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The influence of stimulus ambiguity on category and attitude formation

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Abstract Existing research on categorical ambiguity has mostly examined how consumers assimilate new products into familiar product categories. Extending these findings, this research investigates whether and under what circumstances consumers either create new mental categories for hybrid products or integrate them into existing categories. Specifically, we propose that this effect is influenced by the degree of product ambiguity and the availability of a new category label. We find that as ambiguity increases, the probability of new category creation augments, but product evaluation deteriorates. However, we also find that a new category label can reduce the effects of ambiguity and can improve product evaluation. Thus, the results fill the existing gap in research on the cognitive integration of hybrid products and shed light on how managers may position these products successfully.

Keywords Categorization · Ambiguity · Category label · Product evaluation · Hybrid products

JEL Classification M31 · M37

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1 Introduction

At the 1999 IAA (International Auto Fair in Frankfurt, Germany), Citroën premiered the C3 Pluriel, one of the many vehicles encountered on the road that cannot be classified unambiguously into an established category. According to the manufacturer, this particular vehicle comprised “four cars in one”, namely a saloon car, a cabriolet, a spider, and a pick-up (Etienne 2002). Subsequently, all major car manufacturers followed Citroën’s example; for instance, Renault by introducing the Avantage and Daimler the R-Class. In a similar vein, recent years have also witnessed the emergence of crossover vehicles which combine two or more body types, such as the coupé-style SUVs known as SUCs (sport utility coupés). Manufacturers have come up with these new vehicles to satisfy a diverse range of customer needs and to cope with the stagnating growth on the automobile market (Wright and Sedgwick 2001).

At the same time, platform and module strategies have enabled companies to produce a larger range of models at a lower cost. As a result, market niches are becoming increasingly smaller, leading to an increased fragmentation of the market. This trend, manufacturers and industry experts claim, is likely to continue in the future (Lundegaard 2006). Despite the industry’s enthusiasm for these hybrid vehicles, many of them have not resonated very strongly with consumers. Moreover, hybrid products are beginning to proliferate in a number of additional industries (e.g., groceries, bikes, cameras), increasing the need for an accurate understanding of how consumers categorize and evaluate these products.

Specifically, the current literature has not paid much attention to when and why consumers may create new mental categories for hybrid products. Instead, most studies have examined the mental representation of these products into existing categories, suggesting that the classification and evaluation of hybrid products entail a focused processing of individual product properties (Moreau et al. 2001; Gregan-Paxton et al. 2005; Rajagopal and Burnkrant 2005). Furthermore, research also indicates that consumers, despite an apparent enthusiasm for a large range of products, can at times be overwhelmed by a nontransparent product range (Iyengar and Lepper 2000; Herrmann and Heitmann 2006), which makes it even more interesting to study consumers’ reactions to hybrid products in more detail. Specifically, a number of issues currently remain unanswered: How do customers integrate hybrid products into their knowledge structures? When are hybrid products allocated to an existing or a new category? What implications do consumers’ processing patterns hold for the design of new products? To answer these questions, we develop a set of hypotheses about the processing of hybrid products and examine these hypotheses in a controlled laboratory experiment with a sample of managers.

2 Conceptual background

2.1 Categorization in consumer research

Information processing theories have investigated how consumers process and evaluate new products. Whereas rational choice theory assumes that decision

makers hold well-defined preferences, the information-processing approach endorses bounded rationality (Bettman et al. 1998). That is, preferences for a particular product may be constructed on the spot and may be influenced by situational constraints and the availability of cognitive resources. Since processing capacities are limited, individuals frequently act as “cognitive misers” in order to cope with all of the impressions they are confronted with in their daily lives (Fiske and Taylor 1984). Such parsimony is facilitated when the cognitive system allocates two or more objects into a common category, thereby rendering these objects equivalent (Markman and Ross 2003; Rosch 1978). Categorization, then, represents the superficial, top-down processing of information.

According to dual process models, information processing can switch from this standard mode to extensive bottom-up processing if and when an individual is motivated and disposes of sufficient cognitive resources (Fiske and Neuberg 1990). Categorization effects are not only related to many cognitive functions such as prediction, inference, and preference formation (Markman and Ross 2003), but are also of great relevance in a consumer context. That is, consumers’ product and market knowledge is often organized in a hierarchical manner, aggregating a range of individual stimuli into market segments, consideration sets, and product classes (Sujan and Dekleva 1987; Ratneshwar and Shocker 1991).

In a hierarchical categorization system, basic categories are particularly important because they represent the highest degree of intercategory differentiation at maximum intracategory homogeneity. In this respect, basic categories highlight the common features of stimuli while simultaneously delimiting them from neighboring categories to the maximum extent (Mervis and Rosch 1981). These categories are subsequently used to structure and differentiate products, such that consumers’ decisions are often affected by their existing mental categories (Alba and Hutchinson 1987). Therefore, understanding when consumers rely on their existing categories and when they decide to create a new category after being exposed to a new product is of great importance to marketing research.

2.2 Ambiguity and category formation

A great deal of studies have investigated how consumers assimilate new products into their existing categories (e.g., Meyers-Levy and Tybout 1989). When exposed to a new product, consumers can usually decide whether they want to assimilate a product into an existing category, relegate the product to a subcategory, or create an entirely new category. Since product categories are complex mental schemas that contain the category label, the individual’s knowledge of the product attributes, and the interrelationships between these attributes, establishing new categories can require a considerable amount of cognitive effort (Markman and Ross 2003). Thus, studies by Sujan and Bettman (1989) and Meyers-Levy and Tybout (1989) have found that consumers create a subcategory when a strong or moderate discrepancy exists between a new product and the basic category, but assimilate the product into the category when the discrepancy is marginal.

These studies, however, have only examined how consumers process newly launched products that clearly belong to a certain category. In this respect, these

studies may not adequately account for how consumers categorize and evaluate new products such as digital cameras and crossover vehicles, which are often composed of several product categories. Such products are usually referred to as hybrid or ambiguous products (Gregan-Paxton et al. 2005; Rajagopal and Burnkrant 2005). Ambiguity refers to a state of uncertainty, where a stimulus (e.g., a word, a picture, or another person's behavior) may not have a fixed value or meaning and may be interpreted in more than one way (Hoch and Deighton 1989).

Existing research suggests that ambiguity may be a common occurrence in many consumption decisions. For instance, Gierl (2006) points out that the exact outcome of many decisions that consumers make in their daily life is ambiguous; for example, it may be hard to predict the life time of a computer battery since this would not only depend on the quality of the hardware but also on how the consumer treats the battery. Hence, it is often impossible to express an attribute as a fixed value; instead, it must be expressed as a minimum value or a probable interval. Interestingly, Gierl (2006) finds in two experiments that such outcome ambiguity may actually have positive consequences, such that the appeal of a product can be increased if a clear disadvantage is represented in ambiguous terms rather than fixed terms. Hence, consumers may not only be used to ambiguity, but companies may also use the ambiguity inherent in many consumptions decisions to their advantage.

For hybrid products, ambiguity may not only stem from the product's attributes but also from the categorization task itself. Specifically, "information about a new product makes it difficult or impossible to place the novel offering in a single, existing category" (Gregan-Paxton et al. 2005, p. 127) because partially contradictory information entails different possibilities for interpreting product properties (Hoch and Ha 1986; Hoch and Deighton 1989). In particular, consumers may find it difficult to decide whether they should assimilate the product into one of their existing categories or refrain from assimilating the product, thereby effectively creating a new category. Given the relevance of categories for consumers' decisions, it seems important to fill this void and examine when product ambiguity promotes new category creation.

Specifically, we propose that category creation may depend on the extent of ambiguity. The ambiguity of hybrid products like crossover cars typically increases with the number of product types (in this case, body types) that are combined. If a highly ambiguous product is integrated into an existing category, both the category's homogeneity and its differentiation from other basic categories decrease and result in a less accurate knowledge representation (Alba and Hutchinson 1987; Bettman et al. 1998). Since individuals usually aim to make the most accurate judgments possible (Moskowitz et al. 1999), one may postulate that the likelihood of consumers creating a new (sub)category for a hybrid product increases with the degree of ambiguity inherent in the product (Weber and Crocker 1983). Hence,

H1 The greater the ambiguity, the greater the likelihood of new category creation.

2.3 The impact of labels on category formation

Category labels, which shed light on an object's category allocation and thus provide information beyond similar features (Yamauchi and Markman 2000; Lingle

et al. 1984), play a crucial role in categorization. Firstly, because a label draws attention to categorical features and applies exclusively to a category, it has higher cue validity and is optimally suited for intercategory differentiation (Rosch and Mervis 1975). Thus, inferences about a new object are often influenced by the applicable category label (Murphy and Ross 1994). From the perspective of schema theory, a label integrates a category's typical properties as an associative network (Hastie 1981). Indeed, Sujan (1985) shows that allocating a well-known category label to a new product triggers the transfer of knowledge from the category to the product, as a result of which preferences may be more strongly influenced by the label than the product's attributes.

However, these studies only investigate how labels referring to existing categories affect the classification of new products and do not examine the impact of labels referring to new categories. If a company wishes to differentiate itself from the competition through an innovative vehicle design, it does not want consumers to allocate the vehicle to an already existing category but rather explicitly aims to establish a new category. Hence, in this case a company would need to match the product with a new, neutral label that does not allow for the transfer of existing knowledge. Nonetheless, we postulate that labels may affect information processing even in these cases by increasing the likelihood that consumers will form a new category.

There are at least two theoretical accounts to support this prediction. Firstly, Hilton's (1995) model of conversational inference proposes that communication is usually characterized by a number of implicit norms. For instance, individuals are likely to assume that all of the information that they receive from an intentional source (e.g., a company) is relevant (see also, Grice 1975). If not, why would that information be mentioned in the first place? Hence, if a new product is coupled with a new category label, consumers may feel compelled to use the label for processing the product. Put differently, consumers may infer that the product indeed belongs to a new category, otherwise why would a company undertake the effort of communicating a new category label? Secondly, studies on subtyping processes demonstrate that individuals can readily create new (sub)categories when given categorizing information, even if that information is completely neutral (Kunda and Oleson 1995; Yzerbyt et al. 1999). For instance, Kunda and Oleson (1995) remark that people are "remarkably adept at generating theories to explain how just about any attribute may be related to just about any outcome" (p. 566). As such, consumers may be very adept at explaining why a new category label is different from existing labels and why the product should be subsumed under that new category. Thus,

H2 Specifying a new category label for a hybrid product increases the likelihood of new category creation.

2.4 The interaction between ambiguity and category labels

Apart from influencing the outcome of the categorization process, labels may also affect how much cognitive strain consumers experience during processing. More specifically, we propose that new category labels may increase or decrease cognitive

strain, depending on how ambiguous the product is. When ambiguity is low, consumers may tend to assimilate the product into an existing category (Sujan and Bettman 1989; Meyers-Levy and Tybout 1989). In this case, an unfamiliar category label may undermine this assimilation process, increasing cognitive strain. When ambiguity is high, on the other hand, a label provides an integrative description for hard-to-assimilate heterogeneous information, thereby facilitating the creation of a new category and decreasing cognitive strain. Thus,

H3 In the case of high (low) ambiguity, specifying a new category label for a hybrid product decreases (increases) the cognitive strain felt during categorization.

Finally, the categorization and evaluation of ambiguous products may not only be determined by the product's properties but also by the processing procedure itself (Lee and Labroo 2004; Cho and Schwarz 2006). That is, research on metacognitive experiences shows that feelings of conceptual fluency—a facet of processing fluency characterized by low perceived difficulty in processing new external information—have a positive impact on evaluation (Schwarz 2004). Moreover, conceptual fluency is facilitated when individuals have suitable mental concepts for processing and categorizing a new stimulus (Schwarz 2004). As such, coupling a highly ambiguous product with a new label should facilitate categorization, increase feelings of fluency, and affect product evaluation in a positive manner. The reverse should be true for products low in ambiguity since a new label would interfere with an efficient categorization, thereby decreasing feelings of fluency. In sum, as postulated in H3, the interaction between ambiguity and category label specification should also apply to product evaluation and should be mediated by the cognitive strain felt during categorization. Hence,

H4a In the case of high (low) ambiguity, specifying a new category label for a hybrid product results in more (less) favorable product evaluation.

H4b This interaction effect is mediated by the cognitive strain felt during categorization.

3 Empirical study

The research hypotheses are also summarized in Fig. 1.

3.1 Design of the study

The empirical study used a 2 (product ambiguity: high, low) \times 2 (label specification: yes, no) between-subjects design, in which participants were presented with a fictitious ad.

3.1.1 Independent variables

In our study, we decided to focus on the general product category of cars. To manipulate our independent variables, we developed a fictitious advertisement of

the type customarily used for new product launches. In the current context, the product stimulus needed to meet two key requirements. Firstly, the product needed to be manipulated at two levels of ambiguity; secondly, the label must be recognized as a new segment label rather than being perceived as a product brand. To this end, we selected a standardized picture of the Mercedes-Benz R-Class, integrated it into a fictitious ad, and falsely labeled the product as the Mercedes-Benz D-Class. Because the R-Class has only generated very low revenues (Kraftfahrt-Bundesamt 2008), one can safely assume that the majority of the population has no clear schema of that particular vehicle.

To create two different levels of ambiguity, we combined the typical properties of different body types. These properties were obtained through a separate pretest with 105 participants using a simplified Kelly repertory grid. Briefly, participants were asked to specify vehicle properties and their respective opposites. Aggregating these responses, we were able to develop a number of claims that described a particular kind of car and were mostly specific to this car. To check the validity of our claims, we asked another 20 participants (marketing experts as well as nonexperts) to allocate these claims to their respective body types. When a particular claim was classified correctly by at least 70% of the respondents, it was adopted without reservation. Claims that were not classified unambiguously were discussed with participants and subsequently modified. As a result, we obtained a number of claims that unambiguously described a particular body type. Furthermore, by combining claims from different body types into a new model, we were able to systematically vary the degree of ambiguity. The final selection consists of the four properties that are shown in the ads in Fig. 2.

Since the segment label must be neutral with regard to particular body types, the pretest also checked the connotations of potential category labels. Specifically, participants were successively presented with three potential labels—*variantourer*, *cross-tourer*, and *sportstourer*—and asked for their associations in a laddering

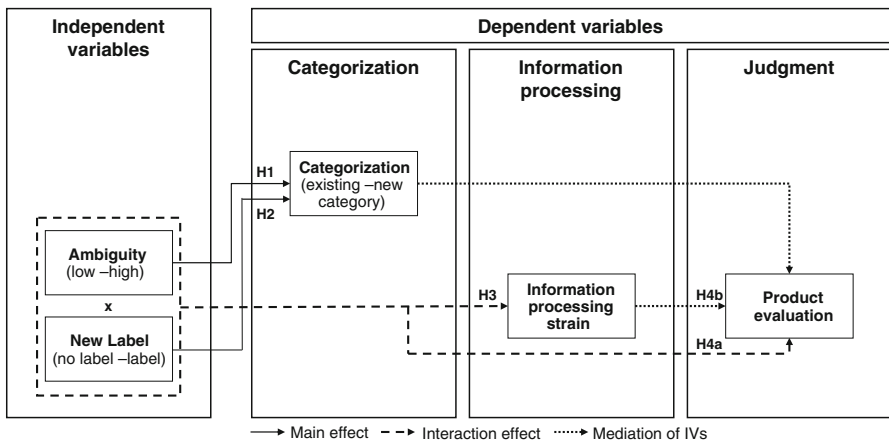


Fig. 1 Summary of hypotheses

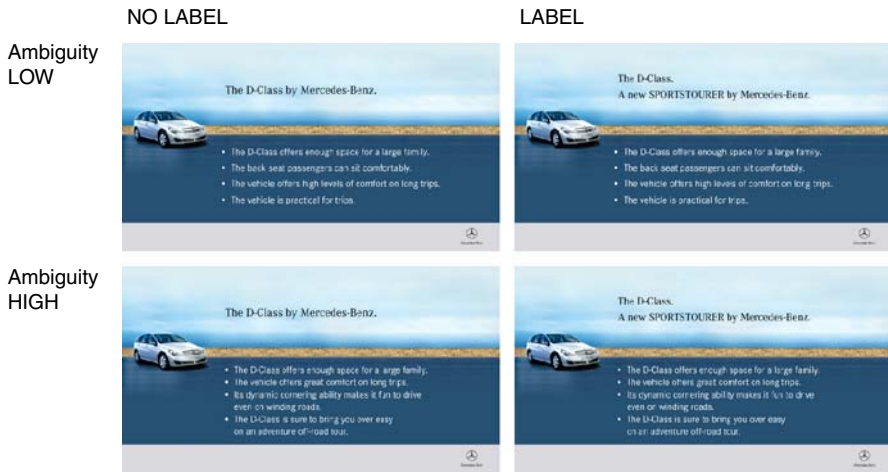


Fig. 2 Marketing advertisements under experimental conditions

procedure. When instructed to allocate the category label to what they considered the most suitable vehicle type, 74% of our respondents allocated the *crossstourer* label to SUVs, while 40% allocated the *varioutourer* label to minivans. Because of these strong associations these terms could not be used as new labels, such that we chose the *sportstourer* label, whose associations with existing body types are less clear cut.

3.1.2 Participants and procedure

A total of 120 non-marketing professionals participated in the study during an executive MBA course at a Swiss university in November 2007. The participants were between 24 and 60 years old ($M = 37.49$, $SD = 8.68$), 71% were male, and the overwhelming majority owned their own cars (80%). To exclude experimenter effects, we guided all participants through the paper-and-pencil survey by means of written instructions although an experimenter was present at all times to answer any questions. Each participant received a five-page document to be completed individually, which included a short introduction informing participants about the increasing product diversity in the automobile market. Since previous studies have indicated that individuals only process ambiguous information systematically when they are sufficiently motivated (Moreau et al. 2001; Rajagopal 2004), we told participants that their answers were highly relevant and would be useful for launching the new car (Johar 1995).

In the first part of the study, participants were asked to group twelve standardized photos (of German makes of saloons, station wagons, minivans, and SUVs) in line with a card-sorting procedure. Upon completion, participants were presented with the experimental ad and were asked to form an opinion of the advertised vehicle. Following this, participants responded to the dependent variables, the manipulation check, and the control variables.

3.1.3 *Dependent variables and manipulation check*

Since we are interested in exploring the relationship between ambiguous products and categorization, one of our main dependent variables examined if participants grouped the vehicle into an existing category or created a new category. We accounted for individual knowledge structures by asking participants to group each of twelve vehicle photos (i.e., Audi A6 sedan, BMW 5 series sedan, Mercedes-Benz E-class sedan, BMW 5 series estate, Mercedes-Benz E-class estate, VW Passat estate, Audi Q7, BMW X5, Mercedes-Benz M class, Ford C-Max, Opel Zafira, VW Touran) into different categories based on similarity. Following this, participants had to assign the target vehicle into one of the formed categories or had to create a new one.

A number of multi-items scales were employed to gain insights into the underlying categorization procedure. All items used 7-point scales. Firstly, as a measure of perceived categorization difficulty (PDC), participants indicated how difficult it had been to allocate the vehicle to a given group on one item that had been adapted from Brömer (2000). Secondly, we also measured participants' confidence in having arrived at the correct categorization decision (CCD). Whereas Jacoby et al. (1974) and Brömer (2000) use a single item for this construct, we used a three-item scale measuring participants' confidence, conviction, and certainty in the categorization task (Urbany et al. 1997). Thirdly, we also assessed perceived stimulus overload (PSO) by using six items adapted from previous research to reflect an additional aspect of processing inconsistent information (Sproles and Kendall 1986; Heitmann et al. 2007).

Since the categorization task may not adequately reflect participants' attitudes toward the product, we also measured product evaluation (PRE) by using a five-item scale adapted from Rajagopal (2004). Finally, as a check on the ambiguity manipulation, we asked participants how undecided they were when they needed to classify the vehicle on one item from Brömer (2000). All of the items used in the study are listed in Tables 1 and 2.

3.1.4 *Control variables*

A number of control variables that may also affect the dependent variables were included in the analysis.¹ To account for participants' knowledge about cars, we adapted a three-item scale from Mukherjee and Hoyer (2001) that asked participants to rate their knowledge about cars (see Table 2). Furthermore, we also wanted to control for participants' level of familiarity with the Mercedes-Benz brand. To this end, we asked participants to indicate whether or not they were familiar with five

¹ One limitation of our design is that the control variables were measured *after* participants had been exposed to the ads. Hence, the manipulations may have affected the level of the control variables. As a result, we are unable to test whether the experimental groups were homogenous with respect to the control variables *before* exposing them to the ads (a necessary precondition for ANOVA analyses). This issue is discussed further in the final discussion.

Table 1 Operationalization of dependent variables

	Item
PDC	When you had to categorize the vehicle in the ad, how easy was the categorization for you?
1	To categorize the vehicle, was very easy (1)—very difficult (7) to me
CCD	Once you had categorized the vehicle in the ad, how convinced were you to have had made the right decision?
1	I was very uncertain (1)—very certain (7)
2	I was not at all convinced (1)—absolutely convinced (7)
3	I was not at all confident (1)—absolutely confident (7)
PSO	Please evaluate the product range in the automotive market. To what degree do the following statements apply? Please indicate the level of your consent using the following scale: 1 means “I do not agree at all”, 7 means “I totally agree”
1	Given the variety of models one is never quite sure which model satisfies one’s own needs best.
2	There are so many models to choose from, that I am sometimes confused
3	Most models are very similar, so it’s hard to differentiate
4	It’s difficult for me to gain an overview over the models offered
5	It’s hard for me to detect clear cut differences among the models offered
6	It’s hard for me to compare competing models offered
PRE	Please evaluate the vehicle regarding the following aspects
1	Bad (1)—good (7)
2	Not at all desirable (1)—very desirable (7)
3	Unattractive (1)—attractive (7)
4	Negative (1)—positive (7)
5	I don’t like it at all (1)—I like it very much (7)

Table 2 Operationalization of control variables

	Item
PK	We are interested in how familiar you are with cars. Please rate your automotive knowledge on a 7-point scale using the following items
1	Compared with your family and friends, how familiar are you with the features of different car models and types? [not at all familiar (1)—very familiar (7)]
2	How familiar are you with different car models and types in general? [not at all familiar (1)—very familiar (7)]
3	Compared with your family and friends, how much experience do you have with different car models and types? [no experience at all (1)—lots of experience (7)]

brands of Mercedes-Benz (i.e., A-class, E-class, R-class, CLS, and SLK). These items were summed to form a brand familiarity index. Lastly, we also included participants’ gender and age as potential control variables.

3.2 Results of the study

3.2.1 Manipulation check

Our results show that the ambiguity manipulation was successful. Specifically, participants exposed to an ad that was highly ambiguous felt more undecided during categorization than participants exposed to an ad that was lowly ambiguous ($M_{\text{high amb}} = 4.83$ vs. $M_{\text{low amb}} = 2.82$, $t_{(112.559)} = -8.533$; $P < 0.001$). Furthermore, participants in the high ambiguity conditions also reported more difficulty during categorization ($M_{\text{high amb}} = 4.97$ vs. $M_{\text{low amb}} = 2.67$; $t_{(111.161)} = -10.041$; $P < 0.001$), less confidence in their decision ($M_{\text{high amb}} = 2.46$ vs. $M_{\text{low amb}} = 4.84$; $t_{(107.761)} = 11.761$; $P < 0.001$), and more perceived stimulus overload ($M_{\text{high amb}} = 5.47$ vs. $M_{\text{low amb}} = 2.67$; $t_{(118)} = -15.439$; $P < 0.001$) than participants in the low ambiguity conditions.

3.2.2 Control variables

To test for differences in terms of knowledge, we first averaged the three knowledge items (Cronbach's $\alpha = 0.979$). A $2(\text{ambiguity}) \times 2(\text{label})$ ANOVA revealed a significant main effect for ambiguity ($F_{(1,116)} = 9.379$, $P < 0.003$), indicating that category knowledge was affected by the ambiguity manipulation. Specifically, participants who were exposed to the ad with higher ambiguity rated their category knowledge lower ($M_{\text{high amb}} = 2.81$) than those viewing the ad with lower ambiguity ($M_{\text{low amb}} = 3.81$). Considering that we measured knowledge after participants had been exposed to the ads, this result is not very surprising. That is, participants that were exposed to a car that they had never seen before and that was highly unusual may simply have believed that their knowledge of cars was not up-to-date. Given this breach of the independence criterion, it was not possible to include category knowledge as a covariate in the analysis.

Next, we tested for the effects of brand familiarity. A one-way ANOVA showed that there were no significant differences across the experimental groups in terms of brand familiarity ($F_{(1,116)} = 0.74$, $P > 0.53$). In other words, the groups were homogenous with regard to this variable. Furthermore, brand familiarity did not emerge as a significant covariate in any of the subsequent analyses; that is, it was unrelated to the dependent variables. Similar results were obtained for gender and age. These variables were not distributed differently across the experimental groups and did not affect any of the dependent variables.

3.2.3 Categorization, information processing, and product evaluation

To test the effects of product ambiguity and label specification on category formation, we postulate main effects for both independent variables (H1 and H2). We tested these hypotheses using a contingency test in which all analyses are based on a 2×2 contingency and no expected frequencies are less than five (see Table 3).

Thus, we calculated the χ^2 -value using the Yates-corrected test statistic, which rejects the null hypothesis of independence between ambiguity and category

Table 3 Cross-tabulation of category formation by ambiguity and category label

Ambiguity	Category description	New category	Existing category	Total
Low	No label	12 38.7%	19 61.3%	31 100.0%
	Label	7 23.3%	23 76.7%	30 100.0%
	Total	19 31.1%	42 68.9%	61 100.0%
High	No label	19 63.3%	11 36.7%	30 100.0%
	Label	12 41.4%	17 58.6%	29 100.0%
	Total	31 52.5%	28 47.5%	59 100.0%

Note: Given as observed frequencies and percent of label

formation ($\chi^2_{\text{corr}} = 4.802$; $P < 0.028$). Specifically, 50 out of 120 participants decided to create a new category after seeing the ad for the target vehicle. As indicated by the significant χ^2 -value, the likelihood of creating a new category was affected by the ambiguity manipulation. Out of the 50 participants creating a new category, 31 (62%) had previously seen the ad high in ambiguity, whereas only 19 (38%) had seen the ad low in ambiguity. Put differently, participants were significantly more likely to create a new category after having been exposed to a highly ambiguous product. In a similar vein, participants were more likely to assign the new car to an existing category when the product was not very ambiguous. Out of the 70 participants using an existing category, 42 (60%) had seen the ad low in ambiguity. Hence, these results support H1 and confirm the relevance of ambiguity in the creation of new categories.

Regarding H2, however, there is no significant effect of label specification on category formation ($\chi^2_{\text{corr}} = 3.545$; $P > 0.06$) even though the phi coefficient indicates a moderately strong effect ($\varphi = 0.189$; $P < 0.039$).

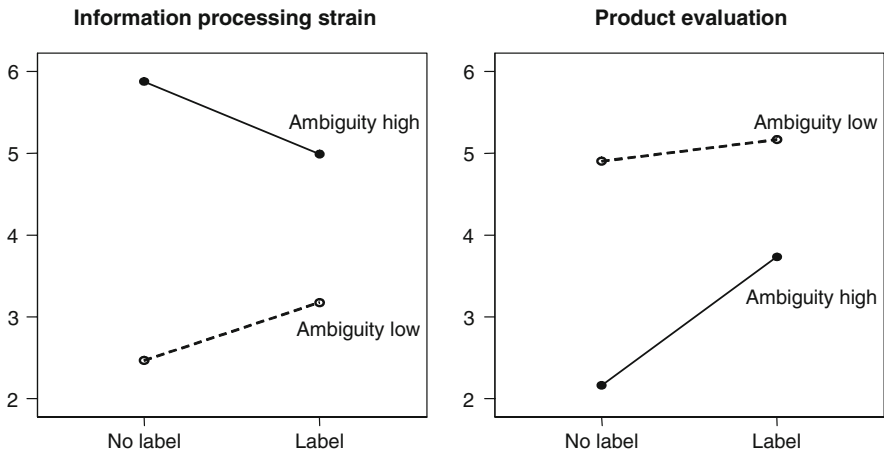
As shown by the manipulation checks, increasing levels of ambiguity hinder information processing. In the following, these variables were analyzed in greater depth. Specifically, H3 postulated an interaction effect between the two independent variables. That is, an unknown label should impede categorization when ambiguity is low by countering the assimilation effect that is induced by low schema discrepancy. Conversely, in the case of high ambiguity, a label should offer a summary description of heterogeneous information that is difficult to assimilate.

As the information-processing constructs are highly intercorrelated, we aggregated all items into an index by calculating the mean (Cronbach's $\alpha = 0.966$).²

² Arguably, the coefficient Alpha for this aggregated measure is considerably large. Peterson (1994) argued that high coefficients may imply high redundancy between the items rather than indicating reliability. To test whether this affected our results, we conducted all of the analyses for each of the three constructs separately (i.e., difficulty, confidence, and overload). In all cases, the results were identical, increasing our confidence that our results were not adversely affected by a potential item redundancy.

Table 4 Correlations between the information-processing constructs

	PDC	CCD	PSO
Perceived difficulty of categorization (PDC)	1		
Confidence in the categorization decision (CCD)	-0.588*	1	
Perceived stimulus overload (PSO)	0.654*	-0.722*	1

* $P < 0.01$ **Fig. 3** Mean values for information processing strain and product evaluation based on ambiguity and specification of a category label

From a theoretical viewpoint, it seems that difficulty during the evaluation procedure and confidence in the categorization decision cannot be distinguished, but are facets of one construct representing information processing strain at a more general level (see also Table 4).

To test H3, we conducted a 2×2 ANOVA. This analysis showed that participants subjected to high ambiguity reported greater processing strain ($M_{\text{high amb}} = 5.44$) than those subjected to low ambiguity ($M_{\text{low amb}} = 2.82$) ($F_{(1,116)} = 406.624$; $P < 0.001$; $\varepsilon = 0.87$), an effect that Cohen (1988) considers large. Additionally, even though the factor label displays no significant main effect ($F < 1$), the interaction between the two independent variables is significant ($F_{(1,116)} = 37.874$; $P < 0.001$; $\varepsilon = 0.57$). That is, specifying a category label reduces processing strain when ambiguity is high but increases it when ambiguity is low. Hence, H3 is confirmed. The interaction effect is also displayed in Fig. 3.

In a next step, we examined the effect of our independent variables on product evaluation (Cronbach's $\alpha = 0.968$). A 2×2 ANOVA yielded two significant main effects. That is, ambiguity has a negative impact on product evaluation ($M_{\text{high amb}} = 2.94$, $M_{\text{low amb}} = 5.03$, $F_{(1,116)} = 111.581$, $P < 0.001$, $\varepsilon = 0.98$), whereas label specification has a positive impact ($M_{\text{label}} = 4.46$, $M_{\text{no label}} = 3.56$, $F_{(1,116)} = 21.571$, $P < 0.001$, $\varepsilon = 0.43$). Furthermore, the interaction is also

significant ($F_{(1,116)} = 10.949, P < 0.001; \varepsilon = 0.31$). As Fig. 3 shows, a label has a more positive impact on product evaluation when ambiguity is high than when it is low. Thus, H4a is confirmed.

Finally, H4b postulated that processing strain has a negative effect on product evaluation and mediates the effect of the independent variables. Put differently, H4b seeks to demonstrate a mediated moderation effect. In such a case, the interaction term has to exert a significant effect on the dependent and mediating variables; furthermore, the mediating variable has to affect the dependent variable (Baron and Kenny 1986). As elaborated previously, the independent variables interact to affect both the dependent variable (i.e., product evaluation) and the mediating variable (i.e., information processing strain). The full model was tested by using a generalized linear model. Whereas the tests show main effects and an interaction of the independent variables, processing strain does not significantly impact product evaluation ($F_{(1,115)} = 2.226; P > 0.138$). Therefore, H4b cannot be confirmed. In addition, we checked whether ambiguity's negative effect on product evaluation might be mediated by the categorization decision, an assumption that is not supportable by simple mediation analysis. We find that even though creating a new category negatively affects product evaluation in an ANOVA ($F_{(1,118)} = 8.789; P < 0.004$), including ambiguity and categorization in a two-way ANOVA only produces a main effect for ambiguity ($F_{(1,117)} = 80.182; P < 0.001; \varepsilon = 0.828$).

4 Summary of results and discussion

4.1 Discussion

According to social cognition research, categorization is useful in information processing by reducing the complexity of external stimuli (Fiske and Taylor 1984; Rosch 1978). Most importantly, categorization may not only help consumers by establishing similarities between different objects, but may also help them by providing information about the general category the objects belong to (i.e., the typical product and benefit features of the category; Yamauchi and Markman 2000). The present study, however, is the first to show that the degree of product ambiguity can affect the generation of new categories. In contrast, previous studies have mostly examined how and when consumers integrate hybrid products into existing categories that are designated by the researchers (Gregan-Paxton et al. 2005; Moreau et al. 2001). The present study addresses this limitation through a two-stage process that first activates participants' category structures by asking them to categorize products that are unambiguous and only then asks them to allocate a hybrid product against these structures.

As postulated, increasing ambiguity exerts a positive influence on category formation but affects product evaluation negatively by impeding information processing, a finding in line with the subtyping model of Weber and Crocker (1983). As the discrepancy between an object and a familiar schema increases, so too does the probability that the consumer will create a new (sub)category. Our study also provides some support for the basic finding that a label exerts a greater influence on

information processing than the product's properties (Moreau et al. 2001; Rajagopal 2004). That is, even though new labels may not allow consumers to infer the schema associated with the category, new labels may still influence processing by encouraging the creation of new mental categories. Although the results did not confirm the postulated main effect, the analysis confirms the dominant role of a label in information processing.

In addition, an unknown category label can mitigate the drawbacks of high levels of ambiguity. Thus, a label provides a formal bracket for ambivalent information and facilitates information processing by supplying a peripheral indication for category-based processing (Fiske and Neuberg 1990). Since the pretest produced no clear associations between the body type and the category label, this effect appears to be independent from the other features of the stimulus. In other words, the mere specification of a category label facilitates cognitive processes.

Furthermore, our results are also consistent with research showing that ambiguity can affect attitudes negatively. For example, Brömer (2000) found that attitudes toward inconsistently portrayed products were significantly more negative than attitudes toward products portrayed neutrally. In line with these findings, our results show that ambiguity is inherently negative and that the provision of a label can mitigate this effect, which is especially true for highly ambiguous stimuli. Hence, complex and inconsistent information has a negative effect, whereas a well-structured stimulus like a category label exerts a positive influence. This finding underscores the importance of labels for launching hybrid products and creating new vehicle segments.

Our results also provide insights about the underlying process. Specifically, Lee and Labroo (2004) show that conceptual fluency exerts a positive influence on product evaluation. As such, the availability of adequate mental categories for processing a stimulus leads to improved product evaluations, whereas difficulty in categorization negatively impacts such evaluations. These findings suggest that processing procedures may also have influenced product evaluations in our study. Contrary to expectations, we found that cognitive strain did not mediate the effects of ambiguity and label specification on product evaluation. Hence, ambiguity and category labeling do not seem to be process-related but are inherently negative and positive. Moreover, because the categorization decision does not mediate the effects of ambiguity, we conclude that new categories are not inherently negative. Instead, it seems more likely that they are evaluated less favorably because of the negativity of ambivalence.

In sum, our results show that high ambiguity may lead to the creation of new categories but may affect product evaluation negatively. Introducing a new category label, however, moderates this relationship, exerting a positive effect for products that are high in ambiguity.

4.2 Practical implications

As the competition in the automotive industry has grown more intense over the years, manufacturers have tried to tap new market niches with new, crossover vehicles. These attempts, however, have not always been successful. Since

consumers usually have relatively stable categories regarding products—especially for long-life products like cars—establishing new categories is a difficult challenge. On the other hand, past successes like the emergence of the SUV and minivan segments suggest that creating new segments is possible but not easy.

Particularly, hybrid products may create uncertainty in consumers' minds and may be difficult to process. Thus, consumers need clear information to cope with these products. Firstly, the product line has to clearly convey its benefits. As hybrid products combine properties of two or more existing product types, companies have to take into account customers' knowledge structures. Formerly exclusive USPs can now be offered in a single product. Creative departments in the car industry are called upon to design a distinctive, yet visually appealing new concept, building on known features that help the customer in integrating the innovation in his mental product world. The design should therefore stress the key functions of the new concept.

But the tangible product may only be one factor influencing success in the marketplace. When the crossover car is highly ambiguous, a new category label may reduce consumers' cognitive effort and may therefore support the positioning of the new vehicle. This may be especially true for brands that employ an alphanumeric nomenclature, thereby implying a structure of the product portfolio. In these cases, an adequate label may substantially facilitate the cognitive integration of the new product into the existing portfolio.

One aspect that we did not address in our study is how a category label needs to be designed in order to facilitate the creation of a new category. That is, will any label help category creation or are labels that are distinct, meaningful, and comprehensible more effective than ones that are less so? For instance, research on stereotyping has found that people can easily relegate a deviant member into a subcategory and hence preserve their stereotypes when they are given an additional, neutral piece of information about the deviant (Kunda and Oleson 1995). However, such subtyping processes are only possible when that information is meaningful and indicative of the person's character (e.g., the deviant's profession), but not when it is obviously irrelevant (e.g., knowing that the deviant brushes her teeth in the morning; Hilton and Fein 1989). These findings may also be of relevance in the current context. That is, in our study we used the term "sportstourer" to label the new vehicle. Arguably, this label was relevant and facilitated category creation by indicating that the concept "sporty" may be a useful principle to organize the different product attributes. Hence, one may argue that labels that are clearly irrelevant will not facilitate category creation. Examining how different types of labels affect the categorization and evaluation of hybrid products thus presents an interesting area for future research.

Overall, our findings suggest that market success cannot be ensured by the product alone; rather, a targeted marketing strategy is necessary for launching new products successfully. Hence, manufacturers need to consider how their customers structure the market and need to clearly delineate the features that distinguish the new product from familiar product types (Ries and Trout 2001). In a similar vein, product managers need to analyze whether a new product offers enough potential for a new category or whether it should be marketed within an extant product group.

In sum, companies managing multiple brands need to structure and present their product portfolio in a clear manner in order to ensure long-term success.

4.3 Limitations and avenues for further research

To examine how stimulus ambiguity and category labels affect category creation and processing procedures, we manipulated ambiguity at the conceptual, verbal level by varying the number of claims used to advertise the product. However, such explicit claims are not the only factor influencing the categorization of new products. Product design may also play a decisive role (Kreuzbauer and Malter 2005). Thus, innovative designs can be of importance, particularly for products with high development costs and long product life cycles (Carbon and Leder 2007). Hence, the extent to which design ambiguity influences the perception and categorization of new products would be an interesting topic for further study.

Additionally, we have implicitly assumed that consumers will always categorize a new product, either by assigning it into an existing category or by creating a new category. Arguably, consumers may only be willing to expend the cognitive energy necessary for categorizing a product if they have a critical, minimal level of interest in the product. In the context of our study, this seemed to be a reasonable assumption (i.e., managers studying for an executive MBA evaluating an upscale car like Mercedes-Benz). Possibly, our results may have been different if we had used a product and/or a category that was of little or no interest to our participants. In this case, consumers may be reluctant to process an ambiguous product in greater depth and may reject the product straight away. Put differently, they may not categorize a product at all if they show little interest or acceptance in the first place.³ Hence, interesting insights may be gained by varying the level of ambiguity as well as participants' interest in the general category.

One important limitation of our experimental design concerns the fact that the control variables were measured after participants were exposed to the ads (see also footnote 1). Hence, it was not possible to determine whether there was homogeneity within and between the experimental groups with respect to the control variables prior to the start of the study. Previous research in this area has also not considered this important point. That is, these studies have either not considered knowledge or existing preferences as potential control variables (e.g., Moreau et al. 2001) or have measured these variables after participants had viewed the experimental stimuli (e.g., Gregan-Paxton et al. 2005; Rajagopal and Burnkrant 2005). From this perspective, it would have been preferable to measure the control variables prior to exposure in order to ensure "a priori" homogeneity and/or to ascertain that potential differences in terms of knowledge and preferences did not affect the results in an adverse manner.

In terms of further research, it would also be important to explore how many hybrid products are needed before consumers are willing to create a new segment. Drawing on the product-market definition by Day et al. (1979), we propose that consumers may only begin to see a new category when several such products are

³ We thank an anonymous reviewer for pointing out this possibility.

launched on the market. Thus, one may examine whether it is the timing or the number of products presented that is decisive in this context. Analyses of this kind may also be relevant for the launch of “me-too” products whose early entrant advantage has been amply demonstrated (Carpenter and Nakamoto 1989). Specifically, it is unclear whether the success of a pioneering hybrid product would depend on competitors launching products of the same type.

Lastly, it may be worthwhile to explore how perceptions of risk influence the evaluation of hybrid products. That is, when faced with a hybrid product, consumers may not only be unsure as to how to categorize the product but may also be uncertain if and to what extent the product will live up to their functional expectations (Campbell and Goodstein 2001). From this perspective, communication strategies aimed at reducing the risk inherent in hybrid products (e.g., guarantees, mental analogies, celebrity endorsements) may serve to enhance the acceptance of these products. This may be especially the case for high-involvement products that involve significant financial expenditures such as the cars that we investigated in this study.

References

- Alba JW, Hutchinson J (1987) Dimensions of consumer expertise. *J Consum Res* 13(4):411–454
- Baron RM, Kenny DA (1986) The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *J Pers Soc Psychol* 51(6):1173–1182
- Bettman JR, Luce MF, Payne JW (1998) Constructive consumer choice processes. *J Consum Res* 25(3):187–217
- Brömer P (2000) Einstellungsbildung: Erlebte Ambivalenz, subjektive Schwierigkeit und Antwortlatenz bei evaluativ inkonsistenten, konsistenten und neutralen Informationen (Attitude formation: experienced ambivalence, perceived difficulty, and response latency when information is either evaluatively inconsistent, consistent, or neutral). *Z Exp Psychol* 47(2):115–128
- Campbell MC, Goodstein RC (2001) The moderating effect of perceived risk on consumers’ evaluations of product incongruity: preference for the norm. *J Consum Res* 28(3):439–449
- Carbon CC, Leder H (2007) Design evaluation: from typical problems to state-of-the-art solutions. *Thesis* 24(2):33–37
- Carpenter GS, Nakamoto K (1989) Consumer preference formation and pioneering advantage. *J Mark Res* 26(3):285–297
- Cho H, Schwarz N (2006) If I don’t understand it, it must be new: processing fluency and perceived product innovativeness. In: Pechmann C, Price LL (eds) *Advances in consumer research*, vol 33. Association for Consumer Research, Duluth, pp 319–320
- Cohen J (1988) *Statistical power analysis for the behavioral sciences*, 2nd edn. Lawrence Erlbaum Associates, Hillsdale
- Day GS, Shocker AD, Srivastava RK (1979) Customer-oriented approaches to identifying product markets. *J Mark* 43(4):8–19
- Etienne T (2002) C3—un « Pluriel » fort singulier. *Le Figaro* September 9: 10
- Fiske ST, Neuberg SL (1990) A continuum of impression formation, from category-based to individuating processes: influences of information and motivation on attention and interpretation. In: Zanna MP (ed) *Advances in experimental social psychology*, vol 23. Academic Press, San Diego, pp 1–74
- Fiske ST, Taylor SE (1984) *Social cognition*. Addison-Wesley, Reading
- Gierl H (2006) Präferenzen bei Ergebnisambiguität (Preferences in the case of outcome ambiguity). *Zeit f Be* 76(6):1187–1216
- Gregan-Paxton J, Hoefler S, Zhao M (2005) When categorization is ambiguous: factors that facilitate the use of a multiple category inference strategy. *J Consum Psychol* 15(2):127–140

- Grice HP (1975) Logic and conversation. In: Cole P, Morgan JL (eds) *Syntax and semantics 3: speech acts*. Academic Press, San Diego, pp 41–58
- Hastie R (1981) Schematic principles in human memory. In: Higgins ET, Hermann CP, Zanna MP (eds) *Social cognition: The Ontario symposium, vol 1*. Lawrence Erlbaum Associates, Hillsdale, pp 39–88
- Heitmann M, Lehmann DR, Herrmann A (2007) Choice goal attainment and decision and consumption satisfaction. *J Mark Res* 44(2):234–250
- Herrmann A, Heitmann M (2006) Providing more or providing less? Accounting for cultural differences in consumers' preference for variety. *Int Mark Rev* 23(1):7–24
- Hilton DJ (1995) The social context of reasoning: conversational inference and rational judgment. *Psychol Bull* 118(2):248–271
- Hilton JL, Fein S (1989) The role of typical diagnosticity in stereotype-based judgments. *J Pers Soc Psychol* 57(2):201–211
- Hoch SJ, Deighton J (1989) Managing what consumers learn from experience. *J Mark* 53(2):1–20
- Hoch SJ, Ha YW (1986) Consumer learning: advertising and the ambiguity of product experience. *J Consum Res* 13(2):221–233
- Iyengar SS, Lepper MR (2000) When choice is demotivating: can one desire too much of a good thing? *J Pers Soc Psychol* 79(6):995–1006
- Jacoby J, Speller DE, Berning CK (1974) Brand choice behavior as a function of information load: replication and extension. *J Consum Res* 1(1):33–42
- Johar GV (1995) Consumer involvement and deception from implied advertising claims. *J Mark Rev* 32(3):267–279
- Kraftfahrt-Bundesamt (2008) Neuzulassungen von Personenkraftwagen nach Segmenten und Modellreihen (New car registrations by segments and model types). Retrieved 25 January 2008, from <http://www.kba.de/>
- Kreuzbauer R, Malter AJ (2005) Embodied cognition and new product design: changing product form to influence brand categorization. *J Prod Innov Manag* 22(2):165–176
- Kunda Z, Oleson KC (1995) Maintaining stereotypes in the face of disconfirmation: constructing grounds of subtyping deviants. *J Pers Soc Psychol* 68(4):565–579
- Lee AY, Labroo AA (2004) The effect of conceptual and perceptual fluency on brand evaluation. *J Mark Res* 41(2):151–165
- Lingle J, Altom M, Medin DL (1984) Of cabbages and kings: assessing the extendibility of natural object concept models to social things. In: Wyer RS, Srull TK (eds) *Handbook of social cognition, vol 1*. Lawrence Erlbaum Associates, Hillsdale, pp 71–117
- Lundegaard K (2006) A new generation of SUVs. *Wall St J (East Ed)* 10:D1–D6
- Markman AB, Ross BH (2003) Category use and category learning. *Psychol Bull* 129(4):592–613
- Mervis CB, Rosch E (1981) Categorization of natural objects. *Annu Rev Psychol* 32:89–115
- Meyers-Levy J, Tybout AM (1989) Schema congruity as a basis for product evaluation. *J Consum Res* 16(1):39–54
- Moreau CP, Markman AB, Lehmann DR (2001) “What is it?” Categorization flexibility and consumers' responses to really new products. *J Consum Res* 27(4):489–498
- Moskowitz GB, Skurnik I, Galinsky AD (1999) The history of dual-process notions, and the future. In: Chaiken S, Trope Y (eds) *Dual-process theories in social psychology*. Guilford Press, New York, pp 12–36
- Mukherjee A, Hoyer WD (2001) The effect of novel attributes on product evaluation. *J Consum Res* 28(3):462–472
- Murphy GL, Ross BH (1994) Predictions from uncertain categorizations. *Cogn Psychol* 27(2):148–193
- Peterson RA (1994) A meta-analysis of cronbach's coefficient alpha. *J Consum Res* 21(2):381–391
- Rajagopal P (2004) Consumer categorization and evaluation of ambiguous products. Unpublished doctoral dissertation, Ohio State University, Columbus OH
- Rajagopal P, Burnkrant RE (2005) Consumer categorization and evaluation of ambiguous products. In: Menon G, Rao AR (eds) *Advances in consumer research, vol 32*. Association for Consumer Research, Duluth, p 362
- Ratneshwar S, Shocker AD (1991) Substitution in use and the role of usage context in product category structures. *J Mark Res* 28(3):281–295
- Ries A, Trout J (2001) *Positioning: the battle for your mind*, 3rd edn. McGraw-Hill, New York
- Rosch E (1978) Principles of categorization. In: Rosch E, Lloyd BB (eds) *Cognition and categorization*. Lawrence Erlbaum Associates, Hillsdale, pp 27–48

- Rosch E, Mervis CB (1975) Family resemblances: studies in the internal structure of categories. *Cogn Psychol* 7(4):573–605
- Schwarz N (2004) Metacognitive experiences in consumer judgment and decision making. *J Consum Psychol* 14(4):332–348
- Sproles GB, Kendall EL (1986) A methodology for profiling consumers' decision-making styles. *J Consum Aff* 20(2):267–279
- Sujan M (1985) Consumer knowledge: effects on evaluation strategies mediating consumer judgments. *J Consum Res* 12(1):31–46
- Sujan M, Bettman JR (1989) The effects of brand positioning strategies on consumers' brand and category perceptions: some insights from schema research. *J Mark Res* 26(4):454–467
- Sujan M, Dekleva C (1987) Product categorization and inference making: some implications for comparative advertising. *J Consum Res* 14(3):372–378
- Urbany JE, Bearden WO, Kaicker A, Smith-de Borrero M (1997) Transaction utility effects when quality is uncertain. *J Acad Mark Sci* 25(1):45–55
- Weber R, Crocker J (1983) Cognitive processes in the revision of stereotypic beliefs. *J Pers Soc Psychol* 45(5):961–977
- Wright C, Sedgwick D (2001) Cross-dressing. *Automotive News International* 27–28 February 2001, pp 14–15
- Yamauchi T, Markman AB (2000) Inference using categories. *J Exp Psychol* 26(3):776–795
- Yzerbyt VY, Coull A, Rocher SJ (1999) Fencing off the deviant: the role of cognitive resources in the maintenance of stereotypes. *J Pers Soc Psychol* 77(3):449–462