

Notes & Comments

Can Consumers Calculate Best Buys?

NOEL CAPON
DEANNA KUHN*

Within the cognitive development literature, a sizeable body of evidence has accumulated indicating that logical reasoning ability undergoes developmental transformations, and, furthermore, that not all individuals develop to the most advanced level. As a result, there is considerable variation in level of logical reasoning within an adult population (Neimark 1975; Papalia and DeVento Bielby 1974). It is likely that an individual's level of logical reasoning ability significantly affects his/her functioning as a consumer, but such effects remain largely unstudied, inasmuch as assessment of logical reasoning ability typically has taken place only in formal psychological test situations (Kuhn 1979a). The present study investigates one such possible effect.

The ability to reason at the level of formal operations (Inhelder and Piaget 1958) is defined behaviorally by the presence of certain reasoning strategies, notably isolation of variables, systematic combination, proportionality, and correlation. Subsequent research has supported Piaget's findings that these reasoning strategies are not evident until at least early adolescence. What is unique about the stage of formal operations, as was suggested in the preceding paragraph, is that it appears to be the only stage in Piaget's sequence that is not attained universally.¹

*Noel Capon is Associate Professor, Graduate School of Business, Columbia University, New York, NY 10027. Deanna Kuhn is Associate Professor, Laboratory of Human Development, Graduate School of Education, Harvard University, Cambridge, MA 02138. The authors wish to thank Maria Carmel Gurucharri for assistance in data collection. Author Capon acknowledges support from the Faculty Research Fund, Graduate School of Business, Columbia University.

Because of its relevance to consumer decision making, the focus of the present study was the formal operational reasoning strategy of proportionality, which entails the conceptualization of quantity in relative, rather than only absolute, terms. A number of studies have found only a limited incidence of the ability to reason proportionately (Karplus and Peterson 1970; Karplus, Karplus, and Wollman 1974; Lunzer 1965; Lunzer and Pumfrey 1966). Though subjects in these studies were still in their teens, little further development would be probable with their advancement into adulthood. This evidence led to our hypothesis that a significant number of adults would be unable to utilize a proportional reasoning strategy in a simple consumer decision-making context. If confirmed, such a finding would suggest that investigation of the underlying reasoning capacities of adult consumers in everyday decision-making tasks is an important area for further research.

A preliminary investigation (Capon and Kuhn 1979) supported this hypothesis. The present study investigates this hypothesis more thoroughly, utilizing a larger sample size and exploring the relationship between education and ability to use proportional reasoning.

METHOD

Subjects

The subjects were 100 female shoppers at a supermarket in a middle-income area in Cambridge, Massachusetts.

¹For comprehensive reviews of the literature relating to formal operations, see Keating (1980), Kuhn (1979b), or Neimark (1975).

Roughly 95 percent of the sample were Caucasian and five percent were Hispanic or Black. Twenty-two of the subjects had some high-school education or less, 25 had high-school diplomas, 33 had attended or graduated from college, and 20 had at least some graduate-level training.

Procedure

A young female interviewer approached shoppers individually in the supermarket and asked them to spend a few minutes assisting with a supermarket survey. She told them that they would receive one dollar in compensation for their time and, in addition, a chance to win 50 dollars. Upon agreeing to participate, the subject was paid one dollar and was offered a seat at a small table in the supermarket before beginning the interview, which lasted an average of five to ten minutes. The interview began with a short questionnaire on shopping habits, designed to make the subject feel at ease. The subject was then presented two problems, and was told that if she got either of them right she would get a chance to win 50 dollars, along with all other participants who got right answers. It was explained that there would be a drawing, and that she would have one chance in the drawing for each problem she got right.

The subject was then shown two bottles of Schilling garlic powder, identical except in size. The label on the larger bottle bore two weight indications, 2.37 oz. and 67 g. On the cap of the larger bottle, the price, 77¢, was clearly marked. The smaller bottle similarly bore two weight indications, 1.25 oz. and 35 g. A similar price marking of 51¢ on the smaller bottle was crossed off, but readable, and a sale tag marked 41¢ was clearly visible on the side. The interviewer commented to the subject, "You may want to use paper and pencil for these questions, so I'll just leave them here for you to use whenever you want." Referring to the garlic powder, she then continued, "Suppose this were a product you used a lot of. When you went to the store to buy some, you found you had a choice between these two sizes. How could you tell which one is the better buy?"

If the subject's response was similar to "you would have to figure it out," the interviewer asked the subject to do that, using the pencil and paper, if she wished. If the subject said that either "the bigger one" or "the one on sale" was a better buy, the interviewer asked, "How could you check to make sure the sale/bigger one is actually the better buy?" The intent here was to elicit the most advanced level of reasoning of which the subject was capable. If necessary, the interviewer asked, "Could you explain to me how you got that answer?" The interviewer recorded the subject's verbal response, and retained any written calculations performed by the subject. When the subject indicated either that she had reached a conclusion or was unable to proceed further, she was asked to mark on a 10-cm. barometer scale, with end points *very certain* (0 cm.) and *very uncertain* (10 cm.), how certain she was that the choice she had made was truly the better buy.

To assess the possibility that some subjects who were

unable to solve the preceding problem might nevertheless be successful if the ratio were a simple one (in this case 2:3), a second problem was included. The subject was shown two cans of ARRID XX aerosol deodorant, again differing only in size, one marked 8 oz. and the other 12 oz. The smaller can was marked \$1.36 and the larger can \$2.11 (no sale tag was used). The procedure that followed was identical to that used for the garlic powder.

Following completion of both of these problems, the subject was asked to complete the written questionnaire mentioned earlier. Questions in the final section pertained to the highest grade the subject had completed in school and whether she had ever studied problems like these in school.

The prices of the products were at a level currently being charged in supermarkets in the area. The actual prices were chosen such that there was a very slight difference in value between the two products (32.8¢ per ounce versus 32.5¢ per ounce for the garlic powder, and 0.170¢ per ounce versus 0.176¢ per ounce for the deodorant). In fact, the bigger bottle of garlic powder and the smaller can of deodorant were the better buys.

RESULTS

Classification of Reasoning Strategies

Subject's responses fell into six categories (Table 1).² The strategies described in these categories reflect a range from primitive strategies based on factors extraneous to the data to logically correct, completely generalizable strategies. Overall, the types of responses are similar to those obtained by Karplus and others (Karplus and Peterson 1970; Karplus, Karplus, and Wollman 1974; Lunzer 1965) in conventional psychological test situations.³

Category 1: Extraneous, task-extrinsic. Subjects in this category did not utilize the given price or weight data, even when encouraged to do so. Reasoning was based on factors extrinsic to the task objective, though task instructions directed the subject's attention explicitly to the criterion of "better buy" and suggested disregarding extraneous factors. Typical responses were:

"I'd buy the small one; I'd never use the big one up."

"I always buy the large sizes; I don't like to shop often."

Category 2: Extraneous, task-intrinsic. Subjects in this category, likewise, did not utilize the given price or weight data. Reasoning, however, was oriented to the task objective, and an inference was based on one or two additional cues in the task situation: the subject indicated either that the one labeled on sale is a better buy (garlic powder only)

²A subset of 50 responses was categorized by two independent raters and a reliability of 0.87 obtained; differences were resolved through discussion.

³More elaborate data would be required to establish that these categories comprise a developmental sequence; see Wohlwill (1973) for a discussion of the issues. No such claim is intended based on the present data.

TABLE 1
CLASSIFICATION OF REASONING STRATEGIES

Number	Category name	Description of operations	Conceptually correct	Inference present	Inference correct
1	Extraneous, task-extrinsic	Various	No	—	—
2a	Extraneous, task-intrinsic: sale	Choose alternatively marked sale	No	Yes	—
2b	Extraneous, task-intrinsic: size	Choose largest alternative	No	Yes	—
3	Partial, noninferential	Various	No	No	—
4	Subtraction	Calculate weight or weight and price differences and infer, with or without further calculation	No	Yes	—
5	Weight ratio diagnosis	Identify weight ratio and apply to prices	Yes	Yes	Varies
6	Direct ratio	Calculate price/weight or weight/price ratios	Yes	Yes	Varies

or that the larger size is a better buy. Probing ("How could you check to make sure the sale/bigger one is actually the better buy?") in these cases did not elicit any more sophisticated levels of reasoning.⁴

Category 3: Partial, noninferential. Subjects in this category applied some operations to at least some of the available weight or price data. They were unable, however, to complete these operations, and indicated inability to proceed further or to make an inference. The operations employed were wide-ranging and contained various elements of the operations involved in Categories 4 through 6. For example, one subject noted, "Four ounces added to the small one equals half more" (deodorant), but was unable to proceed further. Another subject calculated both the difference between the two prices and the difference between the two weights, then divided the price of the larger by the weight difference, but could not proceed further.

Category 4: Subtraction. These strategies covered a broad range of complexity but were characterized by the predominant use of subtraction operations and, in contrast to Category 3, presence of an inference. For example, one subject calculated the weight difference and the price difference and then noted, "With the bigger one you get 32 more grams for 36 more cents" (garlic powder), concluding that the larger was the better buy. Another subject calculated the weight difference and the price difference, and the ratio of the latter to the former. She then multiplied this ratio by the smaller weight and concluded that the larger was the better buy.

Category 5: Weight ratio diagnosis. Strategies in this category involved diagnosis of the ratio of the two weights.

⁴Even though subjects classified into Categories 1 and 2 did not make reference to either the price or quantity data, it is possible that proportional reasoning was within their competence. However, as the interview itself and the motivational incentives were designed specifically to minimize the performance/competence gap, we regard this explanation of Category 1 and 2 performance as extremely unlikely. The method used in the present study is dependent on the assumption that subjects had conscious awareness of, and could articulate, the strategies they used.

In the deodorant problem, conceptually correct calculations that followed this diagnosis were various, for instance, multiplying the price of the smaller product by 3/2 and comparing to the price of the larger, subtracting the price of the smaller product from the price of the larger and comparing this result with half the price of the smaller, and, finally, calculating the price per 24 ounces for each alternative by multiplying the prices of the small and large products by three and two, respectively. Occasionally, subjects made incorrect inferences following correct calculations.

A similar approach was possible on the garlic powder problem, based on an approximate ratio of 2:1. For example:

"About the same; just double the price and the size of the small one—you get three grams more for five cents more."

"Well, almost twice as much for less than twice the price; the big one is cheaper."

Category 6: Direct ratio. These strategies involved the calculation of direct ratios, either price per unit weight or weight per unit price, prior to the inference, and are highly generalizable. Included here are responses that consisted of a correct strategy followed by an incorrect inference, i.e., selecting the product with the higher price per unit weight as the better buy.

Subjects' Performance

In the garlic powder problem, numbers of subjects classified in Categories 1 through 6, respectively, were 7, 12, 15, 5, 33, and 28. In the deodorant problem, these numbers, again in Categories 1 through 6, respectively, were 7, 10, 16, 7, 24, and 36.⁵

⁵Of the 100 subjects, 66 scored at the same level on the deodorant and garlic powder problems, 23 had scores differing by one level, eight differed by two levels, and three differed by three or more levels. Of the 34 subjects who scored at different levels, 20 used a more advanced strategy on the deodorant problem, and 14 used a more advanced strategy on the garlic powder problem. Thus, the majority of subjects applied the same strategy to both problems, despite the fact that the ratio was a much simpler one in one of the problems.

The most striking result is the small number of subjects who employed a direct ratio strategy (Category 6). Moreover, not all of these subjects were able to make the correct inference following the correct ratio calculations, and, as a result, an even smaller number of subjects (23 of 28 and 34 of 36 in the garlic powder and deodorant problems, respectively) were able to complete the task correctly using a direct ratio strategy. (Incorrect solutions due to arithmetic errors were not penalized.)

Similar numbers of subjects, 33 for the garlic powder problem and 24 for the deodorant problem, employed the weight ratio diagnosis strategy (Category 5). In the deodorant problem, however, the only one in which a correct answer is unambiguously attained with this strategy, three subjects made incorrect inferences following a correct calculation.

The remaining strategies were conceptually incorrect. Twenty of the subjects in the garlic powder problem and 23 in the deodorant problem made at least some use of the available size or weight data, though their strategies were conceptually incorrect (Categories 3 and 4); in a large proportion of these cases, however, the subject was not able to carry a set of operations through to completion and make a resulting inference (Category 3).

The other subjects, 19 in the garlic powder problem and 17 in the deodorant problem, made no attempt to use the available size or weight data (Categories 1 and 2). The majority of these subjects relied on one of the two other cues present in the task situation and, as noted earlier, were incapable of any more advanced reasoning, when questioned further.

Degree of subjects' certainty about the correctness of their answers was related to category of reasoning, but the direction of this relationship was contrary to what might be predicted. Thus, in both problems, subjects using the most primitive strategies (Categories 1 and 2) were more certain of their choices than subjects who completed a calculation and made an inference (Categories 4, 5, and 6). For the garlic powder problem, $\bar{X}(1,2) = 0.99$ and $\bar{X}(4,5,6) = 3.09$, $p < 0.01$; for the deodorant problem, $\bar{X}(1,2) = 0.41$ and $\bar{X}(4,5,6) = 1.23$, $p < 0.01$.

To examine the relationship between educational level and performance, chi-square tests were carried out for the two problems separately. The relationship was very similar for the two problems; only that for the garlic powder problem is shown in Table 2. Results of chi-square analysis of the data in Table 2 were significant: chi-square = 29.77, $p < 0.001$. A similar result was obtained for the deodorant problem: chi-square = 33.05, $p < 0.001$. Despite these significant associations, not all subjects having advanced education used the higher-category strategies. Likewise, a number of subjects with less than high-school education used the most advanced strategies.⁶

⁶The relatively high average education level of subjects in this study may have accounted for their superior performance relative to subjects in our previous study (Capon and Kuhn 1979).

TABLE 2
CATEGORY FREQUENCIES BY EDUCATION LEVEL, GARLIC
POWDER PROBLEM

Education level	Categories		
	1 and 2	3 and 4	5 and 6
Some high school or less	12	3	7
High school diploma	6	8	11
Attended or completed college	1	8	24
Graduate training	0	1	19

DISCUSSION

Should the present findings be taken as a mandate for compulsory unit-pricing? Perhaps, but some caution is advisable before endorsing such action as a full and final remedy. First of all, unit-price information may not be used when it is available (Capon and Lutz 1976), and even when it is used, there still may be errors in interpretation, influenced to some degree by how the information is displayed (Gatewood and Perloff 1973; Russo, Krieser, and Miyashita 1975; Russo 1977). Thus, an institutionalization of unit-pricing may need to be accompanied by significant effort in the area of consumer education.

But, at a broader level, the question should be raised as to whether we should not be concerned with individuals' ability to determine such information for themselves. Unless we are sure that consumers have the ability themselves to make the critical comparisons and appropriate inferences, control of consumers' purchasing behavior remains, to some significant degree, in the hands of others. Furthermore, although educational level is certainly related to the ability in question, the presence of higher education by no means guaranteed it (nor did the absence of higher education assure its absence). Thus, how we might promote consumers' mastery of such cognitive strategies seems worthy of concern comparable with what kinds of information should be provided to the consumer.

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Life Styles and Consumption Patterns

STEPHEN C. COSMAS*

The total assortment of goods and services used by a consumer is hypothesized to be a mirror image of his/her life style (Levy 1963). This paper tests this relationship by means of activity, interest, and opinion (AIO) and product-use data collected from 1,797 female respondents drawn from a nationwide mail panel.¹

Many commercial and some published studies have developed relationships between particular brands or products and life style (see Wells 1975; Wells and Cosmas 1977; Ziff 1971 for a review of these studies), but this study differs in relating the consumer's total product and service assortment to life style.

The specific hypotheses examined are:

- H1:** There is a relationship between consumers' life styles and their total product-assortment decision.

- H2:** Each consumer life style has its own unique product assortment.

METHOD

Respondents completed a mail questionnaire containing 250 six-point, agree-disagree AIO items and 179 seven-point frequency-of-use product items.² Q-factor analysis was used to form life style and product typologies. This involved drawing two random subsamples of 450 respondents, the computer's limit for clustering. Each of these

¹The 1,797 respondents represented approximately a 90 percent response rate from a sample of 2,000. However, this was not the true response rate. According to Ferber (1980), the true response rate of a consumer mail panel is a function of the response rate of those who are mailed a questionnaire and the percentage that the selected sample is of the total panel. In the case of this study, the sample represented about 20 percent of the total panel, which, when combined with the sample response rate (90 percent) would give a true response of approximately 18 percent.

²To minimize any measurement effects from contiguity of the life-style and frequency-of-use product items in one questionnaire, the two sets of items were separated by an entirely different set of items which required respondents to alter their mental task.

*Stephen C. Cosmas is Associate Professor of Marketing, College of Commerce, Department of Marketing, DePaul University, Chicago, IL 60604. The author would like to thank Needham, Harper and Steers Advertising, Inc., Chicago, IL, especially their Director of Research, William D. Wells, for their support of this research.