Stellingen

Behorende bij het proefschrift “Consumers’ Reactions to Ambiguous Product Information: the Categorization of Hybrid Products”.

1. Het categoriële maatschap van een hybride product is veranderlijk.
   *Dit proefschrift*

2. Het wetenschappelijke uitgangspunt om zich te concentreren op het algemene in het specifieke (inductie) in plaats van op het specifieke zelf heeft ertoe geleid dat de huidige modellen van categorierrepresentatie onbruikbaar zijn om te voorspellen welke classifications consumenten in de praktijk zullen maken.
   *Mede dit proefschrift*

3. Hoewel het categoriële maatschap van een product hoofdzakelijk bepaald wordt door de functionaliteit van het product, is de invloed van de vorm van het product op de categorisatie ervan dermate groot dat het aanbeveling verdient bij de bestudering van categorisatieprocessen stimulusteraal te gebruiken dat bestaat uit een combinatie van perceptuele en conceptuele informatie.
   *Mede dit proefschrift*

4. Aangezien categorisatie veelal automatisch plaatsvindt, valt het te betwijfelen of een post hoc reconstructie door middel van zelfrapportage een natuurgetrouwe weergave van het leidende categorisatieproces geeft. Omdat hybride producten moeilijk automatisch geclassificeerd (kunnen) worden, zijn ze bij uitstek geschikt om categorisatieprocessen te bestuderen.
   *Mede dit proefschrift*

5. Meer nog dan bij een niet-hybride product, bepaalt de naam die aan een hybride product wordt gegeven zijn commerciële succes.
   *Mede dit proefschrift.*

6. Acceptatie van de “theory view” van categorierrepresentatie leidt vanzelfsprekend tot de conclusie dat de ontwikkeling van nieuwe (hybride) producten dient plaats te vinden in samenwerking met de consumenten waarvoor het product bedoeld is, aangezien de categorisatie van een nieuw (hybride) product bepaald wordt door de nuttige theorie van diezelfde consumenten en niet, zoals de “similarity view” veronderstelt, door de objectieve eigenschappen van de producten zelf.

7. Het sociaal-wetenschappelijke equivalent voor het natuurwetenschappelijke adagium “Meten is weten” is “Observeer veren is leren”.

8. Het feit dat het aantal echtscheidingen de laatste vier decennia verviervoudigd is, suggereert dat mensen gevoeliger zijn voor het psychologische principe van “social proof” dan voor dat van “commitment and consistency”.


9. Terwijl het zoeken naar de zin van zinloos geweld letterlijk zinloos is, is de poging het te begrijpen dat geenszins.

10. Voor veel problemen is een gedragsverandering een geschikt alternatief voor een technische oplossing. Iemand die tijd tekort komt, kan beter vroeger opstaan dan een snellere computer kopen.
Theses

Accompanying the dissertation "Consumers' Reactions to Ambiguous Product Information: the Categorization of Hybrid Products".

1. The category membership of a hybrid product is inconstant.

2. The scientific principle of concentrating on what is general in the specific (induction) instead of the specific itself has led to the redundancy of present category representation models as predictors of the classifications that consumers will make in practice.

3. Although the category membership of a product is predominantly determined by its functionality, the influence of the product's form or shape on its categorization is important enough to recommend that when studying categorization processes stimulus material should be used that is a combination of perceptual and conceptual information.

4. As categorization invariably occurs automatically, it is doubtful whether a post-hoc reconstruction by means of self-report is a true-to-life rendering of the actual categorization process. As hybrid products are difficult to class automatically, they pre-eminently lend themselves for the studying of categorization processes.

5. The name given to a hybrid product determines its commercial success more than is the case with a non-hybrid.

6. Acceptation of the "theory view" of category representation naturally leads to the conclusion that the development of new (hybrid) products must take place in conjunction with the consumers for whom they are intended. This is because the categorization of a new (hybrid) product is determined by the naive theory of the same consumers and not, as the "similarity view" presupposes, by the objective characteristics of the product itself.

7. The social-scientific equivalent of the (natural) scientific maxim "Measuring is knowing" is "Observe is learning".

8. The fact that the number of divorces has quadrupled in the last four decades suggests that people are more sensitive to the psychological principle of "social proof" that they are to "commitment and consistency".


9. Whereas the search for the meaning of senseless violence is - literally - senseless, the attempt to understand it is anything but.

10. A change of behavior is for many problems a suitable alternative to a technical solution. Whoever lacks time would do better to get up earlier than to buy a fast computer.
Consumers' Reactions to Ambiguous Product Information

The Categorization of Hybrid Products
Consumers' Reactions to Ambiguous Product Information

The Categorization of Hybrid Products
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ISBN 90 5166 815 5

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Cover design: Krijn Zuyderhoudt and Kaj Morel

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Acknowledgements

"Ik hou van werken zolang het werken is waarvan ik hou"

Johan Cruijff, Het Parool, 4 November 1978.

I have enjoyed working on this dissertation from the start. Naturally, frustration occasionally took over and turned the study of hybrid products into my personal Himalaya. Nevertheless, I have never questioned or regretted my decision to write it. Now that it is ready, I would like to thank the people that contributed to it.

I wish to thank my supervisors Walle Oppedijk van Veen and Jan Schoormans. Walle, you have shown a perfect understanding of how to guide me. Allowing me ample freedom, stimulating me to take decisions when the time was right, reassuring me at those moments I lost faith in the project, and always making time for me whenever you saw that I needed it. It has been a pleasure working together. Jan, you have made me see that the only thing that truly matters in life is the side people are going first: left or right. I appreciate your friendship. Our trips to the ACR conferences, our stay in Lochem, and our walks through the polder (spotting the great silver heron) are great examples of how to combine work with pleasure. They also represent some of our most productive moments. Let’s go on like that.

To my former roommates in Delft, Gerard Loosschilder and Sylvia Mooy: thank you for everything, especially during the first years when so many things were new. Dirk Snelders: your “Brabantsse moppen” have caused me stomachache. Erik-Jan Hultink: the Land of Promise is waiting for us. Danielle Hendriks: thank you for the drinks after work. You never let me down. Marielle Creusen, Jan Poot, Hanny de Wilde, Jürg Thöike, Sandra Snoek, and all colleagues in Delft, it has been great to be around. (I am coming back!)

I am grateful to Agnes Tan and Karin Langelaan for running the PEL, to Dick van Egmond, Bas Bakker, Leon Arkesteijn, Seval Bilici, and Niels Vink for assisting me with the research, to Johan van Rekom and professor Heiser for their advice on the analysis of the sorting data, and to Diane Ricketts and Julie Lawson for editing the text.
I express my gratitude towards Fred van Raaij and Berend Wierenga for offering me the opportunity to combine my research with teaching at the Erasmus University. To my colleagues at the department of Marketing Management: thank you and good luck. Ad Pruyn and Peeter Verlegh, I have enjoyed your company and working together. I am looking forward to working with you in the future.

To my dear friends and paranympths Krijn Zuyderhoudt and Marieke Wilke: it is great to have you beside me! Kristina, your presence has given me the inspiration that I needed to finish this book. You are wonderful! Papa, mama, and Chantal, I am so happy to be one of you. Thank you for your love and support.

Leiden, Rotterdam, Delft
September 2000
1 The Development of Hybrid Products

In their struggle for survival in a competitive market, companies are constantly trying to come up with new products that will satisfy consumers' needs better than existing products. During recent years, an increasing number of companies have taken the approach to combine two or more existing products (referred to as the source products) or product functions into a new multifunctional product\(^1\). Such products are referred to as "hybrid products". The development of hybrid products appears to be an effective strategy to introduce new products to the market as hybrid products reduce costs for the customer and increase efficiency (Mayer 1996). Numerous examples can be found in the marketplace, including products like the telephone-answering machine, the CD-i player, the television-video recorder, the fax-scanner-copier, the binoculars-Walkman (Figure 1.1.) and, in the near future, the microwave-bank ("Financiële magnetron" 1998; "Bankieren doe je thuis" 1998), the screenfridge (http://www.electrolux.com/screenfridge/start.htm), and the motorbike-car combination.

Figure 1.1
Binoculars or Walkman?

Note 1 According to Urban and Hauser (1993), hybrid products may occur as a result of linking engineering opportunities to market opportunities, because "looking at markets (...) rather than application of specific technologies may give a different and creative perspective" (p. 144). They show how this approach could lead to hybrids such as a bracelet-watch or a glasses-watch (Urban and Hauser 1993, Figure 5.8, p. 145).
The share of hybrid products on the market can increase significantly, given the growing importance of high-technology and ICT and due to the presence of common technological platforms (e.g., digital processors and operating systems) across products and product categories (Jain and Ziamou 1995). Recent examples of hybrid products that make use of common technological platforms are the GSM telephone with computer games and internet applications (Wireless Application Protocol), and the car multimedia systems (which are produced by VDO Dayton, for instance: http://www.vdodayton.com/products/navigation/h_index.htm).

Since hybrid products are combinations of existing products, they possess attributes that are associated with several different product categories, enabling classification into each of these. As a consequence, the classification of hybrid products is ambiguous. In accordance with Ha and Hoch (1989), ambiguity is defined as the potential for multiple interpretations of category membership. For example, a television-video recorder could belong to the category TELEVISION, but also to the category VIDEO RECORDER. Ha and Hoch further explain that “ambiguity is most likely to arise when the consumer faces uncorrelated attributes” (p. 354). Characteristic for hybrid products is that their constituent components stem from different, previously independent, product categories. The total set of attributes associated with one source product is thus uncorrelated with the attribute set that makes up the other source product. This is exactly the condition under which Ha and Hoch predict ambiguity to occur.

In order to understand a new hybrid product, consumers first need to categorize it. They have to assign the hybrid to the category that best matches it. In the case of hybrid products, categorization is not straightforward. How are consumers to determine the best matching category for a product that fits into several categories if it contains elements associated with each and every one of them? There is a bias for people to assume that categories are mutually exclusive (Hampton 1998), i.e., in the eyes of consumers a product cannot belong to more than one category at the same time. Since hybrid products violate this intuitive assumption, consumers are almost certain to experience feelings of conflict and uncertainty. As a result, their intention to adopt the hybrid product will be lower (Rogers 1983; Ziamou 1999).

Apart from the fact that consumers’ intentions to adopt hybrid products will be lower, companies face the problem that they will need to know into which category consumers will classify hybrid products. Many aspects of marketing strategy depend on this, such as market segmentation, product positioning, and advertising (Yi and Gray 1996). Take the BMW C1, for instance (see Appendix 1.1). How should this vehicle be positioned: as a car?
with the qualities and size of a motorbike, or as a motorbike with the comfort and safety of a car? BMW has chosen to position the C1 as a “new form of personal mobility”, but how should they communicate this positioning? More importantly, will consumers accept this positioning? Will they perceive the C1 as it is advertised? Will they compare it with other motorbikes or with other cars, and with which (type of) motorbikes or cars? Will they acknowledge the relative advantage that the product is claimed to possess? The C1 has the appearance of a scooter with some kind of top on it. Will this top convince consumers of the claims of comfort and safety that BMW makes? Or will the appearance of the C1 remind consumers of a transportation vehicle for the disabled, to which it also bears some resemblance?

As the example of the motorbike-car combination illustrates, the ambiguity that characterizes hybrid products considerably broadens the range of issues companies have to consider in the case of new product introductions. The decision process becomes more complex, which increases the probability of errors. Failing to correctly predict category membership for the hybrid product or failing to communicate the intended category to consumers, for instance, may easily result in the product becoming a flop. In order to be able to introduce hybrid products that will be commercially successful, it is essential for companies to know how consumers categorize hybrid products (although this is by no means a guarantee of success). It is the aim of this dissertation to provide this knowledge.

1.1 Hybrid Products Defined

Following Jain and Ziamou (1995), hybrid products, also known as hybrids, are defined as:

Products that combine the functionality of previously established independent products in a single new product package (...) A single new product emerges from the combination of the individual component items (p. 375-376).

Jain and Ziamou (1995) observe that “hybrids are especially prolific in a high-technology and information technology context due to the presence of common technological platforms, such as digital processors and operating systems, across a variety of products” (p. 375). The recent emergence of the multimedia personal computers like the Apple I-Mac and the Toshiba Infinia illustrates this observation well, since these products could never have been created without a common technological platform (i.e. computer technology) providing a connection between the individual components.

Four qualifications can be inferred from the Jain and Ziamou definition that define what a hybrid product is:

1. A hybrid product is an actual physical product. Service packages could also be regarded as hybrid products (e.g. a life insurance policy
combined with an investment fund), but services are not considered in this dissertation.

2. A hybrid product is a combination of established individual components. The source products that constitute a hybrid product are functionally related and may not be taken physically apart. Putting a television on top of a video recorder does not create a television-video recorder, since the individual components are still physically separable.

3. A hybrid product is the result of combining at least two different functionalities. A product’s functionality is its core function and should as such be distinguished from product features, like “show view” on a video recorder or a “removable front” on a car audio system. A wide-screen, high-definition television is not, for instance, a hybrid product, since it only has a single core function, which is to display and broadcast moving images. The additional features on a wide-screen television (i.e., differently proportioned screen size and a high-definition screen resolution) may provide extra value to consumers, but they do not change the core function of the wide-screen television. In conclusion, the third qualification states that a hybrid product combines the core functions of two or more independently established products.

4. The different functionalities of a hybrid product are usually not new, because these functionalities are the core functions of existing products out of which the specific new hybrid product has been created. Although it is not a matter-of-course, combining the core functions of existing products to form a new hybrid product could lead to a really new functionality that is the direct result of the specific combination of existing core functions. For example, an alarm clock-CD player provides the opportunity to be woken up with self-selected music instead of a buzzer. This new option is the direct result of combining the core functions of alarm clock and CD player.

An aspect that has not been included in the definition of hybrid products is the time that a hybrid has been on the market. Is an alarm clock-radio or a sofa-bed still a hybrid product? These hybrids have been on the market for so long that consumers have grown accustomed to them. It is questionable whether these products are still perceived as hybrid products after all this time. The position that is taken here on this issue is that, formally, hybrids like the alarm clock-radio and the sofa-bed are still hybrid products, because they still combine the primary functions of the source products. This does not necessarily mean, however, that they are still perceived as hybrid products by consumers. As it is argued in chapter 6, hybrid products may as time goes by lose their hybridity to consumers. Some consumers may no longer view the hybrid as a hybrid, because they do not use it as such anymore (e.g. a sofa-bed that is used exclusively as a sofa). Nevertheless, few consumers would be willing to deny that the sofa-bed is still a sofa-bed.

Note 3 For the sake of simplicity, from this point on, hybrid products are assumed to consist of no more than two source products. In reality, hybrid products consisting of two source products are indeed most common, but combinations of more than two source products occur as well.
The Degree of Innovation of Hybrid Products

The degree of innovation of a product is defined in terms of changes along three dimensions: product benefits, technological capabilities, and consumption or usage patterns (Veryzer 1998). The product benefit dimension refers to the new capabilities of the product in terms of the needs that it satisfies as perceived and experienced by the consumer or user. The technological capability dimension refers to the degree to which the product involves expanding technological capabilities (i.e. the way functions are performed) beyond existing boundaries. The consumption pattern dimension refers to the degree of change required in the thinking and behavior of the consumer in using the product. A product can be new or innovative along one or more of these dimensions.

How innovative are hybrid products on each of the three dimensions? With respect to the first dimension, hybrid products generally offer new benefits to consumers as a result of combining existing product functions, but these benefits do not necessarily relate to new functionalities. For example, the television-video recorder combination does not provide any new functionalities, but it does offer a new benefit in the sense that it can be moved around the house easily. The same holds for the technological capability dimension. Combining existing products into new products may result in new functionalities, but it does not automatically do so. The distinction between hybrids that provide new functionalities and hybrids that do not corresponds to the distinction that Jain and Ziamou (1995) make between enhanced hybrids and parity hybrids. Enhanced hybrids are hybrids that deliver a new functionality as a direct result of the particular combination of source products. A digital camera, for instance, combines a photo camera with computer technology to create a completely new set of functions like watching photos on the spot and retaking bad photos. By contrast, in the case of parity hybrids the particular combination of source products does not lead to additional value exceeding the value of the individual components. For example, the extra value generated by combining a telephone and an answering machine is restricted to the advantage of having a single product instead of several separate products. In terms of consumption patterns, the third dimension of innovation, hybrid products may require different ways of thinking about and dealing with them, but again, they do not necessarily do so. For instance, using a message watch requires a different set of operations than a regular watch does. The use of a message watch has to be learned. Considering all three dimensions of innovation, hybrid products are really new in the sense that they do not yet exist, but at the same time they are not new because consumers are familiar with the (use of) the individual components. In sum, it is difficult to tell how innovative hybrid products are in general. Depending on the specific hybrid product in question, hybrid products may be highly innovative on all three dimensions, or they may be barely innovative at all.
1.2 Rationale for Developing Hybrid Products

Why do companies choose to develop new hybrid products? Probably, companies have the idea that developing hybrid products is a relatively easy way to create new products. As most things have already been invented, it appears easier to present a combination of old products in a new guise than to come up with a completely new product. Indeed, new-to-the-world products form only ten percent of all newly developed ones (Kotler 1997). Nevertheless, if the purpose is to create new products, why do companies choose to create hybrid products? Why not simply add a new feature to an existing product and create a new product in this way? The reason for this is that novel hybrid products are "newer" than product modifications (i.e., existing products with a new feature) in that the latter are much harder to differentiate from existing products. They belong to the same category as their source category. In contrast, a new hybrid product is truly different from existing products. It belongs to a different category than its source categories. By developing new hybrid products, companies have the opportunity to develop new (sub)markets.

Earlier, it was noted that the idea for a new hybrid products may occur as a result of linking engineering opportunities to market opportunities (Urban and Hauser 1993). Alternatively, the development of a new hybrid product may be inspired by the success of the individual source products. If the source products have proven to be successful on their own, why not combine them to create an equally or even more successful product? (In reality, the market for the combined product is often very small.) In addition to these intuitive reasons, developing hybrid products enables firms to increase performance and to create competitive advantage by reducing production, storage and transportation costs, by enhancing the opportunity for price discrimination, by increasing customer value, and by raising entry barriers (Paun 1993)\(^4\). Each of these strategies is discussed briefly.

Reducing Costs

Generally, it is more efficient to produce a single product rather than two or more. After all, such production requires less machinery and the available

---

Note 4 These strategies to increase company performance are taken from the literature on product bundling (Gaeth, Levin, Chakravorty, and Levin 1990; Suri and Monroe 1995; Yadav 1994; Yadav and Monroe 1993). Product bundling occurs when two or more products (goods or services) are sold as a single package (Paun 1993). For example, when arrangements are made for a skiing holiday, the bundle will include transportation, accommodation, ski equipment, and ski courses. Like hybrid products, product bundles consist of multiple independent functionalities. However, product bundles are not single product entities, but several distinct products (services) that are sold together. The individual goods in a product bundle may be functionally related but they are not physically integrated. The individual components that constitute a hybrid product are both functionally related and physically integrated. Furthermore, product bundles frequently include services, whereas hybrid products do not. Finally, product bundling is mainly a selling strategy, whilst developing hybrid products is a product innovation strategy.
machinery can be used more efficiently. In addition, less raw material is needed, less packaging material, less storage space, and less transportation space. Manufacturing hybrid products can thus reduce production, storage and transportation costs.

Enhancing Price Discrimination and Price Differentiation Opportunities
One of the advantages of hybrid products over and above separate source products is that customers may be persuaded to buy the hybrid product whereas they would not buy all the individual source products. This is likely to happen, when the price of the hybrid product is lower than the total sum of the individual source products. Alternatively, a new hybrid product may be bought to replace existing source products. If the hybrid product is an acceptable alternative to the source products for consumers, then there will be a relatively strong increase in profit. The cost price of producing only the hybrid product will be lower than the cost price of producing the individual source products. At the same time, the retail price of the hybrid product can be higher than the retail prices of the source products because of the extra value the hybrid product has. However, replacing several source products with a single hybrid product may be a form of cannibalism and could reduce profitability. Consumers who buy a telephone-answering machine are no longer expected to buy a telephone and answering machine separately.

Increasing Customer Value
The perceived value of hybrid products may be substantially greater than the perceived value of (any of) the source products it replaces. Hybrids may offer new benefits or even new functionalities as in the case of enhanced hybrids. An alarm clock playing a CD will be appreciated more than a regular one that is only able to produce an irritating beep. Travelling with an hair dryer-iron combination (see Appendix 5.3) instead of a hair dryer and an iron saves space and weight in the suitcase.

In spite of the definite advantages attached to the purchasing of hybrid products (e.g. supplying additional functionalities, saving space, saving energy consumption), consumers may simultaneously perceive the purchasing of a hybrid product as a risky investment, since they will anticipate the chance of the product combination breaking (down). If the hybrid has to be repaired, the entire product will be taken away. Moreover, if the damage proves irreparable, the whole product will have become worthless, including the part that might still work properly.

Raising Entry Barriers
Developing hybrid products in a particular market segment may present considerable barriers to providers of non-hybrid products, since the standard for that segment then becomes the hybrid product rather than the non-hybrid product. Entry barriers become particularly high, in cases where
companies have the exclusive rights to the production of a hybrid product. Competitors are not allowed to copy the product and consumers within the particular market segment will not accept alternative products.

1.3 Developing Successful Hybrid Products

The major problem for companies who wish to develop successful hybrid products is that the uncertainty, and thus the perceived risk, is high. Little is known about the way that consumers categorize hybrid products and, accordingly, about the way new hybrid products should be positioned. The research presented in this dissertation commenced in reaction to experiences in business and industry with the development of new hybrid products. The experiences of two companies, Philips and Olivetti, are briefly described to illustrate the kind of problems companies may encounter when developing new hybrid products.

The development and introduction of an interactive navigation system for cars confronted Philips with a type of problem that they were not familiar with. The interactive car navigation system is not a concrete product, but a system that integrates all sorts of functions and that consists of a whole set of hardware components. The hardware components are a number of computers, a satellite receiver, and a mobile telephone. The major problem for Philips was to decide what the new system really was and, more importantly, as what (e.g. board computer, electronic map, all-in communication system) the new system should be put on the market. In short, Philips had a hard time deciding on the most suitable identity for their new product.

Another company that developed a hybrid product is Olivetti, a computer firm that created a multimedia computer. A passage from this firm's press release (Olivetti 1996) clearly illustrates the hurdles this company had to take during the development of the Envision:

A research was conducted to gather information about the taste and the requirements of consumers with regard to design, usage, and functions. The main purpose of the research was to delineate the conceptual positioning of the Envision, in other words to find out with which promise the Envision would best meet the preferences of the consumer market. Respondents evaluated four different concepts or identities of the Envision and indicated their preference: a PC to work at home; a PC for the family; a PC as 'multifunctional integrator'; and a PC for the electronic highway. The concept of the PC as multifunctional integrator was preferred by most people.

With regard to the naming of the new hybrid, the press release continues:

The name 'computer' is hardly appropriate anymore for this strange black device that does not betray its function at first sight: a mixture of CD player, Hi-Fi-chain, and PC. Olivetti named 'the thing' Envision, the first computer especially designed to be used in combination with the television.
From the examples of Philips and Olivetti four major issues emerge that companies involved with the development of hybrid products must deal with:

1. Which of all possible product combinations should a company choose and bring onto the market in order to introduce a new hybrid product that fits consumers' expectations and experiences best, so that the chances of the hybrid product becoming a commercial success will not be a priori diminished?

2. How does a company know what the most commercially successful product combination is, and more importantly, how should a company select the most successful product combination?

3. How should a company integrate multiple product functions into a single product entity?

4. How should a company communicate the multiple identity of a hybrid product and the specific product advantage that may result from it?

What these four issues boil down to is that designing and positioning new hybrid products presents companies with a dilemma that "reflects a tension in marketing decisions between designing products to be identified with a category while differentiating them from other products in that category" (Viswanathan and Childers 1999, p. 75). Ratneshwar and Shocker (1988, p. 284) have formulated this dilemma as follows:

> If the product offering is too similar to what already exists, it is likely to be assimilated by many to an existing category, if not ignored entirely. But if it is very new and different, the likelihood of a new category resulting may also be low. No matter how novel something is, people will attempt to understand it in terms of what they already know. Inability to comprehend for many could result in no categorization and work against the new product's success.

An important point in light of the present dissertation is that Ratneshwar and Shocker explicitly state that the commercial success of a hybrid product may be directly related to consumers' ability to categorize the hybrid product. This statement explicitly stresses the practical relevance of the dissertation. Obviously, if Ratneshwar and Shocker are right, consumer categorization of hybrid products should be of great concern to companies developing them.

The dilemma of developing and positioning hybrid products may be understood by looking at two major developments that have taken place within the market for consumer durables. These developments are the advances in technology and, related to this point, the changing relation between a product's function and form. To start with the first, technological progress makes it possible to create practically any hybrid product one can come up with, while at the same time consumer information processing and behavior with regard to hybrid products are hardly known. Jointly, these facts make it difficult to predict which new hybrid products will be successful and which will not. Second, the relation between product function and product form has changed significantly. For many products the form is no longer dependent on the function. This is particularly true for high-
technology products. As a result, many products lack a characteristic appearance, i.e. an appearance that is distinct and that makes clear what the product is. The remainder of this section will focus on each of the previously mentioned issues regarding the development and positioning of hybrid products (i.e. selecting a combination that meets consumers' desires and expectations, selecting a commercially successful combination, integrating multiple functions into a single form, communicating the multiple identity and its advantage).

1.3.1 Unlimited Opportunities

The examples of the Philips interactive car navigation system and the Olivetti Envision show that in the near future, as technological limitations are gradually overcome, the opportunities to create new products will become practically unlimited. Combining advanced computer and communication technologies allows for the development of highly sophisticated new product combinations such as the WAP phone. The fact that everything can be made raises a new kind of problem for companies. As the number of alternatives increases, deciding which of all technologically feasible product combinations should be developed and brought on the market becomes considerably more complex. For example, try to imagine how many different product combinations Olivetti could make with the available technologies. Why did Olivetti decide to develop the specific Envision home PC that they developed? More importantly, how did Olivetti select this particular alternative out of the sheer countless number of home PCs that they were able to make? Which selection criteria did Olivetti apply? The same questions may be asked regarding the future of WAP-related products. In a situation of unlimited technological opportunities, the consumer has become the limiting factor, not technology itself. The question is no longer whether a company is able to make a particular product, but whether consumers understand and want it. As the next subsection explains, little is known about consumers' reactions to hybrid products.

1.3.2 Consumers' Reactions to Hybrid Products Are Unknown

The success of a new hybrid product is completely dependent on the willingness of consumers to buy the new hybrid product; the consumer is sovereign (Engel, Blackwell and Miniard 1995). Consumers' wishes and demands determine whether a new hybrid product becomes a commercial success or whether it can be added to the list of product failures. In order to anticipate the commercial success of a new hybrid product, companies need to know what the wishes and demands of their customers are. Consumer research can provide this knowledge. Sensible companies rely on consumer research, as no consumer research or consumer research in only the final stages of the new-product development process, is one of the reasons why many durable goods fail in the market place (Mahajan and Wind 1992).
At this point in time, consumer literature discussing hybrid products is scarce. Jain and Ziamou (1995) introduce the concept of hybrid products and give some research propositions. A paper by Mukherjee and Hoyer (1997) discusses novel attribute products, which could be regarded as hybrid products. The authors formulate several research hypotheses, but they do not report any empirical research either. Yi and Gray (1996) present a study in which they examined how the categorization of an ambiguous product (i.e. something that could either be a bookbag or a suitcase) was affected by manipulating the characteristics of the product (i.e. including a highly-characteristic feature of either the bookbag or the suitcase in the product description). Strictly speaking, the ambiguous product of Yi and Gray is not a hybrid product, because it is not a combination of products, but a product that could be interpreted as being one product or another. More recently, Gill and Dubé (2000) wrote a paper on hybrid products, which they call composite products. These authors propose a distinction between generic composite products, which are combinations of existing products (e.g. clock-radio), and branded composite products, which are combinations of a brand and existing products (e.g. a Sanyo clock-radio). Their study examined whether and how the information that is associated with a brand may affect the categorization and resulting evaluation of hybrid products. In fact, Gill and Dubé did not study the actual categorization process of hybrid products; they investigated the effect of additional information, in this case brand-related information, on the categorization process of hybrid products.

Besides the four studies mentioned above, no other studies were found within the marketing and consumer literature that focused directly on hybrid products. Attention has been paid, however, to related but distinct ideas, such as discontinuous innovations (e.g. Veryzer 1998), product ambiguity (e.g. Yi and Gray 1996), schema incongruity (e.g. Meyers-Levy and Tybout 1989), and fuzzy set theory (e.g. Viswanathan and Childers 1999).

In short, knowing what consumers think of new hybrid products and how they appreciate these products seems to be a necessary, though insufficient, condition to create successful hybrid products. As a result of a lack of knowledge of consumers' reactions to hybrid products, it is problematic for companies to anticipate whether a new hybrid product meets the needs and expectations of their customers. Uncertainty about future product success is high.

1.3.3 Integrating Multiple Functions into a Single Product Form

Any product is a material manifestation of a particular function molded into a particular form. The function and form of a product are mutually dependent. The intended function not only determines the form of the product ("form follows function"), but the form of the product also determines its function, i.e. what you can do with it (Creusen 1998; Veryzer 1995). There is no function (i.e. product) without a form and there is no form
without a function. The strength of the dependence relationship between function and form may vary across products. For some products, like a pair of scissors, the form depends heavily on the function. For other products, like personal computers, the form is relatively independent of the function. This is the case here, because the miniaturization of electronic components decreases the dependence of form on function (Creusen 1998).

Thus, although the form of every product is always determined by its function to some extent, there is always a degree of freedom to shape a product as well. This freedom explains why not all hair dryers, cars, CD players, or chairs look alike. Within the boundaries set by the functional requirements, designers create the definitive product form. The latitude designers have depends on the strength of the function-form relationship within the product they are designing. The greater latitude designers have when creating a chair rather than a CD player is reflected in the enormous variety of chairs in comparison with the much smaller variety of CD players which all look relatively similar (i.e. black or dark-gray rectangular boxes with a few buttons and the disc compartment in the middle).

What does the function-form dependence mean for the creation of hybrid products, where multiple functions have to be materialized into a single product form? If there is a strong relationship between function and form, integration seems to be difficult. The integration of a food processor with a television set is problematic, since the function-determined product forms of the food processor and the television are difficult to combine. By contrast, when the product form is less dependent on the function, integration of product functions is relatively easy. For example, integrating a fax into a computer is relatively simple, because the form of a fax is very flexible and does not interfere with the form of a computer.

In conclusion, this subsection has explained that a particular product combination (i.e. a hybrid product) may be conceptually feasible but technically unfeasible, because it is impossible to create a product form in which each of the core functions can be made operational. As the number of core functions rises and the dependence between function and form increases, the translation of all product functions into a single product form becomes increasingly difficult.

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Note 5 This argument does not hold for products that are created solely for aesthetic reasons, like works of art. These objects are not the subject of this study.

Note 6 The design of a CD player is not only restricted by functional requirements per se, but also by habit or tradition. In principle, a CD player could take almost any form. The electronic components that are required to perform the core function are relatively small and could be built into other forms than the black boxes that are usually built around them. Bang & Olufsen have produced several excellent examples of CD players that completely break with the traditional form. Nevertheless, the black box format of most CD players is functional in the sense that it fits with other audio equipment and that it has a size that is practically convenient.
1.3.4 The Product as Communicator: Friction between Form and Function

Since the form of a product is largely dependent on the core function(s) of the product, in due time a strong association develops between the form and the function of the product. The product form becomes the representation of the product function. This association works in two ways. On the one hand, a particular function is associated with a particular product form. For example, cycling automatically evokes an image of a bicycle. On the other hand, a particular product form tells the perceiver what the function of this product is. People who see a hair dryer know what they can do with it.

For many new products, and for hybrid products in particular, the form-function association has weakened. The product form no longer reveals the product’s function. “This strange black device does not betray its function at first sight” (Olivetti 1996). The explanation for the disconnection between form and function is that current new product development is characterized by the application of computer and information technology. The technological progress in these areas make it possible to integrate increasingly more functions into single product forms, without changing the product form at all. Ultimately, a complete independence between the form and the functions of a product may occur. For example, on a computer a function is nothing else than a software program. The addition of new functions (read: software) does not have any effect on the appearance of the product. The fax function of a personal computer is provided by computer software instead of an actual fax machine. It is almost impossible to tell from the outside of a computer whether it contains a fax. With a computer, this also applies with regard to the invisibility from the outside of its many functions.

The absence of a relation between product form and product function implies that products no longer communicate their complete set of functionalities to their users. Having said this, one of the challenges that confronts developers of hybrid products becomes apparent: how is it possible to integrate several product functions in one product form in such a way that consumers can still infer the different functionalities from the physical product? What is the use of introducing a television-video recorder when nobody notices the video recorder? The advantage of any hybrid product lies in the combination of functions, so if consumers do not notice the combination, they will not notice the product advantage either. Creusen (1998, p. 14) stresses the importance of this topic: “A key design issue is how to structure a product so as to promote understanding and use”.

1.3.5 Developing Successful Hybrid Products: Conclusion

Recapitulating all that has been written in this section, the task for manufacturers of new hybrid products is complex, and designing and marketing them is difficult. As Urban and Hauser (1993, p. 172) note:

*A new product is both a physical entity and a psychological positioning. A product must perform from an engineering viewpoint, but customers will not buy the product if they do not perceive that it delivers the benefits they need.*

Thus, not only do potentially technically incompatible functionalities need to be integrated into a single physical product, but these functionalities also need to be communicated to consumers. Most importantly, consumers need to know what the hybrid product is and what its benefits are. To the degree that manufacturers succeed in explaining these factors to consumers, the discrepancy between the goals of the manufacturer and the expectations of the consumer will be relatively small. In this case, commercial success will not a priori be frustrated by the ambiguous identity of the hybrid product. In contrast, if consumers do not recognize what the new hybrid product is and what it offers, manufacturers are in trouble. Consumers will probably not buy their product if they do not understand it. In the words of Creusen (1998, p. 23): "It is plausible that in order to purchase a product, it first has to be identified as an exemplar of the wanted product category. This means that the product has to be successfully categorised*.

By nature, hybrid products refer to multiple categories, making them susceptible to consumer "miscategorization". Evidently then, and in line with Ratneshwar and Shocker (1988), categorization plays a crucial role in the potential commercial success of a new hybrid product. Consumers' comprehension of a new hybrid product is directly related to their ability to categorize it. It is exactly for this reason, that categorization theory has been chosen as the theoretical framework from which to approach the problem that has been outlined in this chapter. By understanding how consumers categorize hybrid products, suppliers may have the opportunity to anticipate consumers' reactions and develop new ones that are understandable to consumers.

1.4 Goal of the Dissertation

The main objective of this dissertation is to understand and explain how consumers categorize (new) hybrid products. There is a large body of literature on product categorization, but at this point in time there is hardly any knowledge about the categorization of *hybrid* products. Through empirical research this dissertation intends to achieve two goals. First, this dissertation aims at developing and empirically validating a theoretical model that integrates existing theories about categorization to result in a model that describes and explains how consumers categorize hybrid
products. This theoretical model should provide answers to the following questions:

- How are hybrid products represented in the mind of consumers?
- How do consumers cognitively organize hybrid product categories? What kind of categories do they create for hybrids products?
- Which product information do consumers use in order to categorize hybrid products, i.e. what are the product dimensions on which the categorization of hybrid products is based?
- How does the categorization of hybrid products differ from the categorization of non-hybrid products?
- How does the categorization of hybrid products develop over time? How do consumers' experiences with hybrid products influence the categorization thereof?
- How can product developers, designers and marketers influence consumer categorization of hybrid products?

The last question refers to the second, practical goal of the dissertation, which is to provide product developers (i.e. designers and marketers) with a set of practical recommendations and guidelines that may help them: (1) to develop new hybrid products that will not only be understandable to consumers, but that will also be categorized into anticipated categories; and (2) to successfully introduce hybrid products on the market.

1.5 Relevance of the Dissertation

The present developments on the market show that a substantial number of product innovations concern hybrid products. Moreover, this number is predicted to increase as a result of the progress in information and computer technology (Mayer 1996). The presence of common technological platforms across a variety of products, such as digital processors and operating systems, create circumstances under which it is relatively easy and efficient to develop hybrid products (Jain and Ziamou 1995). This implies that the problems that were sketched above will become more relevant in the near future and that the need for information about the interaction between consumers and hybrid products will increase.

Yi and Gray (1996) observe that there are many products that can be classified into multiple categories, i.e. their categorization is ambiguous. A new product may have properties associated with several different product categories. According to Yi and Gray, the question of what determines the particular categorization of ambiguous products is of interest to marketers, practitioners, consumer researchers and psychologists. The answer to the question "would be relevant to many aspects of marketing strategy, such as market segmentation, product positioning, and advertising" (Yi and Gray 1996, p. 606).
1.5.1 Theoretical Relevance

As the brief literature review in 1.3.2 has shown; publications about hybrid products are practically non-existent, an observation that has also been made by Yi and Gray (1996, p. 608): "Little research has been done on the categorization of products associated with several different categories." Obviously, the lack of knowledge about how consumers interact with hybrid products is enormous. Sceptics may remark that this lack of information about hybrid products is due to a lack of interest in them, i.e. that nobody cares. The examples of Philips and Olivetti suggest otherwise: hybrid products do matter to product developers and also consumer researchers are beginning to pay attention to them. In her presentation about the processing of incongruent information at the 1997 annual conference of the Association for Consumer Research, Joan Meyers-Levy proposed that more attention should be paid to a particular type of schema incongruent products, namely products that refer to different product categories, in other words, products that could be classified into multiple product categories. Already in 1988, in a paper describing important problems and caveats related to the categorization paradigm within marketing, Ratneshwar and Shocker remark:

An important issue that needs to be addressed is the process by which pre-existing cognitive categorical structures are modified to accommodate new categories. From a research standpoint this issue is germane to an identification problem: how does one draw the boundaries around a new category, and can one offer a defensible definition for distinguishing this category from other collections or groupings of objects? New category formation does not appear to be an automatic process in response to an encounter with something new, or even a process that is easy for the marketer to initiate. The marketing of a technologically 'new to the world' product may serve to stimulate consumer interest or awareness, but this need not imply a new category will necessarily form around it (....) Quite independent of technological or producer-side evaluations of the 'degree of newness', the product may be assimilated to cognitive structures with minimal effects on the latter, or it may be simple ignored (p. 280).

Ratneshwar and Shocker do not talk about hybrid products in particular, but it is evident that the identification problem they mention is notably relevant in the case of hybrid products. Whatever, this citation demonstrates that the lack of research on hybrid products stems neither from a lack of interest nor importance.

Apart from filling up the knowledge gap about hybrid products, research into the categorization of hybrid products may help to solve contemporary issues in the categorization literature. The relevance of categorization studies is aptly put by Lakoff (1987, p. 6-7):

Categorization is not a matter to be taken lightly. There is nothing more basic than categorization to our thought, perception, action, and speech (....) Without the ability to categorize, we could not function at all, either in the physical world or in our social and intellectual lives. An understanding of how we categorize is central to any understanding of how we think and how we function, and therefore central to an understanding of what makes us human.
In spite of the attention categorization has received and the empirical research that has been done in this field, many questions have still not been answered satisfactorily; the most important one concerning the way in which people determine category membership. Several models of category representation and organization have been suggested (for an overview see Claey s 1993; Lakoff 1987, Smith and Medin 1981), but none of these has proven to be accurate enough and, more importantly, empirically applicable. The theory about hybrid products that is developed in this dissertation builds on and integrates existing categorization theories. As a result, this study into the categorization and evaluation of hybrid products may provide useful insights into the general categorization issues that are examined by researchers within various disciplines. For example, the probabilistic view on categorization, or prototype theory (Rosch 1978), is generally accepted as a plausible theory about category representation. A large part of the empirical findings can be explained through this theory. It will be interesting to see how prototype theory will hold in the case of hybrid products, since they refer to more than one prototype.

1.5.2 Practical Relevance

Much has already been said about the practical relevance of research into hybrid products. On the basis of his study of discontinuous innovations, Veryzer (1998, p. 147) concludes that:

The degree to which a product is innovative and the effect of discontinuities on customer evaluation should be examined and understood early on in the development process. (...) Care should be taken throughout the development process to have customers evaluate a product (whenever possible) on all discontinuity dimensions so that problems and deficiencies may be addressed well before the design is finalized.

With regard to the relevance to product designers, Veryzer (1999, p. 512) emphasizes the importance of the communicative aspects of the product design [italics added]:

Attention should be paid to a design's ability to foster proper (i.e. intended) interpretations across the range of relevant customer segments – especially when a product's form is highly unusual or novel. In such cases categorization can be especially difficult since consumers do not have a basis for interpreting the product (...). In the case of some unfamiliar new products, customers are likely to rely on internalized rules for whatever product class is cued by the design of the new product regardless of whether or not it is appropriate. This can lead to numerous problems for a new product, from misuse to outright rejection. Awareness of the likely relational rules that a product design is prone to activate and sensitivity to the interpretations fostered by various constellations of expediency can provide direction for establishing new designs which facilitate proper categorization. Technologically complex products, in particular, are at the mercy of consumers abilities to understand and interact with them.

In short, the relevance of this dissertation to designers and marketers lies in a better understanding of consumer categorization behavior which will enable them to anticipate possible risks inherent to the development of
hybrid products, such as selecting the "wrong", i.e. a commercially unsuccessful, identity for the product, creating one that consumers do not understand, or failing to communicate its true identity to consumers.

1.6 Overview of the Dissertation

This investigation concentrates on the mental activities constituting the categorization process with respect to hybrid products. Consumer preference construction, purchase behavior and post-purchase attitude towards hybrid products will not be examined.

Consumer categorization activities are examined using a comparative approach, meaning that the issue of how consumers categorize hybrid products will be tackled by comparing the unknown categorization process of hybrid products with the better known categorization process of non-hybrid products. The choice for a comparative approach was dictated by a lack of theory about how people interact with hybrid products. Since little knowledge is available about the categorization of hybrid products, the most viable alternative was to depart from the existing theory about object categorization. A priori, categorization theory seemed to provide a solid theoretical foundation for investigating hybrid products for three reasons. First, the basic principles of categorization theory are intuitively plausible and universal. Second, categorization theory has evolved from a long history of reasoning about object identity and classification (as far back as Aristotle) during which several fundamental theoretical shifts have been made (see Medin 1989). The result is a relatively advanced theory about categorization. Finally, the theoretical growth of categorization theory has been accompanied by extensive research within various disciplines such as linguistics, biology, anthropology, sociology, experimental psychology (perception and learning), and cognitive psychology. Categorization theory has been recognized as a widely applicable and useful theory.

The dissertation is organized as follows. Chapter 1 introduces the concept of hybrid products and outlines the problems related to the development of hybrid products. It explains why hybrid products need to be investigated and what the relevance of hybrid products is to product developers. The remaining chapters of the dissertation deal with the research questions that were formulated in section 1.4.

Chapter 2 is about the representation of products in the minds of consumers and about the way they assess category membership. Two views of concepts are discussed: the similarity-based view and the theory-based view. The dominant theories within each view are described briefly. The similarity-based theories are the classical theory, the probability theory and the exemplar theory. Theoretical models that belong to the theory-based view of categorization are psychological essentialism and two-tiered concept
meaning. The different views and theories are evaluated with respect to their applicability as possible explanatory frameworks for the central theoretical problem of this dissertation. The chapter ends with an account of the categorization process of hybrid products that will serve as the conceptual model throughout the dissertation.

Before presenting four studies into the categorization of hybrid products, a side step is taken in the third and fourth chapter to examine two fundamental issues regarding the product categorization process in general. The first regards the type of product categories that consumers create. Which of all possible ways to divide objects into categories do consumers use? Are products grouped together on the basis of overall similarity or on the basis of single dimensions? Do consumers create product categories at the basis level (i.e. product class level) such as the classification literature suggests? Chapter 3 describes two studies that were conducted to provide an answer to the previous questions. Specifically, these studies examine the validity of one of the central hypotheses within contemporary categorization theories, which is that people categorize products into basic-level categories on the basis of overall similarity with other category members. This hypothesis, called the basic-level superiority hypothesis, is highly relevant to the present research since the inherent ambiguity of hybrid products depends directly on the supposition that people tend to interpret objects in terms of basic-level category membership.

The second issue, which is dealt with in chapter 4, concerns the product dimensions (knowledge bases) consumers use to determine category membership. If it is true that products are categorized into basic-level categories on the basis of overall similarity, what then are the underlying product aspects that these basic-level categories are based upon (i.e. the dimensions of likeness)? In order to understand why consumers create the product categories they do, it is necessary to know what these dimensions are (e.g. function, form or use). From a practical point of view, these dimensions are important since they could provide designers and marketers with suggestions as to what product aspects could be manipulated to guide consumer classification of hybrid products. In the third study, respondents perform several grouping tasks on the same sets of pictures of electric appliances and furniture that are used in the first two. Through open interviews the product aspects that determine group membership are gathered. Content analysis is used on these product characteristics to identify the dimensions that underlie category membership.

After having assessed whether consumers categorize products into basic-level categories and what the dimensions underlying product categorization are, chapter 5 examines the effect of hybridity on product categorization. In Study 4a the assumptions are tested that: (1) hybrid products are more ambiguous than non-hybrid products; (2) hybrid products are classified less accurately than non-hybrid products; (3) the classification of hybrid
products requires greater cognitive effort than the classification of non-
hybrid products; and (4) consumers find hybrid products odd compared
with non-hybrid products. Study 4b is designed to find out whether the
hypothesized differences between hybrid and non-hybrid products will also
occur if the products are unfamiliar rather than familiar.

Chapter 6 elaborates on the effect of familiarization on the categorization of
hybrid products. The chapter explains how experience that consumers gain
about hybrid products may affect category membership over time. Study 5
explores whether hybrid products that are new to consumers are classified
differently than those with which consumers are familiar. The main
hypothesis posits that unfamiliar hybrid products will be classified into a
category of their own more often than familiar hybrid products, which will
sooner be assigned to the best matching source category.

Chapter 7 extends the research into hybrid products by presenting a
theoretical account of what hybridity is in term of the different types of
attributes that hybrid products possess. The sixth and final empirical study is
described in which the typicality of the attributes of the source products of a
particular hybrid product (e.g. a television-video recorder) is systematically
varied in order to influence its categorization.

The final chapter summarizes the main findings of Study 1 to Study 6. It
discusses several implications for categorization theory. Furthermore,
managerial implications concerning marketing and product development
are given, as well as suggestions for future research. The chapter concludes
with a critical evaluation of the development of hybrid products as a
successful new product development strategy.
2 The Representation of Products in Consumers' Minds

Suppose that a friend goes into town and sees the new product, Xava, in a shop window. Something that looks like a Walkman. How does (s)he determine what this new product is, in other words, how does (s)he assess category membership? Rips (1989, p. 21) provides the following answer:

If you want to know whether an object is a category member, start with a representation of the object and a representation of the potential category. Then determine the similarity of the object representation to the category representation. If this similarity value is high enough, then the object belongs to the category; otherwise, it does not.

In this view, categorization takes place by determining the degree of similarity between the new product Xava (i.e. the "Walkman") and a particular category representation (i.e. the concept of WALKMAN) that is available in memory. If Xava fits the representation of Walkman, identification follows; if it does not, the search begins for an alternative concept to which Xava more closely corresponds. An alternative concept either exists or it does not. If there is no concept whatsoever that matches the new product Xava, people may try to create a new category for the so far unidentified product (e.g. a mini-disc player). When this ultimate attempt fails, identification fails and the product will remain unknown.

Figure 2.1
Schematic Model of the Consumer Categorization Process

Classification into most congruent target category
1. Straight fit
2. Assimilation
3. Accommodation
4. Alternative
5. New schema
The schema in Figure 2.1 shows a slightly elaborated version of the categorization process than was described above. Categorization involves comparing a product instance with possible target categories (i.e. categories the product can be assigned to) available in memory. The degree of similarity between the instance and each of the possible target categories is assessed, i.e. the degree of schema congruity, and the product is assigned to the most congruent target category. There are five ways in which classification into the target category can take place, depending on the degree of schema congruity and the amount of cognitive effort that is required to solve the incongruity between the two (Cherian and Jones 1991). More cognitive effort is required to classify a product that is incongruent with any of the target categories than to categorize a product for which a congruent target category is available. The five classification outcomes are listed below (each consecutive outcome is assumed to require an increasing level of cognitive effort).

1. Straight fit
   If there is no incongruity between product and target category, straight fit into the target category will take place with little cognitive effort (e.g. classifying a television into the television category).

2. Assimilation
   If a product is slightly incongruent with the target category, it will be classified into the target category with some cognitive effort (e.g. classifying a television with teletext into the television category).

3. Accommodation
   If incongruity between product and target category increases still further, the product will classified into a subcategory of the target category. If the subcategory already exists, cognitive effort will be limited (e.g. classifying a wide-screen television in the television subcategory wide-screen televisions). If a subcategory does not yet exist, substantially more cognitive effort will be required to categorize the product, as in the case of the classification of the first mountain bike.

4. Alternation
   If neither assimilation nor accommodation suffices to resolve incongruity,

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Note 1 In fact, this option is similar to option 5, the creation of a new schema. The difference is that new schema refers to those situations in which a completely new category is created, in the case of accommodation a new subcategory is created, which means that the basic category (e.g. bicycles) is clear, but a new variant to this basic category needs to be generated. Generating a new subcategory is assumed to require less cognitive effort than generating a new category.

Note 2 Alternation is believed to be a relevant and clear theoretical option for dealing with incongruent products, but it is not very likely to take place in practice. Although going to a higher level of abstraction makes it easier to categorize an incongruent product, it is not a useful strategy. Categorization at high levels of abstraction is general and low-informative, because distinctiveness is low at these levels as the following example will illustrate. The recently introduced mini-disc player by Sony could be classified in the general category of AUDIO EQUIPMENT. This category is so broad, though, that knowing that a product is a piece of audio equipment does not help consumers much to guide their information processing and decision making process. For this reason, alternation is ignored in the remainder of this dissertation.
people may try to fit the product into a more abstract category. Cognitive effort is substantial as it takes place after assimilation and accommodation have been attempted. For example, after assimilation and accommodation have failed, someone may classify the motorbike-car combination as a vehicle.

5. New Schema

If none of the foregoing strategies succeeds, a final option is to create a completely new category that fits the product. This option requires most cognitive effort. A situation asking for the creation of a new category is likely to arise whenever a really new-to-the-world product enters the market. A recent example is the introduction of the compact disc writer.

The list of classification options of Cherian and Jones (1991) is interesting, because it reflects the common-sense notion that some products are harder to categorize than others, as well as the theoretical notion of prototypicality (see further on in this chapter) that holds that some products match (are more prototypical of) existing categories better than others. However, an apparent shortcoming of the Cherian and Jones classification outcome typology is that it does not define at which levels of incongruity one option develops into another. In other words, it is not clear where the boundaries between the alternative outcomes lie. Nor is it clear whether the incongruity dimension should be seen as continuous or discrete. Are the boundaries between the different options fuzzy and broad or discrete and narrow?

For this reason, it is difficult to predict with a fair amount of precision which type of classification will result. Rather, post hoc analysis should be used to identify the degree of incongruity that causes a particular classification outcome, but then the next problem presents itself: it is difficult to unequivocally determine the classification outcomes. How is one to decide, for example, whether a product has been fitted straight into a category or whether it has been assimilated into the same category? In both cases, the classification outcome will be equal. Cherian and Jones themselves do not go into this. To them the important point is that classification can take place smoothly or with greater difficulty depending on how well an instance fits to existing knowledge. In order to get an idea of how an instance is classified, proxy measures have to be taken in the form of the amount of cognitive effort and the degree of schema incongruity. For instance, if the assumption is that consumers will classify a wide-screen television into the television category (i.e. assimilation), schema incongruity should be mild and the degree of cognitive effort substantial. Together, these proxy measures indicate that the wide-screen television was assimilated rather than fitted straight into the television category.

Note 3 Cherian and Jones (1991) actually use the term schema change. However, in describing this stage they note that "when too many discrepant instances accrue and require too much assimilation/accommodation/alternation one can expect new categorization schemas to form." Clearly, Cherian and Jones suggest that people do not so much change from one schema to another (this would be alternation), but that they create new categories to fit the instance to instead.
In spite of the above-mentioned limitations regarding its predictive ability, the Cherian and Jones classification typology serves well to discuss the differences between the categorization of hybrid and non-hybrid products, in particular with respect to the question of whether a hybrid will be classified into an existing (sub)category or into a new category, and to the question of how easy or difficult the categorization process will be.

The relatively simple picture of categorization that has been sketched so far seems intuitively plausible. Thinking about it more thoroughly, though, a torrent of questions comes to mind. How are categories represented in memory? How do people determine the similarity between object and category representation? What are the bases of comparison? Which categories qualify as potential target categories? How similar to a category concept does an object have to be in order to be assigned to it? What will happen when it is classified into more than one category (as in the case of hybrid products)? Can new categories always be created? If not, under which circumstances will new categories be created? In an attempt to come up with answers to questions like the ones above, categorization theorists have concentrated on the first, i.e. how are categories represented in memory (Cohen and Basu 1987; Medin and Ross 1992; Smith and Medin 1981). More specifically, they have wondered why members of the same category belong together. Knowing why members of a category are members of that category and knowing why one member belongs to the same category as others, would make it possible to predict whether some arbitrary object will be a category member or not.

Hence, the issue is according to which principle categories are organized. The dominant view among categorization theorists has been that categories are similarity-based. Objects belong to the same category, because they are similar. Objects are similar to the degree that they share attributes. More recently, however, scholars who adhere to the theory view of categorization have challenged the similarity view of categorization. According to this approach, similarity is too restricted a concept to fully account for categorization phenomena. The similarity view is discussed in section 2.2, followed by an account of the theory view (2.3). First, however, the major theoretical concepts are defined.

2.1 Concepts, Categories and Categorization

Without concepts, mental life would be chaotic. If we perceived each entity as unique, we would be overwhelmed by the sheer diversity of what we experience and unable to remember more than a minute fraction of what we encounter. Fortunately, though, we do not perceive, remember, and talk about

Note 4 The categorization literature that is discussed in this chapter does not deal specifically with the categorization of products but with the categorization of objects in general, of which products form a substantial part.
each object and event as unique, but rather as an instance of a class or concept that we already know something about (Smith and Medin 1981). Concepts thus give our world stability (Smith and Medin 1981). Concepts also allow us to go beyond the information given; for once we have assigned an entity to a class on the basis of its perceptible attributes, we can then infer some of its nonperceptible attributes (Smith and Medin 1981). In short, concepts are critical for perceiving, remembering, talking, and thinking about objects and events in the world (Smith and Medin 1981, p. 1).

As this citation from Smith and Medin clarifies, categories together with concepts serve as building blocks for human thought and behavior. Indeed, "the learning and utilization of categories represents one of the most elementary and general forms of cognition by which man adjusts to its environment" (Bruner, Goodnow and Austin 1977). Following Murphy and Medin (1985) and Medin and Ross (1992), concepts are discerned from categories in the sense that concepts refer to mental representations of a certain kind, whereas categories refer to the sets of objects in the real world "picked out" by the concepts. The distinction between the two is important, as concepts do not actually include all members of the category (e.g. someone's concept of vehicles does not include all vehicles). Sloman, Love and Ahn (1998) explain that concepts and categories are, to a large extent, flip sides of the same coin. They relate the terms to what Tversky and Kahneman call the inside and the outside views. "The inside view regards the internal structure of a concept, its features and what binds them together. The outside view regards some or all of the instances that are believed to be included in the category referred to by the concept" (Sloman, Love and Ahn 1998, p. 192).

Thus, a concept constitutes the mental representation of a category, the information stored in memory about a category. Concepts are equivalent to schemas which are defined by Fiske and Taylor (1991) as cognitive structures that represent knowledge about a category, including its attributes and the relations between them. Throughout this dissertation, the terms (category) concept, (category) schema and (category) representation will be used interchangeably to indicate the mental counterpart of a category.

Categorization involves treating two or more distinct entities as in some way equivalent (Medin 1989). That is, rather than treating each entity as unique, people organize entities into classes of similar things. Categorization is not arbitrary; it serves several essential functions (Medin and Ross 1992). The primary function of categories is identification. Categories help people to determine what things are, they allow them to make contact with the world. A second function of categorization is understanding and explanation. Once an object has been identified, people have access to existing knowledge linked to the category, which enables them to interpret the object. An object identified as a compact disc is known to hold music or information which can be disclosed by playing the disc in a CD player or CD-ROM drive. Third, categories allow people to make predictions. If somebody has identified an object as a magnet, (s)he knows that it will attract an iron spoon, even though this person has not yet actually observed the magnet.
attracting the spoon. Categorization also supports reasoning. Seeing a couple dressed in wedding gown and suit allows one to conclude that it must be their wedding day. Finally, categorization serves the role of communication. To the extent that people share knowledge and index it in terms of the same categories, they will be able to communicate with each other as in the case of physicians discussing the disease of a patient.

The main purpose of this dissertation is to understand and explain how consumers identify new hybrid products. The focus is on the primary function of categorization. At the beginning of this chapter, identification was described as a comparison process in which people determine the degree of similarity between an object and its category representation in memory (see Figure 2.1). The two subsequent sections explain how categorization theorists have tried to model the mental representations of categories.

2.2 The Similarity View of Category Representation

The main proposition of the similarity view, i.e. things belong to the same category because they look similar, is intuitively compelling. Rips (1989, p. 21) explains why:

A specific egg - one you have never seen before - looks a lot like other eggs. It certainly looks more like eggs than it looks like members of most other categories. And so it is hard to escape the conclusion that something about this resemblance makes it an egg or, at least makes us think it's one. In much the same way, if you happen to be a subject in a concept-learning experiment and are told that your job is to decide on each trial whether a meaningless pattern of dots is a member of Category A or of Category B, then you might be right to think that resemblance must be the key to the correct answer. You may have nothing else to go on.

Thus, objects are put together on the basis of visual similarity, because the perceptual properties of objects are easily observable (and often the only properties available for information processing) and provide a straightforward basis for classification.

Three views have been associated with the similarity view of category representation because they share the idea that instances of the same category have in common fundamental (perceptual) characteristics that determine their membership. These are the classical view, the probabilistic view and the exemplar view.

2.2.1 The Classical View

The classical view of category representation dates as far back as Aristotle (Smith and Medin 1981) and assumes that mental representations of
categories consist of summary lists of features or properties that individually are necessary for category membership and collectively are sufficient to determine category membership (Medin 1989). Thus, in order to decide whether a particular geometric form is a square, it suffices to check whether there are four equal-sized sides connected to each other in angles of 90 degrees. All forms possessing these qualities are squares. If any one is missing, the form is definitely not a square. Category boundaries are clear and category membership is unambiguous: objects either belong to a category or they do not. What makes the classical view attractive is that assessing category membership is a straightforward, strict, and clear-cut process. At the same time, these characteristics have also made the view a rigid one, subject to several problems, the most serious ones being the failure to specify defining features, the inability to account for goodness of example effects, and the inability to account for the existence of unclear cases.

2.2.2 The Probabilistic View

The major alternative to the classical view is the probabilistic view. (Rosch 1978; Smith and Medin 1981). It argues that categories are represented by properties that may be only typical of category members. For example, for most people the category apple is described by the properties of edible, round, yellow, and sweet, even though not all apples have these properties (apples may be red or green and sour). On the basis of the instances that people encounter, a summary representation of a category is created which is referred to as the prototype. The prototype is a hypothetical “perfect” example that possesses all of the characteristic features of a category; it does not necessarily exist. The features that form the prototype are weighted according to how central the feature is to the prototype. Central features are given higher weights than less central features. Of all the properties of the concept of bird, for instance, the property lays eggs, for instance, would be given a weight of 1, since all birds lay eggs. The property flies would be given a lower weight, say 0.8, because there are some birds that do not fly. Other properties, like eats insects, would be given a low weight, say 0.2, because there are many birds that do not eat insects. On the basis of the attributes of the prototype and the weight assigned to each attribute, the prototype can be used to decide category membership. An entity X is categorized as an instance of category Y, if and only if X possesses some critical sum of the weighted features of the prototype of Y (Smith and Medin 1981).

A simple example may illustrate how category membership is determined. Table 2.1 lists the prototypical attributes of the concept of bird and the corresponding weights (of course, in reality the list of prototypical attributes

Note 5 For a detailed overview of the different views of category representation, including a discussion of their strengths and weaknesses, the reader is referred to Smith and Medin (1981).
is much longer). The remaining columns present the degree of category membership for blackbird, chicken, bat and snake. Category membership is determined by assigning the weights of the attributes of birds that are present in each of the four animals to each of these animals and summing these. Only if the sum exceeds some threshold value (in this case 2.5), does the animal belong to the category birds. When this procedure is applied to the four animals from Table 2.1, the blackbird and chicken belong to the bird category, whereas the bat and snake fail to reach the critical score of 2.5.

Table 2.1
Category Membership according to the Probabilistic View

<table>
<thead>
<tr>
<th>Prototype bird</th>
<th>Blackbird</th>
<th>Chicken</th>
<th>Bat</th>
<th>Snake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lays eggs</td>
<td>(1.0)</td>
<td>1.0</td>
<td>0.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Winged</td>
<td>(1.0)</td>
<td>1.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Flies</td>
<td>(0.8)</td>
<td>0.8</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Walks</td>
<td>(0.6)</td>
<td>0.6</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Eats insects</td>
<td>(0.2)</td>
<td>0.2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>3.6</td>
<td>2.6</td>
<td>2.0</td>
<td>1.0</td>
</tr>
</tbody>
</table>

Table 2.1. also illustrates the central notion of the probabilistic view of concepts: category membership is graded (Medin 1989). Some members will be better examples or more typical of a concept than others. For example, people consider a German shepherd to be a better example of a dog than a Pekinese. In the example above, a blackbird with a category score of 3.6 is a more prototypical bird than a chicken (3.0). Thus, prototypicality is equivalent to degree of category membership. According to Rosch (1978), typicality is a function of the degree of family resemblance. The term family resemblance is used to indicate how similar an instance is to all other category members and how dissimilar it is to members of contrasting categories. The more properties an instance shares with other category members and the less properties it shares with members of contrasting categories, the higher the degree of family resemblance will be and the more prototypical the instance will be of the category.

The fact that category membership is graded has several major implications for the way that people assign objects to categories. First, category boundaries are fuzzy rather than strict, as in the case of the classical view. It is not exactly clear when an object still belongs to a category and when it does not. Is a car still a car when its wheels are removed? From the classical point of view, this question would have a clear-cut answer. If the number of wheels is a defining feature of the car concept, the answer is no, otherwise it is yes. The probabilistic view, however, does not provide such clear-cut answers. Second, the probabilistic view of concepts allows for the existence of unclear cases. Is a car with three wheels a car? Is a reclining bicycle a
bicycle? Is carbonated fruit juice a fruit juice or a soft drink? Any example of a category may have several typical properties but not so many that it clearly qualifies for category membership (Medin 1989). A third implication of the probabilistic view is that objects may be typical of more than one concept simultaneously. Objects may share typical properties with several prototypes, such as the platypus (Figure 2.2), a mammal that looks like a beaver with a duck-bill, swims like a fish, and lays eggs like a bird.

Figure 2.2
The Platypus: Resemblance to Multiple Different Prototypes

The notion that objects may be prototypical of more than one concept and may thus be classified into several different categories is particularly relevant given the type of objects that are studied in this dissertation, namely hybrid products. A television-video recorder, for example, has the characteristic features of both a television and a video recorder. Does this mean that it belongs to both categories? One could also argue that it belongs to neither one. Or should one conclude that a television-video recorder represents a completely new concept?

2.2.3 The Exemplar View

The exemplar view proclaims a slightly different interpretation of the probabilistic view. It denies that there is a single summary representation; instead, categories are claimed to be represented by means of examples (Medin 1989). According to the exemplar view, an object may be identified as a chair, not because it is so similar to the chair prototype, but because it reminds people of particular chairs they encountered earlier. In spite of the clear distinction between the two views (categories are represented by a hypothetical prototype versus real instances), Medin (1989) emphasizes that the probabilistic view and the exemplar view rely on the same similarity principle. Category membership is determined by "whether some candidate is sufficiently similar either to the prototype or to a set of encoded examples, where similarity is based on matches and mismatches of independent, equally abstract, features" (p. 1471).
2.2.4 Summary

In summary, according to the classical view, categories are represented by a set of necessary and sufficient attributes. Only when objects possess all necessary attributes, will they be members of the category, otherwise they will not. The probabilistic view rejects the notion of defining attributes. Instead, categories are represented by an "ideal" category member, the prototype. Objects are assigned to a particular category, if they are sufficiently similar to the prototype. To conclude, the exemplar view rests on the same principle as the probabilistic view, but rather than regarding concepts as prototypes, it sees concepts as a collection of all previously encountered instances. In order to establish category membership, objects are compared to a set of real category exemplars rather than to the prototype.

2.3 The Theory View of Category Representation

The models of category representation discussed within the framework of the similarity view have in common that they treat concepts as collections of attributes and categorization as a similarity-based attribute-matching process (Murphy and Medin 1985). The underlying assumptions are the following (Medin 1989):

1. Concepts are equivalent to lists of attributes.
2. These attributes can be treated as independent and additive.
3. These attributes have all roughly the same level of abstractness.
4. Similarity between objects increases as they share higher numbers of attributes and decreases as a function of mismatching or distinctive attributes.

Rips (1989, p. 27) summarizes the essence of these models, which he calls "resemblance models", as follows:

A trout is generally similar in size, shape, and other characteristics to other fish, and it is generally dissimilar to members of contrast classes like mammals and reptiles. Subjects therefore believe trouts to be typical fish, assume that trouts enjoy a high degree of membership in the fish category, and are very likely to categorize trouts as fish. That's the resemblance theory of concepts in a nutshell.

Similarity-based models of category representation have been challenged by authors (Medin 1989; Medin, Goldstone and Gentner 1993; Murphy 1993; Murphy and Medin 1985; Rips 1989) who argue that such accounts of category representation are "insufficient to explain conceptual coherence and the richness of conceptual structure" (Murphy and Medin 1985, p. 297). They are insufficient, since they do not say anything about why people have the categories they have, and since the relation between similarity and
category membership is unclear. Do things belong to the same category because they are similar, or do they seem similar because they are in the same category (Medin 1989)? Murphy and Medin (1985) see three major problems with an exclusive focus on similarity as the explanatory principle of categorization: (1) it assumes that categorization is limited to attribute matching; (2) it does not say what the relevant attributes are, i.e. the attributes that determine similarity; and (3) it treats concepts as being little more than the sum of their components. According to the authors, category representations also include information about operations, transformations and relations among attributes. To give an example, when people consider the concept of car, most of them do not only know what it looks like, but they also know how to operate it, they recognize the different functions related to the different parts of the product (like motor, gas tank, steering wheel, dashboard, wheels, windscreen wipers, headlights), and they know what the relation is with other products (e.g. it can be used to pull a trailer). The main point that the critics of similarity-based concept models make is that such models are inadequate, because they "fail to represent intra- and inter-concept relations and more general world knowledge (...) Human interests, needs, goals, and theories are ignored" (Murphy and Medin 1985, p. 289, p. 295).

2.3.1 Concepts as Organized by Theories

As an alternative to the formal, similarity-based view of concepts, the theory view of concepts proposes that concepts are organized by theories. The term theory is used "to mean any of a host of mental 'explanations', rather than a complete, organized, scientific account" (Medin and Murphy 1985, p. 290). Murphy (1993, p. 177) defines theories as "sets of interconnected relations, and concepts are the units connected by these relations. Thus, a theory does not exist independently of its concepts, and a concept is partly defined by the theories it enters into".

According to the theory view, everyday classification is very much like scientific classification, the difference being that lay theories are less accurate and less detailed than those of scientists. Categorizing an object is a matter of applying the relevant theory (Rips, 1989). Such a theory consists of all knowledge with regard to a concept. It includes information about characteristic properties as well as information about the relationship between the concept and the world outside, meaning the context in which the concept exists. The difference between the two views may be illuminated by the following example. Imagine that you are driving on the highway during summer holidays. It is hot outside. When you look into the distance, to the road ahead of you, you see that the asphalt has become liquid. Knowing that asphalt is solid, a fact that is confirmed by the fact that you are driving on it, the observation of it as a liquid should be rather troublesome, especially since you are heading in that direction. At this point, though, theory comes into play. Apart from your knowledge of asphalt being solid and black and being used for surfacing roads, you know something more.
You know that black surfaces absorb radiation, causing the asphalt to become extremely hot, heating the air above. As a result of the trembling air, the road ahead appears to be liquid (fata morgana), but you know that it is not. Reassured you drive on. (To experience what will happen “without” theory, make sure you take a toddler in the car.)

Theories help people to learn concepts in three independent ways (Murphy 1993). First, in addition to the perceptual system, theories will help to identify the features that form the basis of the concept. It reads *in addition* to the perceptual system, because identification is often not based on perceptual properties alone (e.g., a toy dog is not a dog, in spite of the fact that it shares all but a few perceptual features with a real dog). Second, theories define the respects for similarity, i.e. theories provide the basis for comparison. This function of theories is aptly illustrated in the case of ad hoc categories (see Barsalou 1983 and section 2.7). The grouping of a towel, tent, knife, book, tennis racket and first-aid kit into the same category will seem odd out of context, but it will become meaningful in the light of the category THINGS TO TAKE ON A HOLIDAY. Third, theories may influence how people represent and organize (new) categories in memory. An example of this function is taken from Coburn (1996). The author describes his travels through the United States accompanied by a 84-year-old Nepalese woman, Aama, who has lived in a small village near the Himalaya all her life. This was the first time she was out of her environment. One day, Aama and Didi, Coburn’s girlfriend, enter a restroom. The following passage, freely translated from Dutch, describes what happens next.

Aama’s hands were covered with salt and sugar from the snacks she had in the car. Didi opened the metal door to the toilets and Aama stepped over the elevated aluminum threshold, unsure whether she could put her feet on it. Didi mixed hot and cold water in the sink and then turned the bottle with blue soap upside down to pour a squirt into Aama’s hand. Aama brought her hand to her face as if she was ready to wash it, but instead she poured the soap into her mouth, held her head back and began to gargle loudly. Her mouthwash was blue as well. Didi realized. She quickly explained the difference and helped Aama to rinse her mouth, which immediately filled with soap bubbles. An open litter basket with a white litterbag inside stood next to the sink. Aama turned around, approached it backwards until she sat on it and lifted her skirt. Didi interrupted her and took her to the toilet. That looked just like the litter basket (p. 114).

Clearly, Aama’s representation of the blue soap and the litter basket is influenced by her personal theory about the world and the purpose of objects.

2.3.2 What about Similarity?

Adherents to the theory view do not deny that similarity plays a role in categorization. It is generally true that members from the same category look a lot alike. Thus, in many ordinary settings it makes perfect sense to determine category membership on the basis of similarity since more often than not attribute matching is an effective strategy. Not always, though, as
there are instances that are highly similar to a category without being members, just like there are genuine category members that look more like members of some other class (Rips 1989). In fact, these two possibilities are one and the same, but phrased from different perspectives. Take the taco-radio in Figure 2.3, for example. The radio looks very much like a taco, but it is not. That is, it is highly similar to a category of which it is not a member. This is exactly the same as saying that the radio truly is a radio, even though it looks much more like a taco.

Figure 2.3
Taco-Radio

The effectiveness of similarity-based attribute matching as an identification device is demonstrated by the automatic and rapid way (in the order of a few hundred milliseconds, Rips 1989) in which object identification takes place. In general, objects are identified the moment they are perceived. It is hard to imagine that any process other than pattern matching could be responsible for such quick identifications. Still, this conclusion should not be accepted too lightly. What seems to be rapid classification based on the matching of perceptual attributes, may well turn out to be the result of more

Note 6 The exceptions to the rule that similarity matching is an effective strategy to determine category membership concern artifacts rather than natural objects. As Garner has proven with his taco-radio, artifacts can be poured into practically any form the designer can think of without altering their category membership. This is true because artifacts are classified on the basis of their primary function which is often largely independent of their appearance. As long as the designer does not change the function of the artifact, (s)he may change the appearance to fit any desired category. The reason that this line of reasoning does not hold for natural objects is that the relationship between objects and their appearance is given by nature and cannot be changed, unless genetic manipulation is applied. Natural objects are what they are and changing their appearance to fit another category does not work as was empirically demonstrated by studies of Rips (1989) and Kel (in Murphy 1993).
complicated procedures (Rips 1989). The fact that people are able to rapidly classify visually represented objects to superordinate or ad-hoc categories (see further on in this chapter) suggests that processes beyond similarity may be involved.

In short, although conclusive evidence is absent, identification is believed to predominantly take place on the basis of visual similarity. People will only turn to additional knowledge (i.e. theory) to make sense of an object, when identification cannot be achieved by instantaneous pattern matching. For this reason, Murphy and Medin (1985) suggest that the influence of theories on categorization may particularly occur when objects are novel or ambiguous (as in the case of hybrid products), or when the categorization must be explained or justified.

Table 2.2  
The Similarity-Based versus the Theory-Based Approach

<table>
<thead>
<tr>
<th>Aspect of conceptual theory</th>
<th>Similarity-based approach</th>
<th>Theory-based approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept representation</td>
<td>Similarity structure,</td>
<td>Correlated attributes plus underlying principles that determine which correlations are noticed</td>
</tr>
<tr>
<td></td>
<td>attribute lists,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>correlated attributes</td>
<td></td>
</tr>
<tr>
<td>Category definition</td>
<td>Various similarity</td>
<td>An explanatory principle common to category members</td>
</tr>
<tr>
<td></td>
<td>metrics, summation of</td>
<td></td>
</tr>
<tr>
<td></td>
<td>attributes</td>
<td></td>
</tr>
<tr>
<td>Units of analysis</td>
<td>Attributes</td>
<td>Attributes plus explicitly represented relations of attributes and concepts</td>
</tr>
<tr>
<td>Categorization basis</td>
<td>Attribute matching</td>
<td>Matching plus inferential processes supplied by underlying principles</td>
</tr>
<tr>
<td>Weighting of attributes</td>
<td>Cue validity, salience</td>
<td>Determined in part by importance in the underlying principles</td>
</tr>
<tr>
<td>Interconceptual structure</td>
<td>Hierarchy based on</td>
<td>Network formed by causal and explanatory links, as well as sharing of properties picked out as relevant</td>
</tr>
<tr>
<td></td>
<td>shared attributes</td>
<td></td>
</tr>
<tr>
<td>Conceptual development</td>
<td>Feature accretion</td>
<td>Changing organization and explanations of concepts as a result of world knowledge</td>
</tr>
</tbody>
</table>

1 Taken from Murphy and Medin 1985, p. 298.

2.3.3 Summary

So far, what has been said about category representation is that the similarity-based view of category representation treats concepts as lists of defining (classical view) or characteristic (probabilistic view) attributes. According to the theory view such a representation of categories is too
restricted in the sense that people's knowledge about categories comprises information about relationships of category properties with each other and of category members to the world in addition to the characteristic properties. Table 2.2 on the previous page summarizes the major differences between the two approaches.

To be perfectly clear, the theory view does not deny the idea that concepts have a particular essence that is represented by a set of characteristic attributes. Instead, it argues that this essence can only be understood within the framework of larger knowledge structures (Murphy 1993).

Next, attention will be paid to two accounts, representative of the theory view, that elaborate on the specific relationship between a category's essence and its context, namely psychological essentialism (Medin and Ortony 1989) and the two-tiered theory of concept representation (Michalski 1989).

2.4 Psychological Essentialism

If a number of people are asked to sort a set of objects comprised of chairs, cars, apples and dogs, one could be sure to find the same classes for each individual. Similarly, if one presents the same set of objects one by one and asks people to identify them, it seems very unlikely that anyone would assign an object to a category to which it does not belong (e.g. say that a dog is an apple). Obviously, people are very good at categorization. They generally know to which category a particular object belongs and they know which objects belong to the same category. Moreover, they are inclined to make the same classifications. These observations suggest that people have clear-cut ideas about what causes an object to be a member of a particular category. They know what makes a chair a chair, and an apple an apple. People also know what makes an apple different from a chair. Finally, they are able to explain why an object is what it is and why it is similar to or different from other objects. All in all, people seem to be wholly aware of the essence or underlying nature of things.

The notion that things have essences by virtue of which they are what they are and not something else is named essentialism. Essentialism is described as follows:

Among the properties that things have, some are essential; that is, they are those properties that make the thing what it is, and without which it would not be that kind of thing. Other properties are accidental - that is, they are properties that things happen to have, not properties that capture the essence of the thing (Lakoff 1987, p. 161).

The concept of essentialism is problematic from a philosophical point of view though (Medin and Ortony 1989). The problem is that what a thing is, is not independent of how it is described. The same object may correctly be
described as, for example, a piece of glass, a vase, or a bottle. This means that one and the same object needs to have as many essences as there are descriptions. But this undermines the very notion of an essence as some unique hidden property of an object by virtue of which it is the object that it is. For this reason, the term psychological essentialism is used as the psychological analog of metaphysical essentialism (Ahn 1998; Bloom 1996; Medin and Ortony 1989; Strevens 2000). Rather than claiming that objects have essences, psychological essentialism proposes that people believe that objects have essences. Here, the distinction between psychological and metaphysical essentialism is irrelevant, since the interest is in how people perceive objects and not how objects really are.

In their discussion of psychological essentialism, Medin and Ortony (1989) propose that the knowledge representations people have for categories contain an essence placeholder. The essence placeholder is that part of the category representation that holds the information about the essence of the category. In some but certainly not in all cases, the information in the essence placeholder may constitute a set of necessary and defining properties, much in the way the classical view advocates. In other cases, the essence placeholder might be filled with a more complex and incoherent "theory" of what makes the thing the thing that it is. The major point that Medin and Ortony, adherents to the theory view, make is that the essence of a category is not always apparent in the appearance of category members, which is exactly the reason why similarity-based categorization is inadequate. In order to determine category membership, inspection of the physical, visually perceptible, surface properties of an object may not be sufficient. Frequently, people need to have insight into the deeper properties of the concept to be able to identify an object as a category member. For example, solely judged on their surface properties toy dogs are similar to real dogs. The essential difference between toy dogs and real dogs is represented by the deep property ANIMATION. A toy dog will not be perceived as a real, living dog, not even when the toy dog moves, barks, and responds to human attention like a real dog as the Sony robot dog does (Figure 2.4 on next page; see also Appendix 2.1).

Clearly, surface properties and deep properties are not unrelated. Surface properties often reflect deep properties. Gender assessments are based on people’s physical characteristics, which explains why it is so difficult to determine the gender of dressed babies who do not yet possess clearly perceptible gender-specific characteristics. According to Medin and Ortony, surface properties are "frequently constrained by, and sometimes

Note 7 The essence placeholder is what other authors have called the core (Miller and Johnson-Laird 1976; Smith and Medin 1981). Miller and Johnson-Laird (1976, p. 291) describe a concept’s core as being "an organized representation of general knowledge and beliefs about whatever objects or events the word [in a lexical field] denote – about what they are and do, what can be done with them, how they are related, what they relate to". The conceptual core, which contains theory-related attributes, is contrasted with attributes that are perceptually salient and therefore useful in identification, but with little connection to the intrinsic nature of the concept (Murphy and Medin 1985).
generated by, the deeper, more central parts of concepts" (p. 180). In cases where the deep properties impose strong constraints, the surface properties will provide strong clues of category membership. Where the constraints are relatively weak, as with many goal-derived categories (e.g. THINGS TO TAKE ON A HOLIDAY), surface properties will be less good indicators of category membership. In cases like this, that is, when surface properties do not reflect deep properties and hence category membership, the relation between surface properties and deep properties will have to be learned. How else should anybody be able to understand that a tent, a stove, a towel, a deck of cards and an insect repellent could belong to one and the same category? This situation also applies to products with weak form-function associations, because those functions that cannot be derived from the product's appearance need to be learned in some other way. Consumers need to be taught that their car contains ABS, for instance, or that their television is provided with teletext. In the case of hybrid products, consumers need to learn all the source products that are combined in it.

Figure 2.4
Sony Robot-Dog

Figure 2.5 on the next page provides a schematic picture of how psychological essentialism views conceptual structure. Concepts consist of deep properties (i.e. theory) and surface properties. The deep properties belong to the essence of the concept. The surface properties may either belong to the essence, they may be related to it, depending on the strength of the constraints imposed by the deep properties, or they may have nothing to do with the concept at all (i.e. they are accidental and redundant). In

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Note 8 The idea that surface properties may be more or less dependent on deep properties is reflected in the adage "form follows function". For some products, like a pair of scissors, the form is heavily dependent on the function. It is very difficult to change the archetype of scissors without affecting their functional performance. In contrast, for many technological products, like computers, the form-function dependence is low or non-existing. Computers exist in many different forms (e.g. desk computers, laptops, i-Macs, notebooks, palmtops), all performing more or less the same functions.
Chapter 2

Figure 2.5 the first possibility is indicated by the presence of the S-property in the essence. The arrows running from deep properties to surface properties represent the second possibility. The remaining surface properties in Figure 2.5 represent redundant surface properties.

Figure 2.5
Conceptual Structure according to Psychological Essentialism

To illustrate, what would the essentialists' conceptual structure of a bicycle look like? The deep properties of a bicycle would be properties like mode of transportation, man-powered, and move by pedaling. Surface properties belonging to the essence would be having wheels, and having a frame. Surface properties linked to the deep properties but not belonging to the essence are things like having handlebars, having pedals, and having a chain. Finally, redundant surface properties would be things like size, color, the presence of a carrier, lights and a bell.

It is often difficult to draw the line between core properties and more peripheral properties (Murphy and Medin 1985). In the above example one may argue that pedals are very essential parts of a bicycle. Indeed, most people would think they are. The reason for not treating pedals as core features of bicycles is that a bicycle without pedals is undoubtedly still a bicycle. The absence of pedals does not change the concept of a bicycle. Even a rowing bicycle, which lacks many of the parts of a "standard" bicycle, is still a bicycle (see http://home-1.worldonline.nl/~context/ric/jwz/roeifiets.html, 5 July 2000).

What the example of the bicycle has shown then, is that there is no such thing as the essence of a concept. Indeed, psychological essentialism dissents from metaphysical essentialism precisely with regard to this point. There is no such thing as the essence of a concept; there is only the essence of a concept as it perceived by people. Therefore, an implicit consequence of psychological essentialism is that the essence of a concept is affected by
people's intuitive, personal theories about the concept and about the rest of the world. Since people's personal theories differ and since these theories develop over time, the exact notion of what it is that makes something the thing that it is may differ between people and over time. Thus, although people (within the same culture or society) will have the same global interpretation of a particular concept, its exact meaning will vary from one person to another and it will continuously develop along with people's theories.

2.5 Two-tiered Concept Meaning

Michalski (1989) is another author that subscribes to the theory view of concepts. His hypothesis that concept meaning is two-tiered reflects "the intuition that the meaning of most concepts cannot, in principle, be defined in a crisp and context-independent fashion" (p. 122). Instead, Michalski suggests that "the meaning of a concept is a dynamic structure built each time anew, in the course of an interaction between some initial base meaning and the interpreter's background knowledge in the given context of discourse" (p. 122). Category representations are constructed out of two parts, namely the base concept representation (BCR) and the inferential concept interpretation (ICI). The BCR forms the heart of the concept. It covers all factual information about the concept, including the most common, typical properties of the concept, representative examples, counter-examples, exceptions and other known facts about the concept. The BCR is broader than a concept's essence or core, as it does not only define the general, typical, or essential meaning of a concept, but it may also include concrete examples of the concept. The ICI stands for the process of interpreting the BCR according to various contexts by means of inferential reasoning. In other words, the BCR holds the facts about a concept, whereas the ICI constitutes the theory about the concept. In order to identify an object, both components, i.e. facts and theory are required. Michalski has proposed the following formula for the degree of match (M) between an object (O) and a category representation (CR):

\[ M_{O \cdot CR} = f(O, CR, CX, BK), \]

that is, the degree of match is not just a function of the object and the category representation as the traditional theories assume, but also of the context (CX) and the background knowledge (BK). Note that this formula is merely conceptual; it identifies the relevant factors for determining the match between objects and categories. It cannot be used for calculations.

Michalski illustrates his approach with the following example:

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Note 9 Although the essence of concepts may differ between different cultures, cross-cultural research into categorical structure suggests that these differences may be relatively small or even non-existing (e.g. Malt 1995).
Consider the concept of sugar maple. Our prototypical image of a sugar maple is that it is a tree with three- to five-lobed leaves that have V-shaped clefts. (…) Being a tree, a sugar maple has, of course, a trunk, roots, and branches. Suppose now that while strolling on a nice winter day someone tells us that a particular tree is a sugar maple. Simple introspection tells us that the fact that the tree does not have leaves would not strike us as a contradiction of our knowledge about sugar maples. This is surprising, because, clearly, the presence of leaves of a particular type is deeply imbedded in our typical image of a maple tree. The two-tiered theory of concept representation explains this phenomenon simply: The inferential concept interpretation associated with the general concept of tree evokes a rule: “In winter deciduous trees lose leaves.” By deduction based on the subset relationship between a tree and a maple tree, the rule would be applied to the latter. The result of this inference would override the stored standard information about maple trees, and the inconsistency would be resolved (p. 132).

2.6 Theories of Category Representation:
Conclusion

In the previous sections several theories of concept representation were discussed. The literature on concept representation deals with the structural principles that underlie categories, i.e. the principles that determine whether different objects are members of the same category. Two general views emerge from the literature. The classical and dominant view has been the similarity view of concepts which advocates that concepts are organized on the basis of similarity. Things that are similar belong to the same category. Categorization is considered to be a similarity-based attribute matching process. Assessing category membership boils down to comparing an object to a set of defining or characteristic properties that represent the category. If the object possesses all or enough of these properties, it will be a member, otherwise it will not. No additional knowledge or background information is required for identification.

The theory view of concepts goes further than the similarity view in the sense that category representations do not merely consist of lists of attributes, but also incorporate contextual information and background knowledge. As the name suggests, a concept is seen as someone’s naïve theory of what the concept is, what its characteristic properties are, what it does, how it is used, how it is related to other concepts and to the world. In brief, a concept represents all information that people have about a particular category, including specific exemplars, unclear cases, and exceptions. Someone who identifies an object compares it to a category theory instead of to a limited set of defining and characteristic properties. Adherents to the theory view claim that it provides a more promising account of categorization than the similarity view since “it begins to address the question of why we have the categories we have or why categories are sensible. In fact, coherence may be achieved in the absence of any obvious source of similarity among examples” (Medin 1989, p. 1474). Indeed, unlike a similarity-based account
of categorization, the theory view of categorization is able to explain why ad hoc categories are coherent, i.e. why ad hoc categories cohere and make sense to the perceiver despite the fact that their members do not appear to belong together.

Although the conception of concepts as mini-theories is fully adopted here, it does not enhance actual understanding. In order to understand how, or even better, to predict whether some object will be a member of a particular category, it is not very helpful to know that attention should be paid to the complete knowledge structure rather than just to the characteristic properties of the object, if this knowledge is not made explicit. The good thing about characteristic properties is that they can be defined to a large extent as a result of which they can be used to predict category membership. In contrast, theories are relatively abstract, and therefore less suitable to explain categorization in real situations.

Both the two-tiered theory and the theory of psychological essentialism have tried to provide a more explicit account of the theory approach. Only psychological essentialism has been successful in its attempt. The two-tiered theory is interesting, discriminating between factual information (BCI) and inferential information processing (ICI), but like the theory view, it remains at too abstract a level to be a useful approach for the study of categorization. Psychological essentialism on the other hand, describes concepts in terms of (surface and deep) properties and explains how these two types of properties are related. For this reason, the conceptual model of category representation that forms the basis of the current dissertation (see section 2.8) closely resembles the model of psychological essentialism.

To recapitulate all that has been said in this section about category representation and object identification, categories are assumed to be represented by knowledge structures (i.e. schemas or theories) containing all information about the category and its members. More specifically, in accordance with psychological essentialism, concepts are perceived as having an essential part that predominantly consists of deep properties and a non-essential part formed by surface properties. Classification takes place on the basis of the deep properties in combination with the surface properties that they constrain.

2.7 Conceptual Structure: How Are Categories Related?

So far, categories have been treated as existing in isolation. Theories of category representation describe how single categories are stored in memory. However, categories do not stand alone. People have so many categories at their disposal that they need to organize them in some way or another to be able to use them effectively. Such a set of interrelated
categories is called a conceptual structure or a schema (Howard 1992). The
term schema may cause confusion, since it is also used to denote a concept,
i.e., the representation of a single category rather than a set of associated
category representations. Howard (1992) explains that there is no hard
distinction between these two meanings of schema, since "virtually any
concept can be regarded as a schema because it involves the interrelation
of several component concepts and virtually any schema can be regarded
as a concept. Which term we use largely depends on our purposes at the
time (Skemp, 1979)" (p. 100). Here, in order to avoid confusion, the term
schema is used solely to indicate the representation of a single category,
whereas the term categorical structure stands for the mental structure in
which consumers organize the collection of category representations in their
minds.

Categorical structures may be taxonomic or non-taxonomic. A taxonomy is a
hierarchical system by which categories are related to one another by
means of class inclusion (Roach 1978). An example of a taxonomy is
FURNITURE – CHAIR – KITCHEN CHAIR. These categories correspond to the three
levels of inclusiveness that are generally distinguished within a taxonomy,
namely the superordinate level, the basic level and the subordinate level
(e.g. Claey's 1993). Higher level categories subsume lower level categories
(e.g. FURNITURE includes all chairs and CHAIR includes all kitchen chairs).
Descending the hierarchy, categories become less inclusive, less distinct,
but more specific. The degree of inclusiveness refers to the number of
objects within a category. The superordinate-level category FURNITURE
contains more objects than the basic-level category CHAIR, which includes
more objects than the subordinate-level category KITCHEN CHAIR. The level of
distinctiveness refers to how distinct a category is from others at the same
hierarchical level. Clearly, the category KITCHEN CHAIRS differs less from the
alternative subordinate-level category ARMCHAIRS than the superordinate-
level category FURNITURE differs from the category VEHICLES. Finally,
specificity concerns the amount of information that is required to describe
the category. It takes much more information to describe what a kitchen
chair is than it does to describe the category FURNITURE.

An implication of the use of taxonomic structures to organize categories is
that one and the same object may be classified at any level within the
taxonomy. A particular thing could be identified as a tenor saxophone, a
saxophone or a musical instrument, depending on the person who classifies
it. This fact is problematic since it raises the question of which of the
available options people will choose. The answer to this question is that
people prefer to classify objects at the basic level of inclusiveness. The
preference for the basic level, referred to as basic-level superiority in the
literature, is discussed in greater detail in chapter 3.

Besides taxonomic categories, people use categories that do not fit within a
taxonomic hierarchy (Medin and Ross 1992). This is true because the world
does not only exist of categories of objects but also of categories of activities,
feelings, occupations, convictions, relationships and other categories that are neither superordinate nor subordinate with respect to each other. People need all of these categories as well in order to make sense of their environment and in order to communicate with one another.

In addition, particular situations may stimulate people to create new categories on the spot. For example, bus passengers stranded in the Sahara as a result of a broken engine may create the category **THINGS TO SURVIVE IN THE DESERT**. Categories like these are called ad hoc categories (Barsalou 1983, 1985, 1991). Ad hoc categories are always related to a particular situation, context or goal. Although they are labeled *categories*, ad hoc categories in fact represent an alternative, non-taxonomic way to link categories together. Thus, ad hoc categories are categorial structures rather than categories. Usually, the members of ad hoc categories cover different taxonomic categories, as in the case of the category **CHRISTMAS GIFTS**. As a result, the members of ad hoc categories do not look alike. They are held together not by visual similarity, but by the purpose they serve or by the situation they apply to. Still, like taxonomic categories, ad hoc categories possess a graded structure. They contain typical and atypical members (e.g. water is a more prototypical member of the category **THINGS TO SURVIVE IN THE DESERT** than a hair brush).

In sum, categories may be organized both into taxonomic and non-taxonomic structures. This makes human categorial structures very flexible and adaptive. New categories may be incorporated into existing taxonomic structures relating them to existing categories, whereas non-taxonomic categories may be created if the situation so requires. As a result, one and the same category may be organized very differently and be associated with very different categories across time and across contexts.

### 2.8 The Categorization of Hybrid Products

Thus far, the account of categorization has concerned objects in general without specifying the exact nature of these objects. Now, a conceptual framework for the study of the categorization of *hybrid* products will be proposed. As hybrid products differ from non-hybrid products in the sense that they possess multiple identities (i.e. a hybrid product is all of its source products in one), the categorization process with regard to hybrid products raises specific questions as to how people identify products for which there are several candidate categories instead of one.

#### 2.8.1 The Conceptual Structure of Hybrid Products

The difference between hybrid and non-hybrid products becomes particularly clear if one thinks about the essence of hybrid products. Whereas non-hybrid products always have a single essence, which in no
way needs to be clearly identifiable, the essence of hybrid products is ambiguous. This ambiguity occurs since two independent essences, namely the essences of the source products, are merged into a single hybrid essence. The question is whether the hybrid essence is merely the sum of the essences of its components or whether it is more than that, meaning that hybrid products have essences of their own. In other words, are hybrids truly new products or do they stay combinations of source products with two distinct identities?

Figure 2.6 shows the conceptual structure of a hybrid product H composed of the source products A and B. For the sake of clarity, no distinction is made between deep and surface properties and the arrows indicating the relationship between deep and surface properties have been omitted. To keep it simple, A and B are assumed to have essences each consisting of three properties. The number of non-essence properties is irrelevant. Because H is a combination of the previously existing products A and B, its essence contains all essential properties of A and B. After all, H is both A and B, so it should possess the essential properties of both A and B. In addition to the essential properties of A and B, H may also possess essential properties of its own. In order to be truly essential to H, these properties should not belong to the essences of either A or B.

![Conceptual Structure of a Hybrid Product](image)

- **H** = Property hybrid product H
- **A** = Property source product A
- **B** = Property source product B
- **H** = Essence hybrid product H
- **H** = Non-essence hybrid product H

It is not evident that every hybrid product will possess essential properties of its own, i.e. H properties that are essential to the hybrid, but not to either of the source products. For example, it is hard to come up with properties that are essential to a television-video recorder that do not belong to the conceptual essences of either TELEVISION or VIDEO RECORDER. The true essence of a television-video recorder is that it is both a television and a video recorder. In other words, in order for products to be hybrid products, neither of the source products can be absent.
The distinction between parity and enhanced hybrids (Jain and Ziamou 1995; see chapter 1) may be of help to explain whether the essence of a hybrid is more than the sum of the essences of its constituent components. In the case of a hybrid being enhanced, its essence is likely to consist of more than the essential properties of A and B, since the hybrid provides something that the individual source products do not. To illustrate, part of the essence of an alarm clock-radio is its ability to awaken people with radio music, a quality that neither the alarm clock nor the radio have on their own. In sum then, some hybrid products, like enhanced hybrids, may possess unique essential properties (the H's in the essence of Figure 2.6), but it is unknown whether this will always be true (although the idea seems intuitively plausible). For other hybrid products, essential hybrid properties H appear to be absent or are at least hard to identity. For now, this issue remains open to speculation.

A final remark concerning Figure 2.6 regards the non-essential properties of hybrid product concepts. Among these properties one is sure to find properties that are linked specifically and only to the hybrid concept H. The number of non-essential H properties will differ per hybrid product concept (e.g. a television-video recorder has few of them, whilst a blender-scales combination (see chapter 6) has many).

Considering the picture of the conceptual structure of hybrid products as it has been sketched above, it becomes clear why hybrid products are ambiguous. A hybrid product concept possesses essential properties of A, B and possibly H. Therefore, a person may identify the hybrid as A, B or H, depending on which of the properties (i.e. A, B or H) are salient to the person and depending on the weight (s)he attributes to each of these properties.

2.8.2 Assessing Category Membership for Hybrid Products

Remember Rips' (1989) account of the way categorization generally takes place. According to him, an object belongs to a category if the representation of the object is sufficiently similar to the representation of the category. However, Rips does not say what will happen if the representation of an object is sufficiently similar to several different category representations, as in the case of hybrid products. Following the principle of sufficient similarity, hybrid products would be assigned to all categories with which they share essential properties (i.e. the source categories). Does this mean that hybrids are members of more than one category at the same time? It does not, since people tend to strive for clear identifications in which something is one thing and not another. Hence, in the case of hybrid products an additional principle becomes operative, namely that a hybrid cannot be a member of source category A if it is also sufficiently similar to source category B and vice versa. Under such conditions, the existing source categories are too restricted to include the hybrid and a new (hybrid) category will have to be created.
To clarify the differences between the categorization of non-hybrid and hybrid products (see the flow charts in Figure 2.7 and Figure 2.8), both processes, including possible outcomes, are discussed briefly. It should be noted that no assumptions are made regarding the way in which the process takes place. Consumers may go through the different stages sequentially, concurrently, or they may do both. Furthermore, the flows charts show the outcomes of each stage in the decision process. Consumers either go ("yes") or do not go ("no") on to the next step. The charts do not incorporate decisional (un)certainty. Thus, they do no reveal whether proceeding to the next step is easy, quick and certain, or difficult, slow and uncertain.

Figure 2.7
The Classification Process of Non-Hybrid Products

To start with the categorization of non-hybrid products (Figure 2.7), a first possibility is that the product fits straightly into the first category with which it is compared (1). Second, if the similarity between the product and the target category representation is insufficient, an alternative category may be found into which the product does fit (2). When no alternative categories can be found, people may create a new category for the product (3). Finally, if people are unable to create a new category, which may occur when people
are completely clueless about the product's identity, identification will fail and the product will remain unknown (4).

In comparison with the relatively straightforward identification process of non-hybrid products, the identification of hybrid products is more complex (see Figure 2.8). The route most likely to be followed has been highlighted. It represents the process in which both components of the hybrid product are recognized. The outcome of the process will depend on the question of whether the hybrid is familiar or unfamiliar. When the hybrid is familiar, it will be classified into its corresponding hybrid category (3). When the hybrid is unfamiliar, a new category may be created for it (4). Of course, there is also the possibility that the hybrid is so new that it will not be identified (5).

Figure 2.8
The Classification Process of Hybrid Products
Two outcomes sketched in Figure 2.8 have not been explained yet, namely those noted as 1 and 2. These outcomes represent the possibility that the hybrid is not categorized as a hybrid product, but as a source product. If Outcome 1 materializes, the hybrid has been identified as source product A. If Outcome 2 occurs, the hybrid has been classified into source category B. There are two situations in which consumers may end up categorizing the hybrid into one of the source categories instead of into a hybrid category. First, consumers may recognize one component of the hybrid product but fail to recognize the second, leading to an erroneous classification into either one of the source categories. The classification is considered incorrect since it is the result of a misinterpretation of the hybrid product. On the other hand, consumers could be fully aware of both components but still decide that the hybrid belongs to one of the source categories rather than to a (new) hybrid category, for instance because they intend to use the hybrid mainly for one of its primary functions. Whether accidental or deliberate, in either case the result will be the same: the hybrid will be categorized as a non-hybrid.

2.8.3 The Position of Hybrid Products within Consumers’ Categorical Structures

After having illustrated how the categorization of non-hybrid and hybrid products takes place, it is still not clear which place hybrid products have within people’s categorical structures. How are hybrid products (or categories) related to other products (categories)? Phrased differently, at which taxonomic level (i.e. superordinate, basic or subordinate) are hybrid products categorized? This question is considered in the next chapter. Specifically, chapter 3 tests the basic-level superiority hypothesis, which has frequently been supported in previous categorization research. According to this hypothesis, one universal level of abstraction exists, called the basic level, at which all individuals find it most useful to think about objects (Johnson and Mervis 1997). As a consequence, people tend to categorize objects into basic-level categories.

At the end of the first chapter it was stated that the basic-level superiority hypothesis is highly relevant in the case of hybrid products because it explains the ambiguity that characterizes hybrid products. Hybrid products are believed to be ambiguous because consumers try to assign them to a single, best fitting, basic-level category. As there are two basic-level categories that fit the hybrid equally well (but not well enough as it will be argued in chapter 5), consumers do not know which of these categories to choose. Ambiguity exists. However, if people categorized products into other than basic-level categories, hybrid products would not be ambiguous to consumers. If consumers were satisfied knowing that the motorbike-car combination is some kind of vehicle, for instance, or that it may be used for getting around town, there would not be a categorization problem. The basic-level superiority hypothesis, though, predicts that such general
classifications will not suffice for consumers. Consumers prefer to make more specific classifications. They want to know what the product is, i.e. they want to know to which basic-level category the hybrid belongs. It is in this way that consumers' preference for basic-level categorization is responsible for the ambiguity inherent in hybrid products. Therefore, the validity of the basic-level superiority hypothesis is tested before the categorization of hybrid products is investigated.
3 Principles Determining Product Classification: What Kind of Categories Do Consumers Create?

This chapter is closely related to the next one. The purpose of the current chapter is to elucidate what kind of categories consumers create when they categorize products. Chapter 4 then investigates what the bases for these classifications are. It identifies the product dimensions (e.g., form, function, use) that consumers consider when they assign products to categories. Because of the connection between chapters 3 and 4, the same experimental approach, known as "free classification," was applied in both. In a free classification task, individuals arbitrarily sort a set of stimuli into discrete groups. Such a task is appropriate for examining both the type of product categories that consumers form and the product dimensions on which these categories are based.

Returning to the issue of which product categories consumers apply, the studies reported in this third chapter were designed to find out whether consumers classify products into basic-level categories as the basic-level superiority hypothesis posits. Earlier, it was noted that empirical evidence in support of the basic-level superiority hypothesis is extensive. This raises the question of why it was necessary to explicitly test this hypothesis in this dissertation. Why not take it for granted? First of all, although the basic-level superiority hypothesis has been supported in many empirical studies, it has not been established for actual object classification tasks, i.e., tasks in which people sort a number of objects into categories (see subsection 3.2.1). It is not known whether basic-level superiority shows up in such tasks. Second, a review of the categorization and consumer literature has revealed few studies that explicitly examined how people classify products. Instead, categorization research has dealt almost exclusively with natural objects or artificially created abstract stimuli (like the ones in Figure 3.1). There is thus no empirical evidence that products are sorted in similar ways as natural objects or artificial stimuli are.
In examining the kind of product categories that consumers create, two streams of literature are relevant. Section 3.1 reviews the literature on category construction. The research reported on this topic has investigated the organizing principles that people apply when sorting objects into categories. Classification is believed to take place either on the basis of overall similarity or on the basis of single dimensions. Classification based on overall similarity is known as family resemblance sorting; classification based on single dimensions is known as one-dimensional sorting. The second body of literature concerns the literature on basic-level superiority. In short, the research on basic-level superiority suggests that people will sort objects into basic-level categories, because these categories are the most cognitively efficient. These concepts are explained in more detail in section 3.2.

Section 3.3 explains the free classification approach and the reasons for selecting this particular method to study consumer product classification. It also considers the main issues involved in designing free classification tasks.

Section 3.4 presents the research hypotheses, which are tested in two empirical studies. The results of these free classification studies are discussed next. In the first study, participants sorted sets of pictures of furniture and electrical equipment without having received any instruction in advance (section 3.5). The second study was a replication of the first one, but this time participants received an instruction with the intention of eliciting a particular type of classification, namely basic-level classification (section 3.6).

At the end of this chapter, in section 3.7, the knowledge from categorization literature, including the validity of the basic-level superiority hypothesis, is critically reviewed in light of the empirical findings from the two classification studies to arrive at a provisional account of consumer product categorization.

3.1 Family Resemblance Sorting versus One-dimensional Sorting

People faced with the task of dividing a set of items into categories may do so in numerous ways. Thus, it is possible that different people presented with the same set of items will each sort these items differently. Categorization theory (see chapter 2), however, predicts that it is very unlikely that everyone will create different categories. It sooner suggests that people naturally classify objects on the basis of overall similarity or family resemblance. As family resemblance is widely believed to characterize natural categories, it is a reasonable hypothesis that people, when asked to sort such items, will normally reconstruct these family resemblance categories (Spalding and Murphy 1996). According to Regehr and Brooks (1995, p. 347), "it seems
very natural to assume that items that appear similar to each other belong together”. Medin, Wattenmaker and Hampson (1987) explain why family resemblance classification is a natural way to classify objects:

One of the most salient properties of categories is that their members appear to be more similar to each other than to members of contrasting categories. This observation leads naturally to the suggestion that people should sort examples into categories so as to maximize within-category similarity relative to between-category similarity (p. 244).

Following their review of the empirical work on category structure, in particular the work of Rosch and Mervis, Medin et al. (1987) conclude that “it is difficult to escape the intuition that family resemblance sorting ought to be natural” (p. 275).

3.1.1 Empirical Findings

The arguments of Medin and his fellow researchers appear to be compelling and their conclusion sound. It is surprising, then, to find that the empirical research on object sorting shows that family resemblance sorting occurs far less often than categorization theory would predict. Instead of putting similar objects together, people often prefer to sort objects along a single dimension. For example, beverages may be classified into alcoholic versus non-alcoholic, hot versus cold, carbonated versus non-carbonated, or healthy versus unhealthy.

Table 3.1 summarizes the main results from the reviewed studies. In order to facilitate the interpretation and comparison of the findings of the different studies, the table also reports the kind of stimulus material used in the study and the type of sorting task that subjects performed. Medin, Wattenmaker and Hampson (1987) employed a variety of category structures and stimulus structures designed to induce family resemblance sorting but almost all subjects preferred one-dimensional sorting. In one of their studies they explicitly tried to prevent one-dimensional sorting by creating stimuli for which no straightforward one-dimensional sorting strategy could be used. Even in this case, one-dimensional sorting was the most common strategy. Ann and Medin (1992) found that family resemblance sorting only took place when one-dimensional sorting did not work. This finding is in line with the authors’ two-stage model of category construction. According to this model, people will first classify items according to the most salient dimension. Next, the unclear cases, i.e., those items that do not have an extreme value on the salient dimension, will be classified on the basis of their overall similarity to the items that have already been classified. In other words, one-dimensional sorting is the primary way to sort objects, rather than family resemblance sorting. Regehr and Brooks (1995) also showed that one-dimensional sorting was the dominant sorting strategy, even when there was an overwhelming overlap of features between stimuli. Finally, the studies of Lassaline and Murphy (1996) and Spalding and Murphy (1996) replicated the finding that one-dimensional sorting is the norm when people sort objects.
### Table 3.1
Empirical Findings on Object Classification

<table>
<thead>
<tr>
<th>Authors</th>
<th>Stimulus material</th>
<th>Sorting task</th>
<th>Main findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spalding and Murphy</td>
<td><strong>Number of stimuli</strong> 20 stimuli, 2 categories, 10 exemplars per category</td>
<td>• Read descriptions in advance; (2) sort cards in 2 equal-sized groups; (3) confidence rating (1-10) and explain basis of sorts</td>
<td>• If features could be integrated into meaningful categories FR sorting increased, but overall 1-D sorting was the norm</td>
</tr>
<tr>
<td>(1996)</td>
<td><strong>Format</strong> Descriptions, 5 attributes</td>
<td>• Lay out cards and read descriptions; (2) sort in 2 groups most natural, no restrictions to size; (3) confidence rating (1-10) and explain basis of sorts</td>
<td>• If there are contradicting features, FR sorting was difficult, 1-D sorting was dominant</td>
</tr>
<tr>
<td></td>
<td><strong>Type of stimuli</strong> Vehicles, animals, buildings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lassaline and Murphy</td>
<td><strong>Number of stimuli</strong> 20 stimuli, 2 categories, 10 exemplars per category</td>
<td>• (1) Single look through the stack; (2) answering set of questions; (3) sort in 2 groups most natural, no restrictions to size</td>
<td>• If property relationships were made salient, FR sorting was dominant, otherwise 1-D sorting was dominant</td>
</tr>
<tr>
<td>(1996)</td>
<td><strong>Format</strong> Both descriptions and pictures, 8 attributes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Type of stimuli</strong> Vehicles, animals, buildings, novel bugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regehr and Brooks</td>
<td><strong>Number of stimuli</strong> 10 to 22</td>
<td>• Sort-full-array procedure (sorting while all stimuli remain visible)</td>
<td>• 1-D sorting was very robust when sorting a simultaneously presented array of stimuli, even when there was an overwhelming overlap of features</td>
</tr>
<tr>
<td>(1995)</td>
<td><strong>Format</strong> Pictures consisting of 4-10 items</td>
<td>(1) Sorting in 2 groups most natural, no restrictions to size</td>
<td>• When comparing pairs of stimuli, FR sorting appeared to be dominant</td>
</tr>
<tr>
<td></td>
<td><strong>Type of stimuli</strong> Artificial mini-pictures, holistic blobs, geometric figures</td>
<td>(2) Explain sorting • Match-to-standards procedure: sort stimuli one at a time, no looking back at previous items • Match-from-array procedure</td>
<td>• Strong effect of the array of stimuli on the type of sorting</td>
</tr>
</tbody>
</table>

1. FR = Feature Relevance
<table>
<thead>
<tr>
<th>Authors</th>
<th>Stimulus material</th>
<th>Sorting task</th>
<th>Main findings</th>
</tr>
</thead>
</table>
| Ahn and Medin            | • Number of stimuli 10  
• Format  
Both drawings and pictures, varying on 4 dimensions  
• Type of stimuli Artificial "starfish", artificial stimuli | • Sort in 2 groups most natural, no restrictions to size;  
(2) explain sorting  
• Sort in 2 equal-sized groups; (2) explain sorting  
• Sort in 2 groups most natural, no restrictions to size | • Evidence for a 2-stage model of category construction was found; people first tend to sort 1-D, after which the stimuli that do not fit are sorted on the basis of FR structure  
• When more than 2 groups were allowed, FR sorting did not occur |
| Wattenmaker              | • Number of stimuli 8  
• Format  
Descriptions, varying on 4 dimensions  
• Type of stimuli Fictitious animals, medical symptoms, objects that could substitute a hammer | • (1) Read descriptions in advance; (2) sort cards in 2 equal-sized groups most sensible (3) explain sorting | • When categories were sorted from memory, 1-D sorting was preferred  
• When categories were sorted perceptually, FR sorting was preferred, in contrast with other findings |
| Medin, Wattenmaker, and Hampson | • Number of stimuli 10 to 14  
• Format  
Drawings, descriptions, and lists, varying on 4 or 6 dimensions  
• Type of stimuli Artificial cartoon-like animals, personality traits, medical symptoms, animals | • (1) Lay out and look over examples; (2) sort into 2 equal-sized groups most natural; (3) Explain sorting | • FR sorting hardly occurred, in spite of efforts to elicit FR sorting by changing the attribute structure of the stimuli. 1-D sorting was the norm  
• When attributes could be connected by underlying principles, FR sorting increased largely |
| Gutman (1981)            | • Number of stimuli 18  
• Format  
Words  
• Type of stimuli Food effects, texture words, cereal names | • Free sorting, no restrictions to the number of categories or number of items in a category | • No results on type of sorting  
• Preference for a relatively small number of categories (2 to 6) |

1 FR = family resemblance; 1-D = one-dimensional
3.1.2 Reconsidering the Empirical Findings

The reviewed literature suggests that one-dimensional sorting rather than family resemblance sorting is the most natural way to sort items in a sorting task. However, the empirical evidence suggesting a preference for one-dimensional sorting should be put in perspective in three ways.

First, several authors actually found support for the assumption that people prefer family resemblance sorting. Wattenmaker (1992) compared perceptually-based category construction with memory-based category construction and found that people engaging in a perceptual sorting task tended to sort objects according to a family resemblance principle rather than along a single dimension. The author concludes that "this result is significant given fairly substantial evidence that adult subjects often prefer to sort on the basis of single dimensions" (p. 1135). Other authors have shown that family resemblance sorting occurs when the relationship between the attributes of the stimuli is made salient. Making people aware of inter-attribute relationships can be done by providing people with meaningful categories (Spalding and Murphy 1996), theories or underlying principles (Medin, Wattenmaker and Hampson 1987), or by having people perform an inductive task (Lassaline and Murphy 1996). For example, Lassaline and Murphy asked their subjects questions such as "Given that this animal has a short tail, what kind of teeth would you expect it to have?" (1996, p. 96). A final condition under which family resemblance sorting takes place was demonstrated by Regehr and Brooks (1995). They observed that family resemblance sorting was produced when the sorting task consisted of comparing pairs of objects instead of a full array of objects. As an explanation for this result, Regehr and Brooks suggest that family resemblance sorting represents a less powerful organizing principle than one-dimensional sorting:

The presence of the full array seemed to encourage scanning of the entire array, and scanning of the entire array seemed to highlight the repetition of specific dimensional values across stimuli in the set, thereby overriding the experience of overall similarity across the stimuli within a family resemblance category (p. 357).

A second reason why the apparent preference for one-dimensional sorting should be interpreted with care, is provided by Spalding and Murphy (1996). They wonder what one-dimensional sorting really is. People may construct rather abstract dimensions from the concrete stimulus dimensions and sort the stimuli accordingly. For example, people may arrange objects on the basis of the dimension modern versus old-fashioned. Such a dimension would have to be abstracted from several concrete stimulus characteristics rather than representing any single stimulus dimension by itself. Spalding and Murphy question whether such classifications could be considered to be one-dimensional classifications, since they are really based on some type of overall similarity.
Finally, the evidence of a preference for one-dimensional sorting should be treated with caution, because the reported studies are limited in several ways. The most serious limitation concerns the fact that the experimental tasks that subjects in these studies carried out were restricted classification tasks. Inspection of the third column of Table 3.1 shows that in all studies, except Gutman’s, subjects were forced to sort the stimuli into two categories. Such a task is likely to encourage one-dimensional sorting since it is sufficient and relatively easy to find a single criterion that distinguishes one category from the other, rather than distinguishing the two categories on the basis of overall similarity. This is particularly true if the number of stimuli is relatively small and if the stimuli are artificial and limited with respect to the number of dimensions on which they differ. Under these conditions, a discriminating feature readily presents itself.

Figure 3.1
Stimulus Material Used in the Study of Medin, Wattenmaker and Hampson (1987) Grouped by a Family Resemblance Structure

For example, for the experimental stimuli used by Medin, Wattenmaker and Hampson (1987) that are pictured in Figure 3.1, by far the most salient feature is the shape of the head (i.e. the mouse-like ears versus the star-shaped head). Therefore, this feature is likely to dominate the family resemblance structure that is present in the stimulus set. It is doubtful that these results also hold for true free classification tasks, in which people can construct as many categories as they wish and where a single sorting criterion cannot accurately capture the category structure that is present in the stimulus set. Returning to the material of Medin, Wattenmaker and Hampson, a division in four groups (1. mouse-head, spotted body; 2. mouse-head, striped body; 3. star-head, spotted body; 4. star-head, striped body) seems to capture the differentiation within the stimulus set most sensibly.

A limitation that is closely related to the previous one is that the classification studies were all designed to contrast family resemblance sorting with one-dimensional sorting. The stimulus material was constructed in such a way that people would sort them either according to a family resemblance principle or according to a single dimension. Possible other sorting
strategies that people may have wanted to use were virtually excluded by the way the stimuli were constructed.

Finally, the stimulus material used in the reviewed classification studies consisted primarily of (descriptions of) artificial stimuli from non-product categories such as the stimuli in Figure 3.1. It is not clear whether people sort (pictures of) real products in similar ways.

3.1.3 Conclusion

Do people involved in a free classification task sort objects on the basis of family resemblance or on the basis of similarity on a specific dimension? On this matter the reviewed studies are inconclusive. Whilst they predominantly suggest that people have a preference for one-dimensional sorting strategies, the empirical evidence is weakened by the fact that: (1) classification experiments have come up with several conditions under which family resemblance sorting does occur; (2) the difference between one-dimensional sorting and family resemblance sorting is not necessarily very strict; and finally (3) the reviewed studies have several significant limitations. Apart from these limitations, the reported experimental tasks differ to such an extent from a true free product classification task that the published outcomes do not have great predictive validity for the product classification experiments that are described later on in this chapter.

A final observation with regard to the reviewed studies is that they concentrate on the horizontal dimension of categorization, leaving the vertical dimension out of consideration. (The horizontal and vertical dimension of categorization were discussed in chapter 2.) All studies reported have been concerned with the within-category structure, i.e. they have tried to unravel the principles (family resemblance or one-dimensional) according to which people categorize objects. Apart from their internal category structure, categories are also characterized by their inter-category structure. The inter-category structure concerns the degree of differentiation people make between categories. They may show a low degree of differentiation in their classifications, sorting stimuli into broad, general, relatively abstract categories. People may also show a high degree of differentiation, implying a preference for classifying objects into small, differentiated, specific categories. The reviewed classification literature does not consider this aspect (i.e. the vertical dimension) of categorization at all. A stream of research that has considered the vertical dimension is the research on basic-level superiority addressed in the following section.
3.2 The Role of the Basic Level in Consumer Product Classification

Chapter 2 introduced the basic level of categorization as the intermediate level of taxonomies, i.e. hierarchical structures that relate categories to each other by means of class inclusion. This section gives a more elaborate exposition of the basic level of categorization and its role in product classification.

3.2.1 Basic-Level Superiority

One of the most persistent and universal findings within categorization research has been the existence of a preferred level of categorization: people most quickly and accurately use basic-level categories to label everyday, common objects (Rosch, Mervis, Gray, Johnson and Boyes-Braem 1976). For example, when people see a picture of a German shepherd, they are most likely to identify this picture as a DOG (basic-level) rather than as an ANIMAL (superordinate level) or as a GERMAN SHEPHERD (subordinate level). This so-called basic-level superiority (called basic-level advantage by other researchers) has been replicated extensively in the categorization literature (see Johnson and Mervis 1997; Lassaline, Wisniewski and Medin 1992; Lin, Murphy and Shoben 1997; Markman and Wisniewski 1997; Murphy and Wisniewski 1989; Tanaka and Taylor 1991). Markman and Wisniewski (1997) summarize the most frequently observed results: (a) pictures of isolated objects are categorized the fastest at the basic level; (b) people almost exclusively use basic-level names in free naming tasks; (c) children learn basic-level concepts sooner than other types of concepts; (d) basic-level names are most common in adult discourse; (e) different cultures tend to use the same basic-level categories, at least for living kinds (see also Malt 1995); and (f) the basic-level advantage holds across a wide range of domains, including environmental categories, computer programs, personality types, and events.

A variety of factors are believed to contribute to basic-level superiority in categorization (Lassaline et al. 1992; Markman and Wisniewski 1997). First, basic-level category labels are generally relatively short and people tend to use shorter names in everyday communication (e.g. DOG instead of GERMAN SHEPHERD). This relates to the second factor: basic-level categories are most frequently used. Frequency of use may lead to a greater accessibility of basic-level categories during cognitive processing. To illustrate this point, since you will be most likely to refer to your car as a car rather than as a Volvo 340 SL. The concept CAR will come to mind earlier when you think of your car than the concept VOLVO 340 SL. Basic-level categories are also the first ones to be learned. Therefore, it may well be that people prefer basic-level categories out of habit. A fourth explanation mentioned in the literature posits that the basic-level is the most abstract level at which category
members share parts. A common part structure may facilitate classification at the basic level. For example, most bicycles, with two wheels and handlebars, are more easy to classify as a bicycle than as a vehicle, as vehicles do not share these parts. Filth, in comparison with instances from basic-level categories, which possess similar overall shapes, members from superordinate categories lack a single perceptual representation (e.g., chairs look alike, furniture does not). Shape similarity may make it easier to recognize different instances as members of the same basic-level category. Note that shape similarity does not explain why an instance should be classified at the basic level rather than at the subordinate level. Finally, basic-level categories may be superior because they are thought to be highly differentiated. The differentiation arises because basic-level categories have "both a high degree of within-category similarity and a high degree of between-category dissimilarity" (Markman and Wisniewski 1997, p. 55). Due to this quality, basic-level category members are relatively easy to recognize as belonging together and being different from members of contrasting categories.

Of the six explanations mentioned above, four have been invalidated. Murphy and Smith (1982) investigated the first three explanations and they concluded that name length, frequency of co-occurrence and order of learning were not responsible for the basic-level superiority effect. Murphy (in Lassaline et al. 1992) found that explanation four does not hold either; parts were neither necessary nor sufficient for a basic-level advantage.

Taken together, the literature suggests that basic-level superiority is rooted in the attribute structure of basic-level category members, in particular in their perceptual attribute structure. According to Murphy and Brownell (1985), this structure is such that basic-level categories are at a level that maximizes the combination of distinctiveness ("how dissimilar a category is to its contrast categories", p. 71) and specificity ("how specific, informative, or narrowly defined a category concept is", p. 71). Further, on the basis of the degree of distinctiveness and specificity, Tanaka and Taylor (1991, p. 470-471) explain the privileged status of the basic-level categories.

On one hand, superordinate-level categories are highly distinctive, but not very informative, and on the other hand, subordinate-level categories are highly informative, but are not very distinctive. Thus, with respect to differentiation, the intermediate basic-level categories represent the optimal level of categorization because they are both specific (as compared to superordinate-level categories) and distinctive (as compared to subordinate-level categories).

Consider an instance of an armchair. If the purpose of classification were to maximize distinctiveness, it would be most effective to classify the armchair at the superordinate level. Identifying the instance as a piece of furniture maximally differentiates it from contrasting superordinate categories such as vehicles, clothes, or toys. In contrast, in order to maximize specificity, it would be ineffective to classify the armchair as a piece of furniture since that
does not tell much about its identity. It could still be a lot of different things. Classification at the subordinate level would maximize specificity (it would be highly informative to know that something is an armchair), but distinctiveness would be relatively low (an armchair is relatively similar to a kitchen chair). Rather than being both \textit{maximally} specific and distinctive, concepts at the basic level are \textit{sufficiently} specific and distinctive, identifying something as a chair will suffice to inform people what the instance is, although the concept chair carries less information than the concept armchair. At the same time, the basic-level concept chair is clearly different from instances from neighboring basic-level categories, such as tables or cupboards, although this difference is less than the one between contrasting superordinate categories, such as furniture and clothes.

3.2.2 The Effect of Expertise on the Basic Level of Classification

In the previous subsection, it was noted that the basic level of classification can be defined as the level at which categories are both sufficiently specific and distinctive. Since both the degree of specificity and the degree of distinctiveness are rooted in the attribute structure of the stimuli, it appears that the basic level is given for a particular stimulus set. This conclusion is oversimplified, though, since it ignores the influence of expertise on basic-level classification. Rosch and her colleagues (in Tanaka and Taylor 1991) suggested that the basic level might vary according to individual differences in the amount of knowledge about the stimulus set.

Different amounts of knowledge about objects can change the classification scheme. Thus, experts in some domain of knowledge can make use of attributes that are ignored by the average person (p. 477).

Several studies have shown an effect of expertise on the level of classification. Tanaka and Taylor (1991) demonstrated that: (1) the distinctiveness of subordinate-level categories increased as the level of expertise rose; (2) experts tended to name objects at the subordinate level rather than at the basic level; and (3) for experts subordinate categories and basic-level categories were equally accessible. Medin, Lynch, Coley and Atran (1997) examined the classification behavior of three types of tree experts (taxonomists, landscape workers, and parks maintenance personnel) and discovered that each of these groups differed in the way they classified trees. Johnson and Mervis (1997) investigated the effect of varying levels of expertise on basic-level superiority. Their main results were the following. In comparison with novices: (1) the lexicon of experts is more comprehensive and elaborate (i.e. experts have more words and more hierarchical levels at their disposal); (2) experts possess richer attribute sets at subordinate levels; (3) the classification of objects at sub-basic levels is faster and more automatic; (4) experts name objects according to sub-basic-level names; (5) experts generate attributes related to behavior or function, whereas novices come up with perceptual physical attributes; (6) experts weighted species-related perceptual features more heavily. Johnson and Mervis (1997)
conclude that expertise increased access to categorical information at sub-basic levels, causing these sub-levels to function as basic. At the same time, they found that the original basic level never lost its privileged status.

In sum, the reported studies support the idea that as expertise on a particular domain increases, subordinate or sub-subordinate classification levels may function as basic in addition to the "true" basic level. In other words, experts possess more than one basic level of classification. The idea that subordinate levels become basic, can be easily explained by applying the concepts of distinctiveness and specificity. The argument presented earlier was that people strive for an optimal balance that maximizes specificity without losing distinctiveness. The point with subordinate categories is that they are more specific than basic-level categories, but that distinctiveness is too low to allow for effective classification. However, a higher level of expertise causes subordinate categories to become more differentiated, i.e. more distinctive. When this happens, subordinate categories may be preferred to basic-level categories, since the gain in specificity is not nullified by a loss in distinctiveness.

These remarks may seem to contradict the claim that the degrees of specificity and distinctiveness are embedded in an object's attribute structure. This is not the case. The effects of expertise on the level of classification lie in a difference in salience, perception and evaluation of an object's attributes between experts and novices, and not in the attribute structure itself. When novices and experts are confronted with identical objects, they abstract and process information from these objects differently. The differences between expert and novice consumers nicely illustrates the ideas of the theory view of categorization (see chapter 2). According to this view, experts have different, more sophisticated theories at their disposal than novices. As a result, the expert's essence of an object is also likely to differ (slightly) from that of a novice.

What should be the final verdict on the status of the basic level in object classification? Without exception, all studies discussed confirmed the existence of basic-level superiority. People tend to use basic-level categories when they classify objects. The research on the effects of expertise on classification showed that higher levels of object knowledge may cause categories at sub-basic levels to function as basic-level categories. However, this does not challenge the position of the true basic level. It simply means that more experienced people may show a weaker preference for basic-level classification because they have alternative ways of classification at their disposal that are equally or even more cognitively efficient.

3.2.3 Determining the Basic Level of Classification

The conclusion from the literature on basic-level superiority reads that the privileged status of basic-level categories is believed to result from their particular quality of being both distinctive and specific. Assuming that this is
true, the next issue that needs to be addressed concerns the determination of the hierarchical level within a particular product taxonomy that coincides with the basic level. Depending on the level of differentiation within product taxonomies, the basic level may be situated relatively high or relatively low within the hierarchy. For example, a pair of trousers has many subordinates and will thus be at a relatively high position within the clothing hierarchy. In contrast, the position of a Walkman, which has few subordinates, will be near the bottom of the audio equipment hierarchy. Since the position of the basic level depends on the product taxonomy under consideration, some operational definition is needed to determine what the basic level for a given taxonomy is.

Rosch and her associates have described four operational definitions that converge at the basic level (see Johnson and Mervis 1997). The basic level is the most inclusive level at which:

- The objects of a category possess numbers of attributes in common (e.g. chairs all have legs, a seat and a back).
- Highly similar sequences of motor movements are made to objects of a category (e.g. the act of sitting down on a chair is the same, irrespective of the exact chair that one sits down on).
- The objects of a category begin to look very much alike (e.g. different chairs look alike since they have the same archetype).
- It is possible to form a mental image of some "average" member of a category (e.g. try to form a mental image of the average member of the superordinate category furniture and then of the average chair).

Claeys (1993) acknowledges that it is not possible to unambiguously determine whether an object is classified at the basic level of inclusiveness using the aspects listed above individually. For example, applying the similar-sequences-of-motor-movements criteria would not differentiate between chairs, benches and couches, or between cars, buses, and trucks. However, taken together, the four aspects may provide a strong indication of the basic level of inclusiveness within a particular object domain.

3.3 Free Classification

As noted earlier, in a free classification task, individuals arbitrarily sort a set of stimuli into discrete groups. Handel and Imai (1972) distinguish free classification tasks, in which the subject decides on the number of categories, from restricted classification tasks, in which the researcher sets the number of categories. Regehr and Brooks (1995) use the term free classification to refer to a classification task in which objects are sorted in two categories in a way that seems sensible or natural. According to Handel and Imai (1972), this would be a restricted rather than a free classification task, since the number of categories is given in advance.
3.3.1 Applying Free Classification on Consumers' Product Categories

In the empirical studies reported in this third chapter, a free classification task was used to examine the categorization principles that consumers apply when grouping products. The rationale for this approach was provided by the basic assumption underlining all free classification research reported in the literature: free classification tasks reflect actual consumer categorization behavior. In other words, the best way to find out how people categorize objects is by letting them categorize objects and see how they do it.

The degree to which free classification tasks mirror actual categorization strategies depends on two things. First of all, free classification tasks should be natural, since categorization is a natural process. In the second place, free classification tasks should be realistic, i.e. they should resemble the classification tasks that people perform in everyday life. To start with the question of whether free classification tasks are *natural*, Regehr and Brooks (1995, p. 361) remark that "one of the appeals of the free classification task is that it seems quite natural and straightforward". Although these authors do not make clear why a free classification task is natural and straightforward, a strong case for their claim is provided by research with very young children. Studies in developmental psychology have shown that by about one year of age, even before they can talk, children start to spontaneously sort objects into categories. Gopnik and Meltzoff (1992) demonstrated that 18-month-old children who were playing would spontaneously group objects into two categories. This result shows that object sorting occurs naturally form a very early age.

With respect to the second requirement that free classification tasks should be *realistic*, a variety of object-sorting tasks occur frequently in everyday situations. Sorting the laundry or post, packing a suitcase and separating the garbage are regular sorting tasks of domestic life. Many consumer activities also involve the sorting of objects. Selecting an insurance policy requires the differentiation and selection of one of many different financial services offered by various companies. Buying implies the formation of consideration sets, i.e. dividing the available products into those that should be considered for purchase and those that should not. In conclusion, free classification is suitable for the study of consumer categorization behavior where such tasks are both natural and realistic to consumers.

3.3.2 Setting Up a Product Classification Experiment

When designing a product classification task for a consumers study, several issues need to be considered. These issues concern the stimulus material and the sorting task.
Stimulus Material

The relevant aspects with respect to the stimulus material are the number, format and kind of objects represented by the stimuli. The number of stimuli affects the degree of freedom in the sorting task. There is a disproportionately high increase in the number of possible sorts as the number of stimuli increases. Although people may not consciously consider this mathematical fact, they are likely to be sensitive to the size of the stimulus set. A larger stimulus set will lead people to perceive a larger number of ways to sort the stimuli. A second reason why the number of stimuli used in a sorting task matters is that human processing capacities are limited. People have trouble dealing with too many stimuli at the same time (Bettman 1979). For this reason, the stimulus set for a free classification task should be manageably small, avoiding overly complicated sorting tasks. On the other hand, it should be sufficiently large to allow different sorts to occur, in order to avoid spurious correspondence between classifiers.

The presentation format (written description or picture) of the stimuli is another relevant factor, since verbal information processing has been found to differ from visual processing (Paivio 1991). In addition, the degree of realism of the stimuli affects the validity of consumer evaluations particularly when people have little knowledge about the stimuli they are evaluating (Loosschilder 1998). De Bont (1992) examined the effect of stimuli presentation on the reliability and validity of product evaluations measured in conjoint analysis. No differences were found between evaluations based on product descriptions and evaluations based on product pictures. This suggests that descriptions, as well as pictures, could be used in product-sorting tasks. However, a product-evaluation task carried out in conjoint analysis differs considerably from a product-sorting task. Product sorting is primarily based on the matching of perceptual attributes. Product appearance plays a dominant role in this process, much more than the individual quality- or price-related attributes that are important in conjoint analysis. Since the appearance of a product can be closely mirrored by a picture but is difficult to describe, a stimulus set designed for a product-sorting task should contain product pictures rather than product descriptions.

The type of objects that the stimuli represent is relevant with respect to the generalizability of the findings. Can the sorting of artificial stimuli be compared to the sorting of real objects? Is sorting natural objects (e.g. trees) the same as sorting manufactured products (e.g. telephones)?

Sorting Task

With regard to the sorting task, three decisions have to be taken. In the first place, a choice has to be made between a free and a restricted classification task. If the latter option is preferred, the number of categories should be set. Second, a mode of sorting has to be chosen. Are participants to sort the stimuli one at a time or are they presented with the full array of stimuli? The third decision concerns the question of whether participants should receive
a sorting instruction or not, and, if so, what kind of instruction would be most appropriate?

Since this chapter presents an exploratory research into the categorical structure of product information in memory, a true free classification task is most appropriate. Participants should not be forced in any way to sort products into a pre-set number of categories, since such a classification may not reflect their natural and actual between-category structure.

The issue of whether the stimuli should be sorted one at a time or all at once is more difficult to resolve. Regehr and Brooks (1995) have demonstrated that stimuli presented in an array are arranged differently than stimuli presented in pairs. However, Regehr and Brooks used a restricted classification task. Therefore, it is not clear whether the results go for a free classification task as well. The degree of realism of the sorting task does not favor a particular sorting mode either, since in everyday life products are sorted one at a time, as well as simultaneously. In short, it is not clear whether individuals in a free classification task should group the stimuli all at once or one at a time.

Finally, a true free classification task requires participants to be free to decide how they wish to sort the stimuli. After all, any form of instruction is manipulation, which runs contrary to the discovery of people's natural and spontaneous categorical structure.

3.4 Predicting Consumer Product Sorting in a Free Classification Task

On the basis of the insights from both the classification literature (section 3.1) and the basic-level categorization literature discussed in section 3.2, this section presents the main predictions about consumers' sorting behavior in a free classification task.

The literature on basic-level categorization suggests that people will spontaneously sort products into basic-level categories. Basic-level categories are both specific and distinctive. In a world where people are thought to strive for cognitive economy (Rosch 1978), this quality makes basic-level categories the most efficient concepts for dealing with real life instances. Mervis (1980, p. 292) contends that:

A basic level of categorization [exists] in which categories 'make sense'. That is the most general level at which categories are formed according to large, naturally occurring attribute clusters. Categories at this level are more differentiated from each other than are categories at any other level. Thus, basic level categories are the most obvious way of dividing the world.
Additional support for the claim that basic-level sorting is most likely to occur comes from the vast amount of empirical evidence of the basic-level superiority found for the wide range of cognitive tasks (see subsection 3.2.1). Although these cognitive tasks differ from free sorting tasks, the pervasiveness of the basic-level superiority effect makes it plausible that basic-level categories will have a privileged status in free sorting tasks as well.

Hypothesis 1

In a free classification task people will sort products into basic-level categories rather than into superordinate or subordinate categories.

This first hypothesis appears to be in conflict with the findings reported in section 3.1 that people prefer one-dimensional classification rather than family resemblance classification. If people prefer to classify stimuli along a single dimension, as the classification literature suggests, there is no reason to assume that people will classify objects at the basic level, since one-dimensional classification may take place at any level of inclusiveness. Although this argument holds, it does not provide sufficient ground to reject Hypothesis 1. As was argued before, the findings indicating the preference for one-dimensional sorting were far from conclusive and limited to specific types of classification tasks. Furthermore, one-dimensional classification and basic-level classification do not exclude one another, since the dimensions used to classify objects will often coincide with the dimensions that define basic-level categories. This is particularly true for the classification of products, since basic-level product categories are predominantly defined by their primary functionality which is also their most salient dimension and therefore very likely to form the basis of one-dimensional sorting. For example, sorting a set of vehicles on the basis of their primary functionality will yield basic-level categories such as bus, car and bicycle. A final reason why Hypothesis 1 should not be rejected on the basis of the results regarding one-dimensional sorting is that these results were obtained in restricted classification tasks that consisted of assigning a number of stimuli to one of two possible categories (i.e. stimuli had to be divided into two (equal-sized) groups). In order to perform such tasks, people do not need to consider the overall similarity between the stimuli since the identification of a single distinctive property between the stimuli suffices to carry out the task. In contrast, a free classification task requires people to direct attention towards overall similarity between products, because it will be very unlikely that all stimuli can be classified into meaningful categories on the basis of the same single dimension. In conclusion, the observed preference for one-dimensional classification constitutes no convincing empirical evidence against Hypothesis 1. In contrast, one-dimensional classification and basic-level classification can be independent modes of classification that exist next to each other. This possibility is discussed in the final section of this chapter.
Apart from the preference for one-dimensional classification, the classification literature has demonstrated an effect of expertise on consumer classification. High levels of product knowledge or product experience enable consumers to classify at sub-basic levels. Thus, for relatively expert or experienced consumers, Hypothesis 1 may not hold. Nevertheless, it is difficult to predict exactly how expert consumers will classify products. Whilst they are able to make finer distinctions between products than non-experts, this does not automatically mean that experts will actually make them. It is possible that expert consumers prefer to classify products at the basic level when the sorting does not require further differentiation, though they could also create sub-basic-level categories. Since the effect of consumer expertise on the outcome of a free classification task cannot be predicted a priori, possible influences will be examined post hoc.

Mervis' (1980) claim that basic-level categories are the most obvious way of dividing the world, does not only imply that individual people will tend to classify products into basic-level categories rather than into superordinate-level or subordinate-level categories, it also suggests that people sorting the same products will very much create the same basic-level categories.

Hypothesis 2

In a free classification task people will largely create the same (basic-level) categories.

This expectation is based on the idea that:

The structural properties of informativeness and distinctiveness that appear to account for this [basic-level] advantage (...) seem to be relatively stable, invariant aspects of conceptual representations. This stability is most probably due to the fact that basic-level perceptual information is always available in a visual identification or categorization task (Lin et al. 1997, p. 47).

In other words, since the product characteristics that determine the basic level are stable and invariant across products, the basic-level categories for a particular set of products are given. Assuming that people prefer to sort products at the basic level, it logically follows that the resulting (basic-level) categories will be the same for everyone.

3.5 Study 1: Spontaneous Product Classification

The study presented in this section was designed to test both hypotheses. The following subsections explain the stimulus material used and the experimental task conducted. Then the results are presented and discussed in light of the literature about free classification and basic-level superiority.
3.5.1 Method

Participants
Twenty-nine people, 15 men and 14 women, ranging in age from 18 to 65 (M = 43.0), participated in the study. Participants were selected from the household panel of the Product Evaluation Laboratory of the Delft University of Technology. This panel consists of an a-select sample of inhabitants of Delft and the surrounding area (Tan, 1997). Participation was voluntarily, took about 30 minutes, and was rewarded with a small monetary compensation.

Stimulus Material
The stimulus material, shown in Appendix 3.1, consisted of color pictures of electrical equipment (46 pictures) and furniture (52 pictures), collected from brochures and magazines. The stimulus sets were constructed with the requirements mentioned in subsection 3.3.2 in mind. Both sets consisted of a sufficiently large number of items to allow participants ample freedom to sort the stimuli. At the same time, although the relatively large number of stimuli may have complicated the experimental task, pre-testing showed that participants had no trouble sorting the pictures. A further consideration concerned the composition of the stimulus sets. The sets were composed in such a way that they did not appear to render one particular level of inclusiveness (i.e. the basic level) more likely than another. Finally, to avoid participants judging the product pictures rather than the products themselves, the size and the quality of the product images were made uniform.

Procedure
Participants were invited to the lab individually. Fifteen participants viewed the electrical equipment stimuli; fourteen received the furniture stimuli. Men and women were evenly divided over the two groups. On arrival, participants were told that they were going to perform a product-grouping task. They ran through the product pictures to get a first impression of the stimulus set. A brief written instruction then explained the sorting task (Appendix 3.2). This instruction told participants to group products that "fit together" in the same group (literally, the Dutch instruction read: "Wilt u die plaatjes in groepen bij elkaar leggen, waarop dingen staan die u goed bij elkaar vindt passen?"). The number of groups and the number of products within a group were not specified in the instruction. No indication of good or bad groupings was given. On completing the task, participants named each group and noted the numbers of the pictures within each group. This procedure resulted in a record of the original grouping each participant made.

With respect to the design of the experimental task (see subsection 3.2.2), note that the experimental task was a true free classification task. Furthermore, the full array of stimuli was presented. Finally, participants were entirely free to create any classification they wished.
Measures
Prior to the experiment, for both stimulus sets the basic-level categories were defined by applying the four operational definitions described earlier (subsection 3.2.3). This procedure yielded 20 basic-level categories for the electrical equipment stimuli and 5 for the furniture stimulus set. The frames in Appendix 3.1 mark the basic-level categories for both product groups.

3.5.2 Results

Free Classification Task
All participants quickly and easily performed the product-sorting task. The common procedure was to carefully start looking at the array of product pictures on the table. Participants then started to make a first preliminary subdivision, which was refined during the remainder of the task. The final sort was generally reached within 10 minutes (15 minutes was the maximum). Participants were not inclined to alter their final sort, not even when they were offered the opportunity ("Are you really sure that this is the way you want to sort the stimuli?").

These observations support the notion that a free sorting task is a natural task for people to perform. Furthermore, it suggests that the relatively large-sized stimulus sets did not cause problems for participants. After their first acquaintance with the array of product pictures, participants efficiently dealt with them.

Data Analysis
The analysis of data resulting from a free sorting task is complicated by the fact that the data format is different for each individual. The number of groups as well as the number of items in a group differs between individuals. In order to be able to compare the sorting behavior of individual participants, a data structure is required that is equal for all participants. A way to equalize the individual data files is to convert the grouping data of each participant into separate co-occurrence matrices. The rows and columns of such a co-occurrence matrix contain the stimuli. By means of zeros and ones a score is given to each pair of stimuli. A zero indicates that a pair of products did not occur in the same group, whereas a one signifies that two products were grouped together. Figure 3.2 presents an occurrence matrix containing the group structure for seven arbitrary stimuli. The pattern of zeros and ones reveals that the seven stimuli in this matrix were grouped into three groups (A, C and E; B and G; D and F). Since A, C and E are grouped together, a "1" is placed in the AC cell, the AE cell, the CE cell. Since the cells on the diagonal do not represent product pairs, these cells get neither a "0" nor a "1". Furthermore, the matrix is symmetric, since there is no difference between pair AB and pair BA. Note that the exact group structure can be reproduced from the co-occurrence matrix. Analogously to the seven-item matrix from Figure 3.2, fifteen 46 x 46 co-occurrence matrices for the electrical equipment stimuli and fourteen 52 x 52
co-occurrence matrices for the furniture stimuli were created containing the grouping data for the participants in this study.

Figure 3.2
Individual Co-Occurrence Matrix for the Grouping of Seven Stimuli

<table>
<thead>
<tr>
<th>Stimulus</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>D</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>E</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>G</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

The next step to make the grouping data suitable for statistical analysis was to convert the individual co-occurrence matrices into variables. The cells from the upper half of the co-occurrence matrices were put behind each other in the same order (i.e. from top to bottom) for each individual. For the matrix from Figure 3.2 this action would yield the following variable with 21 observations: 010100-00001-0100-0100-00-0. The same procedure was followed for the data of the present study, resulting in two data files, one for participants sorting the electrical equipment stimuli (comprising 15 variables that each contain 1035 observations) and one for participants grouping the furniture stimuli (14 variables; 1326 observations). These data files formed the input for the statistical analyses to be presented next.

Level of Classification: Testing Hypothesis 1
Hypothesis 1 that people tend to sort products into basic-level categories was tested using the following procedure. First of all, comparable to the way that was explained above, in both data files an additional variable was created containing the basic-level co-occurrence matrix, i.e. the co-occurrence matrix that would result if the stimuli were categorized into the predefined basic-level categories indicated by the frames in Appendix 3.1. Second, the binary squared Euclidean distances (BSED, see Norusis 1994) were calculated between the co-occurrence data of each participant and the basic-level co-occurrence data. The BSED represents the degree of correspondence between the groups that participants made and the expected basic-level categories. By dividing the BSED by the total number of observations and subtracting it from 1, the degree to which participants followed the expected basic-level categorization was calculated. Table 3.2 presents the proportions of basic-level correspondence for each participant in both product groups.

Note 1 The calculation of the binary squared Euclidean distance is explained in the SPSS manual (Norusis 1994). Put simply, it compares the columns of zeros and ones and counts the number of times that the values in the columns do not match.
Table 3.2
Correspondence with Basic-Level Categories (Study 1)

<table>
<thead>
<tr>
<th></th>
<th>Electrical equipment</th>
<th></th>
<th>Furniture</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>BSED(^1)</td>
<td>Correspondence with basic level (^2)</td>
<td>n</td>
</tr>
<tr>
<td>1</td>
<td>18</td>
<td>0.96</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>0.98</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>34</td>
<td>0.97</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>35</td>
<td>0.97</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>92</td>
<td>0.91</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>98</td>
<td>0.91</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>100</td>
<td>0.90</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>8</td>
<td>112</td>
<td>0.89</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>9</td>
<td>141</td>
<td>0.86</td>
<td></td>
<td>9</td>
</tr>
<tr>
<td>10</td>
<td>156</td>
<td>0.85</td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>11</td>
<td>178</td>
<td>0.83</td>
<td></td>
<td>11</td>
</tr>
<tr>
<td>12</td>
<td>213</td>
<td>0.79</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>13</td>
<td>213</td>
<td>0.79</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>14</td>
<td>331</td>
<td>0.68</td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>15</td>
<td>357</td>
<td>0.66</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(n = 15\) \hspace{1em} M = 140 \hspace{1em} M = 0.87 \hspace{1em} \hspace{1em} n = 14 \hspace{1em} M = 198 \hspace{1em} M = 0.85

\(SD = 105\) \hspace{1em} SD = 0.10 \hspace{1em} \hspace{1em} SD = 101 \hspace{1em} SD = 0.08

1 The BSED represents the number of mismatches between a respondent’s classification and the expected basic-level classification.

2 Correspondence = 1 - (BSED / 1035)

3 Correspondence = 1 - (BSED / 1326)

Table 3.2 shows that the correspondence between the categories that participants created and the expected basic-level categories is 0.87 for the electrical equipment stimuli and 0.85 for the furniture stimuli. To test whether these proportions differed significantly from chance (\(p = .5\)), binomial tests were carried out using the following equation (Siegel and Castellan 1988, p. 43):

\[
z = \frac{(Y - 0.5) - Np}{\sqrt{Npq}}
\]

where \(Y\) is the number of fits, \(N\) is the total number of observations, \(p\) is the probability of a match, and \(q\) is the probability of a mismatch. Both \(p\) and \(q\) are 0.5 in this case since binary variables are used. Applying the equation yields a \(z\)-value for electrical equipment (\(N = 1035\), \(Y = 895\)) of 23.4, and a \(z\)-value of 25.5 for the furniture stimuli (\(N = 1326\), \(Y = 1128\)). Both values are highly significant (\(p < .001\)). This means that the proportions of matches that were observed for both stimulus sets did not result from chance.
To test whether the difference between the mean proportion of basic-level correspondence for the electrical equipment stimuli ($M = 0.87$) and the furniture stimuli ($M = 0.85$) was significant, a $t$-test was performed. The difference was not significant ($t_{27} = -0.414$, $p = .682$), meaning that the correspondence with the basic-level categories was equally high for the electrical equipment sorts and the furniture sorts.

What can be said about the degree of correspondence between the categories that participants created and the expected basic-level categories? Is Hypothesis 1 confirmed given the mean basic-level correspondence of about 0.85? Considering the large number of possible product pairs and the relatively small number of participants, a mean correspondence of 0.85 appears to be extremely high. Nevertheless, the correspondence is not perfect. Apparently, some deviations from the expected basic-level categories occurred.

**Visual Inspection of the Sorting Data**

In order to determine how participants deviated from the basic-level categories, the co-occurrence matrices were examined visually. Since interest was in the overall category structure of the experimental stimuli, the individual co-occurrence matrices per superordinate category were added. The resulting group co-occurrence matrices indicate the number of times that each pair of pictures occurred. Appendices 3.3 and 3.4 show the group co-occurrence matrices for the electrical equipment stimuli and the furniture stimuli respectively. The diagonals show the total number of participants (15 and 14 respectively). The group co-occurrence matrices contain information about which products were grouped together by how many participants. This makes it possible to distinguish clusters of products that were put together by most of the participants. In addition, product pairs that were created by few participants can also be located.

Two manipulations were carried out on the group co-occurrence matrices in order to make them more suitable for visual inspection, i.e. to make any potential pattern in the matrices clearly visible (see Adams 1991). In the first place, the rows and columns were sorted according to class membership. For example, the upper nine rows and the first nine columns of the matrix in Appendix 3.3 contain products belonging to the superordinate category kitchen appliances, subdivided into the basic-level categories blenders, mixers, toasters and coffee makers. Second, only those product pairs (i.e. cells in the matrix) were printed that were observed for half of the participants or more. Product pairs observed for less than half of the participants were not shown since interest was in the correspondence rather than in the difference between participants. After these manipulations, a visual pattern of differently sized squares emerged along the diagonal in both matrices. Each square represents a set of product pictures that were grouped together by more than half of the participants.
What do the group co-occurrence matrices disclose about participants' product sorts? Most importantly, they show that the relatively high degree of basic-level correspondence (0.85) reported earlier needs to be interpreted with care. Clearly, products belonging to the same basic-level category were put together by most of the participants. However, rather than forming separate basic-level categories, participants tended to merge basic-level categories into superordinate categories in the case of the electrical equipment stimuli. Evidently, the differences between the basic-level categories within the same superordinate were not large enough to treat them as separate categories. In contrast, the furniture stimuli were divided into subordinate categories instead of basic-level categories. Whereas the distinction within superordinate-level categories seemed to be too small to elicit further subdivision in case of the electrical equipment group, the furniture stimulus set appears to be distinctive to such a degree that it "calls for" subordinate-level classification.

A second observation is that with regard to the furniture group co-occurrence matrix the data pattern is not very coherent. In all expected basic-level categories, many product pairs were observed for less than half of the participants (the empty cells within the shaded squares). Moreover, the frequencies in the matrix are relatively low. As a whole, the group co-occurrence matrix in Appendix 3.4 looks somewhat arbitrary and disorderly, pointing out that participants did not perceive a clear category structure within the furniture stimuli. This is in contradiction with the finding that the mean proportion of correspondence for the furniture stimuli was equal to the mean proportion of matching pairs observed for the electrical equipment stimuli.

Third, in both group co-occurrence matrices several stimuli stand out. To start with the electrical equipment, the pair of kitchen scales (#31) was included in the superordinate category small kitchen equipment rather than forming a basic-level category of scales together with the pair of bathroom scales. The pair of bathroom scales (#30) was given its own category, although they were also categorized as equipment for personal care by nearly half of the participants (see the italics in row/column 30). The video Walkman (#44) fell out of its basic-level category. It was placed in a group together with the television, wide-screen television and television-video recorder combination. Apparently, the correspondence with the television category was the most obvious for participants. Finally, the video recorder (#35) was categorized in two groups, namely video equipment and audio equipment.

With regard to the furniture, some stimuli were not included in any group at all. One of the occasional tables (#1), the sofa bed (#20), and the barstool (#39) were put in a category of their own. Apparently, these objects were considered to differ too much from the other stimuli in the set to be grouped with other objects. Several other objects fell outside the expected groups as well, but did not form a category by themselves. The occasional table with
wheels (#2) was grouped together with some of the chairs, as was the footstool (#38). The rattan bench (#27) and rattan chair (#28) were grouped together in a superordinate-level category that could be labeled "rattan furniture". Eight participants put the blue couch (#21) in the same group as the blue armchair (#35). Although these objects belong to different basic-level categories, they were probably put together based on their color and style, since the armchair and couch were part of the same sitting unit.

A final observation is that participants sometimes classified products differently than expected. In case of the electrical equipment for example, 17 participants categorized one of the freezers (#14) as a washing machine. Another example is the video recorder, which was grouped together with one of the CD-players 12 times and with the CD-i-player 10 times. The explanation for these "errors" seems to be that the freezer is so visually similar to the washing machines, and the video recorder is so visually similar to the CD(i)-player that, based on the product pictures only, participants' classifications were erroneous. Something similar can be seen in the case of the furniture stimuli, where many participants thought that the occasional tables (#1 and #2) were stools or chairs. Comparably, a number of participants had trouble with identifying the bar stool and, as a result, set the bar stool apart as something unknown.

Conclusion

The analyses of the co-occurrence matrices show that, while the mean proportion of matching product pairs suggests a high degree of basic-level correspondence, participants presented with the electrical equipment stimuli tended to sort at the superordinate level, whereas participants presented with the furniture stimuli showed a preference for subordinate categorization.

Two post-hoc analyses were carried out to check the validity of the observations from the co-occurrence matrices. First, since participants in the electrical equipment group showed a preference for superordinate-level categorization, participants' sorts should show a higher degree of correspondence with the superordinate categories that can be distinguished within the stimulus set. To check this assumption, BSEDs were calculated between the observed sorts and a particular superordinate sort (the superordinate categories are listed in Appendix 3.5). The mean superordinate-level correspondence was 0.88 (SD = 0.05), compared to the mean basic-level correspondence of 0.87 (SD = 0.10, see Table 3.2). The difference is only small, but it indicates that participants' tendency to sort the electrical equipment stimuli into superordinate-level categories was at least as strong as their tendency to produce basic-level categories.

Exactly the same procedure was followed for the participants in the furniture group, except that in this case, the subordinate-level correspondence was calculated (for the subordinate categories see Appendix 3.5). A preference
for subordinate-level sorting was observed in case of the furniture stimuli after all. The mean subordinate-level correspondence was higher than the mean basic-level correspondence (0.88; SD = 0.05 versus 0.85; SD = 0.08), supporting the observed preference for subordinate-level sorting. So, based on the post-hoc analyses Hypothesis 1 should be rejected. Rather than sorting products into basic-level categories, people prefer subordinate-level or superordinate-level classifications, depending on the product set they sort.

Given this conclusion, how is it possible that the level of basic-level correspondence is as high as it is? A correspondence of 0.85 seems to suggest that a significant amount of basic-level sorting took place. The paradoxically high degree of correspondence has two main causes. In the first place, the correspondence measure is based on binary squared Euclidean distances. This means that a completely random sort will show a basic-level correspondence of 0.50 since, based on chance, half of the product pairs will match. For the electrical equipment stimuli a correspondence of 0.50 would mean that half of the total number of product pairs (1035/2 = 517) match. In comparison, a correspondence of 0.85 indicates a match of 880 pairs, which appears to be high. However, one should realize that of these 880 matching pairs 517 would have occurred whatever sort participants would have made. A more realistic estimate of the degree of basic-level correspondence can be achieved by relating the number of non-coincidental matching pairs to the total number of non-coincidental pairs. For the furniture stimuli this calculation would lead to a basic-level correspondence of 363 / 517 = 0.70.

The second reason for the relatively high level of correspondence is that basic-level categories are hierarchically linked to both superordinate and subordinate categories. If people create superordinate categories, basic-level correspondence will necessarily be high as well since these superordinate categories comprise the same basic-level categories. To illustrate this point, the correspondence between the superordinate-level classification from Appendix 3.5 and the basic-level classification was calculated for the electrical equipment stimuli. This correspondence is 0.88, which equals a number of 910 matching pairs. The same story holds for the correspondence between subordinate-level and basic-level classifications for the furniture stimuli (correspondence = 0.90, number of matching pairs = 1193). These figures make clear that even when people create exact superordinate or subordinate categories, basis-level correspondence would automatically reach about 90 percent. In short, in order to get a realistic impression of the practical significance of the different correspondence scores, the biases that were described above (i.e. half of the pairs match due to chance and basic-level categories are logically related to superordinate and subordinate categories) should be taken into consideration. For this reason, when practically feasible, visual inspection of the group co-occurrence matrices should take place in combination with correspondence calculations.
Correspondence between Participants: Testing Hypothesis 2

To check to what degree participants created the same (basic-level) categories (Hypothesis 2) squared binary Euclidean distances between the sort of each participant and those of all other participants were calculated, averaged per individual, and divided by the total number of observations to get the mean proportion of correspondence between the sort of each participant and the sorts of all other participants (see Table 3.3).

Table 3.3
Mean Correspondence between Participants (Study 1)

<table>
<thead>
<tr>
<th></th>
<th>Electrical equipment</th>
<th></th>
<th>Furniture</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean correspondence with other participants</td>
<td></td>
<td>Mean correspondence with other participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>BSED $^1$</td>
<td>n</td>
<td>BSED $^1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>129</td>
<td>0.88</td>
<td>1</td>
<td>167</td>
<td>0.87</td>
</tr>
<tr>
<td>2</td>
<td>136</td>
<td>0.87</td>
<td>2</td>
<td>173</td>
<td>0.87</td>
</tr>
<tr>
<td>3</td>
<td>138</td>
<td>0.87</td>
<td>3</td>
<td>176</td>
<td>0.87</td>
</tr>
<tr>
<td>4</td>
<td>139</td>
<td>0.87</td>
<td>4</td>
<td>177</td>
<td>0.87</td>
</tr>
<tr>
<td>5</td>
<td>140</td>
<td>0.87</td>
<td>5</td>
<td>178</td>
<td>0.87</td>
</tr>
<tr>
<td>6</td>
<td>142</td>
<td>0.86</td>
<td>6</td>
<td>180</td>
<td>0.87</td>
</tr>
<tr>
<td>7</td>
<td>142</td>
<td>0.86</td>
<td>7</td>
<td>186</td>
<td>0.86</td>
</tr>
<tr>
<td>8</td>
<td>142</td>
<td>0.86</td>
<td>8</td>
<td>213</td>
<td>0.84</td>
</tr>
<tr>
<td>9</td>
<td>145</td>
<td>0.86</td>
<td>9</td>
<td>246</td>
<td>0.82</td>
</tr>
<tr>
<td>10</td>
<td>147</td>
<td>0.86</td>
<td>10</td>
<td>254</td>
<td>0.81</td>
</tr>
<tr>
<td>11</td>
<td>149</td>
<td>0.86</td>
<td>11</td>
<td>257</td>
<td>0.81</td>
</tr>
<tr>
<td>12</td>
<td>161</td>
<td>0.84</td>
<td>12</td>
<td>259</td>
<td>0.81</td>
</tr>
<tr>
<td>13</td>
<td>178</td>
<td>0.83</td>
<td>13</td>
<td>293</td>
<td>0.78</td>
</tr>
<tr>
<td>14</td>
<td>237</td>
<td>0.77</td>
<td>14</td>
<td>323</td>
<td>0.76</td>
</tr>
<tr>
<td>15</td>
<td>266</td>
<td>0.74</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$n = 15$ $M = 159$ $M = 0.85$ $n = 14$ $M = 220$ $M = 0.83$

$SD = 40$ $SD = 0.04$ $SD = 51$ $SD = 0.04$

1. The BSED represents the average number of mismatches between a respondent’s classification and the classifications of all of the other participants.
2. Correspondence = 1 - (BSED / 1035)
3. Correspondence = 1 - (BSED / 1326)

The Siegel and Castellan equation (1988) was used again to test whether the mean proportions per product group ($M = 0.85$ versus $M = 0.83$) differed significantly from chance ($p = .5$). Both proportions were significantly different (electrical equipment: $z = 22.3$, $p < .001$, $N = 1035$, $Y = 876$; furniture: $z = 24.3$, $p < .001$, $N = 1326$, $Y = 1106$).
A T-test tested the difference between the mean proportion of between-participants correspondence for electrical equipment (\(M = 0.85\)) and furniture (\(M = 0.83\)). The difference was not significant (\(t_{27} = -0.836, p = .411\)), meaning that the correspondence between participants was equal irrespective of whether they received the electrical equipment stimulus set or the furniture stimulus set.

On the basis of these analyses it seems fair to conclude that Hypothesis 2 is confirmed, particularly when one takes into account the ratio between the number of product pairs and the number of participants. Thus, for both product groups participants agreed to a large extent about the way to categorize the product pictures.

3.5.3 Discussion

Two questions formed the starting point of this first study. First, do consumers spontaneously use basic-level categories when they categorize products, and second, do consumers correspond in the way they categorize products? Based on the results of Study 1, the answer to the first question is negative and the answer to the second question positive. This result is problematic, since the assumption that consumers' classifications concur, is based on the notion that there is a universal most obvious way to categorize, namely basic-level categorization. Having found that the idea that basic-level categories are the most natural categories was not confirmed, the theoretical basis for Hypothesis 2 loses much of its strength. Nevertheless, participants show a high degree of correspondence in their classification behavior.

In order to find an explanation for these paradoxical findings, it is necessary to understand why participants in Study 1 deviated from the ostensibly obvious basic-level sorts. Several explanations are suggested here. The first two explanations relate to the composition of the particular stimulus sets that were used in this study. First of all, the a priori defined basic-level categories may not have been "true" basic-level categories. In essence, this implies that the criteria used to define the basic-level categories were not optimal. Given the vast empirical research on the qualities of basic-level categories, there does not seem to be much reason to doubt the validity of the criteria. Furthermore, it seems to be difficult to come up with an alternative basic-level category structure that would be more valid. In order to validate the predefined basic-level categories, an expert in the categorization literature defined the basic-level categories for both stimulus sets. This expert came up with exactly the same basic-level category structure, although some individual stimuli were put in different categories. Based on these arguments, the explanation that the pre-defined basic-level categories were false is rejected.

A related possibility is that the stimulus sets contained too many atypical exemplars of the basic-level categories incorporated in the stimulus material. The presence of these atypical stimuli may have blurred (basic-
level) categorization since category membership of atypical stimuli is relatively ambiguous and may evoke uncertainty, causing people to make classifications that would not have been considered in the absence of the atypical stimuli. For example, the presence of the atypical bar stool within the category chairs, is likely to have led participants to consider the creation of a subcategory stools within the basic-level category chairs. If the bar stool had not been included in the stimulus set, no such consideration would probably have come to participants' minds. In this respect, atypical exemplars may have caused participants' sorts to deviate from strict basic-level sorts. Indeed, some of the stimuli did not seem to fit in well with the others, but the number of atypical stimuli in both stimulus sets was too limited (i.e. video-Walkman, digital video, bar stool, occasional tables) to account for the clear preference for either superordinate or subordinate classification.

The previous explanations concerned the construction of the stimulus sets. The remaining explanations have to do with the categorization process itself. A first possibility is that participants' sorts were influenced by their expertise. In subsection 3.2.2 evidence was presented that for expert consumers subordinate levels may function as basic. In order to control for possible effects of expertise, participants' perceived level of expertise was measured using the 2-item product knowledge scale (i.e. relative to other people and relative to most of their friends) proposed by Bloch, Ridgway and Sherrel (1989). This scale was translated into Dutch and, to keep in line with the other scales used in the study, the original 5-point scale was converted into a 7-point scale (1 = a great deal of knowledge ("erg veel kennis"); 7 = little or no knowledge ("erg weinig kennis"). The Dutch questions read: (1) "Vindt u dat u in vergelijking met anderen veel kennis heeft over electrische apparaten (meubilair)?"; (2) "Vindt u dat u in vergelijking met uw vrienden veel kennis heeft over electrische apparaten (meubilair)?". Inter-item correlations were 0.74 for electrical equipment and 0.82 for furniture. An examination of the correlations between the expertise scale and the number of groups and the group size did not yield significant correlations. The level of expertise did not influence the categories that participants made. Still, in spite of the fact that no general effects of expertise were found, it is possible that, in the case of the furniture stimuli, the formation of subordinate categories is accounted for by the fact that for this particular product group the subordinate level functioned as basic level². The data do not support this explanation. The mean perceived level of expertise was 4.11 (SD = 0.98) on a 7-point scale, indicating that participants did not rate themselves as experts at all.

A further explanation for the deviation from basic-level sorting is that it may have been dominated by the presence of salient alternative sorting cues. For the furniture stimuli the high number of participants that grouped the blue couch and blue armchair together and the rattan chair and rattan bench illustrated this. In the case of the electrical equipment stimuli, color seems to

Note 2 This explanation does not hold of the electrical equipment group where superordinate rather than subordinate classification prevailed.
have been the decisive cue for creating the groups kitchen appliances and audio equipment. This explanation is in line with studies that found that sorting often takes place on the basis of one or a few salient stimulus characteristics (Medin, Wattenmaker and Hampson 1987; Regehr and Brooks 1995).

Alternatively, participants' product sorting may have been guided by the size of and variation in the stimulus set rather than by basic-level superiority. Rosch's (1978) principle of cognitive economy posits that people use categories to gain as much information about the environment as possible while preserving finite resources as much as possible. Concretely, this principle would imply that people performing a sorting task strive for a classification that requires a limited amount of cognitive effort while containing sufficient groups to capture the variation in the stimulus set. Only when basic-level classification is the most cognitive economic solution, will people sort products into basic-level categories. The findings from Study 1 support the idea that basic-level classification may be overruled by more cognitively thrifty classifications. The number of electrical equipment basic-level categories is relatively large and requires participants to take comparatively much cognitive effort to distinguish between fairly similar products (e.g. the audio equipment). On the other hand, the few relatively large furniture basic-level categories require little cognitive effort, but within-category variation is large, requiring participants to differentiate further between category members to increase the informational value of the categories.

The final two explanations could point out that the basic level does not play a role in product classification. People may rather choose to classify objects at superordinate or subordinate levels or across basic-level categories, depending on whichever sorting cue is salient (e.g. color, category size). Which cue is salient depends on the stimuli that are sorted as well as on the people doing the sorting. For example, for functional products, like electrical equipment, the most salient dimension is the functionality of the product. In contrast, more fashionable products like furniture have, apart from functionality, several other salient dimensions like place of usage, design (style) and material.

Considering all explanations, the following conclusion is drawn. The suggestion that basic-level categories do not play a role in product categorization is rejected in the sense that they are believed to really be conceptually basic, like categorization theory postulates. Basic-level categories reflect the way that people think about categories and they constitute the basis from which practical classification takes place. This conclusion is supported by the substantial correspondence between the observed groups and the basic-level categories. At the same time, the group co-occurrence matrices showed that participants deviated considerably from the expected basic-level categorization. Basic-level sorting appears to have been "overruled" by sorting cues that were highly salient within the
particular categorization context, such as personal experiences (e.g., "This is how the objects are placed in my house"), color (e.g. blue couch and chair, white goods versus brown goods), usage/purpose (e.g. appliances for personal care, appliances for food preparation), the presence of atypical, fuzzy, or unique exemplars (bar stool, video-Walkman, television-video recorder, sofa-bed, kitchen scales, CD-i player), and the degree of distinction within the stimulus set (e.g. bunk-beds, single beds and double beds within the basic-level category beds). To the extent that these cues are salient and sensible, like place of usage (e.g. kitchen versus bedroom), material (e.g. wood versus metal), or sense modality (e.g. visual versus auditory) people’s classifications may agree more or less with each other.

In short, the results of Study 1 do not make clear whether people categorize products into basic-level categories like the basic-level superiority hypothesis predicts. Thus, it is still not clear whether this hypothesis is valid in the case of product categorization. The second and following study was designed to solve this issue.

3.6 Study 2: Basic-Level Product Classification

Based on the outcomes of the first study, Study 2 builds on the following working hypothesis about the role of the basic level within product classification: people recognize basic-level categories, but they tend to dissent from these categories whenever the conditions under which the classification takes place are such that an alternative way of sorting is more efficient. It is assumed that basic-level categories truly are the most natural way to organize concepts in memory and that people use basic-level categories to mentally process product information. However, when actual behavior needs to be displayed, the level of categorization is determined by the specific behavioral conditions. Categorization may be influenced by the specific classification task, the stimulus set that needs to be classified, or by ad hoc goals or idiosyncratic thoughts or preferences. For example, people may classify furniture according to how they have furnished their homes or according to a personal style or preference. Such ad hoc influences may overrule basic-level categorization which represents a logical way to sort the furniture, but which does not serve the specific goals or preferences of the individual at that moment in time.

To investigate how basic the basic-level is, a second study was carried out that was identical to the first except for the instruction that participants received, namely to create those categories that were most natural (obvious) to them. The purpose of this instruction was to eliminate any factor that could lead people to depart from basic-level categorization. If product information in memory is organized naturally around basic-level categories, urging people to create the most obvious categories should result in basic-level
classification. In comparison with Study 1, participants were expected to create more basic-level categories and to show a higher degree of correspondence in their basic-level sorts:

Hypothesis 3
People will create more basic-level categories when they are instructed to create the most obvious categories than when no such instruction is given.

Hypothesis 4
People will show a higher degree of correspondence in their tendency to create basic-level categories when they are instructed to create the most obvious categories than when no such instruction is given.

3.6.1 Method

Respondents
New participants were recruited from the household panel of the Product Evaluation Laboratory of the Delft University of Technology. This time, 89 people, 47 men and 42 women, with an average age of 40.8 cooperated. As in Study 1, participation took about 30 minutes and was rewarded with a small monetary compensation.

Stimulus Material
The stimulus material was identical to the material used in Study 1 (Appendix 3.1).

Procedure
The procedure was identical to that of Study 1, except for the written instruction outlining the sorting task. In contrast to the instruction presented in Study 1, participants were specifically requested to sort the stimuli into the most obvious groups (in Dutch: "Het is de bedoeling dat u de indeling maakt, die voor u het meest voor de hand ligt, die het meest vanzelfsprekend is"). The complete instruction can be found in Appendix 3.6. Apart from this particular request, as in Study 1, participants were completely free to create any number of categories with any number of items.

Measures
The preset basic-level categories are the same as in the first study (Appendix 3.1).
3.6.2 Results

Free Classification Task
Again participants had little trouble performing the free sorting task. In spite of the fact that the instruction may have lead participants to take time to consider the most obvious sort, participants just as quickly and easily performed the product-sorting task as they did in Study 1.

Data Analysis
The data analysis followed the same procedure as in the first study (described in paragraph 3.5.2). This resulted in an electrical equipment data file (46 variables; 1035 observations) and a furniture data file (52 variables; 1326 observations).

Basic-Level Correspondence: Testing Hypothesis 3
The binary squared Euclidean distance was calculated between the sort of each participant and the basic-level sort and averaged across participants. The mean basic-level correspondence for the people presented with the electrical equipment stimuli was 0.92 and the percentage of the furniture group was 0.88. Both proportions did not result from chance (electrical equipment: $z = 26.9, p < .001, N = 1035, Y = 950$; furniture: $z = 27.5, p < .001 N = 1326, Y = 1165$).

The difference between the mean proportion of basic-level correspondence for the electrical equipment stimuli and the furniture stimuli was significant ($t_{87} = 2.41, p < .05$), meaning that the correspondence with the basic-level categories was higher for the electrical equipment sorts than for the furniture sorts.

Two additional T-tests were performed to test the assumption that people would create more basic-level categories when they received the basic-level sorting instruction that they were given in Study 2. The mean basic-level correspondence for the electrical equipment group was higher in Study 2 than in Study 1 ($M_{Study2} = 0.92, M_{Study1} = 0.87, t_{87} = 2.12, p < .05$). The outcome in the furniture group was similar, but in this case the difference was not significant ($M_{Study2} = 0.88, M_{Study1} = 0.85, t_{87} = 1.11, p = .27$). Thus, Hypothesis 3 was supported for the electrical equipment group only. Nevertheless, these findings point out that, when participants were instructed to sort the product stimuli into the most obvious or most natural groups, more basic-level categories resulted than when they were not instructed to do so.

In order to get an impression of the practical significance of these findings, the group co-occurrence matrices again serve as a useful tool. Compare Appendix 3.3 with Appendix 3.7, and Appendix 3.4 with Appendix 3.8 and notice the clear "improvement" in basic-level correspondence for both product groups. The group co-occurrence matrices of Study 2 are much
more coherent and unequivocal than those of Study 1. The apparently small increase in the average basic-level correspondence reflects a real and substantial improvement in the fit between the sorts that participants created and the pre-defined basic-level sort. Even in the case of the furniture stimuli, for which no significant difference was found between the two studies, the co-occurrence matrices clearly show that the preference for basic-level categorization was higher in Study 2 than in Study 1.

Correspondence between Participants: Testing Hypothesis 4

The support found for Hypothesis 3 suggests that Hypothesis 4 will also be confirmed; people creating the (most obvious) basic-level categories are also likely to agree more with one another, since the basic-level categories are given and are, consequently, the same for everyone. Indeed, the analyses presented below demonstrate that participants in the second study agree more with one another than participants in the first study with regard to the groups they formed.

In this case, the binary squared Euclidean distance was calculated between the sort of each participant with all other participants. Inter-participant correspondence was 0.89 ($SD = 0.05$) for the electrical equipment stimuli and 0.85 ($SD = 0.06$) for the furniture stimuli and did not result from chance (electrical equipment: $z = 25.1, p < .001, N = 1035; Y = 922$, furniture: $z = 25.6, p < .001 N = 1326; Y = 1130$). The difference in inter-participant agreement was significant ($t_{67} = -3.50, p < .001$).

A difference was also found between the participants in the first and second study. In accordance with Hypothesis 4, correspondence between participants was significantly higher in the second than in the first study for the electrical equipment group ($M_{\text{Study 2}} = 0.89, M_{\text{Study 1}} = 0.85, t_{66} = 3.23, p < .01$). For the furniture stimuli the difference was not significant ($M_{\text{Study 2}} = 0.85, M_{\text{Study 1}} = 0.83, t_{88} = 1.12, p = .27$).

3.6.3 Discussion

The purpose of Study 2 was to find out how basic the basic-level really is. The working hypothesis that emerged from Study 1 was that that people use basic-level categories to organize product information in memory, but that in actual classification tasks person-, stimulus- and task-related factors may cause people to dissent from basic-level classification. The instruction presented to participants in Study 2 intended to rule out such “disturbing” factors in order to create a classification task in which the most natural classification strategy would emerge.

Study 2 provided strong support for the working hypothesis sketched above. Both hypotheses 3 and 4 were confirmed. After having received the sorting instruction, participants clearly sorted the product pictures into basic-level
categories, although some non-basic-level sorting did still occur. Moreover, agreement between participants was significantly higher in comparison with the agreement found in Study 1. Together, the findings of Study 2 suggest that basic-level categories are truly conceptually basic and represent the most natural way of dividing products into categories although people will often deviate from basic-level categorization in actual classification tasks. Thus, basic-level superiority also seems to apply to the categorization of products.

3.7 General Discussion of Consumer Product Classification

How do consumers categorize? Which product categories do they form? General consensus among categorization researchers is that people put those objects together in a category that bear some resemblance to one another. According to this family resemblance view, category membership is based on the overall similarity between an object and the members of a particular category. The classification literature presented in section 3.1 demonstrated that, contrary to expectation, people generally prefer to construct categories on the basis of a single dimension (e.g. blue versus red objects). Only under specific circumstances will family resemblance sorting occur: (1) when people are engaged in a perceptual sorting task; (2) when inter-attribute relationships are salient; and (3) when objects are sorted in pairs instead of in an array. In spite of the fact that the preference for one-dimensional sorting has frequently been replicated, for reasons that were described in subsection 3.1.2, the empirical evidence does not provide compelling arguments to dismiss the idea that categories are created on the basis of family resemblance. Another reason why the family resemblance view should not be dismissed on the basis of the evidence from the reviewed classification studies is that these classification studies have exclusively focused on the within-category structure, ignoring the between-category structure.

The between-category structure was covered in section 3.2, which reviewed the literature about basic-level superiority. The notion of basic-level superiority presupposes that when people categorize objects, they will do so at the basic-level of inclusiveness. The reason for this basic-level preference is that categories at the basic level are both specific and distinctive, making them the most efficient for classification. On the basis of the two streams of literature hypotheses were formulated and empirically tested. In subsection 3.7.1 the resulting view of consumer product categorization is recapitulated and related to existing categorization literature. Finally, in subsection 3.7.2 some research limitations follow.
3.7.1 Consumer Product Classification: Integrating Theory and Empirical Findings

On the basis of the combined findings of Study 1 and Study 2, the following conclusion is drawn about the way that consumers categorize products. Consumers do tend to classify products into basic-level categories since this is the most cognitive economic way to cope with them. Confronted with a product, they first try to assess to which basic-level category this product belongs. In this way, each product is awarded a place within the mental product hierarchy that relates the product to all other products known to the consumer. After basic-level category membership has been established, alternative classification processes may take place, depending on personal motives, abilities, and ad hoc preferences or thoughts. Claeys (1993, p. 117) comes to a similar conclusion in her discussion of the taxonomic categorization paradigm:

The latter implies that taxonomic categories constitute the basic knowledge structures that are permanently available in memory to serve classification and description of their members and from which goal-oriented subsets can be derived. In terms of cognitive economy it may prove beneficial to the consumer to construct and store taxonomic structures and to use goal-derived categories in specific setting only, when the goal or usage context is primed.

In reality, this means that basic-level classification will only then occur, when conditions that render other modes of classification more efficient are absent. Study 2 indeed showed that when participants were encouraged to ignore alternative sorting cues by stimulating them to create the most obvious categories, basic-level classification occurred. Evidently, basic-level categories were the most obvious categories, corroborating the conception that basic-level classification is fundamental. However, without specific instructions (Study 1) other modes of classification are likely to occur, primed by cues that are more salient than the taxonomic (basic-level) category structure present in the products.

Note that this account of product categorization also explains the finding that people prefer to sort products on the basis of a single dimension (see section 3.1). In Study 1 this is exactly what happened. When sufficiently salient, single dimensions dominated the basic-level category structure underlying the stimulus sets. When people were lead to disregard these “arbitrary” dimensions, the basic-level category structure emerged. Ergo, the preference for one-dimensional sorting is not incompatible with the preference for basic-level sorting, as the initial idea may have been (see section 3.4).

The conception that basic-level classification is fundamental is in line with the opinion of both Rosch and Barsalou. Rosch (1978) writes that:

In fact, objects may be first seen or recognized as members of their basic category, and that only with the aid of additional processing can they be identified as members of their superordinate or subordinate category (p. 34 - 35).
Similarly, Barsalou (1991) states that taxonomic (basic-level and subordinate-level) categorization is primary, whereas superordinate or ad-hoc categorization is secondary. Primary categorization is defined as a person's initial categorization of an entity, and secondary categorization as any subsequent categorization. This means that a product first has to be taxonomically classified or identified before any goal-related categorization can take place. As Barsalou (1991) puts it: "It is unlikely that people use goal-derived categories or superordinates without having made a basic or subordinate level categorization first" (p. 48). In short, Barsalou acknowledges that people may not sort objects into basic-level categories at the end, but in order to arrive at such classifications some amount of basic-level categorization has had to have taken place.

In an earlier paper, Barsalou (1985) explained the difference between (primary) taxonomic and (secondary) ad-hoc categorization in terms of their use. Taxonomic categories are generally used for classification, whereas ad hoc categories are more often used for instantiation. Thus, when consumers need to identify products, taxonomic categories are used. In contrast, when consumers need to come up with specific examples that apply to a specific situation (e.g. buying a present for a friend), they use ad hoc categories to generate examples. From this point of view, it becomes understandable why taxonomic (basic-level) classification will not occur frequently in daily life.

Mere product identification, i.e. taxonomic classification, is hardly ever the final purpose of consumer categorization. This could raise the suggestion that taxonomic classification is relatively unimportant. This is certainly not the case. On the contrary, identification is critically important. Product identification serves as a necessary input for subsequent classifications which are related to specific consumer actions or purposes. For example, in order to recognize the danger and jump aside, a pedestrian crossing the street has to identify the approaching object as a car first. In exactly the same way, in order to make sense of hybrid products, consumers first need to know what the hybrid product is. Before they know how to use and appreciate hybrid products, consumers need to determine to which basic-level category it belongs.

3.7.2 Research Limitations

The experimental stimuli were product pictures and not product descriptions. Several conceptual differences between pictorial and verbal representations exist. Vriens, Loosschilder, Roosbergen and Wittink (1998) mention three such differences. Pictorial representations offer the opportunity to include design aspects in the stimuli, they provide a closer resemblance to actual products. Moreover, they are processed differently than verbal representations and Vriens et al. (1998) refer to a variety of research on this. One of the differences they point out is that verbal descriptions may generate different connotations than the corresponding pictorial representation of the same product. More generally stated, the issue is that it is unknown exactly what information people abstract from
pictorial representations. To which aspects of the picture do they pay attention? Which information from the picture do people process? In other words, it is impossible to determine precisely which information will be communicated to participants. Verbal representations do not have this drawback, or at least to a much lesser degree. When participants read the same product description, the information conveyed will be much more unequivocal than when participants receive a picture of that product.

Except for the above-mentioned conceptual differences between pictorial and verbal product representations, also the type of classification will differ between representation modes. Product pictures may be classified both perceptually and conceptually, whereas product descriptions, per definition (product descriptions do not include perceptual information), can only be classified conceptually (cf. Cherian and Jones 1991). In the case of product pictures, the favored mode of classification will be perceptual since perceptual information is much more salient than conceptual information. For this reason, the probability that a video recorder is grouped together with a CD player (something which several participants did) will be much greater when these products are presented as pictures than as descriptions. After all, perceptually the video recorder and CD player are hardly distinguishable, whereas conceptually they are completely different products. It is very unlikely that participants would have classified these products together, if they had received descriptions instead of pictures.

In an attempt to connect the mode of representation (verbal vs. visual) to the nature of categories, Feldman (1988) developed a classification system for category representation (Table 3.4).

<table>
<thead>
<tr>
<th>Visual representation</th>
<th>Easy</th>
<th>Difficult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal representation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Easy</td>
<td>Taxonomic categories</td>
<td>Ad hoc/goal relevant categories</td>
</tr>
<tr>
<td>Difficult</td>
<td>Pictoliteral categories</td>
<td>Domain-specific ignorance</td>
</tr>
</tbody>
</table>

1 Taken from Feldman (1988)

Ease of visual representation and ease of verbal representation denote the ability of the person engaged in classification to create a visual or verbal representation of the object(s) to be categorized. If it is difficult to create both a visual and a verbal representation, there is domain-specific ignorance. This situation exists when a product is unknown to the consumer, e.g. when the first television came on the market. Pictoliteral categories are categories for which it is easy to come up with a visual representation, but difficult to come up with a verbal one (e.g. the inkblots of the Rorschach
test). Easy verbal representation and difficult visual representation characterize *ad hoc categories* (e.g., it is difficult to come up with a single visual image of the category dangerous things). Finally, the "easy-easy" cell includes *taxonomic categories*, for which both verbal and visual representations can easily be constructed. Although Feldman himself makes no such inference, a possible implication of his classification system is that presenting participants with product pictures encourages taxonomic classification at the expense of alternative modes of classification (e.g., *ad hoc* or one-dimensional classification).

A limitation of the methodology used in this chapter is that the assumed "basicness" of the basic level is inferred from the *outcomes* of the sorting task and not from the actual *classification process* itself. The classification process was not registered. Therefore, it is difficult to substantiate the claim that people *first* classify products at the basic level and that they go on from there to arrive at their final classifications. In chapter 4 an attempt is made to map the actual categorization process by having participants thinking aloud during a classification task and by recording the entire task on video. The results of the third study are described in the next chapter but at this point one observation is mentioned that supports the idea that products are first identified as members of their basic-level category. Participants in Study 3 (chapter 4) were found to assign a basic-level category label to each product they were sorting (e.g., somebody would go through the set of furniture pictures, pick out several tables and mumble "a table, another table, this table goes with the others,..."). Thus, even when they were creating a non-basic-level sort, participants in Study 3 had already determined basic-level category membership for each product. In short, although this chapter has not actually demonstrated that consumers first categorize products at the basic-level even if their final categories are not at the basic-level, the results of Studies 1 and 2 combined with the aforementioned finding from Study 3 have yielded compelling evidence in favor of the basic-level superiority hypothesis. Consumers indeed tend to assign products to basic-level categories.
4 Dimensions Determining Consumer Product Classification

The previous chapter produced evidence that the basic-level superiority hypothesis, which thus far has only been established for cognitive tasks such as object recognition, free naming and category learning, also holds for the classification of products. Consumers tend to sort products into basic-level categories according to overall similarity (i.e. family resemblance). Chapter 3 also demonstrated that when products share a single salient aspect, people base their categorizations on these aspects rather than on overall similarity.

The current chapter builds on the first two studies by investigating the product aspects that consumers use to classify products. Rather than asking which products consumers put together, the question is why consumers put certain products together and set others aside. For example, why did participants in Study 1 create a category of equipment for personal care? What is it that hair dryers, toothbrushes and shavers have in common? Why do these objects belong together in the eyes of consumers? It is these "dimensions of likeness" (Smith and Evans 1989), i.e. the product dimensions that form the basis of classification, that this fourth chapter intends to identify. The word product dimension refers to a particular aspect of a product (Medin, Wattenmaker and Hampson 1987). The aspects of a product are all things that make up the product, both concrete (e.g. form, function, size, usage, color, material and production) and abstract (e.g. benefit, meaning, value and name)\footnote{Besides the word "dimension", alternative expressions have been used to refer to the dimensions of a product, such as "type of product attributes" (Leikoff-Haugus and Mason 1993; Medin, Wattenmaker, and Hampson 1987), "inherent nature of product attributes" (Myers and Shocker 1981), and "knowledge domain" (Maclnnis, Nakamoto, and Mani 1992). Confusingly, consumer researchers have also used the word dimension to denote the conceptual counterpart of a feature (Johnson and Fornell 1987). The difference between dimensions and features is that dimensions are continuous attributes on which objects differ as a matter of degree, whereas features are dichotomous attributes that objects either do or do not have (Johnson, Lehman, Fornell and Horne 1992). Rather than representing a collection of attributes referring to the same aspect, a dimension is a specific kind of attribute, namely an attribute that can take on a range of values.}. 

Note 1

Besides the word "dimension", alternative expressions have been used to refer to the dimensions of a product, such as "type of product attributes" (Leikoff-Haugus and Mason 1993; Medin, Wattenmaker, and Hampson 1987), "inherent nature of product attributes" (Myers and Shocker 1981), and "knowledge domain" (Maclnnis, Nakamoto, and Mani 1992). Confusingly, consumer researchers have also used the word dimension to denote the conceptual counterpart of a feature (Johnson and Fornell 1987). The difference between dimensions and features is that dimensions are continuous attributes on which objects differ as a matter of degree, whereas features are dichotomous attributes that objects either do or do not have (Johnson, Lehman, Fornell and Horne 1992). Rather than representing a collection of attributes referring to the same aspect, a dimension is a specific kind of attribute, namely an attribute that can take on a range of values.
Several reasons exist to concentrate on the dimensions of likeness. Knowledge about the product dimensions that underlie categorization is essential in order to understand why people create the categories that they do. Nevertheless, little research has been reported on this topic. Consumer researchers have acknowledged that the investigation of the bases of classification is an important topic in product categorization. Cohen and Basu (1987, p. 456) note that "the nature of category knowledge that forms the basis/standard for the comparison" is a fundamental information processing issue, together with "the nature of the comparison process itself", and "the degree of automaticity associated with the process". At the same time, they consider the product information on which classification is based less important and less interesting than the way this information is processed: "Identification of a subset of attributes as particularly important to a judgment of similarity is useful, but this only speaks to the 'what' and not to the 'how' of the process" (p. 455). Thus, apart from this remark, the Cohen and Basu study ignores the attributes that form the basis of similarity judgments and discusses the categorization process.

The focus on the categorization process itself, rather than on the product aspects that form the basis of the comparison process, is dominant in the categorization literature. There is a lack of research dealing with the information that forms the input for the classification process: "Little is known about the knowledge domains consumers use to judge similarity among product categories" (MacInnis, Nakamoto and Mani 1992, p. 260). All publications on categorization, with exception of the one by MacInnis et al. that is discussed further on in this chapter, concentrate on how product information is processed during categorization, neglecting the issue of what information is processed. In other words, empirical attention has been devoted nearly exclusively to the formal, process-related aspects of product categorization, leaving the substantive, content-related aspects untouched. The observed lack of research is in sharp contrast with the acknowledged significance of the substantive aspects of the categorization process and calls for empirical research like MacInnis et al. (1992) conducted and like the study that is described in this chapter.

Besides its theoretical relevance, the examination of the product aspects that consumers use to compare products is of practical relevance to product developers, marketers and retailers. Meyers and Shocker (1981) explain this point by distinguishing customer-determined attributes from producer-determined ones. Customer-determined attributes are those that depend on the perception and interpretation of the customer. Producers have no direct control on these. Generally speaking, customer-determined attributes refer to the (functional and emotional) benefits of the product. In contrast, producer-determined attributes concern those attributes that are under direct control of the manufacturer. These attributes are the actual physical product properties and the elements of the marketing mix, such as pricing, promotion and distribution. The influence that companies can exert on
consumers is limited to these factors\(^2\). In the end it is consumers who
determine how the specific product attributes and marketing efforts are
evaluated and appreciated.

From this point of view, it is essential that manufacturers know which product
properties consumers use to categorize hybrid products. The category to
which a new hybrid product is assigned determines which information is
activated, and through this process, which attitudes and preferences
become active. Companies can only affect consumer preferences and
attitudes to the extent that the attribute set considered by consumers
contains producer-determined attributes. The current research helps to
elucidate whether the attributes that consumers use for classification of
hybrid products are producer-determined, in which case classification of
hybrid products may be steered by manufacturers, or whether they are
customer-determined, in which case little influence is possible.

This chapter is composed as follows. Section 4.1 reviews previous research
on product dimensions and links it to the literature reported in related
disciplines such as design theory and product semantics. The research
questions are formulated in section 4.2. Section 4.3 presents the
methodology and results of the empirical study carried out to discover the
product dimensions that form the basis of product categorization. Finally,
section 4.4 holds the conclusions, limitations and implications of the study.

### 4.1 Previous Research on Product Dimensions

This section reviews literature from design theory and product semantics,
literature on product attributes, and two empirical studies that indirectly deal
with the dimensions underlying product classification. The first study,
conducted by Markman and Wisniewski (1997), investigated the similarity
structure of superordinate versus basic-level categories. The second study,
carried out by MacInnis, Nakamoto and Mani (1992), explored which
product dimensions consumers consider when assessing similarity between
categories.

#### 4.1.1 Design Theory and Product Semantics on Product Dimensions

Design theory and product semantics are scientific disciplines that both deal
with the fundamental question what constitutes a product. Design theory

Note 2

Shocker and Shrinivasan (cited in Myers and Shocker 1981) call such attributes
"actionable" to indicate that these are the properties that producers can act upon to effect
consumer behavior.
suggests that products are defined by their specific form, usage, and function (Müller 1990). The product form consists of material, structure and construction, the usage refers to the specific application of a product (where and how a product is used), and the function denotes the primary function or the purpose of a product. Product form, function and usage and the relation between these concepts, develop within a culture and change over time as a result of changes in technology, culture and society, and as a result of the need for new product functions.

Klöcker defines a product in terms of its identity (Vihma 1995). A product’s identity holds the following three kinds of information: (1) *information about existence*: being existent as a material object, the product expresses (announces) ‘here’s a thing’; (2) *information about origin*: the product informs about its designer, manufacturer, country and culture; and (3) *information about quality*: the product informs about its function, usage and maintenance. Though more abstract, Klöcker’s description of product identity is in line with Müller’s account of product dimensions. Klöcker’s first point relates to Muller’s form dimension: a product is matter, constructed in a specific way to result in a specific form. Muller’s dimensions of function and usage are mentioned in Klöcker’s third point. Müller’s notions about the relation between products and culture, technology and society are reflected in Klöcker’s second point.

Both Müller and Klöcker treat a product as an objectively defined, value-free object; a product is a thing with a particular form, that serves a particular goal if it is used in a particular way. They do not pay attention to the qualities that people attach to products, such as their symbolic meaning and emotional value. Within the field of semantics, the meaning that a product expresses is a central concept. Vihma (1995) suggests that a product can be divided into four dimensions, namely: (1) the *material dimension* which refers to the material(s) the product is made of; (2) the *syntactic dimension* which covers the product’s structure and technical functioning; (3) the *semantic dimension* which denotes the expressive and representational qualities of the product (the meaning the product communicates); and (4) the *pragmatic dimension* which refers to everything concerning the usage of the product. Vihma notes that the distinction between the semantic and pragmatic dimension is blurred, because the usage of a product is dependent of the meaning of the product and vice versa. In this respect, the view of Bense (in Vihma 1995) is illustrating: “One cannot understand the pragmatics of a product if all of its dimensions are not considered. The pragmatic dimension is conceived as resulting from the other three” (p. 50).

The parallel between the four dimensions described above and the form, function and usage dimensions can easily be drawn. The material dimension and the syntactic dimension represent the properties that determine the form and function of a product. These dimensions concern the way a product is physically constructed to perform its intended function. The pragmatic dimension corresponds to the usage dimension, although it is more broadly defined in terms of the complete context in which a product is used rather
than in normative terms of how the product should be used to function properly. Finally, the semantic dimension represents the meaning of a product in its most broad sense. It stands for everything a product communicates. The semantic dimension represents precisely the symbolic and affective aspects of a product that are neglected by Muller and Klöcker.

4.1.2 Types of Product Attributes

Within consumer research, the distinction between the objective physical properties and the subjective meaning of a product is generally acknowledged. Having reviewed existing typologies of product meaning or attributes, Finn (1985) remarks that:

One most common distinction is between the physical aspects of the product - those objectively examinable aspects - and other aspects of the product's meaning. A second is the distinction between the utilitarian or functional attributes, which release benefits for a consumer of the product, and the symbolic associations that are attached to the product (p. 37).

Finn (1985) concludes that the typology proposed by Myers and Shocker best captures the common distinctions between the typologies, a conclusion that is endorsed in recent research by Lefkoff-Hagius and Mason (1993), and Creusen and Schoormans (1997). Meyers and Shocker (1981, p. 213) distinguish four types of product properties:

1. **Physical properties** are "the most objective types of product descriptors, in the sense that they are measurable on some sort of physical scale".
2. **Pseudo-physical properties** are "also objective in nature but are not as measurable on a physical scale".
3. **Benefits" describe the advantages from using a product/service".
4. **Imagery properties" refer to various types of associations that have come to be suggested or evoked by the product. They usually indicate how the product itself (or usage of the product) represents the user to other people".

Although the four types of properties are all related to the product, Myers and Shocker indicate that products themselves consist entirely of physical and pseudo-physical properties. Benefits involve subjective evaluations about the product, and imagery properties have no direct relation with the product itself; they are not intrinsic to the product. In other words, (pseudo-)physical properties are product referent, benefits are task or outcome referent, and imagery properties are user referent. What is important in light of the present discussion is that, according to Meyers and Shocker, products are entirely defined by their physical and pseudo-physical properties. Benefits and imagery properties are not intrinsic properties of the product, but are inferred from the (pseudo-)physical properties that define it. This view corresponds to the position of Muller and Klöcker that a product is defined by its product-referent dimensions of form, function and usage.

Another attribute typology, one that deviates from the generally accepted Meyers and Shocker typology, has been suggested by Claeys (1993, p. 147)
who mentions five types of product properties:

1. *Functional properties* are "those attributes that refer to the specialized function of the product. This includes what you can do with it, when and by whom it is used and what its consequences are".
2. *Perceptual properties* are "all kinds of objectively perceptible characteristics, tangible and visible features".
3. *Parts* are product aspects that are perceived to be parts or ingredients.
4. *Evaluative properties* are indications of a value on an attribute (e.g., high price) or subjective statements about an attribute (e.g., tasty, delicious).
5. *Brand specific properties* are "those attributes that refer directly to the brand or the producer".

Of these five types of product attributes, only the first three refer directly to the product and could be regarded as product-referent.

### 4.1.3 Empirical Research on Product Dimensions

A final source of information concerning product dimensions is provided by the empirical studies of Markman and Wisniewski (1997) and MacInnis, Nakamoto and Mani (1992). Markman and Wisniewski investigated the way pairs of categories differ from each other. They posed that the difference between categories is the result of the number of commonalities (i.e., common properties) and the number of alignable differences (i.e., different values on common properties) that categories share. Although their analysis mainly involved the number of similarities and differences, they also performed a content analysis on the similarities and differences that subjects listed. The resulting dimensions included function, category, material, owner, part, location, cost, commodity, when used, animacy, size, naturalness, color, weight and shape. The exact meaning of these dimensions is not explained in the paper, but relying on their labels these dimensions seem to correspond to the ones discussed so far. Naturalness and animacy are the exceptions, but the presence of these dimensions is explained by the fact that several of the categories judged in the experiment involved categories of living things such as animals, birds and insects.

MacInnis, Nakamoto and Mani (1992) used a thought-listing task in an attempt to identify the product dimensions consumers use to judge comparability across products. The experimental task was a pair-wise comparison between a referent category and five different comparison categories. For example, subjects had to articulate as many differences and similarities between the referent category ballpoint pens and the comparison categories mechanical pencils, markers, disposable razors, staples and car parts. Content analysis of the elicited attribute lists revealed 11 dimensions: physical product properties, users, usage, usage occasion, production, purchase location, benefits, targets, packaging, purchase situation and marketing. In addition to dimensions related to appearance (physical product properties, packaging) and use (usage, users, usage occasion), MacInnis and her co-authors identified dimensions concerning marketing.
and manufacturing (production, targets, benefits, marketing, purchase situation, purchase location). It should be noted that few subjects mentioned properties related to marketing and manufacturing, suggesting that they are relatively unimportant to determine similarity between categories.

Table 4.1 summarizes dimensions reported in the literature that are suggested to play a role in consumer product categorization: function, appearance, use, evaluation and marketing/manufacturing.

<table>
<thead>
<tr>
<th>Literature</th>
<th>Literature</th>
<th>Literature</th>
<th>Literature</th>
<th>Literature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muller (1990)</td>
<td>Form</td>
<td>Function</td>
<td>Usage</td>
<td>Information about origin</td>
</tr>
<tr>
<td>Klöcker</td>
<td>Information about existence</td>
<td>Information about quality</td>
<td>Information about quality</td>
<td>Information about origin</td>
</tr>
<tr>
<td>Claeyts (1993)</td>
<td>Perceptual properties Parts</td>
<td>Functional properties</td>
<td>Functional properties</td>
<td>Evaluative properties</td>
</tr>
<tr>
<td>Markman &amp; Wisniewski (1997)</td>
<td>Size Color Shape Material</td>
<td>Function</td>
<td>When used</td>
<td>Location Cost Commodity</td>
</tr>
<tr>
<td>MacInnis, Nakamoto &amp; Mani (1992)</td>
<td>Physical properties Packaging</td>
<td>Usage User Usage occasion</td>
<td>Benefits</td>
<td>Packaging Production Targets Marketing Purchase situation Purchase location</td>
</tr>
</tbody>
</table>
4.2 Research Questions

The main purpose of the research reported in this chapter is to identify the basis underlying product classification. When consumers group objects into categories, on the basis of the available literature, they are expected to pay attention to its function, appearance, usage and evaluative properties, and to marketing- and manufacturing-related aspects thereof (see Table 4.1).

Furthermore, it is believed that function, appearance and use are the most important dimensions for discriminating between categories. These dimensions are directly related to the product. Products are created to perform particular functions and to be used in a certain way (Roozenburg and Eekels 1995). Products are functions materialized in a particular form. Hence, products are predominantly characterized by their function, the appearance that is related to this function, and by their use. Evaluative and marketing-related aspects are secondary product properties that only play a part after function, form and use have been considered. Consumers will therefore primarily base their classifications on function, appearance and use of the products.

Finally, the dimensions on which consumers base their classifications, are thought to vary across different levels of inclusiveness. Several studies have shown that at different levels of inclusiveness different types of product properties are processed (Johnson 1989; Johnson and Fornell 1987; Johnson, Fornell and Lehmann 1990): at higher levels of inclusiveness more abstract product properties are processed to judge the degree of similarity between categories; at lower levels of inclusiveness more concrete properties are evaluated in the comparison process. Product properties related to the use and benefits of a product are thought to be more abstract, whereas the observable, physical product properties are the more concrete ones (Finn 1985; Johnson 1989; Johnson and Fornell 1987; Leikoff-Hagius and Mason 1993; Myers and Shocker 1981). Based on this evidence, the following link between the level of categorization and the salience of the product dimensions is expected to exist: at higher levels of inclusiveness more abstract dimensions such as product function and product usage are expected to be the most frequent bases of classification; at lower levels of inclusiveness product classification will more frequently be based on concrete dimensions such as product appearance.

In sum, this part of the dissertation was set up to find an answer to the following questions:

1. Which product dimensions do consumers use to classify products into categories?
2. How salient is each of these product dimensions?
3. What is the relation between the level of inclusiveness at which product classification takes place and the product dimensions this classification is based on?
4.3 Study 3: Dimensions Underlying Consumer Product Classification

Below, the third empirical study is described that was designed to reveal the dimensions consumers use to classify products. The experimental task was similar to the one applied in studies 1 and 2, but this time the emphasis was on the bases for classification rather than on the classification itself.

4.3.1 Method

Participants
Twenty-nine people, 16 men and 13 women with an average age of 43.5, from the household panel of the Product Evaluation Laboratory of the University of Technology in Delft volunteered to participate in the study. Participation took 45 to 60 minutes. Participants received a small monetary compensation.

Stimulus Material
The stimuli in this study were the same pictures of electrical equipment and furniture that were used in Study 1 and Study 2 (see Appendix 3.1).

Procedure
Since the purpose of the study was to reveal the dimensions that consumers use to classify products, the free-classification approach followed in Study 1 and Study 2 was combined with a technique for knowledge elicitation, called self report. In self report, individuals think aloud whilst solving a problem or carrying out a task (Christiaans 1992). In general, people find it relatively straightforward to think aloud (Dorst 1997). Nevertheless, as people are not used to verbalizing what they are thinking, thinking aloud should be practiced prior to the actual experimental task (Christiaans 1992).

Another consideration with regard to the design of the experimental task concerned the fact that different people may categorize the same set of stimuli at different levels of inclusiveness. If participants are all asked to create a single sort, some sorts will be at the subordinate level, others will be at the basic level, and still others will be at the superordinate level. In order to compare the product dimensions that consumers use at different levels of inclusiveness, each participant has to make at least three sorts, assuming that everybody is able to create a superordinate, basic-level and subordinate sort. One way to achieve this is to have everybody create a superordinate-level sort first, followed by a basic-level sort and finally a subordinate-level sort. This procedure would require that participants are provided with a definition of each type of sort in advance. This is

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Note 3 The term sort is used to denote the result of a classification task. It refers to the way that participants divide a set of stimuli into groups.
problematic for two reasons. First, it is difficult to a priori define the superordinate and subordinate categories, since these are not clearly defined (in contrast to the basic-level categories that are given) and because multiple superordinate and subordinate sorts are possible. Second, forcing participants to create a certain type of sort undermines the free classification approach of the study. Characteristic of this approach is that participants decide how many and which categories they create. For these reasons, a different procedure was followed, which will be explained next.

Participants were invited to the lab individually. On arrival, the general procedure was explained. Before starting the experimental task, thinking aloud was practiced by having participants try a simple jigsaw puzzle for several minutes. Then, participants quickly ran through the stack of product pictures to get a general impression of the products that they were going to classify. Fourteen participants received the furniture stimuli; the other fifteen received the electrical equipment stimuli. A written instruction explaining the grouping task was presented next (Appendix 4.1). This instruction told participants to classify the products in the pictures on the basis of perceived similarity between them and not on the basis of personal preferences or other idiosyncratic judgments. This was emphasized to stimulate participants to focus on the dimensions of likeness and not on the dimensions of liking.

Participants were free to decide on the number of groups and on the number of items in a group (i.e. the task was a true free-classification task). On completion of the initial grouping task, participants were interviewed with respect to the classification they had made. In this way, as much information as possible about the reasons for classification was collected in addition to the thoughts expressed whilst thinking aloud. Consequently, if they had made many small groups during their initial sort, participants were instructed to join these into more inclusive (superordinate) categories; alternatively, participants were told to subdivide the products further into less inclusive (subordinate) categories, if they had only made a few, large groups. Again, participants explained their reasons for classification. This procedure was repeated until participants indicated that they could not join or subdivide the stimuli further. In this way, superordinate, basic-level and subordinate sorts were elicited for every participant. The number of sorts differed between participants, depending on their classification behavior. At the same time, information was gathered about the bases for classification at each level of inclusiveness. The complete grouping session was recorded on video in order to establish afterwards which products were placed in which categories and which thoughts were expressed during grouping tasks and interviews.

4.3.2 Results

Thinking Aloud
Most participants had experienced little trouble with thinking aloud. Only a few of them expressed that they just forgot to think aloud, because it was not
what they would normally do. Nevertheless, the thinking-aloud procedure did not elicit many product thoughts. Participants limited themselves to simply stating the product name of each product they classified. This may be the result of the fact that the process of object classification develops mostly automatically and subconsciously. The outcome is produced at the same time the process takes place. Not all “modes of thinking” can be easily captured in a thinking aloud task (Dorst 1997). The process of classifying objects may represent just such a mode of thinking.

In conclusion, the value of the thoughts that participants ventilated during the sorting tasks was limited. The analyses presented next are predominantly based on the remarks participants gave during the interviews following the grouping tasks.

Product Sorts

The 29 participants created a total of 98 sorts, an average of 3.38 sorts per person. Table 4.2 summarizes the main characteristics of the sorts created of the electrical equipment stimuli and the furniture stimuli. The mean number of sorts that participants created was 3.53 for electrical equipment and 3.21 for furniture. This difference was not statistically significant ($t_{27} = -0.949$, $p = 0.351$). A glance at the frequency distribution of the number of sorts reveals that the equal average is misleading. In the electrical equipment condition, most participants made three or four different sorts (80.0 percent). In contrast, participants in the furniture group predominantly made two or three different sorts (71.4 percent). Thus, the number of sorts tended to be larger for the electrical equipment group.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Electrical equipment</th>
<th>Furniture</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td>15</td>
<td>14</td>
<td>29</td>
</tr>
<tr>
<td>Total number of sorts</td>
<td>53</td>
<td>45</td>
<td>98</td>
</tr>
<tr>
<td>Mean number of sorts</td>
<td>3.53</td>
<td>3.21</td>
<td>3.38</td>
</tr>
<tr>
<td>Mean number of groups per sort</td>
<td>12.00</td>
<td>11.40</td>
<td>11.72</td>
</tr>
<tr>
<td>Number of participants creating 2, 3, 4, and 5 sorts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 sorts</td>
<td>1 (6.7 %)</td>
<td>3 (21.4 %)</td>
<td>4 (13.8 %)</td>
</tr>
<tr>
<td>3 sorts</td>
<td>7 (46.7 %)</td>
<td>7 (50.0 %)</td>
<td>14 (48.3 %)</td>
</tr>
<tr>
<td>4 sorts</td>
<td>5 (33.3 %)</td>
<td>2 (14.3 %)</td>
<td>7 (24.1 %)</td>
</tr>
<tr>
<td>5 sorts</td>
<td>2 (13.3 %)</td>
<td>2 (14.3 %)</td>
<td>4 (13.8 %)</td>
</tr>
<tr>
<td>Number of sorts consisting of the listed number of groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 - 10</td>
<td>29 (54.7 %)</td>
<td>22 (48.9 %)</td>
<td>51 (52.0 %)</td>
</tr>
<tr>
<td>11 - 20</td>
<td>14 (26.4 %)</td>
<td>18 (40.0 %)</td>
<td>32 (32.7 %)</td>
</tr>
<tr>
<td>21 - 33</td>
<td>10 (18.9 %)</td>
<td>5 (11.1 %)</td>
<td>15 (15.3 %)</td>
</tr>
</tbody>
</table>
A similar result was found for the number of groups that participants made in each sort. The mean number of groups per sort did not differ significantly for both product groups (\( M = 12.00 \) versus \( M = 11.40 \); \( t_{56} = -0.379, p = 0.705 \)). The frequency distribution reveals a different pattern between the number of groups created in the electrical equipment sorts and the furniture sorts. The percentage of sorts consisting of two to ten groups was approximately equal for both stimulus sets, (54.7 versus 48.9). The differences concern the sorts containing 11 to 20 groups and 21 to 33 groups. There was a greater tendency to divide the furniture stimuli in 11 to 20 categories (electrical equipment: 26.4 percent versus furniture: 40.0 percent) and the electrical equipment stimuli into more than 20 classes (electrical equipment: 18.9 percent versus furniture: 11.1 percent).

Dimensions Underlying Product Classification

Content analysis was performed on the transcripts of the 2051 remarks that participants made during the experiment, using the WinMax Pro program (Kuckartz 1995). Nineteen dimensions were identified, representing sets of remarks about similar aspects of the products and product sorts: appearance, color, form, material, size, style, function, what is it for?, what does it do?, what is it?, usage, usage intensity, usage situation, place of usage, user, number of users, relationship, quality, parts, and product label\(^4\) (see Appendix 4.2 for a description of the dimensions). Thirty-nine remarks (1.9 percent) could not be classified into any of the 19 dimensions.

To validate the semantic meaning of the dimensions two independent judges were presented with the sets of remarks and asked to: (1) label the sets of remarks; and (2) indicate which remarks in each set did not fit in. The labels of the two judges are given in Appendix 4.3. Eighteen labels were literally the same or synonymous with the labels that resulted from the content analysis. Less than one percent of the total number of remarks did not fit into the set to which it was assigned. The high agreement between the

Note 4
It is questionable whether "product label" should be regarded as a product dimension. The remarks covered by this dimension were all product names. Simply stating a product name, as nearly every subject did, does not point out at all which product aspects are considered. A product's name might be inferred from the appearance, function or any other product dimension. Stating a product name implies reproducing a learned relationship between an object (i.e. product) and a linguistic term connected to that object by means of the acquired language system. Rather than providing insight into the product aspects considered, a product label symbolizes all information (i.e. all dimensions) concerning a product. In other words, a product label represents a whole product category and not just a single product. For example, the label television does not only apply to the single television an individual is looking at, but to any other television as well. Thus, the situation may arise that participants who are asked to explain why two televisions belong to the same category, say that these televisions are televisions because they are both televisions. Although this explanation makes perfect sense, it is not very informative with regard to the actual aspects that define both products as televisions. For this reason, product label is not considered to be a product dimension. The fact that category labels were so frequently mentioned during the classification task, suggests that the association between categories and their names is so strong that it appears to be very difficult to think about categories in other than linguistic terms.
judges suggests that it is possible to group participants’ remarks about the similarities between products and product categories in homogeneous sets (dimensions) with relatively clear, differentiated semantic meanings.

Table 4.3
Examples of Remarks Referring to Quality and Relationship

<table>
<thead>
<tr>
<th>English</th>
<th>Dutch (original)</th>
<th>English</th>
<th>Dutch (original)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A couch is much more important, since it does not only have to be beautiful designed, but comfortable too.</td>
<td>Een bank vind ik als goed en veel belangrijker, omdat hij niet alleen qua vormgeving erg mooi moet zijn maar ook qua comfort.</td>
<td>I have tried to arrange the products as they would be in a catalogue.</td>
<td>Ik probeer dezelfde producten bij elkaar te leggen, zoals ik ze in een catalogus zou aantreffen.</td>
</tr>
<tr>
<td>Folding chairs save space.</td>
<td>Klapstoeltjes zijn de ruimtezuivers.</td>
<td>The relation is that a couch and an armchair would be grouped around such a table. Thus, a couch and two or three of those armchairs. Or a small couch, a larger one and one armchair.</td>
<td>Die relatie is dat ik me kan voorstellen dat een bank en een fauteuil om zo'n tafel gegroepeerd zijn. Dus een bank en twee of drie van die fauteuils. Of een tweezitsbank, een driezitsbank en één fauteuil.</td>
</tr>
<tr>
<td>I would say, this is for relaxation and that will wear you out.</td>
<td>Ik zou zeggen dat is de afdeling ontspanning en dat is de afdeling inspanning.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have paid attention to the comfort of the chairs. These are the “warmer” chairs.</td>
<td>Hier heb ik op het comfort gelet van de stoelen. Dit zijn de wat warmere stoelen.</td>
<td>I have paid attention to what stands together in my house.</td>
<td>Ik heb gekozen wat er in mijn huis een beetje bij elkaar staat.</td>
</tr>
<tr>
<td>It is easy to remove and clean when it is dirty.</td>
<td>Het is makkelijk afneembaar als ie vies is.</td>
<td>Well, I told you before. It is just as if I am in the household appliances department. There is some similarity but not a lot.</td>
<td>Nou, ik heb het al eerder gezegd, het is net of ik een elektronica zaak binnen kom, hè als af bij Correct binnen komt, dus het heeft iets met elkaar te maken, maar toch net zo veel met elkaar te maken.</td>
</tr>
<tr>
<td>Like I said, the cupboards on legs look more spatial than the wardrobes without.</td>
<td>Bij de kasten, dat heb ik al gezegd, op poootjes, dat geeft een wat ruimtelijker effect dan kleerkasten op de grond.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>These are the more simple food processors.</td>
<td>Dan zijn dit de wat eenvoudigere keukenmachines.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comparing the 19 dimensions with the five dimensions identified in the literature (see Table 4.1), seven can be related to appearance (appearance, color, form, material, size, style, parts), four to function (function, what is it for?, what does it do?, what is it?), and six to use (usage, usage intensity, usage situation, place of usage, user, number of users). The two remaining
dimensions do not fit with any of the five dimensions. The dimension quality represents those remarks that have to do with: (1) values participants ascribe to products, for example "this is a luxurious, comfortable chair"; and (2) affordances (Gibson 1982), for example "a Walkman is portable". If anything, these remarks might be considered to be what Claeyx (1993) calls evaluative properties, but this is not clear. The dimension relationship directly refers to the relation of categories with society and culture. It covers remarks such as "I made these groups, because this is how these products are usually grouped and how you will find them in stores". Other examples of the type of remarks that were assigned to these two dimensions are in Table 4.3.

Participants in the study did not mention marketing- or manufacturing-related aspects as reasons for their classifications. This result is probably due to the type of experimental task performed: participants divided an array of product pictures into categories. A classification task like this requires individuals to distinguish between a number of related product categories. The purpose of the task, i.e. identifying those similarities and differences that are relevant to determine which products belong together and which do not, encourages people to focus on concrete category-defining dimensions such as function, use and appearance at the expense of non-category-defining dimensions such as marketing and manufacturing. In contrast, the publications that have identified dimensions related to marketing and manufacturing, applied pair-wise comparison tasks in which subjects judged the similarity between categories Markman and Wisniewski 1997; MacInnis, Nakamoto, and Mani 1992). In a pair-wise comparison task, the comparison is between two product categories only. The goal of the task is to note any similarity or difference that comes to mind with regard to the categories under consideration. Such a task requires different information processing strategies, as a result of which participants are likely to pay attention to different aspects of the products, including aspects that have little discriminative power such as marketing and manufacturing.

Level of Analysis
At this point, a side-step is taken to consider a more fundamental point regarding the analysis of the product dimensions, namely that dimensions can be considered at different levels of abstraction. The 19 dimensions identified in the present study are grouped under the five dimensions abstracted from the literature. For example, seven dimensions are related to appearance; these dimensions can be considered as sub-dimensions of the more general appearance dimension. Similarly, there are sub-dimensions of function and use. The fact that dimensions exist at different levels of specificity, also implies that they can be analyzed at these different levels. Hence, it has to be decided which level of analysis will be applied to the data. The data could be analyzed at the level of the general dimensions of appearance, function and use, or at the level of the sub-dimensions that resulted from the content analysis.
The choice for a general or more specific level of analysis depends on the goal of the research. The sub-dimensions are characterized by a high category specificity. The sub-dimension number of users, for instance, has occurred since the furniture stimulus set included single and double beds; the number of users is namely a relevant concept to distinguish between them. In the same way, the sub-dimension users was mentioned by participants making a distinction between the shaver and the lady shave. The general dimensions, on the other hand, are not category specific. They apply to product categorization in general. No matter what category is considered, consumers are assumed to pay attention to appearance, function, and use. In sum, the identified sub-dimensions are too specific if the goal is to identify the dimensions that consumers use to classify products in general. Analysis at the general level asks for more general dimensions, dimensions that are not linked to a specific set of products. On the other hand, if the goal is to understand why consumers categorize certain products together, general dimensions are too general. Knowing that somebody separates two CD-players on the basis of appearance, for instance, does not clarify which aspect(s) of the appearance distinguishes one CD player from the other.

In the remainder of this chapter, the dimensions are examined at both levels, depending on goal of the particular analysis. The issue of the abstraction level of product dimensions will be considered further in the discussion at the end of this chapter.

Salience of the Product Dimensions

The salience of the product dimensions was assessed in the following manner. The comments participants made with regard to their initial classification were checked for the presence of remarks from any of the 19 identified dimensions⁷. A dimension was considered to be relevant for classification, if participants made at least one remark regarding that dimension. In this way, distortion of the data resulting from repetition was prevented as it did not matter how many times a particular dimension was mentioned. The number of remarks regarding a specific dimension did not influence its salience.

In Table 4.4 the salience of each product dimension for participants’ initial classifications of the furniture stimuli and the electrical equipment stimuli are listed. The salience of a dimension was computed as the ratio of the number of initial sorts in which the particular dimension was mentioned and the total number of initial sorts for the product group. Since each participant created one initial sort, the total number of initial sorts equals the number of

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Note 5 The reason for considering participants’ first classification only was twofold. First of all, as noted earlier, not everyone created the same number of classifications. This means that some participants were over-represented in the sample, whilst others were under-represented. Second, the dimensions that participants used to create consecutive sorts, will undoubtedly have been effected by the manner in which they classified the stimuli the first time. For this reason, the data from other than the initial sorts will be biased.
participants in a condition. (The data for one person in the electrical equipment condition were missing, so \( n = 14 \).) For example, if 10 of the 14 participants in the furniture condition said that they based their initial classification on the size of the products, the salience of size would be \( 10/14 = 0.71 \). In other words, the salience scores denote the percentage of participants that based their initial sort on each of the listed dimensions.

**Differences between Stimulus Sets**

Table 4.4 shows that salience of several of the dimensions differs between the two stimulus sets. The right column of Table 4.4 contains the results of the chi-square tests that were carried out to check which dimensions were more salient in one product group than in the other.

**Table 4.4**

Salience of the Product Dimensions for Initial Classifications

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Furniture</th>
<th>Electrical equipment</th>
<th>Total group</th>
<th>Test of difference $^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td>0.50</td>
<td>0.64</td>
<td>0.57</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td>0.21</td>
<td>0.21</td>
<td>0.21</td>
<td></td>
</tr>
<tr>
<td>Form</td>
<td>0.64</td>
<td>0.29</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td>0.71</td>
<td>0.00</td>
<td>0.36</td>
<td>$\chi^2_i = 15.56; p &lt; .001$</td>
</tr>
<tr>
<td>Size</td>
<td>0.50</td>
<td>0.57</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>Style</td>
<td>0.43</td>
<td>0.00</td>
<td>0.21</td>
<td>$\chi^2_i = 7.64; p &lt; .01$</td>
</tr>
<tr>
<td>Parts</td>
<td>0.57</td>
<td>0.64</td>
<td>0.61</td>
<td></td>
</tr>
<tr>
<td>Appearance (aggregate)</td>
<td>0.51</td>
<td>0.34</td>
<td>0.42</td>
<td></td>
</tr>
<tr>
<td>Function</td>
<td>0.57</td>
<td>0.36</td>
<td>0.46</td>
<td></td>
</tr>
<tr>
<td>What is it for?</td>
<td>0.64</td>
<td>1.00</td>
<td>0.82</td>
<td>$\chi^2_i = 6.09; p &lt; .05$</td>
</tr>
<tr>
<td>What does it do?</td>
<td>0.36</td>
<td>0.71</td>
<td>0.54</td>
<td></td>
</tr>
<tr>
<td>What is it?</td>
<td>0.93</td>
<td>1.00</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>Function (aggregate)</td>
<td>0.63</td>
<td>0.77</td>
<td>0.70</td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td>0.29</td>
<td>0.21</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Usage intensity</td>
<td>0.00</td>
<td>0.29</td>
<td>0.14</td>
<td>$\chi^2_i = 4.57; p &lt; .05$</td>
</tr>
<tr>
<td>Usage situation</td>
<td>0.57</td>
<td>0.29</td>
<td>0.43</td>
<td></td>
</tr>
<tr>
<td>Place of usage</td>
<td>0.79</td>
<td>0.79</td>
<td>0.79</td>
<td></td>
</tr>
<tr>
<td>User</td>
<td>0.07</td>
<td>0.29</td>
<td>0.18</td>
<td></td>
</tr>
<tr>
<td>Number of users</td>
<td>0.79</td>
<td>0.00</td>
<td>0.39</td>
<td>$\chi^2_i = 18.12; p &lt; .001$</td>
</tr>
<tr>
<td>Use (aggregate)</td>
<td>0.42</td>
<td>0.31</td>
<td>0.36</td>
<td></td>
</tr>
<tr>
<td>Relationship</td>
<td>0.14</td>
<td>0.36</td>
<td>0.25</td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>0.36</td>
<td>0.14</td>
<td>0.25</td>
<td></td>
</tr>
</tbody>
</table>

1 Salience was computed by dividing the number of initial sorts in which a particular dimension was used (denoted by the letter S) by the total number of initial sorts for the product group: furniture: S/14; electrical equipment: S/14.

2 Only significant tests are displayed.
Significant differences were found for five dimensions: material, style, what is it for?, usage intensity, and number of users. The dimension what is it for? occurred more frequently in the electrical equipment group (1.00) than in the furniture group (0.64); nevertheless, this dimension was salient in both conditions. This is not the case for the remaining dimensions. Usage intensity was salient for electrical equipment only (0.29), whereas material (0.71), number of users (0.79), and style (0.43) were relevant dimensions only with regard to the classification of furniture. As was noted previously, these results indicate that some of the dimensions used for classification are category specific; they are salient for one category but not for another.

Most Salient Dimensions
The most salient product dimensions (salience greater than 0.75) were not the same for the two stimulus sets. For furniture they were: what is it? (0.93), place of usage (0.79), and number of users (0.79). More than 75 percent of the participants said that they based their classifications on these dimensions. For electrical equipment, the most salient dimensions were: what is it? (1.00), what is it for? (1.00), and place of usage (0.79). Note that the first two dimensions are mentioned by everybody. Note further that what is it? and place of usage were highly salient dimensions for both product groups, suggesting that these dimensions may be less category specific.

Aggregate Dimensions: Appearance, Function, and Use
To get a better overall picture, the seven appearance-, four function-, and six use-related dimensions were clustered (i.e. averaged) into three aggregate dimensions appearance, function, and use. At first sight, appearance and use appear to be more salient for furniture, and function seems to be more salient for electrical equipment. The differences between the stimulus sets were not significant, though. Within both stimulus sets, function was judged to be the most important basis for classification. For furniture, the difference in salience of the three dimensions were all non-significant. For electrical equipment, function was significantly more salient than appearance ($p < .001$) and use ($p < .001$). These results provide an answer to the second research question. The high salience observed for function supports the assumption that durable products are predominantly characterized by their function. When consumers divide products into categories, category membership depends the most strongly on the function of the products.

Classification at Various Levels of Inclusiveness
Examining the relationship between the level of inclusiveness at which product classification occurs and the salience of the product dimensions underlying these classifications can further specify the results about the salience of the respective product dimensions. In order to elicit sorts at different levels of inclusiveness, participants were stimulated to make additional sorts following their initial one. Depending on how they grouped the product pictures the first time, their next sort was a joining or a
subdivision of the groups created during the initial sort. This procedure resulted in 98 sorts.

The level of inclusiveness at which a particular sort was made, was determined by first identifying the sort that most strongly resembled the basic-level classification as defined by the operational criteria described in subsection 3.2.3. Next, the superordinate level of inclusiveness was defined as that level, at which fewer, larger groups occurred, while the subordinate level of inclusiveness was characterized as the level at which participants created more, smaller groups. From the total of 98 sorts 34 (34.7 percent) were at the subordinate level, 27 (27.6 percent) at the basic level, and 37 (37.7 percent) at the superordinate level. On the basis of the transcripts of the interviews, it was determined which of the product dimensions were used as bases for classification for each of the 98 sorts\(^6\).

For both stimulus sets, the relationship between the level of inclusiveness and the dimensions used for classification was examined by means of five one-way analyses of variance with the level of inclusiveness (superordinate, basic, subordinate) as the independent variable; the dependent variables were the aggregate dimensions function, appearance, and use, and the dimensions quality and relationship\(^7\). The results of the analyses of variance are pictured in Figure 4.1. On the left side the means are listed; on the right side significant differences are indicated by different characters.

**Furniture**

Figure 4.1 shows the salience of each dimension at the superordinate, basic, and subordinate level of inclusiveness. The only significant result was that appearance was more often used as a basis for classification at the subordinate level than at the basic or superordinate level. This makes sense, because the differences at the subordinate level of classification mainly concern differences in physical appearance (e.g. different instances of a

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Note 6 Unlike the salience analysis reported in the previous paragraph that applied only to participants’ initial sorts, the current analysis was based on all sorts. This means that the sample of observations is biased in the sense that some participants made more sorts than others did. Furthermore, the observations in the sample are interrelated since participants’ subsequent sorts were dependent on their initial ones (see footnote 5). Dependence among observations has severe consequences for the significance and the power of the F-statistic. According to Stevens (1990, p. 44), “Just a small amount of dependence among the observations causes the actual \(\alpha\) to be several times greater than the nominal \(\alpha\).” He gives examples showing that even when dependence is small, the actual \(\alpha\) is already ten times the nominal \(\alpha\). Stevens suggests that in case of correlated observations, testing should take place at more stringent levels of significance, such as \(\alpha = .01\) or \(\alpha = .001\). To get an idea about the amount of dependence among the observations of the current study, intraclass correlation is computed according to the formula: \(R = (MS_w - MS_s) / (MS_s + (n - 1) MS_w)\), where \(MS_w\) (mean sum of squares between) and \(MS_s\) (mean sum of squares within) are the numerator and denominator of the \(F\)-statistic and \(n\) is the number of participants per group (Stevens 1990, p. 44). Applying this formula to the data results in intraclass correlations varying from \(R = 0.05\) to \(R = 0.15\). Following Stevens’ suggestions (1990, Table 2.1, p. 45), a more stringent significance level is taken, namely a nominal \(\alpha\) of .005.

Note 7 The six dependent variables were dichotomous variables (0 = not observed, 1 = observed) which were treated as being measured at the interval level.
kitchen chair). Several trends were observed. Function was least salient at the superordinate level. The salience of use and quality increased at lower levels of inclusiveness. Finally, the dimension relationship hardly occurred as a basis for classification in the furniture condition.

Figure 4.1
Relation Between the Level of Inclusiveness and the Dimensions Used for Classification

Furniture

\[
\begin{array}{ccccccc}
0.00 & A & 0.21 & A & 0.12 & A & 0.00 & A \\
0.18 & A & 0.48 & A & 0.21 & A & 0.08 & A \\
0.52 & B & 0.43 & A & 0.32 & A & 0.35 & A \\
\end{array}
\]

\[
\begin{array}{ccccccc}
& Appearance & Function & Use & Quality & Relationship \\
F_{2,42} = 16.23 & F_{2,42} = 2.43 & F_{2,42} = 4.24 & F_{2,42} = 3.02 & F_{2,42} = 0.74 \\
p < .005 & p = .100 & p = .021 & p = .060 & p = .484 \\
\end{array}
\]

Electrical equipment

\[
\begin{array}{ccccccc}
0.18 & A & 0.54 & A & 0.19 & A & 0.17 & A \\
0.37 & AB & 0.86 & A & 0.24 & A & 0.29 & A \\
0.45 & AB & 0.57 & A & 0.26 & A & 0.43 & A \\
\end{array}
\]

\[
\begin{array}{ccccccc}
& Appearance & Function & Use & Quality & Relationship \\
F_{2,42} = 7.15 & F_{2,42} = 9.30 & F_{2,42} = 0.60 & F_{2,42} = 1.11 & F_{2,42} = 3.14 \\
p < .005 & p < .005 & p = .554 & p = .339 & p = .052 \\
\end{array}
\]

Electrical Equipment

The pattern of results for the electrical equipment group was almost identical to that observed for the furniture data, although the salience levels were considerably higher for all dimensions but use. This difference between the two conditions should be attributed to the biases explained in footnote 6, since the analysis of the initial sorts (see Table 4.4) did not yield any significant differences regarding the five dimensions included in the current analysis. The high salience scores for electrical equipment suggest that participants in this condition were more inclined to report their thoughts in subsequent sorts, that participants with relatively high salience scores dominated the sample, or both. Two divergent results should be mentioned. Function was significantly more salient at the basic than at the other levels of inclusiveness. Furthermore, although the dimension relationship was low in both conditions, the pattern of scores was exactly opposite. For electrical equipment, this dimension was salient only at the superordinate level; for furniture, relationship only played a role in subordinate-level sorts. It is not clear why this happened.
**Dimension Salience per Level of Inclusiveness**

In order to test whether the differences between the dimensions at each level of inclusiveness were significant, one-way analyses of variance were carried out, comparing the mean salience of each dimension per classification level. This time, no distinction was made between the two stimulus sets, because the previous analysis showed that the outcomes for both groups were highly comparable. The results are given in Table 4.5. At the superordinate level, function was significantly more salient than all other dimensions, which did not differ significantly from one another. At the basic level of inclusiveness, the dimensions function was significantly more salient than the other dimensions. Relationship was least salient; more in particular, this dimension was not used at all to classify the product pictures. The most salient dimension at the subordinate level was appearance, although the difference with function, quality and use was not significant. Again, relationship was the least salient, although this time it was used in some occasions.

<table>
<thead>
<tr>
<th>Level of inclusiveness</th>
<th>Mean salience $^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Superordinate</strong></td>
<td></td>
</tr>
<tr>
<td>Quality</td>
<td>.14 $^a$</td>
</tr>
<tr>
<td>Appearance</td>
<td>.14 $^a$</td>
</tr>
<tr>
<td>Use</td>
<td>.18 $^a$</td>
</tr>
<tr>
<td>Relationship</td>
<td>.19 $^b$</td>
</tr>
<tr>
<td>Function</td>
<td>.48 $^b$</td>
</tr>
<tr>
<td>$F_{4,177} = 9.17; p &lt; .001$</td>
<td></td>
</tr>
<tr>
<td><strong>Basic</strong></td>
<td></td>
</tr>
<tr>
<td>Relationship</td>
<td>.00 $^a$</td>
</tr>
<tr>
<td>Quality</td>
<td>.19 $^{a,b}$</td>
</tr>
<tr>
<td>Use</td>
<td>.22 $^b$</td>
</tr>
<tr>
<td>Appearance</td>
<td>.28 $^b$</td>
</tr>
<tr>
<td>Function</td>
<td>.68 $^c$</td>
</tr>
<tr>
<td>$F_{4,125} = 24.80; p &lt; .001$</td>
<td></td>
</tr>
<tr>
<td><strong>Subordinate</strong></td>
<td></td>
</tr>
<tr>
<td>Relationship</td>
<td>.06 $^a$</td>
</tr>
<tr>
<td>Use</td>
<td>.31 $^b$</td>
</tr>
<tr>
<td>Quality</td>
<td>.36 $^b$</td>
</tr>
<tr>
<td>Function</td>
<td>.46 $^b$</td>
</tr>
<tr>
<td>Appearance</td>
<td>.50 $^b$</td>
</tr>
<tr>
<td>$F_{4,160} = 10.12; p &lt; .001$</td>
<td></td>
</tr>
</tbody>
</table>

1 Different lowercase characters indicate significant differences.

In answer to the third research question, taken together, these analyses demonstrate the high salience of function at all levels of inclusiveness. At the subordinate level, appearance is more salient than function, but not significantly so. The importance of appearance-related product aspects increased as the level of inclusiveness lowered. These findings are in line with the literature on concrete and abstract product properties (see section 4.2). At the subordinate level function does not discriminate between categories very well, because at this level different subcategories usually have the same functionality. Only at higher levels of inclusiveness, and in
particular at the basic level, do functional product aspects discriminate between categories, because products within the same category have the same functionality, whereas products from different categories have different functions. In contrast, more concrete product aspects were judged mainly at the subordinate level of inclusiveness, where the function of products within the same category is often identical. Under such conditions, comparison between products has to take place on the basis of appearance-related information.

The findings with regard to relationship are also in line with what the literature suggests. The remarks indicated by this dimension typically involved abstract statements about how products are related to each other. Such considerations could be sooner expected to play a role when people make general, superordinate categories than when they distinguish between highly specific subordinate categories. This is exactly what happened in the current study. Participants did not mention relationship as a basis for classification when forming subordinate (0.06) or basic categories (0.00), but it became a salient sorting dimension (0.19) when participants engaged in superordinate classification.

The results for use were less clear. Like appearance, use was the most salient at the subordinate level (0.31), but this difference was not significant. At all levels of inclusiveness, use and appearance were equally salient. This is surprising, because use-related product information is thought to be more abstract than appearance-related product information. Consequently, use should have been relatively salient at the superordinate level, but this was not observed.

4.4 General Discussion

Consumers group products together on the basis of their similarities and dissimilarities. However, any two products share an arbitrary number of similarities and differ from each other in an arbitrary number of ways (Medin, Goldstone, and Gentner 1993). Hence, the construct of similarity is not useful to explain consumers' classifications, unless one is able to specify the ways or respects in which products are similar (Medin, Goldstone, and Gentner 1993; Murphy and Medin 1985). The study reported in this chapter has identified these dimensions of likeness for two sets of products originating from the superordinate categories of furniture and electrical equipment. In a free classification task, participants sorted these products into groups and explained their reasons for doing so. Content analysis of these explanations revealed the product dimensions underlying participants' sorts. Furthermore, the importance of each identified dimension for product classification was assessed. Finally, the relationship between the level of specificity of participants' sorts and the salience of the identified product
dimensions was determined. Before turning to these three topics, the main limitations of the study are discussed in subsection 4.4.1.

4.4.1 Research Limitations

The present study attempted to register participants’ reasons for putting products together and keeping them apart by having them thinking aloud during the classification task. Thinking aloud tasks generally produce large and rich data bases (Dorst 1997). In this case, it did not. Participants merely stated product names. An earlier explanation was that some cognitive tasks are more difficult to capture by thinking aloud than others. Categorization may represent such a task. It goes automatically and rapidly, producing an outcome at the same time it takes place. It is over before people are able to realize why they created the categories that they did. It is the outcome (i.e. the product names) rather than the process (i.e. the reasons for their classifications) that participants reported. Thus, whereas, a priori, the thinking-aloud procedure seemed to be a suitable way to elicit the reasons for participants’ classifications, in practice it did not result in useful data. Instead, the information collected during the interviews at the end of each sorting round formed the input of the analyses. As is the case with all post hoc self-reported data, it is questionable whether information collected afterwards, accurately reflects the thoughts that participants had during the task. In spite of its limitations, the outcomes of Study 3 have demonstrated that post hoc reports of the product dimensions determining product classification are helpful to learn what consumers do when they categorize products.

The third research question concerned the relation between the level of inclusiveness and the salience of the product dimensions. As a result of the experimental procedure to elicit classifications at different levels of inclusiveness, the data for different participants were hard to compare. The number of sorts varied between participants, as did the number of superordinate and subordinate sorts. Furthermore, the order of sorts differed from one subject to another. Some participants started with a subordinate sort, followed by a basic level classification and two superordinate sorts. Others started with a basic-level sort, followed by a superordinate sort, and finishing with a subordinate sort. These differences within the individual data sets lead to the problems pointed out in footnotes 5 and 6, of which the dependence among observations was the most important. In retrospect, several alternative methods could have been used to investigate this particular relationship. One method would be to have different groups of participants judge completed sorts at different levels of inclusiveness and ask them to indicate what the rationale for each type of classification could have been. Another possibility would be to explain in advance what superordinate, basic-level and subordinate classifications are, and let participants create each type of classification in the same order. Even better could be to use a between-subject design rather than a within-subject
design and have three groups of participants create each different type of classification. In this way, learning or task effects can be avoided.

4.4.2 Product Dimensions Determining Category Membership

The explanations that participants gave for grouping products together could be summarized by 19 product dimensions. Seven of these dimensions were related to the appearance of the product: appearance, color, form, material, size, style and parts. Four dimensions concerned functional product aspects: function, what is it for?, what does it do? and what is it?. Six dimensions referred to the use of the product: usage, usage intensity, usage situation, place of usage, user, and number of users. The remaining dimensions, named quality and relationship, did not fall under either of the general dimensions of appearance, function and usage. The quality dimension concerned remarks like “these are comfortable chairs”, “this chair saves space”, or “these are straightforward tables”. Rather than actual physical product properties, the properties assigned to quality were evaluative judgement on the basis of the physical properties of the product. For example, chairs or couches were labeled comfortable if they were cushioned and upholstered. Participants viewing a picture of a folding chair inferred that it would save space. The dimension relationship emerged as a result of the fact that categorization is guided partly by habit, tradition or common practice. Some participants indicated that they grouped products together “because they are always grouped together like that”, or “since this is how they are organized in stores”. In the case that participants gave such reasons for their sorts, they actually categorized products according to principles used by other people. From this point of view, relationship is not a true product dimension like the other dimensions, as it does not refer to any product aspect in particular.

4.4.3 Salience of the Product Dimensions

What is the contribution of each product dimension with regard to the determination of category membership? In analyzing the salience of the 19 identified dimensions, it became clear that the dimensions that underlie participants’ sorts are partly dependent on the stimulus set that is sorted. The dimensions material, style and number of users were quite salient to distinguish between different pieces of furniture, but they were never used as sorting cues within the electrical equipment group. In contrast, usage intensity and type of user (men or women) were salient dimensions for the grouping of just the electrical equipment. These dimensions were irrelevant for the classification of furniture. Clearly, each set of products will render specific dimensions salient, namely those dimensions that best distinguish between the products that are sorted.

Given this observation, one may question the use of identifying the dimensions underlying consumer products classification. If a different set of
dimensions is found to be relevant any time a different group of products is considered, the identification of these dimensions appears to be an endless and hardly constructive task. Fortunately, the dimensions are not as arbitrary as the above remarks suggest. First of all, many of the identified dimensions played a significant role in the classification of both furniture and electrical equipment. These dimensions could well turn out to be important, irrespective of the categories under consideration. Furthermore, the salience of the aggregate dimensions of function, appearance and use are stable across categories. When participants grouped products, function-related product aspects were the most important in both conditions, a result that was also found by Markman and Wisniewski (1997, Table 7, p. 65). This finding is not surprising, realizing that products exist because of their functionality to the user. Basically, products are materialized functions. The next most important classification base was product appearance. Products that looked similar, that had the same color, that were made of the same material, or that shared specific physical characteristics tended to be grouped together. Finally, use was the third most important basis for classification. The specific usage situation or place of usage was an important criterion to group products together.

In sum, in assessments of category membership, functional similarity is most heavily weighed, followed by perceptual similarity and similarity in use. Depending on the particular products and categories that are considered, the set of 19 sub-dimensions may look slightly different (i.e. some of the dimensions may need to be excluded and others included), and their salience may vary a little. Research using stimuli from different categories has to establish how stable and exhaustive the identified product dimensions are, but based on the evidence from Study 3, they are believed to represent a fairly stable and exhaustive set of dimensions that consumers use when they categorize products.

4.4.4 Salience at Different Levels of Inclusiveness

The analysis of the salience of the dimensions was refined by discriminating between classifications at different levels of inclusiveness. Descending down the hierarchy, products within the same category become more and more alike. At the same time, the contrast between categories decreases. At the superordinate level, categories can best be distinguished from one another on the basis of their general function, because this is the aspect that category members have in common. Thus, in order to discriminate between members of different superordinate categories, consumers are expected to compare their general function. Indeed, participants in Study 3 who categorized products at the superordinate level predominantly did so on the basis of their functionality.

Like members from superordinate-level categories, basic-level category members are the most similar to each other with regard to their function, despite the similarity in appearance and their being used in a similar
fashion. For this reason, basic-level categories can most effectively be discriminated on the basis of their function (e.g. CD players look like video recorders but they serve completely different functions). This is also what participants in Study 3 did. In discriminating between categories at the basic level, more than two-third of the participants said that they based their categories on the function of the products.

Finally, in subordinate categories, products are highly similar with regard to function, use and appearance. In this case, the most discriminative aspect is usually the appearance of the product, because the function and use of products with the same subordinate category are often identical. In line with expectation, at the subordinate level, participants distinguished between categories mainly on the basis of physical product properties and overall appearance.

With regard to hybrid products, the conclusion that follows from the analyses presented in this chapter is that, although the appearance and the use of the hybrid may affect categorization, category membership is eventually determined by its function, i.e. the functions of its source products. Since these source functions are associated with different independently existing basic-level categories, hybrid products are assumed to be ambiguous with regard to their category membership. The next chapter investigates whether and how this inherent ambiguity affects the categorization of hybrid products.
5 The Effect of Hybridity on Product Categorization

The previous two chapters have provided two important insights. Chapter 3 extended the literature on basic-level superiority, by demonstrating that the basic-level superiority hypothesis also holds for free classification tasks with (pictures of) real products (i.e. non-artificial stimuli). This finding is critical for the study of hybrid products since it implies that consumers who are confronted with a new hybrid product will try to make sense of it by assigning it to an existing basic-level category. As it was argued at the end of the second chapter (see subsection 2.8.3), the fact that consumers interpret hybrid products in terms of basic-level category membership is responsible for consumers' perception of ambiguity concerning a hybrid's category membership. Thus, by confirming the existence of basic-level superiority in product classification, the empirical evidence from Study 1 and Study 2 has strengthened the plausibility of the assumption that has been made so far, namely that hybrid products are intrinsically ambiguous with regard to category membership.

Chapter 4 has identified the bases of product categorization and their importance. Generally, products are classified according to their function, appearance and usage, of which function is the most important, particularly at the basic level. These findings not only explain which product dimensions consumers use to categorize products, they also enhance the plausibility of the ambiguity assumption further. This is so, because precisely that product aspect on which consumers primarily base their categories, namely the hybrid's function, is also the aspect that makes hybrids ambiguous.

The research described in this chapter was conducted to explicitly examine the validity of the assumption that hybrid products are intrinsically ambiguous. The results from the first three studies suggest that this assumption is credible, although they did not actually examine it. The present research also investigates the effect that the ambiguity present in hybrid products has on their categorization. As has been outlined in the flow charts of the categorization process for both non-hybrids (Figure 2.7) and hybrids (Figure 2.8) presented at the end of the second chapter, the categorization process for both types of product is believed to develop differently. The categorization process concerning hybrid products is more elaborate and uncertain than that of non-hybrid products. Section 5.1 elaborates on the flow charts from chapter 2 by describing in greater detail
the differences between the categorization processes regarding hybrid and non-hybrid products. In section 5.2 an empirical study is reported in which the theorized differences between the categorization of hybrid and non-hybrid products were examined. A second empirical study includes the effect of familiarity on the categorization of hybrid and non-hybrid products (section 5.3). The empirical findings of the two studies and their limitations are discussed in section 5.4.

5.1 Differences between the Categorization of Hybrid and Non-hybrid Products

The major difference between hybrid and non-hybrid products is formulated in the first hypothesis.

Hypothesis 1

Hybrid products are more ambiguous than non-hybrid products.

The remainder of this section will explain why hybrid products are more ambiguous and what the consequences are for the categorization process of hybrid and non-hybrid products. The relevant comparison processes that constitute hybrid and non-hybrid product categorization are pictured in Figure 5.1.

Figure 5.1
Schematic Illustration of the Categorization of Non-Hybrid and Hybrid Products

![Schematic Illustration of the Categorization of Non-Hybrid and Hybrid Products](image)

In this figure, non-hybrid products are indicated by the letter X; hybrid products are denoted by the letters AB, where A and B represent the two source products. The corresponding categories are $X'$, $A'$, $B'$, and $AB'$. When consumers are confronted with either a non-hybrid product $X$ or a hybrid product $AB$, a search in memory starts for a category to which $X$ ($AB$) can be assigned (i.e. the target category). In the case of non-hybrid products,
classification of $X$ into $X'$ happens (almost) automatically as there is only a
single target category that fits the product. The corresponding target
category $X'$ is immediately activated and schema congruity will be high.
Categorization requires little cognitive effort. In terms of the Cherian and
Jones typology (see chapter 2), straight fit will occur. There will be no doubt
about category membership, since there is only one appropriate target
category.

Categorization of non-hybrid products can be seen as a relatively automatic
assignment of a product to a category the moment a good fit is found. In
contrast, if two or more categories are salient, categorization per se becomes
a focal problem, and a more deliberative comparative process is likely
(Cohen and Basu 1987). In other words, whilst the categorization of non-
hybrid products is straightforward as it involves only one target category, the
classification of hybrid products is more complex, because then there are
multiple target categories. The hybrid AB (e.g. alarm clock-radio) can be
classified into source category $A'$ (i.e. alarm clock), source category $B'$ (i.e.
radio), or into the hybrid category $AB'$ (i.e. alarm clock-radio). Of these
options, classification as either $A'$ or $B'$ is less likely to occur, since these
source categories only partly match the hybrid AB (indicated in Figure 5.1
by the dotted arrows and dotted boxes). The hybrid will sooner be assigned
to a category of its own (AB'). In other words, when the choice is between
accommodating the hybrid product to either one of the source categories (to
which it is partly congruent and partly incongruent) and assigning the
hybrid product to the corresponding hybrid category (to which the hybrid is
completely congruent), consumers will most likely opt for the latter.
Nevertheless, resemblance between the hybrid product and one of the
source categories may be sufficiently high to disrupt the classification
process. Consumers could be misled by the apparent similarity between the
hybrid and one of its source categories (e.g. a television-video recorder
looks very similar to a television) and classify it accordingly. When this
happens, classification is erroneous in the sense that the hybrid product is
classified as a non-hybrid.

In sum, the categorization process of hybrid products is believed to be
characterized by moderate degrees of confusion and cognitive effort as a
result of the presence of multiple target categories. This is true, because
hybrid products will activate multiple, different, and possibly conflicting
product categories (category $A'$, category $B'$ and category $AB'$), providing
consumers with several classification options. In fact, categorization of
hybrid products represents the choice problem of deciding in which of
multiple target product categories the hybrid product fits best. This process
has been described in Figure 2.8. (chapter 2). In the case of non-hybrid
products, such a choice problem is absent, a fact that is illustrated in Figure
2.7 by the smaller number of options (four instead of five) and the smaller
number of decisions moments (always one less than in Figure 2.8).
Therefore, the second hypothesis is:
Hypothesis 2
The categorization of hybrid products will involve more cognitive effort than the categorization of non-hybrid products.

Since hybrid products are congruent with their source categories (A and B) as well as with their hybrid category (AB), classification is considered to be less certain and consumers are expected to make classification errors, meaning that they assign the hybrid to a highly congruent source category instead of the accurate hybrid category.

Hypothesis 3
The number of accurate classifications for hybrid products will be lower than the number of accurate classifications for non-hybrid products.

A final difference between hybrid products and non-hybrid products was suggested through research conducted Goodnow (discussed in Bruner, Goodnow, and Austin 1977). In this study, subjects' reactions to a conflicting category cue (i.e. a piece of information that is in conflict with the activated category) were examined. Bruner, Goodnow, and Austin (1977, p. 207) report:

One notable characteristic of cue conflicts is their effect on the subject's surety. When an instance exemplifies such a conflict, Goodnow's subjects report that there is something 'funny' or 'odd' about it and they seem to be uncertain as to what to do. This is the case even though they may not be able to verbalize that the cues before them are 'in conflict' or 'point in opposite directions'.

Goodnow's observations were corroborated by observations in the course of the current research project. People (participants, colleagues and students) to whom examples of hybrid products were shown, ventilated surprise and started to laugh, especially when it concerned a picture of a hybrid product they had never seen before. When asked for the reason, they said that they were surprised by the hybrid's particular combination of products, by its unusual appearance, or by the mere fact that such "weird" products actually exist. Without exception, people's initial reaction was one of surprise; hybrid products were considered to be odd or even weird.

The psychoevolutionary model of surprise (see Schützwohl 1998) may help to explain why hybrid products seem odd to consumers¹. Surprise is thought to be elicited by unexpected events, with unexpected events being those

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¹ The psychoevolutionary model of surprise posits that people need surprise in order to function properly. "Surprise is conceived of as an evolutionary old mechanism whose function it is to enable and motivate processes that serve to analyze the surprising event and, ultimately, to remove the input-schema discrepancy (...) Thus, the ultimate adaptive function of surprise is to ensure, by means of schema revision or knowledge updating, an effective prediction and control of the environment and, hence, successful individual-environment transactions" (Schützwohl 1998, p. 1183).
that deviate from activated knowledge. It is exactly the unexpected combination of source products (i.e. the conflicting cues), the fact that their attribute sets are uncorrelated, that characterizes hybrid products and that makes them odd. This is not to say that non-hybrid products could not be odd. Still, given their ambiguous nature, hybrid products stand a greater chance of being perceived as odd than non-hybrid products.

Hypothesis 4
Hybrid products will be perceived as being more odd than non-hybrid products.

5.2 Study 4a: Consumer Categorization of Hybrid and Non-Hybrid Products

5.2.1 Method

Participants
Participants were 23 men and 21 women, ranging in age from 18 to 65 ($M = 42.2$), from the household panel of the Product Evaluation Laboratory of the Delft University of Technology. They were recruited to participate in two product evaluation studies, which had no relation whatsoever with each other. The two studies were administered in one session for reasons of efficiency. The study reported here was the first study in each session. Participation was voluntary and participants received a small financial compensation. The total time of a session was 60 to 70 minutes. Each study took approximately 30 to 35 minutes.

Stimulus Material
The stimulus material consisted of two plastified A4-size product pictures (see Appendix 5.1), one of a non-hybrid product (i.e. Discman) and one of a hybrid product (i.e. television-video recorder). The television-video recorder (TV-VR) and the Discman were selected from a pool of approximately 20 both hybrid and non-hybrid products, because apart from the fact that one is a hybrid and one is not, these two product seemed to match with regard to most other aspects. In particular, both products are the same type of product, i.e. they both belong to the superordinate category of basic audiovisual equipment, and both products have been on the market for several years and seem to have sufficient levels of market penetration. The time that a product has been on the market and the level of market penetration are important variables as they affect consumers’ familiarity with a product. Familiarity, in turn, could confound possible effects of hybridity, which was the independent variable in the study. For this reason, familiarity of both products was assessed in a pretest among 11 individuals. The mean
familiarity score (on a 7-point scale) was 4.91 \( (SD = 0.83) \) for the television-video recorder and 5.36 \( (SD = 1.12) \) for the Discman. The difference was not significant \( (t_{23} = 1.08; p = .293) \).

**Procedure**

The experiment was administered individually. Half of the participants received the picture of the Discman \( (n = 23) \); the other half received the picture of the television-video recorder \( (n = 21) \). To control for age and gender effects, the two groups of participants were matched with regard to these variables. After having looked at the picture, participants spent approximately 25 minutes filling out a questionnaire.

**Measures**

A three-item *familiarity* scale was included as a control variable (Cronbach’s \( \alpha = 0.89 \)). The items were:

1. I do not know this product [1] - I know this product [7];
2. This product does not seem familiar to me [1] - This product seems familiar to me [7];
3. I have rarely seen this product [1] - I have often seen this product [7].

**Ambiguity** was measured by five items (Cronbach’s \( \alpha = 0.93 \)), namely:

1. How much confusion does the product evoke?
   \( (1 = \text{no confusion at all}; 7 = \text{a lot of confusion}) \);
2. How certain are you that you know what the product is?
   \( (1 = \text{very certain}; 7 = \text{not certain at all}) \);
3. How clear is this product to you?
   \( (1 = \text{not clear at all}; 7 = \text{very clear}) \);
4. I need more information to be able to tell what the product is
   \( (1 = \text{not agree at all}; 7 = \text{totally agree}) \);
5. I need more information to be able to determine what the use of the product is
   \( (1 = \text{not agree at all}; 7 = \text{totally agree}) \).

**Cognitive effort** was scored on two items (Pearson \( r = 0.73 \)):

1. How difficult was it for you to determine what the product is?
   \( (1 = \text{very easy}; 7 = \text{very difficult}) \);
2. How difficult was it for you to name the product?
   \( (1 = \text{very easy}; 7 = \text{very difficult}) \).

The first question relates to the identification aspect of categorization, whereas the second taps into its linguistic aspect. The above questions constitute an indirect measure of cognitive effort, assuming that greater perceived difficulty indicates higher levels of classification effort.

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**Note 2** All scales used in this study were bipolar 7-point scales, unless noted otherwise. The original questions were posed in Dutch, so the exact wording may differ slightly from the translations reported here. These original questions can be found in Appendix 5.2.
The number of correct classifications, i.e. classification accuracy, was determined by asking participants what the product was. This response could be either correct or incorrect, with a correct answer implying that participants mentioned the specific category to which the product belonged (i.e. Discman and television-video recorder).

Participants’ perceptions of product oddity were measured using three statements (Cronbach’s $\alpha = 0.74$):

1. I think this product is common [1] – I think this product is uncommon [7].
2. I think this product is usual [1] – I think this product is unusual [7].
3. I think this product is odd [1] – I think this product is not odd [7].

### 5.2.2 Results

An independent samples T-test of the mean familiarity scores yielded a non-significant difference (television-video recorder: $M = 4.70$; Discman: $M = 5.52$; $t_{48} = 1.65$; $p = .106$), meaning that the television-video recorder and Discman were perceived to be equally familiar.

The first hypothesis stated that hybrid products (i.e. television-video recorder) are more ambiguous than non-hybrid products (i.e. Discman). An independent samples T-test confirmed the hypothesis ($t_{48} = 1.82$; one-tailed probability $p < .05$). The television-video recorder was perceived as being more ambiguous ($M = 2.51$) than the Discman ($M = 1.68$).

With regard to cognitive effort, an independent samples T-test yielded a significant difference between the television-video recorder and the Discman ($t_{48} = 2.74$; one-tailed probability $p < .01$). Participants reported that it was more difficult to categorize the television-video recorder ($M = 3.14$) than it was to categorize the Discman ($M = 1.89$). Thus, Hypothesis 2 was supported.

To test the third hypothesis, that the number of inaccurate classifications will be higher for hybrids than for non-hybrids, a 2 x 2 cross table was calculated. Of the 23 classifications of the Discman, 20 (87 percent) were correct and 3 (13 percent) were incorrect. For the television-video recorder ($n = 21$) the percentages were 86 and 14. The highly similar percentages make clear that there was no difference between the non-hybrid and hybrid condition with regard to the number of accurate classifications (Fisher’s exact test: one-sided $p = .662$). Moreover, the percentage of accurate classifications was very high in both cases. Hypothesis 3 was rejected.

Finally, participants’ perceptions of product oddity were considered. The television-video recorder was judged as being significantly more odd than the Discman ($M = 3.54$ versus $M = 2.42$; $t_{48} = 3.36$; one-tailed probability $p$
< .001), thus confirming the fourth hypothesis. Table 5.1 summarizes the results.

Table 5.1
Summary of Results

<table>
<thead>
<tr>
<th>Hypothesis</th>
<th>Measure</th>
<th>Difference</th>
<th>Hypothesis</th>
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<tr>
<td>H = Hybrid</td>
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<tr>
<td>NH = Non-hybrid</td>
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<td></td>
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<tr>
<td>H1 Ambiguity</td>
<td>TV-VR</td>
<td>mean 2.51</td>
<td>Significant</td>
</tr>
<tr>
<td>H &gt; NH</td>
<td>Discman</td>
<td>mean 1.68</td>
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</tr>
<tr>
<td>H2 Cognitive effort</td>
<td>TV-VR</td>
<td>mean 3.14</td>
<td>Significant</td>
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<tr>
<td>H &gt; NH</td>
<td>Discman</td>
<td>mean 1.89</td>
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<tr>
<td>H3 Classification accuracy</td>
<td>TV-VR</td>
<td>% accurate</td>
<td>86</td>
</tr>
<tr>
<td>H &lt; NH</td>
<td>% accurate</td>
<td>87</td>
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<tr>
<td>H4 Oddity</td>
<td>TV-VR</td>
<td>mean 3.54</td>
<td>Significant</td>
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<tr>
<td>H &gt; NH</td>
<td>Discman</td>
<td>mean 2.42</td>
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5.2.3 Discussion

The results of Study 4a support the assumption that hybrid products are indeed more ambiguous than non-hybrids. As a result, categorization of hybrid products requires greater cognitive effort. Furthermore, consumers think that hybrid products are odd compared to non-hybrid products. Contrary to expectation, however, categorization of hybrid products appears to be as accurate as categorization of non-hybrid products. An explanation for this last finding may be that the hybrid product used in the study (i.e. the television-video recorder) is a familiar hybrid product. Most consumers are familiar nowadays with television-video recorders, many of them even owning one. As a result, consumers are quite accurate at assessing category membership for the television-video recorder, in spite of the fact that they could also have classified it as a television or a video recorder.

The question is then what effect familiarity has on the classification of hybrid products. Familiarity has been defined in several ways. According to Mandler (1982, p. 26), "the common-sense notion of familiarity implies that there exists a representation (a schema) that ‘fits’ the encoded event". Barsalou (1985, p. 631) defines familiarity as "someone's subjective estimate of how often they have experienced an entity across all contexts". Loken and Ward (1990, p. 111) maintain that "in categorization research, familiarity is usually measured as perceived knowledge about an item, also referred to as its meaningfulness". Here, Mandler’s common-sense notion is adopted, because it captures the idea that familiarity is related to frequency of exposure, perceived knowledge and meaningfulness. Thus, familiarity means category availability and refers to the presence or absence in
consumers' minds of a naive theory (see chapter 2) about the object under consideration.

How would the categorization of unfamiliar hybrid products develop? For unfamiliar hybrid products, no hybrid category AB (yet) exists. Consequently, the categorization process that was portrayed in Figure 5.1 and described in section 5.1 will be different in the sense that the classification options have changed. An additional study explored whether the differences between the categorization of hybrid and non-hybrid products that were found for the familiar television-video recorder and Discman also hold for unfamiliar products. The next section will briefly describe the categorization process of unfamiliar hybrid and non-hybrid products and report the findings of the empirical study.

5.3 Study 4b: The Effect of Hybridity on Consumer Categorization of Unfamiliar Products

In the case of unfamiliar products, the comparison processes of non-hybrid and hybrid products from Figure 5.1 can be illustrated as follows (Figure 5.2).

Figure 5.2
Schematic Illustration of the Categorization of Unfamiliar Non-Hybrid and Hybrid Products

Product instance  Comparison  Target category

Non-hybrid X  \( \rightarrow \)  ?

Hybrid AB  \( \rightarrow \)  A'  \( \rightarrow \)  B'  \( \rightarrow \)  ?

Again, non-hybrid products are indicated by the letter X, hybrid products by the letters AB, and the source categories by the letters A and B. The difference with Figure 5.2 is the availability of target categories. For unfamiliar products, the target categories X' and AB', corresponding to the non-hybrid X and hybrid AB (indicated by the question marks), do not exist. With regard to unfamiliar products, consumers do not know what the
unfamiliar instance X (or AB) is. Although X (AB) may cause activity in memory, no specific product schema X' (AB') that matches the instance will become available. Thus, the unfamiliar product X (AB) can not be straightly fitted or assimilated into an existing category. Instead, a new category will have to be formed.

In the case of an unfamiliar hybrid AB, though, consumers have an alternative to make sense of the new instance. They may accommodate the unfamiliar hybrid into one of its familiar source categories, rather than creating a new one. The advantage of such a strategy is that it requires much less cognitive effort. In order for accommodation to take place, it is necessary for the unfamiliar hybrid to be associated with one of its source products, which may then serve as the target category into which the hybrid product can be integrated as a subcategory. The binoculars-Walkman combination, for instance, could become a subcategory within the binoculars or Walkman category. However, a scenario like this will only occur, if the congruity between the unfamiliar hybrid and the source category (whether it pertains to function, appearance, use or whatever other aspect) is sufficiently high. Otherwise, creating a new schema is the only remaining option. In general, new schema creation will be the most probable strategy to classify unfamiliar hybrid products, because the integration of two source products makes the unfamiliar combination so different from both the familiar source categories that it cannot be incorporated into either one of them without violating their within-category similarity structure. Nevertheless, as the creation of a new category is an effortful operation, the possibility that consumers opt for the relatively easy strategy of accommodation after all, cannot be ruled out completely.

In conclusion, under conditions of unfamiliarity, neither hybrid nor non-hybrid products can be easily categorized. Both types of products lack corresponding target categories. In the case of hybrid products, categorization may even be easier as the hybrid's source categories make for potential target categories. Still, it is difficult to foresee how classification will take place. With regard to the four hypotheses about familiar products, then, it is hard to predict how they will hold in the case of unfamiliar products. For example, will unfamiliar hybrid products be more ambiguous than unfamiliar non-hybrids? Probably not, since both products are unknown to consumers so confusion is likely to be high anyway. Similarly, cognitive effort can be expected to be high and classification accuracy to be poor for both hybrids and non-hybrids. Perceived oddity may be the only variable that will differ between hybrids and non-hybrids, because consumers will be able to recognize the source products. Taking everything into consideration, including the fact that testing null-hypotheses (i.e. no differences between hybrids and non-hybrids) is problematic, no specific hypotheses will be tested in the forthcoming study. Instead, Study 4b serves as an exploration into the moderating effect of unfamiliarity on hybridity.
5.3.1 Participants, Stimulus Material, Procedure and Measures

Forty-five members (24 men and 21 women) of the Product Evaluation Laboratory household panel voluntarily participated in the study (average age was 41.2 years). Participation took about 30 minutes and was rewarded with a small financial compensation. The stimulus material (Appendix 5.3) were pictures of a non-hybrid juice centrifuge ($n = 22$) and a hybrid hair dryer-iron combination ($n = 23$). The procedure was identical to that of Study 4a and so were the measures (Cronbach's $\alpha$ was 0.91 for the ambiguity scale and 0.78 for product oddity; the Pearson correlation between the items measuring cognitive effort was 0.58).

5.3.2 Results

First, in order to check whether the hair dryer-iron and the juice centrifuge were equally unfamiliar, an independent samples $t$-test was carried out on the mean familiarity score (Cronbach's $\alpha = 0.60$). This analysis yielded a marginally significant difference ($t_{43} = 2.01; p = .051$). Participants were less familiar with the hair dryer-iron ($M = 1.63$) than with the juice centrifuge ($M = 2.28$).

With the familiar products, the hybrid television-video recorder was more ambiguous than the non-hybrid Discman. In the case of the unfamiliar products, no significant difference regarding ambiguity was found ($t_{43} = 0.012; p = .990$). The mean ambiguity was the same for the hair dryer-iron ($M = 5.12$) and the juice centrifuge ($M = 5.13$).

A similar outcome appeared with respect to the degree of cognitive effort involved in the categorization process. Categorizing the hair dryer-iron required as much cognitive effort ($M = 4.91$) as categorizing the juice centrifuge ($M = 5.07; t_{43} = 0.388; p = .700$).

The number of accurate classifications was higher for the juice centrifuge than for the hair dryer-iron. A 2 x 2 cross table revealed that 7 out of 22 classifications of the juice centrifuge were correct (31.8 percent) against 2 out of 22 (9.1 percent) for the iron-hair dryer. This difference was marginally significant (Fisher's exact test: one-sided $p = .066$). An analysis was made of the type of inaccurate classification that participants made. In the case of hybrid products, participants could be expected to use one of the source categories (i.e. hair dryer or iron) as the target category. As participants indicated what they thought the unfamiliar product was, it was possible to assess whether the iron-hair dryer combination was categorized as...

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Note 3 The result of the pretest ($N = 11$) were as follows: hair-dryer-iron: $M = 2.09$ ($SD = 0.83$); juice centrifuge $M = 2.27$ ($SD = 0.79$). The difference was not significant ($t_{50} = 0.527; p = .604$). The 7-point familiarity scale was the same one that was used for the television-video recorder and the Discman.

Note 4 The result of one subject was missing, therefore $n = 22$. 
as either an iron or a hair dryer. Appendix 5.4 lists the product names that subjects gave to both the juice centrifuge and the iron-hair dryer. Out of the 20 incorrect classifications of the iron-hair dryer, 13 were false in the sense that the mentioned categories did not have anything to do with the hybrid or its source products (e.g. crumb sweeper, air freshener, carpet cleaner). The remaining seven participants classified the iron-hair dryer as an iron. Nobody thought it was a hair dryer. These findings suggest that consumers who are unable to categorize an unfamiliar hybrid, but who do recognize (at least one of) the source products, will categorize the hybrid into the source category to which it is most visually similar (i.e. the most clearly perceptible source category).

The only significant difference between the hybrid and non-hybrid was found for perceived oddity ($t_{53} = 3.18; p < .01$). Participants indicated that the hair dryer-iron ($M = 5.13$) was more odd than the juice centrifuge ($M = 3.95$). Table 5.2 summarizes the results for the unfamiliar products.

<table>
<thead>
<tr>
<th>Result</th>
<th>Measure</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambiguity</td>
<td>Hair dryer-iron mean 5.12</td>
<td>Not significant</td>
</tr>
<tr>
<td></td>
<td>Juice centrifuge mean 5.13</td>
<td></td>
</tr>
<tr>
<td>Cognitive effort</td>
<td>Hair dryer-iron mean 4.91</td>
<td>Not significant</td>
</tr>
<tr>
<td></td>
<td>Juice centrifuge mean 5.07</td>
<td></td>
</tr>
<tr>
<td>Classification accuracy</td>
<td>Hair dryer-iron % accurate 9</td>
<td>Marginally significant</td>
</tr>
<tr>
<td></td>
<td>Juice centrifuge % accurate 32</td>
<td></td>
</tr>
<tr>
<td>Oddity</td>
<td>Hair dryer-iron mean 5.13</td>
<td>Significant</td>
</tr>
<tr>
<td></td>
<td>Juice centrifuge mean 3.95</td>
<td></td>
</tr>
</tbody>
</table>

5.3.3 Discussion

The findings regarding the hair dryer-iron and juice centrifuge appear to support the notion that product hybridity does not affect categorization under conditions of unfamiliarity. Intuitively, it makes sense that, if consumers are unaware of what a product is, it does not matter whether it is hybrid or not. Categorization will be difficult, if not impossible, anyway. In this light, it comes as no surprise that no or only marginally significant differences were found between the hair dryer-iron and juice centrifuge with respect to category ambiguity, cognitive effort and classification accuracy.

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Note 5 A striking observation is that 7 participants thought that the hair dryer-iron was a kind of carpet or floor cleaner. Apparently, for a substantial number of participants the appearance of the hair dryer-iron was associated with this completely different product category, indicating that the design of the hair dryer-iron failed to communicate its identity clearly.
Given these findings, the observed difference for perceived oddity is unexpected, however. Why would people find one product more odd than another, if both products are unknown to them? A possible explanation was suggested earlier, namely that people, unfamiliar with the hybrid as a whole, do in fact recognize the familiar source products that make up the unfamiliar hybrid and are surprised by their unanticipated combination. In the case of unfamiliar non-hybrids, such a process of recognition will be absent.

An alternative explanation should be mentioned here, namely that the difference regarding oddity was an effect of familiarity instead of hybridity. The hair dryer-iron was judged to be less familiar than the juice centrifuge, albeit that the difference was only marginally significant. Therefore, it is possible that participants found the hair dryer-iron odd compared to the juice centrifuge, because it was less familiar and not because it was hybrid. If this is the case, the remaining dependent variables (ambiguity, cognitive effort and classification accuracy) may have been affected by familiarity in a similar way. The mean scores from Table 5.2 refute this supposition. If familiarity had had a substantial effect on ambiguity and cognitive effort, the hair dryer-iron should have been significantly more ambiguous and should have required more cognitive effort than the juice centrifuge, because both unfamiliarity and hybridity would lead to higher ambiguity and greater cognitive effort. In other words, the familiarity effect should have enhanced the hybridity effect. Since this did not happen for ambiguity and cognitive effort, it is implausible that familiarity significantly influenced classification accuracy and oddity. Hence, the first explanation is preferable to the second.

5.4 General Discussion

The aim of this chapter was to test the central assumption of the dissertation that the categorization process of hybrid products occurs differently than that of non-hybrid products, because hybrid products are more ambiguous. On the basis of a simple model, describing the product categorization process as a comparison process between a product instance and the product knowledge (product schema) available in consumer memory, the differences between the categorization of hybrid and non-hybrid products were explained. Since the categorization process of hybrid products is characterized by the presence of multiple congruent target categories compared to a single target category for non-hybrid products, classifying hybrid products was theorized to involve more cognitive effort and to lead to greater classification inaccuracy. Furthermore, the unanticipated combination of source products appears was predicted to make hybrid products more odd in the eyes of consumers than non-hybrids.

An empirical study was conducted to test these hypotheses. A limitation of this study was that it did not incorporate the influence of product familiarity
on the categorization process of hybrid and non-hybrid products. The stimulus material consisted of a familiar hybrid and a familiar non-hybrid product only. For this reason, a second study was carried out with unfamiliar stimuli. The outcomes of both studies are briefly summarized below, followed by a discussion of the effect of hybridity on product categorization and the role that familiarity may play in this process. First, the limitations of the studies are described.

5.4.1 Research Limitations

The most important limitation of the research reported in this chapter concerns the generalizability of the results. Conclusions are based on consumers' judgments about four stimuli, each representing an entire class of products (i.e. familiar non-hybrids, familiar hybrids, unfamiliar non-hybrids and unfamiliar hybrids). Moreover, the theoretical model on which the studies were based, as well as the studies themselves, are fairly coarse and superficial. For this reason, the outcomes of Studies 4a and 4b do not justify strong conclusions and should be treated with great care and reserve. Nor do they provide profound insight into hybrid products and their categorization. The investigation should be replicated with different stimuli to enhance reliability. The value of these initial studies sooner lies in generating ideas and providing directions that can be explored in depth in subsequent research. Chapters six and seven will present two studies that examine the categorization process of hybrid products more closely.

Rather than a limitation, the next point concerns a fundamental problem that characterizes research into the classification of unfamiliar hybrid products. How are consumers to know that something is a hybrid product when they do not even know what the product is? To illustrate, when asked whether the hair dryer-iron was a combination of multiple products, only 74 percent of the participants answered affirmatively. This means, that over a quarter of the participants did not know that the hair dryer-iron was a hybrid product. This percentage may easily reach 80, 90 or even 100 percent for hybrids that have an appearance on the basis of which the source products are difficult or impossible to recognize (e.g. message watch, fax-scanner-copier). The solution to this problem would seem to be simple: just tell participants what the product is and that it is a hybrid. Of course, by telling people that a product is a hybrid, their classification process, which is exactly the process under investigation, will simultaneously be affected. A

Note 6 It is informative to know that another stimulus was included in the study, namely a 100-CD player (see Appendix 5.5), which substituted the unfamiliar non-hybrid juice centrifuge. The familiarity score for the 100-CD player was almost identical to the score of the juice centrifuge. When the 100-CD player was used in the analyses, the results were exactly similar. However limited this replication may be, the fact that a part of the results were exactly replicated using a different stimulus makes the reported conclusions a little more reliable.

Note 7 When this is the case, it will be necessary to use stimulus material that is not merely pictorial, but verbal as well.
solution to this problem does not seem to be readily available. One option would be to take a middle course; present participants with an unfamiliar hybrid product, explain what it can do, and then start the experiment. In this way, consumers know that the product is a hybrid before the familiarization process has taken place (i.e. a product schema has not been developed yet). This approach was taken in Study 5 described in the next chapter.

5.4.2 The Effect of Hybridity on Consumer Product Categorization

Are there any differences in the way that consumers categorize hybrid products compared to how they classify non-hybrid products? What is the effect of product familiarity on the categorization of hybrid versus non-hybrid products? The findings with regard to the familiar television-video recorder and Discman suggest that hybrids are more ambiguous than non-hybrids, that their classification involves greater cognitive effort, and that consumers think they are more odd. As theorized earlier, these differences are believed to stem from the double identity that hybrid products possess. The current findings provide support for this idea.

Contrary to expectation, consumers seem to be as accurate in classifying hybrid products as they are in categorizing non-hybrids. This finding is most likely the result of the fact that the television-video recorder was a familiar hybrid product. When consumers are highly familiar with a hybrid product, they are capable of considering all of its aspects, which makes it unlikely that they will be "deceived" by the hybrid and mistakenly classify it into one of the source categories.

The outcome regarding classification accuracy was the reason for conducting an additional study with unfamiliar products. Indeed, classification accuracy proved to be poorer for the hair dryer-iron than for the juice centrifuge. With respect to ambiguity and cognitive effort, however, the hybrid and non-hybrid no longer differed. A possible explanation for the absence of a hybridity effect for these variables is that participants were not aware of the double identity of the hybrid product, i.e. they did not recognize the iron-hair dryer as a hybrid product. Although this is a plausible idea, it is contradicted by an additional finding of the study. When participants were asked whether the hair dryer-iron was a combination of products, 74 percent answered that they thought it was (although some of them were wrong in the sense that they recognized incorrect source products, like a sanding machine, clothes brush or air freshener). In conclusion, the majority of the participants were clearly aware of the hybrid nature of the iron-hair dryer.

An alternative, more plausible explanation reads that the total absence of a product schema into which the unfamiliar hybrid or non-hybrid product can be classified is responsible for the lack of influence of the product's
hybridity. Consumers simply do not know what the new product is. Under such conditions, ambiguity and cognitive effort are probably high, irrespective of whether the product is a hybrid or not. This is not to say, though, that hybridity has no effect at all on consumer product categorization. First of all, classification was more accurate for non-hybrid than for hybrid products. The type of inaccurate classifications that participants made also revealed an effect of hybridity. In the case of the juice centrifuge, participants just guessed what the product was. In contrast, about one-third of the participants who saw the iron-hair dryer thought that it was an iron. Evidently, in the absence of a clear target category, participants decided that the best option was to assign the hybrid product to one of its source categories, namely the one that was most clearly perceptible in the picture. The second finding that suggests that hybridity affects consumers, even if they do not know the hybrid, is the observation that participants considered the hair dryer-iron to be more odd than the juice centrifuge. Apparently, consumers recognize the particular combination of familiar source products despite the fact that they are unable to identify the product in its entirety.

Taken together, the outcomes of Studies 4a and 4b suggest that hybridity plays a role in the categorization process of familiar as well as unfamiliar products, but that in the latter case this role is only modest. The effect of familiarity on the categorization of hybrid products is far from clear, though. An obvious and practically highly relevant question, for instance, is what will happen if unfamiliar hybrid products become familiar over time. Will the categorization process be different, or will category membership change? Will a hybrid product still be a hybrid product, when consumers have fully incorporated the product concept into their categorical structures, or will it in due course become a non-hybrid product? Chapter 6 will address these questions and explore familiarization effects on the categorization of hybrid products further.
6 The Effect of Familiarization on the Categorization of New Hybrid Products

The empirical study reported in this chapter extends on the Studies 4a and 4b by investigating how the categorization process of new hybrid products is affected by the fact that over time consumers become familiar with them. After a hybrid product has come on the market, consumers become acquainted with it. Consumers start using the hybrid, which provides them with product knowledge they did not possess at the moment it was introduced. As a result of this familiarization process, the classification of the hybrid may change. Imagine a consumer who has bought a fax-scanner-copier. In the beginning, the hybrid is perceived as a really new product combination and will be used for sending faxes, scanning pictures and copying documents. After a while, however, the initial novelty wears off, and the consumer may find her-/himself using the hybrid product primarily as a regular fax machine, because the scanning and copying functions are required less often, or perform below the consumer's quality standards. Thus, after a few months, the hybrid is used almost exclusively for faxing, and so the product becomes nothing other than a sophisticated fax. In the case of the fax-scanner-copier, the initial categorization as a new hybrid product has shifted towards a perception of the hybrid as an enhanced source product (i.e. a sophisticated fax).

Similarly, as described for the fax-scanner-copier, the classification of any new hybrid product may alter as a result of experience. The GSM phone with games and internet may be used predominantly to place ordinary calls, the television-video recorder may be used primarily to watch television, and - in the presence of a decent hi-fi set - the alarm clock-radio may never be used to listen to but simply to be woken up by. In sum, the main idea

Note 1 The opposite may also occur. By using a new product, consumers may discover unexpected functions, functions they did not know the new product possessed, like in the case of most contemporary computer applications. For new hybrid products, such a scenario seems unlikely, since hybrid products are generally bought for their multi-functionality and consumers are aware of the different functions of the hybrid when they buy it.
examine the present chapter is that consumers' actual experience with a hybrid product results in a shift of its category membership. This idea is explained further in section 6.1, which ends with the research hypotheses. The design and results of the empirical study that was conducted to test these hypotheses are described in section 6.2. Additional results regarding the general evaluation of the hybrid products that were used as stimuli in Study 5 are reported in section 6.3, followed by the general discussion in section 6.4.

6.1 How Product Experience Influences Category Membership of Hybrid Products

When consumers are confronted with a new hybrid product, for example in a television or magazine ad, their initial response will be an attempt to classify it by searching the available categories in memory for an appropriate target category (see chapters 2 and 5 for a description of the classification process of hybrid products). Since the hybrid product is new, consumers will not possess a specific (hybrid) category for it (see Figure 5.2). Therefore, they will look for an alternative target category that may not be tailored to the hybrid combination but that is sufficiently fitting. Literature on categorization shows that consumers attempt to understand new products in terms of what they already know (Ratneshwar and Shocker 1988) and so the most likely target categories will be those of the source products that constitute the hybrid. As a hybrid consists of essential features of both source products, it will not fit into either of the source categories. The essential features of source category A will prevent classification into source category B and vice versa. Consumers will therefore be forced to regard the hybrid as a category of its own, similar to (but clearly different from) its source categories. Through a process known as categorization-based knowledge transfer (Gregan-Paxton and Roedder John 1997; Moreau, Markman, and Lehman 1999), consumers build this new hybrid category on the basis of the knowledge, experiences, and expectations they have about the source products that make up the hybrid.

When the above-mentioned process is successfully completed, consumers' cognitive structures are enriched with a proper category for the hybrid product under consideration. When additional exposures to the product occur, consumers' direct and indirect experience will expand their categorical knowledge of the product (Alba and Hutchinson 1987). Ross (1996) posits that interacting with products may affect category representation and classification; by using products consumers may learn additional information about the products that would otherwise have remained hidden. This new information leads consumers to focus more on the attributes that are important for how the product is being used, than merely on the easily observable attributes that predict the category. Three ways in which this might happen are that: (1) interaction may change the attribute weights by
drawing attention towards use-relevant attributes; (2) interaction reveals defining attributes that were previously unnoticeable; and (3) interaction makes consumers aware of correlations between attributes or it helps them to better understand the relation between attributes and their use. The notion that attribute weight may change over time is supported by research of Mittal, Kumar and Tsiros (1999) in a longitudinal study into the satisfaction with cars. They found that for consumers who had just bought a car, service attributes were most important. After 21 months, during which period consumers had used the car and learned about its functionalities, the same consumers now thought that product-specific attributes were the most important. Apparently, familiarization with the car itself caused a shift in attribute importance.

For hybrid products, the above implies that interaction with the product may change the set of defining attributes of the hybrid and, consequently, its classification. For instance, by using the fax-scanner-copier predominantly as a fax, the attributes related to the scanner and copier functions become less noticeable and less important, whilst at the same time the fax-defining attributes become highly salient. The effect of the interaction is twofold. The attributes of the fax-scanner-copier that initially prevented classification into the fax category (i.e. the scanner and copier attributes) lose their category-defining status; classification into the source categories will therefore no longer be obstructed. Moreover, the increased salience of the fax-related attributes favors the classification of the hybrid as a fax. Together, the effects of consumer interaction with the fax-scanner-copier steer categorization towards the fax source category rather than towards the hybrid category.

In short, as consumers become familiar with a hybrid product, they are likely to gain more experience with one of the product's functions than with the other(s), a point that has been illustrated by the examples of fax-scanner-copier, GSM-phone, television-video recorder and alarm clock-radio. This will be the case for most hybrid products as the usage intensity of the individual source products is likely to differ (e.g. a television is used more frequently and with greater intensity than a video recorder). As a result, the knowledge and experience attached to the hybrid category become more and more similar to those attached to the usage-dominant source category. In other words, consumers perceive the hybrid product to be more congruent to the source product from which the most frequently used function is derived, and they are more likely to (re)categorize (Fiske, Lin, and Neuberg 1999) the hybrid as a specific exemplar or subtype of the category of this source product (i.e. enhanced fax machine) than to classify it in a category of its own (i.e. fax-scanner-copier). Thus, the first hypothesis states that:
Hypothesis 1
Compared to hybrid products with which consumers are unfamiliar, familiar hybrid products will less often be classified into a category of their own.

It should be noted that it is possible that category membership for a hybrid product remains unaltered (although it is hard to think of an example of a familiar hybrid of which the usage intensity of the source products is approximately equal). For this reason, familiar hybrid products are hypothesized to be classified into a category of their own less often than unfamiliar hybrids rather than not or never at all.

The implicit assumption in Hypothesis 1 is that familiar hybrids will be more congruent with one source category than with the other (and will thus not be classified into a category of their own). For unfamiliar hybrids such an imbalance is not expected, because consumers' lack of experience with unfamiliar hybrid products has prevented the development of a usage-dominant source category:

Hypothesis 2
Compared to hybrid products with which consumers are unfamiliar, familiar hybrid products are more likely to be perceived as more congruent with one source product than with the other.

A further difference between familiar and unfamiliar hybrids concerns the degree of cognitive effort involved in their classification. In terms of the typology of Cherian and Jones (see chapter 2), consumers who classify an unfamiliar hybrid product need to build a new schema based on the knowledge they possess about the source categories the hybrid is composed of. Building a new schema involves high levels of cognitive effort. In contrast, classification of a familiar hybrid product does not require the creation of a completely new schema. Instead, a familiar hybrid will be accommodated, i.e. it will be identified, as a subcategory of the most congruent source category. As Cherian and Jones (1991) have argued, accommodation requires considerably less cognitive effort than the forming of a new schema. This idea is captured by the final hypothesis:

Hypothesis 3
The categorization of familiar hybrid products will be characterized by lower levels of cognitive effort than the categorization of unfamiliar hybrid products.
6.2 Study 5: The Categorization of Familiar and Unfamiliar Hybrid Products

In Study 5 participants categorized and evaluated pictures of four different hybrid products. The design, procedure and results of the study are described below.

6.2.1 Method

Participants
The research was conducted among 44 members of the consumer panel of the Product Evaluation Laboratory of the Delft University of Technology, 21 men and 23 women, who participated on a voluntary basis. The age of the participants ranged from 18 to 65 years (average 42.5 years). Participation took one hour and was rewarded with a small financial compensation.

Stimulus Material
Appendix 6.1 shows the 12 products that were used as stimuli in the study. Of each product an A5-size photo was reproduced on a white background. The 12 pictures were divided into four sets of three (see Table 6.1). Each set contained a picture of a hybrid product and a picture of the matching source products.

<table>
<thead>
<tr>
<th>Stimulus set</th>
<th>Hybrid product (H)</th>
<th>Source product A (A)</th>
<th>Source product B (B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TV-VR</td>
<td>Television</td>
<td>Video recorder</td>
</tr>
<tr>
<td>2</td>
<td>Sofa-bed</td>
<td>Bed</td>
<td>Sofa</td>
</tr>
<tr>
<td>3</td>
<td>Hair dryer-iron</td>
<td>Hair dryer</td>
<td>Iron</td>
</tr>
<tr>
<td>4</td>
<td>Blender-scales</td>
<td>Blender</td>
<td>Scales</td>
</tr>
</tbody>
</table>

The television-video recorder (TV-VR) and sofa-bed were selected as familiar hybrids, because they have been on the market for several years and most consumers are familiar with them. In contrast, the iron-hair dryer and the blender-scales have not or have only recently been introduced to the market and have so far had a low degree of penetration, i.e. few consumers are familiar with them.

Procedure
The experiment was administered individually. After receiving a brief outline of the experimental procedure and an answering instruction (see Appendix 6.2), participants were presented with the first hybrid product picture, immediately followed by a short questionnaire with three questions about its
familiarity (manipulation check). To those participants who did not know the hybrid, the experimenter explained briefly what the product was and what it was for. This was done to make sure that every participant knew what the hybrid product was before the actual sorting task took place. Next, the experimenter showed the pictures of the corresponding source products and checked whether participants were familiar with them.

The experimental task was a classification task in which participants had to divide the stimuli within each set (i.e. the hybrid product and its accompanying source products) over three cardboard boxes. The task instructions can be found in Appendix 6.3. There were three ways to classify the stimuli. Participants could: (1) put the hybrid product in a separate box; (2) place the hybrid product together with one of its source products; or (3) place the hybrid together with both source products (i.e. put all products together). The use of the cardboard boxes forced participants to make their classification explicit.

To ascertain that participants truly understood the classification task and to make them aware of different classification options, they practiced the experimental task with a set of product pictures that were unrelated to the stimuli of the study (i.e. pictures of a coffee table, a chair and a bookcase). Participants were asked to explain the reason for their classification. Subsequently, the experimenter demonstrated several alternative classifications. Then, a picture of a buffet replaced the picture of the coffee table and the whole procedure was repeated. Again, the experimenter highlighted several alternatives. This procedure was designed to illustrate to participants that there were many different options to divide the pictures among the boxes and many different reasons for doing so (see Table 6.2).

<table>
<thead>
<tr>
<th>Classification</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>[T/C/B]</td>
<td>T, C and B are all furniture</td>
</tr>
<tr>
<td>[T/C] [B]</td>
<td>T and C are often used together</td>
</tr>
<tr>
<td>[T/B] [C]</td>
<td>T and B are both made of wood</td>
</tr>
<tr>
<td>[T] [C] [B]</td>
<td>T, C and B are clearly different things with different functions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>[C/B/F]</td>
<td>C, B and F are all furniture</td>
</tr>
<tr>
<td>[B/F] [C]</td>
<td>B and F are both cupboards</td>
</tr>
<tr>
<td>[C/F] [B]</td>
<td>C and F have the same color</td>
</tr>
<tr>
<td>[C] [B] [F]</td>
<td>All products are used for different things. B and F may both be cupboards, but they serve very distinct purposes</td>
</tr>
</tbody>
</table>

1 Each separate group stands between brackets.
At the end of the two practice rounds, the experimenter emphasized that the illustrated classifications were merely examples of how the stimuli could be classified. Participants were told to make their own classifications, based on any aspect of the products that seemed relevant to them, and that there were no (in)correct classifications. After having indicated that everything was clear, participants started with the classification of the stimulus sets. Following each classification, the experimenter put a blank sheet of paper in every box to diminish the risk that an ongoing classification would be influenced by the visible result of the previous classification. To neutralize possible effects of the presentation order, the four stimulus sets were presented to participants in a random order.

After participants had classified all sets, a set of congruity measures was obtained with regard to each hybrid product (see "Measures"). Due to stringent time constraints (there was a one-hour time limit), panel members could be invited for a maximum of one hour) several participants did not manage to complete the congruity measures for all of the hybrid products. Most of them provided congruity scores for two or three of them. This means that in the analyses involving the congruity measures the sample size is less than the total of 44 (sample sizes are 24 for the hair dryer-iron and the sofa-bed and 25 for the blender-scales and the television-video recorder). Examination of the mean congruity scores revealed that these scores did not differ between participants who managed to complete the measures for all stimuli and those unable to judge the entire set.

The experiment finished when participants had provided congruity scores for the complete set of hybrid products or when they had run out of time. Before participants left, they were debriefed and received their compensation.

Measures

Product familiarity was assessed by means of the same three items that were used in the studies 4a and 4b. The first item measured whether participants knew the product ("Ik ken dit product niet" – "Ik ken dit product"), the second item measured whether the product seemed familiar or not ("Dit product komt me niet bekend voor" – "Dit product komt me bekend voor"), and the third item measured the frequency of exposure ("Ik heb dit product nog niet vaak gezien" – "Ik heb dit product al vaak gezien"). The items were measured on 7-point scales with higher values indicating greater familiarity. Cronbach’s α for the three-item familiarity scale was 0.95.

The first dependent variable in this study concerned the classification of the hybrid product. The hybrid product within each stimulus set could either be categorized into a separate category or not. Participants who decided to do the former could do so in two ways. They could either put every product into a separate category ([H] [A] [B]) or they could keep the hybrid apart and the source products together ([H] [A/B]). Those who did not keep the hybrid
apart could either put the hybrid together with one of its source products ([H/A] [B] or [H/B] [A]) or they could put all the products together ([H/A/B]).

The second dependent variable, congruity of the hybrid with the source products, was measured using two questions, measured on 7-point scales: (1) “To what extent do you find this product to be a good example of a television?” (“In hoeverre vindt u dit product een goed voorbeeld van een televisie, als u let op het product als geheel?”); and (2) “To what extent do you find this product to be a good example of a video recorder” (“In hoeverre vindt u dit product een goed voorbeeld van een video recorder, als u let op het product als geheel?”). Obviously, the questions regarding the other hybrid products included the category names of their source products. Higher values corresponded to higher levels of congruity.

Two items measured on a 7-point scale were used to determine the degree of cognitive effort, the third dependent variable. Participants were asked how difficult it was to divide the pictures among the boxes (“In hoeverre had u moeite met het verdelen van de plaatjes over de dozen?”), and how difficult it was to determine which products belonged together (“In hoeverre vond u het moeilijk om te bepalen of producten bij elkaar hoorden?”). Greater difficulty (i.e. a higher score) was assumed to concur with higher levels of cognitive effort. The Pearson correlation between the two items was 0.75 ($p < .001$). A single scale was constructed by computing the average of the scores on both items.

6.2.2 Results

Manipulation check

The average familiarity score was 6.52 for the familiar hybrids and 2.02 for the unfamiliar hybrids. A repeated-measures ANOVA ($n = 44$) yielded a significant difference (Wilks' $\lambda = 0.081$; $F_{3,41} = 154.96$; one-tailed $p < .001$). The mean familiarity scores of the television-video recorder and the sofa-bed did not differ significantly (television-video recorder = 6.39; sofa-bed = 6.64; $F_{1,43} = 2.41; p = .128$) and neither did the average familiarity scores for the hair dryer-iron and blender-scales (blender-scales = 1.95; hair dryer-iron = 2.08; $F_{1,43} = 0.182; p = .671$). Thus, the experimental manipulation of familiarity was successful.

Classification Results: Testing Hypothesis 1

The classification outcomes ($n = 176$) are presented in Table 6.3. According to Hypothesis 1, the familiar hybrids should have been classified into a separate category less often than the unfamiliar hybrids. This is exactly what happened. Looking at the classification for all four hybrids, 45.5 percent was classified into a separate category and 54.5 percent was not. When the unfamiliar and familiar hybrids are considered in isolation, a completely different pattern emerges. The unfamiliar hybrids were classified into separate categories 52 out of 88 times (59.1 percent). For the familiar hybrid
products the pattern was reversed, and the hybrid was kept separate in only 28 out of 88 classifications (31.8 percent). This difference between familiar and unfamiliar products was significant (Fisher's exact test: \( p < .001 \)). Separate tests calculated for each combination of an unfamiliar and a familiar hybrid confirmed the overall result (blender-scales with sofa-bed: Fisher's exact test: \( p = .017 \); blender-scales with television-video recorder: Fisher's exact test: \( p = .053 \); hair dryer-iron with sofa-bed: Fisher's exact test: \( p = .005 \); hair dryer-iron with television-video recorder: Fisher's exact test: \( p = .018 \)). This means that the results cannot be attributed to idiosyncratic differences between the hybrid stimuli used in the study.

Table 6.3
Classification Results

<table>
<thead>
<tr>
<th>Hybrid classified into separate category or not</th>
<th>Hybrid not apart</th>
<th>Hybrid apart</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental familiarity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unfamiliar Blender-scales</td>
<td>19</td>
<td>25</td>
<td>44</td>
</tr>
<tr>
<td>Hair dryer-iron</td>
<td>17</td>
<td>27</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>52</td>
<td>88</td>
</tr>
<tr>
<td>Percentage</td>
<td>40.9 %</td>
<td>59.1 %</td>
<td>100.0 %</td>
</tr>
<tr>
<td>Familiar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sofa-bed</td>
<td>31</td>
<td>13</td>
<td>44</td>
</tr>
<tr>
<td>TV-VR</td>
<td>29</td>
<td>15</td>
<td>44</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>28</td>
<td>88</td>
</tr>
<tr>
<td>Percentage</td>
<td>68.2 %</td>
<td>31.8 %</td>
<td>100.0 %</td>
</tr>
</tbody>
</table>

Having found evidence supporting Hypothesis 1 that familiar hybrids are less often classified into a category of their own than unfamiliar hybrids, the next step was to examine the classifications in which the hybrid product was

Note 2 The cross table contains multiple entries per individual as each participant classified all four stimulus sets. This situation is in conflict with the assumption of independent observations that is required for the application of \( \chi^2 \) tests (Hays 1988). Violating this assumption may result in unreliable estimations of the probabilities and the related significance levels. Nevertheless, all observations in the cross table were used, since the relatively small number of participants (\( N = 44 \)) would result in (too) few observations per cell. In order to check the validity of the results, the analysis was repeated with a random subsample including one observation per individual only (\( N = 44; 11 \) observations for each stimulus set). The results of this analysis supported the outcomes presented in Table 6.3. The cell frequencies were 7 and 15 (31.8 versus 68.2 percent) for the unfamiliar products and 15 and 7 for the familiar products (Fisher's exact test: \( p = .034 \)).
not set aside (i.e., 41 percent of the unfamiliar hybrids and 68 percent of the familiar hybrids). For these cases, i.e., when participants decided not to classify the hybrid into a separate category, the hybrid products could be expected to be classified together with the most congruent source product as this is the most appropriate alternative target category. This hypothesis was tested applying logistic regression analysis \( (n = 33) \) on the sample of participants that had classified the hybrid together with one of the source categories\(^3\). The predictor variable was the individual difference between the level of congruity of the hybrid with source product A and the level of congruity with source product B (i.e., calculating the difference per individual and then summing these differences). Since the congruity score with B was subtracted from the congruity score with A, a positive difference indicated that the hybrid product was perceived as more congruent with A than with B. In contrast, a negative difference implied that (in the eyes of the participants) the hybrid was more congruent with B than with A. The dependent variable in the analysis was the binary variable "hybrid classified together with A" versus "hybrid classified together with B".

The results of the analysis confirm the hypothesis. The regression model including a constant and the predictor variable is significant \( (\chi^2 = 22.57, p < .001) \). The various goodness-of-fit statistics show that the fit of the model is good \((-2 \text{ Log likelihood} = 23.15; \text{ Goodness of fit} = 19.48; \text{ Cox and Snell} R^2 = 0.50; \text{ Nagelkerke} R^2 = 0.66)\), an observation that is supported by the percentage of accurate classifications of 81.8 percent. The impact of the predictor variable on the classification is significant \( (\text{Wald} = 4.26; \text{ df} = 1; p < .05) \) with a B-value of -2.12. The negative sign of the regression weight indicates that a larger difference between the congruity with A and B (meaning that the hybrid is more congruent with A than with B) will decrease the probability that the hybrid will be classified together with B and vice versa. The results of the logistic regression analysis confirm the idea that people will categorize a hybrid product together with the most congruent source product.

Hybrid-Source Product Congruity: Testing Hypothesis 2

Hypothesis 2 stated that familiar hybrids are more likely to be more congruent with one of their source products than unfamiliar hybrids. In other words, unfamiliar hybrids are expected to be equally (in)congruent with each of its source products. In order to test this hypothesis, absolute individual differences were calculated between the congruity of the hybrid with the first source product and the congruity with the second source

\[ \text{Note 3} \]

This analysis was conducted on a sample including all four hybrid products. Ideally, as the research design was a within-subject design, we should have carried out separate logistic regression analyses for each hybrid product. Note, however, that not each respondent rated all four products (see "Procedure" section), so that such an approach was hindered by limited sample sizes. For each product, a total of 24 to 25 observations had been collected, and this sample was reduced further through the exclusion of those instances where the hybrid product was classified as a separate category. This resulted in final sample sizes per product that were too small \( (n = 6 \text{ to } n = 13) \) to allow for meaningful analyses.
product. Absolute differences were taken because the direction of the
difference was irrelevant. If Hypothesis 2 applies, the absolute mean
individual difference (Table 6.4) should be significantly lower for the
unfamiliar than for the familiar hybrids, since larger differences signify
greater imbalance between the two congruities.

<table>
<thead>
<tr>
<th>Experimental familiarity</th>
<th>Unfamiliar</th>
<th>Blender-scales</th>
<th>Hair dryer-iron</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.52</td>
<td>0.68</td>
<td>1.08</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Familiar</th>
<th>Sofa-bed</th>
<th>TV-VTR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>1.54</td>
<td>1.96</td>
</tr>
</tbody>
</table>

An independent-samples T-test \((n = 98)\) yielded a significant difference
between the unfamiliar and familiar hybrids \((t_{96} = -3.09, p < .01)\). For familiar hybrids the absolute mean individual
difference was significantly higher \((M = 1.76)\) than for unfamiliar hybrids \((M = 0.80)\), supporting Hypothesis 24.

**Degree of Cognitive Effort: Testing Hypothesis 3**

According to Hypothesis 3, cognitive effort should be greater for unfamiliar
than for familiar hybrids. The results of the repeated measures ANOVA point
out that the null-hypothesis, i.e. that the mean level of cognitive effort is
similar for all stimulus sets, should be rejected (Wilks’ \(\chi^2 = 0.740, F_{1,41} = 4.80, p < .01\)). Table 6.5 contains the mean scores. Individual contrast tests
showed non-significant differences between television-video recorder and
sofa-bed \((F_{1,43} = 2.47, p = .123)\), and hair dryer-iron and blender-scales
\((F_{1,43} = 0.092, p = .763)\). Significant differences were found between
television-video recorder and blender-scales \((F_{1,43} = 10.87, p < .01)\), television-video recorder and hair dryer-iron \((F_{1,43} = 9.57, p < .01)\).

---

**Note 4**

Since participants judged all four hybrid products, a repeated-measures ANOVA would
have been a more appropriate analysis than an independent samples T-test. Such an
analysis would, however, have led to a loss of two-thirds of the observations due to the fact
that a complete set of congruity measures had only been obtained for a relatively small
number of participants. The number of remaining observations would be too small to allow
for a sufficiently powerful repeated measures analysis. Alternatively, paired samples T-tests
were conducted for each combination of hybrid products, because in this case the number
of observations would be larger (sample sizes ranged from 14 to 19). In line with
expectation, no significant differences were found for the familiar pair (television-video
recorder and sofa-bed) and the unfamiliar pair (hair dryer-iron and blender-scales). Of the
remaining combinations of a familiar and an unfamiliar product, only the blender-scales
and television-video recorder differed significantly from each other \((p < .05)\).
< .01), sofa-bed and blenders-scales ($F_{1,43} = 3.78$; one-tailed $p < .05$), and sofa-bed and hair dryer-iron ($F_{1,43} = 3.67$; $p < .05$). In brief, both of the unfamiliar hybrids differed significantly with both familiar hybrids, but not with each other; the same applied to the familiar hybrids. Furthermore, classification of the unfamiliar hybrids involved significantly higher levels of cognitive effort than classification of the familiar hybrids ($M = 2.72$ versus $M = 1.95$). Hypothesis 3 is confirmed.

<table>
<thead>
<tr>
<th>Table 6.5</th>
<th>Mean Levels of Cognitive Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental</td>
<td>Unfamiliar</td>
</tr>
<tr>
<td>familiarity</td>
<td>Hair dryer-iron</td>
</tr>
<tr>
<td>Mean</td>
<td>2.72</td>
</tr>
<tr>
<td>Familiar</td>
<td>Sofa-bed</td>
</tr>
<tr>
<td>TV-VR</td>
<td>1.77 $^b$</td>
</tr>
<tr>
<td>Mean</td>
<td>1.95</td>
</tr>
</tbody>
</table>

1 Different lowercase characters indicate significant differences.

6.3 Additional Results from Study 5: Commonness, Understanding, Appreciation and Desire

Before discussing the previous findings, some additional results from Study 5 are reported. These concern the general impression consumers have of hybrid products. Are they at all interested in hybrid products? A number of evaluative judgments about the four hybrid products were taken after participants had finished the classification task. Participants filled out a questionnaire for the hybrid products in the same order as they had classified them during the classification task. Only thirteen participants managed to answer the questionnaire for all four hybrid products within the available time. The remaining 31 participants provided data on two or three of the hybrid products. This resulted in sample sizes of 24 for the hair dryer-iron and the sofa-bed and 25 for the blender-scales and the television-video recorder (total sample size of 98).
6.3.1 Measures

Commonness, Understanding and Appreciation

Participants gave their opinion regarding the 19 evaluative statements that are shown in Appendix 6.4. An exploratory factor analysis (n = 96) was carried out to reduce the relative high number of evaluative statements to a smaller number of general evaluative dimensions. Three factors had an Eigenvalue greater than 1.00 and the scree plot showed a kink at the third factor, suggesting that a 3-factor solution best fitted the data. The three factors accounted for 65.4 percent of the variance. Table 6.6 lists the loadings of the variables on each of the three factors.

Table 6.6
Component Loadings for the Evaluative Statements

<table>
<thead>
<tr>
<th>Item (question number in Appendix 6.4)</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Commonness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This product is different from others (Q1)</td>
<td>0.796</td>
<td>-0.100</td>
<td>-0.219</td>
</tr>
<tr>
<td>This product is only recently on the market (Q2)</td>
<td>0.870</td>
<td>-0.264</td>
<td>-0.083</td>
</tr>
<tr>
<td>There are no other products like this one (Q10)</td>
<td>0.802</td>
<td>-0.039</td>
<td>-0.117</td>
</tr>
<tr>
<td>This product is common (Q12)</td>
<td>0.865</td>
<td>-0.396</td>
<td>-0.164</td>
</tr>
<tr>
<td>This product is striking (Q19)</td>
<td>0.643</td>
<td>-0.042</td>
<td>0.368</td>
</tr>
<tr>
<td><strong>Understanding</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This product is simple to use (Q11)</td>
<td>-0.082</td>
<td>0.691</td>
<td>0.292</td>
</tr>
<tr>
<td>This product is simple to understand (Q13)</td>
<td>-0.178</td>
<td>0.804</td>
<td>-0.078</td>
</tr>
<tr>
<td>This product is logical (Q15)</td>
<td>-0.324</td>
<td>0.758</td>
<td>0.316</td>
</tr>
<tr>
<td>This product is clear (Q18)</td>
<td>-0.220</td>
<td>0.805</td>
<td>0.191</td>
</tr>
<tr>
<td><strong>Appreciation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This product is beautiful (Q4)</td>
<td>-0.136</td>
<td>0.336</td>
<td>0.626</td>
</tr>
<tr>
<td>This product will not break (down) easily (Q5)</td>
<td>-0.040</td>
<td>0.123</td>
<td>0.748</td>
</tr>
<tr>
<td>This product is good (Q9)</td>
<td>-0.114</td>
<td>0.128</td>
<td>0.773</td>
</tr>
<tr>
<td>This product offers value for money (Q14)</td>
<td>-0.206</td>
<td>0.441</td>
<td>0.658</td>
</tr>
</tbody>
</table>

1 The table contains the component loadings after Varimax rotation was applied to the initial solution.

The 19 evaluative judgments could be captured by three factors, namely commonness, understanding and appreciation. Five items (not in Table 6.6) had high loadings on more than one factor, namely the items Q3

Note 5 An overview of the means and standard deviations for each hybrid on each evaluative statement can be found in Appendix 6.5

Note 6 The sample used in the factor analysis contains multiple data points per participant which may distort the factor solution. Nevertheless, in order to have sufficient observations (a minimum of five cases for each variable, see Hair, Anderson, Tatham and Black 1998), the complete sample was used.
(convenient), Q7 (strange), Q8 (surprising), Q16 (interesting) and Q17 (attractive). Item Q6 (this product is expensive) was not included in any of the three factors as the loadings on each factor were low. In fact, the solution of the factor analysis showed that price was the only item with a high loading on the fourth factor (-0.829) which had an Eigenvalue of 1.130.

Three scales were constructed by computing the average of the scores on the constituent items, excluding the five aforementioned items. Cronbach’s alphas were 0.88 for the commonness scale (five items), 0.83 for the understanding scale (four items), and 0.80 for the appreciation scale (four items).

Product Desire
In addition to the evaluative judgments, participants expressed their desire for each of the hybrid products in a single statement: I would not like to have this product at all [1] – I would very much like to have this product [7] ("Ik zou dit product helemaal niet graag willen hebben" – "Ik zou dit product zeer graag willen hebben"). They were also asked to write down the most important reasons why they either did or did not want to have a particular hybrid product ("Wat zijn voor u de belangrijkste redenen waarom u dit product (niet) zou willen hebben?").

6.3.2 Results

Table 6.7 gives the mean scores for the four hybrids on each of the four variables. Differences between the hybrids were tested by means of a one-way ANOVA. The sofa-bed was significantly more common (M = 5.75) than the other hybrids, followed by the television-video recorder (M = 4.86). The hair dryer-iron (M = 2.05) and blender-scales (M = 2.24) were equally uncommon. All hybrid products were understandable, judged by the relatively high values. The television-video recorder (M = 6.25), sofa-bed (M = 6.13), and blender-scales (M = 5.68) were significantly more comprehensible than the hair dryer-iron (M = 4.08). These findings are in keeping with the results regarding familiarity. The familiar hybrids were judged to be significantly more common and comprehensible than the unfamiliar hybrids.

Note 7 Since the design was a within-subjects design, the appropriate analysis would have been repeated measures ANOVA instead of one-way ANOVA, which ignores the interdependencies between the observations. However, as the number of observations that could be applied in a repeated measures analysis was small (n = 13; those participants that judged all four hybrid products), such an analysis would be based on only half of the data. For this reason, the data were analyzed by means of a one-way ANOVA. In addition, a repeated measures ANOVA was performed to check the validity of the outcomes. The results of this analysis are given between parentheses in Table 6.7. The numbers show that the between-subject and within-subject analyses yielded highly similar outcomes.
Table 6.7
Means for Commonness, Understanding, Appreciation and Desire \(^{1,2}\)

<table>
<thead>
<tr>
<th>Stimulus set</th>
<th>Commonness</th>
<th>Understanding</th>
<th>Appreciation</th>
<th>Desire</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hair dryer-iron</td>
<td>2.05 (^{a}) (2.20 (^{a}))</td>
<td>4.08 (^{a}) (4.77 (^{a}))</td>
<td>3.43 (^{a}) (3.46 (^{a}))</td>
<td>2.04 (^{a}) (2.69 (^{a}))</td>
</tr>
<tr>
<td>(n = 24)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blender-scales</td>
<td>2.24 (^{a}) (2.33 (^{a}))</td>
<td>5.68 (^{b}) (5.71 (^{b}))</td>
<td>4.96 (^{b}) (4.90 (^{b}))</td>
<td>3.56 (^{b}) (3.23 (^{b}))</td>
</tr>
<tr>
<td>(n = 25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sofa-bed</td>
<td>5.75 (^{b}) (5.71 (^{b}))</td>
<td>6.13 (^{b}) (6.25 (^{b}))</td>
<td>4.53 (^{b}) (4.81 (^{b}))</td>
<td>3.63 (^{b}) (3.92 (^{b}))</td>
</tr>
<tr>
<td>(n = 24)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TV-VR</td>
<td>4.86 (^{c}) (4.74 (^{c}))</td>
<td>6.25 (^{b}) (6.48 (^{b}))</td>
<td>5.14 (^{b}) (5.12 (^{b}))</td>
<td>4.68 (^{b}) (4.85 (^{b}))</td>
</tr>
<tr>
<td>(n = 25)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Overall significance: $F_{3,34} = 101.37; \quad F_{3,34} = 16.81; \quad F_{3,34} = 13.02; \quad F_{3,34} = 7.77; \quad p < .001 \quad p < .001 \quad p < .001 \quad p < .001$

1 The values in brackets are the mean scores from the repeated measures analysis (n = 13).
2 Different lowercase characters indicate significant differences.
3 To enhance legibility of the table, the commonness scores have been rescaled. High values signify commonness.

Participants most highly appreciated the television-video recorder ($M = 5.14$), the blender-scales ($M = 4.96$), and the sofa-bed ($M = 4.53$); the hair dryer-iron ($M = 3.43$) received a significantly lower appreciation score. The results for product desire show the same picture. Product desire was highest for the television-video recorder ($M = 4.68$), followed by the sofa-bed ($M = 3.63$), and the blender-scales ($M = 3.56$). The least desired product was the hair dryer-iron ($M = 2.04$). Overall, desire for any of the hybrid products was relatively weak as even the most desirable product had a mean score near the mid-point of the scale (4.68).

The reasons participants gave for (not) wanting the hybrid products varied between products. Reasons for buying the television-video recorder were that it is considered to be practical, in particular as a second television for the bedroom, it saves space, there is no hassle with loose cables and plugs, it is easy to move around, the programming of the channels is believed to be easier, and the combination is thought to be cheaper than the constituent components. The most important reason for not buying the television-video recorder is that when one component needs to be repaired, the complete product has to be taken away. In addition, participants think that the screen is relatively small and that the quality of the hybrid is less than the quality of the source products.

Participants would buy the sofa-bed for its practical convenience; the sofa-bed is considered to be ideal for students and people with little space. Furthermore, it provides a place to sleep for unexpected guests. Most participants stated that a sofa-bed is unsuitable for daily use. The main reason not to buy a sofa-bed was that it is believed to be a poor bed. As one
participant "eloquently" put it: "Een bed-bank slaapt voor geen meter" (You sleep terribly on a sofa-bed).

Some participants liked the hair dryer-iron as a travelling device, but the majority did not for a host of reasons. The combination was considered to be weird and completely redundant, the product itself highly impractical, ugly and cheap. Several participants made the remark that they would never use an iron while travelling.

As reasons for buying the blender-scales, participants mentioned that it had a nice, simple and compact design which would be easy to use, easy to clean, and which would fit into the dishwasher. One participant claimed that "The combination is ideal, every mother should have one". Opponents of the blender-scales said that the particular combination was ridiculous and useless. In the words of one of them: "My cupboard is full of so-called 'handy' products. They are never used!"

6.4 General Discussion

The purpose of this chapter was to discover what will happen to the categorization of hybrid products when they become familiar. A theoretical account of the influence of familiarization on consumer classification of hybrid products, including a set of hypotheses, was given and an empirical study set up to test these hypotheses was described. The first part of the discussion will focus on the outcomes of Study 5 regarding familiarization effects. Study 5 also included consumers' general evaluation of hybrid products. These results will be discussed in the second part. The final subsection deals with the limitations of the study.

6.4.1 Familiarization Effects

This chapter has put forward the idea that the categorization of a new hybrid product as a separate hybrid category may change over time as a result of consumers' experiences with it. When a hybrid is new, consumers immediately need to construct a new category to classify the unfamiliar product combination. The only information available to consumers is the knowledge they possess of the hybrid's familiar source categories. On the basis of the category schemas of these source products, consumers create a new hybrid category, which is a combination of the source categories. In the course of time, though, consumers grow accustomed to the unfamiliar hybrid. As the examples of the fax-scanner-copier and the GSM-game phone have illustrated, consumers are likely to develop a usage pattern for the hybrid in which one source function is performed much more often than the other. As a result, categorization shifts towards this source category; the hybrid is no longer perceived as a hybrid product but as an enhanced version of the source product.
The results of the empirical study were in line with the proposed account. The unfamiliar hair dryer-iron and blender-scales were more often classified into a separate hybrid category than the television-video recorder and sofa-bed (Hypothesis 1). Those hybrids that were not classified into a separate category were found to be categorized together with the source product they were most congruent with. A further result was that unfamiliar hybrid products were equally (in)congruent with both of their source products, whereas familiar hybrid products were more congruent with one source product than with the other (Hypothesis 2). Finally, as hypothesized, cognitive effort involved in categorization was higher for unfamiliar products for which a new schema had to be built than for familiar hybrids that could be accommodated into the most congruent source category (Hypothesis 3).

The hypothesis and finding that unfamiliar products are categorized into a category of their own more often than familiar hybrid products is counterintuitive and contrary to the generally accepted notion within schema theory that it is easier to assign an unfamiliar instance to an existing category than to create a new category for it. From this perspective, the results of Study 5 should have been exactly the other way around. Since a hybrid target category does not exist (yet) for an unfamiliar hybrid product, it cannot be assigned to this category. Instead, the unfamiliar hybrid will be accommodated into the most congruent source category. Familiar hybrids, in contrast, for which a corresponding hybrid target category does exist, could be expected to be classified into this category rather than into either of its less congruent source categories. Still, this is not what appears to happen. Apparently, unfamiliar hybrids are so incongruent with their source categories that accommodation is not an acceptable option; consumers have no other alternative than to create a new category. For familiar hybrids something else seems to be going on: the essence of the hybrid changes. The familiar hybrid is no longer seen as a hybrid, because it no longer functions as one.

The conclusion that the essence of a hybrid product may change in the course of time as a result of familiarization, poses a challenge to the most basic and intuitive notion within categorization theory, namely that categories possess a core or essence that defines the categories (see chapter 2 for a discussion of psychological essentialism). Whether this core consists of necessary and sufficient features, as the classical view assumes, a set of prototypical features such as the probabilistic view and exemplar view suggest (Smith and Medin 1981), or of something else, each view of categorization presupposes that there is something that makes an object a member of a one category and not of another (Medin and Ortony 1989). The view of psychological essentialism implies that once an object has been assigned to a particular category on the basis of its characteristic features, it cannot be assigned to another one. In other words, category membership

Note 8 In this discussion the standpoint is taken that products are assigned to basic-level categories, as categorization theorists since Rosch (1978) have done. Whenever the word category is used, it actually means basic-level category.
cannot change\(^9\). Certainly, an object may become more or less typical of the category it belongs to, but it cannot change categories once it has been assigned to one. Still, this is exactly what seems to happen to hybrid products. They are initially assigned to a new hybrid category that is clearly distinct from the source categories it is composed of. Over time, however, (basic-level) category membership changes, as the hybrid is no longer classified as a hybrid but as an enhanced source product. In other words, the core of the hybrid product fundamentally changes. The same set of features that initially defined the combination of a television and a video recorder as a television-video recorder later defines exactly the same combination as a (special kind of) television. Apparently, as a result of familiarization, some of the defining (typical) attributes on the basis of which consumers determined that the television-video recorder was a television-video recorder and not a television lose their status of defining attributes.

A study of Ross (1996) which has already been mentioned in the introduction, may provide an explanation for how the essences of categories can change. According to Ross, interaction with products may (1) change the attribute weights by drawing attention to use-relevant attributes; (2) reveal defining attributes that were previously unnoticeable; and (3) make consumers aware of correlations among attributes or it may help them to understand the relation between attributes and their use better. In sum, interaction with products may cause the change in category defining attributes (i.e. the essence) that allows consumers to alter category membership. This would mean that the composition of the attribute set does not change but that the category-defining power of some of the attributes does\(^10\).

6.4.2 Evaluation

The evaluative judgments show a consistent picture. The television-video recorder and the sofa-bed received the highest scores on all measures\(^11\). These hybrids were judged to be the most common and the most comprehensible. They were also appreciated more positively and product desire was higher.

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Note 9 This claim seems to suggest that categorization is a static process and categories are static entities. This is not what psychological essentialism intends to say. Rooted in the theorizing about natural objects, the claim that category membership cannot change merely refers to the fact that the identity of natural objects cannot change in the course of time. An aging cat remains a cat, even when it eventually dies. Similarly, gold stays gold, even when it is made into a ring.

Note 10 Category-defining power is referred to as attribute centrality (Sloman, Love, and Ann 1998). Chapter 7 explains this concept and presents a study into the relationship between the typicality of the attributes of the hybrid product and its classification.

Note 11 For all evaluative measures except commonness, the blender-scales did not differ significantly from the television-video recorder and sofa-bed. However, the mean scores for the blender-scales on all measures except appreciation were lower than the mean scores for the television-video recorder and sofa-bed.
Commonness and Understanding
It makes sense that the television-video recorder and sofa-bed were considered to be common and comprehensible. Both products have been on the market for several years, the sofa-bed even for several decades (which may explain why the sofa-bed was significantly more common than the television-video recorder). That consumers are familiar with these products was confirmed by the high mean familiarity scores; they have often seen exemplars of them and they possess a certain amount of knowledge of these products. This means that over time, categories (i.e. theories) for these products have developed. As a result, consumers do not experience any trouble making sense of the television-video recorder and sofa-bed.

It is not clear why participants judged the blender-scales to be equally comprehensible as the television-video recorder and sofa-bed (although the mean score was about half a point lower). The blender-scales are a new product that participants were not familiar with ($M = 1.95$). Therefore, the blender-scales could have been expected to receive a lower score on understanding than they actually received. A possible explanation for this unanticipated result is that familiarity and understanding are conceptually independent, meaning that higher familiarity will generally lead to higher understanding, but not necessarily so. Vice versa, low familiarity does not automatically imply low understanding. In spite of the fact that participants were unfamiliar with the blender-scales, this hybrid made sense; the combination of a blender and scales was a logical one in the eyes of the participants, particularly for mothers nursing babies (“The combination is ideal, every mother should have one”).

Appreciation and Desire
Study 5 was designed to examine the classification of hybrid products; it does not provide a systematic investigation into the product aspects that determine the evaluation of hybrid products. For this reason, the conclusions that will be drawn in the present discussion are tentative and speculative; they should not be considered demonstrable facts. The value of the evaluation data is that they paint a general picture of how consumers evaluate a limited but diverse set of hybrid products. In addition, the results may serve as a starting point for future research on the evaluation of hybrid products.

The pattern of results found in the current study - familiar hybrids are preferred more than unfamiliar hybrids - appear to be in line with an explanation that has become known as the familiarity-liking relationship (Rindfleish and Inman 1998); people prefer things they are familiar with. Three possible reasons for this preference for familiar things are that: (1) people like familiar things because they have encountered them many times (mere exposure hypothesis); (2) people like familiar things because they possess much information about these things that is easily accessible (information availability hypothesis); and (3) people like familiar things since these things are liked by most other people (social desirability hypothesis). It
is difficult to judge whether social desirability played a role in the present study, because no data about this concept were gathered. Mere exposure and information availability may have affected participants’ product appreciation and desire, but these principles would not explain why the blender-scales, a hybrid that participants had rarely, if ever, seen before and about which they had little information, was equally appreciated and desired as the television-video recorder and the sofa-bed. Thus, the familiarity-liking relationship does not seem to be able to account for the complete set of findings in this case.

An alternative explanation of why familiar hybrids are more positively evaluated than unfamiliar hybrids is suggested by Yi and Gray (1996). They relate positive product attitudes to the degree of ambiguity or uncertainty regarding categorization. A reduction in ambiguity allows consumers to reliably categorize products, and this may lead to positive affect. The results of Study 5 have shown that hybrid products become less ambiguous and are easier to categorize the more familiar they get. This could explain why familiar hybrids were evaluated more positively than unfamiliar hybrids.

On the basis of the current study, an additional explanation presents itself, namely that consumer appreciation of and desire for hybrid products is linked to the degree to which a hybrid represents a sensible and useful product combination. Hybrids that were regarded as sensible and useful were the television-video recorder, the sofa-bed and the blender scales; these were also the hybrids that participants appreciated and desired the most. The hair dryer-iron was appreciated and desired less. This product was judged to be pointless and redundant: participants explained that they would not buy this hybrid as they considered it to be completely illogical, ridiculous, and useless. Several people remarked that they could not come up with any situation in which they would use, let alone, need a hair dryer-iron. Although the idea that people prefer hybrids that are sensible and useful is intuitively appealing, it is nothing more than an interesting speculation (until it has been validated for a wider range of hybrid products).

A further observation is that the majority of participants in this study neither appreciated nor desired any of the four hybrid products. On average, appreciation of the hybrid products was 4.52 on a 7-point scale; the mean product desire was only 3.48. Although these scores are not claimed to be indicative of consumers in general (due to the limited sample size and the limited number of hybrids), they suggest several reasons why consumers may not be very fond of hybrid products. First of all, consumers may feel that hybrid products have little extra to offer compared to what the source products offer. On the statement “This product offers value for money” participants gave a mean score of 4.67. Alternatively, consumers may be concerned that the quality of the hybrid is less than the quality of the source products. Indeed, some participants explicitly mentioned that they were worried about the (technical) quality of the hybrids. The mean scores on the
items "This product will not break (down) easily" ($M = 4.46$) and "This product is good" ($M = 4.76$) seem to reflect these worries. The doubtful quality of the hybrid products may partly have been caused by the relatively cheap and amateurish appearance that characterizes most of the study's hybrid products. Quality-related product judgments are often based on the overall appearance of the product (cf. Creusen 1998). Another reason why hybrid products may not be very popular with consumers could be that consumers simply do not like deviant products. They may also become a little fed up with the deluge of new and supposedly better products. Several participants expressed feelings of irritation stating that they thought that some of the hybrid products were "ridiculous" or "just one more of these allegedly handy new products that you never use". Finally and obviously, consumers may not like some hybrid products because they are ugly and unattractive. For example, the hair dryer-iron scored $M = 2.67$ on the item "This product is beautiful" and $M = 3.17$ on the item "This product is attractive".

6.4.3 Research Limitations

Familiarization of hybrid products takes place over time, and so do the assumed shifts in category membership due to the experiences that consumers have with hybrid products. For this reason, the effects of familiarization on the classification of hybrid products could be investigated in a longitudinal study better. Rather than comparing familiar hybrids with different unfamiliar hybrids at a single point in time, as it was done in Study 5, the classification of the same hybrid product could be observed over time. Only then will it be possible to demonstrate that classification changes as a result of familiarization, because the categorization process can be analyzed over a longer time span.

In addition, such an approach would allow for an analysis of the major explanatory variable of the study, namely the actual usage of the hybrid product. If it is true that category membership changes from hybrid to enhanced source product because consumers start using the hybrid as an enhanced source product, this usage pattern should become visible over time. An analysis of the actual usage of hybrid products at several moments in time would greatly enhance the validity of the theory and empirical findings that were presented in this chapter.

Within the practical limitations of the present research project, a longitudinal study was infeasible. Therefore, an alternative approach was taken to investigate the principles underlying the familiarization effect for which Study 5 provided support. The effect of consumers' experience with hybrid products on their categorization is assumed to take place through a change in the typicality of the attributes of the hybrid. The final empirical study of this dissertation, which is presented in the next chapter, investigates the
effect of the typicality of the attributes of a hybrid’s source products on the categorization of the hybrid.
7 The Effect of Attribute Typicality on the Categorization of Hybrid Products

The theory of psychological essentialism posits that category representations possess psychological essences (see chapter 2). The psychological essence of a category contains the information that makes the category what it is and not something else. The results of Study 5 are in conflict with the notion that categories possess defining essences, because they suggest that categorical essences may change as a function of familiarization (see chapter 6). As consumers become familiar with hybrid products over time, these hybrids are no longer seen as members of the new hybrid categories that were initially created for them. Instead, consumers recategorize hybrids as enhanced source products; the hybrids become what they are predominantly used for. Thus, the hair dryer-iron may become a hair dryer, the sofa-bed may be just a sofa, the television-video recorder a television, and the message-watch a wristwatch.

The explanation that was suggested to account for the apparent change in the set of essential properties reads that the weight consumers give to the essential properties of the recessive source category changes as a result of usage experience. In other words, properties that were first seen as essential to the hybrid category are no longer perceived as such, leading to a change of category. The extent to which an attribute is essential to a category is determined by how representative or typical of the category the attribute is. The experiment reported in this chapter was designed to test the hypothesis that categorization of hybrid products may be affected and even steered by manipulating the typicality of the attributes of the hybrid products. By systematically varying the typicality of the attributes referring to the source products, categorization may be guided towards either of the source categories. The next section (7.1) explains how attribute typicality affects categorization of hybrid products by linking it to the structural model of

Note 1 As the opposite of the term "dominant source category" the term "recessive source category" refers to the source category with which conceptual similarity is lowest. A hybrid product thus consists of a dominant and a recessive source category.
hybrid products that was sketched in section 2.8.1 and Figure 2.6. Hypotheses are proposed. Section 7.2 describes the experiment that was set up to test them and the methodology and findings are reported. The chapter (7.3) ends with a discussion of the experiment and its outcomes.

7.1 Attribute Typicality and Category Membership

Attribute typicality refers to the extent to which an attribute is shared by members of a category. Attributes shared by many members are the more modal attributes of a category, and hence likely to be in the representation of the category itself (Smith and Medin 1981). This is why typicality has also been referred to as representativeness (Loken and Ward 1987) and goodness-of-example (Rosch 1978).

A concept closely related to typicality is mutability. Mutability pertains to being able to transform the mental representation of an object by eliminating a feature without changing other aspects of the object's representation (Sloman, Love, and Ahn 1998). An attribute is said to be mutable if category membership stays unaltered when the attribute is eliminated or changed. When the color of a car changes, it still remains a car. When the number of wheels is reduced to two, however, it is not so obvious anymore whether it is still a car. The number of wheels is an immutable property of the concept of car. The parallel between typicality and mutability is evident. Immutable properties are central to the category and thus highly typical. The typicality of mutable properties, which are not central to the category, is low.

The distinction between high-typical (immutable) and low-typical (mutable) attributes is highly similar to the distinction between essential and non-essential properties that was explained in chapter 2 (Figure 2.5). Essential properties are highly typical (immutable) as these properties determine what the hybrid product is. Non-essential properties are less typical (more mutable), because they are not central to the category. Below, on the basis of the schematic model of the composition of the attribute set of hybrid products portrayed in Figure 2.6, an explanation will be provided of how category membership for hybrid products may change as a function of attribute typicality.

Figure 2.6 depicted hybrid products as consisting of essential properties of A, essential properties of B, possibly essential properties of H, and non-

Note 2 The essential H-properties are not included in the current account for three reasons. First, as it was argued in section 2.8, it is not clear to what extent H-properties are present in the essence of hybrid products. In any case, it is hard to come up with examples of essential H-properties. Second, H-properties were not included in the experiment. Third, the presence of H-properties would unnecessarily complicate the account.
essential properties. Figure 7.1 portrays four hypothetical representations of a hybrid product. Each representation implies a different combination of essential (high-typical) and non-essential (low-typical) properties.

Figure 7.1
Representation of a Hybrid Product under Different Conditions of Attribute Typicality

When hybrid products are new, essential properties of both A and B are present. Under these conditions, the hybrid is likely to be classified as such. Imagine now that the typicality of the essential properties of B decreases to a level that these properties are no longer high-typical but low-typical. With regard to the schematic representation of the hybrid product, the B-properties originally included in the essence of the hybrid have shifted to the non-essence of the hybrid. With only essential properties of A present, the hybrid is likely to be categorized as an instance of source category A. This is exactly the process that is believed to take place when consumers become familiar with hybrid products; the attributes highly typical of one of the source categories, lose their typicality. In a similar way, a decrease in the typicality of the essential properties related to source category A will lead to classification of the hybrid into source category B. A final possibility is that
the typicality of the essential properties of both A and B is low\(^3\). In that case, only non-essential (low-typical) properties are present. Classification is likely to be ambiguous, because no strong clues for category membership are available.

In sum, the previous account has argued that attribute typicality is a determinant of the congruity between a hybrid product and each of its source categories. Greater numbers of high-typical attributes of source category A (B) lead to higher correspondence between hybrid and source category A (B). As a result, the hybrid will be classified into the most congruent source category. Only when the hybrid is equally congruent with source category A and source category B, will it be categorized into a category of its own. The term \textit{balanced attribute typicality} will be used to refer to the situation in which attribute typicality of both source products is equal (either low or high). Hybrid products that are characterized by balanced attribute typicality will be called \textit{balanced hybrids}. The opposite, \textit{unbalanced attribute typicality}, occurs when the attributes making up the hybrid are more typical of one source product than of the other. Hybrids with such an attribute structure will be named \textit{unbalanced hybrids}. The following set of predictions summarizes the relationships between attribute typicality and schema congruity, and between attribute typicality and classification.

Hypothesis 1a

Compared to unbalanced hybrid products, balanced hybrid products are less likely to be perceived as more congruent with one source category than with the other.

Hypothesis 1b

Unbalanced hybrid products will be perceived as being more congruent with the source category of which high-typical attributes are present than with the source category of which low-typical attributes are present.

Hypothesis 1c

Balanced hybrid products will be perceived as more congruent with the hybrid category than unbalanced hybrid products, but only when the attributes related to both source categories are high-typical.

\*Note 3\* A situation in which a hybrid product consists of low-typical attributes only would occur if the appearance of the hybrid is unrecognizable \textit{and} if consumers have no additional information at their disposal. In reality, this situation will hardly ever occur, because pictorial product information is practically always accompanied by verbal information. The reason for still paying attention to this possibility, is that the account of the relation between attribute typicality and classification of hybrid products would otherwise be incomplete. Furthermore, it was necessary to include this condition in the design of Study 6 to obtain experimental control.
Hypothesis 2a
Balanced hybrid products will be categorized more often into a category of their own than unbalanced hybrid products, but only when the attributes related to both source categories are high-typical.

Hypothesis 2b
Unbalanced hybrid products will be categorized more often into the source category of which high-typical attributes are present than into the source category of which low-typical attributes are present.

7.2 Study 6: Affecting Categorization by Manipulating Attribute Typicality

In Study 6 subjects read descriptions of hybrid products that varied with regard to attribute typicality. The effect of attribute typicality on the categorization of hybrid products was investigated by systematically varying the typicality of the attributes belonging to the schemas of the source products. The current section describes the experimental design, procedure and measures, and it presents the outcomes of the experiment.

7.2.1 Method

Subjects and Design
Subjects were 62 men and 52 women randomly selected from the consumer panel of the Product Evaluation Lab. Subjects were divided into three age groups (20-35 years: 35 subjects; 36-50 years: 41 subjects; 51-65 years: 38 subjects). The average age was 42.9 years. Participation took one hour for which subjects received a small financial compensation.

Subjects were assigned to one of five experimental groups. The design was an incomplete randomized 2 x 2 x 2 between-subjects design (see Table 7.1). The independent variables were familiarity of the hybrid product (high, low), typicality of the attributes of schema A, i.e. the schema of source product A (high-typical “HTA”, low-typical “LTA”), and typicality of the attributes of schema B (high-typical “HTB”, low-typical “LTB”). The low-familiarity x high-typical of A x high-typical of B condition was added to control for the effect of product familiarity. Only one control condition was included, since on the basis of the outcomes of Study 5 familiarity effects could be expected to take place in the condition in which the attributes of both source products were high-typical. In this design, the LTA x LTB and
HTA x HTB conditions represent the balanced hybrids; the unbalanced hybrids are the ones described in the HTA x LTB and LTA x HTB conditions.

Table 7.1
Experimental Design of Study 6 (N = 114)

<table>
<thead>
<tr>
<th>High familiarity</th>
<th>Low familiarity</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT attributes source category A</td>
<td>LT attributes source category A</td>
</tr>
<tr>
<td>HT attributes source category A</td>
<td>HT attributes source category A</td>
</tr>
<tr>
<td>LT attributes source category B</td>
<td>HT attributes source category B</td>
</tr>
<tr>
<td>HT attributes source category B</td>
<td>LT attributes source category B</td>
</tr>
<tr>
<td>LT attributes source category B</td>
<td>HT attributes source category B</td>
</tr>
<tr>
<td>HT attributes source category B</td>
<td>LT attributes source category B</td>
</tr>
<tr>
<td>LT attributes source category B</td>
<td>HT attributes source category B</td>
</tr>
<tr>
<td>HT attributes source category B</td>
<td>LT attributes source category B</td>
</tr>
<tr>
<td>n = 23</td>
<td>n = 22</td>
</tr>
</tbody>
</table>

Stimulus Material

The stimulus material of the experiment consisted of brief product descriptions. Each description started with the same introduction, namely: “Below are the attributes of a product that is put on the market by company X. Would you please read through this list of attributes carefully?” Then, eight attributes were stated, four attributes for each source product. These eight attributes were either high-typical or low-typical for the corresponding source categories.

The familiar hybrid product was a television-video recorder (TV-VR) with the source categories television (TV) and video recorder (VR); the unfamiliar hybrid product was a television-CD player combination (TV-CD) with the source categories television and CD player (CD). The television-CD player combination was selected because it is a non-existing product (and thus per definition unfamiliar) which shares one of its source categories with the television-video recorder (and is thus as similar as possible to the television-video recorder).

The purpose of the descriptions was to manipulate the typicality of the attributes of the source products. In order to create the descriptions, high-typical and low-typical attributes were collected for the television, the video and the CD player category respectively. This was done in two steps. First, 49 participants listed as many attributes for each of the categories as they could think of. Second, 15 to 20 attributes were selected from the obtained lists and presented to 19 participants (20 for the CD player) who judged the degree of typicality for these 15 to 20 attributes from each category by indicating how well each attribute matched the attributes of the corresponding concept. Three qualifications were possible, namely “the attribute fits very well”, “the attribute fits fairly well”, and “the attribute does
not fit at all”. Table 7.2 presents the outcomes of the pretest for the attributes that were used in the product descriptions.

<table>
<thead>
<tr>
<th>Category</th>
<th>Attribute (typicality)</th>
<th>Very good fit</th>
<th>Fairly good fit</th>
<th>No fit</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Television</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTTV</td>
<td>The product has a screen (high)</td>
<td>19</td>
<td>0</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>It is possible to select channels (high)</td>
<td>18</td>
<td>0</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>It is possible to watch programs with the product (high)</td>
<td>18</td>
<td>0</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>You can store channels in the product (high)</td>
<td>15</td>
<td>4</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>LTTV</td>
<td>The product is heavy (low)</td>
<td>4</td>
<td>11</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>The product determines the layout of the living room (low)</td>
<td>6</td>
<td>7</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>The product has subtitles (low)</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>The product displays the active channel (low)</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td><strong>Video</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTVR</td>
<td>You can put a tape into the product (high)</td>
<td>19</td>
<td>0</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>The product can record (high)</td>
<td>18</td>
<td>0</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>The product can be programmed (high)</td>
<td>18</td>
<td>1</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>The product can wind and rewind (high)</td>
<td>18</td>
<td>1</td>
<td>0</td>
<td>19</td>
</tr>
<tr>
<td>LTVR</td>
<td>The product displays the playing time (low)</td>
<td>12</td>
<td>6</td>
<td>1</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>After a particular time the product automatically goes into stand-by mode (low)</td>
<td>8</td>
<td>8</td>
<td>3</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>The product has a large display with much information (low)</td>
<td>6</td>
<td>9</td>
<td>4</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>There are many buttons on the product (low)</td>
<td>3</td>
<td>10</td>
<td>6</td>
<td>19</td>
</tr>
<tr>
<td><strong>CD player</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HTCD</td>
<td>You can put a CD in the product (high)</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>The product has a laser (high)</td>
<td>19</td>
<td>1</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>The product reads music digitally (high)</td>
<td>19</td>
<td>1</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>The product provides high-quality sound (high)</td>
<td>18</td>
<td>2</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

1 The Dutch description of the attributes can be found in Appendix 7.1.
The high-typical attributes were those with the highest number of "very good fit"-qualifications; the low-typical attributes were the attributes that most people believed to fit fairly well. On the basis of the attributes from Table 7.2, five product descriptions were created, one for each experimental cell (see Appendix 7.1). In order to correct for possible order-of-presentation effects, half of the participants received a description in which the order of the attributes was reversed (i.e., $VR_2^TV_2^VR_1^TV_1^VR_4^TV_4^VR_3^TV_3$ instead of $TV_1^VR_1^TV_2^VR_2^TV_3^VR_3^TV_4^VR_4$).

An additional pretest was carried out among 30 people (i.e., six judgments per description) to check whether all descriptions elicited the intended product schemas; the description of the television-video recorder (television-CD player) was expected to activate the schemas of both television and video recorder (CD player) in the subjects' minds, irrespective of whether the attributes were high-typical or low-typical. Thus, even in the low-typical of TV x low-typical of VR condition (LTTV x LTVR), subjects ought to be aware of the presence of television attributes as well as video recorder attributes.

<table>
<thead>
<tr>
<th>Elicited schema</th>
<th>HT TV</th>
<th>LT TV</th>
<th>HT VR</th>
<th>LT VR</th>
<th>HT TV</th>
<th>HT TV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Television</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Video recorder</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>CD player</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>CD-i player</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

After reading a brief description of the product that included the eight attributes, the pretest subjects wrote down which product the description evoked. Table 7.3 displays the results. The descriptions of the television-video recorder elicited both the television schema and the video recorder schema, although people in the HTVR conditions mentioned the television less often than in the LTVR conditions. The description of the television-CD player evoked more diverse schemas; as intended, the product was associated with a television and a CD player, but also with a video recorder, a CD-i player and a computer. This result was not surprising, given the fact that the television-CD player is a non-existing product. The category "other" included products such as a DVD player, coffee machine, stereo and remote control. Taken together, the outcomes of the pretest suggested that the descriptions were quite successful in eliciting the relevant product categories. Nevertheless, in the actual experiment, subjects again listed all
their associations whilst reading the description. These data provided an additional check of the match between the product as intended in the product descriptions and the product as perceived by the subjects.

Procedure
The experiment was administered individually. Subjects were presented with one of the descriptions and requested to write down as many thoughts as possible about the product from the description or the description itself (see Appendix 7.2). Next, subjects answered three questions on the computer, followed by a paper-and-pencil question, followed by another 11 questions on the computer. After they had completed the questionnaire, the purpose of the experiment was explained and subjects received their remuneration.

Measures
The experimental measures are listed in Table 7.4 in the order in which they were obtained. The exact questions (in Dutch) are in Appendix 7.2.

Table 7.4
Overview of Experimental Measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Type</th>
<th>High score means…</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Spontaneous category elicitation</td>
<td>Nominal</td>
<td>-</td>
</tr>
<tr>
<td>2 Category membership</td>
<td>Nominal, multiple choice</td>
<td>-</td>
</tr>
<tr>
<td>3 Classification certainty</td>
<td>Interval, 7-point scale</td>
<td>High certainty</td>
</tr>
<tr>
<td>4 Classification difficulty</td>
<td>Interval, 7-point scale</td>
<td>High difficulty</td>
</tr>
<tr>
<td>5 Helped category elicitation</td>
<td>Nominal</td>
<td>-</td>
</tr>
<tr>
<td>6 Schema congruity source category 1</td>
<td>Interval, 7-point scale</td>
<td>High congruity</td>
</tr>
<tr>
<td>7 Schema congruity source category 2</td>
<td>Interval, 7-point scale</td>
<td>High congruity</td>
</tr>
<tr>
<td>8 Schema congruity hybrid category</td>
<td>Interval, 7-point scale</td>
<td>High congruity</td>
</tr>
<tr>
<td>9 Schema congruity source product 1</td>
<td>Nominal, multiple choice</td>
<td>-</td>
</tr>
<tr>
<td>10 Schema congruity source product 2</td>
<td>Nominal, multiple choice</td>
<td>-</td>
</tr>
<tr>
<td>11 Familiarity</td>
<td>Interval, 7-point scale</td>
<td>High familiarity</td>
</tr>
<tr>
<td>12 Classification difficulty</td>
<td>Interval, 7-point scale</td>
<td>High difficulty</td>
</tr>
<tr>
<td>13 Imagination</td>
<td>Interval, 7-point scale</td>
<td>High imagination</td>
</tr>
<tr>
<td>14 Information sufficiency</td>
<td>Interval, 7-point scale</td>
<td>Insufficient</td>
</tr>
<tr>
<td>15 Information sufficiency</td>
<td>Interval, 7-point scale</td>
<td>Insufficient</td>
</tr>
<tr>
<td>16 Classification certainty</td>
<td>Interval, 7-point scale</td>
<td>High certainty</td>
</tr>
</tbody>
</table>

Characteristics of the Descriptions
On items 14 and 15, subjects rated the informative qualities of the descriptions. Did the descriptions contain sufficient information for subjects to know what kind of product was being explained? Moreover, did the descriptions provide sufficient information to enable subjects to answer the questions? Subjects also had to indicate whether the description enabled
them to develop an idea about what the product was (Item 13). These data were collected to check whether the various descriptions were comparable in the amount and quality of the information they contained.

**Manipulation checks**
The find out whether subjects associated the descriptions with the intended product combinations (i.e. television-video recorder and television-CD player), the experiment started with a thought-listing task (Item 1); subjects wrote down everything they thought of in reaction to the (product from the) description. In addition to this free elicitation task, subjects also indicated for a list of categories to what extent the described product fitted into each of them (Item 5 in Appendix 7.2); subjects could be either very positive that the product from the description matched the listed category, they could be in doubt, or they could be very sure that the product from the description did not fit the listed category. Obviously, the descriptions ought to generate associations with the concepts of television, video recorder, television-video recorder and CD player.

Item 11 was included in the experiment to check whether subjects did indeed perceive the television-CD player to be less familiar than the television-video recorder.

**Dependent Variables**
Subjects assessed category membership by selecting one out of four options (Item 2). The product from the description could be a video recorder (CD player), a television, a television-video recorder (television-CD player), or something else.

Besides assessing category membership, subjects provided several measures of schema congruity (Items 6 to 10). On 7-point scales subjects indicated how much the product from the description corresponded to both of the source categories (i.e. television, video recorder/CD player), and to the hybrid category (television-video recorder/television-CD player combination). An alternative measure of schema congruity was obtained by asking subjects to select one of four statements about the described product (e.g. "The product from the description is a television, although some of the mentioned attributes do not seem to belong to a television").

**Other Dependent Variables**
In addition to category membership and schema congruity, two other dependent variables were included in the study. Classification certainty and classification difficulty are treated separately as no hypotheses were formulated regarding these variables.

Items 3 and 16 asked subjects how certain they were that they could deduce from the description what the product was. Item 16 was posed at the end of the questionnaire to find out whether there were subjects that remained uncertain about category membership even after completing all questions.
Two items (4 and 12) measured classification difficulty. One item was a
direct measure ("How difficult was it to deduce from the description what the
product was?"); the other item was an indirect measure ("I had to read the
description several times before I could tell from the description what the
product was").

7.2.2 Results

Order of Attributes
The order in which the attributes were listed in the product descriptions did
not influence any of the variables in the study. The correlations between
attribute order and the other variables in the study were all non-significant.

Characteristics of the Descriptions: Information
Sufficiency and Imagination
The Pearson correlation between items 14 and 15 was 0.55 ($p < .01$). A 2 x
2 MANCOVA, with typicality of television attributes (high, low) and typicality
of video recorder attributes (high, low) as fixed factors, revealed a significant
main effect of typicality of video recorder attributes (Wilks' $\lambda = 0.76$; $F_{2,68} =
13.79$; $p < .001$). The univariate tests showed that irrespective of the
typicality of the television attributes, subjects presented with descriptions
including low-typical video recorder attributes found it more difficult to get a
general impression of the product on the basis of the product description ($M
= 3.57$) than subjects who received a description containing high-typical
video recorder attributes ($M = 1.94$; $F_{1,66} = 26.18$; $p < .001$). The same
result was found regarding answering the questions on the basis of the
descriptions ($M = 4.20$ vs. $M = 2.73$; $F_{1,66} = 13.45$; $p < .001$).

For power of imagination, the main effect of typicality of video recorder
attributes was significant ($F_{1,66} = 10.15$; $p < .01$). When high-typical video
recorder attributes were present in the description, subjects had less trouble
creating a mental picture of the product from the description ($M = 6.22$)
then when low-typical video recorder attributes were present ($M = 5.29$).
The typicality of the television attributes did not affect imagination power.

An explanation for these findings may be that the low-typical video recorder
attributes were too unspecific. Although these attributes may have been
to be considered typical of a video recorder, they may also have been fairly typical of
many other electronic products (e.g., CD player, camera, micro-wave). This
point will be expounded further on in the discussion.

The implication of these findings is that the quantity and quality of the
information in the descriptions, as measured by the reported items, is not
equal. This fact may have confounded the outcomes on other variables
included in the study. For this reason, the three items that measured
information sufficiency and power of imagination were included in all
conducted analyses of variance. In the following account of the results, the covariates will only be discussed in those cases in which they turned out to be significant.

For the description of the television-CD player \((n = 24)\) the mean score on sufficient information to get a general impression of the product was 3.79 \((SD = 1.74)\), on sufficient information to answer the questions 4.21 \((SD = 2.11)\), and on power of imagination 4.96 \((SD = 1.68)\). Subjects felt that the information provided in the description of the television-CD player was not as sufficient as the information in the description of the television-video recorder (general impression: \(M = 1.83; t_{es} = -4.36; p < .001\); questions: \(M = 2.74; t_{es} = -2.41; p < .05\)). Subjects also found it harder to construct a mental image of the unfamiliar television-CD player than of the familiar television-video recorder \((M = 6.26; t_{es} = 2.84; p < .01)\). These findings are probably caused by the fact that the television-CD player does not exist. For non-existing products, the need for information will be higher and it will be more difficult to create a mental image, than for existing products for which information and mental images are already available.

**Manipulation checks**

The manipulation of familiarity was successful. The description of the television-CD player \((M = 4.42)\) was rated less familiar than the description of the television-video recorder \((M = 6.00; t_{es} = 2.70; \text{one-tailed } p < .01)\).

<table>
<thead>
<tr>
<th>Description</th>
<th>LT TV</th>
<th>HT TV</th>
<th>LT TV</th>
<th>HT TV</th>
<th>HT TV</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT VR</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>HT VR</td>
<td>52.2</td>
<td>47.8</td>
<td>59.1</td>
<td>40.9</td>
<td>40.9</td>
</tr>
<tr>
<td>HT VR</td>
<td>40.9</td>
<td>59.1</td>
<td>30.4</td>
<td>69.6</td>
<td>75.0</td>
</tr>
<tr>
<td>HT VR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HT VR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HT CD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Final</th>
<th>Final</th>
<th>Final</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schema elicited</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Television</td>
<td>52.2</td>
<td>47.8</td>
<td>59.1</td>
<td>40.9</td>
</tr>
<tr>
<td>Video recorder</td>
<td>52.2</td>
<td>47.8</td>
<td>31.8</td>
<td>68.2</td>
</tr>
<tr>
<td>CD player</td>
<td>4.3</td>
<td>95.7</td>
<td>9.1</td>
<td>90.9</td>
</tr>
<tr>
<td>Television-video recorder</td>
<td>21.7</td>
<td>78.3</td>
<td>18.2</td>
<td>81.8</td>
</tr>
<tr>
<td>Television-CD player</td>
<td>0.0</td>
<td>100</td>
<td>0.0</td>
<td>100</td>
</tr>
<tr>
<td>Sample size</td>
<td>23</td>
<td>22</td>
<td>22</td>
<td>23</td>
</tr>
</tbody>
</table>

The second manipulation check concerned the schemas that were elicited by the product descriptions, both spontaneous and aided. The manipulation could be considered successful if the descriptions in the four familiar
conditions evoked the schemas of television and video recorder, and if the
description of the television-CD player triggered subjects to think of
television and CD players. Table 7.5 contains the outcomes of the
spontaneous thought elicitation task. This table lists the percentage of
subjects that mentioned the relevant schemas (i.e. television, video recorder,
television-video recorder, CD player, and television-CD player) in each
condition. Those cells in the table where high percentages ought to occur,
given that the descriptions worked, are printed in bold.

In line with expectation, of all subjects who received a description of a
television-video recorder, not a single one mentioned the television-CD
player. In the HTTV x HTCD condition only 2 subjects had an association
with a television-CD player. Obviously, subjects could not mention the
Television-CD player, as this product does not exist. An equally obvious
observation is that hardly any subjects in any of the TV-VR conditions
referred to a CD player (percentages varying from 4.3 to 13.6). Surprisingly,
this percentage was also quite low in the HTTV x HTCD condition (29.2
percent), where a high percentage could have been expected. With the
exception of people in the HTTV x HTVR condition, few subjects made
reference to the television-video recorder category (21.7 percent or less).
With regard to the schemas of television and video recorder, no unexpected
results occurred — including the high "yes" percentage for the television and
high "no" percentage for the video recorder in the HTTV x HTCD condition —
with one exception. The percentage of subjects within the HTTV x HTVR
condition that mentioned the television was surprisingly low (30.4 percent).
Overall, the pattern of percentages for the television and video recorder
seems to support the hypotheses of the study. Low percentages, indicating
weak associations, correlate with low-typical attributes, whereas high
percentages (strong associations) correlate with high-typical attributes.

The data from the aided elicitation task (see Table 7.6) point in a similar
direction. Note that the table only lists the relevant categories from the
category list (see Item 5, Appendix 7.2)\(^4\). This list did not include the non-
existing category of television-CD players. Note further that the table only
includes judgments indicating high certainty, either about a positive or a
negative match between the product from the description and the listed
categories.

Four eye-catching results are discussed. First of all, the percentages of
subjects who thought that the product in the LTTV x LTVR description
matched the television (81.8) and video recorder (73.9) respectively are
strikingly high considering the fact that the attributes are low-typical and the
observation that the corresponding percentages in the HTTV x HTVR
condition are only 63.6 and 78.3. Similarly, in the HTTV x LTVR condition
the percentages indicating the fit with the television (31.8) and video
recorder (22.7) are inexplicably low. The low percentages in the "no"

\(^4\) Additional categories were included to stimulate subjects to pay attention to other categories
than the ones from the descriptions.
column of this condition point out that almost two thirds of the subjects (63.7 percent) were not sure about the identity of the product in this condition. It is not clear why such high levels of uncertainty only occurred in this particular condition. Another unforeseeable result was the score of 50.0 percent in the VR x HTTV-HTCD-yes cell. Why did the description of the television-CD player induce such a strong association with the video recorder category? Finally, it is unknown why this same description matched the television-video recorder category to the extent that it did (50.0 percent “yes” and merely 18.2 percent “no”). In spite of these unanticipated findings, by and large, the experimental descriptions appear to have succeeded in eliciting the relevant product schemas.

Table 7.6
Results Aided Schema Elicitation (in Percentages)

<table>
<thead>
<tr>
<th>Description</th>
<th>LT TV</th>
<th>HT TV</th>
<th>LT TV</th>
<th>HT TV</th>
<th>HT TV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LT VR</td>
<td>LT VR</td>
<td>LT VR</td>
<td>HT VR</td>
<td>HT VR</td>
</tr>
<tr>
<td>Schema elicited¹</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Television</td>
<td>81.8</td>
<td>4.5</td>
<td>31.8</td>
<td>4.5</td>
<td>40.9</td>
</tr>
<tr>
<td>Video recorder</td>
<td>73.9</td>
<td>4.3</td>
<td>22.7</td>
<td>13.6</td>
<td>63.6</td>
</tr>
<tr>
<td>CD player</td>
<td>17.4</td>
<td>47.8</td>
<td>4.8</td>
<td>71.4</td>
<td>13.6</td>
</tr>
<tr>
<td>Television-Video</td>
<td>95.7</td>
<td>0.0</td>
<td>81.8</td>
<td>0.0</td>
<td>81.8</td>
</tr>
<tr>
<td>recorder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample size</td>
<td>23</td>
<td>22</td>
<td>22</td>
<td>23</td>
<td>24</td>
</tr>
</tbody>
</table>

¹ In this table, “yes” means that the product from the description fits the listed category very well, whilst “no” means that the fit is poor. The answering category “I am not sure whether the product from the description fits the category” is not included in the table.

Dependent Variables: Testing the Hypotheses²

Effect of Attribute Typicality on Schema Incongruity
Hypotheses 1a, 1b, and 1c concern the relationship between attribute typicality and schema congruity. Basically, these hypotheses state that that congruity with the source products will be unequal when attribute typicality is unbalanced, and equal when attribute typicality is balanced. Hypothesis 1a was tested by means of a 2 x 2 ANCOVA. The fixed factors were typicality of television attributes (high, low) and typicality of video recorder attributes (high, low). The dependent variable was the average value of the absolute individual differences between the congruity with the television and the

Note 5 The results for the HTTV x HTCD condition are discussed separately.
congruity with the video recorder. In order to confirm hypothesis 1a, this average value should be significantly higher for the unbalanced hybrids. At the same time, neither the two unbalanced descriptions nor the two balanced descriptions should significantly differ from one another. Research-technically speaking, the interaction effect should be significant, whilst the main effects should not. The results of the analysis yielded no significant differences whatsoever between the four conditions, leading to a rejection of hypothesis 1a. The means for the four conditions (LTTV x LTVR, HTTV x LTVR, LTTV x HTVR, HTTV x HTVR) were 2.17, 2.64, 2.86, and 2.52 respectively.

Two 2 x 2 ANCOVAs were conducted to test hypothesis 1b. The dependent variables were congruity with the television category in the first analysis and congruity with the video recorder category in the second. In both analyses the significant effects that were expected to occur were a main effect of typicality of television attributes and a main effect of typicality of video recorder attributes. A main effect of typicality of video recorder attributes was the only significant effect found in the first analysis \( (F_{1,83} = 6.27; p < .05) \). As predicted, subjects in the LTVR conditions \( (M = 5.27) \) judged the television-video recorder to fit into the television category better than subjects in the HTVR conditions \( (M = 4.49) \). The second analysis with congruity with the video recorder category as the dependent measure yielded no significant effects. The analyses failed to support hypothesis 1b.

An interaction effect was predicted in hypothesis 1c. Congruity with the hybrid television-video recorder category was expected to be higher for the description including only high-typical attributes. No significant effects were found in a 2 x 2 ANCOVA with congruity with the television-video recorder category as the dependent variable. Congruity with the television-video recorder did not differ between conditions. Hypothesis 1c was rejected.

The nominal measures of schema congruity that were also collected in Study 6 (items 9 and 10 in Appendix 7.2) confirmed the absence of systematic relationships between attribute typicality and schema congruity. Table 7.7 presents the number of subjects within each condition that chose each of the four answering alternatives, both for the television and video recorder category. The most striking result is that option 3, which refers to the situation in which the product in the description possesses high-typical attributes of both source categories, was most frequently chosen in the LTTV x HTVR condition, irrespective of whether the target category was a television or a video recorder. Option 3 was expected to occur most often in the HTTV x HTVR condition, in which both television attributes and video recorder attributes are high-typical. As a matter of fact, option 3 is by far the

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Note 6 A positive relationship exists between attribute typicality and congruity with the corresponding source category. A negative relationship exists between attribute typicality and congruity with the contrasting source category. Thus, the presence of high-typical TV (video recorder) attributes will increase the fit with the television (video recorder) schema, but decrease the fit with the video recorder (television) schema.
most frequently selected answer at the aggregate level (45 percent of all subjects preferred it). Evidently, the different descriptions did not urge subjects to choose different classification options.

Table 7.7
Cross Table Experimental Condition by Congruity with Television and Video Recorder

<table>
<thead>
<tr>
<th>Condition</th>
<th>Congruity with television</th>
<th>Congruity with video recorder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>LT TV</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>LT VR</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>HT TV</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>HT VR</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>9</td>
<td>25</td>
</tr>
</tbody>
</table>

1 Option 1: "The product in the description is clearly a television (video recorder)"
Option 2: "The product in the description is a television (video recorder), although some of the attributes do not fit a television (video recorder) very well"
Option 3: "The product in the description is a television (video recorder), but in fact it cannot be a television (video recorder) since some of the attributes do not fit"
Option 4: "The product in the description could be a television (video recorder), but this is not really clear"

Effect of Attribute Typicality on Categorization
The relation between attribute typicality and categorization has been formalized in hypotheses 2a and 2b. Concretely, these hypotheses predict that subjects who received the product description with high-typical television attributes and high-typical video recorder attributes will categorize this product as a television-video recorder more often than subjects in the other conditions. In the HTTV x LTVR condition subjects are predicted to classify the stimulus more often as a television than as a video recorder; the exact opposite is expected to take place in the LTTV x HTVR condition.

Table 7.8 displays the cross table of experimental condition by classification. The frequency distribution is nearly identical in the four conditions, a fact that is reflected in the non-significant chi-square statistic ($p = .166$). In all conditions, the majority of subjects (average of 81.1 percent) classified the stimulus as a television-video recorder. As predicted, this percentage was highest in the HTTV x HTVR condition, but the difference with the other conditions is not significant. With regard to the classifications in the unbalanced conditions, classification into the high-typical source category
occurred as predicted, but frequencies are low and differences insignificant. In brief, both hypotheses 2a and 2b need to be rejected.

Table 7.8
Cross Table Experimental Condition by Classification

<table>
<thead>
<tr>
<th>Condition</th>
<th>VR (%)</th>
<th>TV (%)</th>
<th>TV-VR (%)</th>
<th>Other (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>LT TV</td>
<td>1 (4.3)</td>
<td>1 (4.3)</td>
<td>17 (73.9)</td>
<td>4 (17.4)</td>
<td>23</td>
</tr>
<tr>
<td>LT VR</td>
<td>0 (0.0)</td>
<td>1 (4.5)</td>
<td>17 (77.3)</td>
<td>4 (18.2)</td>
<td>22</td>
</tr>
<tr>
<td>HT TV</td>
<td>1 (4.5)</td>
<td>1 (4.5)</td>
<td>18 (81.8)</td>
<td>0 (0.0)</td>
<td>22</td>
</tr>
<tr>
<td>HT VR</td>
<td>1 (4.5)</td>
<td>1 (4.5)</td>
<td>18 (81.8)</td>
<td>0 (0.0)</td>
<td>22</td>
</tr>
</tbody>
</table>

Classification Certainty and Classification Difficulty

Apart from the hypothesized differences between the experimental conditions with respect to schema congruity and classification, subjects were also expected to differ both with regard to how certain they were about their classification and to how difficult it was to decide what the product was. Two $2 \times 2$ MANCOVAs were conducted to test the effect of attribute typicality on classification certainty ($r = 0.49; p < .01$) and classification difficulty ($r = 0.49; p < .01$).

Classification certainty and classification difficulty were expected to be lower in the balanced than in the unbalanced conditions because the present attributes would activate both source categories equally strongly, making it harder to select one category above the other. For classification certainty, the multivariate test did not reveal the anticipated significant interaction-effect. The three covariates were significant, however, meaning that the informative quality of the descriptions influenced subjects' perceptions of classification certainty (general impression: Wilks' $\lambda = 0.93, F_{2,80} = 3.07, p = .052$; questions: Wilks' $\lambda = 0.92, F_{2,80} = 3.56, p < .05$; power of imagination: Wilks' $\lambda = 0.86, F_{2,80} = 6.45, p < .01$). In contrast, the experimental manipulation did not affect classification certainty.

For classification difficulty, the analysis produced three significant effects: a significant covariate power of imagination (Wilks' $\lambda = 0.88, F_{2,80} = 5.87, p < .01$), a main effect of typicality of television attributes (Wilks' $\lambda = 0.92, F_{2,80} = 3.65, p < .05$), and the interaction effect (Wilks' $\lambda = 0.90, F_{2,80} = 4.34, p < .05$). According to the univariate tests, the covariate was significant for Item 4 ("Difficult to determine what the product is"); $F_{1,80} = 11.88, p < .01$) but not for Item 12 ("Read the descriptions several times"). The main effect of
typicality of television attributes was only significant for Item 4 ($F_{1,62} = 8.45; p < .05$). The interaction was significant for both measures (Item 4: $F_{1,62} = 4.55; p < .05$; Item 12: $F_{1,62} = 6.04; p < .05$). Table 7.9 presents the means. The conclusion that can be drawn from these means is the same for both items. The product descriptions that contained high-typical television attributes were harder to classify than those containing low-typical television attributes. This effect was enhanced when the video recorder attributes were low-typical rather than high-typical. Subjects had the greatest classification difficulty in the HTTV x LTVR condition (bold-printed figures).

Table 7.9
Means for Classification Difficulty

<table>
<thead>
<tr>
<th>Condition</th>
<th>Difficult to determine what product is (Item 4)</th>
<th>Reread description in order to tell what product is (Item 12)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTTV x LTVR</td>
<td>2.57</td>
<td>3.39</td>
</tr>
<tr>
<td>HTTV x LTVR</td>
<td>3.86</td>
<td>5.05</td>
</tr>
<tr>
<td>LTTV x HTVR</td>
<td>2.05</td>
<td>3.23</td>
</tr>
<tr>
<td>HTTV x HTVR</td>
<td>2.13</td>
<td>2.70</td>
</tr>
</tbody>
</table>

The Effect of Product Familiarity
The final set of results concerns the description of the television-CD player which was included in the experiment as a control condition for the HTTV x HTVR condition. If the theoretical model of the categorization of hybrid products that has been proposed in this dissertation is valid, there should be no difference between the classification of the familiar television-video recorder consisting only of high-typical attributes and of the unfamiliar television-CD player consisting only of high-typical attributes. This should be the case because in both conditions subjects are confronted with the same situation. The high-typical attributes of both source products emphasize the hybrid nature of the product more than one of the source products. Under such conditions, classification into a hybrid category is the most likely alternative to take place, irrespective of whether a hybrid category already exists or whether it still has to be created.

Nor on the other dependent variable, schema congruity, are differences expected to occur. Since all the source categories of the television-CD

Note 7 In the case of unfamiliar hybrids, congruity with the hybrid category cannot be measured, since the target category (i.e. the hybrid category) does not exist. In the experiment, congruity with the hybrid schema was measured for the television-CD player by replacing the name of the hybrid in the relevant items. However, it is not exactly clear what concept has been measured in this case. It is possible that subjects created some concept of television-CD player on the spot and imagined how congruent the attributes from the description were with this concept. Such a rudimental concept is clearly different from the concepts of familiar hybrids that have developed over time and of which exemplars also exist in memory.
player and of the television-video recorder are familiar, there is no reason to suspect that congruity with those source categories will be different.

Before reporting the results, it should be remarked that the interpretation of these results is going to be problematic for two reasons. First, predicting that no differences will occur between different conditions is equal to predicting that the null-hypothesis will be confirmed. Confirming a null (or any) hypothesis is statistically impossible (McCroskey and Andersen 1976), one can only reject it. It is impossible either to completely define the experimental conditions (how hard should one look for the thing that might not be there?) or to come to a firm conclusion (what if one had looked harder, or differently?) (Hayes and Ford 1995).

Another reason why it is hard to draw conclusions on the basis of the comparison between a television-video recorder and a television-CD player is that none of the predicted differences between the experimental conditions involving the television-video recorder were statistically significant. Therefore, the outcomes of the analyses of the television-video recorder and the television-CD player are questionnable no matter what they are. Nevertheless, in order to be complete, the results of the analyses will be reported below. Given these considerations, the results may be interesting to the extent that differences between the conditions do occur.

The findings of the manipulation check and the informative quality of the descriptions were discussed earlier. In brief, the thought elicitation task showed that after reading the description only 29.2 percent of the subjects made the association with a CD player, despite the presence of high-typical CD player attributes. In the aided thought elicitation task, however, the percentage was 75.0. On the variables measuring the quality and quantity of information in the descriptions, the television-CD player performed significantly weaker than the television-video recorder on all items. As expected, various independent samples T-tests showed no significant differences concerning congruence with the source schemas and with the hybrid schema. Of the 24 subjects who judged the television-CD player, 17 (70.8 percent) classified it as a television-CD player, two subjects (8.3 percent) thought it was a video recorder, and five subjects (20.8 percent) categorized it as something else. Nobody classified the television-CD player into the television category. The difference with the frequency distribution of the television-video recorder was not significant ($\chi^2 = 5.40; p = .067$). Like subjects in the four TV-VR conditions, subjects in the TV-CD condition almost exclusively categorized the product from the description as a hybrid.

On classification certainty and classification difficulty, the television-CD player differed significantly with the television-video recorder, but only on one of the two items. In the TV-CD condition, subjects indicated that they had to reread the description more often. Moreover, uncertainty at the end of the experiment about what the product was, was higher for the television-CD player than for the television-video recorder. These differences seem to
be related to the difference in familiarity between the two hybrids. The results are summarized in Table 7.10 (significant results are noted by an asterisk).

Table 7.10
Results for the Familiar ($N = 23$) and Unfamiliar Condition ($N = 24$)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Condition</th>
<th>Mean</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absolute individual congruity difference</td>
<td>Familiar</td>
<td>2.52</td>
<td>$t_{56} = 0.41; p = .684$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>2.29</td>
<td></td>
</tr>
<tr>
<td>Congruity with television</td>
<td>Familiar</td>
<td>4.26</td>
<td>$t_{56} = -0.06; p = .951$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>4.29</td>
<td></td>
</tr>
<tr>
<td>Congruity with video recorder (CD player)</td>
<td>Familiar</td>
<td>3.22</td>
<td>$t_{56} = 0.27; p = .786$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>3.08</td>
<td></td>
</tr>
<tr>
<td>Congruity with hybrid</td>
<td>Familiar</td>
<td>6.13</td>
<td>$t_{56} = 0.33; p = .740$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>* Sufficient information to get a general impression of the product</td>
<td>Familiar</td>
<td>1.83</td>
<td>$t_{56} = -4.36; p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>3.79</td>
<td></td>
</tr>
<tr>
<td>* Sufficient information to answer the questions</td>
<td>Familiar</td>
<td>2.74</td>
<td>$t_{56} = -2.41; p &lt; .05$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>4.21</td>
<td></td>
</tr>
<tr>
<td>* Create a mental image of the product</td>
<td>Familiar</td>
<td>6.26</td>
<td>$t_{56} = 2.84; p &lt; .01$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>4.96</td>
<td></td>
</tr>
<tr>
<td>Difficult to determine what the product is</td>
<td>Familiar</td>
<td>2.13</td>
<td>$t_{56} = -1.63; p = .109$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>2.83</td>
<td></td>
</tr>
<tr>
<td>* Reread description in order to tell what the product is</td>
<td>Familiar</td>
<td>2.70</td>
<td>$t_{56} = -3.25; p &lt; .01$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>4.54</td>
<td></td>
</tr>
<tr>
<td>Certain about classification</td>
<td>Familiar</td>
<td>5.83</td>
<td>$t_{56} = 1.47; p = .149$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>5.17</td>
<td></td>
</tr>
<tr>
<td>* Still not certain about what the product is</td>
<td>Familiar</td>
<td>5.57</td>
<td>$t_{56} = 4.40; p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar</td>
<td>3.00</td>
<td></td>
</tr>
</tbody>
</table>

7.3 General Discussion

The purpose of this final empirical chapter was to examine whether the categorization of hybrid products is related to the centrality of the essential attributes. An experiment was conducted in which the typicality of the attributes of both of the source products (i.e. television and video recorder) was systematically varied, resulting in four experimental conditions, two representing balanced attribute typicality (low-typical x low-typical, high-typical x high-typical) and two unbalanced (high-typical x low-typical, low-typical x high-typical). To control for the effect of product familiarity, a fifth condition was added, namely high-typical of TV x high-typical of CD player.
The study predicted that congruity with both the source categories and the hybrid category, and classification would differ between conditions. Specifically, the description in the high-typical of TV x high typical of VR condition was anticipated to be: (1) as congruent with the television category as with the video recorder category; (2) more congruent with the hybrid television-video recorder category than the other descriptions; and (3) classified more often as a television-video recorder than the other descriptions. In the unbalanced conditions (i.e. high-typical of TV x low-typical of VR and low-typical of TV x high-typical of VR), on the other hand, congruity was predicted to be the highest with the dominant source category, leading subjects to categorize the product from the description more frequently into the dominant than into the recessive source category.

The results of Study 6 failed to support any of the hypotheses. In fact, in all analyses only one result was found to be significant, namely the result that congruity with the television category was higher for descriptions including low-typical video recorder attributes than for descriptions including high-typical video recorder attributes. No differences occurred on the main dependent variable, i.e. classification of the hybrid product. In all conditions, subjects almost exclusively indicated that the product in the description was a television-video recorder (television-CD player). Apart from the explanations that will follow below, the observation that all descriptions were predominantly classified as a hybrid product is likely to be an artifact of the specific measure (Item 2, Table 7.4) that was used to determine category membership. Subjects had four options: the description referred to a television, video recorder, television-video recorder, or something else. In retrospect, it seems unlikely that subjects would opt for anything other than the television-video recorder. Even in the unbalanced conditions in which the attributes of one source category were low-typical, a slight doubt about only a single attribute would probably steer subjects towards the hybrid category by way of a negative decision process, which might develop along the lines of: "I don't know for sure whether the product is a television-video recorder, but it is almost certainly not a television (video recorder), because of these television (video recorder)-atypical attributes. On the other hand, these attributes are definitely television (video recorder)-attributes, so my best guess is that it is a television-video recorder. If it is something else, I wouldn't know what that is. Yes, it must be a television-video recorder!" In short, given the composition of the attribute sets, option 3 (television-video recorder) was the most logical option. Options 1 and 2 were suspicious because of the presence of atypical attributes; option 4 was not a logical alternative either, because why would the researchers specify three options and leave the fourth open? Probably, the fourth option was only chosen by those subjects who really had no idea what the product was from the description.

Assuming that subjects indeed approached the item as just described, the question is in which other way category membership could have been measured. One possibility would be to provide subjects with a set of pictures
including a television, a video recorder, a television-video recorder and a few other products, and have them select the picture that best reflects the product from the description. Such a procedure would stimulate subjects to look for a positive rather than a negative match, because both category labels and the exact attributes of the products are unknown. Clearly, the disadvantage is that it is unknown to the researcher what subjects think the products in the pictures are.

Alternatively, category membership could be measured by asking people to state what the product is from the description, or to ask them what product the description makes them think of. This approach was taken in Study 6 to check which product schemas were elicited by the various descriptions (Item 1, Appendix 7.2). Thus, although this measure was taken as a manipulation check, it may actually serve as an alternative to the dependent measure of category membership. As noted earlier, the outcomes of the spontaneous thought elicitation task that subjects performed immediately after they had read the product description, showed a pattern that was largely consistent with the predictions of the study. Consider the first two rows under the first four columns of Table 7.5: with the exception of the already mentioned percentage in the HTTV x HTVR-yes cell, the percentages of subjects that spontaneously referred to the television and video recorder in each condition follows the hypothesis. In the LTTV x LTVR condition, the "yes" percentages for the television and video recorder are equal and relatively low. In the unbalanced conditions, the "yes" percentage is considerably higher for the product of which high-typical attributes are present than for the product of which low-typical attributes are present (HTTV x LTVR: 59.1 vs. 31.8 percent; LTTV x HTVR: 40.9 vs. 77.3 percent). Moreover, the "yes" percentages are higher for the high-typical than for the low-typical conditions. The only cell that is not in accordance with expectation, is the "yes" cell for the television in the HTTV x HTVR condition. The percentage in this cell is lower than anticipated, namely only 30.4 percent. Ergo, if the thought elicitation data are taken as a measure of category membership as it was previously argued, some supporting evidence does appear to exist. In spite of the fact that significant results were not found for the category membership variable (Item 2), the thought elicitation data suggest that the product descriptions did not completely fail in evoking the predicted responses from consumers. These data do not explain, however, why hardly any significant effects were found with regard to the congruity variables. After all, these variables were measured by means of 7-point scales and did not suffer from the problem that the categorical variable for category membership did. The remainder of the discussion will deal with this issue.

A first explanation for the lack of significant results could be that the difference in attribute typicality between the high-typical and low-typical television attributes was too small. Typicality of the low-typical attributes may have been too high, typicality of the high-typical attributes too low, or both may have been the case. A comparison of the percentages in Table 7.5 reveals a small positive difference between the "yes" percentage for the
television under conditions of low video recorder attribute typicality (59.1 vs. 52.2) and a negative (1) difference under conditions of high video recorder attribute typicality (30.4 vs. 40.9). The comparable figures for the video recorder are 77.3 versus 52.2 and 69.6 versus 31.8; these differences are much larger. The results for classification difficulty actually support the impression that the high-typical television attributes may hardly have been more typical than the low-typical television attributes. Subjects reported to have had more trouble with classifying the descriptions with high-typical television attributes than those with low-typical television attributes, particularly when the typicality of the video recorder attributes was low. Thus, the manipulation of attribute typicality of the television attributes appears to have failed to create sufficiently distinct high- and low-typical conditions, which could partly explain the absence of significant differences between them. Further on it is suggested that the low-typical television attribute HAS SUBTITLES may have disturbed the manipulation by functioning as a high-typical attribute. If this is the case, it also illustrates the vulnerability of methods that use attribute lists to manipulate product typicality to the influence of single attributes.

Something else that may have occurred during the experiment is that the descriptions were initially successful in creating different conditions of attribute typicality, but that subjects soon jumped to the schema of the television-video recorder they had already stored in memory and answered the questions on the basis of that instead of the information from the descriptions. Although this claim is difficult to substantiate, it does not seem unlikely that such a process would take place when familiar and easily accessible schemas are involved. Actually, this point raises the question to what extent it is possible to use relatively limited lists of attributes in order to represent products, or more specifically: different versions of products. The information in such an attribute list may simply be too limited, both in quality and quantity, for subjects to work with, let alone to create really different situations. If this were true, it would be a perfectly logical step to turn to the additional information available in memory. The findings regarding information sufficiency and power of imagination suggest that in general subjects reported that the descriptions contained sufficient information to acquire a general impression of the product ($M = 2.74$; $SD = 1.75$) and to answer the questions ($M = 3.47$; $SD = 2.01$). In addition, subjects had little trouble creating a mental image of the product from the description ($M = 5.76$; $SD = 1.46$). Although these findings contradict the idea that the descriptions held insufficient information, they do not quash the possibility that subjects based their answers on information from memory in addition to, or even instead of, the information from the descriptions.

A final reason why the experimental manipulations did not lead to the predicted differences between conditions could be that the link between attribute typicality and categorization is insufficiently strong. In assessing category membership of hybrid products, consumers not only consider how typical the attributes of the hybrid are of the corresponding source category
but they also judge the extent to which the attributes of the hybrid are atypical of the contrasting source category (Hampton 1998). The attribute **HAS A SCREEN**, for instance, is highly typical of televisions and highly atypical of video recorders. As a result, the presence of this attribute will foster categorization as a television and inhibit categorization as a video recorder. In contrast, the property **BLACK** is typical of televisions (i.e. most televisions are black), but it is also typical of video recorders, which are generally black as well. "Blackness" does not foster or inhibit categorization into either of the source categories, because it is not diagnostic, i.e. it does not distinguish televisions from video recorders. In general, the attributes belonging to one source category are highly atypical of the other source category and vice versa, unless these attributes are low-typical (non-essential). For this reason, consumers encountering a new hybrid product are unlikely to categorize the hybrid as an enhanced source product; the high-typical attributes of the other source product prevent this.

More formally stated, attribute typicality provides an indication of how similar an attribute is to the essential attributes of the target category. It does not take account of an attribute's dissimilarity to contrast categories (Rosch 1978). A measure that includes both similarity to the target category and dissimilarity to contrast categories is diagnosticity. **Attribute diagnosticity** has been defined as "the classificatory significance of attributes, i.e. the importance or prevalence of the classifications that are based on these features" (Tversky 1977, p. 342). High-diagnostic attributes distinguish instances from non-instances of a category; they are common within a category and distinctive across categories (Yi and Gray 1996). In other words, an attribute that is high-diagnostic of any category C has both a high correlation with category C and a low correlation with contrasting categories; the attribute is typical of category C and atypical of others.

The difference between attribute typicality and attribute diagnosticity can be formalized using the notions of category validity and cue validity. **Category validity** is the conditional probability that a feature is present, given that an object is a member of a category (e.g. the probability that a coat has a zipper). **Cue validity** refers to the conditional probability that an object is a member of a category given that a particular feature is present (e.g. the probability that something is a car given the presence of four tires). The degree of category validity determines attribute typicality. Features that have a high probability of belonging to a category are typical of that category. In order to be high-diagnostic, typical attributes also have to possess high cue validity. For example, the attribute **HAS A ZIPPER** is high-typical for both SLEEPING BAG and COAT, but is will not serve well to distinguish between sleeping bags and coats, since cue validity is low. In sum, typicality is a function of category validity only, whereas diagnosticity depends on both category validity and cue validity.

In Study 6, low- and high-typical television and video recorder attributes were selected on the basis of how typical they were of the television category
and the video recorder category. It was not measured how diagnostic these attributes were for telling televisions and video recorders from contrasting categories such as stereo sets and CD players. If the attribute lists that make up the descriptions are reconsidered in terms of attribute diagnosticity, several attributes appear to be less useful for manipulating categorization. In general, high-typical attributes stand a bigger chance of being high-diagnostic as well, but not necessarily so. The high typical television attribute HAS A SCREEN, for example, is also high-typical for a computer and thus not very diagnostic. On the other hand, low-typical attributes will usually be low diagnostic. In case of the television attribute HAS SUBTITLES, HOWEVER, attribute diagnosticity is high because only one medium other than television, i.e. the cinema, provides subtitles. As this attribute was included in the low-typical TV conditions, it may have enhanced the typicality in these conditions to equal the typicality in the high-typical TV conditions. All high-typical video recorder attributes could also be attributes of a tape recorder, whereas the low-typical attributes apply equally well to a stereo set. Nevertheless, diagnosticity appears to be rather high for the high-typical attributes because the number of contrasting categories that share these attributes is small.

The superficial analysis of the diagnosticity of the attributes used in the product descriptions has shown that the discriminative power of the descriptions could be improved by selecting attributes on the basis of diagnosticity rather than typicality. Probably, many of the attributes that were selected on the basis of typicality will also appear when selection takes place on the basis of diagnosticity, because typicality and diagnosticity are closely related. It would be interesting to see whether a replication of Study 6 with diagnostic rather than typical attributes would yield the predicted results. Preparations for such a replication have in fact already been taken. In a pilot study among 60 students, attribute diagnosticity was assessed for a set of television, video recorder and CD player properties, including the properties that were used in Study 6. Appendix 7.3 presents the results of this pilot study. As expected, these results show that several of the high-typical attributes from Study 6 were also judged to be high-diagnostic. At the same time, alternative attributes emerge that on the basis of face validity appear to be more suitable for creating truly discriminating conditions.
8 Consumer Categorization of Hybrid Products: Summary and Implications

This dissertation centers around a product strategy that has gained in popularity during recent years: the development of hybrid products. Existing products, functions or technologies are combined into a single new product entity. For companies, such a strategy constitutes an effective way to increase their performance. For consumers, a hybrid product may serve as an attractive alternative because one instead of two products can be bought, which is cheaper and saves space. Based on the results of the six studies that have been presented in the previous chapters, the current chapter discusses whether developing hybrid products is a sensible strategy for new product development.

At first sight, hybrid products seem to be good for both sides (i.e. companies and consumers), but there is a catch. Hybrid products are ambiguous, i.e. they can be assigned to different product categories and as a result, it is difficult to predict consumers' reactions. Several scenarios are possible. First, consumers may understand, appreciate and adopt the new hybrid product. This is what every company would like to see happen. Unfortunately for companies, however, consumers may also misinterpret the new hybrid; they may fail to recognize its multiple identity, assign it to a non-hybrid category, and respond accordingly. For instance, someone may not recognize the calculator incorporated into the wristwatch-cum-calculator, classify it as an ordinary wristwatch and refrain from buying it due to its relatively high price. Alternatively, if consumers do recognize the ambiguity, they may become uncertain about the hybrid's true identity. The result is an increased perceived risk involved in buying the hybrid, making the consumer reluctant to purchase.

Companies introducing new products to the market face high levels of uncertainty. As Trott (1998, p. 90) writes:

It is axiomatic that for new products to be successful in the market they need to be perceived to be beneficial by prospective buyers. The benefit needs to
stand out, to be distinctive and attractive. This distinction needs to be relevant to buyers and it needs to be seen to be relevant by them. It is pointless being distinctive in a way that consumers believe to be irrelevant or incomprehensible.

In the case of new hybrid products, Trott’s remarks are even more relevant than for new products in general, because hybrid products carry the burden of being highly similar to their source products, both perceptually and functionally. As outlined in the first chapter, it may prove to be a great challenge to create a hybrid product that is technically feasible, that is clearly distinct from its source products and other existing products in the sense that it offers additional value to consumers, and that it can be communicated as such (i.e. a distinctive product with additional value).

In order to help companies to rise to this challenge, the research project described in this dissertation investigated how consumers categorize hybrid products. The plan of the research has been as follows. First, the issue of how hybrid products are represented in the mind of consumers was addressed (chapter 2). Several views of categorization were discussed, leading to a model of the structure of hybrid product categories and a model of the categorization process of hybrid and non-hybrid products. Before the categorization of hybrid products was examined, two fundamental issues were addressed, the first concerning the question of the kind of categories consumers use to categorize products (chapter 3). The validity of the basic-level superiority hypothesis (i.e. people prefer to categorize objects into basic-level categories on the basis of overall similarity between them) was tested in two studies. Testing this hypothesis was critical to the research, since the ambiguity that characterizes hybrid products (i.e. they fit into multiple categories at the same time) is assumed to depend on it, that is to say if people do not categorize objects into basic-level categories, hybrid products would not be ambiguous. The second fundamental issue dealt with the bases of product categorization (chapter 4). Understanding how consumers categorize (hybrid) products, requires insight into the product aspects that consumers use to judge similarity between products and to assign them to categories. After having established which product categories consumers create and on which product dimensions these categories are based, the research focussed on the difference between the categorization process of hybrid and non-hybrid products (Study 4, chapter 5). The outcome of Study 4 initiated the examination of the effect of familiarization (i.e. gaining experience with a hybrid product) on the categorization of hybrid products (chapter 6). The explanation for the familiarization effect suggested in chapter 6, namely that experience changes the centrality of the attributes of the hybrid’s source products, was explored in the final empirical chapter (chapter 7).

The next section summarizes the most important empirical findings of the research reported in this dissertation. Section 8.2 discusses several implications for categorization theory. Managerial implications are given in section 8.3. Finally, section 8.4 indicates directions for future research.
8.1 Summary of Key Findings

8.1.1 The Mental Representation of Hybrid Product Categories

Product categorization involves comparison between a product instance and categorical knowledge stored in memory (Cohen and Basu 1987). The second chapter described how categorical knowledge is believed to be stored in the consumer’s mind. Traditional views of category representation have pictured categories as sets of defining attributes, hypothetical prototypes, or collections of real exemplars. The most recent view of category representation, the “theory view”, sees categories as naïve theories, containing all knowledge about a category and its members. They also include knowledge about which products are members of the category and which are not. Among many other things, they describe what the category members look like, what they are used for, how they can be used, what their relationship is with other products, and which role they play for consumers in a particular culture.

According to one particular version of the theory view, i.e. the theory of psychological essentialism, people believe that, and act as though, categories possess essences. The essence of a category is that what makes the category what it is and not something else. The essence represents the information that defines the category, its members and non-members. The essence is more than a set of defining and sufficient attributes, like the classical view posits. The essence also contains information about exceptions, i.e. category members that do not possess all the defining attributes. Thus, part of the essence is formed by the knowledge that category membership is flexible.

In the case of hybrid products, multiple essences exist, namely the essences of the source products. Following the view of psychological essentialism, the conceptual structure of a hybrid product is assumed to consist of essential properties of the source products, possibly essential properties of the hybrid product, and non-essential properties of the source products and the hybrid product (see Figure 2.6). This explains why hybrid products are ambiguous; they can be assigned to each and every source category and to the (new) hybrid category because they combine the essential properties of all of these target categories. It also explains why the categorization of hybrid products is likely to evoke feelings of conflict. The essential properties of source category A facilitate categorization in A and inhibit categorization in source category B. Likewise, the essential properties of source category B encourage categorization in B and discourage categorization in A. In sum, the hybrid can be assigned neither to A nor to B. Categorizing the new hybrid into a new hybrid category AB, is also difficult, since this category does not yet exist.
At the end of the second chapter, the categorization process of hybrid products was described by means of a flow chart picturing the decision process that consumers go through when they categorize hybrid products (see Figure 2.8). Five outcomes were proposed: (1) the hybrid is mistakenly categorized as source product A; (2) the hybrid is mistakenly categorized as source product B; (3) the hybrid is categorized into an existing hybrid category; (4) a new hybrid category is created for the hybrid; and (5) the hybrid cannot be categorized; it remains unknown. The flow chart of the categorization process of hybrid products is reconsidered in the light of the results from the complete research at the end of this section (8.1.7).

8.1.2 Principles Determining Product Classification

In search of an answer to the question of what kind of product categories consumers create, the third chapter reviewed two streams of literature, namely literature on object classification and literature on basic-level superiority. A review of the classification literature revealed two principles according to which people classify objects. People may sort objects on the basis of overall similarity (i.e. family resemblance sorting) or according to a single dimension (i.e. one-dimensional sorting). Based on the literature on the basic-level superiority hypothesis, it was concluded that people categorize objects into basic-level categories according to the family resemblance principle. For example, different instances of a chair would be classified into the basic-level category of chairs, rather than into the superordinate-level category of furniture, the subordinate-level categories of kitchen chairs, folding chairs and arm chairs, or the one-dimensional category of wooden objects. Study 1, in which participants sorted pictures of furniture or electrical equipment, found that basic-level sorting occurred much less frequently than expected. Instead, products were frequently grouped together on the basis of a single aspect, such as color (e.g. blue armchair with blue couch, white versus brown goods), material (e.g. wooden furniture), or specific usage (e.g. hair care appliances). To explain this unexpected finding, it was contended that consumers may refrain from basic-level sorting in the presence of alternative sorting cues. Thus, although products are organized into basic-level categories in memory, actual classification takes place on the basis of whichever cue is salient in the specific situation.

Evidence in support of this explanation was found in the second study which instructed participants to sort the products in the most obvious way. This time, the number of basic-level sorts increased significantly, although some non-basic-level sorting still occurred. In conclusion, the results from studies 1 and 2 support the basic-first hypothesis (Kelter et al. 1984; Murphy and Brownell 1985). In contrast to what the model of category construction proposed by Ahn and Medin (1992) would predict, products are identified first as members of their basic-level categories, after which alternative categorizations may take place. This outcome provides the empirical foundation of the conceptual model of the categorization of hybrid products.
sketched in the second chapter. At the basic level, hybrid products consist of multiple essences. The ambiguity of hybrid products results from consumers' inability to fit these different essences into a single basic-level category.

8.1.3 Dimensions Underlying Product Classification

When consumers assign products to categories, they judge the similarity between the products and the representation of the category (i.e. the essence) in their minds. In the fourth chapter, the dimensions of likeness were identified, that is to say the product aspects that consumers use to decide whether a particular product belongs to a certain category (i.e. the aspects that form the essence). On the basis of a review of different streams of literature (i.e. product design, product semantics and consumer research), five general dimensions were proposed to play a role in product categorization, namely appearance, function, use, evaluation, and marketing and manufacturing. The empirical study conducted to check the validity of these general dimensions yielded 19, of which seven pertained to product appearance, four to product function, and six to product use. The remaining two dimensions, quality and relationship, could not be related to any of the five dimensions mentioned in the literature. Whilst these dimensions covered remarks that were judged to be semantically related, it proved difficult to explain to which product aspects they referred. In fact these dimensions played a relatively small role in participants similarity judgments.

For both stimulus sets (i.e. furniture and electrical equipment) function-related dimensions were the most salient, followed by those regarding appearance and use. Roughly, out of every ten participants, seven classified the products on the basis of functional product aspects, four on the basis of appearance-related aspects, three on the basis of aspects concerning use, and two on the basis of quality or relationship. The salience of the dimensions varied across different levels of inclusiveness. At the superordinate level, function was the most salient, followed by relationship, use, appearance, and quality. At the basic level the order of salience was function, appearance, use, quality and relationship (which had a salience of zero). In comparison with the superordinate level, at the basic-level, appearance gained significantly in importance. At the subordinate level, appearance became an even more important basis for product classification, followed by function, quality, use and relationship. At this level, half of the product sorts were based on the appearance of the products. Again, the dimension relationship played a minor role. In sum, function was found to be a highly important dimension at every level of inclusiveness. The importance of appearance and use as bases for classification increased as categories became more specific. Evaluative and marketing-related dimensions that were found in the literature proved to be insignificant to participants.
8.1.4 The Effect of Hybridity on Product Categorization

Four differences were hypothesized between hybrids and non-hybrids. First of all, in line with the central assumption of the dissertation, hybrid products were predicted to be more ambiguous than non-hybrid products because the former possess multiple identities. As a result of their inherent ambiguity, the categorization of hybrid products was expected to involve greater cognitive effort and to be less accurate. Finally, consumers were hypothesized to find hybrid products relatively odd as a result of the unexpected combination of source products. Support was found for all hypotheses, with the exception of the one regarding classification accuracy (classification of hybrid and non-hybrid products was equally accurate). Participants perceived the hybrid television-video recorder to be more ambiguous than the non-hybrid Discman, they had to employ higher levels of cognitive effort to categorize the television-video recorder, which they found more odd than the Discman. Contrary to expectation, both the television-video recorder and the Discman were correctly categorized by almost 90 percent of the participants.

Since the stimuli in Study 4a were both relatively familiar products, a second study was conducted with unfamiliar stimuli, namely a juice centrifuge (non-hybrid) and a hair dryer-iron (hybrid). The expectation was that the differences found for the television-video recorder and the Discman would disappear if the products were unfamiliar, because unfamiliar products are hard to categorize anyway. Indeed, the results showed that the juice centrifuge and the hair dryer-iron were perceived to be equally ambiguous (and more ambiguous than the television-video recorder and the Discman), cognitive effort was equally high, and classification accuracy was equally poor (i.e. 9 percent for the hybrid and 32 percent for the non-hybrid). Somewhat surprising in this case as well, was that the hybrid product was judged to be more odd than the non-hybrid. Apparently, people recognize the strange combination of source products, even when they do not know the hybrid product as such.

In conclusion, the results reported in chapter 5 suggest that differences between hybrid and non-hybrid products occur when products are familiar; if products are unfamiliar, information processing is elaborate and uncertain under all conditions. Under these circumstances, the effects of product hybridity on cognitive elaboration and classification certainty appear to leave consumers unaffected.

8.1.5 The Effect of Familiarization on the Categorization of Hybrid Products

The fifth chapter showed that the effect of hybridity on consumer product categorization is affected by the degree to which products are familiar to consumers. The categorization of hybrid products was compared to the
categorization of non-hybrid products under conditions of high and low product familiarity. Chapter 6 concentrated on the effect of familiarity on the categorization of hybrid products. It was assumed that the categorization process regarding unfamiliar (or new) hybrid products would be different from that of familiar (or existing) hybrids. Specifically, the categorization process of hybrid products was hypothesized to change over time. Consumers confronted with a new hybrid product are believed to create a new category for the unknown hybrid by combining the familiar schemas of the source products into a new hybrid product schema. Thus, a combination of a hair dryer and an iron, for instance, is categorized as a hair dryer-iron, being half hair dryer and half iron. After this initial classification, however, consumers start using the hair dryer-iron. Specific usage patterns for the hybrid develop. For example, consumers may use the hair dryer-iron exclusively whilst travelling or on holiday. Or they may use it at home, when the regular iron breaks down. Alternatively, someone may use the hair dryer-iron as a hair dryer only, after accidentally burning a hole in his or her clothes the first time (s)he used it. In short, for all kinds of reasons, consumers are likely to develop usage patterns over time; patterns in which one primary function dominates the other. When this happens, the categorization of the hybrid can be expected to change accordingly; rather than being a hybrid product, the hybrid gradually changes into (a special version of) one of its familiar source products.

The results from Study 5 support the familiarization hypothesis. As hybrid products become familiar, they are less often classified into a hybrid category and more often into the source category with which they are perceived to be the most congruent. Furthermore, whilst unfamiliar hybrids tend to be equally congruent with both source categories, familiar hybrids are frequently found to be more congruent with one source category than with the other. Finally, since it is harder to create a new schema for the hybrid than to accommodate it into an existing source schema, the categorization of unfamiliar hybrids requires higher levels of cognitive effort than the categorization of familiar hybrids.

8.1.6 The Effect of Attribute Typicality on the Categorization of Hybrid Products

The explanation for the familiarization effect found in the fifth study was that product experience may change the centrality of the properties of the hybrid product. Conceptually, this means that the essence of a hybrid product changes from a hybrid product essence into a non-hybrid one. Essential properties of one of the source categories no longer define the product, as a result of which classification into a non-hybrid category is no longer inhibited. The sixth study was designed to investigate the plausibility of this explanation.
In an experiment the flexibility of category membership of hybrid products (in this case a television-video recorder) was tested by manipulating the typicality of the properties of the source products. Specifically, hybrid products made up of properties that were high typical of source category A and properties high typical of source category B, were predicted to be congruent with both source categories and would therefore be classified as a hybrid product more frequently than hybrids of which the properties were high typical of only one of the source categories. Four product descriptions were created including high-typical (HT) and low-typical (LT) attributes of televisions (TV) and video recorders (VR), resulting in the following conditions: LTTV x LTVR, LTTV x HTVR, HTTV x LTVR, and HTTV x HTVR\(^1\).

The schema elicitation data supported the classification hypothesis\(^2\). Subjects in the HTTV x HTVR condition most frequently associated the product in the description with a television-video recorder. In the LTTV x LTVR condition, the product was associated as often with the television as it was with the video recorder. In the HTTV x LTVR condition, subjects mentioned the television more often than the video recorder, a result that was exactly opposite in the LTTV x HTVR condition.

The hypotheses regarding schema congruity were not corroborated. Surprisingly, hardly any significant differences were found between the experimental conditions. Two main explanations for the lack of significant results were given. First, the difference in attribute typicality of the television attributes in the high-typical and low-typical conditions appeared to have been too small to induce the predicted differences. Second, the product descriptions consisted of attributes that were selected on the basis of their typicality of the source categories. The discriminative power of the product descriptions used in the different experimental conditions could have been improved by selecting attributes on the basis of attribute diagnosticity instead of typicality.

In sum, on the basis of Study 6, it would be too early to abandon the idea that changing the centrality of the properties of hybrid products could lead to a change of category membership. The findings of the category elicitation tasks, in particular, suggest that consumers are sensitive to information about the centrality of the properties of the hybrid product when they categorize hybrids. Study 6 has also illustrated the power of single attributes in steering classification. The presence of a single attribute can be enough to establish classification into the corresponding category, or to inhibit categorization into a contrasting category. In Study 6 the inclusion of the attribute HAS SUBTITLES seems to have been responsible for the absence of differences between the high-typical and low-typical television conditions. The presence

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\(^1\) In fact, a fifth condition was added to control for product familiarity. Since these analyses did not yield any significant results, this condition is ignored here. The interested reader is referred to chapter 7.

\(^2\) The schema elicitation data were considered instead of the data on the dependent measure due to a measurement problem with the dependent variable (see chapter 7).
of this attribute turned the low-typical description into a high-typical description even though the remaining three attributes were low- rather than high-typical.

8.1.7 The Categorization Process of Hybrid Products

To end the summary of key findings, the categorization process of hybrid products, as described in the flow chart in Figure 2.8, is reconsidered (see Figure 8.1). In Figure 8.1 the most probable routes of categorization for both familiar and unfamiliar hybrids have been maintained. To begin with the categorization of familiar hybrid products, chapter 6 has shown that familiar hybrid products are most likely to be categorized in their usage-dominant source category, which could be either of the source categories. The routes leading to Outcome 1 and Outcome 2 represent these respective processes. It should be noted that in chapter 2, Outcomes 1 and 2 were said to refer to those situations in which consumers failed to recognize both of the source products. Now it is posited that, when a hybrid is familiar, it is unlikely that consumers will make such an erroneous classification. Rather, Outcome 1 and Outcome 2 should be seen as deliberate choices of consumers who accommodate the hybrid into one of its source categories. In fact, Outcome 1 and Outcome 2 in Figure 8.1 represent subcategories of the source categories, whereas in Figure 2.8 they denote the source categories themselves. Note that the categorization of a familiar hybrid product is expected to take place in very much the same way as the categorization of a familiar non-hybrid (see Figure 2.7). Both processes will develop quickly and with little cognitive effort. The difference is that categorizing a hybrid is more elaborate than categorizing a non-hybrid since it involves one extra step. Also note that the route to Outcome 3, representing the categorization of a familiar hybrid into an existing hybrid category has been dotted. On the basis of the results in chapter 6, this outcome is not expected to occur often.

In contrast to familiar hybrids, unfamiliar hybrids are generally categorized into a category of their own (see chapter 6). Since the new hybrid fits neither in source category A nor in source category B, a new hybrid category will be formed (Outcome 4). The route to Outcome 5 has also been dotted, because it is assumed that even a really new hybrid products will not remain unidentified for long. Consumers will soon learn or they will be told what the new hybrid is. In sum, from the five outcomes of the categorization process hypothesized a priori, the current research has suggested that three are most likely to occur.
8.2 Implications for Categorization Theory

8.2.1 The Role of Atypical Attributes

The current account of hybrid product categorization has dealt with an issue that has only recently received attention of categorization theorists, i.e. the categorization of ambiguous products. So far, theoretical models of categorization have concentrated on how people determine the match
between an object and a single category. They have not yet investigated how people categorize objects that fit into multiple categories. The assessment of category membership for hybrid products is a more complex and elaborate process, since it involves multiple decisions about category membership, rather than one. First, consumers have to decide whether the attributes of the hybrid product are sufficiently similar to the attributes associated with source category A. Next, they have to decide whether the attributes associated with source category B are reconcilable with source category A. If they are not, the process starts anew, beginning with determining the match between the hybrid and source category B. This process was explained in the flow chart in Figure 2.8 (see also Figure 8.1).

When consumers assess similarity between a non-hybrid and a target category, they focus on the presence of typical properties. Atypical properties generally receive less attention as they do not determine category membership. This is the case because non-hybrid products generally do not possess many atypical properties. Under such circumstances, it is an effective strategy to assign products to categories on the basis of typical properties. The few atypical properties that may be present can usually be assimilated or accommodated in the product schema. As this dissertation has shown, a classification strategy based purely on the presence of typical properties, does not work for hybrid products. Hybrid products possess too great a number of atypical properties to assimilate or accommodate. The typical properties related to source category A (B) are atypical of source category B (A) and will therefore inhibit classification of the hybrid into source category B (A). In other words, whilst typical properties determine category membership of non-hybrid products, atypical properties are decisive when hybrid products are involved.

Current accounts of categorization do not incorporate the role of atypical properties as defining attributes. Similarity is generally defined as the ratio between the number of common (i.e. typical) and distinctive (i.e. atypical) attributes (Tversky 1977). As the number of common attributes increases relative to the number of distinctive attributes, similarity increases, leading to higher categorization probability. In such a definition, all distinctive attributes, i.e. any attribute that is not shared between an object and its representation, are considered to be equal. However, all distinctive attributes are not equal. True, they are all low typical of the target category, but they may be highly typical of contrasting categories. If this is the case, as it is with hybrid products, the atypical properties are not insignificant, as most categorization models assume. Instead, they may have the power to prevent categorization into the target category. This dissertation has shown that the presence of a single non-membership property, namely an attribute that is highly typical of a contrasting category, may already be sufficient to disrupt classification into the target category (e.g. the low-typical television property HAS SUBTITLES in Study 6). The same appears to be the case when several atypical attributes are present that are only low typical of a contrasting category. Subjects in Study 6 who received a description of a
product consisting of high-typical television properties and low-typical video recorder properties classified this product as a television-video recorder rather than a television, of which high-typical properties were present. An illustrative example of how a single non-membership attribute (i.e. the electrical cord) may disturb categorization is provided by Garner (1982) who invented the plug-in flashlight (see Figure 8.2).

Figure 8.2
Plug-In Flashlight

In sum, the role that non-membership attributes may play in the product categorization process has been largely neglected in the categorization literature. The present research with hybrid products suggests that non-membership properties are important and should be included into contemporary theories of (product) categorization. On a conceptual level, this means that, as was mentioned in chapter 7, the notion of typicality should be replaced with that of diagnosticity, which does take typicality with contrasting categories into account.

8.2.2 Classification of Artifacts

The classification studies reported in this dissertation have extended previous research on object classification in three ways: (1) the number of stimuli was significantly larger (i.e. 50 instead of 10 or 20); (2) the stimuli were (pictures of) real products rather than words, natural objects or artificial (geometric) forms; and (3) the experimental task was truly a free sorting task rather than a restricted classification task. Due to the way the classification tasks were set up, the current studies were importantly different
to earlier ones. First, participants were not forced to create either a family resemblance or a one-dimensional sort as they were in almost every other experiment reported in the literature. By having people organize the stimuli in any way they wished, and by providing them with a relatively large number of stimuli, classification was less constrained. In this way, possible alternative classification principles had a greater chance of being discovered. Moreover, the validity of the results was increased, since there was less chance that a particular sorting strategy was encouraged or inhibited by limitations related to the stimulus set, such as the number of stimuli and the degree of variation between the stimuli.

A second difference with previous studies is that the current studies applied categorization theory to the field of artifacts by using pictures of real products rather than artificial stimuli or product names. Categorization theory has been particularly concerned with the categorization of natural kinds (Mervis and Rosch 1981; Rosch 1978; Rosch, Mervis, Gray, Johnson and Boyes-Braem 1976). An important difference between natural objects and artifacts is that natural objects are created by nature whilst artifacts are created by humans. In other words, the attribute structure of natural objects is given (they occur as particular constellations in nature), whereas the attribute structure of artifacts is not. Artifacts are created as specific attribute constellations in order to perform specific functions, but these constellations can be changed within the constraints set by the functions. This difference between artifacts and natural objects is reflected in their correlational structure. The frequency with which properties occur together is much more flexible for artifacts than for natural objects where the frequency of co-occurrence is given. As a result, artifact categories are fuzzier, i.e. they possess less clearly-defined boundaries, than natural object categories. Moreover, the predictive power of artifact categories is lower than that of natural object categories. To illustrate, knowing that something is a bird, one can predict that it has wings, lays eggs and builds nests. One also knows that it will never consist of wood, since wooden birds do not exist. Such claims are difficult to make regarding a chair though. Chairs can have all kinds of shapes and be made of all kinds of material, they can have every color the designer wishes, and so on. Theoretically, a chair can possess practically every imaginable attribute.

In short then, based on the differences sketched above, product categories can be expected to deviate from natural object categories as can the categorization of these different types of objects. Empirical studies have shown that, in general, features internal to the object, such as molecular structure, are considered more important for categorization of natural objects, whereas external features, such as function, are more important for artifact category membership (Ahn 1998). Bloom (1996, 1998) posits that artifacts are not seen as having essences in the same sense as natural kinds: "Artifact categorization is rooted in our intuitions about the creator's intent and how it relates to the physical form of an object". In contrast, the essence of natural objects is given by nature: they are what they are, because they
exist like that. In light of the scope of this discussion, these points are not elaborated on. The interested reader is referred to Bloom (1996, 1998), Malt and Johnson (1998), and Ahn (1998).

Despite the differences that exist between artifacts and natural objects, and this dissertation has confirmed this, product categories are highly similar to natural object categories. They possess a similar graded structure, they can both be organized into taxonomies, and they appear to be governed by the same organizing principles. Like natural objects, products appear to be classified at the basic level first, after which secondary categorization such as subordinate, ad-hoc or one-dimensional categorization may occur.

8.2.3 Similarity View versus Theory View

The notion of categorization that was adopted in this dissertation is the theory view as opposed to the similarity view. Although it was not the intention to decide which of these has the highest validity, the data from this research are in support of the theory view. The similarity view seems to be particularly inappropriate in the case of hybrid products the physical characteristics of which do frequently not reveal their identity. In order to determine category membership, consumers need additional knowledge, such as knowledge about function and usage (situation). Interviews with participants revealed that consumers consider all kinds of things during classification. The following fragments were taken from interviews with subjects from Study 5. One participant explained why (s)he assigned the motorbike-car combination to a separate category as follows:

Yes, the car is definitely going into a box of its own. It is a vehicle for more than one person. The motorbike and that thing, well, how should you do that? I think I'll keep them separate after all. I think it [the motorbike-car combination] forms a separate category. Let me put it this way: a motorcyclist is usually quite sporty. He wants to feel the wind in his face. Somebody who uses that thing, the combination, is someone who uses it as a car, for short distances, into town perhaps. If you go into town, you may go by motorbike, of course, but I don't think you would easily do that.

Another participant put the television-video recorder together with the television and kept the video recorder apart:

The television and the device [the television-video recorder] go together, the video recorder needs to be kept separate. I assume that if I buy a television, I would buy one with a video recorder inside. If I were to buy a video recorder, I would not easily think of buying one with a television inside.

[Interviewer:] Do you only look at the appearance or at its use as well?

Well, a little bit of both actually. When I look at the video recorder, I know where I would put it next to the television. If I were to buy a video recorder, I would find it inconvenient if it also included a television. That would only be fine if I also needed a new television at the same time. In contrast, if I were to buy a television, I could imagine thinking: 'Hey, that's nice, there's a video inside.' But if I already had one, that would be a reason not to buy a television-video recorder.
The next participant explained why (s)he assigned the iron, the hair dryer and the hair dryer-iron to separate categories:

I would divide them into three groups. The function of an iron is different from that of a hair dryer. But there is more. These products belong to completely different categories. Very simple, you use a hair dryer in the bathroom to dry your hair. If you wanted to combine this [hair dryer] with something else, I would not combine it with an iron, which I would use upstairs, for example. These are two different functions joined here in a single product. I believe this is a bad combination. These products do not fit together, because they are used for completely different tasks.

[Interviewer:] Okay, that is clear.

They do not go together at all.

[Interviewer:] You don’t see another possibility to sort these products? It is very clear to you? You don’t think that the combination fits better with either the iron or the hair dryer? You find them completely different?

Well, I wouldn’t make such a combination anyway. A hair dryer could be combined with a comb. That would make for a sensible product. A sensible combination.

[Interviewer:] But if you focus on the correspondence between the two. Is there any way these products might fit together?

No, except if you think of travelling. I go abroad and take... Then, I could imagine this combination saving space, although the products don’t have anything to do with each other. There is one plug. I guess some people might find that convenient.

These and similar observations strongly suggest that consumer categorization is not limited to making similarity judgements. Rather, consumers construct their own theories around a product category, based on their own experiences and knowledge. In order to understand how and why consumers assign products to the categories they do, one should know their naive theories regarding these products. Such an investigation should take place at the concrete rather than at the abstract level at which it is usually discussed in the literature. The examples above illustrate that the reasons people have for putting different products into the same category are highly specific. The general models of category representation that form the basis of most categorization research are unable to explain such specific data (e.g. they explain that people base their categories on overall similarity, but they do not bother to identify which specific aspects of the category members are compared, see chapter 4). The present research has attempted to study product categorization at the concrete level by observing and analyzing classification behavior of individual people with (pictures of) real objects.

8.3 Managerial Implications

What can practitioners learn from the present research? First of all, and most importantly, the current research explains that hybrid products are fundamentally different from non-hybrid products, in the sense that they
possess multiple identities instead of one. This fact affects the way consumers categorize hybrid products, which, in turn, has implications for practical issues related to marketing and product development.

8.3.1 Marketing

Chapter 5 demonstrated that, in accordance with the main assumption of the dissertation, hybrid products are more ambiguous and are perceived as being more odd than non-hybrids, and their classification involves higher levels of cognitive effort. The ambiguity inherent to hybrid products is due to the fact that consumers strive for basic level classification (see chapter 3). Consumers have learned that products from different classes do not belong together. Products from different classes have different functions and forms, and they are used in different ways and for different purposes. The concept of hybrid products forces them to adjust this idea. Functions, forms and uses that have never been associated with one another before have all become aspects of one and the same product. Consumers have to learn this, which may slow down the adoption and diffusion of hybrid products. From a marketer’s perspective, the significant learning costs imposed on consumers by such innovations present not only a challenge, but also an opportunity (Moreau, Markman and Lehman 1999). Marketers have the chance to “teach” consumers what the new hybrid product is and what its benefits are.

Fortunately for practitioners, chapter 3 has shown that consumer categorization is highly flexible. Apart from basic-level categories, consumers group products in almost every possible way, depending on whichever aspect of the product is salient to them. In line with the findings reported in the literature (e.g. Barsalou 1983; Gutman 1982; Medin, Wattenmaker and Hampson 1987), consumers in Study 1 and Study 2 grouped products on the basis of the goal they fulfilled (goal-derived categories such as appliances for personal care), on the basis of subjective beliefs or values (modern versus old-fashioned furniture, necessary versus luxurious household appliances), or on the basis of a single common aspect (one-dimensional categories such as rattan furniture). These results suggest that managers have opportunities to guide consumer classification of hybrid products to desired categories by providing them with specific sorting cues. One way to do this is by offering frames of reference. For instance, an ad for the hair dryer-iron could show a traveler packing her suitcase. By priming a traveling context, consumers are provided with information that may help them to interpret (i.e. to categorize) the new hybrid. Another way in which managers can attempt to activate sorting cues in consumers is by shaping

Note 3
It should be noted that the differences regarding ambiguity and cognitive elaboration were only significant in the familiar condition (i.e. Discman versus television-video recorder). Perceived oddity, however, was significantly higher for hybrids than for non-hybrids in the familiar and unfamiliar condition.

Note 4
The association with travelling could be increased further by placing the ad for the hair dryer-iron in travel brochures and tour guides. In fact, the photo of the hair dryer-iron that was used as stimulus material was taken from a shopping catalog on board of an airplane.
the retail environment (Desrochers 1998; Veryzer and Hutchinson 1998). For example, the categorization of a digital camera is likely to be affected by its location in the store, that is, whether it is placed among photo cameras or among computers.

It should be noted that the efforts marketers undertake to affect consumer classification of hybrid products may be in vain if they are not continued after introduction. The outcomes of Study 5 make clear that category membership of hybrid products may change over time. A hybrid initially assigned to a category of its own may after a while be seen as a special version of one of its source products. Thus, a company that has finally succeeded in achieving the desired positioning for the hybrid may see all its investments wasted due to a category shift.

In teaching consumers what a hybrid product is, marketers should focus on the high-diagnostic attributes of the source products of the hybrid. "By affecting categorization with highly diagnostic attributes, marketers may induce consumers to consider an ambiguous product for a particular situation" (Yi and Gray 1996, p. 626). The outcomes of Study 6 have yielded some support for the idea that category membership of hybrid products may be affected through the change of the diagnosticity of the properties of the source categories. Thus, marketers should identify the diagnostic properties of the source products and emphasize these in their marketing communications, particularly since high-diagnostic properties are often deep properties (cf. psychological essentialism, chapter 2) which cannot be deduced from the product's appearance. Consider the most diagnostic properties of the television, video recorder and CD player listed in Appendix 7.4, for example. These are all deep properties. Consumers cannot see that a television has teletext, that a video recorder serves to record programs, and that a CD player reads music digitally. These are things that consumers need to know, and that they have to be taught if they do not know them yet. As the sixth study has shown, the inclusion of a single high-diagnostic attribute in the product description (e.g. HAS SUBTITLES) may already be enough to communicate that the product is a hybrid.

8.3.2 Product Development

According to the third study, reported in chapter 4, when consumers categorize products they judge the similarity between them on aspects that are related to function, form and use. Category membership is predominantly determined by the function of the product, and to a lesser degree by its appearance and use. Fortunately for product developers, these dimensions represent the producer-determined or actionable attributes of a product (see chapter 4). This means that producers can do something about them. The results of Study 3 emphasize that one of the most important things product developers should do is to make sure that the hybrid product (design) effectively communicates its functions and the
proper way to operate it. Veryzer (1995, p. 643) underscores this point as follows:

The communicative aspect of design may affect how consumers perceive and categorize a product (e.g. product class, complexity level/technological sophistication), influence their attitude toward its use (e.g. difficult to use), and shape their perception of the risks involved in purchasing the product (e.g. afraid they will never use it because it is too difficult to figure out). Design which makes a product more intelligible assists interpretation and enhances person-product interaction.

As noted in the introductory chapter, the challenge for the designer of a hybrid product is to create a physical product that: (1) distinguishes itself from its source products; (2) that is able to perform the primary functions of the source products; and (3) that communicates these functions to consumers. Obviously, this is no easy assignment. Failure on any of these three aspects is likely to be fatal to the hybrid’s commercial success. A hybrid that is indistinguishable from the source products it is composed of will not be new in the eyes of consumers, and will, therefore, possess no competitive advantage. A hybrid that fails to perform all of its functions at least as well as the individual source products, will probably not be bought either, since it is inferior to the existing source products. Finally, a hybrid that fails to communicate its multifunctional character will also lose much, if not all, of its competitive advantage.

What, then, can product developers do to create successful and intelligible hybrid products? First of all, it seems essential that hybrid products are developed from the perspective of the consumer rather than from the perspective of the company. Many existing hybrids products appear to have been developed without considering consumers’ desires or needs (e.g. the video telephone. Ort 1998). The evaluative data from chapter 6, which will be discussed shortly, indicate that most consumers do not consider hybrid products as useful. Some hybrid products, such as the hair dryer-iron and the blender-scales, are even considered to be completely redundant. In addition, participants indicated that hybrid products are ambiguous and quite difficult to understand. Involving consumers in the development process of hybrid products would not only help to discover the use of new hybrid products early on in the process, but it would also provide developers with the opportunity to test consumers’ understanding of the hybrid. Support for this point is found in a study by Dahl, Chattopadhyay and Gorn (1999). They show that designers making use of a particular form of visual mental imagery, namely imagination imagery, create products that are perceived by consumers to be more useful, original and appealing. With imagination imagery, designers “imagine” how consumers would use the product in real-life situations. According to the authors, including the customer in imagination imagery constrains the solution space by providing appropriate boundaries to focus the designer’s imagination, bringing realism into the design, and leading to products that meet customers requirements better (Dahl et al. 1999). Designing products in this manner seems particularly
important in the case of hybrid products because the multifunctional nature thereof allows for more variation in their use. An excellent example of this was provided by the finding of Study 6 that the use of hybrid products may change over time. Such changes could be anticipated if hybrid products were developed in cooperation with consumers.

Another important issue that developers of hybrid products need to consider is the label they put on the new hybrid because this determines which knowledge is activated. If the hybrid is named motorbike-car combination, the schemas of both motor and car are activated. Consumers are then likely to use these schemas to interpret the hybrid. Moreau, Markman, and Lehman (1999) found that once people have assigned a category label to an object, they will be resistant or unwilling to place an additional label on that same object. For new hybrid products, labeling constitutes a serious problem to developers. In order to communicate the multiple identities of new hybrids, companies generally use a double name, like motorbike-car combination or microwave-oven combination. The research of Moreau et al. (1999) suggests that consumers are likely to use the first label that they are provided with to categorize the new product. Once this label has been used, potential relevant knowledge in a second category may not be used, even when it is activated. For example, once it has been named a motorbike-car, a motorbike-car combination may have become more of a car than of a motor.

However, Moreau et al. (1999) also found that consumers may be able to use the information provided by two category labels if explicit mappings from each category are given. With explicit mappings the authors mean that companies specify the specific correspondence between the two categories. A motorbike-car combination, for instance, could be communicated as a motor in the sense that it has the driving properties and size of a motorbike, and as a car with respect to comfort and safety (in fact, this is exactly how it was done by BMW, see Appendix 1.1). Communicated in this way, consumers are more likely to use both schemas to interpret the motorbike-car combination. Hence, when the label for a new hybrid product consists of a double name, communications concerning the hybrid should explicitly refer to the correspondence between the hybrid and each of its source products in order to encourage consumers to use both product schemas rather than just one.

In sum, the category label given to a new hybrid product is of paramount importance as it determines which schemas consumers will use to categorize it. This is particularly the case for products without a characteristic form, like the so-called "black boxes" (e.g. video recorders, computers, tape decks and CD(1) players). Moreover, once consumers have accepted a label for the new hybrid, it will be difficult to change it. Assuming that category

Note 5 In fact, companies often assign "meaningless" names to new products, like the BMW C1. Such a name is unlikely to activate any schema at all, providing consumers with little knowledge about the product’s identity.
membership for hybrid products may change over time (chapter 6), a label that \textquote{sticks} to the hybrid could prove to be highly inconvenient.

Whenever companies decide to develop new hybrid products, there are two things they may want to keep in mind. Consumers experience less uncertainty about the performance of a new technology (e.g. internet) if it provides them with a new functionality (e.g. ordering books from all over the world), rather than a familiar functionality (e.g. looking up travel information). Applied to hybrid products, this result suggests that hybrid products evoke less uncertainty among consumers when they provide a new functionality in comparison to their source products. Thus, reasoning from this perspective, companies should develop enhanced hybrids instead of parity hybrids (Jain and Ziamou 1995).

Another suggestion to companies is that they should not develop hybrid products that are combinations of products that do not belong to the core competence of the company. Electrolux, for instance, should not introduce the screen-fridge, as their core competence concerns the building of refrigerators and not the construction of computers. Likewise, Sony has a reputation for creating electronic not optical equipment. For this reason, consumers may be suspicious of the binoculars-Walkman. Support for this claim comes from a study of Smith and Andrews (1995), who found that the evaluation of new products depends on consumers' certainty that the company has the ability to create the new product. Companies entering new markets that are not related to the ones they are already active in, as in the case of brand extensions (Porche creating sunglasses), for example, should be aware that consumers may doubt the company's ability to create good quality products for this new-to-the-company market.

### 8.3.3 Developing New Hybrid Products: Do or Don't?

Considering the implications discussed above, is it a sensible policy to develop hybrid products? Basically, companies introducing a new hybrid product to the market can have one of the following strategies. They may wish to replace one of the source products with the hybrid product (e.g. replacing a television with a television-video recorder). Although this may be an effective way to prolong the life cycle of a declining product, it is likely to be inefficient as hybrid products are relatively costly (i.e. the extra profit generated by the hybrid is relatively low or may even be negative compared to the additional costs that the development of the hybrid demands).

Alternatively, the new hybrid product could be introduced as a substitute of both hybrid products (e.g. a hair dryer-iron combination instead of a separate hair dryer and an iron). This would only appear to be a good strategy for a company that does not produce the source products. Moreover, it is questionable whether new hybrid products are perceived as adequate substitutes for their source products. The competitive advantage of hybrid products lies in the fact that consumers buy one product instead of
two, which is cheaper, saves space, and is more friendly to the environment, because it uses less electricity and produces less waste. A prerequisite would be that the hybrid is perceived to perform as least as well as its source products do. It will be shown shortly, that this does not generally seem to be the case. Furthermore, the comments on the television-video recorder presented above, revealed that people can imagine this hybrid to substitute a television, but not a video recorder. A hybrid that is not seen to replace both source products, may be hard to sell, as a previously cited participant made very clear ("If I already had a video recorder, I would not buy a television-video recorder.").

A final option is to introduce a hybrid product as a completely independent product, existing in addition to its source products (e.g. amphibious vehicle). Opportunities to do this seem limited, because such a product would have to be perceived as really novel to consumers, which, as this dissertation has argued, is problematic. Hybrid products could be targeted to specific usage situations, something that is done for most hybrid products currently on the market, such as the television-video recorder for the nursery or the bedroom, the blender-scales for nursing mothers, the motorbike-car combination as a means of city transportation, and the iron-hair dryer for traveling. The problem with this strategy is that the market segments for such hybrid products are relatively small and, therefore, less likely to be profitable. Furthermore, also the marketing and design problems described above come into play. It is difficult to create a new hybrid product that is clearly distinct.

Taking everything into consideration, the introduction of hybrid products appears to create more problems than opportunities. Apart from the points that have already been mentioned, the impression from the current research is that consumers have little interest in hybrid products. This impression is based on talking with approximately 250 consumers (participants in Studies 5-7) and on the evaluation data from Study 6 (section 6.3). Most importantly, consumers feel that hybrid products are superfluous, they do not provide extra value. Furthermore, consumers think that hybrid products perform poorer on their basic functions than their source products do. In the words of one participants: "It is both, but it is a little less of both". In addition, consumers worry what will happen if one of the components breaks down. In fact, this reservation is spontaneously uttered by most people confronted with a hybrid product.

The literature proposes several explanations for consumers' low appreciation of hybrid products. Hybrid products may be unfavorably evaluated because they are highly atypical (Finkielsh and Inman 1998), extremely schema incongruent (Mandler 1982; Meyers-Levy and Tybout 1989; Perraschio and Tybout 1996), or unacceptable as category members (Schoormans and Robben 1997). Although their explanations differ, these authors have all provided empirical evidence that stimuli that dissent greatly from existing stimuli are less liked.
Muthukrishnan (1995) found that if consumers are in an ambiguous decision situation and if they have a positive attitude toward an existing brand, consumers prefer the existing brand to a new one, even if the new brand is objectively superior. As an explanation the author suggests that consumer have gained more experience with the existing brand, causing them to feel more or even overconfident about their judgements about the brand. Additionally, processes such as resistance to change and risk aversion encourage consumers to prefer familiar brands. The observations Mutukrishnan has made with regard to brands are likely to apply to hybrid products which create feelings of ambiguity. The suspicion that participants ventilated about (the performance of) hybrid products appears to reflect their resistance to the unknown hybrids and their tendency to avoid the risks that are associated with them (e.g. one of the components breaking down).

8.4 Future Research into Hybrid Products

This dissertation dealt with the mental representation and the categorization of hybrid products. Consumer evaluation of hybrid products was only briefly touched upon. Future research into hybrid products should further explore how consumers process ambiguous product information and how they evaluate ambiguous products.

An initial suggestion for further research was proposed at the end of chapter 6. In order to study the effect of consumers’ experience with hybrid products on the categorization and perception thereof, it would be interesting to observe how hybrid products are categorized during their life cycle, from introduction to decline. This would also provide opportunities to discover which hybrid products are successful and whether there is a relation with the way they are categorized.

Considerable empirical evidence has been gathered with regard to the relation between the degree of match with existing knowledge and the type of information processing that will occur. Sujan (1985) found that consumer judgments are mediated by category-based affective (i.e. holistic) processes, when incoming product information matches product category knowledge in memory. When incoming product information does not match category knowledge in memory, piecemeal (i.e. analytic) processes mediate consumer judgments. Cohen and Basu (1987) hypothesized that in the case where multiple category representations are present, consumers will rely on analytic rather than wholistic processing. Ozanne, Brucks and Grewal (1992) found evidence for an inverted-U relationship between the degree of discrepancy between incoming and existing product information and the depth of information search, the breadth of information search, and categorization uncertainty. Products that are moderately discrepant elicit deeper and broader information search behavior and greater uncertainty.
about category membership. Meyers-Levy and Tybout (1989) and Perracchio and Tybout (1996) found the same result with regard to consumer evaluation. Moderately incongruent products were evaluated more positively than either low-discrepant or high-discrepant products.

These findings provide interesting avenues for research into hybrid products. On the basis of the articles of Sujan (1985) and Cohen and Basu (1987), one could expect consumers' judgments about hybrid products to be based on analytic processing. This could form the hypothesis for an empirical study. Alternatively, empirical research could concentrate on the degree of discrepancy of hybrid products. The relevant question would be whether hybrid products are moderately or extremely incongruent. The answer to this question would reveal how consumers seek information about hybrid products, how certain or uncertain they are about category membership of hybrid products, and how they appreciate hybrid products.

Future research into hybrid products could also deal with inference making, i.e. how consumers make predictions about a product on the basis of their classification of it. Ross and Murphy (1996) find that people tend to use only a single category for making predictions, even when they are not certain as to which of the multiple categories the product belongs. It would be worth investigating how consumers make predictions about hybrid products. Do they base these on one of the source categories only? If they do, which source category would this be?

Earlier it was claimed that practitioners may try to influence the categorization of hybrid products by providing frames of reference that can help consumers to interpret the hybrid and that could aid its adoption and diffusion. This idea could be tested in an experiment. For example, in a 2 by 2 factorial design, one half of the subjects could read a story about traveling and the other half could read a story about going to a sport event. Then, half of the subjects would receive a picture of a binoculars-Walkman and the other half a picture of a hair dryer-iron. In this way, the effect of a congruent or incongruent frame of reference on the classification and evaluation of hybrid products could be assessed.

Finally, it would be interesting to find out how designers view the development and design of hybrid products. In this dissertation attention has only been paid to consumers' reactions to hybrid products. The assertion that designing hybrid products is a challenge to designers, raises the question how they perceive hybrid products. A first indication may be found in a study conducted among graduate students in design engineering ($N = 30$), who judged a set of six hybrid products with regard to the degree of *functional compatibility* (i.e. the extent to which the main functions of the source products fit together), *functional novelty* (i.e. the extent to which the hybrid provides something new compared to the functions of the individual source products), *functional expressiveness* (i.e. the degree to which the form of the hybrid product informs the perceiver of the functions it performs),
and *form compatibility* (i.e. the extent to which the source products can be materialized in a single product form). The complete set of results is too extensive to report here, but an interesting observation was that according to the design students the relatively unfamiliar hybrids in the stimulus set (i.e. iron-hair dryer, motorbike-car combination, blender-scales and binoculars-walkman) performed significantly poorer than the familiar hybrids (i.e. sofa-bed and television-video recorder) on all measures except functional novelty. In general, the design students found that none of the presented combinations offered new opportunities compared to the source products.

### 8.5 Recommendations

Considering all that has been written in this dissertation, the conclusion is that companies should think carefully before they decide to invest in the development of new hybrid products. Hybrids products seem to cause more trouble than competitive advantages. The marketing and development problems with respect to hybrid products are highly similar to those regarding really new products. Hybrids are ambiguous, adoption and diffusion rates are likely to be low, and learning costs can be expected to be high. Communicating the multifunctional character of hybrids is no easy task. Even if a company succeeds in doing this, there is the risk that hybrid products are recategorized after consumers have grown accustomed to them, which in turn devalues the investments made to achieve the particular positioning. Moreover, consumers do not seem to be charmed by hybrid products. They think they are largely superfluous, they are sceptical about their quality, and they perceive significant risks, such as having to buy a new product if one of the components breaks (down). Therefore, rather than developing hybrid products, and notwithstanding the apparent ease and advantage of combining two existing products into one new one, companies would do better to invest in products that are really new. Those who nevertheless wish to develop hybrid products are advised to bear the following recommendations in mind:

- Develop hybrid products that are more than a mere combination of their source products. Create hybrids that offer a new functionality (i.e. enhanced hybrids). Enhanced hybrids are easier to distinguish as they offer a relative advantage over their source products.
- Do not develop combinations outside your core competence. Consumers may doubt the quality of such combinations.
- In the development process involve the consumer from the start. This increases the likelihood of developing a hybrid that is useful and appealing to consumers.
- Do whatever is needed to make the new hybrid as intelligible as possible. This reduces learning costs and accelerates adoption and diffusion.
• Be aware of the power of a product label. Explicitly communicate the correspondence between the hybrid and its source products.
• Offer frames of reference to aid understanding and to guide interpretation toward the desired positioning.
• Shape the retail environment in such a way that the desired positioning is encouraged.
• Have marketing communications focus on diagnostic attributes.
• Make sure that the desired positioning does not shift by continuously supporting it.

Given the reservations made here, it will be interesting to see whether the trend towards developing new hybrid products will continue to grow during the next decades. The idea for this dissertation was inspired by the practical problems of a firm trying to develop a new hybrid product for the consumer market. The research project reported in this dissertation was started because, at that time, no knowledge about consumers' reactions to, and in particular categorization of hybrid products was available. If, as it now seems to be the case, more companies become involved in the development of hybrid products, additional research into consumers' reactions to hybrid products will certainly be required. Hopefully, the findings of this dissertation will prove to be useful to build on.
Summary

One product development strategy that won increasing popularity is the creation of hybrid products. Here, two (or more) existing products (the source products) are combined into a single entity to form an entirely new product combination (e.g. a television-video recorder). Companies would seem to have four reasons for developing hybrid products:

1. It is easier to combine existing products than to develop a truly new one.
2. The inspiration for a hybrid stems from the success of existing products. In that sense, combining products that have proven to be successful would seem a sensible strategy.
3. The idea for a new hybrid product may also originate as the results of "creativity programs", in which for example engineering and marketing opportunities are linked.
4. Developing hybrid products provides companies with the opportunity to increase performance and create competitive advantage.

In order to understand a new product, consumers first need to know what it is; they need to categorize it. Since a hybrid is a combination of products that previously existed as independent entities, each with their own identity, the possibility exists that they will be classified (by consumers) into multiple categories. As this classification will occur simultaneously, this makes them ambiguous, i.e. it is not clear to which category the hybrid products belong. Ambiguous products are problematic to consumers as the latter generally tend to assign a product to one category only. However, because hybrid products can in fact be assigned to more than one category, consumers are likely to experience feelings of uncertainty and conflict. They simply do not know what to make of the hybrid. As consumers' adoption intention decreases with uncertainty, this point is important for companies.

An additional problem for companies is that, in order to be able to create an optimal marketing mix and even more importantly, to explain what the new hybrid is and what its benefits are, they need to know in advance how consumers will categorize it. Failing to correctly predict its category membership or to communicate the intended positioning to consumers, may easily result in the product becoming a flop. Thus, if companies wish to develop a successful hybrid product, they need to know how consumers will

categorize it. This dissertation aims to describe and explain consumer categorization of hybrid products on the basis of seven empirical studies.

Products categorization involves comparing a product instance with a representation of this product in memory. The second chapter reviews existing models of categorization and distinguished two perspectives. The dominant, traditional view, called the similarity view, sees categorization as a similarity-based attribute matching process. On the basis of how well their attributes match, objects are categorized. Adherents to the theory view have challenged the similarity-based models and claim the people possess naive theories (theories containing all the information people have about categories and their members). In building a model to show how hybrid products are represented in memory, one version of the theory view, called psychological essentialism, is followed. According to psychological essentialism, people believe that each object has an essence that makes it what it is and not something else. From this perspective, a hybrid product possesses a combined essence of its source products - which is exactly the reason why it is ambiguous. After proposing how hybrid products how hybrid products are represented in memory, the second chapter ends with a description of how they are categorized and compares this process with that of non-hybrids. These descriptions form the input for the two empirical studies (4a and 4b) into the categorization of hybrid products that are described in chapter 5.

First, however, chapters 3 and 4 deal with two issues that are critical to the study of hybrid products. The first concerns the type of product categories that consumers create. The second issue broaches the product aspects on which consumers base their categories. In chapter 3 it is theorized that consumers have a tendency to classify products into basic-level categories (e.g. chairs, cars, hair dryers) on the basis of the overall similarity between them. This tendency, known as the basic-level superiority hypothesis, is argued to be responsible for consumers’ trouble with categorizing hybrid products and therefore needs to be tested first. In two classification studies (Study 1: \( N = 29 \) and Study 2: \( N = 89 \)), participants group a set of photos from two superordinate product categories (i.e. furniture and electrical equipment) in order to discover the type of categories consumers create. The conclusion from these studies is that, in accordance with the basic-level superiority hypothesis, people first identify products as members of their basic-level category, after which subsequent classifications, for example ad hoc, goal-derived or one-dimensional classifications, may follow.

In the fourth chapter, the methodology of the first two studies is followed to identify the product dimensions underlying consumer product categorization. These dimensions are essential to understand why people create the categories that they do. By means of a thinking-aloud procedure, participants \( (N = 29) \) explain the reasons for their classifications. Nineteen dimensions are identified, of which all but two are related to either function, appearance or usage. Additional analyses show that, in general, function is
the most important basis of classification, followed by appearance and usage. Considered per level of inclusiveness, function is the most important at the superordinate and basic level, whereas appearance is the most important at the subordinate level.

After having established which product categories consumers create and on the basis of which product dimensions, chapter 5 investigates how hybrids are categorized in comparison with non-hybrids. In the first study (Study 4a), participants \((N = 44)\) judge the photos of a hybrid (television-video recorder) and a non-hybrid (Discman). The hybrid product is found to be more ambiguous, harder to classify, and more odd than the non-hybrid. Both products are equally accurately classified. To examine whether these differences also exist under conditions of low product familiarity, Study 4b \((N = 45)\) is carried out with an unfamiliar hybrid (iron-hair dryer) and an unfamiliar non-hybrid (juice centrifuge). This time, all differences disappear, except for the difference in oddity. The unfamiliar hybrid is perceived to be more odd than the unfamiliar non-hybrid.

As the findings from chapter 5 show a difference between unfamiliar and familiar hybrid products, chapter 6 investigates whether product familiarity affects the categorization of hybrid products.

The main assumption is that, as consumers become more familiar with a new hybrid, they will no longer categorize it as a hybrid but as an enhanced version of the source product. This occurs when one function is used more intensively than the other, of which they the most intensively.

This assumption is confirmed in Study 5 \((N = 44)\) in which participants categorize two familiar (television-video recorder, sofa bed) and two unfamiliar hybrid products (iron-hair dryer, blender-scales). Participants also rate several evaluative statements about each hybrid and their desire for them. Factor analysis of the evaluative statements reveals three factors, namely understanding, commonness and appreciation. As expected, the two familiar hybrids are rated as being more common than the two unfamiliar ones. On appreciation and desire, the iron-hair dryer is rated lower than the other hybrids which are equally appreciated and desired.

The explanation for the familiarization effect found in chapter 6 is that category membership of familiar hybrids changes due to a shift in the centrality of the properties of the source products of which the hybrid is composed. As the properties of one source product become less essential, the hybrid shifts towards the other source category. In the sixth study (chapter 7) the validity of this explanation is examined by having different subjects \((N = 114)\) classify different descriptions of the same hybrid product (i.e. television-video recorder). The descriptions vary systematically with regard to the typicality of the attributes of the source products. The main prediction is that the description of attributes that are high-typical of a television and attributes that are high-typical of a video recorder will be
categorized into a hybrid category more often than the other descriptions. This prediction is not confirmed on the basis of the main dependent variable, probably due to a measurement artifact, but it is confirmed on the basis of the data regarding the manipulation check. With hardly any significant differences having been found, all further hypotheses are not confirmed. The suggested explanation is that the concept used to manipulate centrality in the study, namely typicality, is not discriminative enough and it would be preferable to use diagnostically.

The conclusion of the dissertation is that product developers should think twice before they decide to develop new hybrid products, because these are more liable to give anxieties than opportunities. As states before, hybrid products are ambiguous to consumers, inhibiting their adoption, diffusion and learning. It is not easy to communicate the multifunctional character of hybrids. Even if a company does succeed in doing this, consumers can still recategorize the hybrid after they have grown accustomed to it. The investments made to achieve the particular positioning will have been largely in vain.

Another concern for companies is that consumers do not seem to be all that fond of hybrid products. They see them as superfluous, they doubt their quality, and they are afraid of having to buy an entirely new product when one of the components breaks (down). Several recommendations are given for companies who nevertheless are considering the manufacture of hybrid products.
Samenvatting

Een productontwikkelingsstrategie die de laatste jaren aan populariteit heeft gewonnen is het ontwerpen van hybride producten. Twee (of meer) bestaande producten (de deelproducten) worden gecombineerd tot één nieuw product. Bedrijven lijken vier redenen te hebben om hybride producten op de markt te brengen:

1. Het is gemakkelijker om een nieuwe combinatie van bestaande producten te verzinnen dan om een compleet nieuw product te bedenken.
2. Het succes van bestaande producten leidt tot het idee deze samen te brengen in een nieuw hybride product.
3. Het idee voor een nieuw hybride product komt voort uit creativiteitsprogramma’s zoals het koppelen van technische ontwikkelingen aan marketingmogelijkheden.
4. Het op de markt brengen van hybride producten biedt mogelijkheden om commerciële prestaties te verbeteren en concurrentievoordeel te behalen.

Om een hybride product te kunnen begrijpen moeten consumenten eerst weten wat het is. Ze moeten het hybride product kunnen categoriseren. Aangezien hybride producten combinaties zijn van producten die al als afzonderlijke producten bestaan, dat wil zeggen producten die al tot een bepaalde categorie behoren, kunnen ze in meerdere categorieën tegelijk gecategoriseerd worden. Hierdoor zijn hybride producten ambigu: het is niet duidelijk tot welke categorie ze behoren. Consumenten hebben moeite met het categoriseren van hybride (ambigue) producten, omdat ze geneigd zijn elk product aan slechts één categorie toe te kennen. Een product kan dus niet tegelijkertijd tot twee verschillende categorieën behoren. Omdat hybride producten wel in meer dan één categorie passen, zullen ze gevoelens van onzekerheid en conflict oproepen. Consumenten weten niet goed wat ze van hybride producten moeten maken. Dit is een belangrijk gegeven voor bedrijven, omdat producten waarover consumenten onzeker zijn minder snel door hen geaccepteerd zullen worden.

Een bijkomend probleem voor bedrijven die een hybride product op de markt willen brengen is dat ze van tevoren moeten weten hoe consumenten dit nieuwe product zullen categoriseren. Die kennis is onontbeerlijk om een

optimale marketing-mix voor het nieuwe hybride product te kunnen samenstellen en, nog belangrijker, om te kunnen communiceren wat het is en wat de voordelen ervan zijn. Als bedrijven er niet in slagen om het categorielidmaatschap van een nieuw hybride product te voorspellen of als ze er niet in slagen om de gewenste positionering aan consumenten over te brengen, is de kans groot dat het product een commerciële mislukking wordt. Dus, om succesvolle nieuwe hybride producten op de markt te brengen moeten bedrijven weten hoe deze producten door consumenten gecategoriseerd zullen worden. Door middel van zeven empirische studies poogt deze dissertatie het categorisatieproces van hybride producten te beschrijven en te verklaren.

Productcategorisatie bestaat uit het vergelijken van een product met de representatie van dit product in het geheugen. Hoofdstuk 2 geeft een overzicht van bestaande modellen van categorisatie. Twee stromingen worden besproken. De dominante, traditionele stroming, de zogenaamde Similarity View, beschouwt categorisatie als het vergelijken van eigenschappen. Objecten worden bij elkaar in een categorie gestopt op basis van hoe goed hun eigenschappen overeenkomen. Volgens de aanhangers van de Theory View worden categorieën niet enkel gevormd op basis van overeenkomstige eigenschappen, maar op basis van alle informatie die mensen verzameld hebben met betrekking tot deze categorieën (naiëve theorieën). Bijzondere aandacht gaat uit naar een bepaalde theorie binnen deze stroming, namelijk het psychologisch essentialisme. Volgens deze theorie geloven mensen dat elk object een essentie heeft die het object maakt tot wat het is en niet tot iets anders. Bezien vanuit dit oogpunt bezitten hybride producten een dubbele essentie die bestaat uit de essenties van de deelproducten. Juist deze dubbele essentie maakt hybride producten ambigu. Nadat is verklaard hoe hybride producten in het geheugen geregistreerd worden, beschrijft het tweede hoofdstuk tenslotte hoe hybride producten gecategoriseerd worden en vergelijkt dit proces met dat van niet-hybride producten. Deze beschrijving vormt de theoretische basis voor de twee empirische studies naar de categorisatie van hybride producten die beschreven worden in hoofdstuk 5 (Studie 4a en 4b).

Alvorens ingegaan wordt op de categorisatie van hybride producten, komen in hoofdstuk 3 en hoofdstuk 4 twee onderwerpen aan bod die essentieel zijn voor het onderzoek naar hybride producten. Deze onderwerpen betrekken het type categorieën dat consumenten creëren en de productaspecten die de basis vormen voor deze categorieën. Hoofdstuk 3 onderzoekt de veronderstelling dat consumenten de neiging hebben om producten in te delen op basis van algehele overeenkomst in zogenaamde “basic-level” categorieën (bijv. stoelen, auto’s, strijkijzers). Deze neiging, die bekend staat als de basic-level superioriteitshypothese, wordt verondersteld de oorzaak te zijn van de problemen die consumenten met het categorielidmaatschap van hybride producten hebben en dient daarom als eerste getoetst te worden. Om erachter te komen wat voor type productcategorieën consumenten
maken, sorteren proefpersonen in twee classificatie-experimenten (Studie 1: N = 29 en Studie 2: N = 89) een verzameling plaatjes van producten afkomstig uit de algemene categorieën meubilair en elektrische apparatuur. De conclusie van deze studies is dat mensen, in overeenstemming met de basic-level superioriteitshypothese, producten eerst identificeren als lid van een bepaalde basic-level categorie waarna classificatie in bij voorbeeld ad-hoc of unidimensionele categorieën volgt.

In Studie 3 (hoofdstuk 4) wordt dezelfde methode gevolgd als in de eerste twee studies om de productdimensies te identificeren die ten grondslag liggen aan de categorieën die consumenten vormen. Inzicht in deze dimensies is vereist om te begrijpen waarom mensen bepaalde categorieën wel maken en andere niet. Door proefpersonen (N = 29) hardop te laten denken worden de redenen voor hun classificaties achterhaald. Negentien dimensies worden geïdentificeerd die met uitzondering van twee ervan betrekking hebben op productfunctie, productvorm en productgebruik. Analyses tonen aan dat over het geheel genomen productfunctie de belangrijkste basis voor classificatie vormt, gevolgd door productvorm en productgebruik. Beschouwd per niveau van abstractie blijkt dat productfunctie de belangrijkste dimensie is op het superordinate en het basisniveau, terwijl productvorm de belangrijkste dimensie is op het subniveau.

Nadat is vastgesteld wat voor type productcategorieën consumenten creëren en op basis van welke dimensies ze dat doen, vergelijken hoofdstuk 5 de categorisatie van hybride producten met de categorisatie van niet-hybride producten. In een eerste studie (Studie 4a) beoordelen proefpersonen (N = 44) de plaatjes van een hybride product (televisievideorecorder) en van een niet-hybride product (Diskman). Het hybride product blijkt meer ambigu en vreemd te worden gevonden en moeilijker te categoriseren. Beide producten blijken echter wel even accuraat gecategoriseerd te worden. Om na te gaan of deze verschillen ook bestaan in het geval dat de producten onbekend zijn, wordt Studie 4b (N = 45) uitgevoerd met een onbekend hybride product (föhn-strijkijzer combinatie) en een onbekend niet-hybride product (sapp centrifuge). In dit geval zijn de verschillen niet langer significant, met uitzondering van het verschil in vreemdenheid. Proefpersonen vinden het onbekende hybride product vreemder dan het onbekende niet-hybride product.

Aangezien er in hoofdstuk 5 een verschil wordt gevonden tussen bekende en onbekende producten, onderzoekt hoofdstuk 6 het effect van bekendheid op de categorisatie van hybride producten. De hypothese is dat consumenten die bekend raken met een nieuw hybride product dit product niet langer zullen categoriseren als een hybride, maar als een bijzondere versie van het deelproduct waarvan de functie het meest gebruikt wordt. Deze hypothese wordt ondersteund door de resultaten van Studie 5 (N = 44) waarin proefpersonen twee bekende hybride producten (televisievideorecorder en bedbank) en twee onbekende hybride producten (föhn-
strijkijzer en blender-weegschaal) categoriseren. Daarnaast geven proefpersonen hun mening op een aantal evaluatieve stellingen en geven ze aan of ze elk hybride product wel of niet zouden willen kopen. Factoranalyse van de evaluatieve stellingen onthult drie factoren, namelijk begrijpelijkheid (understanding), gewoonheid (commonness), en waardering (appreciation). Zoals verwacht blijken de bekende hybride producten gewoner gevonden te worden dan de onbekende hybride producten. Met betrekking tot waardering en de wens tot kopen wordt de foehn-strijkijzer minder positief beoordeeld dan de andere hybride producten.

De verklaring voor het effect van bekendheid dat gevonden is in hoofdstuk 6 is dat het categorieldmaatschap van een hybride product verandert als gevolg van een verandering in de centraliteit van de eigenschappen van de deelproducten waaruit het hybride product bestaat. Naarmate de eigenschappen van het ene deelproduct minder centraal komen te staan, verschuift het categorieldmaatschap in de richting van de andere deelcategorie. In Studie 6 (hoofdstuk 7) wordt de validiteit van deze verklaring onderzocht door verschillende proefpersonen (N = 114) verschillende beschrijvingen van hetzelfde hybride product (televisievideorecorder) te laten categoriseren. De beschrijvingen verschillen systematisch ten aanzien van de typicaliteit van de attributen van de deelproducten. De belangrijkste voorspelling luidt dat de televisievideorecorder die beschreven wordt aan de hand van eigenschappen die zowel typisch zijn voor een televisie als voor een videorecorder vaker in een eigen hybride categorie zal worden geclassificeerd dan de televisievideorecorders uit de andere beschrijvingen. Deze voorspelling wordt niet bevestigd door de resultaten met betrekking tot de voornaamste afhankelijke variabele, waarschijnlijk als gevolg van een meetartefact, maar wel door de gegevens met betrekking tot de manipulatiecontrole. De overige hypotese worden niet bevestigd; significante verschillen worden nauwelijks gevonden. Een mogelijke verklaring hiervoor is dat het theoretische concept dat gebruikt is om centraliteit te manipuleren, namelijk typicaliteit, niet onderscheidend genoeg is. In plaats van typicaliteit zou diagnosticiteit gebruikt dienen te worden.

De conclusie van deze dissertatie is dat productontwikkelaars heel goed moeten nadenken voordat ze besluiten een nieuw hybride product op de markt te brengen. Hybride producten brengen meer problemen met zich mee dan dat ze mogelijkheden bieden. Hybride producten zijn ambigu voor consumenten, waardoor adoptie, diffusie en leren belemmerd worden. Het multifunctionele karakter van hybride producten is moeilijk duidelijk te maken aan consumenten. Zelfs wanneer een bedrijf hierin slaagt, bestaat de mogelijkheid dat consumenten het hybride product hercategoriseren in een andere categorie als ze eenmaal aan het hybride product gewend zijn geraakt. De investeringen die gemaakt zijn om een bepaalde positionering te bereiken zullen dan grotendeels tevergeefs zijn geweest. Verder lijkt het erop dat consumenten niet erg gecharmeerd zijn van hybride producten.
Consumenten vinden ze overbodig, ze twijfelen aan de kwaliteit ervan, en ze vrezen dat ze een compleet nieuw product zullen moeten kopen als één van de componenten kapot gaat. Aan bedrijven die desondanks hybride producten op de markt willen brengen, worden een aantal aanbevelingen gedaan.
References


McCroskey, James C., and Janis F. Andersen (1976), "The Relationship between Communication Apprehension and Academic Achievement
among College Students", Human Communication Research, Vol. 3 (1), 73-81.


Appendices
Halve smart

Is het een motor.? Is het een auto.? Het is de C1! 'Een geheel nieuwe vorm van mobiliteit' jubelt BMW, schepper van deze – volgens ons – overdekte scooter. Of halve Smart. En halve smart is gedeelde smart, waarmee we maar willen aangeven dat de C1 misschien wel de oplossing van al je file-, weer- en parkeerleed is. Waar mogelijk optimaal beschermd, zit je helm- (indien ontheffing daarvoor van de minister verkregen wordt) en overall-loos comfortabel op (in?) deze 125 cc automaat. Met een maximaal vermogen van 11 kW (15 pk) bij 9250 toeren p/min ligt zijn top even boven de 100 km/u met een verbruik van minder dan 3 liter/100 km. De C1 (die minimaal f 14.740,- gaat kosten) wordt deze zomer op de Nederlandse en Belgische markt verwacht. In Italië, Duitsland, Frankrijk, Zwitserland en Spanje is men ons al voorgegaan. Info: www.press.bmw.com

De BMW C1 Louis Vuitton-zorte, voor de echte fashion addicta.

Article taken from Man, May 2000, p. 50
Appendix 2.1
Sony Robot-dog

*Courtesy of BBC News*

**Sony unveils robot-dog**

Is robo-dog the pet of the future? Sony believes the robot industry can overtake the games market. A metal hound went on show in Tokyo on Tuesday that can bark but not hear. It can cock its leg but will not leave a mess on the carpet. It can even sulk but will never die - at least, not until its batteries run down. The new toy was unveiled by Sony. Aibo, as it is called, is one of the most advanced "toy" robots yet developed commercially. The company hopes to drive an emerging market in cyber-pets following the worldwide success of Tamagotchi.

Aibo was put through its paces in a demonstration which began when it stood up after being patted on the head. It then waved hello with its front paw. Its best trick was catching a pink ball, which it saw using the color camera installed in its nose.

**Robot domination**

"The last 10 years of the 20th Century were dominated by personal computers and the Internet," said Sony vice president Toshitada Doi. "For the next 10 years, until 2010, we are certain that robots with independent movement will be the big thing." The gleaming metallic puppy has 18 joints producing 250 types of movement. It can play ball, crouch as if urinating and move its head, body and all its legs.

Aibo's owner can praise his dog by touching its head for more than two seconds. A sharp slap on the head is interpreted as punishment and puts the robot into a sulk.

At the moment, most of the commands are delivered via a remote control, but voice control is being worked on. Aibo, which means partner in Japanese, can make plenty of noise itself, barking, talking and even singing in English or Japanese.

**Tickle my tummy**

The dog is loaded with sensors including the color camera, heat sensors, an infra-red range finder, touch sensors, acceleration and speed sensors and a stereo microphone A death function was debated by Sony but not included. Aibo can be revived at any time.

They will be on sale on the Internet from 1 June. Sony said it hoped to sell 3,000 in Japan and 2,000 in the United States.

Sony said it recognized that Aibo would never be a substitute for real dogs. "It is technically impossible to replace real animals with robots. In a sense, it would be a profanity to God," said general manager Tadashi Otsuki.
Appendix 3.1
Stimulus Material Study 1 and Study 2
Appendix 3.2  
Study 1: Spontaneous Sorting-Task Instruction  
(in Dutch)

Wat gaat u met de plaatjes doen?

Terwijl u de onderstaande uitleg leest, zullen de plaatjes op tafel worden uitgelegd. Als dat gebeurd is en als u na het lezen geen vragen meer heeft, kunt u beginnen met het maken van de groepen. U kunt dat doen door de dingen die u in dezelfde groep vindt passen bij elkaar te leggen. U krijgt hiervoor ruim de tijd. Als u klaar bent, zal de proefleider u nog enkele vragen stellen. Eerst volgt nu de uitleg.

Bekijkt u zo meteen de plaatjes op tafel aandachtig. Wilt u die plaatjes in groepen bij elkaar leggen, waarop dingen staan die u goed bij elkaar vindt passen. Dingen die niet bij elkaar passen, stop u in verschillende groepen.

U mag zelf weten hoeveel groepen u maakt en hoeveel dingen u in elke groep stopt, zolang als er maar minimaal twee dingen in een groep zitten. Alleen als er dingen bij zitten die u echt niet in een groep kunt stoppen, kunt u die apart leggen.

Het maakt dus niet uit hoe u de plaatjes indeelt. Een indeling is nooit goed of fout. U legt gewoon die plaatjes bij elkaar die het beste bij elkaar passen.

U heeft voldoende tijd om de plaatjes in te delen. U hoeft zich niet te haasten, maar het is ook niet nodig om eindeloos na te denken. Het gaat om de indeling die u in eerste instantie zou willen maken.

Aarzelt u niet om te zeggen wanneer iets op dit moment nog niet helemaal duidelijk voor u is.

Als alles duidelijk is, kunt u beginnen met het indelen van de plaatjes.

Appendix 3.4
Study 1: Product Group Occurrence Matrix for the Furniture Stimuli\(^1\), \(^2\)

<table>
<thead>
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<td>(14)</td>
<td>(15)</td>
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</tbody>
</table>

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1. Only cells containing seven or more observations are printed.
2. The frames mark the groups created by more than half of the participants. The shaded squares indicate the expected basic-level categories.
Appendix 3.5
Electrical Equipment: Superordinate Categories
Furniture: Subordinate Categories

Superordinate Categories of Electrical Equipment

Small domestic appliances  food processor, blender (2 types), mixer (2 types), shaver (3
types), crumb thief, iron (2 types), hairdryer (2 types),
kitchen balance, balance, mouth shower (2 types), filter
coffee maker, espresso coffee maker, toaster (2 types)

Large domestic appliances  washing machine (2 types), refrigerator (2 types), freezer (2
types), furnace (2 types), vacuum cleaner (2 types)

Photo and film equipment  photo camera, video camera

Audio equipment  stereo set, micro stereo set, CD player (2 types), Walkman,
Discman

Visual equipment  video Walkman, television video recorder, CD-i player,
laser disc player, video recorder, television, wide-screen

Subordinate Categories of Furniture

Tables  dining table (6 types), coffee table/occasional table (3 types)

Cupboards  chests of drawers (5 types), wardrobe (2 types), bookcase,

buffet (2 types), kitchen cupboard (2 types), bathroom closet

Chairs  arm chair (5 types), kitchen chair (3 types), foot stool, rocking

chair, bar stool, folding chair

Seats (multiple)  bench (3 types), couch (4 types), sofa bed, bench closet

Beds  single bed (3 types), double bed (5 types), bunk bed (2
types)
Appendix 3.6
Study 2: Basic-Level Sorting-Task Instruction
(in Dutch)

Wat gaat u met de plaatjes doen?

Terwijl u de onderstaande uitleg leest, zullen de plaatjes op tafel worden uitgelegd. Als dat gebeurd is en als u na het lezen geen vragen meer heeft, kunt u beginnen met het maken van de groepen. U kunt dat doen door de dingen die u in dezelfde groep vindt passen bij elkaar te leggen. U krijgt hiervoor ongeveer tien minuten de tijd, dat is meer dan genoeg. Als u klaar bent, kunt u aan de proefleider de vragenlijst vragen. Eerst volgt nu de uitleg.

Wilt u zo meteen de plaatjes op tafel aandachtig bekijken? Ik wil u vragen die plaatjes in groepen bij elkaar te leggen, waarop dingen staan die op elkaar lijken. Dingen die niet op elkaar lijken, stopt u in verschillende groepen.

U mag zelf weten hoeveel groepen u maakt en hoeveel dingen u in elke groep stopt, zolang als er maar minimaal twee dingen in een groep zitten. Alleen als er dingen bij zitten die u echt niet in een groep kunt stoppen, kunt u die apart leggen.

Het is mogelijk dat u meerdere manieren ziet om de plaatjes in groepen in te delen. U kunt echter maar één indeling maken. Het is de bedoeling dat u die indeling maakt, die voor u het meest voor de hand ligt. Het maakt niet uit welke indeling dat is. Een indeling die u maakt, is nooit goed of fout. U maakt gewoon die indeling die voor u het meest vanzelfsprekend is.

Bij deze taak gaat het erom dat u de dingen indeelt op basis van de eigenschappen van de dingen. Wat hebben de dingen die op de plaatjes staan afgebeeld met elkaar gemeenschappelijk? Wat is de overeenkomst tussen de dingen? Lijken op betekent in dit onderzoek dus gemeenschappelijk hebben met.

Het is dus niet de bedoeling dat u de dingen indeelt op basis van hoe mooi of lelijk, of hoe handig of onhandig de dingen volgens u zijn, of hoe graag u de dingen zou willen hebben. Hoe mooi of handig een ding is of hoe graag u een ding zou willen hebben, wordt namelijk niet bepaald door de eigenschappen van dat ding, maar door uw persoonlijke mening over of uw voorkeur voor het ding.

Z.O.Z
Het volgende voorbeeld zal proberen duidelijk te maken waarop u moet letten bij het indelen van de groepen. Stel dat u de volgende dieren in groepen moet stoppen: hond, rat, kakkerlak, en lieveheersbeestje. U zou twee groepen kunnen maken, namelijk hond-lieveheersbeestje en rat-kakkerlak omdat u honden en lieveheersbeestjes leuk en aardig vindt en ratten en kakkerlakken vies en eng. In dit onderzoek moet u juist niet een indeling maken zoals hierboven gedaan is, maar een indeling die gebaseerd is op de eigenschappen van de vier dieren. Honden en ratten hebben een aantal eigenschappen gemeenschappelijk die anders zijn dan de eigenschappen die kakkerlakken en lieveheersbeestjes gemeenschappelijk hebben. Honden en ratten zijn allebei zoogdieren, ze hebben allebei een vacht, vier poten en een staart, en het zijn allebei alles-eters. De kakkerlak en het lieveheersbeestje hebben andere kenmerken gemeenschappelijk. Het zijn beiden insecten, ze zijn zeer klein in vergelijking met de hond en de rat, ze leggen eieren, ze hebben geen vacht, ze eten planten, en ze hebben zes in plaats van vier poten. Op basis van de genoemde eigenschappen van de vier dieren horen de hond en rat bij elkaar in een groep en de kakkerlak en het lieveheersbeestje.

Als u deze uitleg helemaal gelezen hebt, gaat u de plaatjes in groepen indelen. Zoals gezegd, heeft u daarvoor 10 minuten. Dat is ruim voldoende.

Denkt u er nogmaals aan dat u volledig vrij bent te bepalen hoeveel groepen u wilt maken en welke dingen u in elke groep stopt. Waar het om gaat, is dat u die indeling maakt die voor u het meest voor de hand ligt, het meest vanzelfsprekend is. Het maakt niet uit hoeveel groepen die indeling bestaat.

Deze uitleg is behoorlijk lang. Aarzelt u alstublieft niet om te zeggen wanneer iets niet helemaal duidelijk voor u is.

Als alles duidelijk is, kunt u nu beginnen met het indelen van de plaatjes.

Als u uw indeling gemaakt heeft, waarschuw dan de proefleider.
Appendix 3.7
Study 2: Product Group Occurrence Matrix for the Electrical Equipment Stimuli

1 Only cells containing 22 or more observations are printed.
2 The frames mark the groups created by more than half of the participants. The shaded squares indicate the expected basic-level categories.
# Appendix 3.8

## Study 2: Product Group Occurrence Matrix for the Furniture Stimuli

1. Only cells containing 23 or more observations are printed.
2. The frames mark the groups created by more than half of the participants. The shaded squares indicate the expected basic-level categories.
Appendix 4.1
Study 3: Sorting-Task Instruction (in Dutch)

U dient eerst de hele uitleg te lezen, voordat u aan de taak kunt beginnen.

Wilt u zo meteen de plaatjes op tafel aandachtig bekijken? Ik wil u vragen die plaatjes in groepen bij elkaar te leggen, waarop dingen staan die op elkaar lijken. Dingen die niet op elkaar lijken, stopt u in verschillende groepen.

U mag zelf weten hoeveel dingen u in een groep stopt, zolang als er maar minimaal twee dingen in een groep zitten. Alleen als er dingen bij zitten die u exact niet in een groep kunt stoppen, kunt u die apart leggen.

Bij deze taak gaat het erom dat u de dingen indien op basis van de eigenschappen van de dingen. Wat hebben de dingen die op de plaatjes staan afgebeeld met elkaar gemeenschappelijk? Wat is de overeenkomst tussen de dingen? Lijken op betekent in dit onderzoek dus gemeenschappelijk hebben met.

Het is dus niet de bedoeling dat u de dingen indien op basis van hoe mooi of lelijk, of hoe handig of onhandig de dingen volgens u zijn, of hoe graag u de dingen zou willen hebben. Hoe mooi of handig een ding is of hoe graag u een ding zou willen hebben, wordt namelijk niet bepaald door de eigenschappen van dat ding, maar door uw persoonlijke mening over of uw voorkeur voor het ding.

Het volgende voorbeeld zal proberen duidelijk te maken waarop u moet letten bij het indelen van de groepen. Stel dat u de volgende dieren in groepen moet stoppen: hond, rat, kakkerlak, en lieveheersbeestje. U zou twee groepen kunnen maken, namelijk hond-lieveheersbeestje en rat-kakkerlak omdat u honden en lieveheersbeestjes leuk en aardig vindt en ratt en kakkerlakens vies en eng. In dit onderzoek moet u juist niet een indeling maken zoals hierboven gedaan is, maar een indeling die gebaseerd is op de eigenschappen van de vier dieren. Honden en ratten hebben een aantal eigenschappen gemeenschappelijk die anders zijn dan de eigenschappen die kakkerlakens en lieveheersbeestjes gemeenschappelijk hebben. Honden en ratten zijn allebei zoogdieren, ze hebben allebei een vacht, vier poten en een staart, en het zijn allebei alles-etters. De kakkerlak en het lieveheersbeestje hebben andere kenmerken gemeenschappelijk. Het zijn beiden insecten, ze zijn zeer klein in vergelijking met de hond en de rat, ze leggen eieren, ze hebben geen vacht, ze eten planten, en ze hebben zes in plaats van vier poten. Op basis van de genoemde eigenschappen van de vier dieren horen de hond en rat bij elkaar in een groep en de kakkerlak en het lieveheersbeestje.

U gaat dus zo meteen de plaatjes in groepen indelen. U heeft daarvoor ongeveer tien minuten de tijd. Dat is meer dan voldoende. U kunt rustig aan doen.

Deze uitleg is behoorlijk lang. Aarzelt u alstublieft niet om te zeggen wanneer iets niet helemaal duidelijk voor u is.
Appendix 4.2
Description of Product Dimensions

Appearance-related dimensions
Appearance  Any remark that clearly relates to the appearance of products, without further specifying which aspect of the product's appearance is concerned. These remarks are often formulated in terms of "to look like".
Color       Any remark that refers to the color of products.
Form        Any remark that refers to the form or design of products.
Material    Any remark that refers to the material that products are made of.
Size        Any remark that refers to the size of products.
Style       Any remark that refers to the style of products.
Parts       Any remark that consists of concrete and highly specific properties, mostly in terms of "Object X has...", or "Object X is ...able".

Function-related dimensions
Function     Any remark which includes the word function or a derivation.
What is it for? Any remark that refers to the goal of products.
What does it do? Any remark that refers to what products do.
What is it?  Any remark about what a product is, other than just stating the product name. Remarks are clearly related to the function of products and are often formulated in terms of "this belongs to...", "this is all...", or "this has to do with...".

Usage-related dimensions
Usage        Any remark that refers to the usage of products. Closely related to function, but usually the word usage is specifically mentioned.
Usage intensity Any remark that refers to the usage frequency or intensity of products.
Usage situation Any remark that refers to the situation in or the circumstances under which products are used.
Place of Usage Any remark that particularly refers to the place where products are used.
User         Any remark that refers to the specific user of products.
Number of users Any remark that refers to the number of users of products.

Other dimensions
Relationship  Any remark that refers to the relation of categories with each other, society and culture. It covers remarks like "I made these groups, because this is how these products are usually grouped and how you will find them in stores".
Quality      Any remark that contains derived, more abstract product properties
Appendix 4.3
Product Dimensions: Comparison Between Judges (in Dutch)

<table>
<thead>
<tr>
<th>Product dimension</th>
<th>Product dimensie</th>
<th>Judge 1</th>
<th>Judge 2</th>
</tr>
</thead>
<tbody>
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<td>Appearance</td>
<td>Uiterlijk</td>
<td>Uiterlijke gelijkenis</td>
<td>Uiterlijk</td>
</tr>
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<td>Waar is het voor?</td>
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<td>Wat doet het?</td>
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<td>Wat het apparaat doet</td>
</tr>
<tr>
<td>What is it?</td>
<td>Wat is het?</td>
<td>Categorie</td>
<td></td>
</tr>
<tr>
<td>Usage</td>
<td>Gebruik</td>
<td>Gebruiksmogelijkheid (gebruik)</td>
<td>Gebruiksmogelijkheid</td>
</tr>
<tr>
<td>Usage intensity</td>
<td>Intensiteit gebruik</td>
<td>Gebruiksfrequentie</td>
<td>-</td>
</tr>
<tr>
<td>User</td>
<td>Gebruiker</td>
<td>Gebruikers</td>
<td>Gebruiker (kenmerken van…)</td>
</tr>
<tr>
<td>Number of users</td>
<td>Aantal gebeurkers</td>
<td>Aantal personen dat meubilair gebruikt</td>
<td>Aantal personen</td>
</tr>
<tr>
<td>Usage situation</td>
<td>Gebruikssituatie</td>
<td>Associatie met…</td>
<td>Gebruikssituatie</td>
</tr>
<tr>
<td>Place of usage</td>
<td>Plaats gebruik</td>
<td>Gebruikstruimte</td>
<td>Plaats</td>
</tr>
<tr>
<td>Relationship</td>
<td>Onderlinge relatie</td>
<td>Onderlinge relatie</td>
<td>Verwantschap</td>
</tr>
<tr>
<td>Quality</td>
<td>Kwaliteit</td>
<td>Toegevoegde waarde</td>
<td>Comfort</td>
</tr>
</tbody>
</table>
Appendix 5.1
Stimulus Material Study 4a

Familiar non-hybrid: Discman

Familiar hybrid: television-video recorder
Appendix 5.2
Original Measures Study 4 and Study 4b (in Dutch)

Familiarity
- Ik ken het product niet 1 2 3 4 5 6 7
  Ik ken het product
- Het product komt me niet bekend voor 1 2 3 4 5 6 7
  Het product komt me bekend voor
- Ik heb dit product nog niet vaak gezien 1 2 3 4 5 6 7
  Ik heb dit product al vaak gezien

Ambiguity
- Hoeveel verwarring roept dit product bij u op?
  Helemaal geen verwarring 1 2 3 4 5 6 7
  Heel veel verwarring
- Hoe zeker bent u ervan dat u weet wat dit product is?
  Heel zeker 1 2 3 4 5 6 7
  Helemaal niet zeker
- Hoe duidelijk is dit product voor u?
  Zeer duidelijk 1 2 3 4 5 6 7
  Helemaal niet duidelijk
- Ik heb meer informatie nodig, voordat ik kan zeggen wat dit product is.
  Helemaal niet mee eens 1 2 3 4 5 6 7
  Helemaal mee eens
- Ik heb meer informatie nodig om te kunnen bepalen waar dit product voor dient.
  Helemaal niet mee eens 1 2 3 4 5 6 7
  Helemaal mee eens

Cognitive effort
- Hoe moeilijk vond u het om te bepalen wat dit product is?
  Heel erg makkelijk 1 2 3 4 5 6 7
  Heel erg moeilijk
- Hoe moeilijk vond u het om dit product te benoemen?
  Heel erg makkelijk 1 2 3 4 5 6 7
  Heel erg moeilijk

Number of correct classifications
- Wat is dit product? Geef hieronder kort aan wat het product volgens u is.

Product oddity
- Ik denk dat dit product gewoon is 1 2 3 4 5 6 7
  Ik denk dat dit product ongewoon is
- Ik vind dit product gebruikelijk 1 2 3 4 5 6 7
  Ik vind dit product ongebruikelijk
- Ik denk dat dit product niet vreemd is 1 2 3 4 5 6 7
  Ik denk dat dit product vreemd is
Appendix 5.3
Stimulus Material Study 4b

Unfamiliar non-hybrid: juice centrifuge

Unfamiliar hybrid: iron-hair dryer
Appendix 5.4
Product Names for Iron-Hair Dryer and Juice Centrifuge (in Dutch)

Iron-hair dryer
(Föhn-strijkijzer)

fohn-strijkijzer
fohn-strijkijzer
kruimeldief
stoomstrijkijzer*
modern strijkijzer*
luchtverfrisser
vloerreiniger
hete lucht strijkijzer*
kruimeldief
strijkijzer*
soort vloerreiniger
sealapparaat
reinigingsapparaat
reissstrijkijzer*
strijkijzer* voor tapijt
tapijtreiniger
strijkijzer*
strijkijzer*
soort stofzuiger
tapijtreiniger
schoonmaakproduct
tapijtreiniger

Juice centrifuge
(Sapcentrifuge)

sapcentrifuge
koffiezetapparaat
flessenwarmer
ijsmachine
sapcentrifuge
keukenmachine,mixer
friteuse
ijsmachine
keukenmachine
sapcentrifuge
elektrische koffiemaler
keukenmachine
soort mixer
sapcentrifuge
sapcentrifuge
ijsmaker
keukenmachine
sapcentrifuge
sapcentrifuge
fruitpers
babyvoedingverwarmer
vruchtenpers

N.B. Correct names are printed in italics.
Source category names are marked with an asterisk.
Appendix 5.5
Alternative Stimulus for the Unfamiliar Non-hybrid Condition:
The 100-CD-player
Appendix 6.1
Stimulus Material Study 5

Hybrid (H)  Source product 1 (S1)  Source product 1 (S1)
Appendix 6.2
Study 5: Answering Instructions (in Dutch)

HET BEANTWOORDEN VAN DE VRAGEN IN DIT ONDERZOEK

In de loop van dit onderzoek krijgt u op verschillende momenten vragen voorgelegd. Die vragen gaan steeds over de producten die u te zien krijgt. De beantwoording van de vragen vindt plaats aan de hand van antwoordschalen. Misschien kent u zulke antwoordschalen al. Omdat de antwoordschalen die in verschillende onderzoeken gebruikt worden vaak net iets van elkaar verschillen, leggen we voor alle zekerheid uit hoe de schalen in dit onderzoek werken.

Bij elke vraag treft u steeds de rij getallen van 1 tot 7 aan met aan beide uiteinden een korte beschrijving, zoals in het onderstaande voorbeeld.

<table>
<thead>
<tr>
<th>VOORBEELD</th>
</tr>
</thead>
<tbody>
<tr>
<td>In hoeverre is het weer in Nederland vergelijkbaar met het weer in Engeland?</td>
</tr>
<tr>
<td>Absoluut niet vergelijkbaar</td>
</tr>
</tbody>
</table>

Als u vindt dat het weer in Nederland **absoluut niet te vergelijken** is met het weer in Engeland, omcirkelt u de 1.

Als u vindt dat het weer in Nederland **precies hetzelfde** is als het weer in Engeland, omcirkelt u de 7.

Als u vindt dat het weer in Nederland **evenveel niet als wel** lijkt op het weer in Engeland, omcirkelt u de 4.

Van belang is dat u weet dat als u een 1, een 2 of een 3 omcirkelt, u aangeeft dat uw antwoord meer overeenkomt met de beschrijving aan de linkerkant van de schaal dan met de beschrijving aan de rechterkant van de schaal. In dit voorbeeld betekenen 1, 2 en 3 dus dat u vindt dat het weer in Nederland **meer niet dan wel** lijkt op het weer in Engeland.

Als u een 5, een 6 of een 7 omcirkelt, geeft u aan dat uw antwoord meer overeenkomt met de beschrijving aan de rechterkant dan met de beschrijving aan de linkerkant. In dit voorbeeld geeft u dan aan dat het weer in Nederland **meer wel dan niet** lijkt op het weer in Engeland.

U zult zien dat de beschrijvingen aan de uiteinden van de schaal niet bij elke vraag hetzelfde zijn. Let daarom steeds goed op bij het geven van uw antwoord, wat er bij de schaalëinden staat.

Wilt u elke vraag beantwoorden door het cijfer te omcirkelen dat het beste overeenkomt met uw mening, Er zijn geen goede of foute antwoorden. Elk antwoord is goed, zolang als het overeenkomt met uw mening.

Als u nog vragen heeft met betrekking tot de bovenstaande tekst, kunt u die nu stellen.
Appendix 6.3
Study 5: Classification Task Instructions (in Dutch)

WAT GAAT U DOEN?

U heeft zojuist drie producten te zien gekregen. Het is de bedoeling dat u deze producten gaat verdelen over de drie dozen die voor u op tafel staan. U kunt dat op drie verschillende manieren doen, namelijk door één, twee of drie dozen te gebruiken. Hieronder staat uitgelegd in welk geval u één, twee of drie dozen dient te gebruiken om de plaatjes te verdelen.

1. U gebruikt één doos

Als u vindt dat de drie producten bij elkaar horen, legt u ze in één doos bij elkaar.

2. U gebruikt twee dozen

Als u vindt dat twee van de drie producten bij elkaar horen, doet u die twee producten in één doos en het derde product in een andere doos.

3. U gebruikt drie dozen

Als u vindt dat de drie producten geen van allen bij elkaar horen, doet u elk product in een aparte doos.

U mag zelf bepalen of u de drie producten in één, twee of drie groepen wilt verdelen. Elke verdeling is wat ons betreft goed. Het gaat erom dat u aangeeft of bepaalde producten volgens u bij elkaar horen of niet.

Om helemaal duidelijk te maken wat u dadelijk gaat doen en hoe u de plaatjes over de dozen kunt verdelen, kunt u eerst een keertje oefenen. Geeft u even een seintje als u zover bent.
Appendix 6.4
Study 5: Evaluative Judgments (in Dutch)

*Kunt u bij de volgende vragen aangeven wat uw mening is over het product dat u net gezien heeft? Omcirkelt u het cijfer dat uw antwoord het beste weergeeft.*

<table>
<thead>
<tr>
<th></th>
<th>Dit product is niet anders dan andere producten</th>
<th>Dit product is handig</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product wordt volgens mij al sinds lange tijd verkocht</td>
<td>Dit product is mooi</td>
</tr>
<tr>
<td>2</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is onhandig</td>
<td>Dit product gaat niet gemakkelijk kapot</td>
</tr>
<tr>
<td>3</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is lelijk</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product gaat gemakkelijk kapot</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is duur</td>
<td>Dit product is goedkoop</td>
</tr>
<tr>
<td>6</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is niet vreemd</td>
<td>Dit product is vreemd</td>
</tr>
<tr>
<td>7</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is saai</td>
<td>Dit product is verrassend</td>
</tr>
<tr>
<td>8</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is slecht</td>
<td>Dit product is goed</td>
</tr>
<tr>
<td>9</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Er zijn al andere producten zoals dit</td>
<td>Er zijn nog geen andere producten zoals dit</td>
</tr>
<tr>
<td>10</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is niet eenvoudig te gebruiken</td>
<td>Dit product is eenvoudig te gebruiken</td>
</tr>
<tr>
<td>11</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is gewoon</td>
<td>Dit product is ongewoon</td>
</tr>
<tr>
<td>12</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is moeilijk te begrijpen</td>
<td>Dit product is eenvoudig te begrijpen</td>
</tr>
<tr>
<td>13</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product biedt weinig waar voor je geld</td>
<td>Dit product biedt veel waar voor je geld</td>
</tr>
<tr>
<td>14</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is onlogisch</td>
<td>Dit product is logisch</td>
</tr>
<tr>
<td>15</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dit product is oninteressant</td>
<td>Dit product is interessant</td>
</tr>
<tr>
<td>16</td>
<td>1 2 3 4 5 6 7</td>
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</tr>
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<td>Dit product is aantrekkelijk</td>
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<td>17</td>
<td>1 2 3 4 5 6 7</td>
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<td></td>
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<td>18</td>
<td>1 2 3 4 5 6 7</td>
<td></td>
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<td></td>
<td>Dit product is onopwinnend</td>
<td>Dit product is opwinnend</td>
</tr>
<tr>
<td>19</td>
<td>1 2 3 4 5 6 7</td>
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</table>
Appendix 6.5
Evaluative Judgments (in Dutch): Means and Standard Deviations

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<th>Judgment</th>
<th>Hybrid ¹</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Niet anders – Anders</td>
<td>TV</td>
<td>3.24</td>
<td>2.05</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>2.54</td>
<td>1.69</td>
</tr>
<tr>
<td></td>
<td>BW</td>
<td>5.96</td>
<td>1.31</td>
</tr>
<tr>
<td></td>
<td>FS</td>
<td>6.21</td>
<td>0.98</td>
</tr>
<tr>
<td>2. Lang Verkocht - Kort verkocht</td>
<td>TV</td>
<td>2.24</td>
<td>1.42</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>1.25</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>BW</td>
<td>6.04</td>
<td>1.24</td>
</tr>
<tr>
<td></td>
<td>FS</td>
<td>6.54</td>
<td>1.18</td>
</tr>
<tr>
<td>3. Onhandig – Handig</td>
<td>TV</td>
<td>5.96</td>
<td>1.40</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>5.37</td>
<td>1.76</td>
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<td>BW</td>
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<td>1.22</td>
</tr>
<tr>
<td></td>
<td>FS</td>
<td>3.04</td>
<td>2.03</td>
</tr>
<tr>
<td>4. Lelijk - Mool</td>
<td>TV</td>
<td>4.76</td>
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<td></td>
<td>BB</td>
<td>4.21</td>
<td>1.67</td>
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<td>BW</td>
<td>5.08</td>
<td>1.85</td>
</tr>
<tr>
<td></td>
<td>FS</td>
<td>2.67</td>
<td>1.46</td>
</tr>
<tr>
<td>5. Gemakkelijk kapot – Niet gemakkelijk kapot</td>
<td>TV</td>
<td>4.64</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>4.50</td>
<td>1.56</td>
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<td>1.30</td>
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<td>FS</td>
<td>3.58</td>
<td>1.53</td>
</tr>
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<td>6. Duur – Goedkoop</td>
<td>TV</td>
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<td>1.34</td>
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<tr>
<td></td>
<td>BB</td>
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<td></td>
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<td></td>
<td>FS</td>
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<td>1.61</td>
</tr>
<tr>
<td>7. Niet vreemd – Vreemd</td>
<td>TV</td>
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<td>0.96</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>1.42</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>BW</td>
<td>3.92</td>
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<tr>
<td></td>
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<td>1.74</td>
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<td>8. Saai – Verrassend</td>
<td>TV</td>
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<td>0.96</td>
</tr>
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<td></td>
<td>BB</td>
<td>3.67</td>
<td>1.69</td>
</tr>
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<td></td>
<td>FS</td>
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<td>2.05</td>
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<td>9. Slecht – Goed</td>
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</tr>
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<td>BB</td>
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<td>1.64</td>
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</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>--------</td>
<td>-------</td>
<td>--------------------</td>
</tr>
<tr>
<td>10. Geen andere producten zoals dit product</td>
<td>TV</td>
<td>2.92</td>
<td>2.38</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>1.88</td>
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<tr>
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<td>BW</td>
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</tr>
<tr>
<td></td>
<td>FS</td>
<td>5.58</td>
<td>1.93</td>
</tr>
<tr>
<td>11. Niet eenvoudig te gebruiken – Eenvoudig te gebruiken</td>
<td>TV</td>
<td>6.26</td>
<td>0.79</td>
</tr>
<tr>
<td></td>
<td>BB</td>
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<td>1.18</td>
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<td></td>
<td>FS</td>
<td>4.58</td>
<td>1.89</td>
</tr>
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<td>12. Gewoon – Ongewoon</td>
<td>TV</td>
<td>2.84</td>
<td>1.46</td>
</tr>
<tr>
<td></td>
<td>BB</td>
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<td>1.16</td>
</tr>
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<td>5.88</td>
<td>1.45</td>
</tr>
<tr>
<td></td>
<td>BB</td>
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<tr>
<td></td>
<td>FS</td>
<td>4.29</td>
<td>2.44</td>
</tr>
<tr>
<td>14. Weinig waar voor je geld – Veel waar voor je geld</td>
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<td>5.60</td>
<td>1.04</td>
</tr>
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<td></td>
<td>BB</td>
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<td>15. Onlogisch – Logisch</td>
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<td>6.36</td>
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<td></td>
<td>FS</td>
<td>3.17</td>
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</tr>
<tr>
<td>16. Oninteressant – Interessant</td>
<td>TV</td>
<td>5.44</td>
<td>1.23</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>4.42</td>
<td>1.72</td>
</tr>
<tr>
<td></td>
<td>BW</td>
<td>5.44</td>
<td>1.29</td>
</tr>
<tr>
<td></td>
<td>FS</td>
<td>3.75</td>
<td>2.23</td>
</tr>
<tr>
<td>17. Onduidelijk – Aantrekkelijk</td>
<td>TV</td>
<td>4.84</td>
<td>1.43</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>4.46</td>
<td>1.79</td>
</tr>
<tr>
<td></td>
<td>BW</td>
<td>5.44</td>
<td>1.26</td>
</tr>
<tr>
<td></td>
<td>FS</td>
<td>3.17</td>
<td>1.66</td>
</tr>
<tr>
<td>18. Onduidelijk – Duidelijk</td>
<td>TV</td>
<td>6.48</td>
<td>0.87</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>6.13</td>
<td>1.39</td>
</tr>
<tr>
<td></td>
<td>BW</td>
<td>5.44</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>FS</td>
<td>4.29</td>
<td>1.92</td>
</tr>
<tr>
<td>19. Onopvallend – Opvallend</td>
<td>TV</td>
<td>4.48</td>
<td>1.05</td>
</tr>
<tr>
<td></td>
<td>BB</td>
<td>3.54</td>
<td>1.61</td>
</tr>
<tr>
<td></td>
<td>BW</td>
<td>5.80</td>
<td>1.32</td>
</tr>
<tr>
<td></td>
<td>FS</td>
<td>5.12</td>
<td>1.96</td>
</tr>
</tbody>
</table>

1  TV = televisie-videorecorder
    BB = bed-bank
    BW = blender-woogskaal
    FS = linnen-strijkijzer
Appendix 7.1
Study 6: Product Descriptions (in Dutch)

Low-typical of television, low-typical of video recorder (LTTV x LTVCR)
Hieronder staan de eigenschappen van een product dat door bedrijf X op de markt wordt gebracht. Wilt u deze eigenschappen aandachtig doorlezen?
- Het product bepaalt de indeling van de huiskamer
- Het product schakelt na bepaalde tijd automatisch over op stand-by
- Het product is zwaar
- Er zitten veel knoppen op het product
- Het product heeft ondertiteling
- Het product heeft een groot display met veel informatie
- Het product geeft de huidige zender weer
- Het product geeft de speelduur aan

High-typical of television, low-typical or video recorder (HTTV x HTVCR)
Hieronder staan de eigenschappen van een product dat door bedrijf X op de markt wordt gebracht. Wilt u deze eigenschappen aandachtig doorlezen?
- Het product heeft een beeldscherm
- Het product schakelt na bepaalde tijd automatisch over op stand-by
- Met het product kun je programma’s bekijken
- Er zitten veel knoppen op het product
- Op het product kun je de zender kiezen
- Het product heeft een groot display met veel informatie
- Op het product kun je de kanalen programmeren
- Het product geeft de speelduur aan

Low-typical of television, high-typical of video recorder (LTTV x HTVCR)
Hieronder staan de eigenschappen van een product dat door bedrijf X op de markt wordt gebracht. Wilt u deze eigenschappen aandachtig doorlezen?
- Het product bepaalt de indeling van de huiskamer
- Er kan een band in het product
- Het product is zwaar
- Het product kan opnemen
- Het product heeft ondertiteling
- Je kunt het product programmeren
- Het product geeft de huidige zender weer
- Het product kan vooruitspoelen en terugspoelen

High-typical of television, high-typical of video recorder (HTTV x HTVCR)
Hieronder staan de eigenschappen van een product dat door bedrijf X op de markt wordt gebracht. Wilt u deze eigenschappen aandachtig doorlezen?
- Het product heeft een beeldscherm
- Er kan een band in het product
- Met het product kun je programma’s bekijken
- Het product kan opnemen
- Op het product kun je de zender kiezen
- Je kunt het product programmeren
- Op het product kun je de kanalen programmeren
- Het product kan vooruitspoelen en terugspoelen

Unfamiliar, high-typical of television, high-typical of CD player (HTTV x LTCD)
Hieronder staan de eigenschappen van een product dat door bedrijf X op de markt wordt gebracht. Wilt u deze eigenschappen aandachtig doorlezen?
- Het product heeft een beeldscherm
- Er kunnen CD’s in het product
- Met het product kun je programma’s bekijken
- Het product heeft een laser
- Op het product kun je de zender kiezen
- Het product leest muziek digitaal
- Op het product kun je de kanalen programmeren
- Het product geeft een goede kwaliteit geluid
Appendix 7.2
Study 6: Measures

The measures that are marked with an asterisk belong to the TV-CD player condition.

1 Spontaneous category elicitation

Wilt u hieronder zo veel mogelijk gedachten opschrijven die u had tijdens het lezen van de beschrijving van het product of die u nu heeft naar aanleiding van de beschrijving?

Schrijf u alles op, ongeacht of het voor u eenvoudig, moeilijk, belangrijk of onbelangrijk lijkt.

Maakt u zich geen zorgen over hoe u het opschrijft, maar schrijft u alstublieft wel leesbaar.

Neemt u rustig de tijd om zoveel mogelijk gedachten op te schrijven.

2 Category membership

Het product dat op het vorige scherm werd beschreven is volgens u:

1. een videorecorder
2. een televisie
3. een tv-video-combinatie
4. een ander product

2* Category membership

Het product dat op het vorige scherm werd beschreven is volgens u:

1. een CD speler
2. een televisie
3. een tv-CD speler-combinatie
4. een ander product

3 Classification certainty

Bij de vorige vraag heeft u aangegeven wat het product in de beschrijving volgens u is.

Hoe zeker bent u van uw antwoord?

Heel onzeker 1 2 3 4 5 6 7 Heel zeker

4 Classification difficulty

Bij de eerste vraag heeft u aangegeven dat het product in de beschrijving één van de volgende vier producten was:

1. een videorecorder
2. een televisie
3. een tv-video-combinatie
4. een ander product
Hoe moeilijk of makkelijk was het voor u om te bepalen welk van deze vier producten het product in de beschrijving was?

Heel veel moeite 1 2 3 4 5 6 7 Heel weinig moeite

4* Classification difficulty

Bij de eerste vraag heeft u aangegeven dat het product in de beschrijving één van de volgende vier producten was:

1. een CD speler
2. een televisie
3. een tv-CD speler-combinatie
4. een ander product

Hoe moeilijk of makkelijk was het voor u om te bepalen welk van deze vier producten het product in de beschrijving was?

Heel veel moeite 1 2 3 4 5 6 7 Heel weinig moeite

5 Helped category elicitation

Hieronder staan een aantal groepen producten, bijvoorbeeld de groep geluidsapparatuur. Wilt u voor elke groep in het onderstaande schema aangeven hoe goed het product uit de beschrijving volgens u in deze groep past. Dit doet u door een kruisje te zetten in één van de drie kolommen achter elke groep.

Bijvoorbeeld: Wij vragen u hoe goed een tomaat past in de groep fruit. Als u vindt dat een tomaat goed past in de groep fruit, dan zet u een kruisje in de kolom 'Ja, zeer zeker.' Twijfelt u of een tomaat in de groep fruit past, dan zet u een kruisje in de kolom 'Het zou kunnen, maar ik weet het niet zeker.' Vindt u dat een tomaat zeker niet in de groep fruit thuis hoort, dan zet u een kruisje in de kolom 'Nee, zeker niet.'

Wilt u nu, op dezelfde manier als in het voorbeeld hierboven, aangeven hoe goed u het product uit de beschrijving vindt passen elk van de volgende groepen. (U dient dus achter elke groep producten één kruisje te zetten in één van de drie antwoordkolommen.)

<table>
<thead>
<tr>
<th>Geluidsapparatuur</th>
<th>Ja, zeer zeker</th>
<th>Het zou kunnen, maar ik weet het niet zeker</th>
<th>Nee, zeker niet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radio</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Video</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Computer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lichaamverzorgingsapparatuur</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Antwoordapparaat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CD speler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magneton</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Keukenapparatuur</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Videoapparatuur</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electrische tandenborstel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stereo-installatie</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Televisie</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electronische weegschaal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meubelat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tweed-cd-combinatie</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beveiligingapparatuur</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cassettedeck</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verwarmingsthermostaat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walkman</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6  Schema congruity source category 1

Hieronder vragen we u aan te geven in hoeverre het product uit de beschrijving in de categorie televisies past. Wat we daarmee bedoelen is dat we willen weten of u vindt dat het product uit de beschrijving past bij het beeld dat u van televisies in het algemeen heeft.

<table>
<thead>
<tr>
<th></th>
<th>Past heel erg goed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Past heel erg slecht</th>
</tr>
</thead>
</table>

7  Schema congruity source category 2

Hieronder vragen we u aan te geven in hoeverre het product uit de beschrijving in de categorie videorecorders past. Wat we daarmee bedoelen is dat we willen weten of u vindt dat het product uit de beschrijving past bij het beeld dat u van videorecorders in het algemeen heeft.

<table>
<thead>
<tr>
<th></th>
<th>Past heel erg goed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Past heel erg slecht</th>
</tr>
</thead>
</table>

7* Schema congruity source category 2

Hieronder vragen we u aan te geven in hoeverre het product uit de beschrijving in de categorie CD spelers past. Wat we daarmee bedoelen is dat we willen weten of u vindt dat het product uit de beschrijving past bij het beeld dat u van CD spelers in het algemeen heeft.

<table>
<thead>
<tr>
<th></th>
<th>Past heel erg goed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Past heel erg slecht</th>
</tr>
</thead>
</table>

8  Schema congruity hybrid category

Hieronder vragen we u aan te geven in hoeverre het product uit de beschrijving in de categorie tv-video-combinaties past. Wat we daarmee bedoelen is dat we willen weten of u vindt dat het product uit de beschrijving past bij het beeld dat u van tv-video-combinaties in het algemeen heeft.

<table>
<thead>
<tr>
<th></th>
<th>Past heel erg goed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Past heel erg slecht</th>
</tr>
</thead>
</table>

8* Schema congruity hybrid category

Hieronder vragen we u aan te geven in hoeverre het product uit de beschrijving in de categorie tv-CD speler-combinaties past. Wat we daarmee bedoelen is dat we willen weten of u vindt dat het product uit de beschrijving past bij het beeld dat u van tv-CD speler-combinaties in het algemeen heeft.

<table>
<thead>
<tr>
<th></th>
<th>Past heel erg goed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>Past heel erg slecht</th>
</tr>
</thead>
</table>
9  Schema congruity source product 1

Wilt u aangeven met welke uitspraak u het het meest eens bent?

1. Het product in de beschrijving is duidelijk een televisie
2. Het product in de beschrijving is een televisie, hoewel sommige eigenschappen in de beschrijving eigenlijk niet zo goed bij een televisie passen
3. Het product in de beschrijving is weliswaar een televisie, maar eigenlijk kan het geen televisie zijn, omdat sommige eigenschappen in de beschrijving niet bij een televisie passen
4. Het product in de beschrijving zou een televisie kunnen zijn, maar dat is niet duidelijk

10  Schema congruity source product 2

Wilt u aangeven met welke uitspraak u het het meest eens bent?

1. Het product in de beschrijving is duidelijk een videorecorder
2. Het product in de beschrijving is een videorecorder, hoewel sommige eigenschappen in de beschrijving eigenlijk niet zo goed bij een videorecorder passen
3. Het product in de beschrijving is weliswaar een videorecorder, maar eigenlijk kan het geen videorecorder zijn, omdat sommige eigenschappen in de beschrijving niet bij een videorecorder passen
4. Het product in de beschrijving zou een videorecorder kunnen zijn, maar dat is niet duidelijk

10* Schema congruity source product 2

Wilt u aangeven met welke uitspraak u het het meest eens bent?

1. Het product in de beschrijving is duidelijk een CD speler
2. Het product in de beschrijving is een CD speler, hoewel sommige eigenschappen in de beschrijving eigenlijk niet zo goed bij een CD speler passen
3. Het product in de beschrijving is weliswaar een CD speler, maar eigenlijk kan het geen CD speler zijn, omdat sommige eigenschappen in de beschrijving niet bij een CD speler passen
4. Het product in de beschrijving zou een CD speler kunnen zijn, maar dat is niet duidelijk

11  Familiarity

In hoeverre bent u het eens met de uitspraak hieronder?

"Als ik de eigenschappen lees die in de beschrijving genoemd worden, heb ik het gevoel dat het gaat om een product dat niet bestaat."

Een hoger cijfer betekent in dit geval dus dat u vindt dat de beschrijving gaat over een product dat niet bestaat.

Helemaal mee eens  1  2  3  4  5  6  7  Helemaal mee eens

12  Classification difficulty

In hoeverre bent u het eens met de uitspraak hieronder?

"Ik heb de beschrijving meerdere keren moeten lezen, voordat het me duidelijk was wat het product uit de beschrijving is."

Een hoger cijfer betekent in dit geval dus dat u de beschrijving meerdere malen heeft moeten lezen voordat u wist wat het product uit de beschrijving is.

Helemaal mee eens  1  2  3  4  5  6  7  Helemaal mee eens
13 Imagination

In hoeverre bent u het eens met de uitspraak hieronder?

"Aan de hand van de beschrijving kon ik me een voorstelling maken van het product."

Een hoger cijfer betekent in dit geval dus dat u zich aan de hand van de beschrijving een voorstelling van het product kon maken.

Helemaal mee oneens 1 2 3 4 5 6 7 Helemaal mee eens

14 Information sufficiency

In hoeverre bent u het eens met de uitspraak hieronder?

"De beschrijving bevatte voldoende informatie om te weten over wat voor soort product het ging."

Een hoger cijfer betekent in dit geval dus dat u vindt dat de beschrijving voldoende informatie bevat om te weten over wat voor soort product het ging.

Helemaal mee oneens 1 2 3 4 5 6 7 Helemaal mee eens

15 Information sufficiency

In hoeverre bent u het eens met de uitspraak hieronder?

"Ik had het gevoel dat in de beschrijving informatie ontbrak die nodig was om de vragen te kunnen beantwoorden."

Een hoger cijfer betekent in dit geval dus dat u vindt dat in de beschrijving informatie ontbrak die nodig was om de vragen te kunnen beantwoorden.

Helemaal mee oneens 1 2 3 4 5 6 7 Helemaal mee eens

16 Classification certainty

In hoeverre bent u het eens met de uitspraak hieronder?

"Ik weet op dit moment nog steeds niet zeker wat het product uit de beschrijving is."

Een hoger cijfer betekent in dit geval dus dat u op dit moment nog steeds niet zeker weet wat het product uit de beschrijving is.

Helemaal mee oneens 1 2 3 4 5 6 7 Helemaal mee eens
Appendix 7.3
Attribute Diagnosticity Scores for TV attributes, VCR attributes and CD attributes (in Dutch)

Respondenten waren 49 studenten bedrijfskunde aan de Erasmus Universiteit Rotterdam. Zij kregen de volgende schriftelijk instructie (in dit geval voor eigenschappen van televisies):

Instructie
Hieronder staan een aantal eigenschappen van televisies. Het is de bedoeling dat je voor elke genoemde eigenschap aangeeft in hoeverre je die eigenschap onderscheidend vindt voor televisies. Een eigenschap is onderscheidend als die eigenschap televisies duidelijk onderscheidt van andere producten. Die eigenschap is dus kenmerkend voor televisies en tegelijkertijd niet kenmerkend voor andere producten.

Het volgende voorbeeld zal duidelijk maken wat we verstaan onder een onderscheidende eigenschap. De eigenschap "maakt eten in zeer korte tijd warm" is onderscheidend voor de categorie magnetrons. Een kenmerkende eigenschap van een magnetron is namelijk dat eten zeer snel opgewarmd kan worden. Andere producten hebben deze eigenschap niet of veel minder. Een eigenschap die minder onderscheidend is, is de eigenschap "je kunt de tijd instellen". Deze eigenschap is wel kenmerkend voor een magnetron, maar er zijn ook redelijk veel andere producten waarmee je de tijd kunt instellen, zoals een wekker, een video recorder of een mobiele telefoon. Tot slot zijn er ook eigenschappen die helemaal niet onderscheidend zijn voor een magnetron, zoals "werkt op elektriciteit". Hoewel een magnetron inderdaad op elektriciteit werkt, zijn er enorm veel andere producten die op elektriciteit werken. Deze eigenschap maakt dus geen duidelijk onderscheid tussen magnetrons en andere producten.
Je kunt je antwoord steeds aangeven door een cijfer van 1 tot 7 te kiezen dat het beste je antwoord weergeeft. Hoe hoger het cijfer, des te meer onderscheidend vind je het genoemde kenmerk.

<table>
<thead>
<tr>
<th>Eigenschap</th>
<th>Eigenschap is helemaal niet onderscheidend</th>
<th>Eigenschap is heel onderscheidend</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Het product heeft een beeldscherm</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft een afstandsbediening</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Op het product kun je de zender kiezen</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Je kunt het volume regelen</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft een aan/uitknop</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Met het product kun je programma's bekijken</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft teletekst</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft de huidige zender weer</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Op het product kun je de kanalen programmeren</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product is zwaar</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product bepaalt de indeling van de huiskamer</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft ondertiteling</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft een wekkerfunctie</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft luidsprekers</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Je kunt kleuren instellen of bijstellen</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft een stand-bye knop</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Er zit een stekker aan het product</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
<tr>
<td>• Het product heeft een antenne of kabel nodig</td>
<td>1 2 3 4</td>
<td>5 6 7</td>
</tr>
</tbody>
</table>
De gemiddelde scores voor elke eigenschap staan hieronder in afnemende waarde weergegeven. Tussen haakjes staan de standaard deviaties. De eigenschappen die in de experimentele beschrijvingen zijn gebruikt zijn schuin gedrukt met tussen haakjes of ze laag-typisch (LT) of hoog-typisch (HT) zijn.

**Eigenschappen televisie (n = 16)**
- Het product heeft teletekst 6.31 (0.79)
- Met het product kun je programma's bekijken (HT) 5.63 (1.31)
- Het product heeft ondertiteling (LT) 5.00 (1.79)
- Op het product kun je de kanalen programmeren (HT) 4.94 (1.24)
- Op het product kun je de zender kiezen (HT) 4.81 (1.42)
- Het product heeft een antenne of kabel nodig 4.63 (1.50)
- Het product geeft de huidige zender weer (LT) 4.56 (1.31)
- Het product heeft een beeldscherm (HT) 4.13 (2.00)
- Je kunt kleuren instellen of bijstellen 4.13 (1.50)
- Het product heeft een afstandsbediening 3.63 (1.78)
- Het product bepaalt de indeling van de huiskamer (LT) 3.50 (2.19)
- Het product heeft een stand bye knop 2.81 (1.72)
- Je kunt het volume regelen 2.69 (1.62)
- Het product heeft luidsprekers 2.44 (0.96)
- Het product heeft een wekkerfunctie 1.94 (1.00)
- Het product is zwaar (LT) 1.44 (1.09)
- Het product heeft een aan/uit knop 1.19 (0.40)
- Er zit een stekker aan het product 1.06 (0.25)

**Eigenschappen video recorder (n = 17)**
- Het product kan opnemen (HT) 4.82 (1.29)
- Er kan een band in het product (HT) 4.76 (1.56)
- Het product kan vooruitspelen en terugspelen (HT) 4.41 (1.28)
- Het product geeft je de speelduur aan (LT) 4.41 (1.23)
- Je kunt het product programmeren (HT) 3.94 (1.43)
- Het product schakelt na bepaalde tijd automatisch over op stand bye (LT) 3.59 (1.73)
- Het product heeft een afstandsbediening 3.41 (1.73)
- Het product heeft een groot display met veel informatie (LT) 3.06 (1.30)
- Het product geeft stereo geluid 3.06 (1.89)
- Er zitten veel knoppen op het product (LT) 2.12 (1.17)
- Het product geeft de tijd weer 1.94 (1.20)
- Het product is zwart 1.76 (1.60)
- Er zit een stekker aan het product 1.59 (1.50)
- Het product heeft een aan/uit knop 1.47 (1.33)

**Eigenschappen CD speler (n = 16)**
- Het product leest muziek digitaal (HT) 5.13 (1.59)
- Er kunnen CD's in het product (HT) 5.06 (1.98)
- Het product biedt de mogelijkheid snel van nummer te wisselen 5.06 (1.53)
- Het product heeft een laser (HT) 5.00 (1.59)
- Het product geeft een goede kwaliteit geluid (HT) 4.31 (1.54)
- Het product geeft de speelduur aan 4.13 (1.63)
- Je kunt het product programmeren 3.07 (1.67)
- Het product heeft een lade 2.69 (1.49)
- Het product heeft een high-tech uiterlijk 2.37 (1.20)
- Het product heeft een display 2.00 (1.21)
- Het product heeft een afstandsbediening 1.69 (0.95)
- Het product is zwart 1.63 (1.41)
- Het product heeft een reclamekoekje vorm 1.50 (0.89)
- Het product heeft een aan/uit knop 1.31 (0.79)
Curriculum Vitae

Kaj P. N. Morel (1971) started studying Chemistry at Leiden University in 1989, but switched to (Social and Organizational) Psychology one year later. He received his master’s degree (cum laude) in 1995. In the same year he began his doctoral dissertation research at the School of Industrial Design Engineering at the Delft University of Technology. Since 1999 he has been working as an Assistant Professor at the Marketing Management Department of the Erasmus University Rotterdam, combining his Ph.D. research with lecturing on consumer behavior and marketing communications. Up till now, his research has dealt with social dilemmas, consumer complaint behavior, aesthetic preference, and consumer product categorization. He presented his work at several international conferences and published in *Gedrag en Organisatie*, and *Advances in Consumer Research*. As of November 2000, he will continue his work as an Assistant Professor at the School of Industrial Design Engineering at the Delft University of Technology.