

absolute physical magnitudes of the stimuli, whereas statistical analysis of the SOE revealed no systematic changes in magnitude and direction with changes in the absolute physical magnitudes of the stimuli. Taken together, these data provide further support for the view that the TOE is a perceptual phenomenon not explainable in terms of simple response bias, verbal categorization of stimulus values toward the mean, or by the idea that the activation induced by one stimulus is compared to a lower (or higher) fidelity mental referent of the other. The use of SRS permits consideration of current random walk and diffusion models without assumptions concerning the simple subtraction of stimulus information and hence realistic modification of these models to allow for explanations of the paired comparison of stimuli based on sensation weighting and influence of generic information.

References

- Allen, L.G. (1977). The time-order error in judgments of duration. *Canadian Journal of Psychology*, 31, 24-31.
- Bradley, R.A., & Terry, M.E. (1952). Rank analysis of incomplete block designs: I. The method of paired comparisons. *Biometrika*, 39, 324-345.
- Davidson, R.R., & Beaver, R.J. (1977). On extending the Bradley-Terry model to incorporate within-pair order effects. *Biometrics*, 33, 693-702.
- Diederich, A., & Busemeyer, J.R., (2006). Modeling the effects of payoff on response bias in a perceptual discrimination task: Bound-change, drift-rate-change or two-stage-processing hypothesis. *Perception & Psychophysics*, 68, 194-207.
- Hellström, Å (1979). Time errors and differential sensation weighting. *Journal of Experimental Psychology: Human Perception and Performance*, 5, 460-477.
- Hellström, Å (1985). The time-order error and its relatives: Mirrors of cognitive processes in comparing. *Psychological Bulletin*, 97, 35-61.
- Hellström, Å (2003). Comparison is not just subtraction: Effects of time- and space- order on subjective stimulus difference. *Perception & Psychophysics*, 65, 1161-1177.
- Jamieson D.G., & Petrusic, W.M. (1975). Presentation order effects in duration discrimination. *Perception & Psychophysics*, 17, 197-202.
- John, I.D. (1975). A common mechanism mediating the time-order error and cross-over effect in comparative judgments of loudness. *Australian Journal of Psychology*, 27, 51-60.
- Kellogg, W.M. (1931). The time of judgment in psychometric measures. *American Journal of Psychology*, 241, 1-52.
- Link, S.W. (1975). The relative judgment theory of two choice response time. *Journal of Mathematical Psychology*, 12, 114-135.
- Link, S.W. (1978). The relative judgment theory of the psychometric function. In J.Requin (Ed.), *Attention & Performance VII*. (pp. 619-630). Hillsdale, NJ: Erlbaum.
- Link, S.W. (1992). *The wave theory of difference and similarity*. Hillsdale, NJ: Erlbaum.
- Luce, R.D. (1959). *Individual choice behavior: A theoretical analysis*. New York: Wiley.
- Maeda, H. (1959). On the inhibitory effects of extrapolated stimuli in the successive comparison of brightness (I). *Japanese Journal of Psychology*, 30, 3-20.
- Masin, S.C., & Agostini, A. (1991). Attentional scanning and space errors. *Perception & Psychophysics*, 50, 285-289.
- Mattingley, J.B., Bradshaw, J.L., Nettleton, N.C., & Bradshaw, J.A. (1994). Can task specific perceptual bias be distinguished from unilateral neglect? *Neuropsychologia*, 32, 805-817.
- Ratcliff, R. (1978). A theory of memory retrieval. *Psychological Review*, 85, 59-108.
- Vandkerckhove, J., & Tuerlinckx, F. (2008). Diffusion model analysis with MATLAB: A DMAT primer. *Behavior Research Methods*, 40, 61-72.

TWO METHODOLOGICAL APPROACHES TO COGNITIVE ALGEBRA OF PURCHASE CHOICE

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Abstract

A consumer's evaluation of a product is affected by several factors. Information integration theory assumes that the evaluation process consists in a combination of information integration rules known as cognitive algebra. Functional measurement methodology applied to information integration theory provides the way of determining the most adequate integration function. Conjoint analysis was originated in mathematical psychology and developed in market research by Paul Green to determine the factors that predict consumer preferences for multi-attribute options about a wide variety of products and which combination of a limited number of attributes is most influential on respondent choice. In the present study, consumers' perceptions have been evaluated regarding three different prices, discounts, and brands of milk. Both functional measurement and conjoint analysis were used with the aim of estimating all the possible effects of interaction. The results are discussed in light of these two methodological frameworks.

The perception of a product convenience is a multi-attribute choice process in which several factors, like price (Olson, 1977), variety, habit, quality, brand name, even country of origin (Anderson & Cunningham, 1972; Hastak & Hong, 1991), affect the final evaluation by the consumer; the principal difficulty lies in detecting and identifying those factors that greatly influence the process; many kinds of multi-attribute utility models have therefore been developed for marketing applications with the aim of defining which product attributes move the consumer towards a precise purchase choice (J. G. Lynch, 1985; Oral & Kettani, 1989). Above all, two paradigms have been very effective: 'Conjoint analysis' (Luce & Tukey, 1964; Green & Rao, 1971; Green & Srinivasan, 1978) and 'Functional measurement', a methodology of Information integration theory (Anderson, 1981).

Despite the fact that these models are very similar in spirit, they emphasize different aspects (Lynch, 1985). The present work aims to simultaneously apply these models in order to integrate and compare them. In particular the goal of the experiment is threefold: firstly, to study how the perception of brand, price and discount affect the evaluation of dairy milk offers; secondly, to detect which integration function provides the best description of the evaluation phenomena; thirdly, to discuss the results obtained with the two methodologies.

Cognitive algebra and Functional Measurement

Information integration theory (Anderson, 1981) is a general paradigm applied in many fields of psychology, psychophysics and cognitive sciences. It assumes that perception, thought and action depend on the integration of multiple determinants: each level of a factor, that describes some attribute of a phenomenon, is represented in a cognitive system by a pair of values: a subjective scale value and a weight that represent its importance. Subjects' final responses depend on the integration of these pairs and IIT describes these processes adopting

three different models, known as ‘cognitive algebra’: additive, multiplicative, and averaging; in particular we will focus on additive and averaging models.

The additive model is a linear combination of the subjective scale value (note that in this case weights are confounded with scale units), so the ANOVA reveals no significant interaction among the factors, and the resulting graph of marginal means shows parallelism between curves, except for response variability; in contrast, the averaging model, that is a weighted sum of the subjective scale values, is not linear, and weights and scale value have to be identified as parameters, the ANOVA reveals significant interactions and the graph of marginal means shows deviations from parallelism.

Conjoint analysis

Conjoint analysis (Luce & Tukey, 1964) is a general methodological approach that has even been applied in marketing research with the aim of defining which product’s attributes move the consumer towards a purchase choice, and quantify its importance (Green & Rao, 1971; Green & Srinivasan, 1978).

Central to the approach is the concept of utility, meant as the satisfaction that a subject gains through the purchase of a consumer good. The Conjoint analysis techniques are based on the principle that the benefit given by a product depends on its characteristics: so, global utility is decomposed in various part-worth utilities, each one related to a different product characteristic, that allow us to obtain the relative importance index of a factor. From the methodologies available for the estimation of those part-worth utilities, we have chosen the one based on Ordinary Least Squares, which consists of fitting a linear regression model with dummy variables; beta parameter estimates represent the weight of the factor levels.

Experiment

Participants

20 students (11 female and 9 male, average age: 22.75 years).

Apparatus and stimuli

Subjects filled out a web-designed questionnaire, whose pages showed a tag with a description of a product profile and a response scale (from 0 to 20) to rate the subjective evaluation of the profile convenience. Tags were presented three times for the full-factorial design (Brand: 3 levels, Price: 3 levels, Discount: 3 levels) and for each two-way sub-design for a total of 162 pages, and an experiment duration of 15-20 minutes.

Procedure

Three brands of milk were selected: the first one, named A, well-known in Italy; the second one, named B, less famous; and an invented third one, named C, with a name that suggested a local provenance.

Six starting prices and three discount value (0%, 10%, 20%) were chosen to obtain three discounted prices (€ 1.32, € 1.44, € 1.56), as shown in Table 1. Discount, brand name and starting price were shown to the subjects. When the tag profile reported “Discount: 20%” or “Discount: 10%” starting price was crossed out as in a marketplace offer, but discounted price was not shown; instead, if the discount level was 0%, the label “No discount applied” was reported and the discounted price was shown directly. In such a way subjects were unaware of the effective cost of the product, and they were obliged to infer it by the presented factors.

Table 1: Price of the brands of milk. Starting price is submitted to a certain discount level to obtain the effective price, which is the level of the price variable

Starting Price	Discount	Discounted Price
1.95	20%	1.56
1.73	10%	1.56
1.80	20%	1.44
1.60	10%	1.44
1.65	20%	1.32
1.47	10%	1.32

Results and Discussion

Considering the starting price as a factor, independentl of the brand, an ANOVA with orthogonal contrasts was performed comparing pairs of different starting prices that, submitted to different discounts, gave the same effective cost: results revealed that a rough estimation of the real price appears be more accurate with higher starting prices than with lower ones ($F = 7.87$; $p < .05$), as shown in Figure 1.

Conjoint analysis, performed with effect coding on the principal effects of the full factorial design, showed that Discounted Price had the greatest relative importance (61%) while the Discount and Brand had approximately the same importance (~ 20%).

Orthogonal contrasts showed that there was no significant three-way interaction ($F = 1.06$; $p = 0.39$), whereas all two-way interactions were significant except for Brand x Discount. They also revealed that brand A, the most famous, was preferred to both B and C ($F = 16.87$; $p < .01$) and that there was no significant difference between those two.

Brand and Discounted Price

Integration of these factors, in the 10% and 20% discount case, revealed a significant interaction ($F = 2.91$; $p < .05$) and the subjects adopted an averaging model for the integration function; in contrast, in the 0% discount case, subjects adopted an additive integration function and there was no significant interaction ($F = 1.82$; $p = .13$); however, when the label “No discount applied” was omitted (sub-design, right panel of figure 2) they returned to an averaging model ($F = 3.40$; $p < .05$).

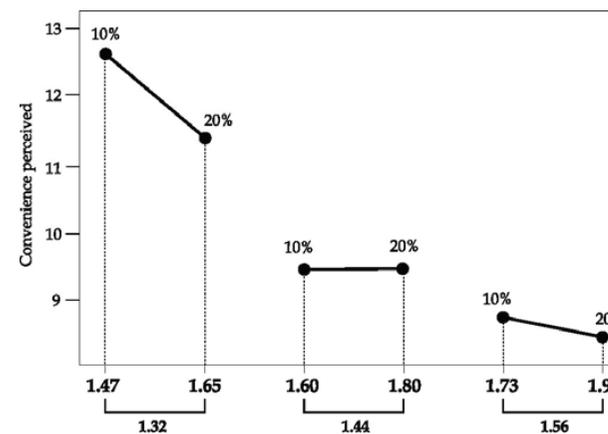


Figure 1: Influence of the discount variable on the trend of a Brand x Price interaction.

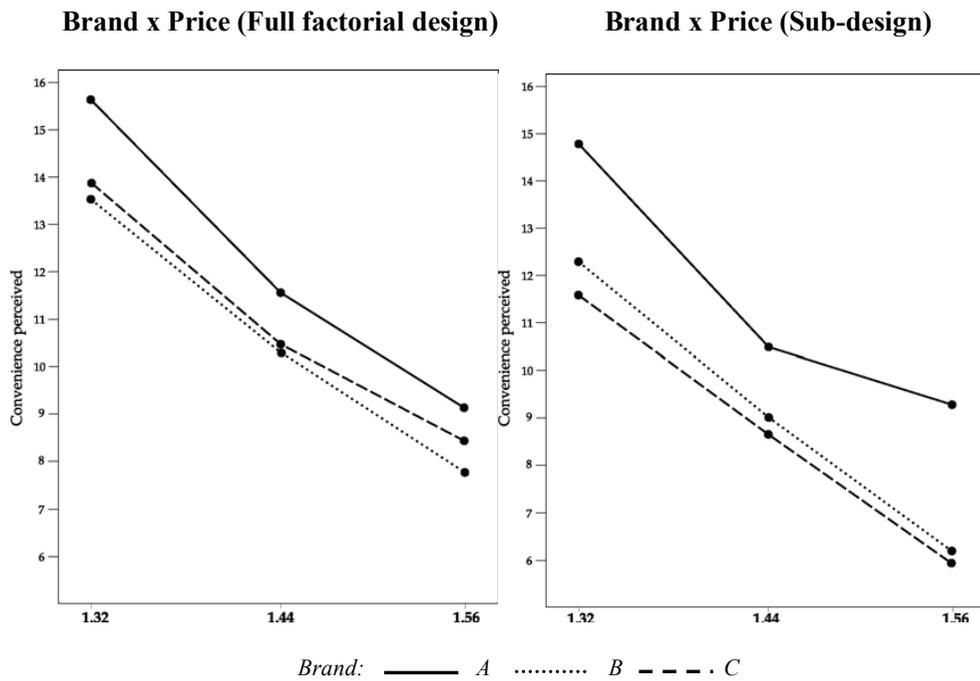


Figure 2: Marginal means for the full factorial design with 0% discount level (left panel) and for the sub-design Brand x Price (right panel).

Brand and Discount

These two factors are integrated additively: neither the full-factorial design, nor the sub-design, revealed significant interactions. The perception of convenience of brands, decreased, in the first one, with the increases in discount ($F = 7.82$; $p < .05$); while, in the second one, the trend was inverted ($F = 50.73$; $p < .01$) and that is also confirmed by the part-worth utilities of Conjoint analysis, shown in table 2.

Discounted Price and Discount

These two factors were integrated in an averaging way: interactions were significant in both the full-factorial design ($F = 10.80$; $p < .01$) and sub-design one ($F = 10.68$; $p < .01$), but the general trend of convenience perception changed strongly with the presence (full-factorial) or absence of the brand indication (sub-design).

Figure 3 for the full-factorial design (left panel) reveals that, when the starting price was followed by the discount information, the subjects judged the offer worse than in the case in which they had the price and an indication of 0% discount, despite the fact that the effective cost of the product was the same in both cases; it is worth noting that this happened only with the low price: when the final cost was higher, instead, the preferences became equivalent, as orthogonal contrasts confirm ($F = 37.16$; $p < .01$). This supports the idea of a preventive integration operation that increases in accuracy with the increased value of the presented price.

In the sub-design case (right panel of figure 3) the absence of brand indication, for higher price, implies an increased influence of the discount factor in the global evaluation of convenience ($F = 24.47$; $p < .01$).

Table 2: Part-worth utilities estimated with the Conjoint Analysis for the full factorial design and for all the sub-designs.

Factor	Level	Full factorial design	Sub-designs		
			Brand x Discount	Price x Discount	Brand x Price
Brand	A	0.63	0.63	/	0.76
	B	0.34	0.43	/	0.35
	C	0.36	0.43	/	0.28
Price	1.56	0.00	/	0.69	0.00
	1.44	0.32	/	0.48	0.39
	1.32	1.00	/	0.59	1.00
Discount	20 %	0.29	1.00	1.00	/
	10 %	0.41	0.48	0.76	/
	0 %	0.62	0.00	0.00	/

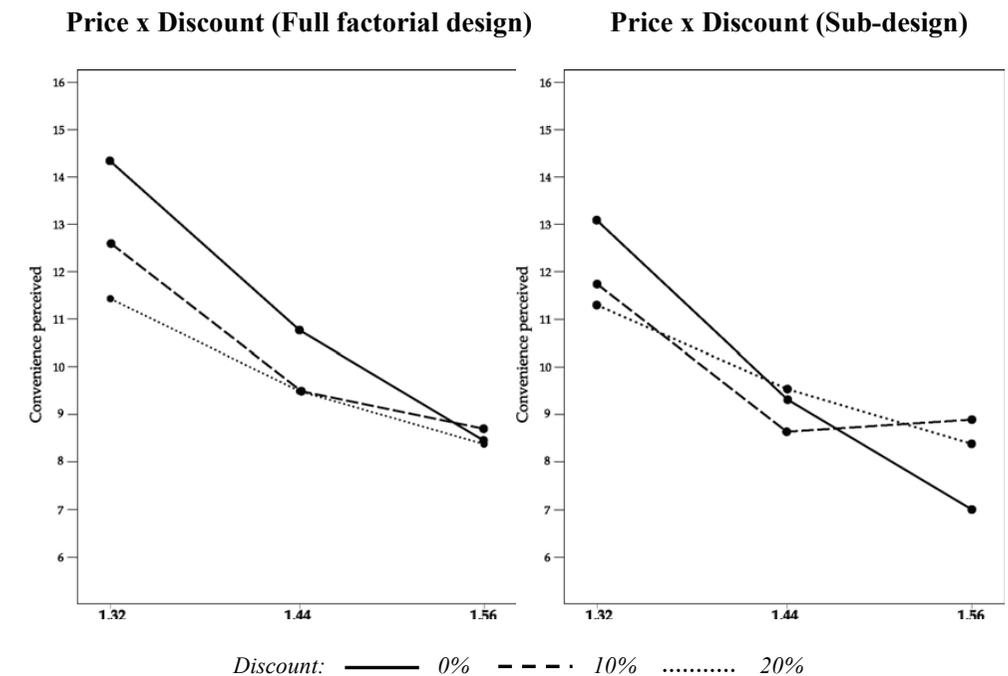


Figure 3: Plot of marginal means for the price x discount interaction, for the full factorial design (left panel) and for the sub-design (right panel).

Conclusions

The results suggest that the perception of the product's final price, as a result of a prior integration of the shown factors, affects the consumer's evaluation of an offer.

The accuracy of such a process seems to increase with the increases in starting price, even if consumers tend to underestimate the product final price; this is supported by the

observation that the presence of a price seems to move the consumer to purchase a profile without discount, despite the fact that final prices were the same in all the designs.

It also seems to be influenced by the subjective evaluation of the brand: not only are famous brands given more consideration than unknown ones, but the presence or absence of brand indication has a strong influence on the global judgment.

“Conjoint analysis and Functional measurement appear to be largely complementary, not competitive” (Luce, 1977); the former is capable of providing the relative importance of the factors, especially for principal effects; the latter, instead, works particularly in the presence of interaction effects trying to describe the integration process that underlies them.

They both prove useful for globally analyzing the trend of the phenomenon, however, in Conjoint analysis, if a non additive integration rule is required, “part-worth utilities are estimated only as a vehicle for estimating the overall evaluation of each option” (Lynch, 1985) thus losing the psychological information that instead is typical of the information integration paradigm.

References

- Anderson, N. H. (1981). *Foundation of information integration theory*, Academic Press, New York.
- Anderson, N. H. (2001). *Empirical direction in design and analysis*, Erlbaum, Mahwah, NJ.
- Anderson, W.T. & Cunningham, W. H. (1972). Gauging foreign product promotion. *Journal of Advertising Research*, 12, 29-34.
- Green, P. E. & Rao, V. R. (1971). Conjoint measurement for quantifying judgmental data. *Journal of Marketing Research*, 8, 355-363.
- Green, P. E. & Srinivasan, V. (1978). Conjoint analysis in consumer research: issues and outlook. *Journal of Consumer Research*, 5, 103-123.
- Hastak, M. & Hong, S. T. (1991). Country-of-origin effects on product quality judgments: an information integration perspective. *Psychology and Marketing*, 8 (2), 129-143.
- Luce, R. D. & Tukey, J. W. (1964). Simultaneous conjoint measurement: a new type of Fundamental measurement. *Journal of Mathematical Psychology*, 1 (1), 1-27.
- Luce, R. D. (1977). Conjoint measurement: a brief survey. In: Bell, D.E., Keeney, R. L. & Raiffa, H. (Eds), *Conflicting Objectives in Decisions*, Chichester, Wiley.
- Lynch, J. G., Jr. (1985). Uniqueness issues in the decompositional modeling of multi-attribute overall evaluations: an information integration perspective. *Journal of Marketing Research*, 22 (1), 1-19.
- Olson, J. C. (1977). Price as an informational cue: effects on product evaluation. In: Woodside, A. G., Sheth, J. N. & Bennet, P. D., (Eds), *Consumer and industrial Buying Behaviour*. Amsterdam: North Holland.
- Oral, M. & Kettani, O. (1989). Modelling the process of multiattribute choice. *The Journal of the Operational Research Society*, 40 (3), 281- 291.

COMPARISON BETWEEN TEACHER'S LIFE EVENTS RATING SCALE (TLERS)

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Abstract

The main purpose of the present study was to compare ratings of teachers' life events (TLERS) in high school and elementary school teachers. 138 teachers from several elementary and high schools from São Paulo State and 20 teachers from Elementary and High School Fernando Lobo, Juiz de Fora – Minas Gerais State- Brazil answered these questionnaires. Pearson's correlation was 0.26, indicating that, probably, cultural and social factors can influence teachers' social representations. The Beck Inventories BDI and BAI in Juiz de Fora's teachers indicated low anxiety and no traces of depression.

Kamizaki & Faleiros Sousa (2001) proposed the Teacher's Life Events Rating Scale questionnaire (TLERS) to determine the events in a teacher's life that can affect and activate social readjustment-- the intensity and length of time necessary to accommodate to a life event regardless of its desirability (Holmes & Rahe, 1967), whether it produces stress or not. This scale was administered to 138 teachers from São Paulo State - Brazil. Relationships with students such as *facing disrespectful students* and *discipline problems* were considered to require the greatest degree of social readjustment.

Goal

The main objective of the study was, using the psychophysical method proposed by Stevens (1975), to determine the differences between teachers from Juiz de Fora, Minas Gerais State and teachers from several cities of São Paulo State, Brazil.

Method

Subjects: The subjects were 19 teachers: 4 men and 15 women with ages between 23 and 59 years old in EE Fernando Lobo – Juiz de Fora-MG.

Materials: A paper questionnaire was developed, the first page consisting of instructions on magnitude estimation and the second page consisting of a list of 20 teacher's life events.

Procedure: Magnitude estimation (Stevens, 1975) was used with *Correcting tests* as the standard and no assigned modulus. The standard had occupied the 10th position in previous Experiments. Subjects were to judge events in proportion to their rating of the standard. Stimuli were presented in random order.

Results and Discussion

Table 1 shows that *Facing disrespectful students* (M = 115.4, 112.57)) and *Student disinterest* (M = 90.44, 101.07) were rated highest, while *Class Preparation* (M = 1.7, 10.63) and *Class Exhibition* (M = 3.48, 13.46) were minor life events.

Relationships with teachers and students were ranked the most stressful events. These human relations, though complex, are basic pieces in an individual's behavioral and professional life. In this way, the analysis of the relationships between teacher and student involves both interests and intentions. The problem is, almost certainly, in the failure to match these interests and intentions.