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Abstract

The aim of our study was to understand the powe of the brand in the decision of consumers. We evaluate 07 subjects judgment to chocolate brand, taste and to taste knowing the brand using the Direct Magnitude Estimation (DME). The exponent of the power law was used as the quantification of the subject's magnitude. The exponent obtained to brand was 0.34 (r= 0.94) and the obtained to taste was 0.55 (r= 0.97). The theoretical exponent calculated was 0.63. Our empirical exponent obtained for that experimental condition taste knowing brand was 0.71 (r= 0.91). We successfully use direct ration magnitude estimation to quantify the subjective "preference" for chocolates considering two dimensions, taste and brand. Our data suggest that the association of taste and brand inputs a more powerful effect on the decision about how good the chocolate is, since the empirical exponent to taste knowing brand is higher than that theoretically calculated. In conclusion, we can suggest that brand has a strong bias in the decision.

Keywords: Psychophysical Scaling, Magnitude Estimation, Taste Perception, Decision Making, Neuromarketing.

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Introduction

Recently, researchers and professionals in the field of marketing and advertising has sought the aid of neuroscience as a way to understand the foundations of market behavior, as the motivational aspects and decision making (Lee, Broderick, & Chamberlain, 2007; Morin, 2011; Oreja-Guevara, 2009). On the same wave, great attention has been given to methods of psychophysical scaling as a tool for quantitative study for understanding behaviors related to consumption (Crandall, 1992; Labbe, Pineau, & Martin, 2012).

Psychophysical scaling has been applied to a great diversity of conditions, from simple perceptual events as time duration of light and dark conditions (Marinova, 1978), the judgment of odor and flavor (Engen, 1964; Fons, 1970), the sensation of softness (Friedman, Hester, Green, & LaMotte, 2008), to complex events such as the severity of offenses (Kvalseth, 1980) and hedonic values (Lim, 2011; Veldhuizen, Wuister, & Kroeze, 2006).

Although in neuromarketing is called for the use of psychophysiological methods such as measures skin impedance, heart beat rate and the use of high complexity techniques such as functional magnetic resonance imaging (Plassmann, Ramsoy, & Milosavljevic, 2012) and event-related evoked potentials (Ariely & Berns, 2010), the behavioral techniques of subjective scaling measurements has been little used, but with impressive results. Multidimensional scaling was used to planning marketing strategies to attract new physicians to the hospital (Pegels & Sekar, 1987). Another example is the marketing based in the physicians health service based on the patient perception of the medical procedures determining factors for patient satisfaction (Jung & Hong, 2012).

In our study, we addressed a more basic question related to the consumer decision. Can the brand influence our chocolate taste perception? Our rational is regarding to the fact that our decision-making processes are based in both top-down and botton-up processes. The Top-down process in this context means that our perception could influence the chocolate taste and, in our case the brand, could influence the buy decision by the consumer.

Methods

We used the Direct Magnitude Estimation (DME) to assess the subjective metrics related to chocolate taste and the brand strength. The DME method was developed by SS Stevens (Stevens, 1956; Stevens & GALANTER, 1957; Stevens, 1966), in which numbers are directly addressed to the subjective magnitude regarding a stimulus presented. The relation between the subjective magnitude and the physical manipulation of the stimulus can be expressed by the power function:

$\psi = k\varphi^n$ (Eq.1)

This means that the magnitude estimated ψ grows as the physical φ raised to a power of n.

Subjects

The scaling procedure of DME was performed by nine subjects, mean age of 28.6 yrs (SD= 6.3; 4 females). Inclusion criteria were best-corrected visual acuity of 20/20 or better measured monocularly at 4 meters using an ETDRS chart – tumbling E (Xenonio, Sao Paulo, Brazil), refraction of ≤ 3.0 diopters considering the spheric equivalent of astigmatism values, absence of ophthalmological diseases and absence of known neurological and systemic diseases. Smokers and users of alcohol (defined as more than 1 daily dose) were excluded since it could interfere negatively in taste. All subjects gave a signed informed consent to participate in the experiment. All were naive to the specific experimental question. This study is also in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

Materials

Commercial chocolates available in regular markets of Brasil were selected for the study. We chosen seven different brands, based in their price to the consumer. Two brands were of inferior price, three of medium prices and two of superior prices. The prices were based in a kilogram of chocolate and are presented in Table 1 leftmost columns.

The chocolates were fragmented into small pieces sizing approximately 1 cubic cm, immediately before the evaluation begins to avoid lost of odor and taste proprieties.

Procedure

Direct Magnitude Scaling is a very simple procedure and consists of arbitrarily associates a number to a particular dimension, in our case, the chocolate taste first, than the brand. The subject task was to judge the next dimensions relating then to the first dimension, adjusting the number to match their impression. Is the first dimension was numbered as 10 and the second dimension appears to have three-fold more sensation, the subject have to give a corresponding number, in this case 30. For more detailed explanation regarding the method see (Stevens, 1956; Stevens, 1987).

A preliminary training session was performed for each subject to guarantee they had understand the procedure and were able to perform it. The preliminary training consisted of a DME procedure in a task of judge the line length in a series of ten lines. All subject performed it satisfactorily.

The chocolate numbered of four was chosen as our modulus (reference). The subject tasted that chocolate and the arbitrary reference number 50 was associated to it. Than the subject did mouthwash with filtered water to reduce the adaptation to the previous taste and rebalance the mouth pH. Mouthwashes were performed in between all chocolate tastings. Another randomly chosen piece of chocolate was tasted and they have to gave a number based in they judgment.

Additionally, at the end of the experiment session each subject reported a preference for chocolate on an interval scale of 1 to 10 (do not like - like a lot).

Results

All subjects performed the entire session, evaluating the chocolate taste, the chocolate brand and the chocolate taste knowing their brands. The summary of results is shown in Table 1 rightmost columns.

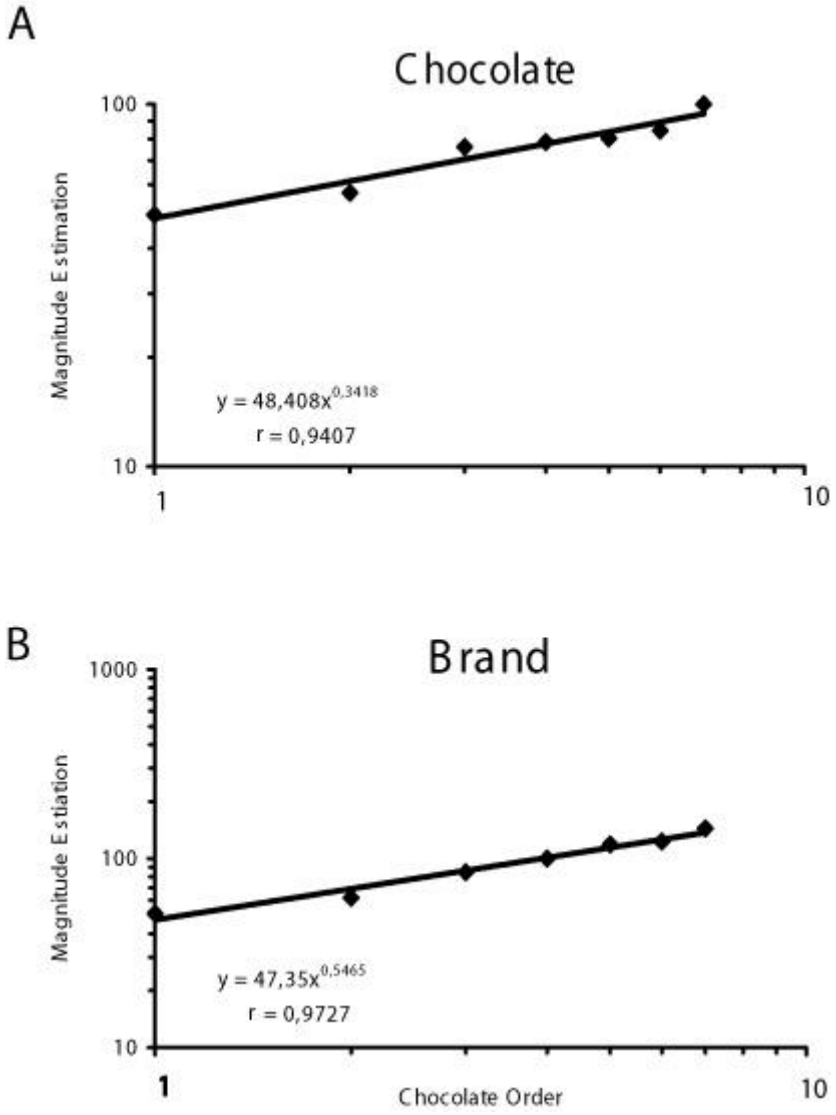
Table 1. Descriptions of chocolates and the DME scores

Brand	Price*	Taste Score	Brand Score	Combined Score
1	15,00	62,9	51,2	28,0
2	21,00	72,4	61,9	75,0
3	30,00	96,4	84,6	84,0
4#	28,00	100,0	100,0	100,0
5	35,00	102,5	118,7	100,9
6	41,50	107,5	122,7	107,9
7	100,00	127,2	144,2	136,2

* Price based on a kilogram of the chocolate
# Chocolate used as the modulus

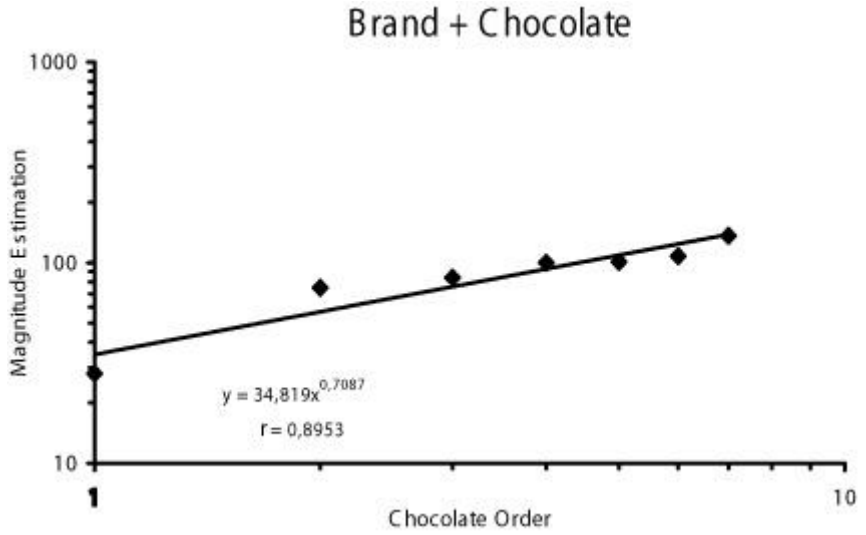
For the chocolate taste, we found an exponent of 0.34, with a high correlation coefficient (r= 0.95), expected in DME procedures. The brand was scaled with an exponent of 0.55 (r= 0.97). These results are shown in Figure 1.

Figure 1. *Magnitude Estimation equations and correlation coefficients to chocolate taste (A) and brand (B). The exponent to chocolate taste is 0.34 and to the brand is 0.55. A high Pearson correlation coefficient was found for both suggesting a strong agreement between the subjects A theoretical exponent can be calculated based on a cross-validation procedure. Since both taste and brand were related to numbers of equal scale, they could be correlated and the final exponent should be calculated as* $A = n_1/n_2$.



The value of the theoretical exponent was 0.62. The empirical result found an exponent of 0.71 (r= 0.91) (see Figure 2).

Figure 2. *Magnitude Estimation equations and correlation coefficients obtained to chocolate taste when the subjects knowing the brand. The exponent calculated was 0.71, also with a high correlation coefficient. The empirically determined exponent was superior to that calculated theoretically of about 0.62.*



A significant negative correlation was found between the score for chocolate preference and the amplitude between the numbers given to the worst and best tastes (r= -0.54; p= 0.042) (Figure 3).

Figure 3. *The negative correlation coefficient measured to a self-titled chocolate preference (10-point scale) and the discrimination ability defined as the amplitude between the lowest and the highest DME score. Better discriminations were obtained for those who had a lower preference to chocolate*

Discussion

In our study, we were able to show that brand can change the chocolate taste suggesting a strong impact factor of the brand in our consumer decision. The results showing a higher exponent when the subject tasted the chocolates knowing their brand in comparison with the theoretical exponent expected by those associations support the idea that the branding is highly potential to modulate the buy decision (Bunn, 1993; Oreja-Guevara, 2009). Our data also support the hypothesis that part of the modulation effect could be regarding to a perceptual change in taste based in the knowledge of the brand.

Our study shows a significant difference, related to the application of research methods of consumer behavior related to the brand. Through scaling psychophysical methods we have been able to quantitatively measure the subjective characteristics of the choice of marks and chocolate flavor. Our results show that DME is an important tool in the study of the determinants of behavioral choices, and can be applied to marketing, for studies in various fields such as preferences, choices and decisions among others.

A critique presented in this context is the fact that neuroscientific approaches to marketing try to find the determinants or "markers" for neural consumption decisions. However, these approaches should be taken with great parsimony, in the sense that the presence of neural activations obtained in neuroimaging studies always need to be correlated with other measures, be they behavioral or electrophysiological. Only the correlational research and analysis of data is that we can increase our ability to inferences based on responses neural associations and their behavioral events. We believe that the neural events obtained by neuroimaging and electrophysiological methods only have value if the aggregated behavioral measures, since by these methods just guesses are permitted, as none of them is a direct measure of subjective response.

No similar result was found in the literature. However, some studies have been found interesting neuroimaging results regarding to the power of brand in the consumer behavior. They cover the initial relations between cerebral activities and consumer choices as the cerebral activity images and brand preferences located at the *prefrontal cortex* (Deppe, Schwindt, Kugel, Plassmann, & Kenning, 2005), the influence of the manner in which options are presented, knowing as the “framing effect” activates the anterior cingulated cortical area (Deppe et al., 2007) and brand knowledge showing dramatic influences on expressed behavioral preferences and on the measured brain responses of the *ventromedial prefrontal cortex* related to them (McClure et al., 2004).

Our hypothesis that branding could modulate taste perception has some support in the literature. A neuroimaging study using fMRI found different areas related to the taste and the pleasantness judgment of food. The author suggests that magnitude estimation of intensity and pleasantness shared common activations in some brain structures, like the *insula* and the *medio dorsal nucleus of the thalamus*. They also found that in a more general way, the

magnitude estimation of pleasantness produced significantly more activation than magnitude estimation of intensity (Cerf-Ducastel, Haase, & Murphy, 2012). Thus, we could argue that the pleasantness of food could be related with a more complex brain mechanisms, in which not only the taste but other information like the brand, could evoked the pleasantness magnitude.

The negative correlation between preference and amplitude added important information regarding the individual judgment ability. The highest the amplitude between the lower and the higher numbered at the DME procedure the lowest the score in a 10-point scale related to their preference for chocolate. This result suggests that subjects with lower preference to chocolate had better taste discriminability performance than those who self-titled a higher preference for chocolate.

We conclude our work by presenting results strongly suggest that the brand has a strong potential in the judgment of chocolate flavor, higher than expected by our theoretical calculation. Furthermore, our results show that there is a substantial indication that our perception of flavor is influenced by the brand. Subjects with self-entitlement of lower preference for chocolate have higher discriminative sensorial flavor than subjects with high preference for chocolate, suggesting that individual variability should be considered in studies of scaling. Our step toward future will study whether different groups have different metrics for their judgment.

Reference List

Ariely, D. & Berns, G. S. (2010). Neuromarketing: the hope and hype of neuroimaging in business. *Nat.Rev.Neurosci., 11,* 284-292.

Bunn, M. D. (1993). Consumer perceptions of medical information sources: an application of multidimensional scaling. *Health Mark.Q., 10,* 83-104.

Cerf-Ducastel, B., Haase, L., & Murphy, C. (2012). Effect of Magnitude Estimation of Pleasantness and Intensity on fMRI Activation to Taste. *Chemosens.Percept., 5,* 100-109.

Crandall, C. S. (1992). Psychophysical Scaling of Stressful Life Events. *Psychological Science, 3,* 256-258.

Deppe, M., Schwindt, W., Kugel, H., Plassmann, H., & Kenning, P. (2005). Nonlinear responses within the medial prefrontal cortex reveal when specific implicit information influences economic decision making. *J.Neuroimaging, 15,* 171-182.

Deppe, M., Schwindt, W., Pieper, A., Kugel, H., Plassmann, H., Kenning, P. et al. (2007). Anterior cingulate reflects susceptibility to framing during attractiveness evaluation. *Neuroreport, 18,* 1119-1123.

Engen, T. (1964). Psychophysical Scaling of Odor Intensity + Quality. *Annals of the New York Academy of Sciences, 116,* 504-&.

Fons, M. (1970). Psychophysical scaling of electric taste. *Acta Otolaryngol., 69,* 366-370.

Friedman, R. M., Hester, K. D., Green, B. G., & LaMotte, R. H. (2008). Magnitude estimation of softness. *Experimental Brain Research, 191,* 133-142.

Jung, M. & Hong, M. S. (2012). Positioning patient-perceived medical services to develop a marketing strategy. *Health Care Manag.(Frederick.), 31,* 52-61.

Kvalseth, T. O. (1980). Seriousness of Offenses - An Experimental-Study Based on A Psychophysical Scaling Technique. *Criminology, 18,* 237-244.

Labbe, D., Pineau, N., & Martin, N. (2012). Measuring consumer response to complex perception: Scaling vs. categorization task. *Food Quality and Preference, 23,* 134-137.

Lee, N., Broderick, A. J., & Chamberlain, L. (2007). What is "neuromarketing"? A discussion and agenda for future research. *Int.J.Psychophysiol., 63,* 199-204.

Lim, J. Y. (2011). Hedonic scaling: A review of methods and theory. *Food Quality and Preference, 22,* 733-747.

Marinova, J. (1978). Scaling of light and dark time intervals. *Acta Physiol Pharmacol.Bulg., 4,* 70-75.

McClure, S. M., Li, J., Tomlin, D., Cypert, K. S., Montague, L. M., & Montague, P. R. (2004). Neural correlates of behavioral preference for culturally familiar drinks. *Neuron, 44,* 379-387.

Morin, C. (2011). Neuromarketing: The New Science of Consumer Behavior. *Society, 48,* 131-135.

Oreja-Guevara, C. (2009). Neuromarketing. *Neurologia,* 4-7.

Pegels, C. C. & Sekar, C. (1987). Marketing hospitals to physicians in the United States. *Int.J.Health Plann.Manage., 2,* 15-24.

Plassmann, H., Ramsoy, T. Z., & Milosavljevic, M. (2012). Branding the brain: A critical review and outlook. *Journal of Consumer Psychology, 22,* 18-36.

Stevens, S. S. (1956). The direct estimation of sensory magnitudes-loudness. *Am.J.Psychol., 69,* 1-25.

Stevens, S. S. (1966). A metric for the social consensus. *Science, 151,* 530-541.

Stevens, S. S. (1987). The direct estimation of sensory magnitudes--loudness. By S. S. Stevens, 1956. *Am.J.Psychol., 100,* 664-689.

Stevens, S. S. & GALANTER, E. H. (1957). Ratio scales and category scales for a dozen perceptual continua. *J.Exp.Psychol., 54,* 377-411.

Veldhuizen, M. G., Wuister, M. J. P., & Kroeze, J. H. A. (2006). Temporal aspects of hedonic and intensity responses. *Food Quality and Preference, 17,* 489-496.