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Product Knowledge and Product Involvement as Moderators of the Effects of Information on Purchase Decisions: A Case Study Using the Perfect Information Frontier Approach

This study ascertains the extent to which consumers achieve highest value-for-money under different conditions. Perfect Information Frontier Approach is applied to examine the influences of providing consumers with information on their purchase decisions, with allowance for the joint effects of prior product knowledge and product involvement on the provided information. A 2 (provided information: simple vs. complex) \times 2 (prior product knowledge: novice vs. expert) \times 2 (involvement: high vs. low) factorial design was employed. Data from 282 survey respondents illustrate that experts were more likely to be persuaded by complex product information than by simple information, while novices reacted similarly to both simple and complex information. The effects of providing complex information to involved novices and providing simple information to involved experts showed the least impact.

A perfectly informed, rational consumer faced with an array of price-quality combinations, would choose a combination that would give the preferred level of quality at the lowest price (or, vice versa, the highest quality for the preferred price). The locus of such "smart purchases" has been given the term Perfect Information Frontier (PIF) by Maynes (1976). In a world of imperfect information, consumers always seek more information as long as the expected payoff from another search exceeds its marginal cost. The implication is that more information would result in a "smarter" purchase. However, do consumers really understand the meaning of relevant product information or fully utilize available information to assist their purchase decisions?

This study examines the influences of information provided to consumers on their decisions in an experimental setting, with allowance for

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the effects of prior product knowledge and product involvement. It is our contention that with these factors accounted for, choices that are not considered smart purchases under a strict application of the Perfect Information Frontier may indeed turn out to be so.

CONCEPTUAL BACKGROUND

The Perfect Information Frontier

Maynes (1976, 535) defined the Perfect Information Frontier as the set of points in price-quality space for which a given level of quality can be purchased at the lowest price. The perfectly informed, rational consumer would purchase only those products which lie on the Frontier. Maynes asserts that the number of observed points lying off the Frontier and their distances from the Frontier represent the degree of imperfection of the market.

This representation of rational choice extends Monroe's (1979) concept of the best purchase decision in the market. Monroe postulated a measure of objective value in the ratio:

$$\text{Value} = \frac{\text{quality}}{\text{price}} \quad (\text{Monroe 1979, 38})$$

Maynes' extension of the concept into price-quality space allows consumers to trade off quality against price and buy, for instance, a lower quality good than Monroe's "best product" at a cheaper price. Maynes has, therefore, generalized the single-valued approach to the concept of the best purchase.

The price dimension of the Perfect Information Frontier is straightforward in that it is measured in money terms. Maynes (1992) states that in order to realize the "true" quality of a product, the second dimension of the Perfect Information Frontier, consumers need to have the ability to fully understand the provided full information. This full understanding/full information (FU/FI) notion of quality is similar to the concept of "objective quality" put forward by Zeithaml (1988) and Lichtenstein and Burton (1989). Quality can be measured through "objective," that is, reproducible, product tests of product quality, such as those carried out by Consumers Union.

Prior Product Knowledge

Prior product knowledge or experience can influence consumers' ability to search for and understand information. Brucks (1984) showed that

the degree to which a consumer feels he or she has knowledge of a product (i.e., subjective knowledge) negatively affects the amount of information sought about the product. In the present context, the consumer with prior knowledge has already been able to move toward the PIF. Such a consumer will have less use for new product information, having less distance to move to get to the PIF than does the consumer with little prior information. On the other hand, consumers with prior knowledge may distinguish easily between simple and complex information. They appreciate the amount of complex information. These consumers may ignore simple information because they already know more than the content of simple information supplies. With this in mind, the following four hypotheses are developed for the present study:

- H₁: Given product information, consumers will make purchase decisions closer to the PIF;
- H₂: Knowledgeable consumers will make purchase decisions closer to the PIF when provided with complex information rather than simple information;
- H₃: Novice consumers will make purchase decisions closer to the PIF when provided with simple information rather than complex information; and
- H₄: The different effect of information complexity is greater for experts than for novices.

Enduring Product Involvement

Enduring involvement represents an ongoing concern with a product that a consumer brought into a purchase situation (Rothschild 1979). It was suggested to be related to consumers' brand choices (Bei and Heslin 1996). Enduring involvement with a product has been represented as an on-going concern with a product that a consumer brings into a purchase situation (Bloch and Richins 1983; Rothschild 1979). Bei and Heslin (1996) found that relatively uninvolved consumers choose better value brands than do involved consumers. They also indicated that knowledgeable consumers with low involvement selected brands closer to the PIF than highly involved knowledgeable ones.

Consumers with high enduring product involvement have been found to be less price conscious than others (Bloch, Sherrell, and Ridgway 1986; Lichtenstein *et al.* 1988), and more likely to make a commitment to a particular brand of a product (Traylor 1981; Beatty, Kahle, and

Homer 1988). One would, therefore, expect such consumers to be less responsive to new information on price-quality relationships than others.

Consumers with high enduring product involvement conduct ongoing information search (Bloch *et al.* 1986) and are expected to have greater prior product knowledge (Lichtenstein *et al.* 1988). Thus, in addition to affecting the response to new information, prior knowledge and product involvement should have an interactive effect.

The effect of prior knowledge and product involvement on the consumer's use of new information in a purchase decision will be influenced by the consumers' ability to process the information. In general, it can be argued that the more complex the information is, the more difficult it will be for consumers to assimilate it into their decisions and, therefore, to reach the Frontier.

From the above, four additional hypotheses are developed for this study:

- H₅: The effect of product information on consumers who have low involvement with a product is greater than on consumers who are highly involved;
- H₆: The effect of providing consumers with complex information is greatest for consumers who have low product involvement and are knowledgeable;
- H₇: The effect of providing consumers with simple information is greatest for uninvolved novice consumers; and
- H₈: Simple information will have the lowest information effect on involved experts, while complex information will have the lowest information effect on involved novices.

METHODOLOGY

This study applies a 2 (provided information: simple vs. complex) × 2 (prior product knowledge: novice vs. expert) × 2 (involvement: high vs. low) factorial design. The effects of these three factors on subjects' purchase decision were examined for three selected products.

To be included in this study, each product had to (1) have different models or brands, and have been examined by the Consumers Union; (2) have a relatively wide price range and a relatively wide quality range, as well as a nonequivalent price-quality relationship; (3) have brands with a high degree of variance in their brand images; (4) be the kind of product that consumers would have a high degree of variance in their prior knowledge; and (5) be the kind of product that consumers would have a high

degree of variance in their involvement.

A survey of recent issues of *Consumer Reports* yielded 14 products that potentially could fit the first two criteria for the study, namely: ice cream, hot dogs, ground coffee, orange juice, fast food, jeans, running shoes, perfume, tennis racquets, bicycles, loudspeakers, cameras, compact disc players, and cars. After conducting a questionnaire survey with 12 professors and graduate students in the area of consumer behavior, researchers narrowed the 14 products down to three products: ground coffee, jeans, and loudspeakers. Respondents thought these three products best fit the last three criteria.

Subjects and Procedures

A survey was distributed by mail to collect data for this study in February 1995. Samples of consumers for testing coffee and jeans were randomly selected from a commercial list purporting to be statistically representative of American consumers. The sample was supplemented from a mailing list of compact disc buyers to ensure a big enough sample of consumers with prior knowledge of loudspeakers would be surveyed. A pretest showed that there were fewer people who had experience with loudspeakers than with the other two products.

A pre-postcard announcing the survey was sent to selected subjects. Two weeks after the postcard, 2,400 surveys were mailed out, 800 for each product. One month after the major survey, subjects received a reminder and another questionnaire.

The controlled variable in the instrument is the amount of information provided. One half of the subjects received simple information on overall product ratings; the other half had complex product information in their questionnaires. Subjects were randomly assigned into these two levels of information groups.

Independent Variables and Measures

The three independent variables in this study are the amount of information provided, prior product knowledge, and product involvement. Provided information is a manipulated variable, while consumers' prior product knowledge and product involvement are measured variables.

The sources of product information were the ratings from *Consumer Reports'* product tests. *Consumer Reports* usually provides two forms of product information: attribute ratings and overall ratings. Attribute rat-

ings are the scores of tested items and associated comments about advantages and disadvantages of each brand (and/or model) of the product class. The overall rating is a summarized score based on the results of separate attributes and weighted by the importance of each item. The overall score serves as the simple information in this study, and the individual attribute ratings provide the complex information. Both forms of information were available in *Consumer Reports* for coffee and loudspeakers (October 1994; March 1994), but only attribute ratings were provided for blue jeans (July 1991). An overall score for blue jeans was developed for this study by multiplying each attribute rating by the corresponding weight, then aggregating results.

The operational definition of product knowledge is consumers' knowledge of terminology, attributes, and usage situations (Brucks 1984). To measure prior knowledge, subjects were assigned as experts or novice consumers based on a median-split of their scores in a knowledge test. With the help of three textile and apparel Professors, as well as some product guides, a total of 62 questions was first generated (*Consumer Reports* 1994; Gall and Gall 1993). After evaluation by known experts in each product category and a pretest with 17 consumers, some questions were dropped. The final knowledge tests contained 11 items for coffee, 12 for jeans, and 12 for loudspeakers.

Because product involvement defined in this study is a long-term enduring involvement, Bloch's Involvement Scale (1981) was chosen. Bloch's scale was designed primarily to measure consumers' long-term interest in a product as a function of individual differences in important values, needs, or self-concept. Bloch's original scale was a 17-item seven-point Likert scale for cars only. These items were modified by the authors to fit the products used in this study. A pretest of the reliability of these modified items yielded a Cronbach's alpha of .84 ($n = 38$) for ground coffee, .92 ($n = 32$) for jeans, and .93 ($n = 24$) for loudspeakers.

Dependent Variables and Measures

The dependent variables of this study were constructed from consumers' purchase decisions both before and after reading the provided product information. For each product, a price-quality map and Perfect Information Frontier were developed prior to administration of the survey.¹

¹For the step-by-step procedure of building a price-quality map and Perfect Information Frontier, please refer to E. Scott Maynes' works since 1973. Maynes' original work involved the collection of

Subjects chose products from a list of brands and models provided in the questionnaire both before and after information about the products was presented to them. It should be noted that respondents were presented with a hypothetical choice, in the sense that no actual purchase took place, and no money changed hands.

The score of each purchase decision was the shortest distance of the selected brand to the PIF line. By definition, the distance to a bent PIF line was the shortest perpendicular distance to any one of the component lines of the PIF.² Theoretically, these distance scores can range from 0 to infinity. The brands located on the PIF are scored as 0. As the score increases, the brand is farther away from the PIF, and the selection is regarded as relatively poorer. The scores (*i.e.*, distance to the PIF) of each available brand for the three products are presented in Table 1 to Table 3. Ground coffee was separated into two parts: caffeinated and decaffeinated coffee (Figure 1 and Table 1) due to incompatibility of price ranges and quality.

Design and Analysis

This study is a 2 (simple/complex information) × 2 (novice/expert) × 2 (high/low involvement) factorial design. Hypothesis 1 examines the difference of respondents' purchase decisions before and after reading the provided information. A within-subject paired t-test is appropriate for this comparison.

Hypotheses 2 to 8 concern the effects of providing information interacted with the effects of product knowledge and involvement. Because consumers' changes of their preferred brands after reading product information depend on their selections before providing the information, two methods were considered to solve this limit of movement measure: (1) using the percentage of the distance change as a dependent variable, and

multiple observations of price per product in local markets. For the purposes of this study, a single price per product was sufficient for the construction of a Perfect Information Frontier. Prices were obtained from Consumer Reports data, as noted in the footnotes to Tables 1 through 3.

²The two lines that form the PIF are

$$a_1X + b_1Y + c_1 = 0 \text{ and } a_2X + b_2Y + c_2 = 0.$$

Then, the shortest distance (S) of a brand (X0, Y0) to the PIF is

$$S = \min \left(\frac{|a_1X_0 + b_1Y_0 + c_1|}{\sqrt{a_1^2 + b_1^2}}, \frac{|a_2X_0 + b_2Y_0 + c_2|}{\sqrt{a_2^2 + b_2^2}} \right).$$

TABLE 1
Quality Scores, Prices, and Distances to the PIF of Coffee Brands

No.	Brand ^a	Quality Score ^b	Price per Cup (¢) ^c	Distance to PIF
1	Eight O'Clock Roaster's Choice Plus	8	7	3.3981
2	Folgers Aroma Roasted	64	6	0.5330
3	Folgers Gourmet Supreme	70	7	1.3326
4	Folgers Custom Roast	82	7	0.0000
5	Folgers Special Roast	64	6	0.5330
6	Gevalia, Colombia	65	14	8.4953
7	Hills Brothers	64	8	2.5319
8	Hills Brothers High Yield	40	6	1.3326
9	Hills Brothers 100% Colombian	80	6	0.0000
10	Hills Brothers Perfect Balance	47	6	1.0994
11	Maxwell House	50	5	0.0000
12	Maxwell House 1892	50	6	0.9994
13	Maxwell House Colombian Supreme	65	7	1.4992
14	Maxwell House Lite	48	5	0.0666
15	Maxwell House Master	38	6	1.3992
16	Yuban 100% Colombian	75	7	1.1660
17	Brim Regular Roast	30	7	1.7365
18	Folgers Aroma Roasted Decaf.	45	7	0.0000
19	Folgers Gourmet Supreme Decaf.	60	9	0.0000
20	Hills Brothers Decaf.	52	8	0.0000
21	Maxwell House Colombian Decaf.	28	8	2.9768
22	Maxwell House Decaf.	31	7	1.6125
23	Sanka	25	8	3.3489

^aBrands 1 to 16 are caffeinated, and brands 17 to 23 are decaffeinated coffee.

^bQuality scores are the average flavor scores (which includes body, favorable comments, such as fruity, floral, clean, sharp aroma, etc., unfavorable comments, such as cereal, stale, astringent, etc.) given by tasters of *Consumer Reports*. The score ranges from 0 to 100.

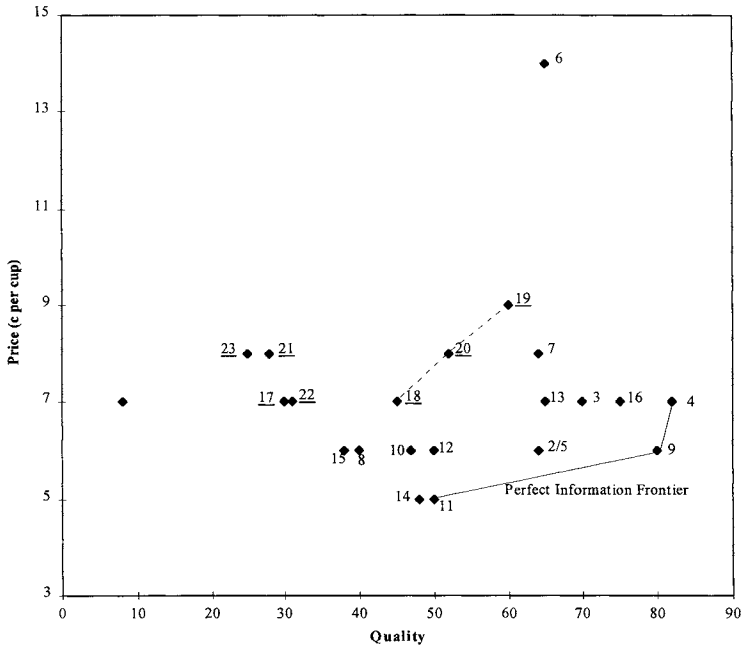
^cPrice per cup is *Consumer Reports'* estimate of the cost of preparing a six-ounce cup using about 1½ tablespoons of coffee.

(2) using the initial distance of a selected brand as a covariate to form an analysis of covariance (Montgomery 1991). The first method had a problem: when the initial distance was zero (*i.e.*, located right on the PIF), then the percentage change could not be calculated, hence, the analysis of covariance (ANCOVA). Respondents' decision distance from the PIF before presenting information is included as a covariate. The dependent variable of ANCOVA is respondents' purchase decisions after reading the information. Wherever testing of group differences was involved, planned contrasts were employed.

FINDINGS

The average response rate was 23 percent. There was no significant difference in response rates among the three products. Also, no significant

FIGURE 1
Price-Quality Map of Coffee



Note. The underlined brand numbers are decaffeinated coffee, and others are caffeinated coffee. The dotted line connecting brands 18, 20, and 19 are the Perfect Information Frontier of decaffeinated coffee, whereas the full line connecting brands 4, 9 and 11 represent the Perfect Information Frontier of regular coffee.

difference in response rates was found between simple and complex information. Respondents were mainly Caucasian (93.4%) female (63.2%), aged 25 to 54 (69.9%), with some college education or higher (75.8%), and with family annual incomes ranging between \$30,000 to \$74,999 (56.2%). The skew toward the well-educated and affluent is likely an artifact of the case-study approach adopted for this study. This phenomenon is discussed in the limitations of the study. Respondents of the three products had similar demographic profiles, with no statistically significant difference among the three groups.

Ground Coffee

Within the 188 returned surveys, 83 respondents did not drink coffee

TABLE 2
Quality Scores, Prices, and Distances to the PIF of Jeans

No.	Brand	Quality ^a	Price (4) ^b	Distance
1	Bugle Boy	61	36.00	19.0873
2	Calvin Klein	69	51.50	33.4996
3	Chic	58	48.00	31.3631
4	Gap	65	31.50	14.1343
5	Gitano	75	21.00	2.4963
6	Guess	72	60.00	41.5718
7	J. C. Penney	68	20.50	2.8512
8	Lands End	80	23.00	4.8746
9	Lee	72	27.00	8.8166
10	Levi's	67	33.75	16.1245
11	L. L. Bean	72	31.25	13.0351
12	Sears	69	17.75	0.0000
13	Wrangler	89	20.20	0.0000

^aOverall quality score is based mostly on durability (which includes abrasion resistance, strength, and construction), as well as shrinkage and color bleeding resistance. The score ranges from 0 to 100.

^bPrice is the average *Consumer Reports*' obtained from its test markets.

FIGURE 2
Price-Quality Map of Jeans

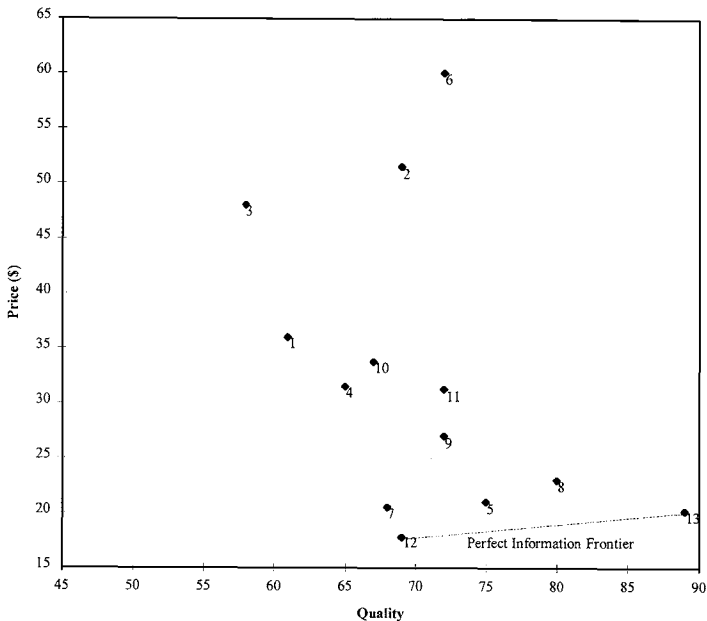


TABLE 3
Quality Scores, Prices, and Distances to the PIF of Loudspeakers

No.	Brand	Quality ^a	Price (4) ^b	Distance
1	Advent Prodigy Tower II	51	300	21.4581
2	Allison AL 110	58	266	12.3509
3	Altec Lansing 96	50	400	28.6940
4	B.I.C. Venturi V620	55	300	17.4659
5	Bose 301 Series III	74	320	0.0000
6	Boston Acoustics HD9	70	340	4.9903
7	Cambridge Soundworks	53	240	15.6320
8	Celestion 5 MKII	64	400	14.7213
9	Cerwin-Vega L-7-B	60	180	4.6563
10	DCM CX-17	70	280	1.2476
11	Infinity RS 325	60	270	10.6043
12	JBL J2080	70	260	0.0000
13	Optimus STS 1000	57	260	12.9712
14	Pinnacle AC 800	58	299	14.4094
15	Pioneer CS-G303	65	180	0.0000
16	Polk Audio S6	58	400	20.7096
17	Sony SS-U610	60	225	7.6497
18	Technics SB-CX300	50	198	15.8315
19	Yamaha NS-A820A	60	360	16.2184

^aOverall quality score is based mostly on accuracy, both normal and after tone corrections. The score ranges from 0 to 100.

^bPrice is the average *Consumer Reports*' obtained from its test markets.

FIGURE 3
Price-Quality Map of Loudspeakers

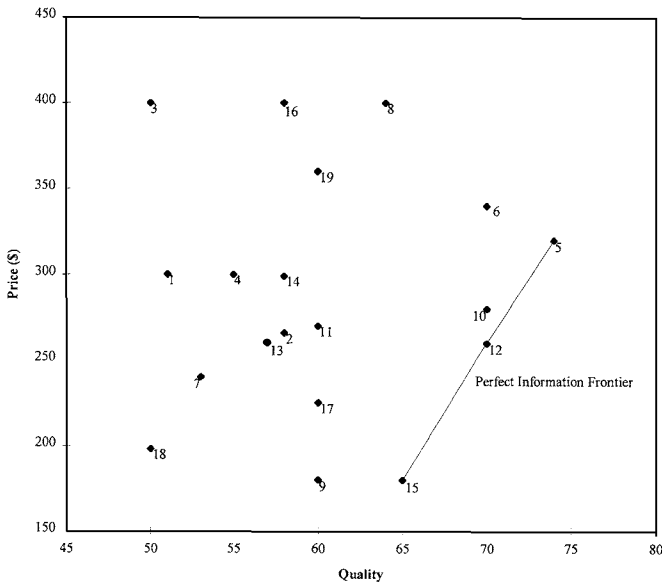


TABLE 4
*Means and Standard Deviations of Distance to the Perfect Information Frontier
 by Information, Knowledge, and Involvement Groups*

	Simple Information				Complex Information			
	High Involved		Low Involved		High Involved		Low Involved	
	Expert	Novice	Expert	Novice	Expert	Novice	Expert	Novice
Ground Coffee								
Before	0.95 (1.21)	0.64 (0.62)	0.81 (0.51)	0.29 (0.28)	1.79 (2.79)	0.79 (1.17)	1.05 (2.39)	0.78 (1.10)
After	0.44 (1.12)	0.49 (0.56)	0.61 (0.56)	0.42 (0.49)	1.15 (2.14)	0.83 (1.15)	0.52 (0.53)	0.80 (1.09)
Jeans								
Before	23.36 (14.83)	13.45 (12.58)	9.04 (7.06)	12.50 (10.13)	18.49 (11.49)	12.05 (11.85)	10.61 (7.89)	11.01 (6.44)
After	20.29 (16.05)	13.45 (12.58)	6.96 (7.20)	8.29 (11.74)	9.86 (7.64)	11.07 (14.11)	10.37 (12.30)	6.70 (12.41)
Loudspeakers								
Before	1.76 (2.93)	4.88 (7.16)	5.41 (9.36)	5.19 (8.66)	4.60 (7.74)	4.77 (7.20)	1.44 (4.77)	5.84 (6.86)
After	3.05 (5.05)	2.17 (4.04)	5.41 (9.36)	0.97 (2.43)	0.95 (2.82)	3.06 (4.19)	0.11 (0.38)	1.53 (3.12)

Note. Values enclosed in parentheses represent the standard deviations. The means and standard deviations presented in this table are before standardized.

or bought ground coffee, bought only private brands (of which prices and quality scores are not available), did not complete the survey, or could not be assigned into either expert or novice, high or low involved group. The final sample size of the ground coffee part of the study was 105.

More than four-fifths of the respondents (83.80%) drank one cup or more per day. Also, 52.90 percent of the subjects bought ground coffee about once a month. The most popular brands were Folgers Aroma Roasted and Maxwell House (47.62%). After reading the information provided, most respondents (28.57%) would consider Folgers Custom Roast for their next purchase, which is located on the PIF.

The range of respondents' coffee knowledge scores was from 0 to 10, with the mean equal to 5.36 and the median equal to 5. The range of involvement scores for ground coffee was from 21 to 102. The mean was 54.13, and the median was 53. A median-split was employed on both subjects' knowledge and involvement scores. The mean and standard deviation of the distance to the PIF for each group are presented in Table 4.

Jeans

Within the 165 returns, about half of the respondents owned five pairs of jeans or more (44.9%) and wore them everyday (55.8%). Also, 75 respondents (45.7%) bought jeans at least twice a year or more often. Levi's and Lee were the dominating brands with 57.00 percent of the respondents' market. After receiving product information, 22.4 percent still chose Levi's, but 34.54 percent would switch to Wrangler or Land's End. Lee's loyal consumers decreased to 12.73 percent.

The final usable sample size for the jeans was 85 after deleting incomplete surveys and local-brand buyers. The range of respondents' knowledge scores was from 0 to 10, with a mean of 4.77 and a median of 5. The range of involvement scores for jeans was from 22 to 104. The mean was 54.22, and the median was 54. Each median-split group's mean and standard deviation of its distance to the PIF are presented in Table 4.

Loudspeakers

The final sample size of loudspeakers was 92. More than half of the respondents owned loudspeakers (64.18%). Around one quarter of the respondents (24.81%) have owned their loudspeakers longer than ten years. About three-quarters of the subjects (74.24%) do not plan to buy loudspeakers in the near future. Bose 301 Series III, which was located on the PIF, was the most preferred brand and model both before (34.33%) and after (46.27%) information was provided. Sony SS-U610 was also popular before the information was provided, such that 25 respondents would choose it if they wanted to buy a pair of loudspeakers. However, only 14 people selected this brand after the information was provided.

Because few people had knowledge about loudspeakers, the average knowledge score for loudspeakers was lower than those of the other products. Respondents' knowledge scores ranged from 0 to 7, with a mean of 2.42 and a median of 2. Their involvement scores ranged from 34 to 110. The mean score was 67.35, and the median was 66.5. Each median-split group's mean and standard deviation of its distance to the PIF are presented in Table 4.

The Effect of Product Type

The interactions between the types of product and the other three variables were examined first by a four-way ANCOVA. None of the four-way, three-way, and two-way interactions involving product types were

significant. The main effect of the product itself had a p-value of .86. Because product type has no interactive effect with other variables, data of the three tested products were pooled together, and product type was treated as a blocking factor in the model (Montgomery 1991).

Because the quality scores and price units were different among the three tested products, the original distance scores for brands were not equivalent for combining these three sets. Therefore, the distance score of each brand in the product categories was standardized (except for the test of Hypothesis 1), with a mean of 50 and a standard deviation of 10.

Manipulation Checks

A manipulation check was carried out to ensure the provided stimuli, simple versus complex information, were truly at different levels of information. Two evaluations were used as manipulation checks: if the information was understandable and if it was overwhelming. Subjects rated these on a 1 to 7 Likert-type scale (1 = strongly disagree).

The result of a between-subject t-test showed that the understandability of simple information (mean = 5.79, SD = 1.37) was greater than complex information (mean = 5.25, SD = 1.41), with $p < .001$ ($T[211, 181] = 3.81$). On the contrary, respondents felt that complex information (mean = 3.37, SD = 1.74) was more overwhelming than simple information (mean = .99, SD = 1.65), with $p = .03$ ($T[201, 177] = 2.16$). These results indicated that the manipulation of information level was effective, although not overwhelmingly large.

Correlation Check between Product Knowledge and Product Involvement

In previous studies, researchers suggested that involvement in a product class was positively related to product knowledge and information search (Bloch *et al.* 1986; Lichtenstein *et al.* 1988). Hence, the correlation between product knowledge and involvement should be checked before the ANCOVA test to ensure that these two factors were not confounded. Product knowledge and involvement were positively correlated at $\alpha < .001$, but the Pearson correlation coefficient was low at .22. The low correlation coefficient indicated that there was no serious confounding effect between product knowledge and product involvement.

Results of Tests of Hypotheses

Hypothesis 1 states that consumers will make a purchase decision

TABLE 5
Analysis of Covariance for the Purchase Decisions after Providing Information

Source	DF	MS	F
Product Type	2	26.05	0.35
Information	1	52.11	0.71
Knowledge	1	4.51	0.06
Involvement	1	176.45	2.39
Information × Knowledge	1	262.27	3.56*
Information × Involvement	1	18.74	0.25
Knowledge × Involvement	1	17.56	0.24
Information × Knowledge × Involvement	1	34.41	0.47
Pre-Information Brand (covariate)	1	6667.38	90.48***
Between-Subject Error	271	(73.69)	
Model [R ² = 0.28]	10	767.47	10.42***

Note. Values enclosed in parentheses represent the mean square error.

* $p < .10$; *** $p < .001$.

closer to the PIF when they receive product information. A paired t-test was employed to test this proposition. The mean change of the before and after information decisions was 2.06, with a standard deviation of .42. This difference had a t value of 4.89, significant at $p < .0001$ level. This indicates that respondents' purchase decisions did indeed move closer to the PIF after they read the provided product information.

The total sample size for the ANCOVA part was 282. Table 5 presents the ANCOVA results. Hypothesis 5 concerns the effect of product involvement, which was not supported because the main effects were not significant.

Planned contrast results are presented in Table 6. Hypothesis 2 states that experts are more likely to make better purchase decisions when complex product information is provided than when simple information is presented. The hypothesis was confirmed with an F value of 3.65 at the $p < .05$ level. Hypothesis 3 states that novices will be influenced more by simple information than by complex information, but this was not the case. Novices reacted to both simple and complex information similarly. The result of the Hypothesis 4 test showed that the effect difference between providing simple and complex information to experts (52.28 vs. 49.43) is larger than the difference of providing information to novices (48.99 vs. 50.19; $F = 3.56$, $p = .06$ level). The crossed lines in Figure 4 illustrate this two-way interaction effect.

Hypotheses 6 to 8 are the group comparisons of three-way interaction (Table 6). Hypothesis 6, that the effect of providing consumers with complex information is greater on uninvolved and knowledgeable consumers

TABLE 6
Planned Contrasts on Distance from the Perfect Information Frontier

Contrasts	DF	MS	F
H ₂ : for experts: complex info. > simple info.	1	268.78	3.65**
H ₃ : for novices: simple info. > complex info.	1	42.00	0.57
H ₄ : diff. of simple and complex information on expert > diff. of simple and complex information on novice	1	262.27	3.56*
H ₆ : providing complex information low involved expert > average of other three groups	1	28.00	0.38
• low involved expert > highly involved expert	1	0.33	0.00
• low involved expert > highly involved novice	1	118.93	1.61
• low involved expert > low involved novice	1	5.07	0.07
H ₇ : providing simple information low involved novice > average of other three groups	1	199.27	2.70*
• low involved novice > highly involved novice	1	58.44	0.79
• low involved novice > highly involved expert	1	337.55	4.58**
• low involved novice > low involved expert	1	62.53	0.85
H ₈ : highly involved novice with complex information and highly involved expert with simple information < all others	1	396.46	5.38**
• highly involved novice < other three groups, with complex information	1	171.10	2.32
• highly involved expert < other three groups, with simple information	1	226.56	3.07*

Note. The greater (>) and less (<) signs in this table represent the effect of independent variables. Hence, when the effect is greater, the average distance of chosen brands is closer to the PIF, and the mean value of dependent variable is smaller.

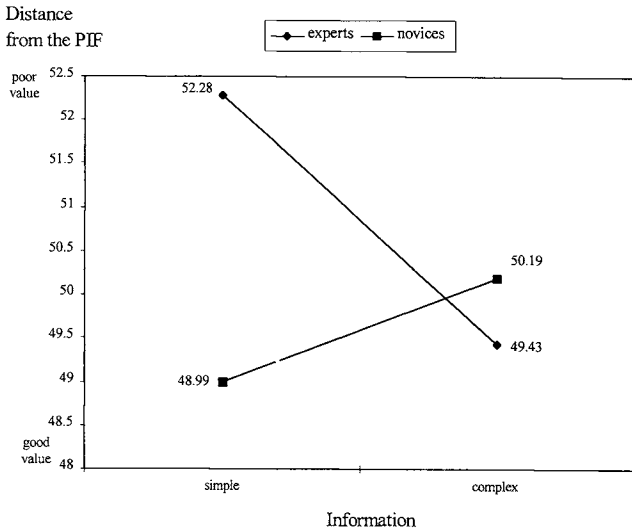
• denotes the sub-group comparison under the hypothesis.

*p < .10; **p < .05.

than on others, was not supported by planned contrasts. However, Hypothesis 7, the corollary that when simple information was provided, the effect of information on uninvolved novices was stronger than on other groups, was moderately supported. When the sample was broken down into three sub-group comparisons (*i.e.*, low involved novices versus highly involved novices, versus highly involved experts, and versus low involved experts), only one sub-group result was significant. The effect of simple information on relatively uninvolved novices was greater than the effect on involved experts ($p = .02$).

The effect of providing complex information to involved novices and the effect of providing simple information to involved experts were significantly less than the information effects on other groups (*i.e.*, H₈, $F = 5.38$, with $p = .02$, Table 6). Breaking Hypothesis 8 into two sub-group

FIGURE 4
The Joint Effects of Product Knowledge and Information Complexity on Brand Selection after Receiving Information



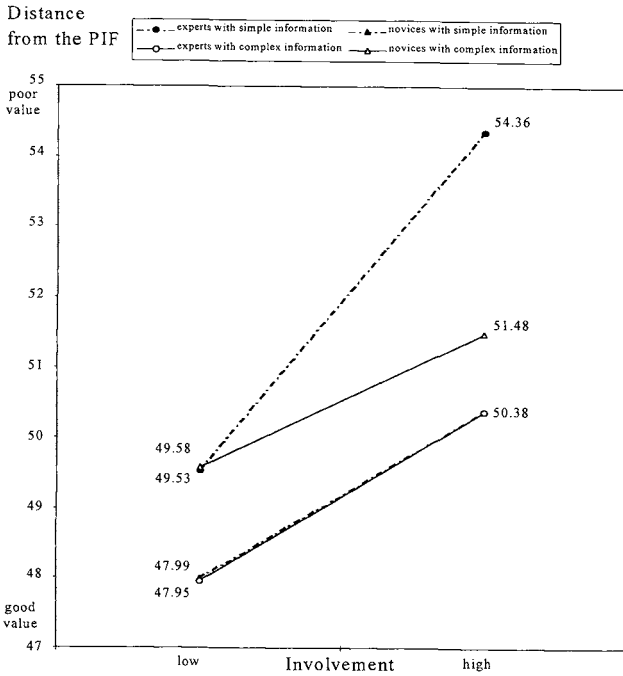
comparisons (*i.e.*, providing complex and simple information), only the simple information group was found moderately significant at the $p = .08$ level. When simple information was provided, the effect of information was weaker on involved experts than on others.

These group comparisons are also illustrated in Figure 5. Most lines in Figure 5 are almost parallel, except for the line of experts with simple information. Highly-involved experts with simple information (mean = 54.36) made purchase decisions farther away from the PIF than did other groups. Although it was not proposed, this difference was tested and found significant with an F value of 3.91, which was significant at $p = .05$ level.

DISCUSSION AND CONCLUSIONS

Given that the overall information effect was confirmed as Hypothesis 1 proposed, the more interesting findings in this study are the joint effects of provided information, product knowledge, and involvement. As found in previous studies and supported here, experts were more likely to be persuaded by complex product information than by simple information. Experts might not trust simple information (which might be differ-

FIGURE 5
Post-Information Distance to the PIF as a Function of Knowledge, Involvement, and Information Complexity



ent from what they know) because they already knew more than the provided information. However, the proposition that novices make better purchase decisions when simple information is presented than when complex information is provided was not supported. Perhaps novices did not have enough background knowledge to process the information. It is also possible that novices did not know which amount of information was helpful for their purchase decisions.

Furthermore, it was found that the difference in the effect of providing simple versus complex information to experts was larger than the difference in the effect of providing two types of information to novices. It is suggested that novices might not understand the complex information provided or might not realize that simple information was not enough to make a best purchase decision. On the other hand, knowledgeable consumers could easily distinguish the differences between simple and com-

plex information. Perhaps simple information, such as the overall quality scores and prices, was too elementary compared to what they already knew. When simple information is provided to them, experts might ignore the information and rely on their own product knowledge to make purchase decisions. Whatever the reason, experts' purchase decisions were significantly different under the two types of information, and the difference was significantly greater than the difference shown for novices.

It should be stated here that an anonymous reviewer has suggested a caveat to the interpretation of the evidence on the impact of complexity of information. The caveat is that the provision of complex information as defined by the listing and values of important attribute may actually amount to offering not more complex, but just "more" information. Although the subjects were provided with the footnotes or "Key Comments" along with the overall scores on attributes, the same reviewer felt that while this certainly makes information on loudspeakers more "complex," the same may not necessarily be said for jeans and coffee.

The effects of product involvement are not just simply associated with brand commitment as shown in previous studies (Beatty *et al.* 1988; Traylor 1981). The findings in the present study showed that the effect of involvement interacted with product information and product knowledge. Providing relatively uninvolved experts with complex information and uninvolved novices with simple information had stronger effects than the effects of other combinations. Involved experts receiving simple information and involved novices receiving complex information were the two groups of consumers who were least likely to be moved toward the PIF. Also, when simple information was provided, the information effect was stronger on uninvolved novices than on involved experts.

These results suggest that overall, to achieve the best effect of product information, experts should be provided with complex information, but simple information can help novices better. Also, both expert and novice consumers have to be relatively uninvolved to accept the provided information.

One additional finding in this study was the significance of the covariate, the brands selected before respondents were provided with information. After they read the provided information, most respondents still chose the same brands they preferred before seeing the information (66.67% for ground coffee, 64.24% for jeans, and 67.67% for loudspeakers). This result revealed that purchase experience was a very important factor for the successive purchase decisions.

IMPLICATIONS AND CLOSING COMMENTS

It has always been assumed that providing more information to consumers can help them make the right purchase decisions and reduce economic loss. However, this assumption has not been investigated thoroughly. This study fills a gap in previous research and examines the effects of provided information on purchase decisions.

The study successfully connects Maynes' Perfect Information Frontier to research in consumer behavior. Maynes' PIF was originally introduced for eminently practical purposes: to examine market efficiency, to provide price and quality information to consumers, and to educate consumers (Geistfeld, Maynes, and Duncan 1980; Maynes 1973, 1976, 1978; Maynes and Assum 1982; Maynes *et al.* 1984). This study uses the PIF as a theoretical basis. It was found that when consumers were provided with relevant and useful information, they moved toward the brands located on the PIF. Hence, the notion of the "Perfect Information Frontier" is validated. We recommend the use of PIF as a framework to investigate consumer behavior in the real market.

This study manipulates the complexity of information by presenting simple versus complex information. In a between-subject experimental design, it remains questionable whether the complex information was complicated enough or the simple information was elementary enough based upon respondents' evaluations. This argument can be related to the set-size effect (Kardes and Sanbonmatsu 1993). Kardes and Sanbonmatsu (1993) suggested that a within-subject design, which presents both simple and complex information (for different products) to subjects, can significantly create the effect of simple (i.e., small set) versus complex (large set) information. Also, when two types of information are presented in different orders, the moderating role of the reference object (*i.e.*, the first presented information) can be detected.

Similar to other consumer research, the results reported in this paper came from an experimental, "case study" type of setting. We have not observed "real world" purchases, with consequent limitations on the generalizability of the results. By the same token, when creating the Perfect Information Frontier, "prices" were the "representative" price published in *Consumer Reports* for each product, not the actual array of multiple prices offered by retailers in local markets. This probably had the effect—especially for coffee and jeans—that (1) the published PIF would be higher than the actual PIF, and (2) payoffs to information would be underestimated. We should add that the procedures for selection of products for

the experiment identified three products that are essentially experience goods. An anonymous referee has recommended further study using search goods for which, it is claimed, consumers might more readily peruse information.

As in many mail surveys, the sample of this study is slightly skewed to female, Caucasian, high education, and high-income groups (Sudman 1976). While the study was of a case study nature where analysis focused on differences between treatment groups and, therefore, non-response bias was not a critical issue, nevertheless the under-representation of non-Caucasian, low-educated, and low-income groups should be noted. Further studies focusing on the provision of information to these consumers would be highly desirable.

Maynes (1991) has suggested that price-quality maps and relevant product information should be provided in local consumer information systems. He argued that price-quality maps can explicitly help consumers' purchase decisions. This argument provides another research direction for future studies: Would a price-quality map move consumers' purchase decisions toward the PIF more than tabulated product information? More research should be devoted to the formation of product information and its effects on consumers' purchase decisions.

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