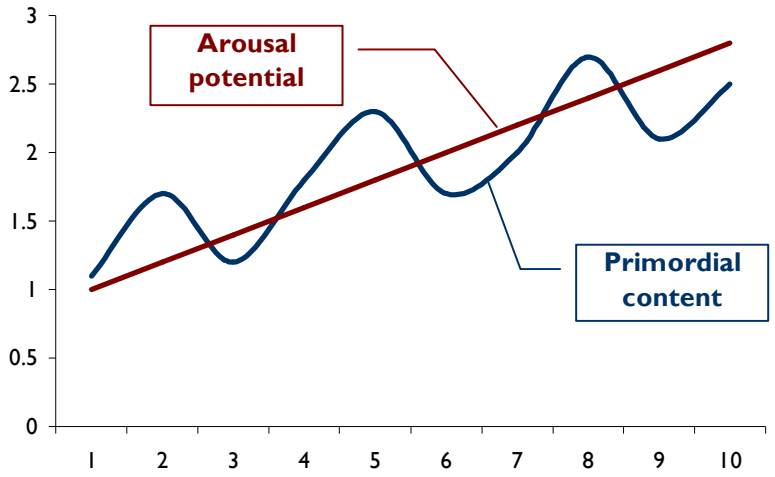


Figure 5.1. Typical change in 'primordial content' and 'arousal potential', over time, for artistic styles – arbitrary data, for illustrative purposes only (adapted from Martindale [1990]).

In order to explore this phenomenon further and to answer question 4 in the Research Objective; Has this (Bentley Interior) cognitive category semantic space been stable over time, or does Martindale's (1990) hypothesis also apply to the brand in such a way that predictions about it can be made?, the model is applied in this chapter to the Bentley

Interior. Exploring the brand's affective content in this way may provide some insights into potential property manipulation and the possible future nature of overall affective content that might be used to describe the category. This chapter also addresses the observations made in chapter 3, whereby historic opinions of products contemporary to the epoch are given from modern day views of those same products. As discussed, outcomes taken in this manner may be prone to influence by nostalgic judgments that may then elevate some fondly thought-of properties and deemphasise others (Martin, 1998). Further, attractive qualities are difficult to distinguish relative to prevailing technological, cultural or social contexts that cannot be appreciated without far reaching insight, if at all.

Finally, the chapter concludes by making some comment in response to question 5 in the Research Objective; If it (the Bentley Interior) does (conform to the theories presented), can we also consider the concept to be an evolutionary meme?

5.2. Affective content analysis (Study 11)

5.2.1. Methodology

Interest in brand characteristics mirroring Martindale's primordial content cycle were explored by taking an alternative approach to the previous techniques deployed in other studies (Martindale & Uemura, 1983; Martindale, 1986; Martindale, 1990). Because these studies were not interested in analysing concept meaning or underlying property characteristics of higher-order concepts, they did not identify any descriptive constructs (e.g.: adjectives) of overall concepts that are important to this research. Therefore, a 'bottom-up', additive test was necessary so that individual descriptors could be used to develop a mean overall value for the complete Interior. This test proceeded through three phases; firstly, an identification the brand's component, lower-order, affective content

expresses as an output following the receipt of product stimuli within contemporary sources; secondly, an analysis of resulting affective content meanings to enable them to combine into descriptive constructs of synonym-type meaning; and thirdly, a calculation of possible affective content trends from the instantiation of the descriptive construct over time.

To conduct this test, material sources that are non-contemporary to the products were considered not to be ideal signifiers of historic brand structures, being indiscriminate and inexhaustive. Consequently, any cognitive categorisation or affective content output effects drawn from them may be inaccurate and risk a misconception of predicted future conditions. Therefore, the source information in this test needed to be of a primary nature and contemporary to the time point in question and consistent in information type (ideally linguistically narrative) to obtain fair and regular distributions of data. Motoring road tests from published journals were identified as the most appropriate primary sources of information about the Bentley brand's past products. These offered a number of unique benefits, being independently written, elaborative (not solely concerned with objective specification), comparative to both preceding and alternative models and remarkably stable in their organization over many decades (most include sections on performance, handling, ride and exterior and interior features, for example). As was the case in chapter 3, Rolls-Royce interiors were considered akin to Bentley interiors between the mid 1930's and the late 1990's (see section 3.3). Original or re-printed articles were sourced from a variety of English language based motoring and general press publications, primarily from the United Kingdom, but also from the United States, Canada and Australia, including *The Autocar*, *The Motor*, *Road and Track* and *The Times*. The articles (A) describing Bentley and Rolls-Royce interiors taken from these publications equated A*n*=105 and were published between 1924 and 2007, with a spread per decade (P) ranging from 1920's, A*n* = 3; 1930's, A*n* = 31. The author examined each article for individual elaborative, emotive descriptors (typically adjectives [J]) of interior feature stimuli as indicators of the

'primordial content' (free thinking, emotive, novel and expressive text) evident in the writing. In total J*n* = 221 unique descriptive instances in all 105 articles were identified. For example; enticing, convenient, imposing, flawless, generous, exquisite etc., were taken from passages such as;

> *'One has the impression of being enveloped in leather and lamb's wool, with walnut veneer to delight your eyes and everything possible for your comfort and convenience within your reach.'*
>
> Road & Track, November 1979 (descriptors extracted underlined)

Consideration was given to the consistency of concept meanings in the publications source countries as a possible bias in the assessment of affective content in texts about the Bentley brand, but with reference to Osgood, May & Miron (1975), that indicated concepts largely produce similar meaning factors across cultures, it was concluded that any cross-cultural variation would be minimal and insignificant to the overall objectives of the study.

In chapter 3, similar adjectives were analysed for meaning and allocated to the twenty properties as the positive pole of the bi-polar SDS. According to that process, the 221 unique adjectives observed in the articles were combined by the author into 23 synonym-type descriptive constructs (C_1, C_2, C_3....C_{23}) in the second phase of the analysis by reference to the property set obtained in chapter 3 and Wordnet 2.1 (http://wordnet.princeton.edu, (for example; enticing into Pleasure / Attraction, convenient into Practicality, imposing into Potency, flawless into Quality / Appeal, generous into Expressive, exquisite into Elegant / Refined). In some cases these constructs have direct meaning associations to the twenty properties and their bipolar adjectives; in others

unique instantiations are obtained. Table 20 identifies the 23 descriptive constructs with their associations to the property set.

Affective Content constructs	Associated Bentley Interior Properties	SD bi-polar scale
C_1 Precision	Fit & Finish	imprecise → precise
	Softness Harmony	dissimilar → similar
	Function Harmony	dissimilar → similar
C_2 Pleasure / Attraction	-	
C_3 Practicality	-	
C_4 Potency	-	
C_5 Quality / Appeal	-	
C_6 Expressive	-	
C_7 Form / Size	-	
C_8 Intricacy / Detailing	Veneer Detailing	simple → intricate
C_9 Hand-crafted	Hand-crafted	machine-made → hand-crafted
	Carpet Execution	machine-made → hand-crafted
	Veneer Hand-crafted	machine-made → hand-crafted
C_{10} Elegant / Refined	CF Refinement	unrefined → refined
C_{11} Bespoke	-	
C_{12} Pedigree / Authenticity	Brightware Authenticity	false → genuine
C_{13} Intelligence	-	
C_{14} Comfort	Trim Panel Softness	hard → soft
C_{15} Understated	-	
C_{16} Sensory	Leather Grade / Grain	rough → smooth
C_{17} Exclusive	-	
C_{18} Natural	Smell	artificial → natural
C_{19} Novelty	-	
C_{20} Luxurious	Carpet Quality	poor → luxurious
C_{21} Structure	Part Stiffness / Robustness	flexible → rigid
	Brightware Solidity	hollow → solid
	Veneer Solidity	hollow → solid
	CF Stiffness / Robustness	flexible → rigid
C_{22} Excellence (above Quality)		
C_{23} Conformity	Colour Harmony	unintegrated → coordinated
	Brightware Harmony	unintegrated → coordinated

Table 20. Affective content constructs and associated properties.

As the number of articles per period (A*n*P) varied, so the absolute quantity of affective content per period varied. Therefore, to obtain a constant measure that was not influenced by the number of articles found, A*n*P was restricted to ≤ 5. The choice of articles was governed by the highest amount of overall affective content present in each period, such that the top scoring articles were included. This had the effect that P produced a constant variable whilst maximising affective content quantity. Values were then represented by individual constructs within-decade quantities and as overall affective content averages in each period, following here Martindale's approach more closely. Table 21 illustrates affective content for each of the 23 constructs identified in the texts between 1924 and 2007 to describe the Bentley interior and the overall affective content it assembles.

	Within-decade Affective Content Construct mentions per decade								
	20's	30's	40's	50's	60's	70's	80's	90's	00's
C_1 Precision	0	2	0	4	3	0	9	3	1
C_2 Pleasure / Attraction	0	1	0	1	0	1	0	3	2
C_3 Practicality	0	10	3	9	7	3	7	1	7
C_4 Potency	1	7	3	2	4	6	6	3	5
C_5 Quality / Appeal	4	7	2	9	9	8	6	6	16
C_6 Expressive	2	5	2	5	1	1	12	0	5
C_7 Form / Size	1	14	7	9	10	7	14	5	6
C_8 Intricacy / Detailing	4	0	1	2	2	1	4	0	12
C_9 Hand-crafted	1	0	0	2	0	0	2	3	2
C_{10} Elegant / Refined	0	2	1	0	1	0	3	0	6
C_{11} Bespoke	0	0	0	0	1	0	2	0	0
C_{12} Pedigree / Authenticity	0	0	1	2	3	3	8	4	3
C_{13} Intelligence	0	0	1	0	0	1	2	0	1
C_{14} Comfort	1	18	2	4	7	4	13	3	13
C_{15} Understated	2	2	6	2	1	0	3	3	3
C_{16} Sensory	0	3	0	2	4	7	6	5	4
C_{17} Exclusive	1	0	0	0	0	0	0	0	0
C_{18} Natural	0	0	0	1	0	0	0	0	0
C_{19} Novelty	2	3	0	1	0	0	1	1	0
C_{20} Luxurious	1	4	1	3	5	0	5	2	8
C_{21} Structure	1	3	0	1	0	0	0	0	3
C_{22} Excellence (above Quality)	2	5	3	4	3	3	7	0	7
C_{23} Conformity	2	2	0	1	0	0	2	0	0
Affective Content per Decade mean	1.09	3.83	1.43	2.78	2.65	1.96	4.87	1.83	4.52
Upper Confidence Interval	1.50	5.45	2.10	3.75	3.71	2.87	6.32	2.50	6.05
Lower Confidence Interval	0.67	2.20	0.77	1.81	1.59	1.04	3.42	1.15	2.99

Table 21. The Bentley Interior, with individual constructs (C_1, C_2, C_3....C_{23}) affective content and overall average affective content quantity, by decade.

5.2.2. Results: Construct affective content

Affective content can be represented by plots of the variability in the quantity of primordial thought evident in the material (Martindale, 1990). In the Bentley Interior, 21 of the 23 constructs demonstrate a sine-curve type oscillating trace that corresponds, generally, to Martindale's findings of primordial thought in other created concepts. For example, C_{10} [Elegant / Refined] (J = beautiful; exquisite; tasteful, for example) exhibits a peak quantity in P = 1930's; 1960's; 1980's; 2000's (affective content quantity = 2; 1; 3 & 6 respectively), and no quantity in P = 1920's; 1950's; 1970's; 1990's (Figure 5.2). The affective content cadence is frequent and increasing and inclines sharply in recent periods.

Figure 5.2. Bentley Interior construct C_{10} [Elegant / Refined] affective content curve. Variability is statistically significant (p = 0.004).

Similarly, C_5 [Quality / Appeal] (J = faultless; good; high quality; ideal; perfect, for example) peak values are high with two distinct troughs in P = 1940's & 1980's/ 1990's (affective content quantity = 2; 6; 6 respectively) (Figure 5.3). The affective content

cadence is lower than C_{10} [Elegant / Refined] but is increasing and also inclines sharply in recent periods.

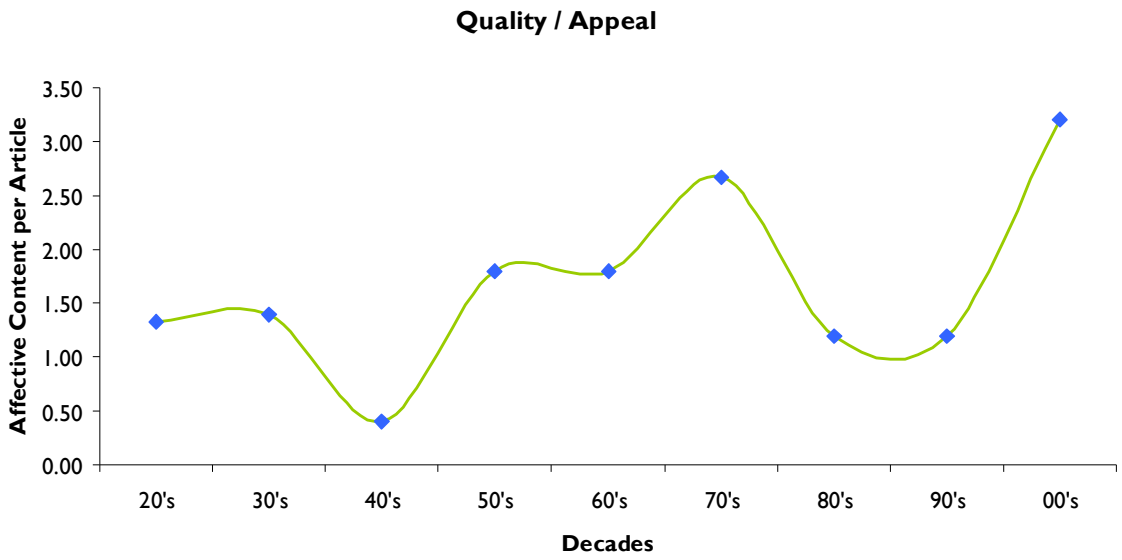


Figure 5.3. Bentley Interior construct C_5 [Quality / Appeal] affective content curve. Variability is statistically significant (p = 0.033).

Appendix 3.1 contains charts that exhibit similar cyclical patterns in all of the 21 other constructs except C_{17} [Exclusive] and C_{18} [Natural], which do not fit to the theory within the literature studied. Both of these produce a single peak (P = 1920's & 1950's respectively) and zero values in other periods. Jointly, these examples were considered not to disprove the general characteristics found, but that either unknown contextual influence was present, or that insufficient J examples were present within the literature. To test against the null hypothesis that affective content for individual constructs is constant, a chi-square distribution test was performed that concluded that at least half of them produce cyclical traces of statistically significant variability (p<0.05). Lack of reliability for the remaining could be due to the level at which the construct is assembled; further combination into wider synonym-type constructs enlarges both the sample size and modifies variability. For example, from the literature there appeared to be discrimination between good, or must-be quality (C_5; Quality / Appeal) and excellent or attractive quality (C_{22}; Excellence; J =

exceptional; fabulous; superior; unmatched, for example). Whilst the former exhibited statistically significant variability as a separate construct, the latter did not. However, combined into one construct of overall 'quality', variability becomes highly statistically significant (p = 0.0063).

5.2.3. Results: Overall affective content

The methodology used explores the affective content in texts describing the Bentley Interior since the 1920's. Although traces conforming to Martindale's theory are generally evident, not all constructs are ascending; a number are clearly declining (e.g.: C_{19}; C_{23}), nor do peak and trough variability or frequency coincide (see Figure 5.4). Combining individual cycles and averaging, provides a compound effect that produces a single curve for the overall concept that corresponds to Martindale's cyclical nature of primordial content, and a linear trend line that indicates monotonously increasing arousal potential; Figure 5.5 illustrates the arithmetic average of overall affective content for the 23 constructs that describe the Bentley Interior between 1924 and 2007, with upper and lower confidence intervals (Hayes 1998) for each period.

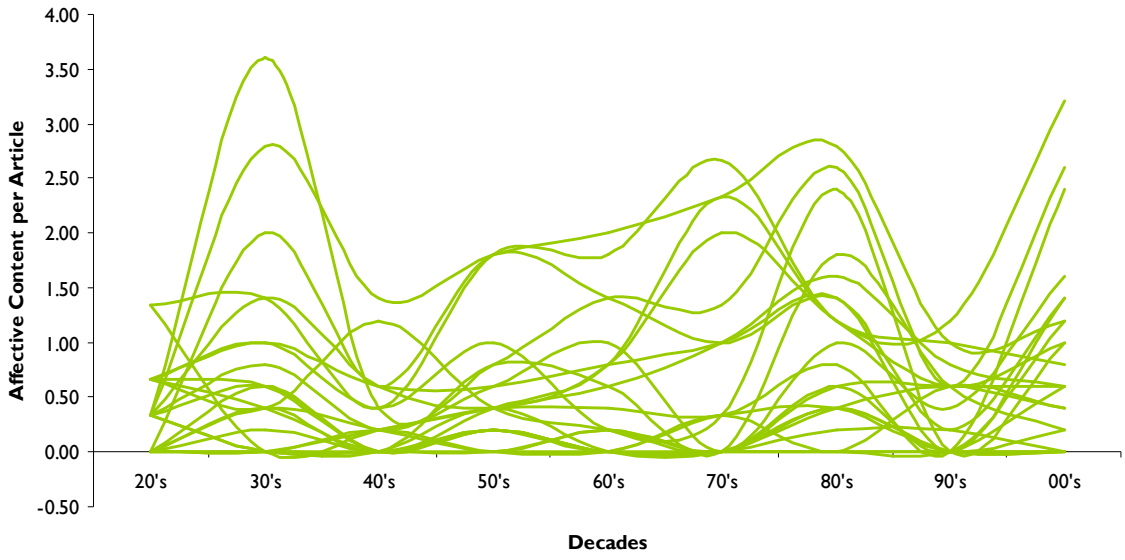


Figure 5.4. Bentley Interior 23 affective content constructs.

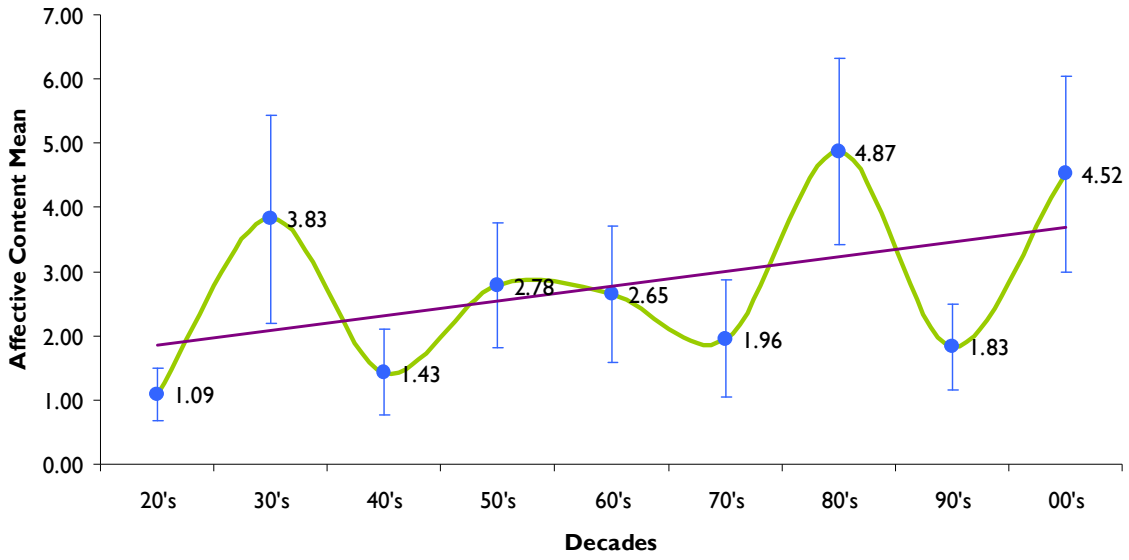


Figure 5.5. Overall mean affective content for the Bentley Interior with linear trend line. Variability is highly statistically significant (p = <0.0001).

Previous research also observed that a condition of peak and trough primordial content would be co-incidental indicators that artistic styles were forced to significantly change by increasing unattractiveness of the preceding style (Martindale & Uemura, 1983; Martindale, 1986; Martindale, 1990). Therefore, with a product, affective content shift should be apparent at, or near to, the point at which significant new product examples are launched to offset natural declining popularity (sales) in prior models, due to factors like ubiquity, changing markets or outdated technologies (Carbon & Leder, 2005; Carbon, Hutzler & Minge, 2006; Hekkert et al., 2003; Snelders & Hekkert, 1999). Figure 5.6 illustrates major new product activity for the Bentley brand overlaid on the affective content cycle. Because data points were plotted at mid-period intervals (in this case, mid-decade) a peak value would be evident at the modal point in the period, which in some cases does not exactly correspond to new product launch dates. Even so, it is clear that changes in overall affective content for the Bentley brand have occurred at, or near to, the introduction of new product examples, as expected by the model.

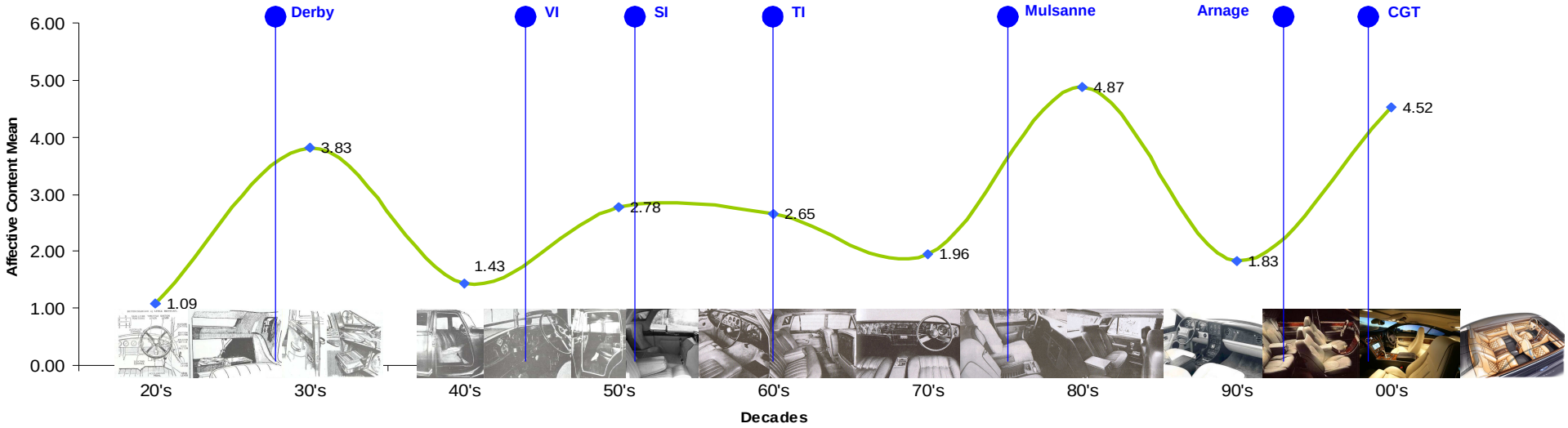


Figure 5.6. Bentley Interior mean affective content 1920 – 2003, with major product launches.

5.2.4. Discussion

In study 2, chapter 3, it was suggested that certain properties like Tool Kits were possibly artificially elevated in importance as stimuli of a typical Bentley Interior due to a modified modern-day view of a historically important feature. Exploring more contemporary sources of material indicates that Tool Kits were not considered especially salient or noteworthy in any epoch (no mention was made in any of the 105 articles studied). However, constructs which were given to Tool Kits in study 2 (Precision; Hand-crafted; Refined) were also evident, and quite strongly so, in the contemporary texts, suggesting that the stimulating descriptors of the properties chosen in chapter 3 have some heredity and therefore validity.

Further, the study of affective content in motoring journals describing the Bentley brand establishes at least two more important principles for brand and product management generally and the interpretation of the Bentley Interior cognitive category specifically. Firstly, patterns of affective content in specific constructs, and overall values (for this brand, within the literature available), generally appear to oscillate in a similar manner to comparable content found elsewhere in other texts describing other concepts; the quantity of affective content in the expression of a construct, in relationship to others and over time, rises and falls with some regularity. According to the established theoretical model, the point of change in quantity of overall affective content within texts describing the Bentley brand is evident around major product launches. A given condition of this change-point is the modification of a category member by the need to develop novel variations in the properties of the new product, balanced by typical elements, thereby stimulating maximum attractiveness. This appears to be reflected in the journalists' cognitive output that moves specific constructs forward in the cycle of increasing / decreasing affective content in their texts. Therefore, it is considered that the brand, in this case, conforms to

the laws defined by this model in a similar manner to other artistic fields, and that these findings further support H_3; If certain properties are more or less important for stimulation (of cognitive categorisation), their descriptors will also be differently important (scaled).

Secondly, the fact that such trends can be traced potentially provides an important insight into the cognitive condition of the brand, its members and category characteristics. Deductions may be made about the current and historical relationship between product properties (stimulatory inputs) and affective responses (associative outputs [e.g. texts]) within technological, social, cultural and, potentially, commercial contexts. For example, declining constructs can be identified and proactively revived, if appropriate, and inclining constructs supported or emphasised within product and brand development activities. Further, if the affective content model continues to be true for the brand, its representation may also be predictable, indicating future construct conditions that might be influenced by the manipulation of specific properties within the product development process for attractiveness and categorisation benefit. Conversely, if a predictive model can be built, the observations made in chapter 4 concerning the apparent stretching of the boundaries of the brand category, evident in the positioning of examples m^h and m^j within the semantic space, may be further informed or disproved.

5.3. Affective content trend development

5.3.1. Methodology

Martindale's theoretical model, as discussed, indicates that a style's potential to cognitively arouse (be attractive), at least for the higher-order concept, will monotically increase over long periods. This appears also to be the case for the Bentley brand. The model also expects that when the primordial thought contained in the style demonstrates

a sharp incline, or sharp decline, stylistic change is immanent, in order that the balance of novelty and typicality contained within the concept be kept in check to promote maximum attractiveness. However, the methodology used in this Thesis requires that if the higher-order increases, as a sum of affective content in lower-order constructs, then the trend lines for lower-order constructs should also generally increase, given approximately similar weighting. Therefore, attention to the characteristics of affective content trends for the underlying constructs of the Bentley Interior reveal important information about possible future conditions that may be anticipated, proactively encouraged through property manipulation, or used to check typicality of products not yet launched, as in the cases of m^h and m^j. In the third phase of this analysis, linear regression calculations are made to forecast the next period (P = 2010's), for each descriptive construct and overall affective content, in order that possible future values can be plotted.

5.3.2. Results

Figures 5.7, 5.8 and 5.9 illustrate the forecast according to linear regression analysis for C_{12} [Pedigree / Authenticity]; C_{16} [Sensory] and overall affective content respectively. Appendix A3.2 includes forecast charts for all other descriptive constructs.

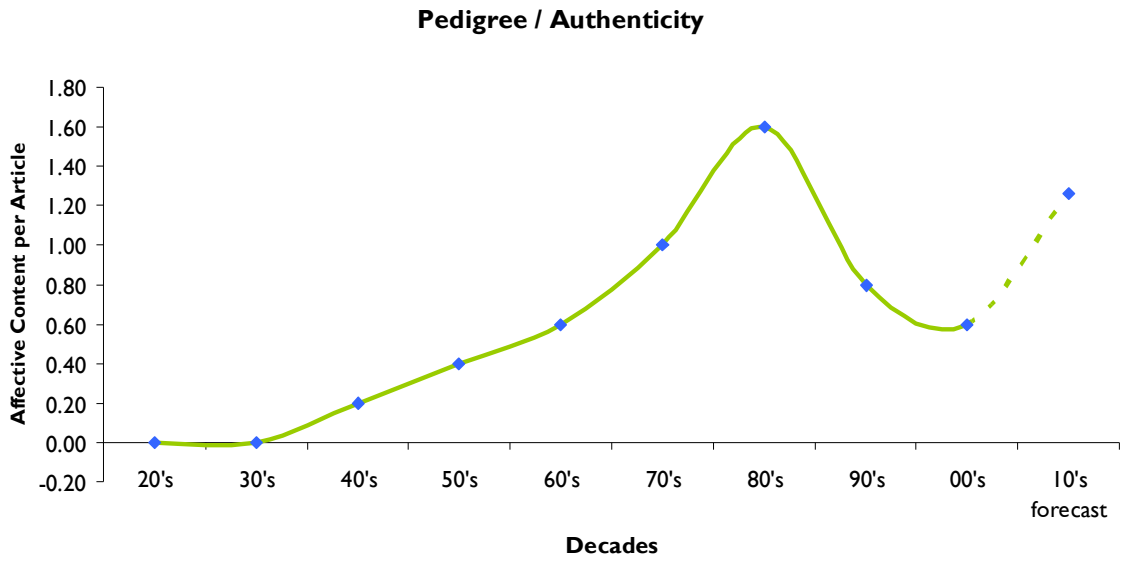


Figure 5.7. Bentley Interior construct C_{12} [Pedigree / Authenticity] affective content curve with forecast.

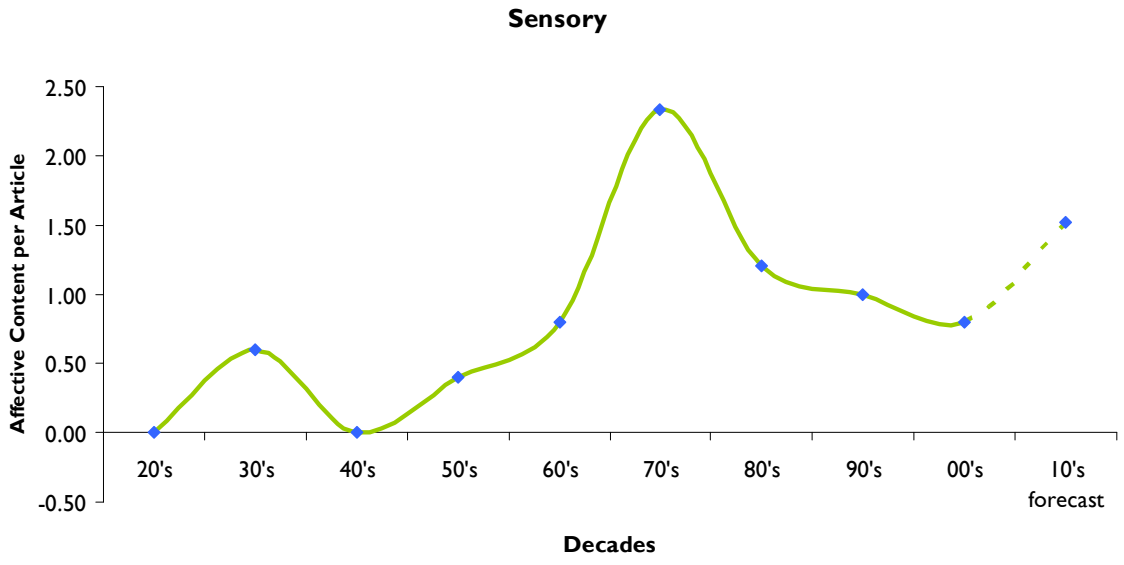


Figure 5.8. Bentley Interior construct C_{16} [Sensory] affective content curve with forecast.

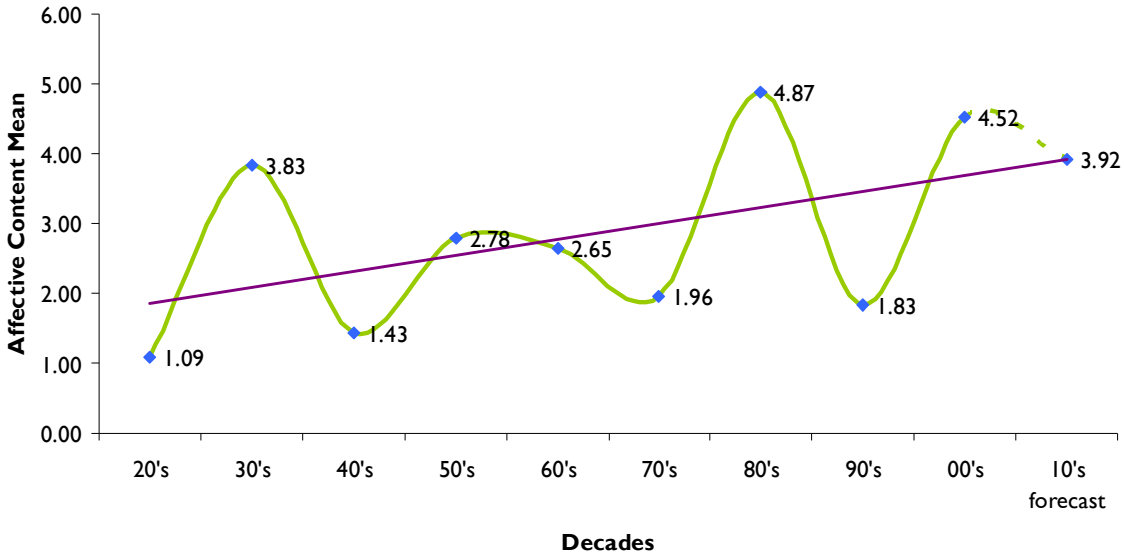


Figure 5.9. Overall mean affective content and linear trend line for the Bentley Interior, with forecast.

By understanding the inclining and declining affective content forecasts and the value of that forecast according to this calculation, a ranking of constructs can be made. This ranking then reflects the predicted relative instantiation of the construct in possible future motoring journal texts when describing, for example m^h or m^j. By using this ranking in the pair-wise conjoint type analysis conducted in study 4 (section 3.5) new property weighting factors can be identified that ultimately modify the positions of members in the semantic space given in chapter 4 as a prediction of the result of stimuli relevance in this period. This modification was obtained by allocating the ranking of the constructs to properties by their associative links given in Table 20, followed by a recalculation of property weightings (see Appendix A1.8) and semantic space locations for the Bentley Interiors m^a – m^j inclusive. The theoretical prototype (tp) also modified in this calculation from *w*EPA; 1.47, 1.76, 1.24 to 1.45, 1.48, 1.90, deemphasising Evaluation and Potency slightly and elevating Activity significantly. For each Bentley Interior, semantic difference to tp (*wD*) were recalculated. Table 22 illustrates average *wD* in studies 5 to 9 and the recalculation based on affective content forecasts, which indicate that the new products m^h and m^j move closer to tp in ranking order under this modification, although *wD* values are greater.

	Measured		Forecast	
Rank	order	*wD*	order	*wD*
1	ma	1.16	mg	1.77
2	mf	1.35	me	1.85
3	ma[6]	1.60	ma	1.94
4	me	1.61	**mh**	2.20
5	mg	1.64	**mj**	2.29
6	mb	1.67	ma[6]	2.41
7	**mj**	1.74	mf	2.53
8	mc	1.78	mb	2.60
9	ma[7]	1.83	mc	2.80
10	**mh**	1.98	ma[7]	2.91
11	md	2.11	md	3.30

Table 22. Semantic difference to tp, m^a - m^j (average, studies 5 to 9, plus forecast *wD*).

5.3.3. Discussion

The extrapolated affective content trends suggest that the new products assessed in studies 8 and 9; m^h and m^j are ranked closer to the theoretical prototype than when ranked against a set of products using contemporary stimuli weighting. Therefore, it could be concluded that they are likely to be more prototypical when launched than they are during the current period of development. Such a conclusion would be beneficial to the likely categorisation of the product and therefore customer satisfaction. However, the modification to property weightings also moved tp semantically further away from both new products and all other products suggesting that, if the calculation is a valid predictor, the semantic reaction to property stimuli could be further improved; in other words, the expectation of the category, as calculated, might be developing faster than the change in

the specification of typicality. Indeed, all but four products (including m^j) now fall outside the minimum Bentley Interior category boundary suggested in section 4.4.3 ($wD \geq 2.21$) but within the maximum boundary posited (≤ 3.39).

Of note also, is the gradient change in overall affective content predicted in the 2010's by this calculation (Figure 5.9). Whilst the affective content changes from peak values in the 1930's and 1990's were steep, the change in the 2010's appears to resemble that of the 1950's, where the change was both shallower and gentler. A characteristic of this period appears to be a more regular cadence of new model introductions (3 major launches in twenty years) (see Figure 5.6), that is echoed by the recently increased new model programme at Bentley since its acquisition by Volkswagen in 1998. If the forecast levels of affective content are extrapolated by two periods, the value increases to 4.15, suggesting the compressed launch activity, relative to other periods, may be coincident with a smaller rate of change in overall affective content in future motoring texts.

These conclusions partially answer question 4 in the Research Objective affirmatively as the affective responses to stimuli within the Bentley Interior category appear to be consistently variable over sequential periods. They are also potentially predictable. However there are two potential limitations of this analysis; firstly, it uses a single data set (motoring journals) as a guide to the future condition of the category, and secondly, the cyclical patterns identified may not be a reaction to the stimuli presented in the vehicles but may reflect patterns generally evident in language and texts over time. Dealing with the first point, referring to the principles of grounded theory adopted in chapter 3, a limited data set, although empirically valid as in this case, potentially loses some of the sensitivities obtained by multiple phenomenological analyses (Gummesson, 2001). These appear especially important in semantically based methodologies. As a result, caution is required if this single source is used alone to confirm the potential categorisation of a product in development. With the second point, linguistic research has identified that

language does change over time, albeit variably in different languages and in different contexts (e.g.: Kroch, 1989; Yang, 2000). However, general patterns of language change appear to evolve over much longer time-scales than those presented in this study (generations; Niyogi & Berwick, 1995; Kroch, 2001) and describe a different quantity / time curve than evident with the affective content in these journals. Therefore, it is likely that the patterns identified here are directly related to object stimuli, although cultural linguistic influence cannot be completely dismissed.

Ultimately, validity of the predictive model in this application can only be given by the results of repeat SDS assessments of Bentley Interior products over the following decades. Nevertheless, it appears to provide some insightful information for product development and the future condition of the branded product category, which is given plausibility by both established research (Martindale & Uemura, 1983; Martindale, 1986; Martindale, 1990) and the conclusions made from the data presented.

5.4. Conclusions and Consequences

The objectives of chapter 5 were to explore if the interpretation of the Bentley Interior category presented in chapter 4 is constant, and if some predictive theories could be applied to it so that it may be refined for use within design, engineering and marketing activities. Chapter 5 also attempted to further understand observations made in chapter 3 about modern-day assessments of historical properties and in chapter 4 about boundary stretch along the paradigmatic 'is like' category axis. Martindale's (1990) theories of artistic change in long established created concept fields like art, poetry and architecture, where the novelty-typicality relationship has been explored and proven to exhibit characteristics that are consistent and repeatable, were used to answer question 4 from the Research Objective; Has this cognitive category semantic space been stable over time, or does Martindale's (1990) hypothesis also apply to the brand in such a way that predictions about it can be made?

The data presented demonstrates that the answer to this question is (partially) affirmative; similar characteristics can be observed in the descriptive constructs of the Bentley Interior, taken from the elaborative language of independently written texts, contemporary to regular time periods over the past 90 years. According to the theory, trends have been identified that indicate changes in stimulatory construct quantity. By constructing the overall affective content from compound constructs, patterns of change appear to correspond to the introduction of major new products. Further, predictions made from this data about the weighting of product properties in the semantic space, suggest that the new products assessed in chapter 4 may be more prototypical when launched than as presented in studies 8 and 9; their positioning may be both good and right for the future condition of the category. However, these conclusions require some further validation, as

they are made from a limited data set, which can only be given by multi-sensory stimuli response assessments made with these and other designs over forthcoming periods.

The Research Objective also asked; If it (the Bentley Interior) does (conform to the theories presented), can we also consider the concept to be an evolutionary meme? (Question 5). Three core characteristics of the cultural concept generally referred to in the literature as a meme are; their apparent properties evolve (Blackmore, 2000); only the fittest properties survive in order that the concept survives (Dawkins, 1976; DeJong, 1999; Wood, 2003); and these properties stimulate concept identification and meaning within a cultural context (Blackmore, 2001). Using Martindale's (1990) theory to analyse reactions to the Bentley Interior, interpreted through linguistically based mentation, suggests that its stimulating properties have evolved. Referring to chapter 4, it is also suggested that these properties, when evident in a product, hold information about identification and meaning that stimulate brand-based cognitive categorisation within a sample of the population. The Literature Review also presented information about the long-term success of the Bentley brand. Therefore, it is reasonable to conclude that the Bentley Interior does exhibit characteristics of an evolutionary meme, and that an interpretation of its evolutionary algorithm, in part, at least, may have been identified.

In a wider context, by understanding the affective content characteristics of properties of an established brand in this manner, valuable information may be collected about the nature and condition of the concept within the collective cognitive consciousness. Two benefits can then be imagined and possibly exploited; firstly, future product offerings may be assessed for likely attractiveness, according to the natural predicted cycle, providing appropriate novelty-typicality relationships are contained within the product's properties and that brand categorisation effects are compliant. Secondly, property manipulation opportunities arise that may be useful in supporting or emphasising specific properties to correct, redirect or support brand or marketing strategies that, in turn, may maximise

authenticity, heredity, brand categorisation effects and therefore attractiveness and increased brand equity.

6. Conclusions and Recommendations for Future Research

6.1. Introduction

This chapter will summarise the research described in chapters 2 through 5 and discuss the case for a unique contribution from the conclusions presented. Additionally, the wider implications of the findings will be discussed. The chapter will be organised into 5 sections; key findings; the central and supporting claims for a unique contribution; the benefits to research and design, engineering and marketing disciplines, both within the field and in a wider context; any limitations and some recommendations for future research. The chapter will assume the reader is familiar with the research background, context, theories and methodologies explored in the Literature Review in chapter 1 and therefore will not expand on those further. However, to refresh, the Research Objective that was proposed at the end of chapter 1 was defined as;

> *The development of a design measure that enables the identification of typical multi-sensory brand-based product properties, their specification, measurement, visualisation and predicted condition, based on cognitive categorisation theory and related methodology, applied to the vehicle interior. As a basis for the hypothesis, the research considers that brands act as cognitive categories in some circumstances* [H_1].

Additionally, the following Research Questions were proposed and answered in the respective chapters;

1. Do brands act as cognitive categories as hypothesised by Boush (1993) and in H_1? (Explored in chapter 2).

2. If H_1 is true, what is the specification of typicality for the Bentley Interior cognitive category (the typical properties that define it)? (Chapter 3).
3. Do Bentley Interior entities populate this interpretation of the cognitive category semantic space in support of the hypothesis? (Chapter 4).
4. Has this cognitive category semantic space been stable over time, or does Martindale's (1990) hypothesis also apply to the brand in such a way that predictions about it can be made? (Chapter 5).
5. If it does, can we also consider the concept to be an evolutionary meme? (Chapter 5).

This chapter will also discuss question 6 in the Research Objective;

6. What are the potential benefits of the unique contribution to the body of knowledge, and design, engineering and marketing practice, firstly in the automotive application and secondly in wider product applications?

6.2. Key Findings

The results from study 1 in chapter 2, provides some evidence to suggest that some brands act as cognitive categories in some circumstances, as implied by Boush (1993). Therefore, the Thesis answered question 1 affirmatively. In so doing, a foundation to the hypothesis (H_1) for the resulting design measurement methodology was created that suggests that a cognitive category can exist with members that are the products of the brand, which share defining characteristics, or properties, to a greater or lesser extent and to which other products can be compared to assess typicality and authenticity.

Studies 2 through 5, in chapter 3, found that the defining properties that specify the typicality of Bentley Interiors may be summarised under six core concepts; Materials and Appearance Overall, Leather Trimming, Carpets, Brightware, Veneer and Control

Functionality. Subjects affective responses to the 20 multi-sensory properties that were also identified to exist within these concepts may be captured in Semantic Differentiation models by bi-polar synonym – antonym constructs, whereby the positive pole describes the theoretical prototypical Bentley position and the negative pole the opposing position, or an alternative brand's positive position. Further, each property's bi-polar scale apparently loads against Evaluation, Potency or Activity factors of affective meaning in a ratio that satisfies established SD theory and allows the category Semantic Space to be visualised in three dimensions. Each property was also identified as being more or less important as categorisation stimuli (proving H_2; some product properties are more or less important in the stimulation of the identification of the cognitive category Bentley Interior, and H_3; if certain properties are more or less important for stimulation, their descriptors will also be differently important (scaled)). The Thesis therefore answered question 2 by identifying a defined set of weighted SD scales by which typicality relationships within the Bentley Interior category may be measured.

Studies 6 through 10, in chapter 4, then systematically built a database of SD scale scores from static and dynamic assessments of seven current Bentley products and 15 non-Bentley competitor products, and static assessments of a further two Bentley products in development. By representing these scores within the three-dimensional semantic space, a visual interpretation of cognitive categorisation was obtained that satisfies H_1 and affirmatively answers question 3 (Figure 6.1). By calculating Semantic Difference values (*D* and *wD*) from these scores, a reliable quantitative value for typicality relationships are also obtained and from it, and the potential category boundary identified (*wD* >2.21). Both thereby appear to validate the specification of typicality for the Bentley Interior proposed in chapter 3. Further, individual property strengths and weaknesses (against the brand theoretical prototype) and threats (competitor proximity to the brand theoretical prototype) were obtained which may prove insightful to future product development activities.

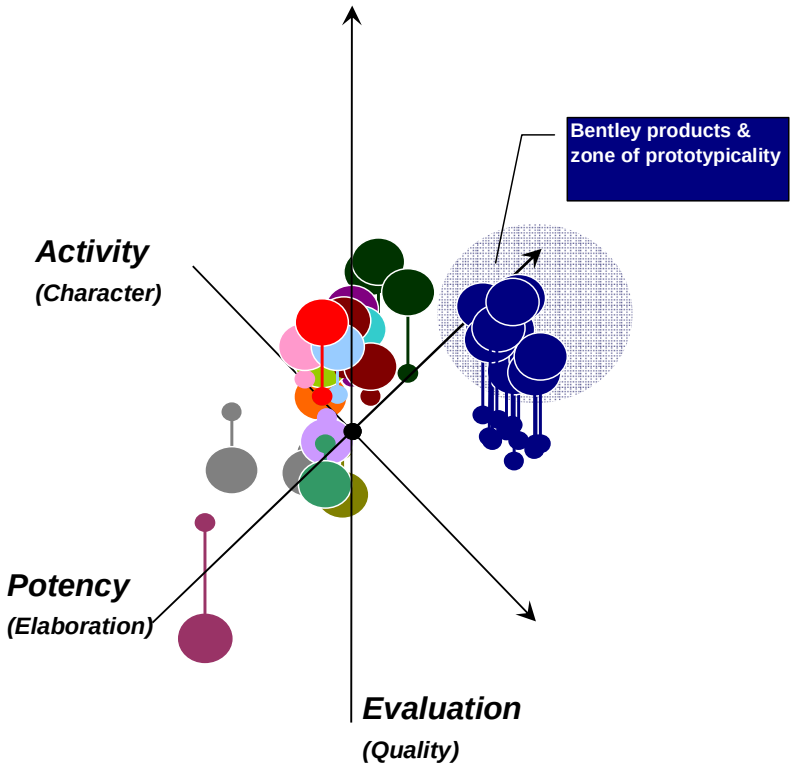


Figure 6.1. Consolidated category semantic space. Weighted EPA positions

Chapter 5 then explored if the Bentley Interior category has been stable over time and if not, are there any patterns evident in it which may be used to predict its future condition. Study 11 used motoring road-test articles for Bentley and Rolls Royce products between 1924 and 2007 to test Martindale's (1990) hypothesis that affective content in general artistic styles changes regularly, as a method to understand an aspect of branded product categorisation effects over these periods. Study 11 concluded that the overall affective content contained in these articles appeared to conform to Martindale's model (Figure 6.2); increasing during periods of stylistic change, coincident with new model introductions. By analysing underlying constructs compared to those identified in studies 2 to 5, and predicting their expected condition in forthcoming periods, a new rank of property weightings was obtained that were used to recalculate the positions of the two Bentley products assessed in studies 9 and 10. This re-calculation showed that these new

designs apparently moved closer to the theoretical prototype when compared to current Bentley products measured in studies 6 to 10, but that *wD* increased as the theoretical prototype moved further away. Therefore, question 4 was partially answered affirmatively.

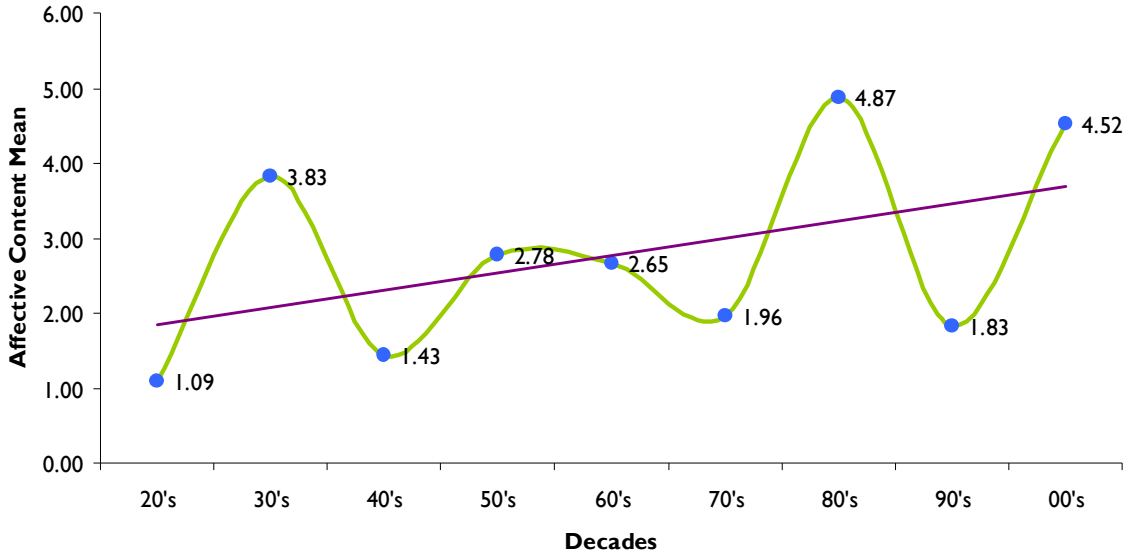


Figure 6.2. Overall mean affective content for the Bentley Interior with linear trend line. Variability is highly statistically significant (p = <0.0001).

Question 5 concerned itself with the issue of the evolutionary algorithm proposed in memetic theory contained in the branded product. The results of study 11 suggest that the Bentley Interior concept has evolved over the past 90 years, possibly due to the influencing factors of technology and cultural change and the laws of novelty. Therefore, the Thesis considers study 11 to support memetic theory in this case.

6.3. The central and supporting claims for a unique contribution

Following the summary of key findings in response to the Research Objectives, the central claim for a unique contribution in this Thesis is defined as;

> The novel application of a design measurement methodology to automotive interiors that enables the identification of brand typical multi-sensory product properties, their specification, measurement and visualisation, based on cognitive categorisation theory and related methodology.

To support the central claim, some further unique contributions are proposed;

1. New evidence that suggests that brands act as cognitive categories in some circumstances (study 1).
2. A novel application of Osgood, Suci & Tannenbaum's (1957) Evaluation, Potency and Activity factors as a method for visualising the brand category in three-dimensional space (studies 6 - 10).
3. A novel application of Osgood, Suci & Tannenbaum's (1957) Semantic Difference calculation as a method for quantifying typicality relationships and category boundaries in the brand category (studies 6 - 10).

4. A novel study of brand-based affective content according to Martindale's (1990) theory of artistic change, suggesting brands behave in similar ways to other artistic styles (study 11).

6.4. Benefits to research and product development

The benefits of the research presented, the key findings and unique contributions, are considered here firstly within the context of the immediate field of design, engineering and marketing high-luxury automotive interiors, and secondly, in a wider context of general product and brand development.

To designers, engineers and marketers of a high-luxury automotive product like a Bentley, where customer satisfactions are significantly influenced by evocative associations stimulated by the receipt of authentic and salient multi-sensory properties through cognitive categorisation of the brand and the branded product, a design assessment and measurement methodology that directly links the specification of the properties within the vehicle interior to those associations, may prove beneficial in two ways. Firstly, the methodology may inform product strategists, designers and engineers' understandings of those links, and in so doing, may lead to faster new product development times by reducing any modification loops that may be necessary to arrive at solutions that are considered right for the brand and by providing a rich source of product knowledge. Consequently it might be expected that the methodology may lead to higher degrees of customer satisfaction by product features meeting their cognitive categorisation expectations of the brand more frequently and more strongly. Concurrently, design and engineering costs might be controlled.

Secondly, the methodology potentially enables product strategy, design, engineering and marketing processes by visualising and quantifying cognitive categorisation effects and specific property stimuli strengths and weaknesses, against the theoretical prototypical position, and any threats posed by competitors to those salient brand values. The methodology may then further enable experimental or actual property manipulation within the design, engineering or marketing process such that direct effects to categorisation and brand distinctiveness can be understood and optimised. For example, study 9, m^h demonstrated a move towards the tp for the property Veneer Handcraftedness (Figure 4.13) as a cognitive reaction to a specific visual design stimuli present within the design model, compared to m^g (Figure 4.7), the preceding model. Similarly, study 10, m^j demonstrated a significant move towards the tp for the property Trim Panel Softness (Figure 4.15) due to a specific change in softness specification and composition of materials within the parts, compared to m^b (Figure 4.1).

Within a wider context, the methodology may help develop some constructs that might be useful within product and brand management generally. During studies 6 to 10 a correlation became apparent between the SD factors of Evaluation, Potency and Activity and general characteristics evident in the Bentley product set and the competitor set. This correlation was qualitatively interpreted as Evaluation (Osgood, Suci & Tannenbaum's [1957], good – bad assessment) ≈ Quality; Potency (the strong – weak assessment [ibid]) ≈ Character; and Activity (the active – passive assessment [ibid]) ≈ Elaboration (see Figure 6.2). For example, within the products studied, the brand that felt subjectively closest to Bentley in the quality of interior execution was Mercedes, as indicated by the strongest competitive Evaluation property scores, whereas the brand that felt subjectively closest to Bentley in the character of its interior execution was Aston Martin, as indicated by the strongest competitive Potency property scores. Such insights might be useful in product positioning, marketing messages and advertising where discussion can be built

around key messages that resonate within the collective user consciousness in relationship to the product category.

In design and engineering processes it is usual that product specifications are considered that ensure functional targets are met in the product design. These targets are traditionally set in relationship to competitive product performance, to ensure that features and properties are good compared to the competitive landscape (akin, perhaps, to Kano et al's [1984] must-be qualities). However, this approach does not necessarily ensure that features and properties are developed that are also right for the brand (in that they appropriately stimulate a categorisation mechanism that matches with the users expectations of the branded product). By adopting an approach that places emphasis on brand-based property specifications, as encouraged by the methodology proposed, it may be possible to add a more rounded approach to product design and engineering generally, that supports and emphasises the development of solutions that are both good and right for the brand.

Further, the methodology provides a clear process for businesses interested in linking some of the qualitative, subjective experiences of the product directly into a form that can be understood, quantified and interrogated by many business functions. To that extent, it may help support the development of a brand's values and possibly influence business models; for example, revenue opportunities might be imagined for product features that possess 'full-content' multi-sensory properties.

Martindale's (1990) model of change in affective content has previously only been applied to artistic styles like music, art, architecture and poetry. In commerce, and specifically branding, it may be possible that the model also has value as a source of information about evolving product attractiveness. For brands where sufficient heredity exists, trends that mirror Martindale's model may be evident. Although this Thesis considered affective

content data that was contemporary to the products under study, Martindale (in Martindale & Uemura, 1983; Martindale, 1986 and Martindale, 1990) used subjects to assess styles after-the-fact and found that this approach successfully reproduced the phenomena. Therefore, it may not be necessary to exactly reproduce the methodology employed in this Thesis to find similar results with other brands. Nevertheless, both the overall effect of affective content that the model illustrates and the underlying constructs that emerge, may provide some insightful information about the optimisation of specific product attributes for maximum attractiveness. Further, the condition of the brand held by users and the point at which, for them, product attractiveness declines, is often complex, intangible and difficult to establish. Planning new product development activities within this context can, therefore, be highly judgemental and somewhat inaccurate. This application of Martindale's model potentially makes the current, and possibly the future condition of the brand clearer. Accordingly, product and brand managers in general may find this information useful in positioning or manipulating new product cycle plans that align with potential changes in user opinion, or in informing brand supporting activities, where the attributes of the product are discussed, like launch advertising, press messages and retail promotions.

To summarise, the methodology identified can be described as a Brand-Product Attribute Specification Strategy ('brand-PASS') and can be drawn as a process model which provides access to the branded product cognitive category for all designers, engineers and marketers (Figure 6.3).

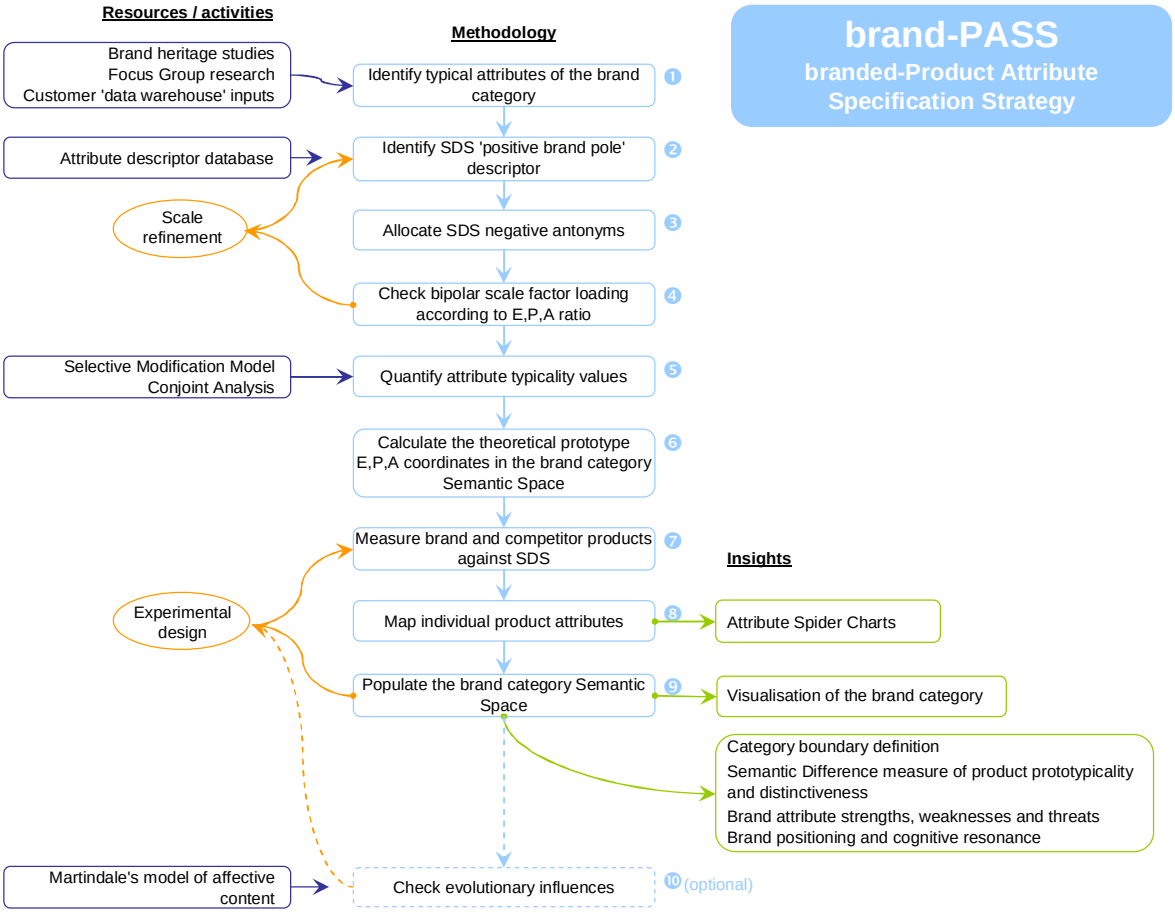


Figure 6.3. The ‘brand-PASS’ methodology.

6.5. Limitations of the research

A number of limitations of the research have been discussed within the Thesis. These predominantly centre on two problems; firstly, the reliability of the linguistic approach to measuring cognitive categorisation and secondly, the validity of using internal company subjects to assess product examples. A third problem will also be discussed here; the demographic of the study subjects in studies 1, 2, 3 and 5 to 10 inclusive.

Within the Literature Review the apparent central role that language plays in the cognitive process, or mentation, as suggested by Pinker (1997 & 2007), was discussed. Following that premise, some studies have found that the linguistically based Semantic

Differentiation technique is a reliable cognitive interpreter of affective responses to concept stimuli (Franzen & Bouwman, 2001; Gatty, 1972; Heise, 1970; Martindale, 1990; Mindak, 1961; St-Jacques & Barrière, 2006). However, Berlin (1980) proposed that language is not logically perfect; the correspondence between the object's properties and the concept, the signifier and signified or the evolutionary algorithm and the meme, cannot always be irrefutable and empirically stable. It is possible, therefore, for the construction of an efficient set of property scales that adequately describe the concept to be problematic (see Table 1). Even though Osgood, May & Miron (1975) found affective meaning responses measured by semantic differentiation to be repeatable across cultures and languages, some caution and exhaustive validation appears advisable when considering SD methodologies for branded product categorisation tasks. Nevertheless, by combining a 'saturated' grounded approach to scale definition and continual refinement through multiple tests, the methodology in this research proved not only reliable but also efficient and economical in application within a commercial framework. However, recognising potential linguistic variability, the product locations described within the semantic spaces in studies 6 to 10 were drawn with large diameter circles.

It is conceivable also that a number of the metaphysical scales employed in this research could be supported by quantitative measures that add accuracy, definition and richness to the linguistically based SD measures. For example; the property part stiffness / robustness could also be described and measured by force / deflection characteristics that might be specified to correspond to specific SDS increments (section 6.6 will discuss this proposal in more detail). However, converting all of the property SDS's to quantitative measures also appears problematic. For example; no natural physical definitions yet exist for Veneer Handcraftedness; here the SD technique appears to be the most appropriate measurement methodology available.

Further, although no specific language comparison studies were conducted as part of this research, alternative language variability studies (e.g.: Kroch, 1989; Yang, 2000) suggest that the patterns in affective content of motoring journal texts described in chapter 5 are more likely to be a direct reaction to product stimuli rather than natural variation in general language. Nevertheless, further research to check alternative but contemporary texts to those studied might add validity to the apparent results.

The problem of the validity of using internal company subjects to assess product examples was previously discussed in section 1.5. Here, consideration was given to other studies that suggest that non-expert or expert-peer assessments do not vary significantly to expert assessments (Cho et al., 2008; Reece et al., 1998; Snow et al., 2008). The number of participants in studies 6-10 (101 in total), the variability of the test environments and the fact that the methodology employed to assess and measure properties was new to the company, all also suggest that the methodology is valid. However, to provide an alternative validation to the inter-company expert and expert-peer assessments made in studies 2, 3 and 5 to 10, and the branded product categorisation conclusions drawn from them, a programme of research with external sources like customers or prospective customers would be useful. Due to the nature of the Bentley customer population, this was not considered practical within the scope of this research, and risked potential problems of statistical significance with any results taken from it. However, other researchers may consider this approach if the external view is easier to obtain and the subject sample sizes are larger.

The demographic of subjects participating in studies 1, 2, 3 and 5 to 10 inclusive may also be of some concern, as it was highly skewed towards a predominately male composition (average of all studies; 91.5% male, 8.5% female; maximum 28.5% female, minimum 0% female. See Appendix 4). Some research has found that in tests of emotionally based reactive assessments to stimuli, there can be a difference in responses between the

sexes (e.g.: Bradley et al., 2001; Wrase et al., 2003). However, any such differences appear to exist at extremes of stimuli (e.g.: erotic or threatening images), with neutral stimuli like, for example, household objects, inducing broadly similar responses from male and female subjects (Bradley et al., 2001). Further, the test demographic in this research, although skewed, closely reflects the Bentley customer gender mix (≈ 10% female) and was generally well spread across the age-range (21 – 60 years, Appendix 4) except for study 1, where the narrow age range has already been discussed (section 2.3.3). Therefore, it appears unlikely that any further bias due to demographics is present in that prejudices the applicability of the results to the subject brand category in this case. Indeed, no qualitative differences were noted during each study. However, in other brand categories, gender mix may be more sensitive, so other researchers are advised to consider an appropriately balanced demographic.

6.6. Recommendations for future research

Like section 6.4; the implications for research and product development, the recommendations for future research will be considered firstly within the context of the immediate field of design, engineering and marketing high-luxury automotive interiors, and secondly, in a wider context of general product and brand development.

Section 6.5 described the possibility of the development of a set of quantitative property measures to complement the qualitative property SDS. For some of the 20 properties identified as specifying the typicality of products within the Bentley Interior category, this appears somewhat reasonable and realistically achievable. For example (as discussed) part stiffness / robustness could be measured and described by force (Nm) / deflection (mm) characteristics; trim panel softness could be measured and described by Bauchometer values, as could softness harmony (by setting tolerance limits); control

functionality refinement and harmony might be measured and described by a combination of force (Nm) to operate, speed (m/s) of operation (which may not be linear, nor equal for opening and closing) and noise (dB), within specific tolerance limits. A methodology for arriving at such values might follow the measurement of product examples post the subjective assessments using the Bentley Interior SDS. Where measured values can be identified that correspond to subjective ratings, quantified specifications may be set and typicality zones possibly identified. Figure 6.4 illustrates a possible force / speed plot for control functionality refinement and harmony.

However, as also noted in section 6.5, there are a limited number of Bentley Interior properties for which complementary quantitative measures can be immediately identified. Further research into the identification of both values for those that are interpretable and measures for those that appear not interpretable might therefore be advantageous to the further development of the methodology identified in this research.

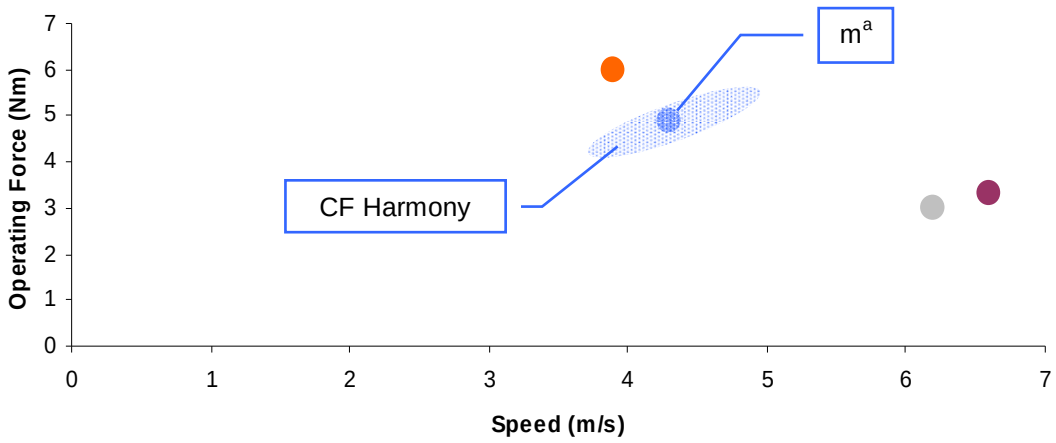


Figure 6.4. Bentley Interior properties Control Functionality Refinement and Harmony, possible quantitative measures (data positions for illustrative purposes only).

As question 4 from the Research Objectives was only partially answered in chapter 5 with respect to the predictive nature of the brand category taken from Martindale's (1990)

model, further repetitive tests to validate the suggested findings over forthcoming periods would be useful. Building a long-term database from the cognitive categorisation assessment and measurement methodology will inevitably help the refinement of the predictive model as anticipated positions can be back-checked to their achieved positions. Once further confidence in the methodology is achieved, discrete property manipulation exercises might be conducted to understand how this affects the obtained results in later periods.

Within the wider context, the design methodology proposed might prove useful for other automotive product features, in other product categories and for other brands. Indeed, further confidence in it would be obtained if repeatability in alternative applications was demonstrated - it appears plausible that it would be both applicable and beneficial beyond the scope of this research. Therefore, the wider benefits to product strategy, design, engineering and marketing suggested in section 6.4 might be realised.

The exploration of Martindale's (1990) model of affective content within commerce (in the case of branding) potentially opens up wider applications than those previously imagined by the originator and not subsequently explored in other research. Indeed, further studies might provide new understanding to underlying evolutionary effects within product development and wider cultural or business fields, thereby providing some supporting data for memetic theories within design and branding.

In either case, the Branded Product Attribute Specification Strategy ('brand-PASS') proposed from this research appears to have some benefit outside the immediate area of application made in this Thesis; to product development, brand development and commerce generally, and possibly other fields concerned with the created concept.

7. References

Bibliography

ABBOTT, M.; SHACKLETON, J.P.; HOLLAND, R.; GUEST, P.; JENKINS, M-J., 2006. Engineering Emotional Identities in High-Luxury Vehicles, Proceedings from 5th. International Conference on Design and Emotion, Sweden 2006.

ABBOTT, M.; SHACKLETON, J.P.; HOLLAND, R. 2007. 'Brand' as Category: An Analysis of Categorisation and Branded Product Concepts, Proceedings from International Association of Societies of Design Research (IASDR) 07, Hong Kong, 12th. – 15th. November 2007.

ABBOTT, M.; SHACKLETON, J.P.; HOLLAND, R. 2008a. Measuring the Brand Category Through Semantic Differentiation. *Journal of Product & Brand Management,* 17 (4) pp. 223-233.

ABBOTT, M.; SHACKLETON, J.P.; HOLLAND, R.; GUEST, P.; JENKINS, M-J., 2008b. Engineering Emotional Identities in High-Luxury Vehicles in P. DESMET, J. VAN ERP, and M-A. KARLSSON, eds. *Design & Emotion Moves,* Newcastle, UK: Cambridge Scholars Publishing, pp 13-35.

ABBOTT, M.; HOLLAND, R., GIACOMIN, J.; and SHACKLETON, J.P., (2009), Changing Affective Content in Brand and Product Attributes. *Journal of Product and Brand Management*, 18 (1) pp17-26.

AAKER, D., A, 1991. Managing Brand Equity; Capitalizing on the Value of a Brand Name. NY, USA: The Free Press.

ACCENTURE, 2005. High Performance in the Automotive Industry. www.autoassembly.mckinsey.com edn. McKinsey and Company.

ALEXANDER, M., 1996. The Myth at the Heart of the Brand. Available: www.semioticsolutions.com: ESOMAR Seminar; The Big Brand Challenge [March 2006].

ANTLITZ, ARNO., DR. ET AL, 2004. Hands on the Wheel; What Customers Really Want From the Automotive Industry. www.autoassembly.mckinsey.com edn. McKinsey and Company.

AUTOWEB, 2002. Bentley GT Coupe; The Marketing Story. Available: www.autoweb.com.au

BARNES, N. and ZHI-QIANG, L., 2004. Embodied Categorisation for Vision-guided Mobile Robots. *The Journal of Pattern Recognition Society,* 37, pp. 299.

BARROFF, R., 2006. Editorial. *Interior Motives,* Jan / Feb 2006.

BARSALOU, L.W., 1985. Ideals, Central Tendency and Frequency of Instantiation as Determinants of Graded Structure in Categories. *Journal of Experimental Psychology: Learning, Memory and Cognition,* 11(4), pp. 629-654.

BARSALOU, L.W., 1983. Ad Hoc Categories. *Memory & Cognition,* 11(3), pp. 211-227.

BASUNTI, A., 2004. Semiotics and Marketing in the United Kingdom: An Explorative Study. Manuscript, London School of Economics and Political Science.

BATRA, R., LENK, P. and WEDEL, M., 2006. Separating Brand from Category Personality. Manuscript, University of Michigan.

BAUMULLER, N., CORNET, A. and ERBENICH, C., 2005. Brand Leverage - Successfully Building Brands Beyond the Obvious. www.autoassembly.mckinsey.com edn. McKinsey and Company.

BAYLEY, S., 2005. Aston Martin V8 Vantage. *Car Magazine,* October 2005. pp.120.

BELK, R.W., 1988. Possessions and the Extended Self. *Journal of Consumer Research*, 15(2), pp. 139-168.

BERLIN, I., 1980. Concepts and Categories – Philosophical Essays. London, UK: Oxford University Press.

BHISE, V.D., HAMMOUDEH, R., NAGARAJAN, R., DOWD, J.D. and HAYES, M., 2005. Towards Development of a Methodology to Measure Perception of Quality of Interior Materials. *SAE,* 2005-01-0973.

BLACKMORE, S., 2001. Evolution and Memes: The Human Brain as a Selective Imitation Device. *Cybernetics and Systems,* 32, pp. 225-255.

BLACKMORE, S., 2000. The Meme Machine. Oxford, UK: Oxford University Press.

BOUSH, D.M., 1993. Brands as Categories. In: D.A. AAKER and A.L. BIEL, eds, *Brand Equity and Advertising: Advertising's Role in Building Strong Brands.* NJ, USA: Lawrence Erlbaum Associates, pp. 299-313.

BRADLEY, M.M., CODISPOTI, M., SABATINELLI, D. and LANG, P.J., 2001. Emotion and Motivation II: Sex Differences in Picture Processing. *Emotion,* 1(3), pp. 300-319.

CARBON, C., HUTZLER, F. and MINGE, M., 2006. Innovativeness in Design Investigated by Eye Movements and Pupillometry. *Psychology Science,* 48(2), pp. 173-186.

CARBON, C. and LEDER, H., 2005. The Repeated Evaluation Technique (RET). A Method to Capture Dynamic Effects of Innovativeness and Attractiveness. *Applied Cognitive Psychology,* 19, pp. 587-601.

CARBONARO, S. and VOTAVA, C., 2005. Paths to a New Prosperity. *The Nordic Textile Journal*.

CASTELFRANCHI, C., 2003. Cognitive Systems: Towards an Integration of Symbolic and Sensor-Motor Intelligence? *ERCIM News,* (53), pp. 10.

CHI, M. T. H., FELTOVICH, P. J., and GLASER, R., 1981. Categorisation and Representation of Physics Problems by Experts and Novices. *Cognitive Science,* 5(2), pp. 121-152.

CHO, K., CHUNG, T.R., KING, W. R., and SCHUNN, C., 2008. Peer-Based Computer-Supported Knowledge Refinement. *Communications of the ACM,* 51(3), pp. 83-88.

CHANDLER, D., 2002. Semiotics: The Basics. 5 edn. Abingdon, UK: Routledge.

CHELIOTIS, S. 2007. CoolBrands 2007/08 – The Road to Cool. In: COOPER, A, ed, *CoolBrands,* London, UK: Superbrands, pp.148-151.

CLARKE, A., 1993. Sensory Qualities. Oxford University Press.

CORBIN, J. and STRAUSS, A., 1990. Grounded Theory Research: Procedures, Canons and Evaluative Criteria. *Qualitative Sociology,* 13(1), pp. 3-21.

CORNET, A. and KRIEGER, A., 2005. Customer-Driven Innovation Management. www.autoassembly.mckinsey.com edn. McKinsey and Company.

CZELLAR, S., 2003. Consumer Attitude Toward Brand Extensions: an Integrative Model and Research Propositions. *International Journal of Research in Marketing,* 20, pp. 97-115.

DANNENBERG, J. and KLEINHANS, C., 2004. The Coming Age of Collaboration in the Automotive Industry. *Mercer Management Journal,* June 2004.

DAWKINS, R., 1976. The Selfish Gene. 1989 edn. Oxford, UK: Oxford University Press.

DE CHERNATONY, L. and MCDONALD, M., 2003. Creating Powerful Brands. 3 edn. Oxford, UK: Elsevier Butterworth Heinemann.

DEAN, D.H., 2004. Evaluating Potential Brand Associations Through Conjoint Analysis and Market Simulation. *Journal of Product & Brand Management,* 13(7), pp. 506-513.

DEJEAN, J., 2005. The Essence of Style. Available: www.luxuryculture.com [November 2005].

DEJONG, M., 1999. Survival of the Institutionally Fittest Concepts. *Journal of Memetics - Evolutionary Models of Information Transmission,* 3(1), pp. 5-21.

DI RISO, G., GHISLANZONI, G. and SCALABRINI, G., Selling the Sizzle - 'Super Car' Marketing in Europe. www.autoassembly.mckinsey.com edn. McKinsey and Company.

DOWNES, S., 1999. Hacking Memes. *First Monday,* 4(10).

ECO, U., 1985. Producing Signs. In: M. BLONSKY, ed, *On Signs.* 1 edn. Oxford, UK: Basil Blackwell, pp. 176-183.

ECO, U., 1976. A Theory of Semiotics. 1 edn. Ontario, Canada: Indiana University Press.

EISENSTEIN, P.A., 2004. Maybach Learning Some Costly Lessons. Available: www.TheCarConnection.com. [March 2004].

ELLISON, H., 2007. The Quest for Authenticity. *LuxeAsia*. Supplement, International Herald Tribune, September 2007. pp. 16-17.

FEAST, R., 2004. The DNA of Bentley - Rich Heritage. Challenging Future. 1 edn. St. Paul, USA: Motorbooks International.

FISHER, H., 2003. Categories and Embodied Objects. *Theory and Psychology,* 13(2), pp. 239.

FODOR, J.A., 1998. Concepts: Where Cognitive Sciences Went Wrong. Oxford, UK: Oxford University Press.

FRANZEN, G. and BOUWMAN, M., 2001. The Mental World of Brands - Mind, Memory and Brand Success. Oxford, UK: World Advertising Research Centre.

GABLIK, S., 1985. Magritte. London, England: Thames and Hudson.

GATTY, R., 1972. Semantic Differential Technique: A Sourcebook (book review). *Journal of Marketing Research,* 9(1), pp. 111-117.

GENTILUCCI, M. and CORBALLIS, M.C., 2007. The Hominid that Talked. In: C. PASTERNAK, ed, *What Makes Us Human?* Oxford, England: Oneworld, pp. 49-70.

GIFI, A.,1990. Nonlinear Multivariate Analysis: Wiley.

GLASER, B.G., 2002. Constructivist Grounded Theory? *Forum Qualitative Social Research,* 3(3).

GOBE, M., 2001. Emotional Branding – The New Paradigm for Connecting Brands to People. New York, USA. Allworth Press.

GONZALEZ, R.W., 2006. Brand Strategy and Design; The Accelerating Importance of Design in Creating Compelling Appeal and Differentiation. Amicus Group Whitepapers. 14.

GOULDING, C., 1998. Grounded Theory: The Missing Methodology on the Interpritivist Agenda. *Qualitative Market Research,* 1(1), pp. 50-57.

GRAYSON, K. and MARTINEC, R., 2004. Consumer Perceptions of Iconicity and Indexicality and Their Influence on Assessments of Authentic Market Offerings. *Journal of Consumer Research,* 31, pp. 296.

GREEN, G., 2007. The Year of Shattered Dreams. *Car Magazine,* December 2007, pp. 114-116.

GRUNTEGS, V., GRUPEN, C., HOELSCHER, A., MITCHKE, M. and WUNRAM, J., 2005. Customer Driven; How to Achieve Sales and Marketing Excellence. www.autoassembly.mckinsey.com edn. McKinsey and Company.

GUERIN, J., 2004. Kansei Engineering for Commercial Airplane Interior Architecture, July 10th. 2004, 16th. QFD Symposium.

GUMMESSON, E., 2001. Are Current Research Approaches in Marketing Leading Us Astray? *Marketing Theory,* 1(1), pp. 27-48.

HAMPTON, J. 2006. Conceptual Combination. Available: www.staff.city.ac.uk/hampton/combination [July, 2006].

HARVEY, M. and EVANS, M., 2001. Decoding Competitive Propositions; A Semiotic Alternative to Traditional Advertising Research. *International Journal of Market Research,* 43(2), pp. 171-187.

HAUG, K., MALORNY, C., MERCER, G. and ZIELKE, A., 2006. Nissan Outperforms Again. Available: www.autoassembly.mckinsey.com [May, 2006].

HAYES, B.E., 1998. Measuring Customer Satisfaction; Survey design, use and statistical analysis methods. Wisconsin, USA. American Society for Quality.

HEATON, C. and GIZZO, R., 2005. Delivering on the Brand Promise; Making Every Employee a Brand Manager. Available: www.autoassembly.mckinsey.com

HEISE, D.R., 1970. The Semantic Differential and Attitude Research. In: G.F. SUMMERS, ed, *Attitude Measurement.* Chicago, USA: Rand McNally, pp. 235-253.

HEKKERT, P., SNELDERS, D. and VAN WIERINGEN, PIET C.W., 2003. 'Most Advanced Yet Acceptable': Typicality and Novelty as Joint Predictors of Aesthetic Preference in Industrial Design. *British Journal of Psychology,* 94, pp. 111-124.

HENDERSON, G.R., IACOBUCCI, D. and CALDER, B.J., 1998. Brand Diagnostics: Mapping Branding Effects Using Consumer Associative Networks. *European Journal of Operational Research,* 111, pp. 306-327.

HJORTH, D. and PELZER, P., 2007. The Fate of Phaeton: Baroque Art for Management's Sake? *Organisation,* 14(6), pp. 869-886.

HODGKINSON, T., 1993. The Affluence of Theory. *New Statesman & Society,* (12th March 1993), pp. 31.

JACOBY, S., 2006. Living the Brand: The Potential of Marketing Innovation. 3rd. World Marketing Conference (Volkswagen), Wolfsburg, Germany, 28th / 29th June 2006.

JENCKS, C., 1987. Le Corbusier and the Tragic View of Architecture. Middlesex, England: Penguin Books.

JOINER, C. and LOKEN, B., 1998. The Inclusion Effect and Category-Based Induction: Theory and Application to Brand Categories. *Journal of Consumer Psychology,* 7(2), pp. 101-129.

KANO, N., SERAKU, N., TAKAHASHI, F. and TSUJI, S., 1984. Attractive Quality and Must-Be Quality. *Translation from 'Hinshitsu' (Quality, The Journal of the Japanese Society for Quality Control),* 14(2). pp 39-48.

KARJALAINEN, T., 2005. Safe Shoulders and Personal Faces: Transforming Brand Strategy to Product Design, *Proceedings of the 12th. International Product Development Management Conference,* Copenhagen, Denmark. 12th. - 14th. June 2005.

KARJALAINEN, T. and WARELL, A., 2005. Do You Recognise This Tea Flask ? Transformation of Brand-specific Product Identity Through Visual Design Dues, *International Design Congress 2005,* 1st - 4th. November 2005.

KELLER, K.L., 1993. Conceptualizing, Measuring, and Managing Customer-Based Brand Equity. *Journal of Marketing,* 57(1), pp. 1-22.

KENNY, A., ed, 1994. *The Wittgenstein Reader.* Blackwell Publishing.

KLEINE, R.E. and KERNAN, J.B., 1991. Contextual Influences on the Meanings Ascribed to Ordinary Consumption Objects. *Journal of Consumer Research,* 18(3), pp. 311.

KOLVENBACH, C., KRIEG, S. and FELTEN, S., 2003. Evaluating Brand Value – A Conjoint Measurement Application for the Automotive Industry. In: A. GUSTAFSON, A. HERRMANN and F. HUBER eds. *Conjoint Measurement: Methods and Applications*. Springer Verlag.

KÖRNER, W.S., 1955. Kant. Middlesex, England: Penguin Books.

KOSLOW, S., 1999. Conjoint Analysis. In: P.E. EARL and S. KEMP, eds, *Consumer Research and Economic Psychology.* Cheltenham, UK: Edward Elgar.

KREUZBAUER, R. and MALTER, A.J., 2005. Embodied Cognition and New Product Design: Changing Product Form to Influence Brand Categorisation. *Journal of Product Innovation Management,* 22, pp. 165-176.

KROCH, A., 1989. Reflexes in Grammar in Patterns of Language Change. *Language Variation and Change*, 1, pp.199-244.

KROCH, A., 2001. Syntatic Change. In: M. BALTIN and C. COLLINS, eds, *Handbook of Contemporary Syntatic Theory.* Wiley-Blackwell.

LACAN, J., 1985. Sign, Symbol, Imagery. In: M. BLONSKY, ed, *On Signs.* 1 edn. Oxford, UK: Basil Blackwell, pp. 203-209.

LAKOFF, G., 1987. Women, Fire and Dangerous Things. Chicago, USA: University of Chicago Press.

LEE, S., HARADA, A. and STAPPERS, P.J., 2004. Pleasure with Products: Design Based on Kansei. Available: www.studiolab.io.tudelft.nl [1st. December, 2006].

LEVI-STRAUSS, C., 1963. Structural Anthropology. Oxford, UK: Basic Books.

LINDSTROM, M., 2005. Brand Sense; How to Build Powerful Brands Through Touch, Taste, Smell, Sight and Sound. London, UK: Kogan Page.

LOKEN, B., JOINER, C. and PECK, J., 2002. Category Attitude Measures: Exemplars as Inputs. *Journal of Consumer Psychology,* 12(2), pp. 149-161.

LOW, J. and BLOIS, K., 2002. The Evolution of Generic Brands in Industrial Markets: The Challenges to Owners of Brand Equity. *Industrial Marketing Management,* 31, pp. 385-392.

MACFARQUHAR, L., 1994. This Semiotician Went To Market. *Lingua Franca,* (September / October 1994), pp. 59-79.

MARGOLIS, E. and LAWRENCE, S., eds, 1999. *Concepts - Core Readings.* Cambridge, Massachusetts, USA: MIT Press.

MARSDEN, P., 2002. Brand Positioning: Meme's the Word. *Marketing Intelligence & Planning,* 20(5), pp. 307-312.

MARTIN, C.L., 1998. Relationship Marketing: A High-involvement Product Attribute Approach. *Journal of Product & Brand Management,* 7(1), pp. 6.

MARTINDALE, C., 1990. The Clockwork Muse; The Predictability of Artistic Change. USA: Basic Books.

MARTINDALE, C., 1986. The Evolution of Italian Painting: A Quantitative Investigation of Trends in Style and Content from the Late Gothic to the Rococo Period. *Leonardo,* 19(3), pp. 217-222.

MARTINDALE, C. and UEMURA, A., 1983. Stylistic Evolution in European Music. *Leonardo,* 16(3), pp. 225-228.

MASON, K. and BEQUETTE, J., 1998. Product Experience and Consumer Product Attribute Inference Accuracy. *Journal of Consumer Marketing,* 15(4), pp. 343.

MCCORMICK, J., 2005. Bentley Finds the Super-Luxury Sweet Spot. *Detroit News,* July 2005.

MEYVIS, T. and JANISZEWSKI, C., 2002. When are Broader Brands Stronger Brands? An Accessibility Perspective on the Formation of Brand Equity. Available: www.cba.ufl.edu [27th. July, 2006].

MILLIKAN, R. G., 1984. Language, Thought and other Biological Categories. Cambridge, Massachusetts, USA: MIT Press.

MINDAK, W.A., 1961. Fitting the Semantic Differential to the Marketing Problem. *Journal of Marketing,* 25(4), pp. 28-33.

MULLER-PIETRALLA, W., 2005. Desire. Exclusivness. Future of Luxury. Unpublished; personal communication.

NAUGHTON, J., 2006. iPod, Icon: How the Little White Box Came to Define our Social Age. *The Observer,* 22nd. October 2006, pp. 10.

NELSON, P.N., 1999. Multiattribute Utility Models. *Elgar Companion to Consumer Research and Economic Psychology*, 1999. pp. 392-400.

NIYOGI, P., and BERWICK, B. C., 1995. The Logical Problem of Language Change. Manuscript. MIT Artificial Intelligence Laboratory. Available: www.student.bu.ac.bd/~mumit/Research/NLP-bib/papers/Niyogi95.pdf [20th. January 2009].

NORDGREN, A., AOYAMA, H., 2006. A Study on the Discrepancies of Kansei Data for Representations of Complex Artifacts. Unpublished – personal communication.

OSGOOD, C.E., MAY, W.H. and MIRON, M.S., 1975. Cross-Cultural Universals of Affective Meaning. 1 edn. University of Illinois Press.

OSGOOD, C.E., SUCI, G.J. and TANNENBAUM, P.H., 1957. The Measurement of Meaning. Illinois, USA: University of Illinois Press.

PAN, Y. and LEHMANN, D.R., 1993. The Influence of New Brand Entry on Subjective Brand Judgements. *Journal of Consumer Research,* 20(1), pp. 76-86.

PEARLFISHER, 2005. Lifemodes. Unpublished; personal communication.

PECH, R.J., 2003. Memetics and Innovation: Profit through Balanced Meme Management. *European Journal of Innovation Management,* 6(2), pp. 111-117.

PHILLIPS, C., December 2005. Branding From the Inside Out: How to Approach Brand Strategy, Brand Measurement and the Management of Brands as Assets. BrandAmplitude. Available: www.brandamplitude.com. [December 2005].

PINKER, S., 2007. The Stuff of Thought. London, UK: Allen Lane / Penguin.

PINKER, S., 1997. How the Mind Works. London, UK: Penguin.

QUESTER, P.G. and SMART, J., 1998. The Influence of Consumption Situation and Product Involvement over Consumers' use of Product Attribute. *Journal of Consumer Marketing,* 15(3), pp. 220.

RATNESHWAR, S. and SHOCKER, A.D., 1991. Substitution in Use and the Role of Usage Context in Product Category Structures. *Journal of Marketing Research,* 28(3), pp. 281-295.

RATNESHWAR, S., SHOCKER, A.D. and STEWART, D.W., 1987. Toward Understanding the Attraction Effect: The Implications of Product Stimulus, Meaningfulness and Familiarity. *Journal of Consumer Research,* 13(4), pp. 520-533.

REECE, W.J., MATTHEWS, L. J., BURGGRAFF, L. K., 1998. Estimating Production Potentials: Expert Bias in Applied Decision Making, Idaho National Engineering & Environmental Laboratory. INEEL/CON-99-01115.

REY, G., 1999. Concepts and Stereotypes. In: E. MARGOLIS and S. LAWRENCE, eds, *Concepts - Core Readings.* Massachusetts, USA: MIT Press.

REYNOLDS, T.J. and PHILLIPS, C.B., 2005. In Search of True Brand Equity Metrics: All Market Share Ain't Created Equal. *Journal of Advertising Research,* June 2005.

ROMANIUK, J. and SHARP, B., 2004. Conceptualizing and Measuring Brand Salience. *Marketing Theory,* 4(4), pp. 327-342.

ROSCH, E., 1999. Principles of Categorisation. In: E. MARGOLIS and S. LAWRENCE, eds, *Concepts - Core Readings.* Massachusetts, USA: MIT Press.

ROWLAND, G. and EVANS, M., 1994. Topographers of the Galactic Frontier. *co-design,* 3(1), pp. 84.

RUST, R.T., ZEITHAML, V.A. and LEMON, K.N., 2004. Customer-Centred Brand Management. *Harvard Business Review,* September 2004.

SCHUTTE, S., 2005. Engineering Emotional Values in Product Design, Linkopings University. Doctoral Thesis.

SHACKLETON, J.P., 1996. The Application of a 'Prototype Theory' Framework to the Modeling of Product Perception and the Emergence of New Product Groups, Chiba University, Japan. Doctoral Thesis.

SHULDINER, H., 2005. Cars for Connoisseures. Available: www.chiefexecutive.net

SIMMS, C.D. and TROTT, P., 2006. The Perceptions of the BMW Mini Brand: The Importance of Historical Associations and the Development of a Model. *Journal of Product and Brand Management,* 15(4), pp. 228-238.

SIMON, H.A., 1996. Sciences of the Artificial. Third edn. Cambridge, Massachusetts: MIT Press.

SMITH, D., 2006. Why the iPod is Losing its Cool. *The Observer,* 10th. September 2006, pp. 3.

SMITH, E.E., OSHERSON, D.N., RIPS, L.J. and KEANE, M., 1988. Combining Prototypes: A Selective Modification Model. *Cognitive Science,* 12, pp. 485-527.

SMITH, E. and MEDIN, D., 1999. The Exemplar View. In: E. MARGOLIS and S. LAWRENCE, eds, *Concepts - Core Readings.* Massachusetts, USA: MIT Press.

SNELDERS, D. and HEKKERT, P., 1999. Association Measures as Predictors of Product Originality. *Advances in Consumer Research,* 26, pp. 588-592.

SNOW, R., O'CONNOR, B., JURAFSKY, D., NG, A.Y., 2008. Cheap and Fast – But is it Good?; Evaluating Non-Expert Annotations for Natural Language Tasks. *Proceedings of the 2008 Conference on Empirical Methods in Natural Language Processing*, Honolulu, October 2008.

SOLOMON, K.O. and BARSALOU, L.W., 2001. Representing Properties Locally. *Cognitive Psychology,* 43, pp. 129-169.

SPRING, P. and WOOD, J., 2005. The Role of Memetics in Metadesign. Available: www.attainable-utopias.org [June 6th. 2008].

ST-JACQUES, C. and BARRIERE, C., 2006. Similarity Judgments: Philosophical, Psychological and Mathematical Justifications, July 2006, *Association of Computational Lingusitics*, pp. 8-15.

TAYLOR, A., III, 2003. Luxury Cars - Got $300,000?; These Cars Are For You. *Fortune,* January 2003.

VALENTINE, V., 2002. Repositioning Research: A New MR Language model, *MRS Annual Conference,* 2002.

VALENTINE, V. and EVANS, M., 1993. The Dark Side of the Onion; Rethinking 'Rational' and 'Emotional' Responses. *Journal of the Market Research Society,* 35(2), pp. 125-143.

VALENTINE, V. and GORDON, W., 2000. The 21st. Century Consumer - A New Model of Thinking, *MRS Annual Conference,* 2000.

VERYZER, R. W., HUTCHINSON, J. W., 1998. The Influence of Unity and Prototypicality on Aesthetic Responses to New Product Designs. *Journal of Consumer Research,* 24, pp. 374-394.

WARELL, A., 2006. Identity Recognition in Product Design: An Approach for Design Management, *13th. International Product Development Management Conference,* 11th - 13th. June 2006, European Institute for Advanced Studies in Management (EIASM). Milan, Italy.

WARELL, A., FJELLNER, C. and STRIDSMAN-DAHLSTROM, J., 2006. Visual Product Identity: Understanding Identity Perceptions Conveyed by Visual Product Identity, *5th. International Conference on Design & Emotion,* Gothenburg, Sweden, 27th - 29th September 2006.

WARLOP, L., RATNESHWAR, S. and VAN OSSELAER, STIJN M. J., 2006. On the Role of Distinctive Brand Cues in Learning Product Quality From Consumption Experience. Available: www.econ.kuleuven.ac.be [November 1st., 2006].

WIEDERMANN, J. and BERAN, M., 2003. The Cogitoid: Towards a Computational Model of the Mind. *ERCIM News,* (53), pp. 19.

WOOD, J., The Wisdom of Nature = The Nature of Wisdom, April 2003. Available: www.attainable-utopias.org [June 6th., 2008].

WRASE, J., KLEIN, S., GRUESSER, S.M., HERMANN, D., FLOR, H., MANN, K., BRAUS, D.F., HEINZ, A., 2003. Gender differences in the processing of standardized emotional visual stimuli in humans: a functional magnetic resonance imaging study. *Neuroscience Letters,* 348, pp 41-45.

WU, Y. and ARDLEY, B., 2001. Brand Strategy and Brand Evolution; Welcome to the World of the Meme. *The Marketing Review,* 7(3), pp. 301-310.

YANG, C.D., 2000. Internal and External Forces in Language Change. *Language Variation and Change,* 12, pp. 231-250.

YORK, P., 2006. From Victorian Values to a License to Print Money. *The Sunday Times,* 23rd. July 2006. Superbrands Supplement, pp. 3.

ZAIRI, M., 1993. Quality Function Deployment: A Modern Competitive Tool. England: Technical Communications (Publishing) Ltd.

ZHANG, L. and SHEN, W., 1999. Sensory Evaluation of Commercial Truck Interiors, SAE. 1999-01-1267.

Picture References

(all web references available 30th. July 2009)

Figure 1.9:

www.homodiscens.com/core_content/ways_of_knowing/image_g/magrittepipe.jpg

Figure 1.14: www.weblogs.newsday.com/sports/football/bob_blog/penguin.jpg;

www.whatbird.wildbird.com/obj/74/_/target.aspx;

www.rspb.org.uk/wildlife/birdguide/name/r/robin/index.asp;

www.rspb.org.uk/wildlife/birdguide/name/s/swallow/index.asp;

www.netstate.com/states/symb/birds/images/de_blue_hen_chicken.jpg;

www.wildanimalsonline.com/birds/ostrich-struthiocamelus.jpg

Figure 1.16: www.futurebrain.free.fr/wp_content/windowslivewriteranotherannoyingtrend-3149ghetto-blaster-051216035418598-wideweb-300x3752.jpg;

www.retropod.com/images/retropod_hip.jpg; www.nevada.com.mk/pd-594167956.htm

Figure 1.17: www.eplacencia.wordpress.com/2008/03/17/452/

Figure 1.18: http://images.businessweek.com/ss/06/01/3_wheel_cars/image/intro.jpg;

www.edmuns.com/media/raidtests/firstdrive/2007/07.toyota.yaris/07.toyota.yaris.340.jpg;

www.wintonsworld.com/cars/a-cars-2004/2004-carpics/paris-04/ford-focus-1.jpg;

www.carforums.net/reviews/makes/pictures/Chrysler12.jpg;

www.californiaexecutivecoach.com/photos/imagelg.jpg

Figure 1.19 - Bentley Motors Limited, 2006

Figure 1.20 – www.porsche-design.com; www.car-rims-wheels.blogspot.com/2009/05/porsche-911-and -rims.html;

www.actualauto.org/img/2008_Porsche_Cayenne_5.jpg

Table 3 -

Pic.	Source	Pic.	Source
1	http://forums.ffonline.com/showtrend.php?t=51766	34	image unavailable
2	www.vacuumcritic.com/dyson	35	www.opera.com/mini/download/nokia/nokia_6225/
3	www.110220volts.com/Merchant2/graphics/00000001/7160.jpg	36	www.physorg.com/news9521.html
4	www.peddernissan.com/New-VehicleResearch.aspx	37	image unavailable
5	image unavailable	38	http://squeekyclean.co.za/wordpress/?p=3
6	www.endgadget.com/2004/09/27/toshiba-new-gadget-mp3-players/	39	image unavailable
7	www.autosite.com/content/shared/articles/templates/index.cfm/article_id_int/374	40	www.ciao.co.uk/Panasonic_MCE4051__6371537
8	www.bestvacuum.com/bosch-vacuum-cleaner.html	41	www.km77.com/marcas/toyota/yaris_03/0primera/med/37.jpg
9	www.abantucommunications.com/catalog/index.php?manufacturers_id=6	42	www.uk.samsungmobile.com/mobile-phones/samsung-m300-specification
10	www.adobe.com/devnet/mobile/articles/sony_clie.html	43	image unavailable
11	www.carforums.net/reviews/makes/Cadillac.html	44	http://reviews.zdnet.co.uk/hardware/audio/0,1000000948,10003937,00.htm
12	www.car.kak.net/2003/11/13/2004-volkswagen-new-beetle-convertible-delivering-even-more-safety-and-fun/	45	http://pdadb.net/index.php?m=specs&id=897&c=nokia_3600
13	www.livingroom.org.au/cameraphone/archives/motorola_v560.php	46	http://www.bestvacuum.com/sebo.html
14	www.ohionet.org/pub_resource_communique2.php	47	http://www.webcarcenter.com/guide/suzuki/swift/4x4/2006/galerie/n1.jpg
15	www.automotive.com/2003/43/hyundai/sonata/reviews	48	www.amazon.co.uk/Dyson-Allergy-turquoise-upright-cleaner/dp/B0000C6XZG
16	www.made-in-china.com/china-products/productviewUapJiGmyznxV/-660-MP3-Players.html	49	http://7awa.roro44.com/vb/8442.html
17	www.66mobile.com/phones/siemens/Siemens-SP65.html	50	www.militaryphotos.net/forums/showthread.php?t=76713
18	www.vacuums4u.co.uk/acatalog/miele-vacuum-cleaners.html	51	www.babez.de/opel/vectraopc/newtitel.jpg
19	www.tech-faq.phonedog.com/cell-phone-research/sony-ericsson-t610.aspx	52	http://di1.shopping.com/images1/pi/10/34/67/76426454-300x300-0-0_Miele+S4282+Bagged+upright+vacuum+cleaner.jpg
20	image unavailable	53	www.bentleymotors.com, 2006
21	www.made-in-china.com/china-	54	http://www.leitronic.ch/Design/mainFrameInhalt_

Pic.	Source	Pic.	Source
	products/productviewYTrQDmxgzJoc/-888-MP3-Players.html		deutsch/Produkte/bebetel/mobiles/mobiles.htm
22	www.gisowatt.industrial-vacuum-cleaners.sul-web.com/index.html	55	http://forum.lowyat.net/topic/846327
23	www.diseno-art.com/encyclopedia/vehicles/road/cars/audi_tt_v6_convertible.html	56	image unavailable
24	www.industri-informasjon.no/newsreview/v2010301-dyson-lanseres-i-norge-stoevsugeren-som-ikke-taper-sugeevne-og-som-tar-inneklimaet-paa-alvor/	57	www.newarabia.net/middle_east_chrysler.php
25	www.cnet.com.au/nokia-7280-240053483.htm	58	www.cyclonicvacuum.com
26	www.fixya.com/support/p618492-sanyo_dab_150m_128_mb_mp3_player	59	www.netcarshow.com/audi/2004-a8_4.2_quattro/800x600/wallpaper_10.htm
27	www.fantasycars.com/Ferrari_360/Ferrari_360_Photos/Ferrari_360_Photo_7/ferrari_360_photo_7.html	60	image unavailable
28	www.about-nokia.com/blog/index.php?itemid=181	61	image unavailable
29	www.crutchfield.com/S-yowYeDHdQaJ/learn/reviews/20040713/review_MP3.html	62	www.allcarwallpapers.com/wallpapers/previews/volkswagen-jetta-506.jpg
30	https://hotbuyselectronics.com/sony_nw_hd5black.htm	63	www.dysoncleaners.blogspot.com
31	www.welectronics.com/gsm/Samsung/samsung_d500.html	64	www.vacuumcritic.com/bagless-vacuum-cleaners/hoover-windtunnel-bagless-vacuum-review/
32	www.gillout.com/archive/story/Unweltfreundlich+und+zuverl%E4ssig%3A+Der+Toyota+Prius+hat+die+niedrigste+M%E4ngelquote+in+der+Kompaktklasse	65	www.esato.com/news/article.php/id=88
33	www.apexsupplies.co.uk/henryvacuumcleanerhvr20022-p-166.html		

Figure 5.6 –

CLARKE, R.M., (eds.) Bentley Cars 1929-1934. Brooklands Books.

CLARKE, R.M., (eds.) Bentley Cars 1934-1939. Brooklands Books.

CLARKE, R.M., (eds.) Bentley Cars 1945-1950. Brooklands Books.

Bentley Motors Limited, 2008

8. Appendix

Appendix 1: *Data Sheets*

Questionnaire

Gender_____ Age_____ Nationality_____

Please answer the following question for each image you will be shown;

What is this ?

Please try to answer this question with your first thought. Please do not debate the answers. You will have approximately 10 seconds to respond to each image.

Image

1	14
2	15
3	16
4	17
5	18
6	19
7	20
8	21
9	22
10	23
11	24
12	25
13	26

A1.1 Brand Categorisation Test feedback form.

Resp	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
Brand	Sansa	Dyson	Nokia	Nissan	Apple	Toshiba	BMW	Bosch	Motorola	Sony	Cadillac	VW	Motorola	Creative	Hyundai	Unkown	Siemens	Miele	Sony Ericsson	Mini	Unknown 2	Gisowatt	Audi	Dyson	Nokia	Sanyo	Ferrari	Nokia	Samsung	Sony	Samsung	Toyota
Sub-brand				z350	I-Pod		3 series					Beetle											TT				F350		Yepp	Walkman		Prius
Cl.	a	b	c	d	a	a	d	b	c	a	d	d	c	a	d	a	c	b	c	d	a	b	d	a	c	a	d	c	a	a	c	d
1	3	1	3	3	1	3	3	3	3	3	3	1	3	3	3	3	3	3	3	1	3	3	3	1	3	3	3	3	3	3	3	3
2	3	1	3	2	1	2	1	2	1	3	2	1	1	1	2	3	1	3	1	1	3	3	1	1	1	3	1	1	3	1	2	1
3	3	1	1	1	1	3	1	3	1	3	2	1	1	1	1	3	1	2	1	1	2	3	1	1	1	1	1	1	1	1	2	1
4	3	1	3	1	1	3	1	3	1	3	3	1	2	1	3	3	1	3	1	1	3	3	1	1	3	5	3	1	3	5	3	3
5	3	1	1	1	1	3	1	2	1	3	2	1	1	1	3	3	1	2	1	1	3	2	1	1	1	1	1	1	3	1	2	2
6	3	1	1	1	1	5	1	2	1	5	2	1	1	1	1	4	1	5	1	1	5	3	1	1	1	1	1	3	5	1	1	1
7	3	1	1	1	1	1	1	2	1	1	2	1	1	3	2	4	1	5	1	1	4	3	1	1	1	2	4	1	3	1	1	1
8	3	1	1	1	1	3	1	2	3	3	1	1	3	3	4	3	3	3	3	1	3	3	1	1	1	3	1	1	3	3	1	3
9	3	1	1	1	1	3	1	3	1	3	3	1	1	1	3	3	1	1	1	1	3	3	1	3	1	3	1	1	3	1	2	1
10	3	2	3	1	1	3	1	2	3	3	3	1	3	3	4	3	4	4	4	4	5	4	4	4	5	4	5	4	5	4	4	4
11	4	2	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	5	4	5	4	5	4	4	4	4	4	4
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13	3	2	3	1	1	3	1	2	3	3	1	1	3	3	1	3	3	2	3	1	3	3	1	1	3	3	1	3	3	3	3	1
14	3	1	1	1	1	4	1	3	1	3	1	1	1	1	1	3	1	3	1	1	3	3	1	1	1	1	1	1	3	1	1	1
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16	3	2	3	3	1	3	1	2	3	1	3	1	3	3	3	3	1	2	1	1	3	2	1	2	1	3	1	1	3	1	2	3
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19	3	2	3	2	1	3	1	2	3	3	2	1	3	3	1	3	3	2	3	1	3	3	1	1	1	3	1	3	3	3	3	1
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22	2	1	3	1	1	2	1	2	1	3	2	1	1	1	2	3	2	2	3	1	3	3	1	1	1	2	1	1	3	2	1	2
23	3	1	1	1	1	3	1	2	1	4	2	1	1	1	1	3	1	1	1	1	3	4	1	1	1	1	1	1	3	1	1	1
24	3	1	3	4	1	3	1	3	1	4	3	2	5	2	4	4	4	2	1	1	3	3	1	1	1	4	4	4	5	1	1	4
25	3	1	3	1	1	3	1	2	1	3	2	1	3	3	3	3	3	3	1	1	3	3	1	1	1	3	1	3	3	3	1	1
26	3	1	3	1	1	3	1	3	3	3	2	1	3	3	3	3	3	3	3	1	3	3	1	1	3	3	1	3	3	3	3	3
27	3	1	1	2	1	4	4	4	1	4	4	4	2	4	4	4	4	4	4	4	4	4	1	4	4	4	4	4	4	4	4	4
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29	3	1	4	4	4	4	4	2	1	4	4	1	4	4	4	4	4	4	4	4	4	2	4	1	4	4	4	4	4	4	4	4
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32	3	2	1	3	1	3	1	4	3	3	4	1	4	5	4	5	5	4	4	4	4	4	4	4	4	4	4	5	4	2	5	4
33	3	1	3	3	1	3	1	3	3	3	3	1	3	3	4	3	3	3	3	1	3	3	1	1	3	3	1	3	3	3	3	3
34	3	4	4	4	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	4	4
35	5	5	1	1	1	3	1	2	1	5	2	1	1	2	1	3	1	1	1	1	5	3	1	1	1	1	1	1	3	1	1	1
36	3	1	1	1	1	3	1	3	1	3	2	1	1	1	2	5	1	3	1	1	3	3	1	1	1	1	1	1	3	1	2	1
37	3	1	1	1	1	3	1	3	1	3	2	1	1	1	3	3	1	3	1	1	3	3	1	1	1	1	1	1	3	1	2	1
38	1	1	1	1	1	3	1	2	1	3	3	1	1	1	1	3	1	1	1	1	3	3	1	1	1	1	1	1	1	1	1	2
39	3	1	3	1	1	3	1	3	3	1	2	1	1	3	1	3	1	3	1	1	3	3	1	1	1	3	1	1	3	1	1	1
40	2	2	3	3	4	4	1	2	3	3	2	1	3	3	3	3	3	2	3	1	3	2	1	2	1	3	1	3	3	1	3	3
41	3	1	3	3	1	2	1	3	3	3	2	1	3	3	4	3	4	3	3	1	3	3	1	1	4	3	1	3	3	1	3	3
42	3	3	3	3	1	5	1	3	3	3	3	1	3	3	3	3	3	3	3	1	3	3	1	1	3	3	2	3	3	3	3	3
43	3	3	3	1	1	3	1	3	3	3	3	1	3	3	4	3	1	3	1	1	3	3	1	1	3	3	1	3	3	3	3	3
44	3	3	3	1	1	3	3	3	3	3	3	1	3	3	3	3	3	3	3	1	3	3	1	1	1	3	1	3	3	1	3	3
45	3	3	3	1	1	4	1	2	3	3	2	1	3	3	4	3	3	3	3	1	3	3	1	3	3	3	1	3	3	3	3	3
46	3	1	1	2	1	1	1	3	3	3	2	1	3	3	1	3	3	3	3	1	3	3	1	1	3	3	2	3	3	3	3	1
47	3	1	3	3	4	4	3	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	4	3	4	1	4	4	4	4
48	3	1	1	4	1	4	1	4	1	4	4	1	4	3	4	4	4	4	4	1	4	4	4	4	4	2	4	4	4	4	4	4
49	3	3	3	2	1	3	1	2	3	3	3	1	3	3	2	3	3	2	3	1	3	2	1	1	3	3	3	3	3	1	3	1
50	3	1	3	3	1	3	1	2	3	3	3	1	1	3	3	3	3	3	2	1	3	2	1	1	1	3	1	1	3	1	1	1
51	3	1	1	4	1	3	1	2	1	3	3	1	1	1	4	3	1	2	2	1	3	2	1	1	1	3	1	3	3	3	1	3
52	3	1	3	3	1	3	1	3	1	3	3	1	3	1	3	3	3	3	3	1	3	3	1	1	3	3	3	1	3	3	3	3
53	3	1	1	1	1	3	1	3	1	3	2	1	1	1	1	3	1	3	2	1	3	3	1	1	1	1	1	1	3	1	1	1
54	3	1	1	1	1	3	1	2	1	3	4	1	3	3	3	3	1	2	2	1	3	2	1	1	1	3	1	1	3	3	1	3
55	3	1	3	1	3	3	1	2	3	3	2	1	3	1	1	3	3	2	3	1	3	2	1	1	1	1	4	1	3	1	1	1
56	3	1	1	2	1	3	1	2	1	3	4	1	1	1	2	3	3	2	1	1	2	2	1	1	3	3	1	2	2	2	1	1
57	3	1	3	3	1	3	1	2	1	3	3	1	1	1	3	3	3	2	3	1	3	2	1	1	1	3	1	1	3	1	1	1
58	3	3	3	3	1	3	1	3	3	3	3	1	3	1	3	3	3	3	3	1	3	3	1	1	3	3	1	3	3	3	3	3
59	3	3	3	3	1	3	3	3	3	3	3	1	3	1	3	3	3	3	3	1	3	3	1	1	1	3	3	3	3	3	3	3

Resp	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65
Brand	George	Ford	Nokia	Apple	VW	Hoover	Ford	Panasonic	Toyota	Samsung	Unknown 3	Apple	Nokia	Sebo	Suzuki	Dyson	Samsung	VW	Opel	Miele	Bentley	Siemens	Apple	Unknown 4	Chrysler	Dyson	Audi	Unknown 5	Apple	VW	Dyson	Hoover	Siemens
Sub-brand		Mondeo		I-Pod Nano	Golf		Focus		Yaris			I-Pod			Swift			Phaeton	Vectra		Continental GT		I-Pod shuffle				A8		I-Pod	Jetta			
Cl.	b	d	c	a	d	b	d	a	d	c	b	a	c	b	d	b	c	d	d	b	d	c	a	c	d	b	d	a	a	d	b	b	c
1	3	3	3	1	3	3	3	3	3	3	3	1	3	3	3	1	3	3	3	3	3	3	1	3	3	1	3	3	1	3	3	3	3
2	1	1	1	1	1	3	1	3	3	3	3	1	1	3	2	3	2	3	3	3	1	1	1	3	2	1	1	3	1	1	3	3	3
3	1	1	1	1	1	3	1	3	1	1	3	1	1	3	1	1	1	2	1	1	1	1	1	3	2	1	1	2	1	1	1	3	1
4	1	3	1	1	1	3	1	3	3	1	3	1	1	3	1	1	3	3	3	3	1	3	1	3	1	1	1	3	1	1	1	3	1
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6	1	1	5	1	1	5	1	5	5	1	5	1	5	4	1	1	1	1	1	5	1	5	1	5	1	5	1	5	1	1	4	5	5
7	1	1	1	1	1	5	1	4	4	4	4	1	4	4	1	1	1	2	1	3	1	1	1	2	4	1	4	4	4	1	1	3	1
8	3	2	3	1	1	3	1	3	2	3	3	1	3	3	1	1	3	3	1	1	1	3	1	3	2	1	1	3	1	1	1	3	3
9	3	3	1	1	1	3	1	3	3	1	3	1	1	3	1	1	1	3	3	1	3	3	1	3	3	1	1	3	1	1	1	3	3
10	5	4	4	4	4	4	4	4	4	4	4	4	4	4	2	5	5	5	4	4	4	4	4	4	4	4	4	4	4	4	5	4	4
11	4	4	4	4	4	4	4	4	4	4	5	4	4	4	4	4	4	4	4	2	4	4	4	4	4	3	4	4	4	4	4	4	4
12	2	3	1	1	1	1	1	2	3	3	2	1	1	2	3	1	3	3	3	2	1	3	1	3	3	1	1	3	1	1	2	1	3
13	1	1	3	1	1	1	1	2	1	3	2	1	3	2	1	2	3	1	1	2	1	3	1	3	1	2	1	3	1	1	2	1	3
14	1	1	1	1	1	3	1	3	1	1	3	1	1	3	1	3	1	1	1	3	1	1	1	2	1	1	1	3	1	1	1	3	1
15	3	4	4	1	4	3	3	4	4	3	4	1	4	4	4	3	4	4	4	4	4	4	1	3	4	3	4	3	1	4	3	4	4
16	1	3	1	1	1	1	1	2	3	1	3	1	1	2	3	1	3	1	4	2	4	1	1	3	3	1	1	3	1	1	1	3	3
17	1	2	1	1	1	1	1	2	3	1	2	1	1	2	2	1	1	4	2	1	1	1	1	2	2	1	1	3	1	1	1	1	1
18	1	1	1	1	1	2	1	2	2	1	3	1	1	2	1	1	1	1	1	3	1	1	1	2	2	1	1	3	1	1	1	3	1
19	1	2	3	1	1	1	1	2	2	3	2	1	3	2	1	2	3	2	1	2	1	3	1	3	1	1	1	3	1	1	1	1	3
20	1	1	1	1	1	3	1	3	1	1	3	1	1	3	1	1	1	1	1	1	1	1	1	3	1	1	1	3	1	1	1	3	1
21	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	5	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
22	1	1	1	1	1	1	1	3	1	1	3	1	1	3	2	1	1	2	5	3	1	1	1	3	2	1	1	3	1	1	1	3	1
23	1	1	1	1	1	1	1	1	1	1	2	1	1	2	1	1	1	1	1	1	1	1	1	2	2	1	1	3	1	1	1	1	1
24	3	3	1	1	1	4	4	4	4	3	3	3	4	3	2	1	3	3	1	2	1	1	1	2	4	1	1	3	1	4	1	4	4
25	1	1	1	1	1	1	1	3	3	3	3	1	3	3	1	1	3	2	1	3	1	3	1	3	1	1	1	3	1	1	1	1	3
26	3	1	3	1	1	3	1	3	3	3	3	1	3	3	3	1	3	2	3	3	1	3	1	3	2	1	1	3	1	1	1	3	3
27	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
28	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
29	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
30	4	4	4	4	4	5	4	2	4	4	4	4	5	4	4	4	4	4	4	4	4	4	4	4	1	4	4	4	4	4	4	4	4
31	4	3	3	4	4	5	4	4	4	4	4	4	4	4	4	5	4	5	4	4	4	4	4	4	4	4	5	4	4	4	4	5	3
32	4	3	5	4	4	5	5	5	4	4	5	4	4	4	4	4	4	3	3	5	4	4	4	4	4	4	4	4	4	4	5	5	5
33	3	3	3	3	1	3	1	3	3	3	3	1	3	3	3	1	3	3	4	3	4	3	1	3	4	1	1	3	1	1	1	3	3
34	4	4	4	4	4	4	4	4	4	4	5	1	4	4	4	4	5	4	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
35	1	1	1	1	1	3	1	3	1	1	3	1	1	3	1	1	1	1	1	1	1	1	1	5	1	1	1	3	1	1	1	3	1
36	3	5	1	1	5	3	1	2	1	1	4	1	1	2	2	1	1	1	2	3	1	1	1	2	1	1	1	3	1	1	1	3	1
37	1	3	1	1	1	3	1	3	1	1	3	1	1	3	2	1	1	1	1	3	1	1	1	3	2	1	1	3	1	1	1	3	1
38	1	3	1	1	1	3	1	3	1	1	3	1	1	3	1	1	1	2	2	1	1	1	1	2	1	1	1	3	1	1	1	3	1
39	1	1	1	1	1	3	1	3	1	1	3	1	1	3	2	1	1	1	1	3	1	1	1	2	1	1	1	3	1	1	1	3	1
40	1	3	3	1	1	1	3	2	3	3	2	1	3	2	3	2	3	3	3	1	3	3	1	3	3	2	1	4	1	1	2	1	3
41	1	3	1	1	3	3	3	3	3	3	3	1	1	2	3	1	3	2	1	3	1	3	1	3	2	1	1	3	1	1	1	3	3
42	3	3	3	1	3	3	3	3	3	3	3	1	3	3	3	1	3	3	3	3	1	3	1	3	3	1	3	3	1	3	1	3	3
43	3	2	3	1	1	3	1	3	3	3	3	1	3	3	3	1	3	2	1	3	1	3	1	3	3	1	1	3	1	1	1	3	3
44	1	3	3	1	1	3	3	3	3	3	3	1	1	3	3	1	3	3	1	3	1	3	1	3	3	1	1	2	1	1	3	3	3
45	3	1	3	1	1	3	1	3	3	3	3	1	3	3	1	3	3	2	1	3	1	3	1	3	1	3	1	3	3	1	3	3	3
46	3	1	1	1	1	3	1	3	1	3	3	1	1	3	2	3	3	2	3	3	1	3	1	3	3	1	1	3	1	1	3	3	3
47	1	4	1	4	4	4	4	4	4	4	4	1	4	4	4	1	4	4	4	4	4	4	1	4	4	1	4	3	1	4	4	4	4
48	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	4	4	4	4	4	4	4	4	4	4	4	4	4	4	1	4	4	4
49	1	3	3	1	1	3	1	2	4	1	3	1	1	3	1	1	1	4	3	3	3	3	1	2	2	1	1	3	1	1	1	3	3
50	1	1	1	1	1	1	1	2	3	1	2	1	1	2	1	1	1	3	1	2	4	1	1	3	2	1	1	3	1	1	1	1	1
51	2	3	1	1	4	1	1	2	4	1	2	1	1	2	3	1	1	3	3	2	3	3	1	3	3	1	1	3	1	3	1	1	3
52	3	3	3	1	3	3	3	3	3	3	3	1	3	3	3	1	3	3	3	3	1	3	1	3	2	1	1	3	1	1	1	3	3
53	3	1	1	1	1	3	1	3	1	1	3	1	1	3	1	1	1	2	1	3	1	1	1	3	2	1	1	3	1	1	1	3	1
54	1	1	1	1	1	1	1	2	1	1	2	1	1	2	2	1	1	2	1	2	2	1	1	3	2	1	1	3	1	1	1	1	1
55	1	1	1	1	1	1	1	2	4	1	2	1	1	2	3	1	3	2	1	2	1	3	1	2	1	1	1	3	1	1	1	1	3
56	1	1	1	1	1	1	1	2	1	1	2	1	1	4	2	1	4	2	2	1	1	1	1	2	2	1	2	3	1	2	1	4	1
57	2	3	1	1	1	1	1	2	3	1	2	1	1	2	3	1	1	3	1	2	3	3	1	3	3	1	1	3	1	3	1	1	1
58	3	3	3	1	3	3	3	3	3	3	3	1	3	3	3	1	3	3	1	3	1	3	1	3	3	1	1	3	1	3	1	3	3
59	3	3	3	1	3	3	3	3	3	3	3	1	3	3	3	3	3	3	1	3	3	3	1	3	3	1	3	3	1	3	3	3	3

A1.2. Brand Categorisation Test entity x subject sets.

Key: 1. Identified by brand; 2. Identified by another brand; 3. Identified by product type; 4. Identified by brand / product association. Classification (Cl.); a. Personal Music Machine; b. Vacuum Cleaner; c. Mobile Phone; d. Car

Board Number	Board Name	Image 1	Image 2	Image 3	Image 4	Image 5	Image 6	Image 7	Image 8	Image 9	Image 10	Image 11	Image 12	Total
2	Brightware-Coachlines (2)	19	4		28	2	11	3	7				11	85
24	Veneer (24)	8	3	29	2	4	7	1		1	20	7	1	83
1	Seamless Construction (1)	6	2	18	7	1	2	9	4	18	9	1		77
7	Tread Plates (7)	21	23	5	1	10		1		1	1	3	1	67
16	Tool Kits (16)	44	6	10										60
25	Luxury Items (25)	2	8	5	26	1		1	1	2	1	10		57
15	Luggage (15)	2	4		13	23		6	5	3				56
20	Seat Styles (20)	10	1	7	1	2	12	2	4	3	9			51
17	Door Trim (17)	2	1	3	5	2	10	5	7	8	3			46
23	Materials (23)	3	1		2			3	4	15	1	7	9	45
35	Branding-1 (35)	2	19	2	1	1		1	5	1	4	6		42
18	Interior Handles (18)				9	3	12	3	1	2	3	5	3	41
6	Grille Detail (6)	13		3	3	1	6	5	2	1	4			38
8	Exterior Handles (8)	2	6	1	11	1	8	2	1		6			38
26	Instruments (26)			1	1	3	22	4	1	2	1	1		36
31	Interior Lighting (31)				7	2	4	22						35
28	Air Vents (28)	13	4	4	2	3	8							34
4	Exterior Lamps-1 (4)	1	2	2		10	9	1	3		1	1	1	31
19	Trimming (19)	2	5		5	4		5	2	7				30
13	Exterior 2-Tone (13)	3	2	4	2	1			4		11			27
10	Glazing (10)	3	6		1	1		2	1	6	2	2	2	26
12	Exterior Colours (12)	3	3	5	1	1	1		1	2	1	8		26
34	General Details (34)	3			12	3			2		1	3	1	25
36	Branding-2 (36)	2	3		1	1	9	1	6		2			25
5	Exterior Lamps-2 (5)		4		2	3	4	5	3	2			1	24
3	Brightware-Bodywork (3)		5		3	7	2	3			1			21
27	Switches (27)	2	5	3	1	1	1	1		4	1	1		20
14	Coachlines (14)	7	3		8				1					19
33	Fixings (33)		6		8						1	2	1	18
9	Door Shut (9)	2	6	2		2			1		2	1		16
32	Cantrail and Pillar Trim (32)	2	1	1	8	4								16
22	Interior Colours (22)	1		1	1	1	1	6	1		1	1		14
29	Ash Trays (29)		1				1		5	5	1			13
21	Piping (21)	2	3		5					2				12
30	Storage Concepts (30)	6	1		2		2	1						12
11	Roof Concepts (11)	2		1	3	1	1		1					9

Vehicle set	Votes
1-1933 Bentley 3.5 Litre Saloon-Thrupp and Maberley	85
2-1950 Rolls Royce Phantom IV-Mulliner	42
3-1953 Bentley R-Type Continental-Mulliner	76
4-1957 Bentley S1 Continental-Mulliner (Flying Spur)	127
5-2002 Rolls Royce Corniche	79

Appendix A1.3. Bentley heritage study (study 2) votes - individual feedback data.

		Unique		Memorable		Differentiated		What it is		What it isn't	
	Model line	6	8	6	8	6	8	6	8	6	8
Property											
5.1.1	Boot stowage features made from leather	☑	☑	☑	☑	☑	☑	Single Colour Hide, functional but simple. A delight feature.	Colour matched car hide, functional but simple. A delight feature. Look handcrafted.	Synthetic, plastic mass produced, colour matched.	Synthetic, plastic mass produced.

Key	☑	Property fully satisfies
	☑	Property not fully satisfies
	☑	Attribute fully satisfies, with some competition

Appendix A1.4. Stage 2, Study 3 data-base example.

Interior Execution

BENTLEY

Secondary Attribute		Property	Strong (negative) ← Neutral → Strong (positive) 3 2 1 0 1 2 3	
Materials and Appearance Appraisal of all interior components with regard to the materials used and the how well they have been executed	*Overall*	Design for Material	compromised	sympathetic
		Smell	artificial	natural
		Colour harmony	unintegrated	co-ordinated
		Fit and finish	inprecise	precise
		Hand-crafted	machine-made	hand-crafted
	Trim panels	Trim panel softness	hard	soft
		Softness harmony	dissimilar	similar
		Part stiffness / robustness	flexible	rigid
		Leather grade / grain	rough	smooth
	Carpets	Carpet quality (density/depth/ gloss/comfort)	poor	luxurious
		Carpet execution	machine-made	tailor-made
	Brightware	Harmony	unintegrated	co-ordinated
		Solidity	foiled	solid
		Authenticity	false	genuine
	Veneer	Solidity	foiled	solid
		Hand-crafted	machine-made	hand-crafted
		Authenticity	false	genuine
Control functionality (less switches) Appraisal of the operation of any moving interior parts E.g. Stowage bins, Ashtrays, Armrests, Air vents (excluding electrical switches and controls)	*Overall*	Refinement	unrefined	refined
		Part stiffness / robustness	flexible	rigid
		Function harmony	dissimilar	similar

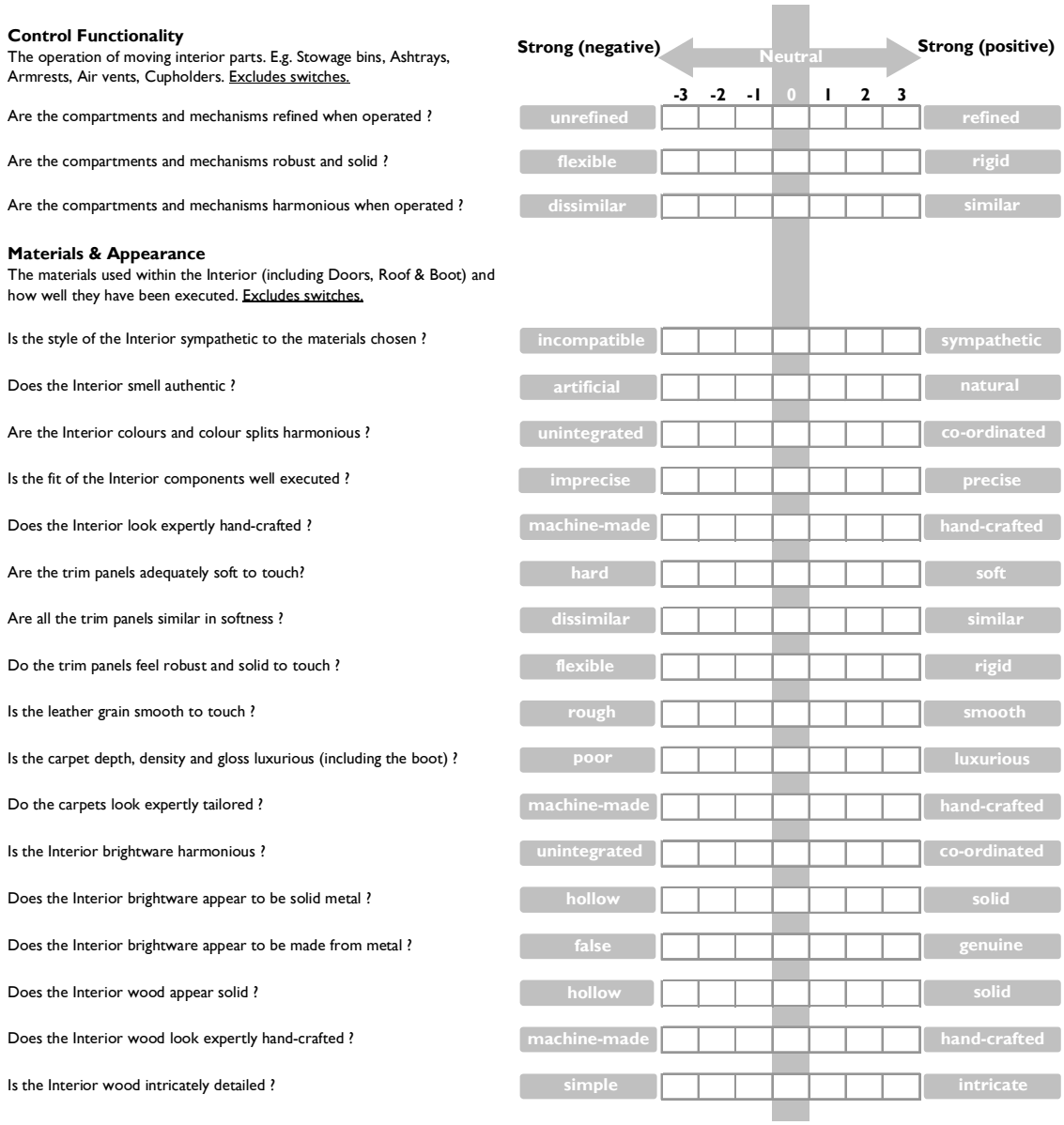
Property assessment objectives;
1. Identifies specific strengths & weaknesses
2. Identifies specific competitive advantage
3. Rates against Bentley brand properties
3. Guides overall attribute score (allows vehicle comparison against specific properties)

Appendix A1.5. Initial SDS response form (pre-tests).

Is 'x' more important than 'y'? Yes = 1, No = -1, Equal = 0			Materials & Appearance																Cont. Functionality			
			Overall					Trim panels				Carpets		Brightware			Veneer			Overall			
		x	Deaign for Material	Smell	Colour harmony	Fit & finish	Hand-crafted	Trim panel softness	Softness harmony	Part stiffness / robustness	Leather grade / grain	Carpet quality	Carpet execution	Harmony	Solidity	Authenticity	Solidity	Hand-crafted	Detailing	Refinement	Part stiffness / robustness	Function harmony	
		y																					
Materials & Appearance	Overall	Design for Material		-1	0	1	1	1	-1	1	-1	0	0	0	-1	0	0	0	-1	1	1	0	1
		Smell	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	19
		Colour harmony	0	-1		1	0	0	-1	0	-1	0	0	-1	-1	0	0	0	-1	0	0	0	-5
		Fit & finish	-1	-1	-1		-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-16
		Hand-crafted	-1	-1	0	1		0	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-12
	Trim panels	Trim panel softness	-1	-1	0	1	0		-1	1	-1	-1	-1	0	-1	0	0	0	-1	1	1	0	-4
		Softness harmony	1	-1	1	1	1	1		1	0	0	0	0	0	1	1	1	-1	1	1	1	10
		Part stiffness / robustness	-1	-1	0	0	0	-1	-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-14
		Leather grade / grain	1	-1	1	1	1	1	0	1		0	0	0	0	1	0	1	-1	1	1	0	8
	Crpets	Carpet quality	0	-1	0	1	1	1	0	1	0		-1	0	-1	0	0	0	-1	1	1	0	2
		Carpet execution	0	-1	0	1	1	1	0	1	0	1		1	0	1	1	1	0	1	1	0	10
	Brightware	Harmony	0	-1	1	1	1	0	0	1	0	0	-1		-1	1	1	1	-1	1	1	0	5
		Solidity	1	-1	1	1	1	1	0	1	0	1	0	1		1	1	1	-1	1	1	1	12
		Authenticity	0	-1	0	1	1	0	-1	1	-1	0	-1	-1	-1		0	0	-1	0	0	-1	-5
	Veneer	Solidity	0	-1	0	1	1	0	-1	1	0	0	-1	-1	-1	0		0	-1	0	0	-1	-4
		Hand-crafted	0	-1	0	1	1	0	-1	1	-1	0	-1	-1	-1	0	0		-1	0	0	-1	-5
		Detailing	1	-1	1	1	1	1	1	1	1	1	0	1	1	1	1	1		1	1	1	16
Control Functionality	Overall	Refinement	-1	-1	0	0	0	-1	-1	0	-1	-1	-1	-1	-1	0	0	0	-1		0	-1	-11
		Part stiffness / robustness	-1	-1	0	0	0	-1	-1	0	-1	-1	-1	-1	-1	0	0	0	-1	0		-1	-11
		Function harmony	0	-1	0	1	1	0	-1	1	0	0	0	0	-1	1	1	1	-1	1	1		4
		Sum	-1	-19	5	16	12	4	-10	14	-8	-2	-10	-5	-12	5	4	5	-16	11	11	-4	
		Relative Sum	18	0	24	35	31	23	9	33	11	17	9	14	7	24	23	24	3	30	30	15	
		Weight	0.47	0.00	0.63	0.92	0.82	0.61	0.24	0.87	0.29	0.45	0.24	0.37	0.18	0.63	0.61	0.63	0.08	0.79	0.79	0.39	10.00
		Rank	11	20	6	1	3	9	16	2	15	12	16	14	18	6	9	6	19	4	4	13	
		Percentage	4.74	0.00	6.32	9.21	8.16	6.05	2.37	8.68	2.89	4.47	2.37	3.68	1.84	6.32	6.05	6.32	0.79	7.89	7.89	3.95	100

Appendix A1.6. Pair-wise CPE weighting test results.

Name:	Vehicle:	Date:



Appendix A1.7. Revised SDS response form (study 3 onwards).

			Materials & Appearance																Control Functionality			
			Overall					Trim panels				Carpets		Brightware			Veneer			Overall			
Is 'x' more important than 'y'? Yes = 1, No = -1, Equal = 0		x	Design for Material	Smell	Colour harmony	Fit & finish	Hand-crafted	Trim panel softness	Softness harmony	Part stiffness / robustness	Leather grade / grain	Carpet quality	Carpet execution	Harmony	Solidity	Authenticity	Solidity	Hand-crafted	Detailing	Refinement	Part stiffness / robustness	Function harmony	
		y																					
Materials & Appearance	Overall	Design for Material		-1	0	1	1	1	-1	1	-1	0	0	0	-1	0	0	0	-1	1	1	0	1
		Smell	1		0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	18
		Colour harmony	0	0		1	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	15
		Fit & finish	-1	-1	-1		-1	1	0	-1	1	1	-1	-1	-1	1	-1	-1	1	-1	-1	0	-7
		Hand-crafted	-1	-1	-1	1		1	1	-1	1	1	0	-1	-1	1	-1	0	1	1	-1	1	1
	Trim panels	Trim panel softness	-1	-1	-1	-1	-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-19
		Softness harmony	1	-1	-1	0	-1	1		-1	1	1	-1	-1	-1	1	-1	-1	1	-1	-1	0	-5
		Part stiffness / robustness	-1	-1	-1	1	1	1	1		1	1	1	-1	0	1	0	1	1	1	0	1	8
		Leather grade / grain	1	-1	-1	-1	-1	1	-1	-1		-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-15
	Carpets	Carpet quality	0	-1	-1	-1	-1	1	-1	-1	1		-1	-1	-1	1	-1	-1	1	-1	-1	-1	-10
		Carpet execution	0	-1	-1	1	0	1	1	-1	1	1		-1	-1	1	-1	0	1	1	-1	1	2
	Brightware	Harmony	0	0	0	1	1	1	1	1	1	1	1		1	1	1	1	1	1	1	1	16
		Solidity	1	-1	-1	1	1	1	1	0	1	1	1	-1		1	0	1	1	1	0	1	10
		Authenticity	0	-1	-1	-1	-1	1	-1	-1	1	-1	-1	-1	-1		-1	-1	1	-1	-1	-1	-12
	Veneer	Solidity	0	-1	-1	1	1	1	1	0	1	1	1	-1	0	1		1	1	1	0	1	9
		Hand-crafted	0	-1	-1	1	0	1	1	-1	1	1	0	-1	-1	1	-1		1	1	-1	-1	0
		Detailing	1	-1	1	1	1	1	1	1	1	1	0	-1	-1	1	-1	0		1	-1	1	7
Control Functionality	Overall	Refinement	-1	-1	-1	1	-1	1	1	-1	1	1	-1	-1	-1	1	-1	-1	1		-1	1	-3
		Part stiffness / robustness	-1	-1	-1	1	1	1	1	0	1	1	1	-1	0	1	0	1	1	1		1	8
		Function harmony	0	-1	-1	0	-1	1	0	-1	1	1	-1	-1	-1	1	-1	-1	1	-1	-1		-6
		Sum	-1	-17	-14	9	0	19	7	-6	15	12	-1	-15	-10	14	-9	-1	13	5	-8	6	
		Relative Sum	18	2	5	28	19	38	26	13	34	31	18	4	9	33	10	18	32	24	11	25	
		Weight	0.47	0.05	0.13	0.74	0.50	1.00	0.68	0.34	0.89	0.82	0.47	0.11	0.24	0.87	0.26	0.47	0.84	0.63	0.29	0.66	10.47
		Rank	11	20	6	1	3	9	16	2	15	12	16	14	18	6	9	6	19	4	4	13	

Appendix A1.8. Reweighting of properties based on predicted affective content ranking.

Appendix 2: *Supplementary Photographs*

Vehicle	Image	Vehicle	Image
m^a : 07MY Bentley Continental Flying Spur + Mulliner Driving Specification		m^b : 07MY Bentley Continental GT	
m^c : 08MY Bentley Continental GT + Mulliner Driving Specification		m^1 : Porsche 911 Turbo	
m^2 : Fearrari 612 Scagletti		m^3 : BMW M6	
m^4 : Mercedes S600L		m^5 : Mercedes CL500	
m^6 : Aston Martin DB9		m^7 : Jaguar XKR	

Appendix A2.1. Study 6 vehicles – Interior images

Appendix A2.2. Study 5 set-up.

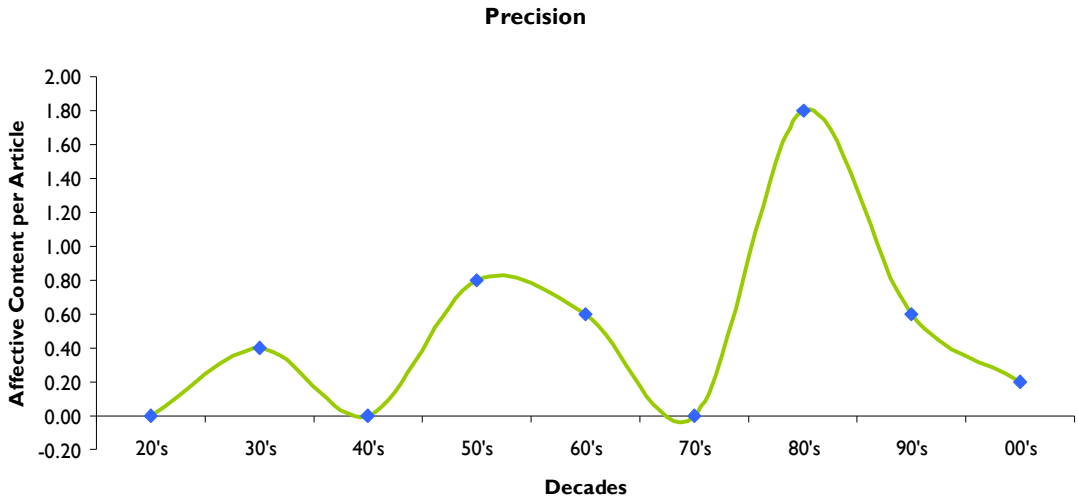
Vehicle	Image	Vehicle	Image
m^a8 : 09MY Bentley Continental Flying Spur + Mulliner Driving Specification		m^f : 09MY Bentley Continental Flying Spur	
m^g : 08MY Bentley Arnage T		$m^4$8 : Mercedes S600L	
$m^8$8 : Lexus LS460		m^{11} : BMW 760Li	
m^{12} : Maserati Quattroporte		m^{13} : Mercedes CLS63 AMG	
m^{14} : Audi S8		m^{15} : BMW M5	

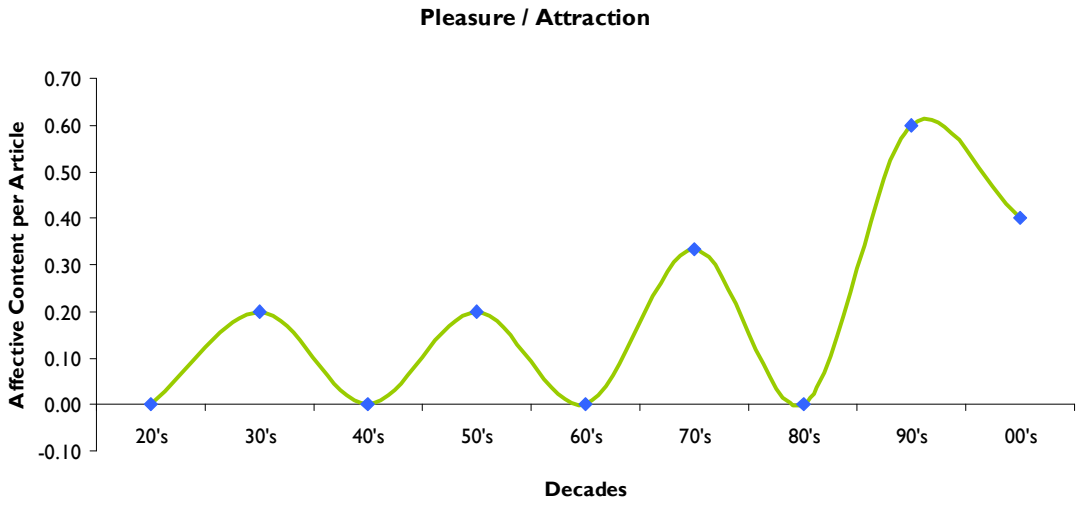
Appendix A2.3. Study 8 vehicles – Interior images.

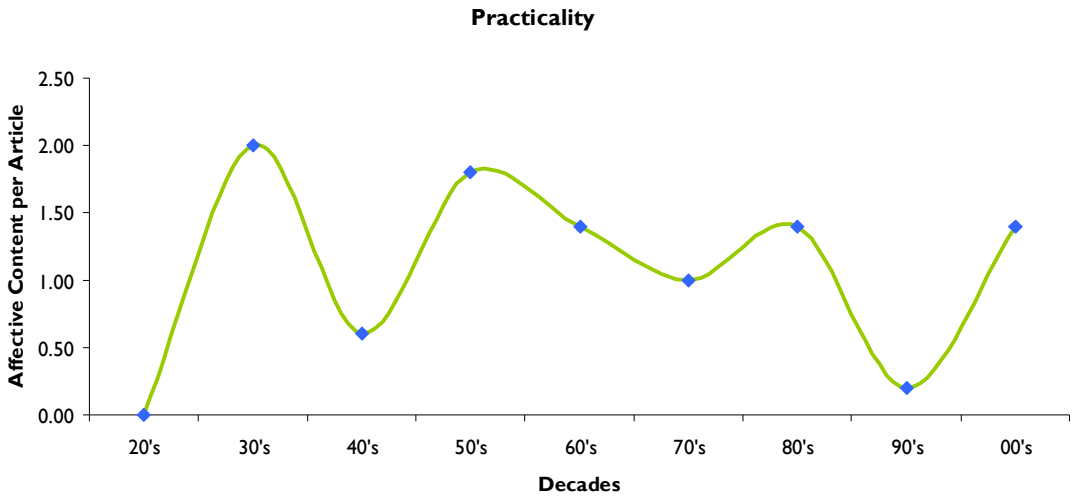
Appendix A2.4. Study 8 set-up

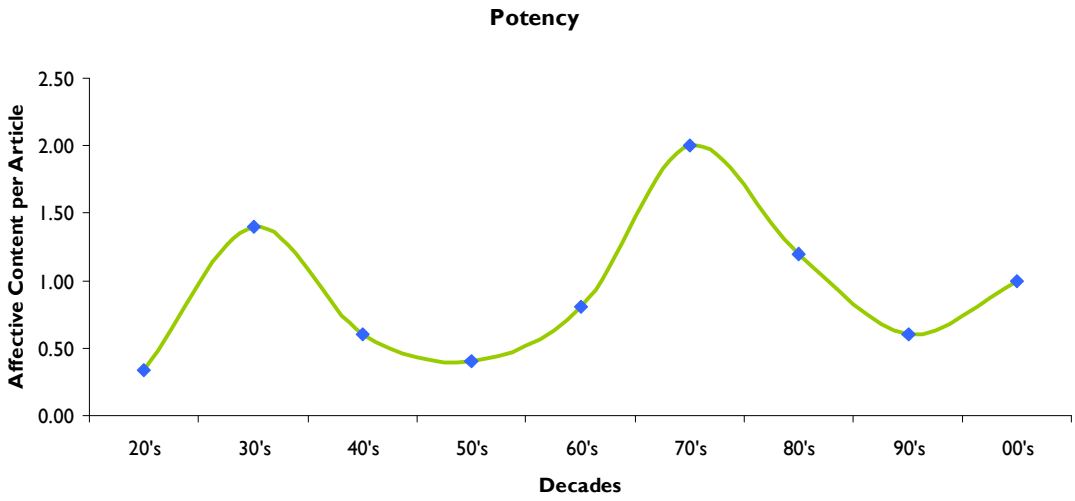
Appendix 3: *Supplementary Charts*

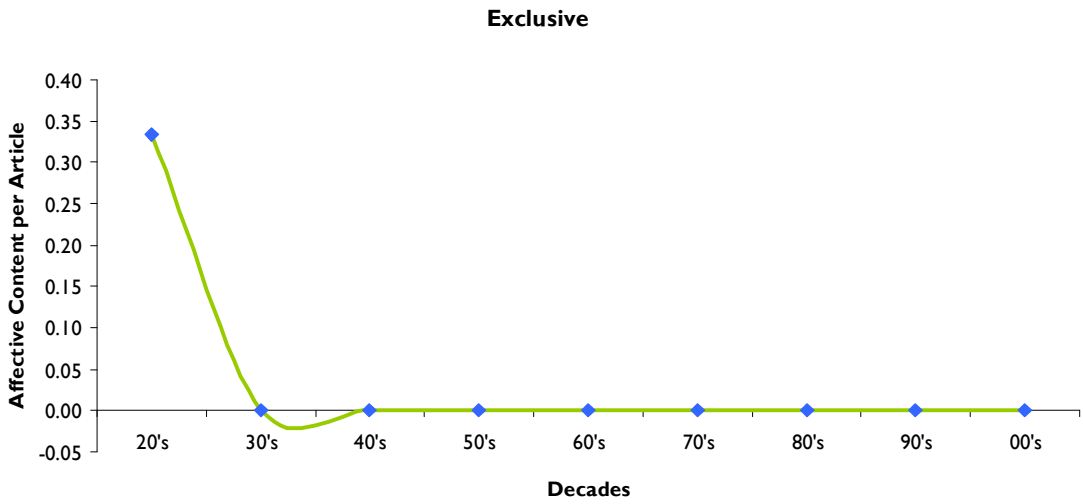
Appendix A3.1 Affective content descriptive construct charts (pp 242 – 248)

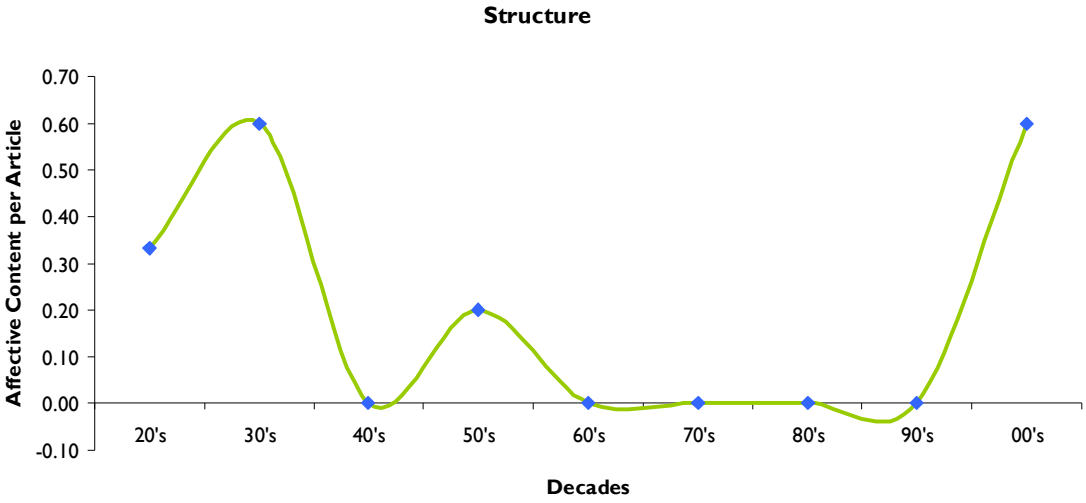


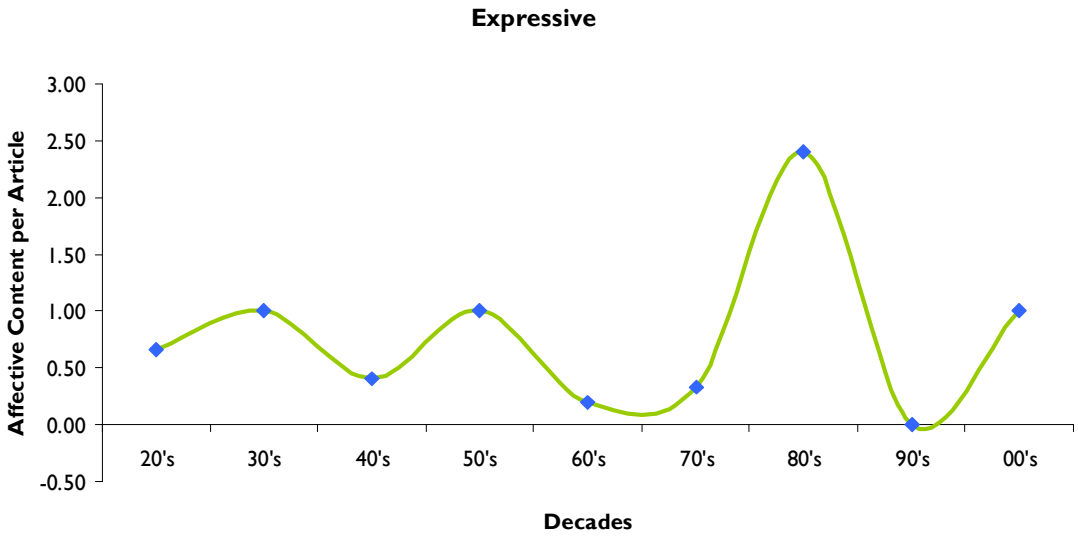


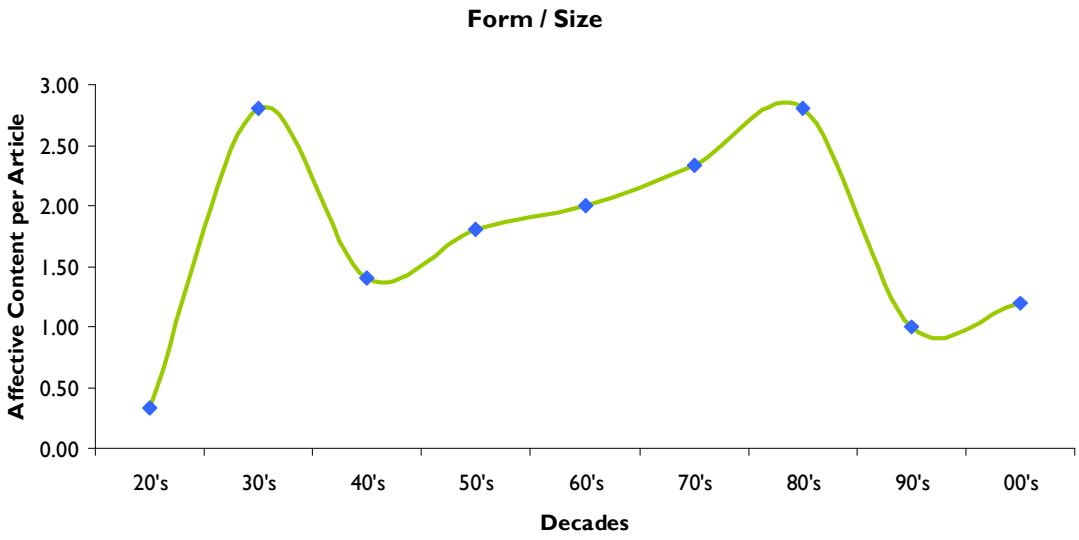

Practicality
Affective Content per Article
2.50
2.00
1.50
1.00
0.50
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

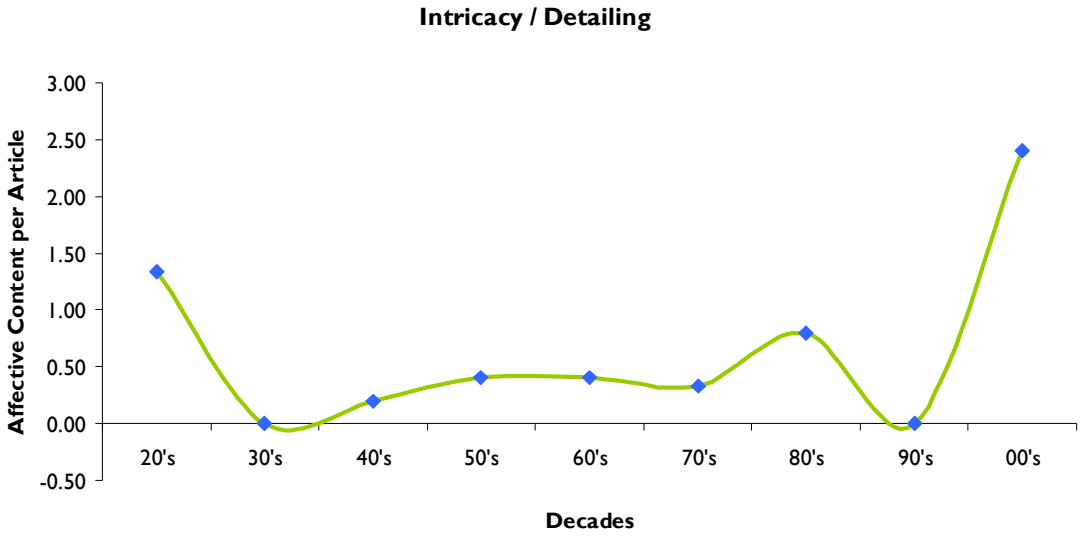

Potency
Affective Content per Article
2.50
2.00
1.50
1.00
0.50
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

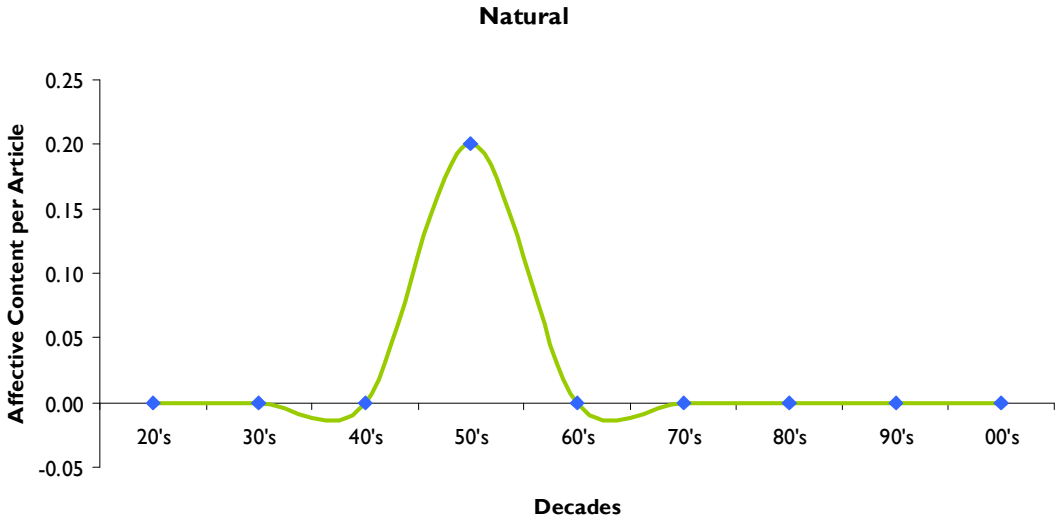

Exclusive
Affective Content per Article
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

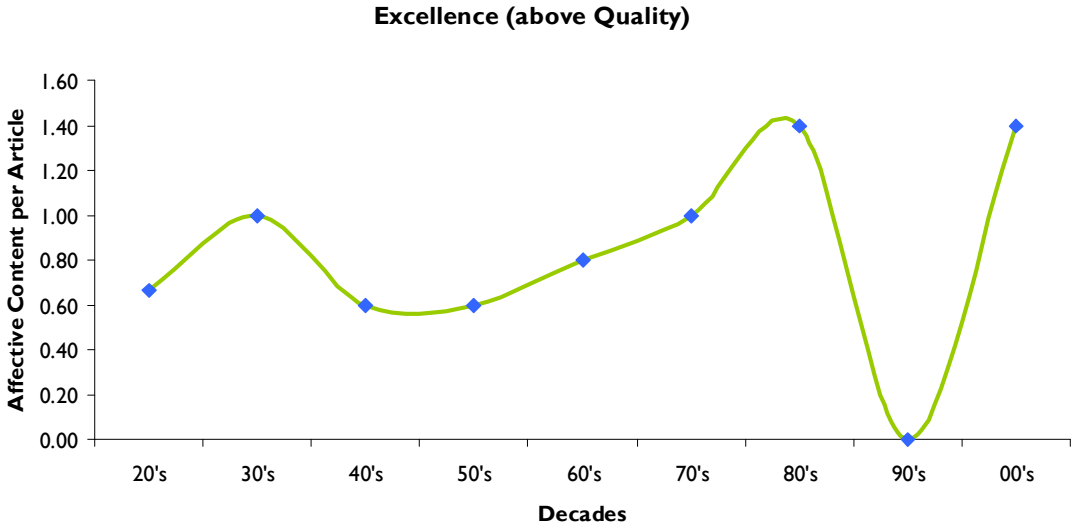

Structure
Affective Content per Article
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

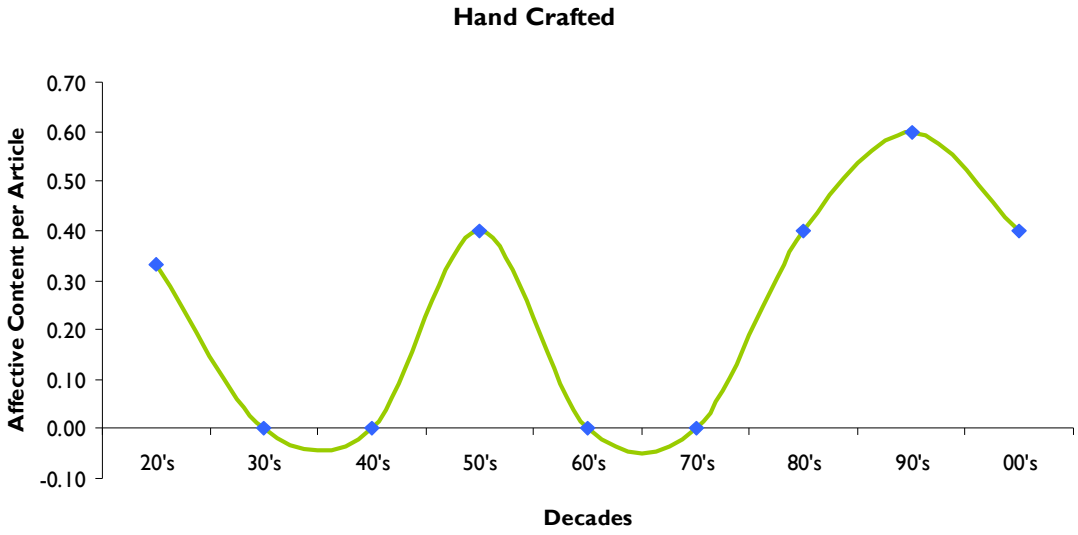

Expressive
Affective Content per Article
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

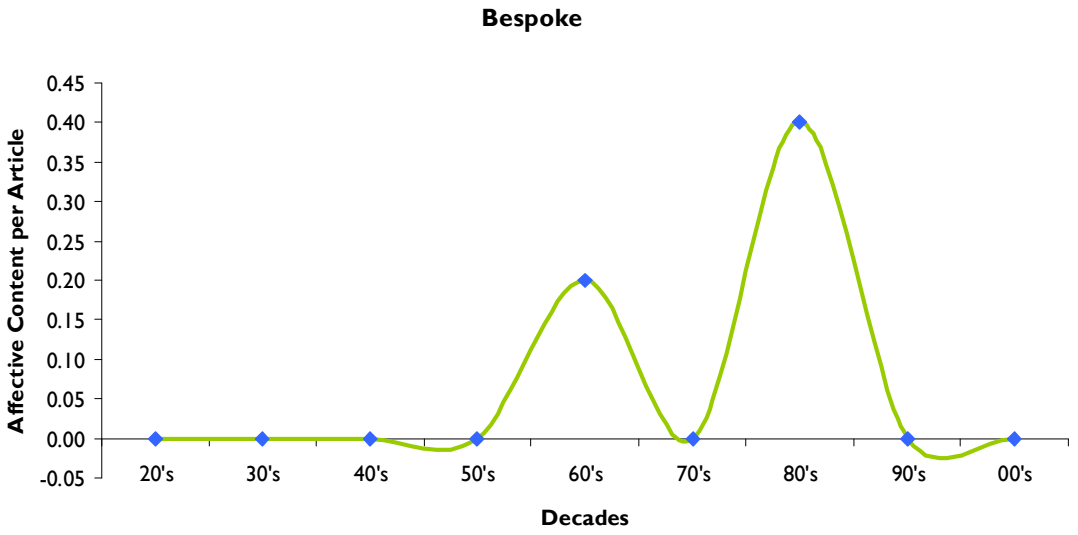

Form / Size
Affective Content per Article
3.00
2.50
2.00
1.50
1.00
0.50
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

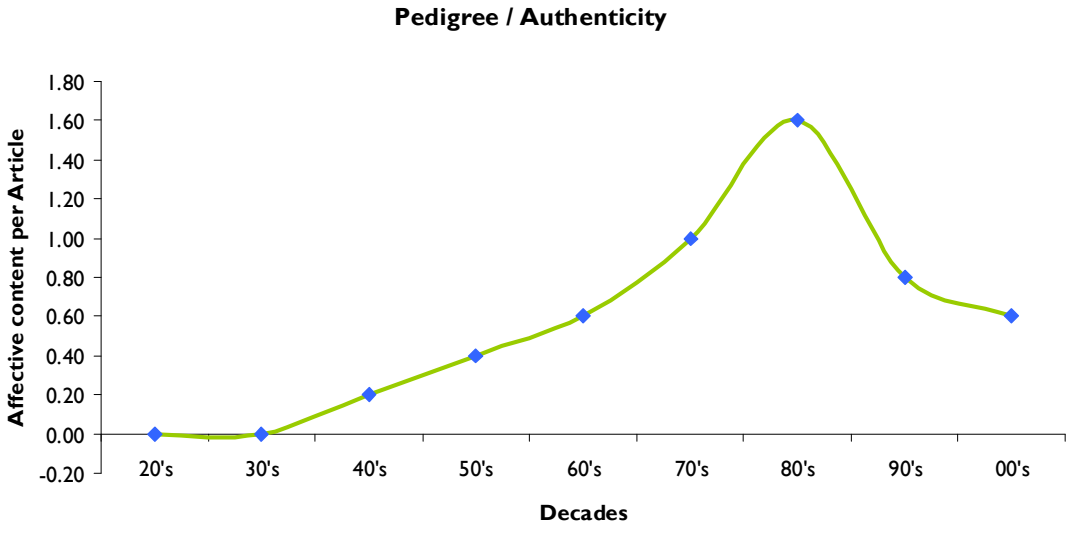

Intricacy / Detailing
Affective Content per Article
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

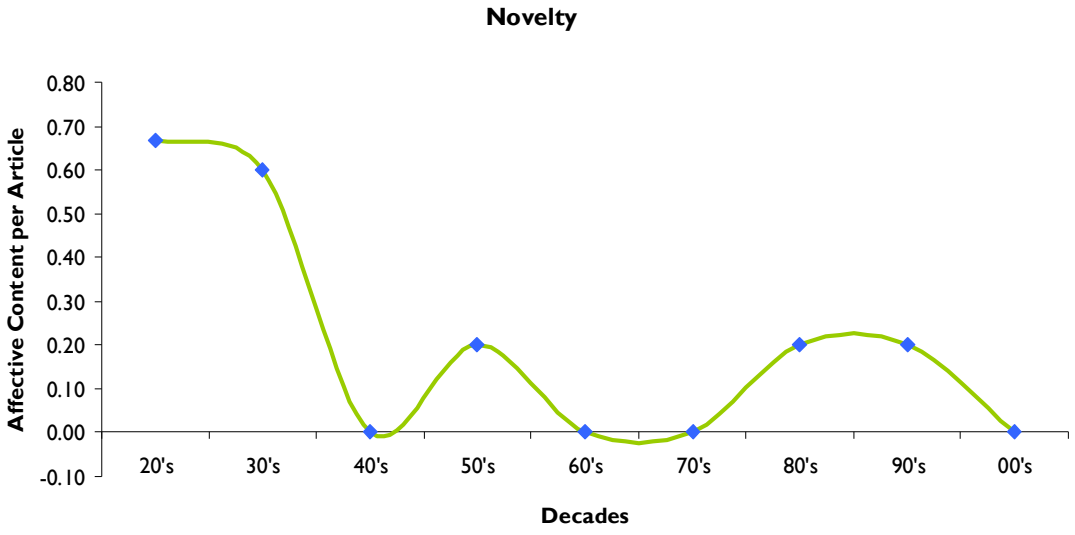

Natural
Affective Content per Article
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

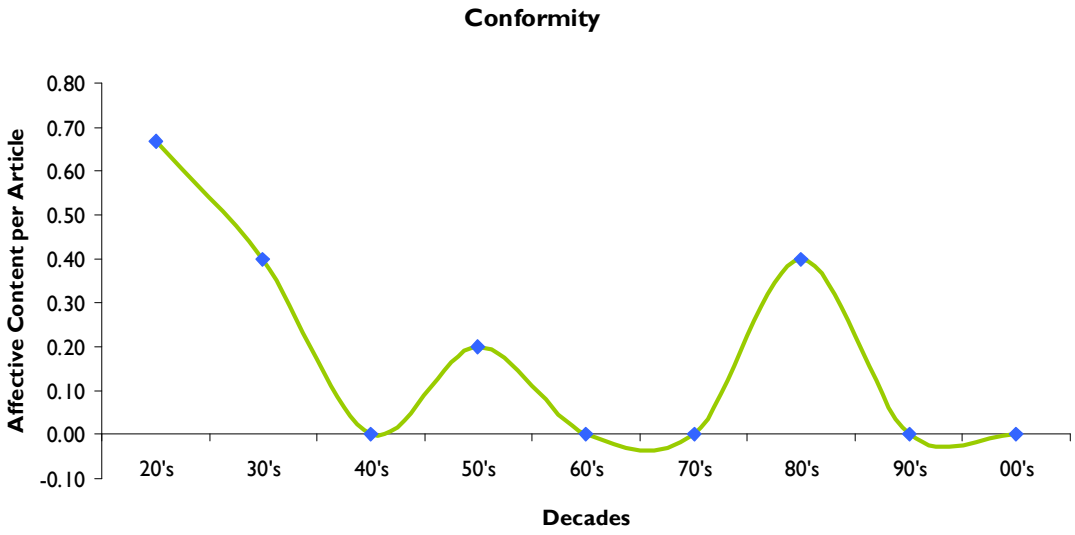

Excellence (above Quality)
Affective Content per Article
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

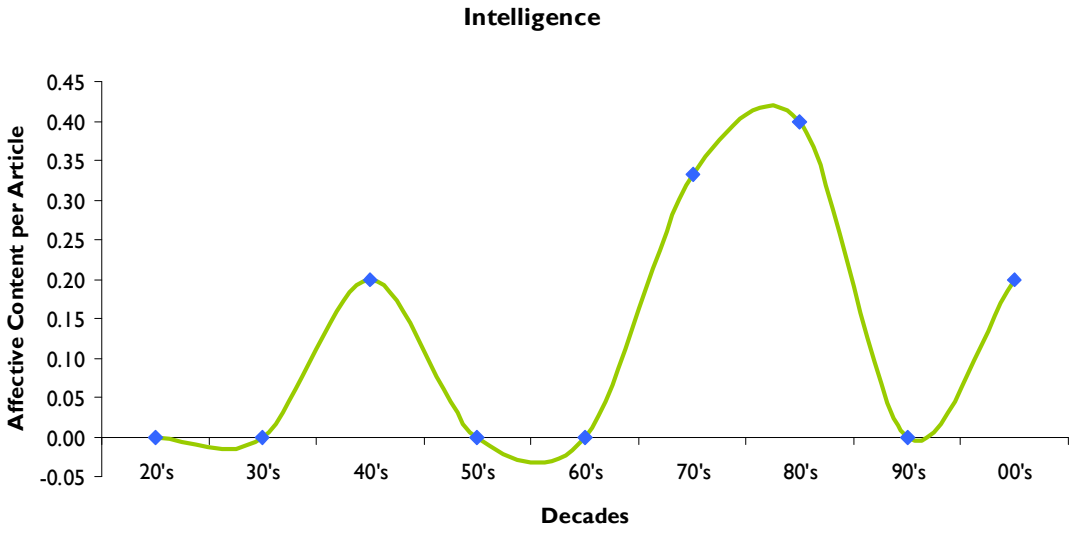

Hand Crafted
Affective Content per Article
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

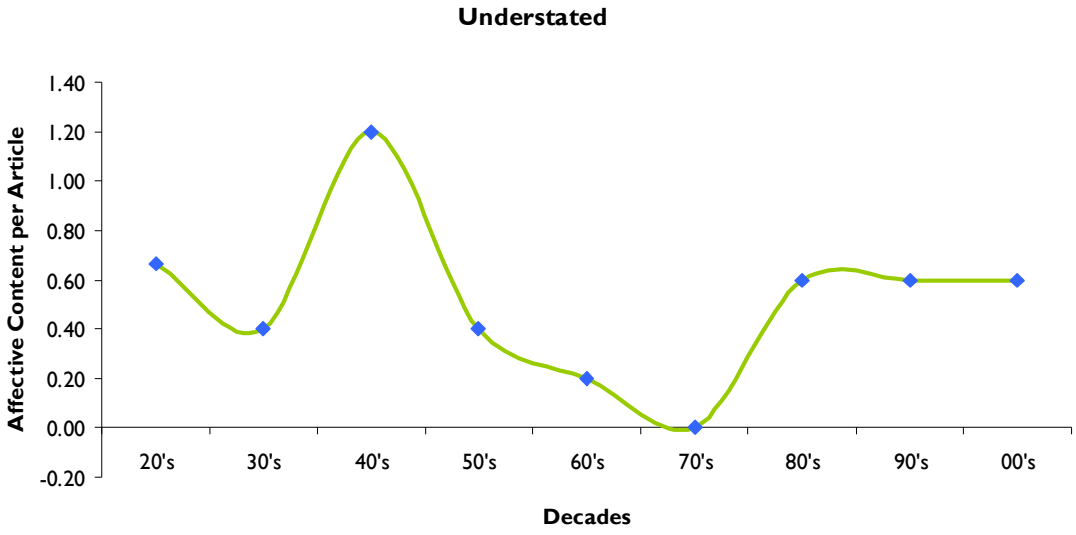

Bespoke
Affective Content per Article
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

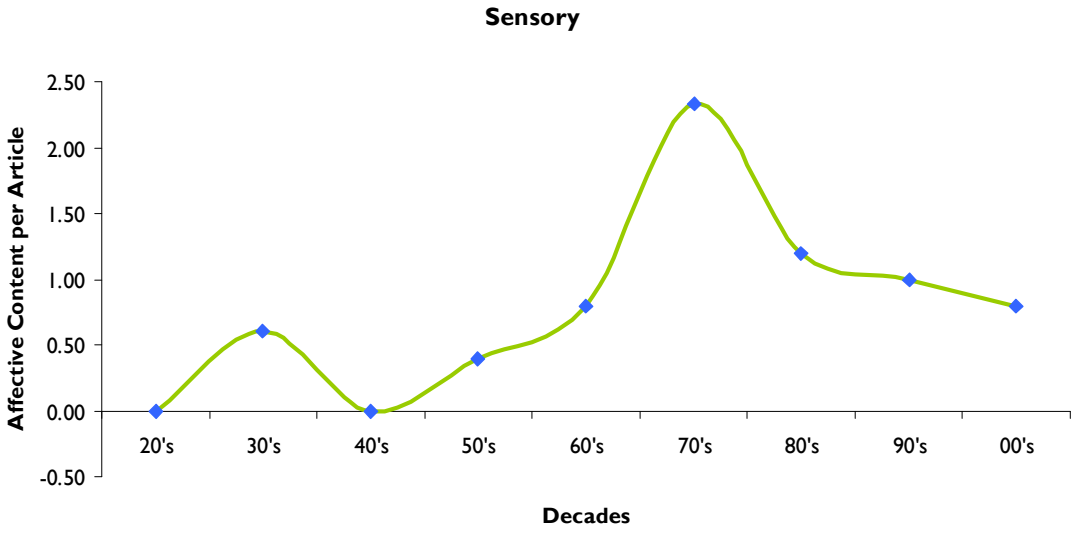

Pedigree / Authenticity
Affective content per Article
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

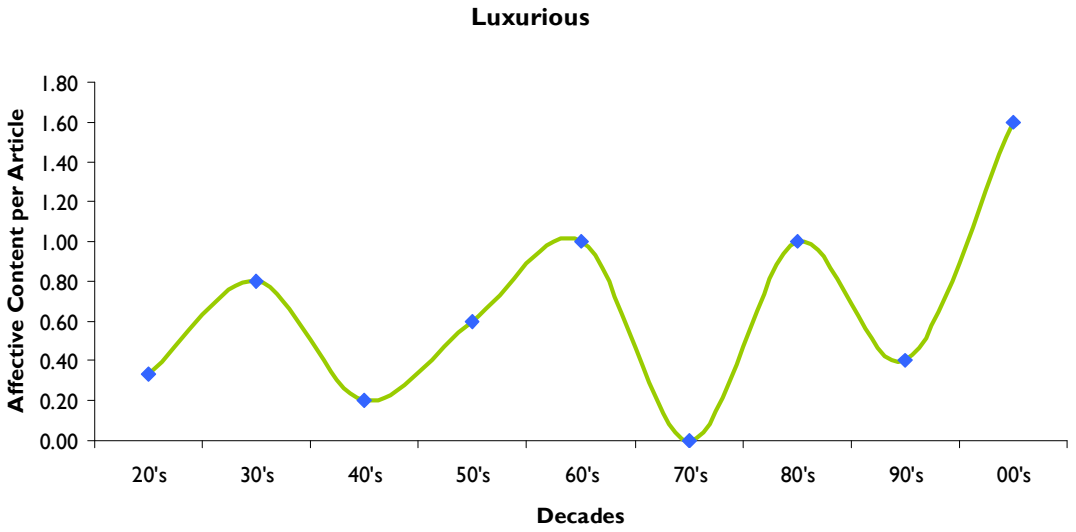

Novelty
Affective Content per Article
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades


Conformity
Affective Content per Article
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

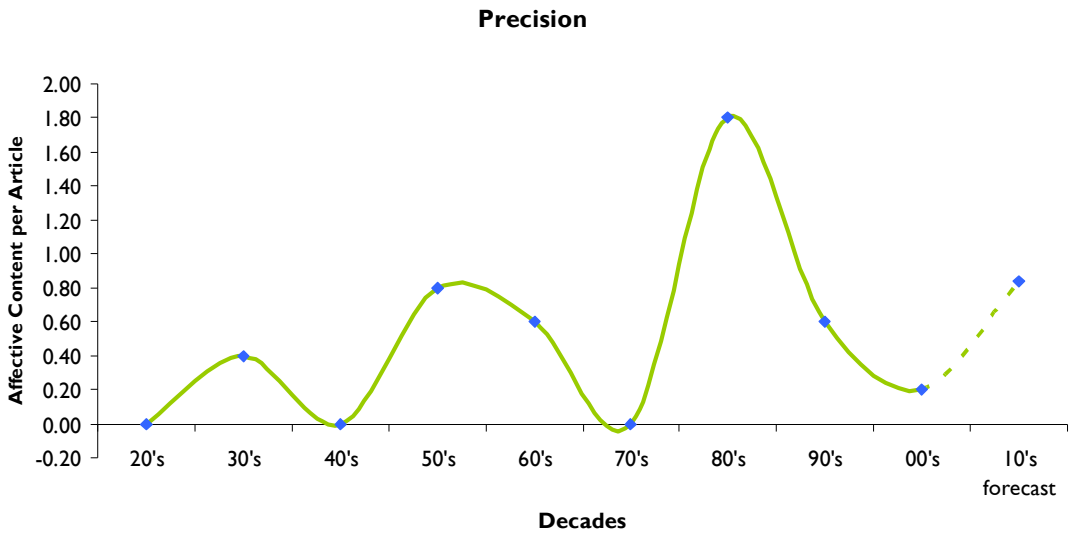

Intelligence
Affective Content per Article
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

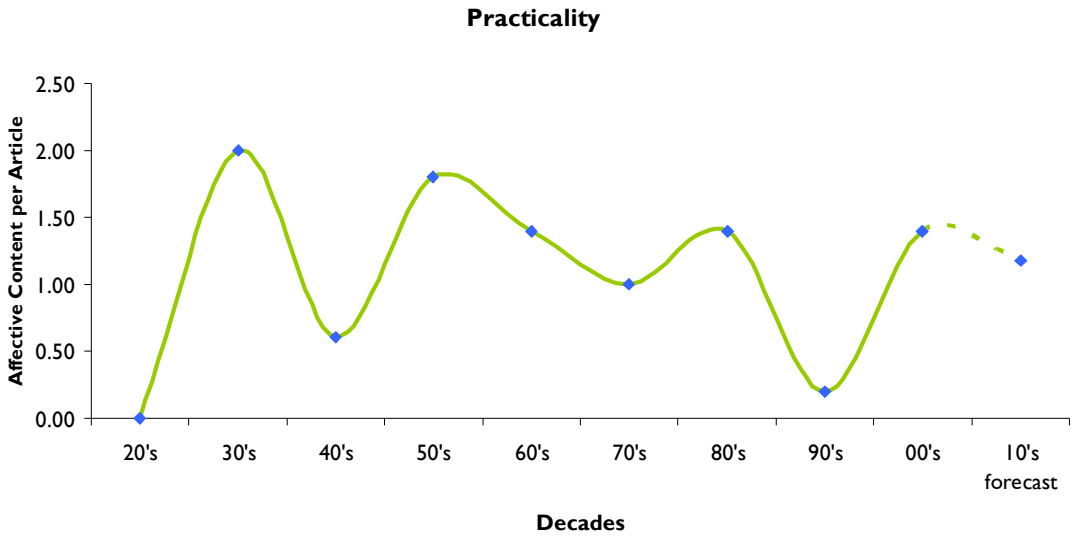

Understated
Affective Content per Article
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

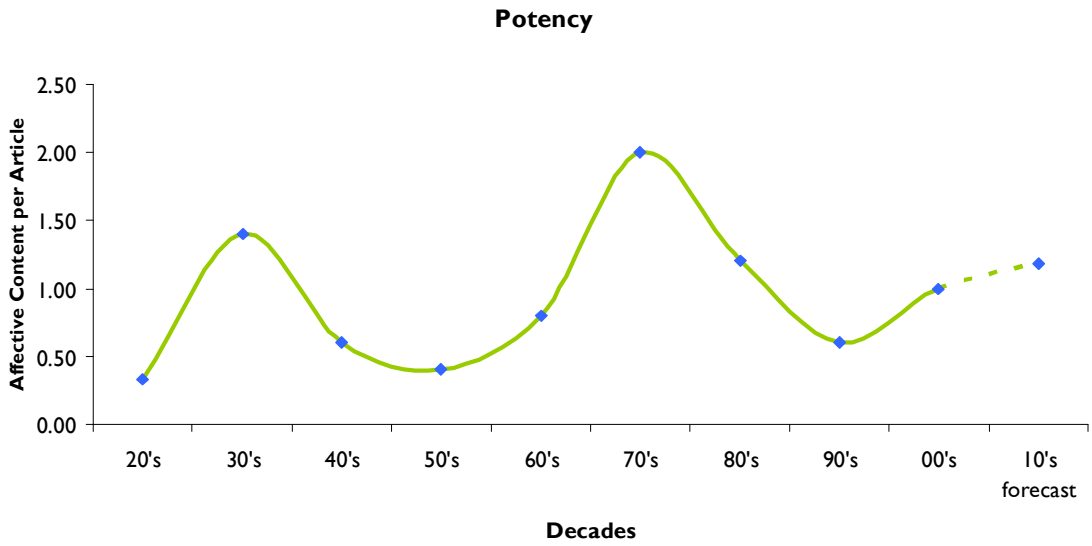

Sensory
Affective Content per Article
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

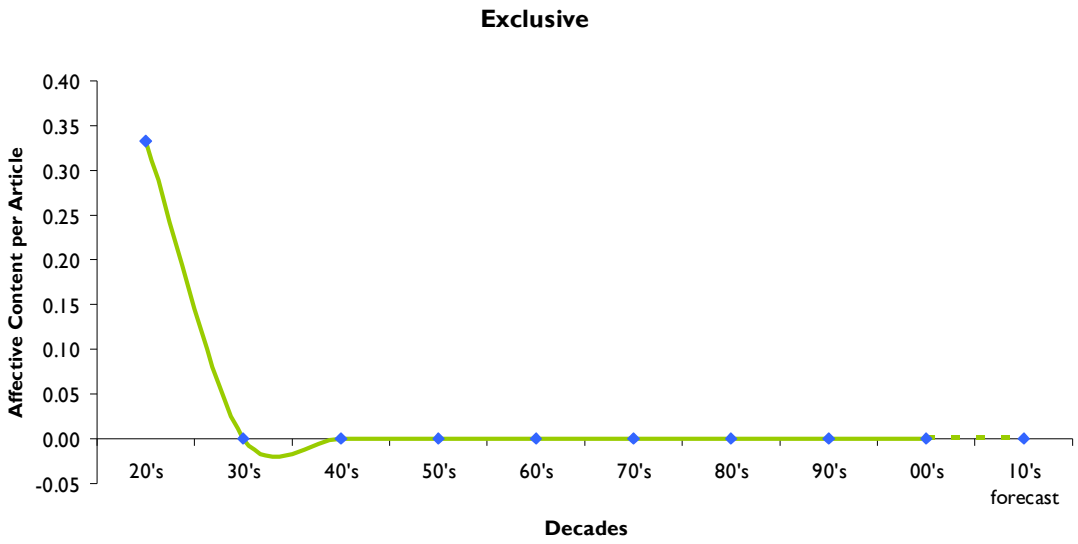

Luxurious
Affective Content per Article
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
Decades

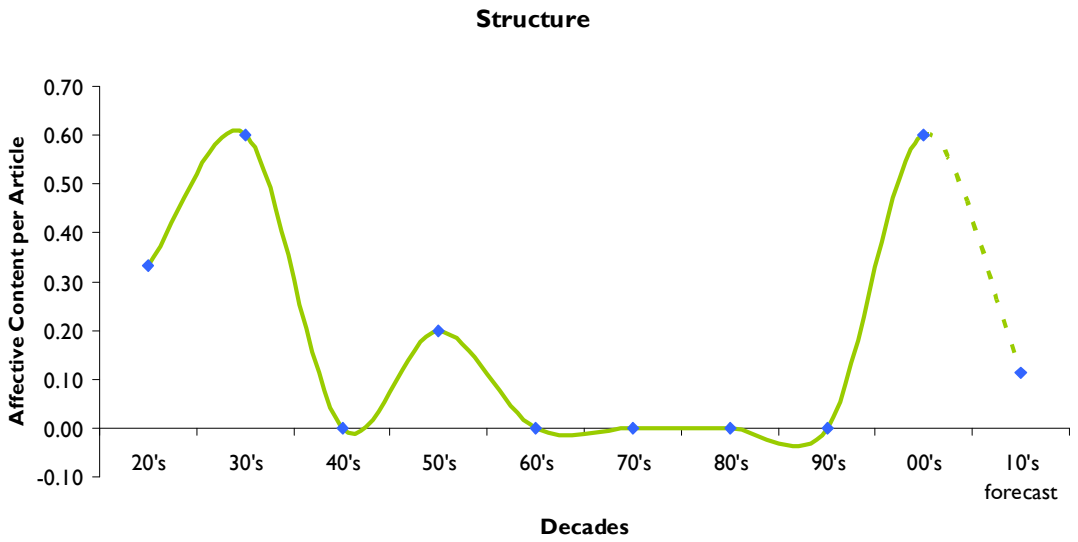
Appendix A3.2 Affective content construct charts with forecast (pp 249 – 256)

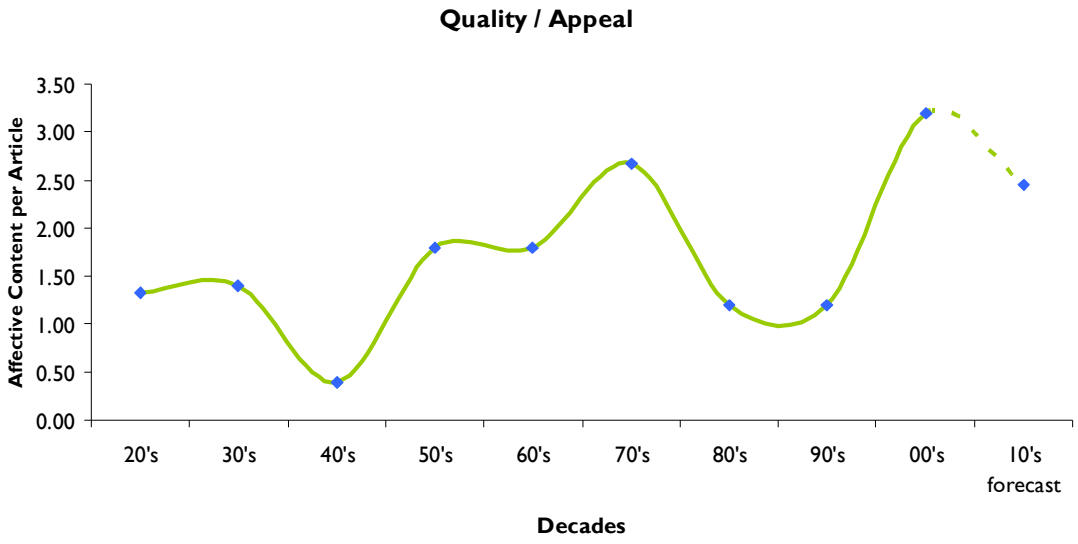


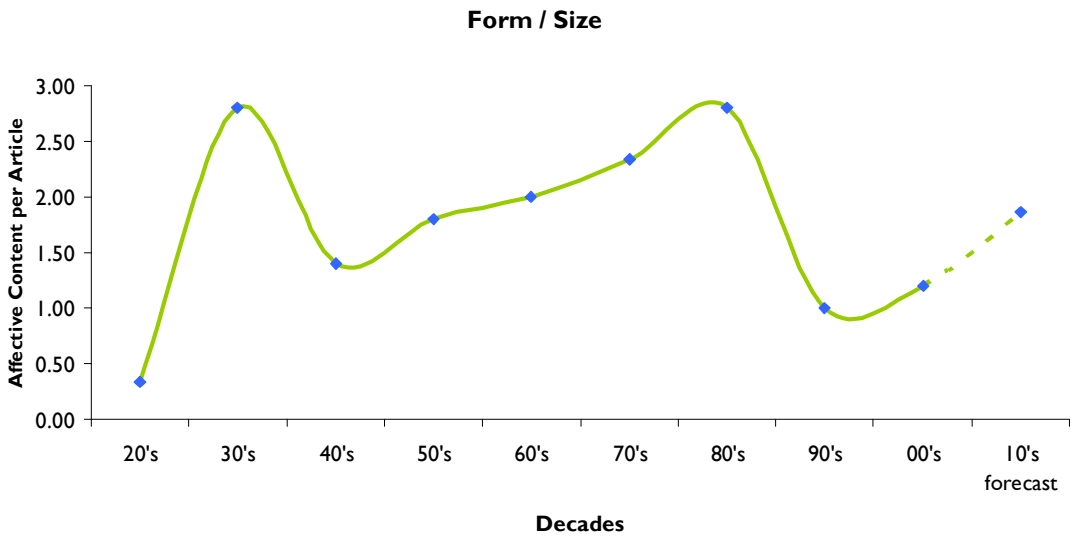

Practicality
Affective Content per Article
2.50
2.00
1.50
1.00
0.50
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades

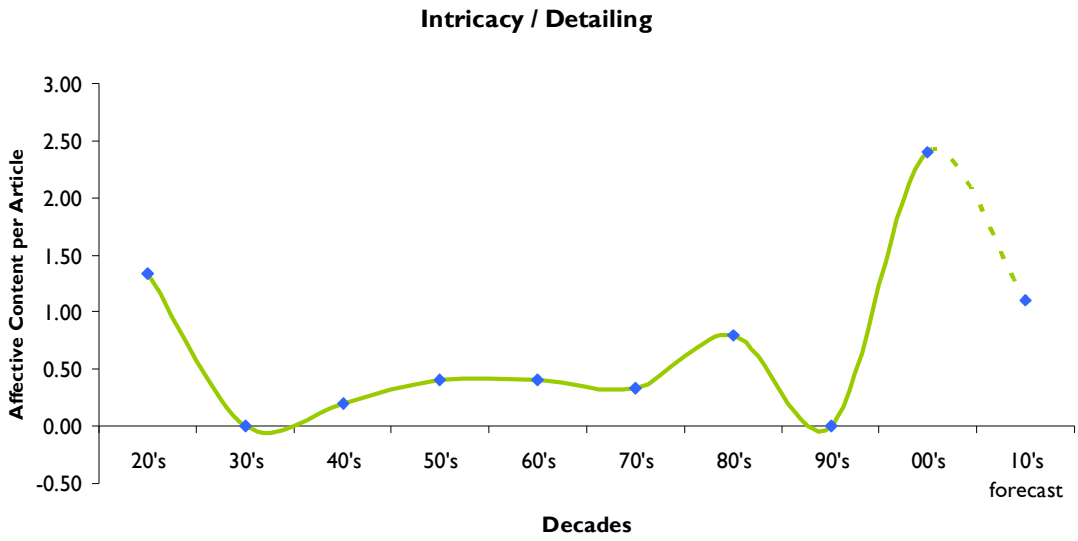

Potency
Affective Content per Article
2.50
2.00
1.50
1.00
0.50
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades

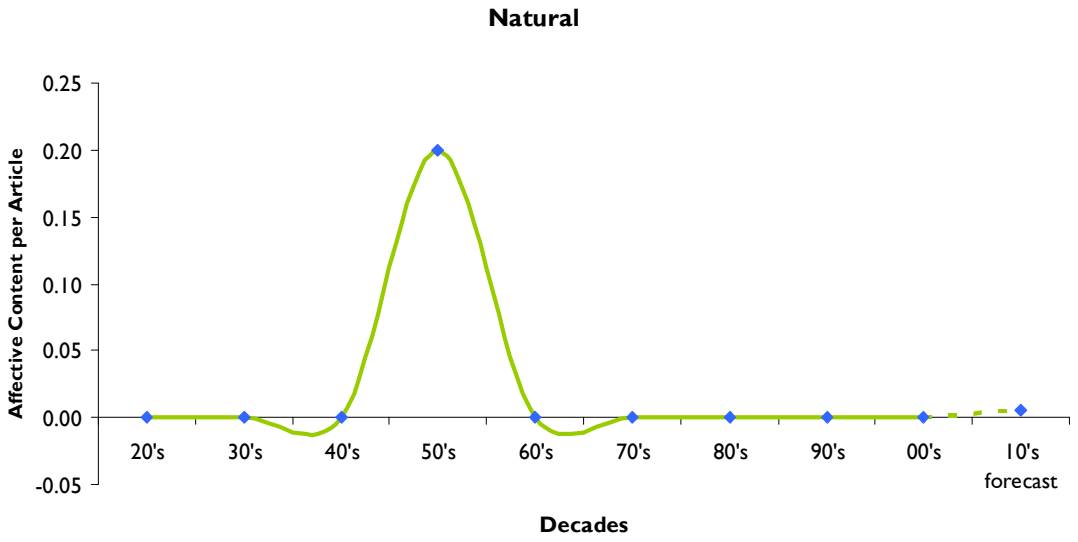

Exclusive
Affective Content per Article
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades

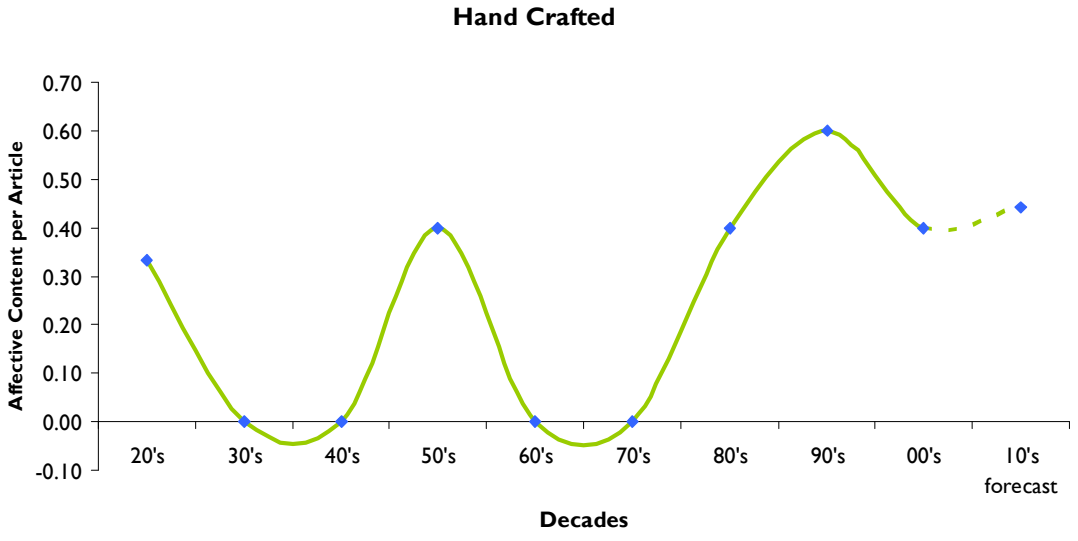

Structure
Affective Content per Article
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades


Quality / Appeal
Affective Content per Article
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades

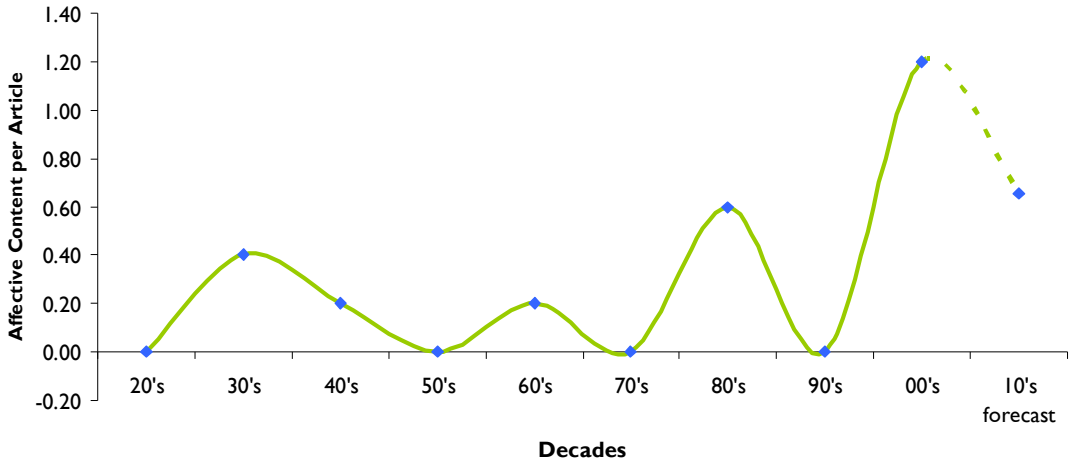

Form / Size
Affective Content per Article
3.00
2.50
2.00
1.50
1.00
0.50
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades


Intricacy / Detailing
Affective Content per Article
3.00
2.50
2.00
1.50
1.00
0.50
0.00
-0.50
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades

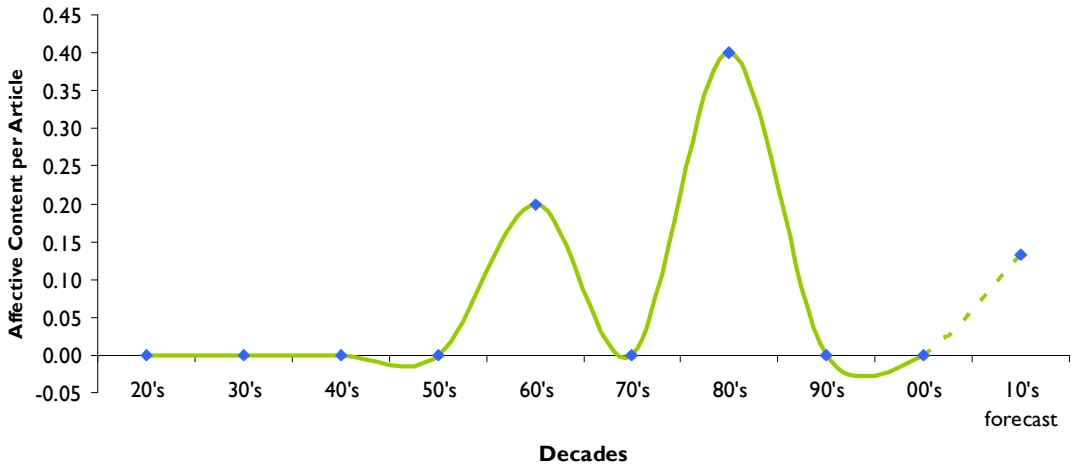

Natural
Affective Content per Article
0.25
0.20
0.15
0.10
0.05
0.00
-0.05
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades


Hand Crafted
Affective Content per Article
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades

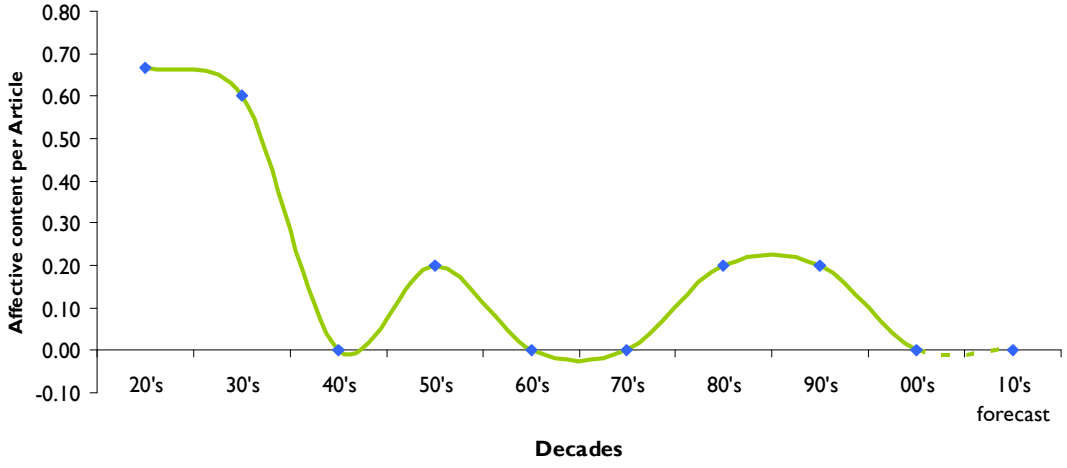
Elegant / Refined

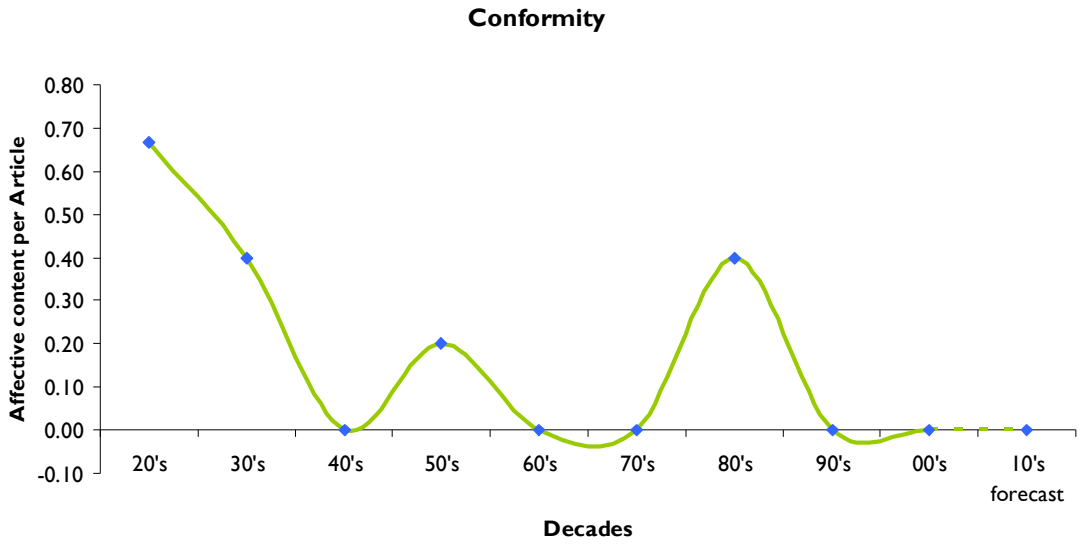


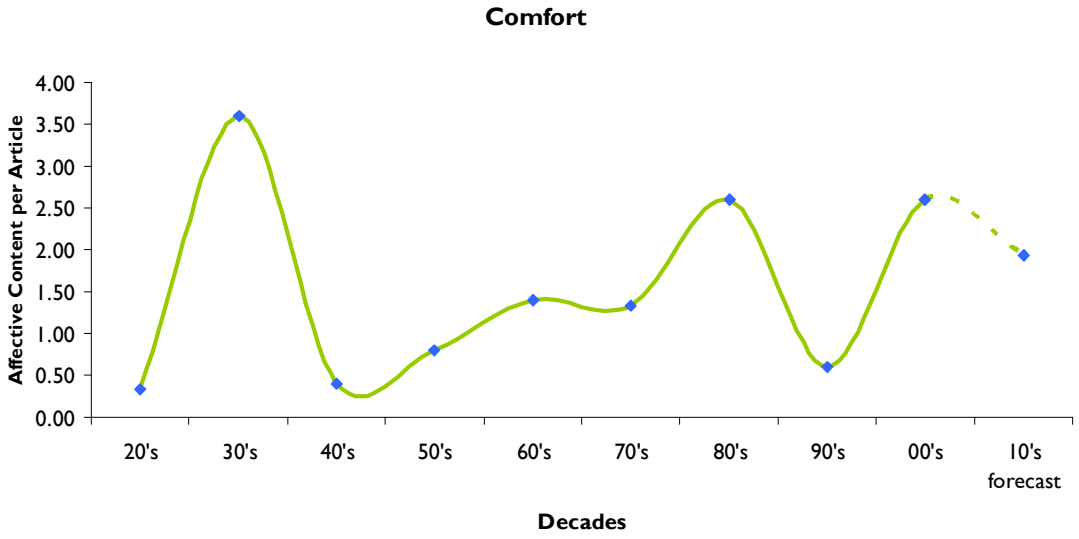
Bespoke

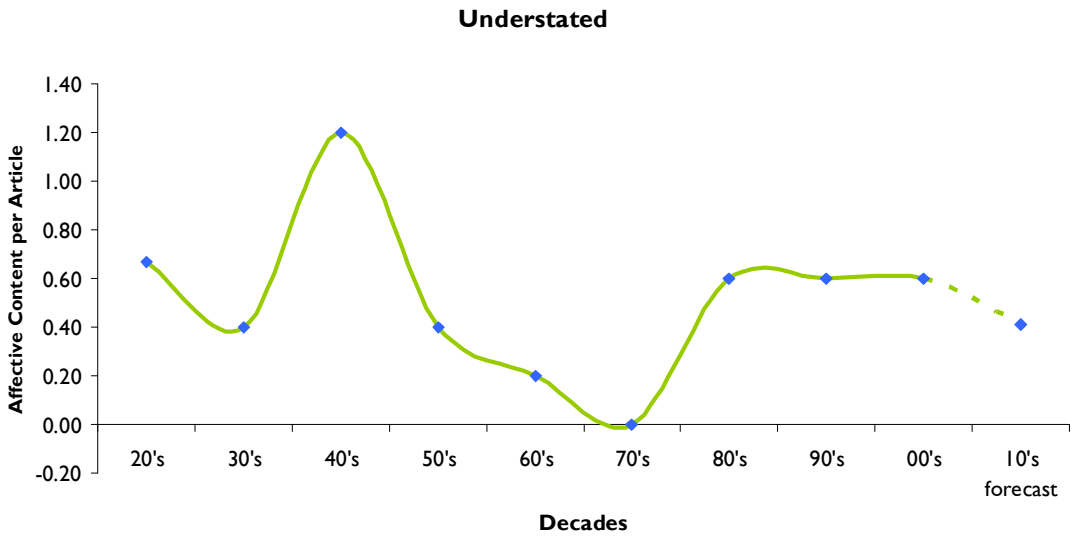


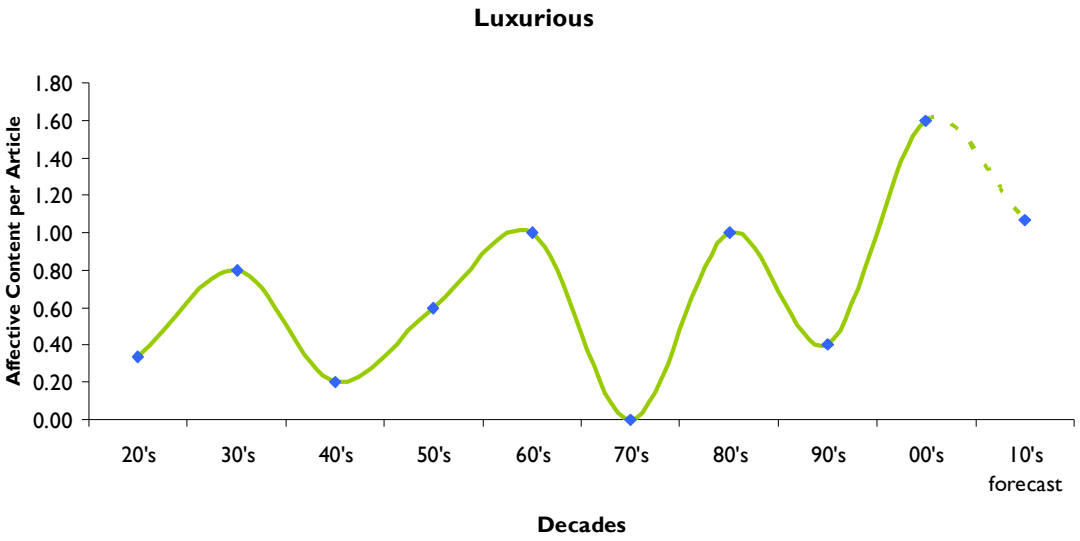
Novelty




Conformity
Affective content per Article
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
-0.10
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades


Comfort
Affective Content per Article
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades


Understated
Affective Content per Article
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades


Luxurious
Affective Content per Article
1.80
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
20's
30's
40's
50's
60's
70's
80's
90's
00's
10's forecast
Decades

Appendix 4: *Study demographics (Studies 1, 2, 3 & 5 to 10)*

Study	Subjects	Occupations	% male, % female	Age-range
1	59	Undergraduate Design students	83% m, 17% f	21-24 years
2	160	IE=41, BE=40, WVE=18, PM=14, Mfg=13, Mkt=9, S=8, EE=3, Q=3, ME=2, Pe=2, Pu=2, CE=2, ChsE=1, ColE=1, PE=1,	90% m, 10% f	23-60 years
3	16	IE=6, ME=3, S=2, Mfg=2, Mkt=1, ColE=1, PM=1	94% m, 6% f	22-50 years
5	5	IE=4, S=1	100% m	26-41 years
6	28	BE=5, WVE=4, S=2, F=2, PE=2, PM=2, Mfg=2, ChsE=2, EE=1, Mkt=1, IE=1	96% m, 4% f	32-51 years
7	28	IE=13, BE=15	89% m, 11% f	22-52 years
8	28	VWE=6, BE=4, PM=4, S=2, IE=2, PE=2, EE=2, ChsE=2, Mfg=1, Mkt=1, ColE=1, ME=1	100% m	28-47 years
9	7	IE=4, ColE=2, S=1	71.5% m, 28.5% f	25-41 years
10	10	IE=3, WVE=2, PM=2, F=1, Mkt=1, Mfg=1	100% m	28-47 years
Total	341		91.5% m, 8.5% f	

Occupation key:

BE: Body Engineering
ChsE: Chassis Engineering
ColE: Colour Engineering
EE: Electrical Engineering
IE: Interior Engineering
ME: Materials Engineering
PE: Powertrain Engineering
WVE: Whole Vehicle Engineering

CE: Chief Executive
F: Finance
Mfg: Manufacturing
Mkt: Marketing
Pe: Personnel
Pu: Purchase
PM: Project Management
Q= Quality
S: Styling