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Title: Brand Recognition and Quality Inferences

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Brand Recognition and Quality Inferences
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Discussion paper

Abstract

Could brands associated with mostly negative information–those with poor reputations–be perceived as superior to unrecognized brands? A reasonable consumer should value reputation; however, it is also sensible to put a heavy weight on brand recognition. To investigate this question, the authors study consumers' inferences about brand quality for products in three domains. Results suggest that brands associated with predominantly negative information are indeed perceived as of higher quality than unrecognized brands. In addition, when consumer inferences are predicted based on different memory cues, the frequency of encountering a brand dominates what people profess to know about it. The authors explore the ecological rationality of this strategy by studying the environmental relationship between expert-judged quality and consumer knowledge.

Keywords: inferences from memory, perceived brand quality, recognition, knowledge valence

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Is the devil you know better than the devil you don't? The marketing literature has demonstrated an adverse effect of negative publicity on product and brand evaluation, arguing against the lay belief that "all publicity is good publicity." For example, Tybout, Calder, and Sternthal (1981) showed that evaluations of McDonald's restaurants were less positive when study participants were exposed to negative rumours about the brand. As one might expect, econometric analyses show that critical reviews have negative effects on box office revenue or book sales (Basuroy, Chatterjee, and Ravid 2003; Chevalier and Mayzlin 2006). However, recent findings introduce the possibility that negative publicity may have different effects on known and unknown brands. Berger and colleagues showed that negative publicity about a product may increase purchase likelihood and sales of unknown products by increasing their awareness, perhaps because consumers remember they heard something about these products, but forget the valence of the information (Berger, Sorensen, and Rasmussen 2010; Skurnik et al. 2005).

But what if people remember that the publicity was bad–could negative brand knowledge still be beneficial?

We address this question by looking at consumer inferences about the quality of actual products, randomly sampled from three categories. A few aspects of our research distinguish it from previous studies on the effect of information valence.

Building on research studying the effect of information valence on product sales (Basuroy et al. 2003; Berger et al. 2010; Chevalier and Mayzlin 2006; Duan, Gu, and Whinston 2008; Liu 2006) or stock prices (Luo 2007), we explore the effect of information valence on people's inferences about brand quality and brand awareness, which are important consumer-based measures of brand equity (Agarwal and Rao 1996; Keller, 1993; Keller and Lehmann 2006).

We stress the importance of knowledge in memory to consumer decision making. Some 20 years after a gulf in the decision making literature was first recognized (Alba, Hutchinson, and Lynch, 1991), there is still little overlap of the consumer behaviour literature with mainstream memory research in judgment and decision making. Much of existing work on consumer decision making is focused on "information grid" studies, in which all relevant brand and attribute information is present before the participant when decision is made. In many real world decisions, however, some or all of the relevant information may not be present (Lynch and Srull 1982). Even when information on all the alternatives is available, people may not use it due to the lack of time and motivation or due to differing accessibility in memory (Bettman and Park 1980; Dickson and Sawyer 1990; Fazio, Powell, and Williams 1989; Hoyer 1984; Johnson and Russo 1984; Simon 1955). In such settings, information in memory influences the way the product information is processed or, if no product information is obtainable, serves as a sole input for consumers' decisions.

Another distinction that sets the present work apart is its focus on *inferences* as opposed to *preferences*, which have been thoroughly studied (e.g., Bettman and Park 1980; Hoyer and Brown 1990). Even though inferences are one of the potential predictors of preferences, these two constructs have distinct influences: consumers can infer that Brand A is of higher quality than Brand B, but show preference for the lower-quality brand because of other criteria, for example, higher affordability of Brand B.

Alternatively, consumers' choice may be affected by their overall attitude towards a brand rather than its perceived quality. Research on *attitudes*, an important aspect of brand knowledge, represents "summary judgments and overall evaluations to any brand-related information" (Keller 2003), including non-product-related attributes and symbolic benefits. Our investigation, however, focuses on specific aspects of product quality,

whereby eliminating the effect of non-product related associations, along with connected constructs such as liking (Ahluwalia, Burnkrant, and Unnava 2000; Zajonc 1968; Zajonc and Rajecki 1969). So, the third specific aspect of this research is its focus on *perceived quality* rather than *overall attitude* towards brands.

Thus, we investigate what people think about brand quality based on what they know about the brands, as opposed to what brands consumers prefer or how they like them. Our larger question is which brands do consumers infer to be of higher quality: the brands associated with mostly negative quality information, or the ones they have never seen or heard of before? As it will be explained, our prediction is that brands associated with mostly negative information will tend to be perceived as superior to unrecognized brands. We test this hypothesis for inferences about individual brands as well as for inferences about brands in paired comparisons.

H1a: Ranking: When making quality inferences about individual brands, consumers infer that recognized brands associated with mostly negative information are of higher quality than unrecognized brands.

H1b: Paired comparison: When making quality inferences about pairs of brands, in which one brand is recognized and the other is not, consumers infer that the recognized brands associated with mostly negative information are of higher quality than the unrecognized brands.

We base these hypotheses on the idea that simple cues can substitute for more complex pieces of information without a considerable decrease in inferential accuracy, because brand information in the environment and inferential cues are often strongly correlated in natural settings (Goldstein and Gigerenzer 2002; Steenkamp 1990). For example, if higher-quality vacuum cleaner brands are associated with a fair number of

both positive and negative facts about brand quality, then consumers may learn that the valence of their knowledge is often not informative for inferring quality. At the same time, if they observe that more commonly mentioned brands tend to be of higher quality, they may learn that perceived environmental frequency, which is a pre-requisite for the more complex memory information represented by knowledge valence, may be a robust single predictor of brand quality.

> **H2:** When memory cues are used to make predictions about people's quality inferences in paired comparisons, models including knowledge valence in addition to other cues are not more accurate than models including only simpler cues, such as recognition and perceived environmental frequency.

In pursuit of externally valid and robust findings, we investigate these links in three domains: refrigerators, vacuum cleaners, and business schools. In our studies, three randomly ordered tasks were performed by each participant. In one of the tasks, participants were asked about the information in their memory for each brand. In the second task, perceived brand quality was elicited: participants guessed the most probable rank a brand could have according to a published quality ranking, such as Consumer Reports or U.S. News and World Report. Finally, they made inferences about quality for pairs of brands in a two-alternative forced choice task. To explore the relationship between volume of the information in the environment and the quality of the object, we used the frequency of citations on various Internet sources for the brands and quality ratings from Consumer Reports or U.S. News and World Report.

We conducted two lab studies, collected field data, and used formal mathematical models to test the hypotheses. First, we will describe the methodology for the lab studies and discuss results relevant to hypotheses 1a and 1b. This will be followed by the section

describing the models and discussing findings related to hypothesis 2. Finally, we will present the results of field data analysis before discussing them in the concluding section.

Study 1

Method

Respondents. One hundred and sixteen participants from the London Business School Behavioural Lab panel took part in the study. To ensure that there were no major differences in the exposure to the stimuli (US universities) through media and other sources, we only drew upon participants who could not have spent more than 6 months in the United States. UK residents served as participants to increase the likelihood that the typical participant would recognize only some of the (US-based) stimuli. All participants were paid 12 British pounds ($19USD) for participating.

Material. The domain under investigation is a set of global business schools, taken from the US News and World Report rankings. To be included in the study, business school names could not include: a US state name (i.e. University of Pennsylvania); a large US city name (i.e. New York University); or contain the word "state" (St. Cloud State University). Universities that had a state or large city name included in their names were omitted because the respondents might recognize the state or the city, but not the university, and mistakenly respond that they recognized the business school (Aribarg, Pieters, and Wedel, 2010). Alternatively, the name of the state or the city might influence the perception about the schools' quality. Universities that had the word "state" included in their names were eliminated because people might perceive the quality of state (University of X) and non-state universities (X State University)

differently. These assumptions are based on the findings that people evaluate unrecognized brand names differently depending on the words in the name (Wänke, Herrmann, and Schaffner 2007). Applied to the domain under investigation, the results of that study suggest that the name "Baylor University", for example, may not really tell anything other than it is unrecognized. However, the "Baylor Community College of Jackson, Mississippi", even if unrecognized, may convey some information about its quality: people may think that community colleges are of different quality than universities, or that Mississippi schools are of different quality than schools outside the state.

Table 1. List of brands and quality scores in the business school domain

Rank	Business schools	Score (US News and World Report)
1	Harvard University	100
2	Stanford University	100
3	Dartmouth College (Tuck)	89
4	Columbia University	88
5	Yale University	80
6	Duke University (Fuqua)	79
7	Cornell University (Johnson)	79
8	Carnegie Mellon University (Tepper)	77
9	Georgetown University (McDonough)	69
10	Emory University (Goizueta)	68
11	Brigham Young University (Marriott)	64
12	Purdue University (Krannert)	63
13	University of Notre Dame (Mendoza)	61
14	Vanderbilt University (Owen)	58
15	Rice University (Jones)	57
16	Babson College (Olin)	55
17	Tulane University (Freeman)	51
18	Temple University (Fox)	49
19	Wake Forest University (Babcock)	48
20	College of William and Mary (Mason)	46

The final list included the top twenty schools (according to the published ranking) that fit these criteria (see Table 1). When the names of the schools were shown to

participants, they were presented in the following way: the full name of the university and the name of the business school in parenthesis, for example, Dartmouth College (Tuck). If the university name is the only name the business school has, only the university name was presented. Participants were advised that the questions in the study concerned US schools only.

Procedure. Each participant answered three randomly ordered sets of questions (henceforth, Question Sets 1, 2 and 3). Before starting each task, the participants were instructed on how to respond to each question and answered several questions that served as a comprehension check. If participants answered any of the questions incorrectly, they were redirected to the instructions and answered the test questions again. After three unsuccessful attempts to answer the questions, the study was paused and the participants had to call a research assistant to continue. In that case, the research assistant clarified the task and ensured the participant understood it.

The goal of the Question Set 1 was to gauge respondents' memory for the stimuli. Participants were asked several questions about each brand: whether or not they had seen or heard of the brand before the study (recognition), how frequently they had seen or heard about it (perceived environmental frequency), how much they knew about its quality (perceived knowledge volume), and what proportion of that knowledge suggested that the quality was good (perceived knowledge valence).

During the recognition task, participants indicated whether or not they recognized each of the 20 US business schools. Each school was presented on a new page. The respondents were asked to answer as quickly and accurately as possible by pressing the "Y" and "N" keys. They were told to keep their fingers over these keys during the experiment, instructed on how the questions were asked, and given several training questions about US cities, before proceeding to the actual recognition task on the US

business schools. The stimuli were presented in the following manner. The question "Do you recognize the following US business school?" was presented for 3000 ms, followed by a fixation point (a cross in the center of the screen) that stayed on the screen for 1000 ms. After the cross disappeared, the screen stayed blank for 1000 ms, after which a school name appeared on the place where the fixation point was. The school name remained on the screen until a response was given. The time that elapsed between the point the school appeared on the screen and the point the participant pressed the keys was recorded. To avoid differential response to the first item presented, participants first answered a question about a US business school that was not included in the analysis, and then about the 20 US business schools from the aforementioned list. The order in which the 20 schools were presented was randomized.

Subsequently, participants indicated how familiar they were with each school. They were asked to think how frequently they had seen or heard of each of the 20 schools when answering this question. To answer the question, they used a slider with "Not familiar at all" and "Very familiar" on its ends, which was coded on a scale of 1 to 50, though these values were not shown to the participants. The slider was programmed to avoid anchoring the respondents to the starting point of the slider handle. Each time a new slider appeared on the screen, it lacked a handle. The handle only appeared once the participant moved the mouse pointer over the slider bar. The order in which the 20 schools were presented was randomized for each participant.

During the last two tasks of Question Set 1, participants used the same type of sliders to answer questions about their knowledge regarding each of the 20 schools. The first question was: "How much do you know about the academic quality of the following US business school?" The responses were measured using 1 to 50 scale, corresponding to "I know little about it" and "I know a lot about it", respectively. The second question,

presented on a new page, was "Of what you know about the academic quality of the following US business school, how much suggests that it is good or bad?" This was coded on a -25 to 25 scale, corresponding to "0% good, 100% bad" and "100% good, 0% bad", respectively. Again, in case of both questions, the corresponding values remained invisible to the participants. The questions were presented separately, one per screen for each of the 20 schools, and appeared in a random order for each participant. To prevent confusion, the slider for the knowledge amount question was vertical, and the one for proportions of bad and good knowledge was horizontal. The participants could indicate that they knew nothing about the school by clicking on a separate "I know nothing about it" button for both questions.

The aim of the Question Set 2 was to measure respondents' quality rank estimates. During this task, perceived quality was elicited while participants guessed the most probable rank a school could have according to a published quality ranking. Participants were told that the ranking they were trying to infer was taken from publications that evaluate business schools. Before beginning the estimation task, the participants were presented with the list of all 20 schools, which were presented in alphabetic order on one screen, and asked to estimate the rank of each US business school according to its academic quality. When performing the actual task, they saw one business school at a time. Each time a new school appeared on the screen, respondents were asked "Where would you guess this school might rank?" and reminded that they were supposed to assign 1 for the highest rank, and 20 for the lowest.

Question Set 3 consisted of paired comparisons. During this task, the participants made inferences about relative academic quality for 100 pairs of business schools randomly drawn from a list of all possible pairs of 20 business schools. As before, participants were told that they were trying to infer which school was ranked higher

according to published rankings. For each question, which was worded "Which of the following two US business schools is ranked higher according to its academic quality?", the respondents were asked to indicate their answer by clicking on one of two buttons, corresponding to each school, on the computer screen. The order in which the 100 pairs of schools appeared in the inference task was determined at random for each participant. On average, participants took 37 minutes to complete the experiment.
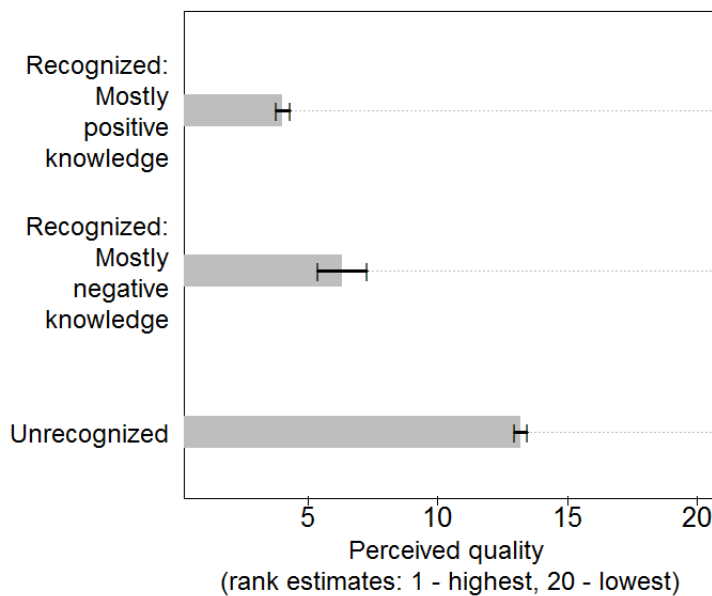
Results and Discussion

Recall that Hypothesis 1a predicted that consumers would rank recognized brands associated with mostly negative information as being of higher quality than unrecognized brands. To test this hypothesis we calculated average quality rank estimates for all unrecognized business schools and all recognized business schools, which individual participants rated as having mostly negative quality in Question Set 1 (the responses to the question capturing perceived knowledge valence were grouped into three categories: *predominantly negative* (RKn–)–"0% good, 100% bad"–"39% good, 61% bad", *predominantly positive* (RKn+) – "61% good, 39% bad"–"100% good, 0% bad", and *neutral* – "40% good, 60% bad"–"60% good, 40% bad"). Any observation with inconsistent responses (for example, a respondent indicated that he/she had knowledge about a particular business school, but his/her other responses indicated that he/she had never seen or heard of that school before) was eliminated from the data set before analyses were conducted.

Our findings show that, in line with past research (Allison and Uhl 1964; Hoyer and Brown 1990; Jacoby, Olson, and Haddock 1971; Goldstein and Gigerenzer 2002), the perceived quality of recognized (R) brands was higher than that of unrecognized (U)

ones. Means of estimated ranks of business schools grouped based on whether they were recognized or not were 5.90 (out of 20) and 12.69, respectively (SE_R = .15, SE_U = .12). A mixed-effect linear model testing the relationship between the estimated ranks, on one side, and recognition as a fixed effect variable and respondents as a random effect variable, on the other side, confirms that estimated ranks for the recognized brands are higher than those for unrecognized ones (β = 7.5, SE = .19, t = 40.29).

Figure 1. Perceived quality for unrecognized business schools and for recognized business schools with different levels of knowledge valence

Furthermore, figure1 demonstrates that the effect of recognition was so strong that even the brands with predominantly poor quality reputation (RKn–) were rated higher (M_{RKn-} = 6.33, SE_{RKn-} = .48) than unrecognized brands. That is, the typical recognized brand associated with poor quality ranked, on average, about 6th out of 20, while unrecognized schools were ranked about 13th out of 20. The results of the afore-mentioned mixed-effect linear model fitted for the subset of the recognized brands

associated with mostly negative knowledge valence and unrecognized brands support hypothesis 1a (1113 responses from 105 respondents, $\beta = 7.16$, SE = .50, t = 14.35).

As would be expected, recognized brands with predominantly positive information were rated higher than the ones with mostly negative information, which is confirmed by the results of an ordered logistic regression analysis: the estimated quality ranks of recognized brands were positively correlated with the proportion of positive information about quality (Spearman $r_s(870) = .59$, $p < .01$; Kendall $\tau(870) = .46$, $p < .01$).

Next, we analysed people's inferences in paired comparisons to test hypothesis 1b, which predicts that, when given a pair of brands, in which one brand is recognized and attributed with predominantly poor quality information and the other is not recognized, consumers infer that the recognized brand is of higher quality. Our results demonstrate that, in most of these cases, participants inferred that the recognized brand was of higher quality: 89% of such pairs for business schools, indicating a strong tendency of people to infer that recognized brands are of higher quality, even when they were attributed with predominantly poor quality information. This result is significantly greater than chance ($\chi^2(1, N = 275) = 99.32$, $p < .01$).

But can these results be generalized for other types of brands or they are specific to business schools? People's choices and beliefs about business schools may be highly influenced by school recognition: consumers may choose business schools not only for their education, but also for the idea that the future employers will recognize their alma mater. In other domains, where advertising is more prevalent and in which brand recognition is less clearly related to quality, it may be the case that consumers attend more to brand reputation. To test for generalization of the results obtained for the business school domain, in study 2, we attempted at replicating the results for two traditional consumer products.

Study 2

 Method

Participants. Two hundred and three people from the panel of regular study participants of the London Business School Behavioural Lab participated in the study. All participants were paid 10 British pounds ($16USD) for participating.

Materials. The brands of consumer goods in the two categories investigated in study 2 were taken from Consumer Reports magazine. A pilot study was run to refine the initial list of brands so that both known and unknown brands of different levels of quality were equally represented. As a measure of quality, we used both overall and attribute scores published by Consumer Report. If the brand had more than one product model scored, the overall scores for the models were averaged to compute the brand score within a particular domain. To calculate the attribute scores, first, all the attribute scores, except price, were added. Then, for the brands that had more than one model scored, these cumulative attribute scores were averaged to compute a brand score within a particular domain. The number of attributes varied across domains. There was a significant positive correlation between the overall and attribute scores (vacuum cleaners: r(8) = .82, *p* < .01; refrigerators: r(10) = .86, *p* < .01).

The final list of consumer brands included 12 brands of refrigerators and 10 brands of vacuum cleaners. In pursuit of a representative design (Brunswik 1956) and to avoid a biased selection of items, the brands were chosen from the refined list by a computerized randomizing procedure. Table 2 lists the brands in each domain along with the calculated scores.

Table 2. List of brands and quality scores in the consumer good domains

Refrigerator brands	Mean overall scores	Mean attribute ratings
Bosch	74.33	4.42
Samsung	72.55	4.20
Thermador	70.50	4.00
Sub-Zero	64.50	3.54
Ikea	64.00	3.63
Electrolux	63.80	3.90
Amana	58.38	3.47
Hotpoint	53.50	3.00
Sanyo	47.00	3.50
Fisher & Paykel	43.50	2.75
Marvel	36.00	1.67
Magic Chef	33.00	3.00

Vacuum cleaner brands	Mean overall scores	Mean attribute ratings
Black & Decker	80.33	3.87
Riccar	67.00	4.08
Panasonic	66.67	3.93
Hoover	66.16	3.95
LG	66.00	4.00
Dyson	63.13	3.78
Aerus	60.00	3.85
Metropolitan	59.00	3.57
Kalorik	49.00	3.00
Koblenz	41.00	3.17

Procedure. Each participant performed three sets of tasks. The first set was used to familiarize the respondents with the questions they were going to be asked throughout the study. Just like in Study 1, the participants were instructed on how to answer each question and tested for comprehension before they could start the actual tasks. A set of printer brands was used for the training tasks. For the last two sets of tasks, participants answered questions about two categories of consumer brands.

For each product category, three sets of questions, similar to those in study 1, were asked. Participants answered all questions about one category before moving to the next one. Question Set 1 was identical to that from study 1 with one exception: when participants were asked to indicate how frequently they had seen or heard of each brand,

they used a slider with "Very rarely" and "Very often" on its ends, corresponding to 1 and 50, respectively. If they had not heard of or seen the brand before the study, they could indicate that by clicking on a special box instead of using the slider. Question sets 2 and 3 were identical to those in study 1. On average, the complete session lasted 48 minutes.

Results and discussion

Hypothesis 1a was supported in the business school domain and predicts that consumers assign higher quality ranks to recognized brands associated with mostly negative information than to unrecognized brands.

In an attempt to reconfirm this result, we calculated average quality rank estimates for all unrecognized brands, all recognized brands attributed with mostly positive information and all recognized brands attributed with mostly negative quality information in the consumer good domains. Just as before, any observation with inconsistent responses (see study 1) was eliminated from the data set before analyses were conducted.

The results for both consumer good domains replicate the results of analysis for business schools. Specifically, the perceived quality of recognized brands was higher than that of unrecognized ones.
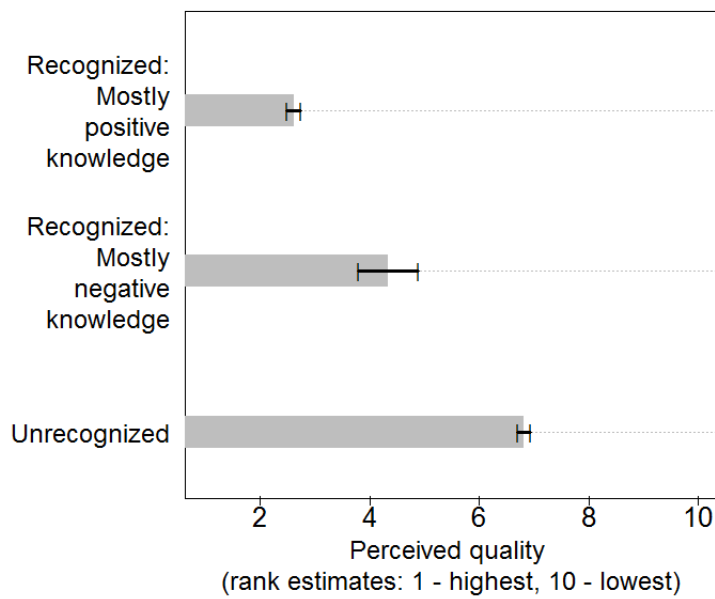
Table 3. Rank estimates for recognized and unrecognized brands

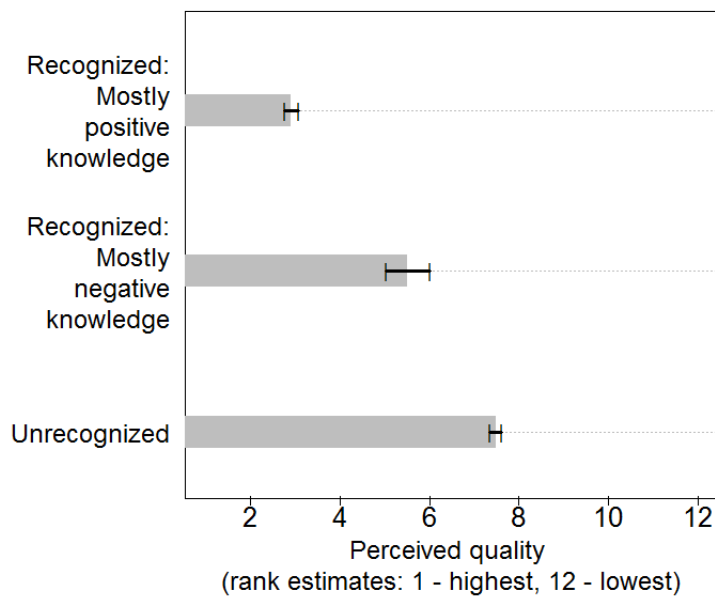| Domain	N of respondents	Recognized brands			Unrecognized brands		
		N	Mean	SE	N	Mean	SE
Business schools	107	872	5.90 (out of 20)	.15	1268	12.69 (out of 20)	.12
Vacuum cleaners	202	887	3.15 (out of 10)	.06	1133	6.77 (out of 10)	.06
Refrigerators	203	1062	3.88 (out of 12)	.07	1374	7.44 (out of 12)	.07

Table 3 shows the means for estimated ranks of brands grouped based on whether they were recognized or not, in each of the three domains.

Figures 2a-b. Perceived quality for unrecognized consumer goods and for recognized consumer goods with different levels of knowledge valence

a. Vacuum cleaners

Perceived quality
(rank estimates: 1 - highest, 10 - lowest)

b. Refrigerators

Perceived quality
(rank estimates: 1 - highest, 12 - lowest)

Furthermore, figures 2A-B show that, again, the effect of recognition was so strong that even the brands with predominantly poor quality reputation were rated higher than the unrecognized brands. A mixed-effect linear model testing the relationship between the estimated ranks, on one side, and recognition as a fixed effect variable and respondents as a random effect variable, on the other side, confirms that estimated ranks for the recognized brands with mostly poor quality reputation are higher than those for the unrecognized ones: vacuum cleaners (1098 responses from 198 respondents), $\beta = 2.78$, SE = .24, t = 11.74; refrigerators (1305 responses from 199 respondents), $\beta = 2.11$, SE = .24, t = 8.78, which supports hypothesis 1a.

For refrigerator brands, which could be ranked between 1 and 12, the corresponding average ranks of recognized brands with predominantly poor quality reputation and unrecognized brands were 5.52 versus 7.51 ($SE_{RKn-} = .25$, $SE_U = .07$). Similarly, for the vacuum cleaner brands, which could be ranked between 1 and 10, the corresponding means were 4.34 versus 6.83 ($SE_{RKn-} = .28$, $SE_U = .06$).

Just as with business schools, recognized brands of consumer goods with predominantly positive information were rated higher than the ones with mostly negative information, which is confirmed by the results of an ordered logistic regression analysis. As table 4 demonstrates, the quality perception of recognized brands was positively correlated with the proportion of positive information about quality.

Table 4. Relationship between estimated ranks and knowledge valence

Domain	N of observations	Spearman r_s	Kendall τ
Business schools	872	.59*	.46*
Vacuum cleaners	869	.55*	.43*
Refrigerators	1026	.56*	.43*

* p < .01

Analyses of people's inferences in paired comparisons aimed at testing hypothesis 1b demonstrate that, across both consumer domains, in most cases, participants inferred that the recognized brand associated with predominantly poor quality information was of higher quality than the unrecognized brand, and proportions of such inferences were significantly greater than chance: 85% of such pairs for vacuum cleaners ($\chi^2(1, N = 270) = 55.93$, $p < .01$) and 78% of such pairs for refrigerators ($\chi^2(1, N = 582) = 42.28$, $p < .01$)).

Even though these rates were lower than the ones calculated for all pairs in which one brand was recognized and the other was not (see table 5), they still indicated a strong tendency of people to infer that recognized brands were of higher quality, even when these brands were attributed with predominantly poor quality information.

Table 5. Mean individual proportion of inferences when a recognized brand is inferred to be of higher quality than an unrecognized brand in paired comparisons

Domain	N of respondents	Mean individual proportion of relevant pairs	Mean proportion of such inferences
Business schools	107	.43	.89
Vacuum cleaners	202	.52	.91
Refrigerators	203	.49	.88

These results suggest that consumers might not use knowledge valence information in making inferences about brand quality when comparing a recognized brand attributed with mostly negative information with an unrecognized brand, and these inferences can be predicted without knowledge valence information.

To test this idea, that is, hypothesis 2, we tried to predict consumers' brand quality estimates based on models that did or did not use knowledge information as predictors of perceived quality.

Models

To compare accuracy of different memory cues in predicting quality inferences in paired comparisons, quality rank estimates were modelled as a function of one or more measures, such as recognition, perceived environmental frequency, knowledge volume and valence, and response latency.

First, quality rank estimates stated by the participants were modelled as a function of one or more cues. One set of models used recognition, response latency, and perceived environmental frequency as predictors, and the other set used knowledge valence and volume, in addition to these three measures. Then, the outputs of these models, that is, quality rank estimate predictions for recognized and unrecognized brands, were used to predict inferences in paired comparisons. Next, these predictions of inference decisions were compared with inferences stated by the respondents, and the percentage of times a model made an accurate prediction was calculated for each model. Finally, two sets of models were compared based on their ability to make accurate predictions of people's inferences in paired comparisons.

Due to the way the variables were measured in different domains, some models could be used for modelling both the recognized and unrecognized brands, but others required separate models for modelling unrecognized brands and the recognized brands with different levels of knowledge volume. For example, perceived environmental frequency was collected using a single scale for both recognized and unrecognized brands in the business school domain, but not in the other domains. When respondents were asked about their perceived environmental frequency in the domains of consumer goods, they had an option of indicating that they had never seen or heard of the brand, in which case their response was coded as 0. If they did not choose that option, the participants

could use a scale ranging between 1, corresponding to "I have seen or heard of it very rarely", and 50, corresponding to "I have seen or heard of it very often". As a result, in the domain of consumer goods, the difference between perceived environmental frequency coded as 0 and 1 is not the same as the difference between perceived environmental frequency coded as 1 and 2. Hence, models using the collected perceived environmental frequency data do not allow for combined modelling of recognized and unrecognized brands in the domains of consumer goods, but can do so in the domain of business schools.

Thus, in the business school domain, for models not including knowledge valence data as a predictor, we modelled quality rank estimates as a function of recognition, response latency, and perceived environmental frequency for both recognized and unrecognized brands.

(1) $$QRE_{ij} = \beta_0 + \beta_1 * R_{ij} + \beta_2 * RL_{ij} + \beta_3 * PEF_{ij} + \varepsilon_{ij},$$

where QRE represents quality rank estimates of person i for brand j, β_0 is the intercept, β_1, β_2, β_3 are slopes estimated for all individuals and brands, and ε_{ij} is the residual, normally distributed with a zero mean and variance σ^2, R is recognition, RL is response latency, and PEF is perceived environmental frequency.

In the consumer good domains, for models not including knowledge valence data as a predictor, we used separate models for modelling unrecognized brands and recognized brands. Rank estimates of recognized brands were modelled as a function of response latency and perceived environmental frequency, and rank estimates of unrecognized brands were modelled as a function of response latency.

(2) $$QRER_{ij} = \beta_0 + \beta_1 * RL_{ij} + \beta_2 * PEF_{ij} + \varepsilon_{ij},$$

where QRER represents quality rank estimates of person i for *recognized* brand j, β_0 is the intercept, β_1, β_2 are slopes estimated for all individuals and brands, ε_{ij} is the residual, normally distributed with a zero mean and variance σ^2, RL is response latency, and PEF is perceived environmental frequency.

(3) $$QREU_{ij} = \beta_0 + \beta_1 * RL_{ij} + \varepsilon_{ij},$$

where QREU represents quality rank estimates of person i for *unrecognized* brand j, β_0 is the intercept, β_1 is a slope estimated for all individuals and brands, ε_{ij} is the residual, normally distributed with a zero mean and variance σ^2, and RL is response latency.

For models including knowledge valence data as a predictor of quality rank estimates, we used the same models for all domains and modelled recognized and unrecognized brands separately. Rank estimates of recognized brands attributed with knowledge about quality, were modelled as a function of response latency, perceived environmental frequency and knowledge volume and valence.

(4) $QRERK_{ij} = \beta_0 + \beta_1 * RL_{ij} + \beta_2 * PEF_{ij} + \beta_3 * KVOL_{ij} + \beta_4 * KVAL_{ij} + \varepsilon_{ij},$

where QRERK represents quality rank estimates of person i for *recognized* brand j attributed with quality knowledge, β_0 is the intercept, β_1, β_2, β_3, β_4 are slopes estimated for all individuals and brands, ε_{ij} is the residual, normally distributed with a zero mean and variance σ^2, RL is response latency, PEF is perceived environmental frequency, and KVOL and KVAL are knowledge volume and valence.

Since ranks are ordinal rather than continuous variables, we used ordered logit model to predict respondents' quality rank estimates. Both fitted and cross-validated values were derived for all models.

Results and discussion

Analysis of the ability of models to make accurate predictions of people's inferences in paired comparisons in all three domains revealed that, as predicted by hypothesis 2, the simpler models, not including knowledge data as one of the predictors of rank estimates, were as accurate as more complex ones, including knowledge data (see table 6).

Table 6. Predictive accuracy of models for inferences in paired comparisons including an unrecognized brand and a recognized brand attributed with quality information (when predictions are made based rank estimates modelled as a function of memory cues)

Domain	N of observations	Percentage of accurate predictions		Fisher's exact test p-value
		Models *not including* knowledge valence	Models *including* knowledge valence	
Business schools	3173	94.30	92.50	.00
Vacuum cleaners	3904	92.98	92.98	1.00
Refrigerators	4756	89.70	89.23	.48

Potential criticism of this method can be the overall complexity of the modelling approach through several afore-mentioned steps, each based on cross-validated outputs, which can lower the accuracy of the more complex models. To overcome this drawback, the accuracy of models was also compared by modelling inferences in paired comparison based on memory cue data directly.

First, inferences in paired comparison were modelled as a function of response latency, perceived environmental frequency, and, were applicable, as a function of knowledge volume and knowledge valence, for the recognized brand. That is, for models not including knowledge data, the probability that a recognized brand is inferred to be of higher quality can be expressed as follows.

(6) $$P_{ij} = \beta_0 + \beta_1 * RL_{ij} + \beta_2 * PEF_{ij} + \varepsilon_{ij},$$

where P represents the probability that person i judges the recognized brand j to be of higher quality, β_0 is the intercept, β_1, β_2 are the slopes estimated for all individuals and brands, and ε_{ij} is the residual, normally distributed with a zero mean and variance σ^2, RL is response latency, and PEF is perceived environmental frequency.

Alternatively, using knowledge data in addition to simpler cues, that probability can be modelled the following way.

(7) $$P_{ij} = \beta_0 + \beta_1 * RL_{ij} + \beta_2 * PEF_{ij} + \beta_3 * KVOL_{ij} + \beta_4 * KVAL_{ij} + \varepsilon_{ij},$$

where P represents the probability that person i judges the recognized brand j to be of higher quality, β_0 is the intercept, β_1, β_2, β_3, β_4 are the slopes estimated for all individuals and brands, ε_{ij} is the residual, normally distributed with a zero mean and variance σ^2, RL is response latency, PEF is perceived environmental frequency, and KVOL and KVAL are knowledge volume and valence.

Then, the outcome of the models, that is, the probability of a recognized brand to be inferred of higher quality, was rounded off to predict the inference in each pair. The

proportion of times the model predicted the inference stated by the respondents correctly was used as measure of predictive accuracy for the compared models shown in Table 7.

Table 7. Predictive accuracy of models for inferences in paired comparisons including an unrecognized brand and a recognized brand attributed with quality information (when predictions are made based on memory cues directly)

| | | Percentage of accurate predictions | | |
Domain	N of observations	Models *not including* knowledge valence	Models *including* knowledge valence	Fisher's exact test p-value
Business schools	3173	95.43	95.43	1.00
Vacuum cleaners	3969	93.58	93.57	1.00
Refrigerators	4781	91.04	90.68	.59

These results suggest that perceived environmental frequency can be a single robust predictor of consumers' inferences about brand quality. To investigate the reasons for such results further, we analysed how the quality of brands is related to the number of times the brands are mentioned in the environment. Can our findings be explained by that relationship? If correlated with the number of mentions, brand quality can be accurately inferred without the use of other cues.

Field data analysis

To explore the relationship between the volume of the information in the environment and the quality of the brands, we used the business school quality ratings from published rankings and the frequency of citations of business schools on the Web, which were collected by a company specializing in sentiment data collection, *General Sentiment*.

In addition, environmental frequency was measured by the number of search results generated by *Google*, *Bing*, and *New York Times* web search engines for the combination of the university name and "business school" or "school of business" word groupings, for example, "harvard" and "business school" or "school of business". We used natural logarithmic transformation to transform the numbers of search results generated by these three sources, that is, search engines, before the results were standardized within each source. Then, mean values of these standardized scores were calculated for each school.
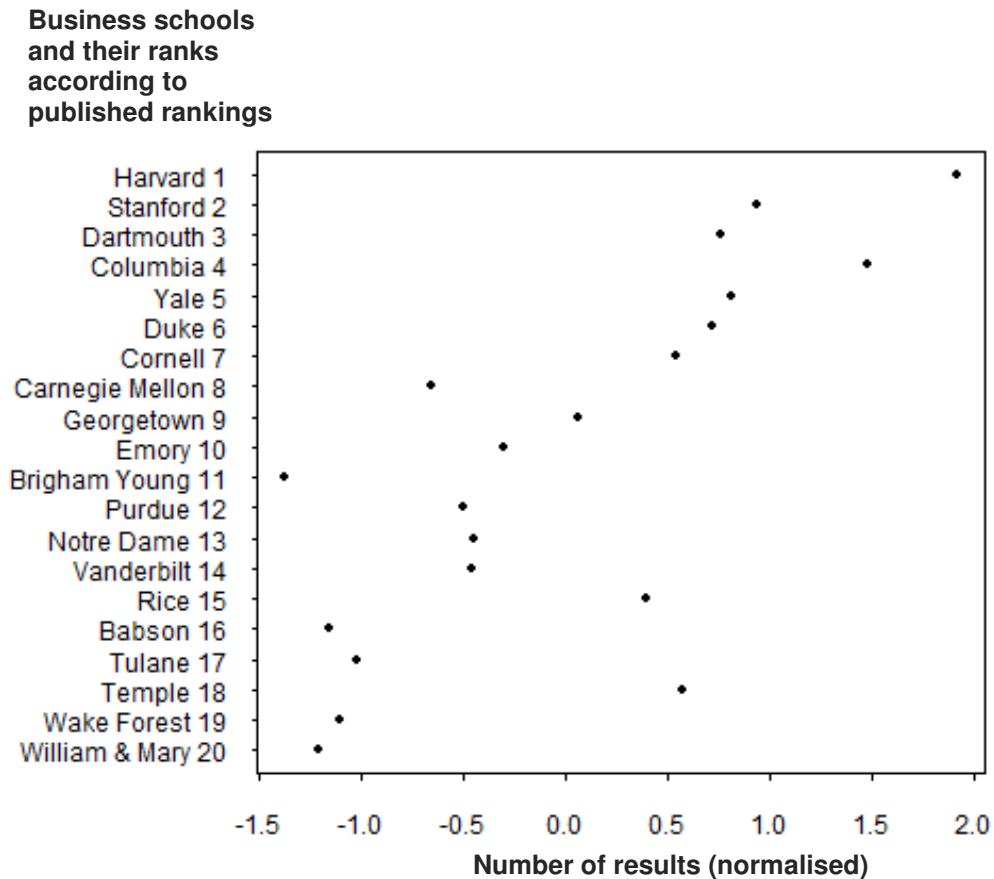
Business school quality ranks were determined by averaging the schools' ranks published by US News and World Report in 2008 and 2009. When quality scores were needed, we used the scores published by US News and World Report in 2008.

Results and discussion

The analysis of the relationship between brand quality and information volume in the environment in the business school domain demonstrate that knowledge valence may not be necessary to make inferences about the quality of brands. As Figure 3 shows, the more frequently business schools are cited on the Web, the higher they are ranked according to the published ratings. Expert-judged brand quality is positively correlated with the average number of Web search results ($r(18) = .83$, $p < .01$) and with the numbers of mentions in news and social media on the Internet ($r(18) = .70$, $p < .01$ for news media and $r(18) = .71$, $p < .01$ for social media).

These findings suggest that, if consumers observe such relationships, they can make inferences following a simple logic: "I have seen brand A and I have not seen brand B, brand A must be of higher quality than brand B, even if I know brand A for its mainly poor quality reputation." What is interesting to know, whether the brands associated with

mostly negative quality information are of higher quality than unrecognized brands according to experts' opinion.

Business schools and their ranks according to published rankings

To answer this question, we calculated average expert-judged quality ranks for all unrecognized business schools and all recognized business schools, which individual participants rated as having mostly negative quality. Our findings show that the expert-judged quality of recognized brands is indeed higher than that of unrecognized ones: means for ranks of business schools grouped based on whether they were recognized or not were 7.25 (out of 20) and 13.27 (SE_{RKn-} = .66 , SE_{U} = .14). A linear regression model testing the relationship between expert-judged quality ranks and recognition stated by 105 respondents for 1113 brands confirms that the ranks for the recognized brands associated with mostly negative knowledge valence are significantly higher than those for

unrecognized ones (β = 6.02, SE = .60, t = 9.97, $p < .001$, R^2 = .08, $p < .001$)[1]. It seems that, in this domain, it is ecologically rational to use environmental frequency as a cue for quality inferences.

But what about the other domains, for example, consumer goods, in which the relationship between quality and environmental frequency can be more distorted by the ability of companies to increase environmental frequency via advertising regardless of the brand quality? The afore-mentioned mixed-effect linear model confirmed that expert-judged ranks of vacuum cleaner and refrigerator brands associated with mostly negative information are higher than ranks of unrecognized brands in these domains (vacuum cleaners: 1098 responses from 198 respondents, β = 2.19, SE = .38, t = 5.83, $p < .001$, R^2 = .03, $p < .001$; refrigerators: 1305 responses from 199 respondents, β = 1.80, SE = .31, t = 5.74, $p < .001$, R^2 = .02, $p < .001$). Mean expert-judged ranks of recognized objects with mostly negative quality associations were 4.48 and 6.67, correspondingly, for the vacuum cleaner brands (SE_{RKn-} = .27, SE_U = .09) and 5.75 and 7.55, correspondingly, for the refrigerator brands (SE_{RKn-} = .27, SE_U = .1). That is, we see the same pattern as in the business school domain.

Discussion

In line with past research, our studies showed that the perceived quality of recognized brands was higher than that of unrecognized ones, and the perception of quality increased with the perceived environmental frequency. As a compelling extension

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[1] The following describes the model used to test the relationship between expert-judged quality and brand recognition.

$$EJQR_j = \beta_0 + \beta_1 * R_{ij} + \varepsilon_{ij},$$

where EJQR represents the expert-judged quality rank for brand j, β_0 is the intercept, β_1 is the slope estimated for all respondents and brands, ε_{ij} is the residual, normally distributed with a zero mean and variance σ^2, R is the dummy variable for brand recognition for respondent i and brand j.

of this result, we find that in all three domains we studied, while proportion of negative information about quality was inversely correlated with quality perception of known brands, the effect of recognition was so strong that even the brands with predominantly poor quality reputation were rated as better than unrecognized. When a familiar brand was compared with an unfamiliar one, mere awareness and perceived environmental frequency could predict inferences as accurately as the other self-stated knowledge participants had. This finding is consistent with firms' tendency to invest heavily in advertisements that provide no product information, and even attract negative attention to a brand, like in case of Benetton's controversial ad campaigns. In 1990s, it used shocking images to grab people's attention: unlike most ads which centred around companies' products or image, Benetton's advertising showed a newborn baby still attached to its umbilical cord, a dying AIDS patient surrounded by his family, or a bloody corpse left by the Mafia. In spite of the criticism and, perhaps, in part due to it, Benetton became one of the most recognized in the world, entering top five, bypassing Chanel and approaching Coca Cola (Toscani 1997).

This pattern mirrors the structure of information in the environment: expert evaluations of quality published by U.S. News and World Report were positively correlated with the number of mentions on the Internet, which, naturally, involves both negative and positive remarks. This suggests that consumers may realize that environmental frequency can serve as a single robust inferential cue for brand quality, in line with our results regarding participants' inferences. This has implications for new brands: when companies have limited resources for brand promotion, they may consider investing in a higher number of exposures to the potential consumer rather than in developing deep knowledge about the brand via informative advertising.

Our findings suggest implications not only for situations when customer use solely the information in their memory, but also when other product information is available, as consumers tend to select only limited amounts of available information and place substantial importance on brand name information (Jacoby, Szybillo, and Busato-Schach 1977). They may use these strategies as coping mechanisms, when facing difficulty processing product information available from various sources while choosing among large number of alternatives in a product category (Bettman, Johnson, and Payne 1991). Ecologically rational to the degree that they are adapted to the structure of an environment, these heuristic decision strategies "can enable both living organisms and artificial systems to make smart choices quickly and with a minimum of information" (Todd and Gigerenzer 2000).

In his recent article, Hauser argues that recognition-based heuristic (Goldstein and Gigerenzer 2002) and its analogues are "excellent descriptions of the decision rules that consumers use to consider and to choose brands" (Hauser 2011) and stresses the need for additional insight into such fast and frugal heuristics (Gigerenzer and Goldstein 1996; Goldstein and Gigerenzer 2002). Discussing the benefits of such research for the design and marketing of products and referring to some theories in marketing science, Hauser suggests why consumers can rely on simple heuristics. According to one of such theories, signalling theory (Erdem and Swait 1998; Milgrom and Roberts 1986; Nelson 1974), the firm will choose to advertise, only if it can recover its advertising expenditures through repeat purchase due to product's high quality. Consumers, who learn through experience that heavily advertised brands are of high quality, infer the brand quality from advertising. And since advertising causes awareness of the brand, they can infer high quality from recognition as well. The ability of recognition to predict quality can be reinforced by observational learning. That is, a consumer might infer that the product is of

high quality, if he or she observes other consumers using the product. Such observation increases awareness, whereby making consumers infer direct correlation between recognition and quality.

Brand awareness increases the likelihood that the brand will be a member of the consideration set (Baker et al. 1986; Nedungadi 1990), the handful of brands that receive serious consideration for purchase. Most people use a consider-then-choose decision rule, when faced with multiple alternatives from which to choose, and inclusion in consideration set can explain significant variation in brand choice and sales (Hauser and Wernerfelt 1990; Srinivasan, Vanhuele, and Pauwels 2010). In the domains of durable goods, such as automobiles, computers, and appliances, simple memory-based decision rules may be less common than in non-durable product categories. Nonetheless, even among durables, consumers may use memory cues for forming a consideration set by screening available alternatives, before seriously evaluating only those brands that are not screened out (Hauser 2011). Our findings contribute to the understanding why awareness plays a critical role in consideration set formation by showing strong effect of recognition on the perceived quality of brands regardless of the valence of knowledge associated with them.

In summary, unknown brands may benefit from negative publicity as long as it raises awareness about them, even if consumers remember this quality information. Of course, it is better for a brand, if consumers have positive knowledge about it, but the fact that recognized brands with predominantly poor quality reputation are still inferred to be of higher quality than unrecognized ones is consistent with the lay theory that "better the devil you know than the devil you don't know."

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