Asymmetries in consumer similarity judgments: a test of the Relative Prominence Model

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Abstract

Asymmetries in individuals' assessments of similarity between objects have been reported since Tversky's landmark article "Features of similarity" (1977). The present paper documents asymmetry in a plurality of consumer settings. Relative Prominence Model (Johannesson, 2000) was applied to the data, and observed asymmetries were described in terms of different prominences of the stimuli. Model implications for several issues in consumer research are discussed.

Key words: consumer decision-making; product judgments; similarity; inferences.

1 Introduction

Whenever an individual compares one object to another, recognizes a pattern as known, or makes a generalization, he is performing a similarity judgement. Similarity is used as a principle to both organize existing knowledge and form new concepts. As consumers, people often think about products and brands in terms of alternatives with some degree of resemblance, and categorize a new product according to its similarity with the existing ones. Therefore, marketing and consumer research has historically devoted great attention to the issue of similarity. Drawing from psychometrics, techniques such as multidimensional scaling (Shepard, 1962) have been widely used in order to understand and represent consumer perceptions of similarity between alternative products and brands, and marketers have traditionally exploited resulting "perceptual maps" for decisions concerning new brand introductions, targeting, and so on.

Typically, approaches to similarity have been geometric in nature: objects have been represented as points in a conceptual space, such that the observed (psychological) dissimilarities between objects correspond to the metric distances between the respective points. That means, the closer two points are, the more similar the two objects are considered to be. However, the plausibility of this "spatial metaphor" (Palmer, 1978) of similarity have been questioned in Tversky's landmark paper "Features of Similarity" (1977). In particular, Tversky provided empirical evidence of the violation of the axiom of simmetry (the distance from object *i* to object *j* is equal to the distance from *j* to *i*). According to his arguments, similarity should not be treated as a symmetric relation. Together with the criticism to geometric models, Tversky provided an alternative theoretical approach to similarity, based on feature matching: the so-called “contrast model” expresses with three parameters the perceived similarity between object *i* and object *j,* as a function of their common features and distinctive features. Johnson and collegues (Johnson, 1981; Johnson, 1986; Johnson and Horne, 1988; Block and Johnson, 1995) first studied the implications of the contrast model in a consumer setting; however, with other notable exceptions (Boush, 1997; Lei et al., 2008), Tversky’s approach had little impact on marketing literature. Arguably, though the contrast model represents a sharable theoretical framework for describing the psychological processes involved in similarity judgments, its lack of guidance with respect to the nature and the weighting of the features considered in judgments (Smith, 1995) constitutes a limitation in its applicability to the marketing domain.

A number of other models emerged (Krumhansl, 1978; Holman, 1979; see also Nosofsky, 1991) which are able to explain systematic violations of the symmetry axiom. According to these models, asymmetry is characterized in terms of a *stimulus bias*, that is, a characteristic pertaining to an individual object. As well as reasonable, such an approach is intuitively applicable to a number of marketing issues. To date, much of the attention consumer researchers have devoted to similarity is due to the fact it serves as the main criterion consumers adopt in order to make inferences between products, brands, and brand categories: perceived "fit" (Tauber, 1988) between parent brand and extension brand increases the inferences from the former to the latter (Aaker and Keller, 1990; Bottomley and Holden, 2001, Boush and Loken, 1991). In a brand extension context, similarity could also act as heuristic in making extension-related judgments (Alba and Hutchinson, 1987; Alba et al., 1994; Maheswaran, 1994). But other than in brand portfolios (see also Balachander and Ghose, 2003; John et al., 1998), similarity-based inferences could happen also with respect to competing brands, as a brand scandal can spill over within a product category (Roehm and Tybout, 2006). More in general, since new brands are learned by comparing them with existing ones (Zhang and Markman, 1998), the representation of the new brand will be influenced by its similarity to previous brands. A parsimoniuos principle to handle asymmetries in perceived similarities could virtually invigorate all these fields of research. Moreover, it could intuitively spring a framework for marketers who seek to predict potential similarity-based externalities among brands in the market, and provide additional guidance for brand portfolio decisions as well.

Similarly to Johnson (1981), the present paper represents a preliminary step in carrying to consumer decision-making research a psychological approach to similarity. Section 2 addresses the literature evidence of asymmetries in similarity judgments; it briefly resumes the contrast model (Tversky, 1977) as the "classic" alternative to geometric models of similarity; and presents a recent alternative approach, called the Relative Prominence Model (Johannesson, 2000), that parsimoniously uses the concept of *stimulus bias* to understand and predict the empirically observable asymmetries in similarity judgments. Section 3 describes a pilot study performed to find evidence of asymmetric similarity judgments in a plurality of settings belonging to the consumer domain, and presents the results of the application of the Relative Prominence Model to the data. Section 4 broadly discusses the marketing relevance of results, and provides an interpretation of previous findings based on the proposed concept of prominence.

2 Approaches to similarity: the Relative Prominence Model

As recalled, theoretical approaches to similarity have traditionally been geometric: mental objects have been represented by coordinates in a space consisting of a number of continuous dimensions, such that there is an inversely functional corrispondence between distance between points in the space and similarity between respective objects. Within these approaches dissimilarity behaves like a metric distance function (δ), which must satisfy the axioms of minimality (1), simmetry (2), and subadditivity (3), for all objects i, j, and k:

$$\delta(i,j) \geq \delta(i,i) = 0 \tag{1}$$

$$\delta(i,j) = \delta(j,i) \tag{2}$$

$$\delta(i,j) + \delta(j,k) \geq \delta(i,k) \tag{3}$$

In his well-known 1977 paper, “Features of Similarity”, Tversky effectively questioned all these axioms. In particular, for what concerns the present focus, Tversky provided empirical evidence in a variety of domains for systematic violations of the simmetry axiom: for example, he found that in direct rating tasks, the judged similarity of North Korea to China exceeded the judged similarity of China to North Korea; consistent results were obtained also from identification confusion data, showing that an object i may be confused with an object j more than j is confused with i. Tversky also proposed an alternative, non-geometric approach to similarity, describing similarity judgments as feature matching processes: in what he calls contrast model, two objects i and j are seen as set of features, respectively I and J; the similarity between i and j is a function depending *positively* on their common features, $(I \cap J)$, and *negatively* on the features distinctive to i, $(I - J)$, and on the features distinctive to j, $(J - I)$. Therefore, overall similarity increases with the quantity of common features and decreases with the quantity of distinctive features. Through manipulation of the weighting factors assigned to the measure function of the three complementary feature sets $(I \cap J)$, $(I - J)$,$(J - I)$, which represent their relative importance with respect to the similarity judgment, one can explain and predict asymmetries in similarity judgments.

According to Tversky (1977), the direction of asymmetries appears to be determined by salience, intensity, frequency, familiarity, goodness in form, and informational content, depending on the investigated domains. Objects less loaded on these factors are often judged as being more similar to objects more loaded than vice versa. Such a view is strongly consistent with another approach in psychological literature, of geometric nature, resumed by Nosofsky (1991): asymmetric proximities (the term Nosofsky uses to define the variously elicited similarities) may reflect properties of individual items. In particular, they may often be characterized in terms of *stimulus bias*, that is, a characteristic pertaining to an individual object[1]. In this way, one can interpret asymmetric proximity as a resultant of symmetric similarity together with differential bias. Nosofsky (1991) reviews a model proposed by Holman (1979) he refers to as the *additive similarity and bias model*. In this model, the proximity of stimulus i to stimulus j, $p(i, j)$, is given by

$$p(i,j) = F\left[x(i,j) + r(i) + c(j)\right] \tag{4}$$

where F is an increasing function, $x(i, j)$ is a symmetric similarity function, and r and c are bias functions on the individual objects. As Nosofsky points out, a number of other models for dealing with asymmetric proximity data, e.g. Tversky's (1977) contrast model and Krumhansl's (1978)

[1]Nosofsky (1991) provided also cases where asymmetry cannot be characterized in terms of stimulus bias.

distance-density model, can be reformulated as special cases of the additive similarity and bias model. According to this approach, by assuming that violations in the metric distance axioms occur because of response bias, one can retain the assumption that similarity and psychological distance are inversely related, thereby not losing the explanatory power of intuitive geometric structures. Johannesson (2000) proposed another special case of this bias-augmented geometric approach, called the Relative Prominence Model (RPM). In this model, the proximity of stimulus i to stimulus j, $p(i,j)$, is given by

$$p(i,j) = s(i,j) \cdot (j_p / i_p) \tag{5}$$

where $s(i,j)$ is a symmetric similarity function, and j_p and i_p are biases of j and i. Indeed, RPM is a special case of the additive similarity and bias model, as after loglinearization Eq. (5) can be rearranged in this form:

$$p(i,j) = \exp\left[\log\left[s(i,j)\right] - \log\left[i_p\right] + \log\left[j_p\right]\right] \tag{6}$$

This is a special case of Eq. (4) in which $F(t) = exp(t)$, $x(i,j) = \log\left[s(i,j)\right]$, $r(i) = -\log\left[i_p\right]$, and $c(j) = \log\left[j_p\right]$. In RPM, biases are called *prominences*: this term generically expresses all the factors mentioned above, that Tversky (1977) identified as determinants of the directionality of asymmetries in proximities. Therefore, RPM augments a traditional geometric model with the notion of relative prominence, in order to descript and predict the evidence that less prominent objects are often experienced as being more similar to more prominent objects than vice versa. To see it, suppose that an object i is more prominent than another object j. According to RPM, the proximity from i to j will be smaller than the proximity from j to i, since the quotient between the prominences is larger when comparing i with j than the other way round. Whereas other bias-based models incorporate two or three parameters, in RPM each object is associated with only one bias parameter (prominence), that affects proximity in both directions. This parsimony seems particular valuable in a marketing domain: as prominences of products and brands can be easily summarized over individuals, the model provides a straightforward criterion to understand and predict asymmetries. A drawback of RPM, that does not predict differences regarding self-similarity of objects, is arguably negligible if one seeks knowledge regarding similarity-based inferences across products and brands in the market. According to Johannesson (2002), as the differences between such instances are likely to be intelligible, the model should work properly in a market setting.

3 Pilot study

3.1 Method and Design

A pilot study was performed in order to verify the existence of asymmetries in proximity judgments regarding brands, products, and services, and to apply the Relative Prominence Model to the elicited data.

Subjects

Subjects were contacted among the author's acquaintances through online instant messaging services. Once a subject accepted to participate in the study, a link to an online questionnaire (hosted by `www.freeonlinesurveys.com`) was immediately sent. A preliminary informal check was done in order to make sure the subjects know the stimuli involved in the questionnaire. A small number of the completed questionnaires were judged unrealiable and not considered in the analysis (see the final discussion). Data presented refer to 60 questionnaires, that were completed by 37 subjects. Subjects received no payment.

Stimuli

Ten sets of stimuli were used in order to test a broad range of different consumer settings. Categories and stimuli were chosen not to provide emblematic examples of asymmetries, as Tversky (1977) and Johnson (1981) did, but to explore more diffusely potentially relevant settings. The proposed perspective is potentially exploitable to understand quite heterogeneous marketing phenomena. Accordingly, the span of the pilot study in terms of settings is wide: tested categories include generic services (information), competing brands (jeans), product portfolios (Apple Mac line), and tourist destinations (Tuscan cities). Each questionnaire admittedly dealt with one specific set of stimuli, which was composed by five instances. These were arbitrarily chosen by the author among the representatives of the categories, in order to increase the likelihood of subjects' acquaintance with the stimuli. Data were collected so that respondents to the questionnaires refer-

Table 1: Stimuli

Set	Stimuli
Electric guitars	Fender, BC Rich, Jackson, Squier, ESP
Apple products (1)	iPod Nano, iPod Touch, iPod Classic, iPod Shuffle, iPhone
Apple products (2)	MacBook, iMac, MacBook Pro, Mac Mini, MacBook Air
Tourist Facilities	Hotel, Holiday Camp, Hostel, Apartment, Camping
Theme Parks	Gardaland, Mirabilandia, Universal, Disneyland, Aqualandia
Jeans	Lee, Armani Jeans, Levi's, Wrangler, Diesel
Political TV shows	Matrix, Otto e Mezzo, Porta a Porta, Ballarò, Annozero
Tuscan Cities	Firenze, Livorno, Viareggio, Forte dei Marmi, Pisa
Information	Radio news, TV news, Online News, Newspaper, Teletext
Communication	E-mail, SMS, MMS, Paper Mail, Instant Messaging

ring to each stimulus set were in a number comparable to Johannesson (2000). Table 1 reports all the stimuli used in the study.

Procedure

For each of the 20 pairs of stimuli $\{(i,j) \mid i \neq j\}$, that was presented in a separate HTML page, the subject was asked to rate how similar the left stimulus i was to the right j on a 20-graded scale (Tversky, 1977; Johannesson, 2000). Pairs of stimuli were presented in a randomised order such that symmetric ones (i,j) and (j,i) were at least 9 pairs distant one from each other.

3.2 Results

3.2.1 Existence of asymmetries in proximity judgments

There were no a priori hypotheses concerning specific asymmetries to be observed. It is here regarded as erroneous to use global indicators such as market results (Johnson, 1981) as criteria for predictions on consumers' perceptions. Especially in a consumer setting, the loadings of the determinants of asymmetry (e.g. frequency or familiarity) are strongly subject-dependent; in other words, with respect to one object, there exists one different prominence for every subject. Despite the likelihood of some constant trends, which represent peculiar cases, there is no valid reason to predict any consistent uni-directional asymmetry across subjects. Thus, in order to test the mere existence of asymmetries, for every provided pair of proximity judgments (i,j) and (j,i),

Table 2: Average Asymmetry Within Stimulus Sets

Stimulus Set	n	Mean t	S.D.	t	Significance
Electric guitars	6	2.33	0.71	6.80	p<.001
Apple products (1)	6	1.73	0.22	4.61	p<.001
Apple products (2)	5	2.21	0.31	5.70	p<.001
Tourist Facilities	8	3.17	0.50	9.27	p<.001
Theme Parks	6	2.56	0.88	7.18	p<.001
Jeans	6	2.33	0.71	6.80	p<.001
Political TV shows	5	2.47	0.51	7.09	p<.001
Tuscan Cities	5	2.07	0.20	6.16	p<.001
Information	6	3.25	3.42	8.00	p<.001
Communication	7	3.08	1.14	8.65	p<.001

asymmetry was calculated as the difference between the two 1-20 ratings, in absolute value. No matter the sign of the difference, as stimulus *i* was judged differently similar to *j* than vice versa, this was regarded as evidence of the existence of asymmetries in proximity judgments. Estimation of prominences through RPM will later provide an interpretation of the results[2].

Evidence of significant asymmetries in proximity judgments was found in all stimulus sets: several pairs of stimuli were often judged as differently similar one to each other. For example, in jeans category, judged similarity of Diesel to Levi's was significantly different than vice versa (t=4.18, p<.05). Among communication services, judged similarity of paper mail to e-mail was significantly different from the judged similarity of e-mail to paper mail (t=4.51, p<.005). A summary of overall results by stimulus set is presented in Table 2. Column 2 presents the number of subjects who responded to the each questionnaire. Column 3 and 4 present the average t-value for which asymmetry was predicted in each set (10 comparisons of pairs were made in each stimulus set), and their standard deviation respectively. Column 5 and 6 present the summary t-values for each stimulus set, and their significance respectively. The results support in the consumer setting the generality of Tversky's (1977) remark that similarity should not be treated as a symmetric relation.

In some cases, the direction of asymmetry in similarity judgments was consistent across subjects: among theme parks, for example, Universal Studios were judged more similar to Disneyland than Disneyland was judged to Universal Studios (t=2.15, p<.05). Among Apple products, the similarity of iPod Nano to iPod Classic was significantly greater than the similarity of iPod Classic

[2] All programming and statistical analyses were made using R, an open-source environment for statistical computing available at http://www.r-project.org/.

Table 3: Significant Uni-directional Asymmetries

Stimulus set	Stimulus *i*	Stimulus *j*	t	Significance
Communication	SMS	Instant Messaging	2.91	p<.05
	Instant Messaging	MMS	2.17	p<.05
	Paper mail	MMS	1.87	p<.10
Jeans	Diesel	Wrangler	1.52	p<.10
	Wrangler	Lee	1.60	p<.10
Theme Parks	Universal Studios	Disneyland	2.15	p<.05
	Universal Studios	Gardaland	1.66	p<.10
Information	Teletext	Radio News	1.75	p<.10
	Teletext	Online News	1.69	p<.10
Apple products (1)	iPod Nano	iPod Classic	1.58	p<.10
	iPod Touch	iPod Classic	1.58	p<.10
Apple products (2)	Mac Mini	MacBook	1.69	p<.10
	MacBook Pro	iMac	1.69	p<.10
Electric Guitars	ESP	Fender	1.58	p<.10
Tuscan cities	Livorno	Lucca	1.87	p<.10
	Forte dei Marmi	Livorno	1.73	p<.10
Tourist Facilities	Hostel	Holiday Camp	3.33	p<.01
	Holiday Camp	Hotel	2.61	p<.05
	Apartment	Camping	1.87	p<.10

to iPod Nano (t=1.58, p<.10). Table 3 presents by stimulus set all the uni-directional significant asymmetries consistent across subjects. Stimuli in Column 2 were judged significantly more similar to stimuli in Column 3 than viceversa. Column 4 and 5 present the t-values for which such asymmetries were predicted, and their significance respectively. Political TV shows stimulus set presented no significant uni-directional asymmetries in proximities. Differently from other tests of asymmetry (e.g. Tversky, 1977; Tversky and Gati, 1978), that employed a between-subject design, in the reported pilot study stimulus pairs (i, j) and (j, i) were collected within subjects. Moreover, the reported significant results were achieved with a small number of respondents for every stimulus set. These peculiarities induce to regard the results as promising.

3.2.2 Description of asymmetries through the Relative Prominence Model

Data were arranged in individual proximity square matrices, in which the rows correspond to the object i in the pair (i, j) and the columns to the object j. RPM was then applied to each of the matrices. The RPM parameter (prominence) was estimated using iterative procedures reported in

Johannesson (2000). These procedures operate directly upon elicited proximities rather than on distances in a spatial representation, meaning that no specific assumptions regarding the relationship similarity - distance need to be made (Johannesson, 2000). The iterative procedures try to minimise the global squared relative error (GSRE), that is $(i \neq j)$:

$$GSRE = \sum_{i,j} \left(\frac{p(i,j) - \tilde{p}(i,j)}{p(i,j)} \right)^2 \tag{7}$$

where $p(i,j)$ is the observed proximity from i to j, and $\tilde{p}(i,j)$ is the predicted proximity from i to j. By using the observed value in the denominator, a given difference between an observed and predicted value is weighted more for a small observed value compared to a high; by raising the expression to the power of two, the error will be more distributed over the whole matrix. As in Johannesson (2000), the overall procedure was repeated 100 times for every single matrix, using different random initializations of the prominence parameters in order to lessen problems with local minima. The fit of the model on each of the matrices was evaluated by means of the average relative error $\overline{RE}$ (Johannesson, 2000), which is given by

$$\overline{RE} = \frac{GSRE}{N} \tag{8}$$

where N is the number of off diagonal cells (20 for all datasets). Table 4 presents the overall results of RPM by stimulus set: for all matrices in each set, Column 2 and 3 report the average of $\overline{RE}$ (over 100 runs), and their standard deviation. Column 4 and 5 report the average lowest $\overline{RE}$, and their standard deviation. Generally speaking, these results are in line with those presented in Johannesson (2002), and RPM seems particularly suitable for describing asymmetric similarities in Apple products, electric guitars, and information services; however, as hinted by the high standard deviations in all stimulus sets, results are strongly variable. That means, according to the obtained data RPM seems differently effective in describing and predicting asymmetric consumer similarity judgments from subject to subject. This argument, together with the above mentioned subject-dependency of asymmetric judgments, advocates the analysis of RPM results at the subject-level. Moreover, the goal of the present paper is different from those of Johannesson (2000; 2002), who compared the power of different bias-based models to handle experimental data. Whereas his work

Table 4: Average model errors by stimulus set

Stimulus Set	Average error	S.D.	Lowest error	S.D.
Electric guitars	0.0222	0.0177	0.0215	0.0164
Apple products (1)	0.0200	0.0109	0.0199	0.0109
Apple products (2)	0.0182	0.0251	0.0175	0.0235
Tourist Facilities	0.0506	0.0449	0.0485	0.0416
Theme Parks	0.0641	0.0390	0.0605	0.0342
Jeans	0.0599	0.0279	0.0576	0.0262
Political TV shows	0.0425	0.0379	0.0419	0.0374
Tuscan Cities	0.0444	0.0370	0.0427	0.0353
Information	0.0296	0.0174	0.0293	0.0171
Communication	0.0573	0.0491	0.0527	0.0408

Table 5: Promincences for Jeans stimulus set

Brand	1	2	3	4	5	6	Avg. 1-6	S.D.
Levi's	.853	.575	.818	.873	.882	.829	.805	.115
Armani Jeans	.840	1.000	.724	.740	.875	.703	.814	.114
Lee	1.000	.777	1.000	1.000	1.000	.757	.922	.120
Wrangler	.804	.781	.693	.992	.782	1.000	.842	.125
Diesel	.730	.739	.764	.816	.831	.714	.766	.048
Lowest err.	.042	.072	.077	.091	.026	.037	.058	.026
Avg. err.	.042	.079	.081	.094	.026	.037	.060	.028

was focused on assessment of relative errors of the models rather than interpretation of estimated parameters, since the concept of prominence is arguably rich in meaning and potentially exploitable in a marketing perspective, in the present paper it is useful to have a closer look at its role in determining elicited asymmetries.

For every subject who judged similarities between stimuli in the Jeans set, Table 5 presents the five objects' prominences, as determined by the iterative procedures. Prominences reported are those determined in the runs with the lowest error, which is presented together with the average error for every subject. As in Johannesson (2000; 2002), it is not assumed that the absolute quantifications of prominences are meaningful, but it is assumed that quantification of relative prominences is. In every individual proximity matrix, the algorithm divided the prominences fitted by the iterative procedures by the highest one. That means, for every subject in each stimulus set, there is (at least) one object with prominence 1.000. According to RPM, a positive difference between proximities of i to j and j to i should be explained by a greater prominence of j with respect to i. This is

Table 6: Prominences for Apple products (1) stimulus set

Product	1	2	3	4	5	6	Avg. 1-6	S.D.
iPod Classic	.860	.932	.992	.930	.954	.921	.931	.044
iPod Touch	.867	.850	.969	.733	.916	.917	.875	.082
iPod Nano	.934	1.000	1.000	1.000	.910	1.000	.974	.041
iPhone	1.000	.919	.965	.854	.993	.921	.942	.055
iPod Shuffle	.817	.861	.909	.903	1.000	.827	.886	.067
Lowest err.	.028	.029	.021	.028	.006	.007	.020	.011
Avg. err.	.029	.030	.021	.028	.006	.007	.020	.011

the case for many evident asymmetric judgments. For example, both subject 1 and 5 rated Wrangler substantially more similar to Lee than vice versa (respectively 16 vs. 6 and 13 vs. 5), and fitted prominences are consistent with their judgments (subject 1: $prom_{Lee}$=1.000, $prom_{Wrangler}$= .804; subject 5: $prom_{Lee}$=1.000, $prom_{Wrangler}$= .728). Subject 2 judged Levi's ($prom_{Levi's}$= .575) far more similar to Armani Jeans ($prom_{AJ}$= 1.000) than vice versa (15 vs. 1). However, prominences do not fit logically in every pair of judgments: for example, subject 1 rated Levi's more similar to Wrangler than the other way round (18 vs. 10), but relative prominences are not consistent with such judgments ($prom_{Levi's}$= .853; $prom_{Wrangler}$= .804).

Prominences determined for Apple products (1) stimulus set (see Table 6) confirm such results. At the subject level, prominences of Apple products (1) are much less variable, which is consistent with the fact that this stimulus set had the lowest average asymmetry (see Table 2). Fitted parameters generally apply well to observed asymmetric proximities: for example, subject 2 rated iPod Shuffle ($prom_{Shuffle}$= .861) more similar to iPod Nano ($prom_{Nano}$= 1.000) than vice versa (15 vs. 6), and so did subject 6 (13 vs. 7; $prom_{Shuffle}$= .827; $prom_{Nano}$= 1.000). However, also in this set like in others, there exist sporadic controversial situations: looking at prominences for subject 1, one could expect at least some degree of asymmetry between the two similarity ratings involving iPod Classic ($prom_{Classic}$= .860) and iPhone ($prom_{iPhone}$= 1.000), but this is not the case (16 vs. 16). The final section will provide some possible explanations of RPM errors, mostly pertaining to the data collection stage. Generally speaking, however, the fitted parameters of the model provide a satisfying explanations of the observed proximities at the subject level. That is, the results support objects' prominences as having predictable directional effects on consumer similarity judgments.

As there were no hypotheses concerning specific asymmetries to be observed, analogously prominences were likely to differ between subjects. Products and services, being branded or not, are differently loaded on factors like familiarity or frequence from individual to individual, and so are prominences, which are proposed to be the general account for such determinants. However, in Table 5 and Table 6 there are some observable general patterns. Among jeans brands, Lee is the most prominent brand for four subjects out of six, while Diesel's relative prominence is often low; this rough observation is consistent with the two significant uni-directional asymmetries observed in the stimulus set, and reported in Table 4. Among Apple products (1), iPod Nano is on average the most prominent, but there is a low variability of prominences also at the stimulus set level. Prominences in Apple products (2) set, not reported in the present draft, show low variability as well, both at subject and at set level. Discussion provides possible explanations for this peculiarity.

4 Discussion and implications

The present paper addressed the issue of asymmetry in consumer similarity judgments. Asymmetry was documented in a variety of consumer settings, supporting Tversky's (1977) conclusion that similarity should not be treated as a symmetric relation. For researchers in consumer behavior and decision-making, to agree on such a statement is quite committing: the concept of similarity is recognized as central in many issues, but it is usually considered as a symmetric relation. For example, almost every study in the research stream on brand extensions (e.g. Aaker and Keller, 1990; Boush and Loken, 1991) has considered "fit" between parent brand and extension brand; but neither in recent times (Hansen and Hem, 2004; Zhang and Sood, 2002) directionality has entered the core of the discourse (for one exception see Boush, 1997), as these and other reported results in cognitive psychology literature would suggest. Actually, similarity *could* be treated as a symmetric relation, if potential violations of the symmetry axiom are reasonably negligible for the issues investigated; but in general, one needs a principle to handle asymmetries.

In this paper, Relative Prominence Model (Johannesson, 2000) was presented as a one-parameter special case of stimulus bias model (Nosofsky, 1991), which interprets asymmetric proximity as resultant of symmetric similarity together with differential bias. It is here argued that RPM can serve as a simple and parsimonious tool to interpret straightforwardly a number of similarity-related marketing phenomena. According to RPM, proximity judgments between objects are influenced by their relative prominences, such that the less prominent object is perceived as more similar to the more prominent object than the other way round. In this paper, RPM was applied to the obtained data in order to describe asymmetries in proximity judgments: differences in elicited proximities, e.g., between Lee and Diesel and vice versa, were explained by means of different prominences of stimuli among respondents.

At the present status, RPM is a model of description and prediction: no guidance is provided regarding the factors that make an object "prominent" in an individual's mind. Understanding *what prominence is*, i.e., what gives rise to asymmetries in similarity judgments, is a fundamental research issue, at least in a marketing perspective: if prominence, as will be shown, could act as predictor of several stylized facts that involve directionality, marketers should be provided with robust criteria to assess it. A roadmap to determine the nature of prominence may be to interpret it as an array of psychological factors, consistently with Johannesson (2002) and Tversky's (1977) first use of the term prominence, and to test the relative power of selected marketing constructs to unfold its essence. Some potential antecedents of prominence are discussed together with RPM marketing implications.

According to associative network theory (Collins and Loftus, 1975; Anderson, 1983), objects in memory are represented by nodes, connected by links that vary in strenght. In marketing literature, the most notable application of this theory is Keller's (1993) conceptualization of brand knowledge: in consumers' memory, a brand is a node to which a number of associations, ranging from to product-related attributes to symbolic benefits, are linked with different strenght. Such a view reminds Tversky's (1977) conception of objects as sets of features that vary in salience. Recently, Lei et al. (2008) compared the power of the two approaches in describing spillover effects among products in brand portfolios. As the predictions of associative network theory and of a "similarity-based model" on a phenomenon involving asymmetric externalities were partially consistent, looking at the former for possible insights regarding the concept of prominence may be useful. Associative network theory provides two possible suggestions regarding the nature of prominence of an object (node): first, it could be related to "strenght of the node or trace in memory" (Keller, 1993, pp. 3), that in a branding context gives rise to individuals' *awareness* of the brand. More convincingly, prominence could depend on the number and strenght of links of the node with other nodes, which in turn determine its *image*. Reasonably, as an object is strongly linked with many features, it should be more prominent in a subject's mind than an object with a few weak associations. This parallelism between *image* and prominence is consistent with the comparison in Lei et al. (2008), but also the construct of *awareness* could be involved in explaining the degree of prominence of an object. In general, relating prominence to associative network theory suggests prominence could represent an articulated measure of "settlement in memory".

Similarity has been described as the main basis individuals use to draw inferences from one object to another. Accepting it is not a symmetric relation suggests that *proximity*, in the sense used in the present paper and in related psychological literature, represents a better construct to use instead of similarity. Consider a brand extension context, which has been reported to be a classic field for consumer research on inferences (Loken et al., 2007). As fit between parent brand and extension brand enhances the transfer of properties from the former to the latter, prominence can be interpreted in two specular ways. First, prominence acts as propeller of active inferences: given a degree of similarity from two objects, the more prominent is the parent brand, the more proximal will be the extension to the parent brand. That means, the greater the extent in which transfer of properties will happen. Second, prominence acts as inhibitor of passive inferences: if the extension product category is prominent in the mind of the consumer, on average he will be less prone to make inferences towards it from the parent brand. If one substitutes prominence with *knowledge*, this argument is strongly consistent with several findings in consumer research literature, which generally predicts that expert consumers are less inclined to be influenced by contextual variables (e.g. Bettman and Sujan, 1987; Hutchinson, 1983; Lynch Jr et al., 1991), such as the parent brand name. A knowledgeable individual does not need to form a judgment in a context given, as he can retrieve from memory a previously formed one (Strack and Martin, 1987; Wanke et al., 1998). As a consequence, the flow of inferences (from the parent brand to the extension product) may result inhibited. In a related study, Hansen and Hem (2004) studied how some features of the relationship between consumers and the extension category influence acceptance of the brand extension. Their findings refer to purchase actions and are hardly comparable, nevertheless are generally supportive of RPM insights. Moreover, the construct of *familiarity*, which is connected with knowledge, is one of the psychological factors Tversky (1977) indicated as determinant of asymmetries. Hansen and Hem (2004) found that affective *commitment* to a brand in the extension category negatively influence the consumer's receptivity to a newly introduced product. This insight suggests that "hot" other than "cold" aspects of cognition (Simonson et al., 2001), such as affect, conflict and other emotions may be connected to prominence. Such a large scope of antecedents of prominence could imply that this property is potentially far from stable in brands. Marketing managers should carefully monitor fluctuations of brand prominence, because also its temporary determinations could have important effects. For instance, a scandal within the product category could spill over or not into the brand according to its temporary prominence, i.e. its momentary power to inhibit passive inferences.

Results of the pilot study show that Apple product lines are "more symmetric" than the other stimuli sets, and prominences consistently present a lower variability. Two possibile explanations are suggested for this preliminary result. The first resides on the commonality between the two stimulus sets, which are both product portfolios (the Apple Mac line and the Apple iPod line, "stretched" to comprehend iPhone). It could be the case that the brand acts as inhibitor of asymmetries, making similarity perceptions between products more symmetric. Though such a view would contradict previous results about spillovers in product lines (Lei et al., 2008), further research should address this issue, and eventually generalise the finding to certain product portfolios. The second potential explanation partially goes back to data gathering. Proximity judgments on Apple products (1) and (2) were provided by the same subjects (the former stimulus set had one respondent more), who were asked to answer the questionnaires because of their familiarity with the brand Apple. More than subjects who completed questionnaires concerning other stimulus sets, these respondents had the characteristic of being "expert" about the stimulus set. Thus, low variability of prominences may depend on subjects' features. Though effects of individuals' familiarity with stimulus sets on similarity/dissimilarity judgments have been explored (e.g. Tversky and Gati, 1978; Block and Johnson, 1995; Dubé and Schmitt, 1999), the issue of asymmetry has been left aside by such studies. The present results suggest that familiarity, other than influencing the direction of asymmetries in similarity between objects, could have an "absolute" inhibitive effect. That is, when a stimulus set is familiar to the subject, occurrence of asymmetries in similarity judgments may be limited. Both the proposed explanations should be investigated by future research, as they could provide useful insights for marketers.

Limitations of the pilot study are acknowledged. First, the procedure induced some subjects to simplify their rating task by polarising their similarity judgments on certain values. Five questionnaires were discretionally invalidated by the author because of the strenght of this phenomenon. Second, the stimuli may have been susceptible to contextual effects. For example, the attention paid by the subjects to certain dimensions may have differed with the pair of stimuli under consideration (Johannesson, 2002). This could account for reported controversial results in estimation of prominences at the subject level. Third, respondents were discretionally chosen by the author, in order that they could provide sensible similarity judgments about the stimuli. RPM represents a promising tool for virtually any consumer research area related to similarity. Brand dilution and enhancement, spillover effects in brand portfolios, externalities between competing brands are examples of research streams that could benefit from considering RPM as additional instrument, and consequently provide practitioners with invigorated guidelines.

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