On the evaluation of savings: the role of numeracy

Michele Graffeo[1] - Nicolao Bonini[2][*]

[1] *Department of Information Engineering and Computer Science (DISI), University of Trento, Trento, Italy*

[2] *Department of Economics and Management, University of Trento, Trento, Italy*

michele.graffeo@unitn.it

Abstract

The aim of this paper is to investigate the mental operations that consumers use to compare discounts that are presented by two presentation formats. Moreover, we studied the differences in the mental operations used by consumers with low and high ability to manipulate numbers (numeracy). The results indicate that low numerate consumers chose the discount without doing any arithmetic operation more frequently than high numerate consumers. Also, consumers who adopted this intuitive decision process were more prone to choose the less advantageous commercial offer which was presented by the percentage-off format.

Keywords: Numeracy; Consumer behavior; Affect heuristic; Intuitive choice; Consumer protection

1. Introduction

Several factors influence the perceived value of a deal. Amongst the most important factors is the price comparison format (Krishna, Briesch, Lehmann & Yuan, 2002). Specifically, the percent-off format (e.g., 20% less) looks

more attractive than the money-off format (e.g., 11€ less), especially when the initial price is low (Armstrong, 2010). Finucane, Peters and Slovic (2003) proposed an explanation based on the affect heuristic and the evaluability principle (Hsee, 1996). The evaluability principle indicates that easy-to-evaluate information forms precise/well defined affective impressions, while hard-to-evaluate information elicits unclear affective impressions. In turn, the precise affective reaction has a greater weight in the decision process, compared to the poor salience of unclear affective reaction. Values expressed in proportional terms (like a percentage discount) are a good example of easy-to-evaluate information because they can be easily mapped on a zero-to-one scale, a sort of normalized form of presentation, which is – at least in part – independent from the context (i.e., the kind of product, the initial price, etc.). Consumers quickly learn which are the standards of the commercial practice concerning the discounts, so they would probably consider "27.5% off" a good discount, since it is close to the upper end of the scale in the usual retail practice. In contrast, an absolute value (e.g., 10€ off discount) requires a context (e.g., the initial price) in order to estimate how good the deal is. The additional information and the related mental operations make the money-off format harder to evaluate, compared to the percentage format. According to Finucane and colleagues (2003) easy-to-evaluate information produces a stronger and more pleasant emotional reaction, hence people should like more the percentage format, compared to the money-off format.

In the context of the evaluation of numerical information the distinction between easy and hard to evaluate is not absolute – it depends on numeracy, i.e. the ability to comprehend, use and attach meaning to numbers (Peters et al., 2006). Peters and colleagues (2006) showed that people with a high level of numeracy have similar responses/reactions to different presentation formats and this may depend their ability to easily convert one format into the other. Highly numerate people may find both money-off and percentage formats equally easy-to-evaluate and this would create a mental representation of the problem which is common to the different problem descriptions. By contrast, people with a low level of numeracy tend to stick with the initial representation of the problem and are strongly affected by the framing of the discount. In their case, the distinction between the presentation formats remains strong, with only the percentage format that is considered easy-to-evaluate, while the money-off format should be hard-to-evaluate. The aim of this paper is to study the choices between percentage and money-off formats and to investigate the mental operations used to compare the two alternative discounts by contrasting the mental processes of people with high and low levels of numeracy.

2. Method

The participants (N = 381; mean age = 40.7; SD = 14.2; 50% males) were interviewed in shops and supermarkets. The participants read three scenarios: two shops offer a deal on the same model of a product (Pillow, Ski Helmet or Backpack). One deal is expressed by the money-off format (e.g., 12€ off) while the other by the percentage format (e.g., 22% off). The scenario (abridged version) reads: "Imagine that you wanted to buy a backpack and you received two flyers. One flyer indicates that shop A, (15 minutes drive from home), sells a backpack that you like for 50€, with a 22% discount. Shop B (15 minutes drive from home) sells the same model of backpack, (initial price: 50€, 12€ discount). In which shop do you want to go?". The order of presentation of the two offers and of the three scenarios was reversed for half of the participants (no order effects). It is important to note that, in order to choose optimally, the consumers should compare analytically the two options and that in all scenarios the percentage discount has a lower value than the money-off discount (e.g., a 22% of 50€ is less that 12€). In order to investigate which comparison process they used, after each choice we asked the consumers whether they converted the discounts into the alternative format before selecting their preferred deal (i.e., if they calculated how much is 22% of 50€ or to which percentage correspond 12€ out of 50€. Doing one calculation is sufficient to find the dominant option). This information is crucial because it indicates to which extent the participants used an analytical process in their decision. Finally, the consumers completed a numeracy questionnaire (Lipkus, Samsa & Rimer, 2001). In the following analyses we use the number of correct answers as a numeracy measure (score range from 0 to 11; mean = 8.1; SD = 2.3; median = 9). In order to analyze the influence of a categorical within-subject variable (the choices for the three products) on the binary choice between the discounts we run a series of *Generalized Estimating Equations* models (GEE) (Hosmer & Lemeshow, 2000) – the factor "product" is not significant, the participants choose similarly for pillows, ski helmets and backpacks.

3. Results

To examine the relationship between Numeracy, Operations used in the decision process and Choice we conducted a mediation analysis (Hayes, 2009). Model A (I.V.: Numeracy. D.V.: Choice): low numerate consumers prefer the percentage discount more frequently than the high numer-

ate consumers (Wald $\chi^2[1]$ = 9.4; p = 0.002; β = 0.11). Model B (I.V.: Numeracy. D.V.: Operations): low numerate consumers choose without any mathematical computation more often than the highly numerate consumers (Wald $\chi^2[1]$ = 155.4; p < 0.001; β = 0.17). Model C (I.V.: Numeracy and Operations. D.V.: Choice) indicates a mediation effect: numeracy does not significantly affect the consumers choice (Wald $\chi^2[1]$ = 2.7; p = 0.097; β = 0.07), while doing any arithmetic operation increases the preference for the money-off discount (Wald $\chi^2[1]$ = 6.4; p = 0.012; β = 0.28). It is important to note that the participants who did not do any operation chose the percentage discount more frequently than the participants who compared the two discounts (52% vs. 32% - Wald $\chi^2[1]$ = 19.7; p < .001), regardless of their arithmetic ability (preference for the percentage discount, low numeracy consumers: 53%; high numeracy consumers: 49%; Wald $\chi^2[1]$ = .14; p = 0.71).

4. Conclusions and discussion

The logic of the mediation model indicates that low numeracy consumers like most the percentage-off framed discount, but this preference is due to their decision process: many of them choose without doing any arithmetic operation and this process facilitates the preference for the saving option that is framed with the percentage-off format. Notably, also the highly numerate participants, prefer the percentage discount when they don't do any calculation. Several elements (e.g., the preference for the easy-to-evaluate option, which generates precise affective impressions and the choice without calculation) indicate that low numerate consumers might use an intuitive decision process, which in this context leads to a suboptimal choice (the percentage discount is lower in value than the money-off discount).

Price comparison is a fundamental element of competition, and prices should be transparent and easy-to-evaluate in an efficient competitive market. Prices are also relevant information in consumer choice. This is particularly true in economic recession times, when consumers strive to keep expenses under control, and try to make most of the value for their money. For all these reasons (e.g., market efficiency; consumer protection), price is also the focus of commercial law systems. For example, the European Union Law on misleading commercial practices states that a way to mislead a consumer is related to "the price or the way in which this is computed, or the stating of a specific advantage related to it" (Directive 2005/29/EC of May 11, 2005, Art. 6, letter d).

Reported findings demonstrate that the way a price comparison is framed is not neutral. For consumers who adopt an intuitive decision process the frame of price comparison matters, and might induce them to make inefficient choices such as preferring the least to the most savings.

References

Armstrong, J.S. (2010). *Persuasive advertising: evidence-based principles*. London: Palgrave Macmillan.

Finucane, M.L., Peters, E., & Slovic, P. (2003). Judgment and decision making: the dance of affect and reason. In: Schneider, S.L., & Shanteau, J. (eds.), *Emerging perspectives on judgment and decision research*. New York: Cambridge University Press, pp. 327-364.

Hayes, A.F. (2009). Beyond Baron and Kenny: statistical mediation analysis in the new millennium. *Communication Monographs*, 76 (4), 408-420.

Hsee, C.K. (1996). The evaluability hypothesis: an explanation for preference reversals between joint and separate evaluations of alternatives. *Organizational Behavior and Human Decision Processes*, 67 (3), 247-257.

Krishna, A., Briesch, R., Lehmann, D.R., & Yuan, H. (2002). A meta-analysis of the impact of price presentation on perceived savings. *Journal of Retailing*, 78 (2), 101-118.

Lipkus, I.M., Samsa, G., & Rimer, B.K. (2001). General performance on a numeracy scale among highly educated samples. *Medical Decision Making*, 21 (1), 37-44.

Peters, E., Västfjäll, D., Slovic, P., Mertz, C.K., Mazzocco, K., & Dickert, S. (2006). Numeracy and decision making. *Psychological Science*, 17 (5), 407-413.