COMMUNICATION MULTISENSORY: COMPOSITION OF STIMULUS TO TRANSMIT AESTHETIC PERCEPTIONS OF THE PRODUCT

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Abstract *— The searches in neuroscience show that split-second human brain evaluates objects and makes judgments unconsciously through sensory information. This article offers a new approach to product communication, integrating conditioning of perceptions that influence the trial, with the multisensory stimuli strategically designed to transmit messages you want about the product. As methodology were elaborated two surveys in specific journals. The first survey in neuroscience journals in the articles focusing on consumer behavior to identify conditioning of the perception that somehow it limit the understanding of the message. The second survey in magazine articles focusing on sensory marketing to establish the sensory stimuli, dimensions and variables used to communicate multisensory messages. As a result we present a method for communicating characteristics that are desired product more effectively through the semantic association in the sensory stimuli.*

Index Terms — Sensory communication, multisensory stimuli, semantic association.

INTRODUCTION

The challenges posed by globalization in terms of the variety of products available on the market for consumers have direct effects on their differentiation. To Chandrasegan [1] Knowing what to communicate and how to communicate product differentiation from competitors has become essential for the success of the product. The field of product development has been engaged in developing products that are increasingly attractive not only to the "eyes" of the consumer, but to all the senses, which could otherwise improve or anticipate the perception of what you wish to communicate. For Peck and Childers [2], although the sense of sight has received increased attention by researchers, the other senses have also developed an important role in information processing. For example, touch (tactile), where both individual and environmental touch-related factors increase impulse purchasing [3]. Meaning the importance of product aesthetics is understood to enable the largest number of possible and desirable sensory channels to better communicate product features.

However, understanding the complexity in the judgment by consumers in the product selection process is no easy task, which is why it has become the object of much research and is indispensable to designers' successful development of the aesthetics of the product [4]. Although neuroscience has advanced the understanding of how the human mind interprets reality and makes judgments [5, 6], as much as the field of sensory marketing has made advances in the understanding and perception of stimuli in consumer judgment [7], with respect to the composition of the aesthetics of the product, there are few approaches (highlights) to integrate the desired characteristics to sensory stimuli necessary to generate the strategic insights into the aesthetics of the product.

Thus, the objective of this study is to develop a methodology that integrate the factors that limit the perception in the choices process and identifying the sensory stimuli which it can anticipate or improve the perception we wish to communicate through the aesthetics of the product.

METHOD

This study was conducted by performing two different steps:

- The first stage through a survey in neuroscience journal articles focusing on human behavior that used fMRI technology (Magnetic Resonance Image Functional) to identify conditionings at perception (c) that influence the sensory perception and that, in any way, interfere with the judgment and choice process. The focus of the first survey was to understand what are the limitations that recognized and proven by neuroscience and to link these limitations to sensory stimuli in order to minimize or to block misperception in the aesthetic composition of the product through fits (wi) to each conditionings, see (1).

$$C(i) = \sum (ci \times wi) \qquad (1)$$

- For the second step was conducted another survey in 12 journals focusing on consumer behavior exploring theme that dealing with sensory stimuli resulting in 55 experiments in this papers researched. This second

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survey had two purposes. First purpose was to identify a common methodology to associate desired characteristics of the product to sensory stimuli associated in these characteristics. The second purpose was to verify in the experiments surveyed the possibility of improving the effectiveness between stimulus (si) and perception, ie, how to compose stimuli in the aesthetics of the product leading to greater assertiveness of what we wish to communicate. Thus we propose a sophisticated manner through the transfer of semantic associations using an interesting component of congruence is that it is determined by the appropriateness or fit (fi) of the semantic association among the characteristics, see (2).

$$S(i) = \sum (si \times fi) \qquad (2)$$

- After the two surveys we sought to bring together the principles of design to compose product aesthetics (A) proposal through multisensory stimuli. The proposed methodology part of a solid foundation in the composition of design and integrates sensory stimuli of independent way associated with each of the five human senses (Xn), from features that we want to evoke in the product.

$$A = \sum [X1\ (Ci \times Si) + X2\ (Ci \times Si) + X3\ (Ci \times Si) + X4\ (Ci \times Si) + X5\ (Ci \times Si)] \qquad (3)$$

RESULT AND DISCUSSION

The result of the paper is discussed in the next section in three steps: Conditionings to sensory perception; Senses and sensory stimuli and aesthetic composition of product.

Conditionings to Sensory Perception

Through the first survey sought to identify the conditionings defined by the area of neuroscience as factors that limit human perception and judgment in the choice process. Table 1 shows the conditions of perception and related articles that have proven through experiments exploring the impact of constraints on judgment and choice process.

TABLE I
CONDITIONINGS AFFECTING THE PROCESS OF CHOICES.

CONDITIONINGS TO PERCEPTION (Ci)	WHAT AFFECTS IN THE CHOICE PROCESS
ATTENTION SPAN	Some factors exert a strong influence on eye movements. When a consumer is exposed to advertisements or a product, the first four eye movements are made in approximately 2.5 s. Our brain filters and selects the most important information that must be given attention [8, 9]. This selection is based on characteristics such as color, luminance, orientation, shape and movement. Other factors are able to gain faster access to attention such as: faces, text, novelty and your own name. People also tend to look at the upper visual field and the right visual field [10-12].
PERIPHERAL VISION AND FOVEA	The fovea is responsible for our good vision, i.e. in high definition. It is 1 m away from the eyes and little more than 2 cm in diameter, the rest is peripheral vision. Peripheral vision is in turn low resolution that allows us just an idea (representation) of what exists around the fovea. The brain`s responses are faster to information coming from the fovea than the peripheral. Experiments have revealed that while peripheral vision is bad, unconsciously we assess what exists around, though with a lower level of attention [13, 14].
PROCESSING CAPACITY	The amount of information reaching us is very large. It is estimated that every second 11 million bits of information are received by the human senses. Of these, we can only process 50 bits [15]. Given the limitations of the processing, the human brain is selective in what interests it or what will be processed. Thus, the composition of the aesthetic design must be considered to limit the amount of information and to use strategies that communicate clearly what is required, i.e. focus on what is important to communicate [16).
POSSIBILITY OF PRIOR STIMULUS (PRIMING)	The priming is a previous stimulus that expands or facilitates communication of the message to be sent. Experiments have shown that the priming effect positively influences the decisions being made. Accordingly, where the possibility exists to use this effect to help communicate the message this should be done . The priming may be a scent, a song, a color, the shape of the product [17, 18].
LABALLED MESSAGES	Labelled messages (predicted value) are values which the consumer anticipates the enjoyment of a particular brand or product before they try or use it. I.e., experiments show that even before consuming a product consumers themselves have expectations that activate their mind for that stimulus and that influences their decision [5, 19].

The survey (i) identified five (5) conditionings factors to the perception discovered by neuroscience through experiments that demonstrate that not only prove the constraints, but also describe how we affect in the judgment and choices process. The attention span, for example, is related to the sense of sight. This is the first information that will build a first overview of the situation or reality, where the brain will filter what is important and should be considered, i.e., given due attention. The fovea and peripheral vision is also related to the sense of sight and their limitation is in the field of vision element, since all that is peripheral vision there is no good definition picture and we only see by the fovea (2 cm to 1 m distance) is what you can see clearly-or good vision.

Snyder [20] confirmed through experiments that the brain can capture 11 million bits of information however, one is only aware of 40 bits, slightly less than that reported by Wilson [15]. On the other hand, for Todorov and Knyazev [21, 22] the human mind is able to judge faces very quickly, in a process that the conscious mind is not involved in. Human faces, for example, have 43 active muscle units that can, combined, represent 3000 facial expressions. This, when analyzed and judged by the unconscious mind, can result in reliable, docile or aggressive people. There exists a standard way that the mind interprets and makes assessment unconsciously [23-25].

Senses And Sensory Stimuli

The second survey presents 55 articles in journals surveyed with a focus on consumer behavior. Table 2 summarizes the results of varying dimensions and variables in the experiments used to test the hypotheses of such articles.

TABLE II
RESULT FOR SEMANTIC ASSOCIATION FOR STIMULI

SENSE (Xi)	STIMULI (Si) - DIMENSIONS / VARIABLE / SCALE
Olfactory	Perfumes environments and product / flavors - ranging volatile aromatic substances: citrus, woody, lactic, floral, plant and animal.
Hearing	Music (tone, compass, harmony, rhythm), voice (tone, pauses, rhythm) noise.
Táctile	Texture (hardness, elasticity, adhesiveness, cohesiveness and viscosity), temperature and weight.
Gustatory	Sweet, sour, bitter, salty, spicy, fermented, fruity, astringent and burning metal.
Visual	Form (shape), size (dimensions), colors (variations and combination of tones), brightness and reflectance of funds, appearance (organization and harmony between the elements). curves, smooth surfaces, solids, robust, yet, similarity, symmetry, proximity, continuity and relationship background

Aesthetic composition of Product

As seen earlier, the human mind possesses a natural ability to recognize patterns and make very quick judgments. The Gestalt theory, which recognizes a pre-disposition in human vision in recognizing these patterns, can help to establish, in the initial contact, an empathy with the product. Baxter[26] says that rules which compose the Gestalt Theory such as symmetry, proximity, similarity and continuity positively influences product style, guiding them in this way for a better visualization. Thus, it facilitates their communication and becomes more attractive. This research made use of the Gestalt rules of the triad of Pierce [27] to compose the aesthetic and functional parameters of the product.

For the development of what was defined as "composition of the aesthetic design of the product", it is necessary to understand the need to distinguish between the conscious and unconscious level to better target the message to be communicated and thus insert the subliminal messages in the level of process. The definition of choice of sensory stimuli will be stimulated and conditioned to each of the senses chosen with their respective constraints to sensory perception. This way, we will better ensure the effectiveness of the message we want to communicate, taking into account the limitations and capabilities of the human mind. The figure 1 schematically represents this evaluation.

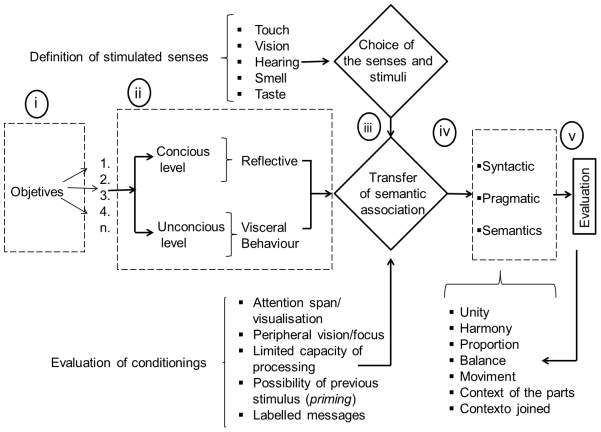

FIGURE 1
SCHEME FOR COMPOSITION OF AESTHETIC DESIGN OF THE PRODUCT

i) Definition of the message (goal) that is wanted to be incorporated in the product for each level or processing layer (visceral, behavioral, reflective) of the parts of the product or the product as a whole. In this first phase we should think strategically to make this step, i.e. it is not unrelated to the strategic planning of the product;
ii) Identify the level of processing (conscious or unconscious) where the message (goal) will be processed. Depending on the level which is determined a product can have, for example, a good appearance (visceral), ease of use (behavioral) and bring good memories (reflective). I.e. combine the objective of the conscious or unconscious level.
iii) Define the stimuli to be used for what you want to communicate. This will be accomplished through the

relationship between the human senses (touch, sight, hearing, smell and taste), listed hierarchically to meet the message (objective), and constraints that influence the judgment. The conditions such as attention span, peripheral vision and focus, processing capacity, or previous prime stimulus and labelled messages serves to remind that for each sense stimulated exist conditions of the human mind that need to be considered to facilitate the understanding of the message. These constraints may limit but also aid the understanding of the message being communicated like the priming effect.

iv) Developing the syntactic, semantic and pragmatic functions. Here it is the practical or operational part where the syntactic function decides the shape and dimensions of the product and how they are composed to convey the message you want to communicate. For the pragmatic function the relationship between the consumer and the performance of the function of the product or part must be developed. The scenario here is important, i.e. have a certain time to activate every sense of the consumer or for their experience (feeling) each function of the product. In semantic function the focus is on the message that the product should stand for. At this stage it is important to meet issues related to culture, style, and souvenirs, social and personal values which are important.

v) Finally evaluate the significant processes of the product, analyzing the interaction between the proposed meaning and what was actually understood by the consumer. Important questions to assess at this stage are harmony, proportion, balance, movement, and context both the assembled product as its parts.

CONCLUSION

The contribution that neuroscience enables in the understanding of how the human mind interprets reality and makes its judgments has provided discussions and advances in other areas of knowledge . In the area of product development it is no different. Much has been researched about the impact of neuroscience on packaging and promotional marketing, however, little emphasis has been given to the impact this brings to the composition of the aesthetics of product design relating to the manner of how the human mind makes its judgments and especially about the sensory limitations of the human brain. Research about the explanatory models of emotion showed that these do not contemplate the complexity of how the human brain selects information that will be used in the judgment process, making no mention of the pre - established hierarchy of the senses or sensory limitations, as well as how the unconscious mind takes part in the judging process. Thus, the task of the designer to communicate product messages that convey specific characteristics, which also must be shared by the consumer, becomes more complexes to development.

The major contribution of this research is the particularity to include in the construction of aesthetic design process two key variables: the conditioning factors of perception and the combination of sensory stimuli in order improve the information effectiveness. The article advocates an approach that relates to the conditioning factors of perception that interfere with human senses and influence in the judgment process, and thus establishes a logical hierarchy able to better communicate subliminal messages or not, which promote empathy of the product to the consumer. The proposal to integrate new discoveries of how the brain unconscious processes information related to the judgment of brands and products, based primarily on experiments using fMRI technology (function Magnetic Resonance Imaging) contrary to leading models to elucidate the emotion, resulted in a more consistent approach methodological, which addresses the issue of taking into account the judging process of the human mind and its limitations.

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REFERENCES

[1] Chandrasegaran, S, Ramani, K, Sriram, R, Horváth, I, Bernard, A, Harik, R, Gao, W, "The evolution, challenges, and future of knowledge representation in product design systems", *Computer-Aided Design*, Vol. 45, 2013, pp. 204-228.

[2] Peck, J, & Childers, T. L. "If it tastes, smells, sounds, and feels like a duck, then it must be a…: Effects of sensory factors on consumer behaviors", In C. P. Haugtedt, P. M. Herr. & F. R. Kardes (Eds.), *Handbook of Consumer Psychology*, Vol. 23, 2008, pp. 193 – 219. New York: Psychology Press.

[3] Peck, J, & Childers, T. L. "If I touch it I have to have it: Individual and environmental influences on impulse purchasing", *Journal of Business Research*, Vol. 59, 2006, pp.765 – 769.

[4] Hoegg, J, Alba, J. W, Dahl, D. W. "The good, the bad, and the ugly: Influences of aesthetics on product feature judgments", *Journal of Consumer Psychology*, Vol. 20, 2010, pp. 419 – 430.

[5] Plassmann, H, Ramsoy, T, Milosavljevic, M. "Branding the brain: A critical review and outlook*," Jounal of consumer psychology.* Vol. 22, 2012, pp. 18 – 36.

[6] Venkatraman, V, Clithero, J, Fitzsimons, G, Huettel, S, "New scanner data for brand markets: how neuroscience can help better understand differences in brand preferences," *Journal of Consumer Psychology*, Vol. 22, 2012, pp.143 – 153.

[7] Krishna, A. "An integrative review of sensory marketing: Engaging the senses to effect perception, judgment e behavior", (2012). *Journal of Consumer Psychology*, Vol. 22, 2012, pp. 332 – 351.

[8] Itti, L, Koch, C, Niebur, E. "A model of saliency-based visual attention for rapid scene analysis", *IEEE Transactions on Pattern Analysis an Machine Intelligence*, Vol. 20, No. 11, 1998, pp. 1254 – 1259.

[9] Wolfe, J. M, & Horowitz, T. S. "What attributes guide the deployment of visual attention and how do they do it?", *Nature Reviews Neuroscience*, Vol. 5, No. 6, 2004, pp. 495 – 501.

[10] Durgin, F. H, Doyle, E. & Egan, L. "Upper-left gaze bias reveals competing search strategies in a reverse stroop task*", Acta Psychologica,* Vol. 127, No. 2, 2008, pp. 428 – 448.

[11] Efron, R, Yund, E. W. "Spatial nonuniformities in visual search", *brain and cognition*, Vol. 31, No. 3, 1996, pp. 331 – 368.

[12] Maunsell, H. R, Treue, S, "Feature-based attention in visual cortex," *Trends in Neurosciences,* Vol. 29, No. 6, 2006.

[13] Paulus, M. Frank, L. R, "Ventromedial pré-frontal córtex activation is critical for preference judgments", *Neuroreport,* No. 14, 2003, pp. 1311 – 1315.

[14] McCamy, M.B, Otero-Millan, J, Macknik, S.L, Yang, Y, Troncoso, X.G; Baer, S.M, Crook, S.M, Martinez-Conde, S, "Microsaccadic Efficacy and Contribution to Foveal and Peripheral Vision", *Journal of Neuroscience*, Vol.32, No. 27, 2012, pp.9194 – 9204.

[15] Wilson, T. D. "Strangers to ourselves: Discovering the adaptive unconscious". *Cambridge*, MA: Belknap Press of Harvard University Press, 2002.

[16] Naselaris, T, Prenger, R, Kay, K., Oliver, M, Gallant, J. "Bayesian reconstruction of natural images from human brain actitity". *Neuron*, No. 63, 2009, pp. 902 – 9015.

[17] Bargh, J, Williams, L. E, 2008, "Experiencing physical warmth promotes interpersonal warmth". *Science*, Vol. 322, No.5901, 2008, pp.606 – 6012.

[18] Haynes, J. D. "Decoding and predicting intentions," *Annals of the New York Academy of Sciences*, Vol. 1224, April, 2011, pp. 9 – 13.

[19] Venkatraman, V, Clithero, J, Fitzsimons, G, Huettel, S. "New scanner data for brand markets: how neuroscience can help better understand differences in brand preferences", *Journal of Consumer Psychology*, Vol. 22, 2012, pp.143 – 153.

[20] Snyder, A, "Autistic genius?", *Nature*, Vol. 428, No. 6982, April 1, 2004, pp. 470 – 472.

[21] Todorov, A. "Inferences of competence from faces predict election outcomes", *Science*, Vol. 308, No. 5728, 2005, pp. 1623 – 1626.

[22] Knyazev, G, Bocharov, A, Slobodskaya, H, Ryabichenko, T, "Personality-linked biases in perception of emotional facial expressions", *Personality and individual differences*. No. 44, 2008, pp. 1093 – 1104.

[23] Roth G. "The quest to find consciousness*," Scientific American Mind,* Vol. 14 – No. 1, 2004, pp.32.

[24] Grebosz, M, Wronska, B. "Sensory impact in the purchase of textile products", *Fibres textiles in Eastern Europe*, Vol. 21, No. 3, 2013, pp. 8 – 12.

[25] Krishna, A, Elder, R. S, Caldara, C. "Feminine to smell but masculine to touch? Multisensory congruence and its effect on the aesthetic experience", *Journal of consumer psychology*, Vol. 20, 2010, pp. 410 – 418.

[26] Baxter, M, "Product design: practical for the design of new products guide".3ª. Ed. São Paulo: *Blucher*. 2011, pp. 245.

[27] Pierce, C. S. "Semiótica", São Paulo, *Perspectiva*, 1977, pp. 340.