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INNOVATING THROUGH NEUROECONOMICS: AN EXAMPLE OF A LIVING CASE APPROACH IN MANAGEMENT EDUCATION

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ET	Eye Tracking
FEA	Facial Expression Analysis
EEG	Electroencephalogram
GSR	Galvanic Skin Response
fMRI	Functional Magnetic Resonance Imaging
RGT	Repertory Grid Technique
STEM	Science, Technology, Engineering and Mathematics
TEC	Costa Rica Institute of Technology

ABSTRACT

At first glance, neuroscience and business might seem like an odd fit. But in fact, economics, psychology, and neuroscience are converging today into the unified discipline of neuroeconomics with the ultimate aim of providing a single, general theory of human choice behavior that can provide social scientists and future managers with a deeper understanding of how they make their own decisions, and how others decide. The present didactic example portrays the implementation of a neuroeconomics' tool - Eye Tracking technology, as a teaching methodology for business students to solve a real-life challenge that was faced by the marketing department of a company in Latin America. Furthermore, it shows how university teaching can be attuned to learning innovation through experiential learning and living cases, through the implementation of a technologically-advanced multidisciplinary approach.

Keywords: eye tracking, neuroeconomics, business psychology, repertory grid technique, business education.

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INTRODUCTION

Costa Rica is considered to be the top-second largest innovation economy in Latin America and the Caribbean according to the Global Innovation Index (Cornell University, INSEAD, and WIPO, 2019). The aforementioned, is not astounding as the country is considered to be a haven for high-tech investment, due to its business milieu encompassed of R&D ecosystems in the areas of IT software development, electronics manufacturing for the smart tech industry, superfood development, and tier III for the MedTech industry (The European, 2017). Also, by the fact that its approximately 5 million inhabitants benefit from a stable democracy with access to free healthcare and education, which is reflected on a 98% literacy rate and a life expectancy of 79.9 years (The World Bank Group, 2019).

In line with the above, the Costa Rican government has launched a national strategy plan to continue developing R&D competences, by articulating a constant flow of science, technology, engineering and mathematics (STEM) graduates from public higher education and vocational training institutions (MICITT, 2018).

In the particular context of management education, the aforementioned has been transformed into an opportunity by the Costa Rican Institute of Technology (TEC) to furtherly implement capacity-building initiatives through its Laboratory of Experimental Economics. This workroom

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setting is used by researchers and lecturers alike, to generate academic and practical outputs for students, academics, and the local business milieu. TEC implements many of the same tools and frameworks as standard economics, combined with psychological and neuroscientific research tools such as Eye Tracking (ET), Facial Expression Analysis (FEA), and Electroencephalogram (EEG), Galvanic Skin Response (GSR), among others.

The present paper provides an overview of the methodological approach behind TEC's living case methodology, which combined Eye Tracking with interviewing techniques (e.g., Repertory Grid Technique), in order to deliver insights to a real-life company in Latin America. As sustained by Grassberger and Wilder (2015), the living case is a work-based pedagogy that implements an authentic client who has a real-world problem, with the intent of increasing student engagement, improving long-term learning outcomes, and hereinafter student value.

This working paper intends to provide an incipient contribution to the field of Management Education and Research, particularly due to the scarcity of studies concerning the pragmatic applications of Eye Tracking Methodology in Organizational Research, in spite of its already proven contribution in the field of behavior analysis across other fields of knowledge and the increasing demand from the business milieu (Meissner and Oll, 2019).

NEUROECONOMICS AND MANAGEMENT EDUCATION

The majority of management scholars and practitioners believe that neuroscience is only about developing a functional map of the brain; however, the reality is that such scientific area is currently exploring more subtle aspects of higher cognitive functions involved in socioeconomic decision-making (Sulkowski and Chmielecki, 2017). In this regard, new scientific fields have arisen that apply neuroscience to core questions in the social sciences and humanities, including neuromarketing, neuropolicy, neuroethics, and neuroeconomics (Levallois, Clithero, Wouters, Smidts and Huettel, 2012).

As sustained by Tallis (2011), we are now in the age of "Neuromania", in allusion to the recent "boom" in employing neuroscientific methods to better understand human behavior in various contexts. The present didactic example is focused on the field of neuroeconomics, and its implications for contributing to more robust and pragmatic learning approaches in the field of management education through the combination of Eye-Tracking methodology with additional sources of data triangulation, like Repertory Grid Technique (RGT).

Neuroeconomics comprises research on the biological mechanisms of decision making, by combining concepts from neuroscience, economics, computer science, and psychology to identify underlying mechanisms, ranging from the response of single neurons to the large-scale behavior of economic market dynamics (Glimcher, 2011; Montague and Berns, 2002; Rangel, Camerer and Montague, 2008).

Specifically, three research themes tend to predominate in Neuroeconomics: i) what are the variables computed by the brain to make different types of decisions, and how do they relate to

behavioral outcomes?; ii) how does the underlying neurobiology implement and constrain these computations?; iii) what are the implications of this knowledge for understanding behavior and well-being across various social and economic contexts? (Sharp, Monterosso and Montague, 2012).

The hype towards neuroeconomics has also been urged not only by scholars but by practitioners and policy makers alike, particularly after the global financial crisis in 2008 which led to the questioning of the figure of *Homo Economicus* by the rational choice theory, and led to acknowledgement of emotional influence on individual decision making within social and economic contexts (Schmitz, Kosezegi, Enzenhofer, & Harrer, 2015).

McDonald (2009), provided a clear scientific framework concerning the above, by sustaining that the subprime mortgages where easily adopted in the United States due to the fact that individuals tend to: focus on the present, while undervaluing the future (i.e., hyperbolic discounting bias); believe that they can get out before the bidding price of an asset crashes by overrating their abilities (i.e., self-serving bias); follow the crowd whilst ignoring the risk (i.e., herding bias); among others.

The above led to the positioning of a distinction in economics between normative theories (i.e., rational choice theories on how individuals should make decisions) and descriptive theories (i.e., prospect theory on how individuals actually make decisions) to explain economic behavior (Schmitz et al., 2015) (please revise Figure 1).

Figure 1. Homo Biopsychosocialicus framework.

Source: Authors.

As sustained in Figure 1, we can now find new concepts that replace the *Homo Economicus* in economic decision-making, in what we conceptually consider as *Homo Biopsychosocialicus*, which reflects how human beings are influenced by: psychological factors (e.g., cognition, affect, heuristics) (Lecouteux, 2016); sociocultural factors (e.g., predetermined roles, expectations, norms, and values) (Dixon, 2010); biological factors (e.g., genes, neuromarkers, unconscious/biological system) (Schmitz et al., 2015); and situational factors (e.g., available time and information, cognitive load) (Ayal, Rusou, Zakay and Hochman, 2015).

Neuroeconomics is often conceived as a big tent constituted of both theoretical modeling and empirical measurement, by encompassing state-of-the-art technologies like functional magnetic resonance imagining (fMRI), neuropharmacological exposures, cognitive load manipulations, response-time measurements, ET, single-neuron measurement, transcranial magnetic stimulation, genotyping, gene expression, animal models, FEA, among others (Camerer, Cohen, Fehr, Glimcher and Laibson, 2016).

In this regard, Eye tracking methodology represents one of the most promising sources of behavioral data for organizational researchers and practitioners, as it contributes to psychology's multimethod data sourcing, by analyzing eye movements as a proxy for attention that is directed to stimuli (Chaffin et al., 2017). Moreover, ET provides a complementary measure to self-reported methods which contain limitations associated to social desirability bias, nonconscious activation, halo and leniency effects, among others (Meissner and Oll, 2019).

Nowadays, ET technologies are being used as a means to provide scientists with opportunities to move beyond descriptive statistics, and consequently incorporate multivariate approaches (Legette, Rice, Carraway, Baker and Conner, 2018). As depicted on a recent review by Meissner and Oll (2019), the majority of studies concerning ET focus on psychological constructs, such as: attention directed to stimuli, attention patterns, level of processing, mental states, emotional arousal, cognitive load, and perceptual fluency. In the case of organizational research, the authors sustain that there is a predominant interest in the underlying processes concerning economic decision making and information search and their corresponding applications in the fields of advertising, branding, pricing, and employee selection.

Following this line, it seems that more academic institutions are recognizing the need to remain well-informed of the rapidly changing business landscape and labor market needs. As an illustration, please consider the following examples (Tobii AB, 2020):

- The University of Hamburg in Germany has equipped its WISO-Research lab with ET to enhance their findings in the context of social and economic science.

- The University of Lund in Sweden provides eye tracking technology at its Humanities Lab.

- The University of Kennesaw in the United States has been implementing ET technology for the analysis of student gaze patterns.

- The University of Bucharest in Romania has launched an Eye Tracking Research course at the Faculty of Sociology and Social Work.

- The Slovak University of Technology (FIIT STU) has introduced an ET lab for user-experience evaluation.
- The Western Kentucky University in the United States is working on assessing the effectiveness of visual design on instructional materials for water education in West Africa.

In spite of the above, there is an apparent lack of studies concerning the application of ET in the curriculum of management education and capacity-building, as well as an increasing demand for novel research approaches that can contribute to the areas of strategic management, entrepreneurship, human resources, among others (Meissner and Oll, 2019).

Following this line, the next section provides a brief overview of the methodological approach behind a living case that was presented to a group of undergraduate business students at the Costa Rica Institute of Technology, based on the challenge presented by a real company in Latin America. Living cases are key to fostering competency-development training, as they implement realistic narratives to actively engage students with both specific course content and broader scientific skill development (Watson, 2019).

LIVING CASE DESCRIPTION

As shown in Figure 2 below, the living case process consisted of the following: i) an initial meeting with the "client" in order to understand the challenge and define the scope; ii) research design of the data collection and analysis; iii) data collection; iv) data processing; and v) delivery of key insights to the "client".

Figure 2. Diagram of the implemented Living Case process.

Scope definition with the "client" → Research design → Data collection → Data analysis → Insights to the "client"
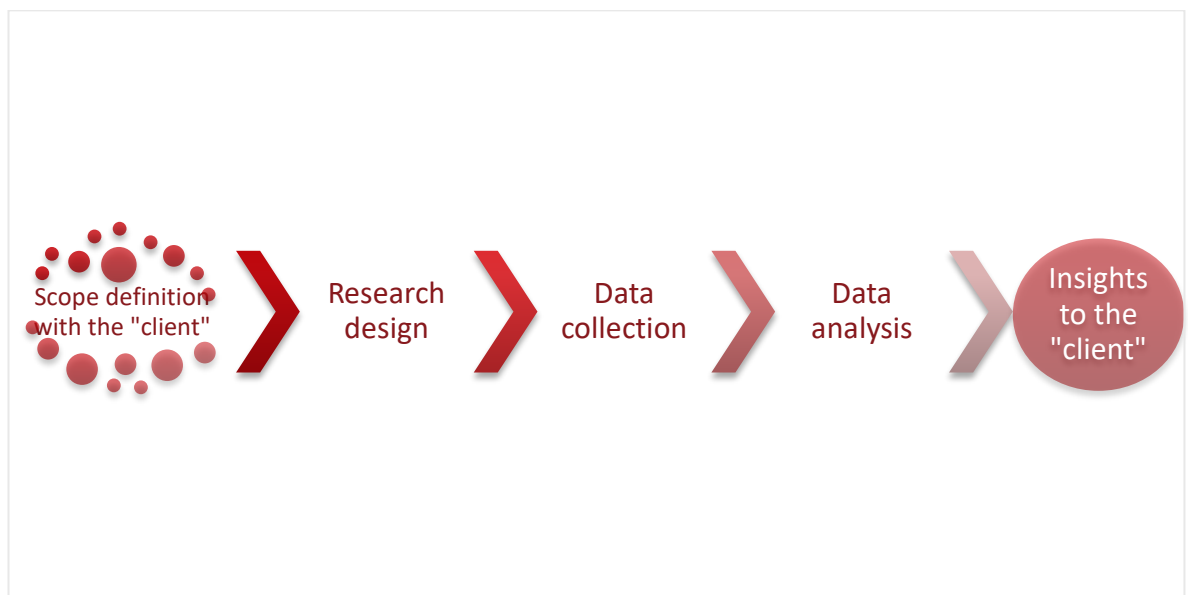
Source: Authors.

Scope Definition

A local company, hereinafter we will use the fictitious name of "Apfel Corporation", had concerns about the consumers' perception concerning the launch of a new premium consumer goods product (henceforth, product "99-XB")[2]. In this regard, "Apfel Corporation" presented a novel product within a similar price range as the competition, with the advantage of having enhanced features in terms of comfort and appearance. Under what seemed to be the same logic as what is portrayed in traditional economic theories, the executives of "Apfel Corporation" assumed that since the new premium product offered a better user-experience at an affordable price, then logically there would be an increase on sales concerning that item. However, the company experienced quite the opposite and left the market research department wondering why their data projections were incongruent with the abovementioned scenario.

Hence, "Apfel Corporation" provided the following question: what is the perception of real decision-makers (i.e., consumers) concerning product "99-XB" and its main competitors? With the purpose of providing insight to the company, the research team at TEC together with a supervised team of Business Administration students worked in the design, implementation, analysis and presentation of a series of insights to "Apfel Corporation", as a means to simulate a real-life consultancy scenario. The following subsections describe the selected approach for the aforementioned challenge.

Research Design

The research approach was chosen to be of exploratory nature due to the scarcity of information concerning the problem. As sustained by Brink and Wood (1998), an exploratory study focuses on what has not previously been studied, and tries to identify new knowledge, insights, understandings, and meanings; as well as to explore factors related to the question of study.

The research strategy was a multiple-case study, since it incorporated more than one case of study in order to establish whether the findings of one case are similar to the ones of other cases (Saunders, Tornhill & Lewis, 2009). According to Yin (2003), multiple-case studies are a recommended method of choice, since the analytical benefits of having several cases are more robust than in the instance of a single case.

The target population was defined as buyers between 20-40 years old, who lived in the great metropolitan area of Costa Rica, and purchased at some specific supermarket chains associated to low-middle income. Based on the above, four participants were selected through probabilistic sampling, with the support of a professional scouting agency that was hired to provide the participants of the study. None of the participants wore any contacts or eye glasses, as well as did not have significant reading/visual impairment that could bias the data collection. The sample was denoted as sufficient as it was not intended to be a statistically inferential study, but rather a pilot approach to a real-life challenge.

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[2] Due to confidentiality reasons, the identity of the company that served as a real-life case example will remain anonymous.

The data collection instruments consisted mainly of Eye Tracking combined with interviewing techniques, which will subsequently be detailed in the following section. The sessions were conducted in the Laboratory of Experimental Economics at TEC.

Data Collection and Analysis

The participants' eye movements during completion of the visual imagery tasks were tracked via Tobii X2-60 system. This table-top system consists of an Eye Tracking camera and infrared LEDs retained in a unit that connects to the computer to capture eye movements by computing corneal and pupil reflection patterns. The tracker operates at a sampling rate of 60 Hz (producing a data point below 35 ms) and has an accuracy (spatial error between true eye position and computed measurement) of ±0.4°, both of which are considered to be satisfactory for measuring eye position (Harsh et al., 2019).

Participants were seated in front of a standard laptop computer connected to the ET system. Each participant was interviewed in an individual session and was asked to sign the corresponding informed consent in order to participate. Before the test, participants were provided a brief overview of the study and general instructions for the session that included a calibration exercise to familiarize the participants with how the graphing tasks would be presented, as well as how to remain in a sitting position about 60 cm away from the screen's center. Please revise Figure 2 as an example of a heat map visual representation during calibration.

Figure 3. Example of an ET heat map visual analysis.

 Source: Authors. Note: Warmer tones (red) denote an increased level of observation intensity.

The test consisted of the randomized presentation of six sets of images, comprising one image per trial. The images were previously selected by "Apfel Corporation", and included one image of product "99-XB", plus five images of its main competitors in the market. Each participant had to simply observe the screen in silence (as recommended by Pernice and Nielsen, 2009). After ET data collection, participants were asked to recall which product(s) caught most of their attention and to state the reason behind (i.e., in terms of either a positive or negative emotional valence).

Tobii Pro Lab was used to record, replay, and analyze participant eye movement. Raw eye-movement data were aggregated and analyzed as heat maps, as a means to better separate different levels of observation intensity than fixation maps based on Spakov and Miniotas (2007). Also, as a means to provide a clearer visualization of data that is more user-friendly to introduce to a non-academic audience (as this is a practical example).

In order to provide a complementary source of data triangulation, RGT was subsequently delivered as an interview technique to each participant. Originally developed by George Kelly (1955) for use in psychological research, RGT has since been applied in a wide range of different disciplines and across multiple qualitative and quantitative studies (Terrill & Flitman, 2002).

In a nutshell, RGT is an in-depth interviewing technique where the interviewee is presented with vague ideas of a product and asked to expand his/ger thoughts, inside the arrangement of a grid (Rodríguez, 2016). Whereas other techniques (i.e., questionnaires, attitude scales, etc.) presuppose that one can use the terms offered by others, RGT technique allows the participant to discover personal constructs in terms of how they experience attitudes, thoughts, and feelings in a personally valid way (Kington, 2009)[3].

Respondents were individually introduced to same 6 images of different products that were previously shown during the ET session (i.e., "99-XB" and its tops 5 competitors), and based on randomly selected triads were led to provide a series of attributes to each product. Data was managed and analyzed via Idiogrid software (version 2.4).

Lastly, participants were hypothetically offered money to purchase one of the products from the images that were previously presented, under the assumption that all products had the same cost. Their response was contrasted in terms of the findings from the ET session, and a rationale was provided by the interviewees. Data collected from the interview was processed based on Mayring's content analysis approach (2000).

Key Insights for the "Client"

In sum, the main trends showed that the majority of participants had in average an intensified heat map in product "99-XB" of the words associated to the characteristics of "premium effectiveness" in the packaging. Meanwhile, in the case of the competitors, the main focus was

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[3] For a critical review of RGT, please revise Harlim (2017).

mostly on the logo and product mascot. Overall, the main competitor of product "99-XB" in the market, was the one that presented in average a wider heat map.

Moreover, the interviews showed that the following attributes for "product 99-XB" differentiated it from its competitors: flexible material, familiar, made of quality, soft, aromatic, neat, and colorful. On the other side, the product was similar to the competition in terms of having insufficient quantity and thickness.

When faced with the imaginary shopping scenario, all participants sustained that they would purchase product "99-XB", as it seemed to be of a premium quality. However, when faced against the findings of ET, only one person confirmed that she would in fact select such product due to the "premium" characteristics that are being promoted in the package.

Conversely, the other participants selected different products, and mainly argued that although quality is important and prominently marketed in "99-XB", the product is part of a brand that is usually associated with being costly and having short special offers. For instance, one participant stated: "it is better to keep on using a regular product, than to get accustomed to a better version that will shortly become unaffordable". Meanwhile, another participant argued "it is better to stick to what you know and are familiarized with, than to be constantly thinking about when it would change [in terms of the price]".

Based on the above, it was suggested to "Apfel Corporation" to conduct further market research studies that would analyze in a larger scale the aspects of brand trust, quantity vs. quality tradeoff, price sensitivity, and loss aversion pertaining to product "99-XB". Also, to make sure to incorporate such findings in terms of the visual attributes that are shown in the package of the product as well as in terms of the positioning of the products in the supermarkets, as a strategic part of the marketing campaign.

DISCUSSION

As previously described, human beings are not curbed to automatically follow price incentives and make a purchase decision out of pure rationality. Far from being *Homo Economicus*, we are beings who have developed emotionally-based cognitive appraisals to judge our surroundings, and such aspect is associated with species survival in order to avoid stimuli that could potentially harm the conservation of the species (Mikolajczak & Luminet, 2008). Thereby, it is plausible to sustain that in our current socioeconomic context, such mental shortcuts can be beneficial or not for consumers depending on the situation and their resources.

Eye Tracking technology together with in-depth psychological interviewing techniques have proven to be a remarkable example of how we need multidisciplinary approaches to respond to complex questions and to attempt to understand human decision-making and behavior (Spencer, 2016). Hence, beyond what is stated on traditional marketing books, it is not about using neurotechnology to better understand "unconscious" emotional arousal to present stimuli

that increases sales, but rather generating insights of how organizations can provide enhanced solutions that are consciously preferred and valued by consumers.

In this regard, when used under adequate guidance from psychology professionals, ET technology can help businesses thrive by understanding how to create actual value for consumers, and thereby organically generate emotions associated with trust and reliability, which can later on evolve towards brand loyalty (Al-Azawi, 2019).

The aforementioned living case allowed management students to familiarize themselves with the eye tracking methodology and to comprehend its advantages in the field of organizational research when combining it with psychological in-depth interviewing. Thereby, the scientific exercise showed how data triangulation approach is key to furtherly understand consumer behavior, as traditional survey and interview data collection techniques used by the company appear to be limited sources of information, as they are usually not designed to strategically navigate answers that contain cognitive biases.

For instance, the case example portrayed a potential status quo effect known as social desirability bias, which occurs when people tend to respond in a way that makes them look as good as possible, thereby under-reporting behaviors deemed inappropriate by researchers or other observers, and/or over-reporting behaviors viewed as appropriate (Donaldson and Grant-Vallone, 2002). As previously mentioned, the majority of interviewees confirmed that they would buy a premium product as their first choice, however when faced against the results of ET, such response varied and the underlying worry in terms of purchase power decision-making was finally revealed.

Hence, the above also leads to the questioning of how perceived brand experience together with loss aversion and fear of uncertainty can influence purchasing decision-making. The above, allowed the research team to gain a deeper insight in terms of how people's intentions, thoughts and behavior can sometimes be unpredictable or incongruent. As described by Rad and Pham (2017), such uncertainty of whether a company would offer one day a lower price depending on an offer, can lead consumers to rely more on affect (emotion) while deciding, due to the psychological discomfort associated with the fear of risk and loss.

Following this line, it is worth mentioning that traditional marketing strategies have to go beyond the assumption that consumers will certainly choose a product based on a mere "quality-quantity-price" ratio, since the slogan "high quality for a lower price" tends to work depending on the consumers' characteristics and purchase power, as well as whether the quality inference is valuated as high enough to compensate the corresponding monetary and quantitative sacrifice (Shirai, 2015).

Moreover, the living case enabled students to first-hand experience what experimental research in the field of business management entails, thereby demonstrating the importance of mixed methods approaches in social and economic sciences. Furthermore, it showcased how limited one-source data collection approaches can be, since data triangulation showed them that it is possible to move past the traditional business research instruments of data collection, and showed them how to be more inquisitive in terms of how individuals construe their own

perceptional correlate (i.e., in-depth interviewing), but also about the discrepancy between what they think they do, say they do, and actually do.

Lastly, it served as an exercise for capacity-building in terms of designing a research project for a real-life company, and to acquire skills in terms of information literacy of interdisciplinary scientific terms; working collaboratively to consider scientific evidence and form arguments for academic and practical purposes; implement existing content knowledge about management education in a novel interdisciplinary setting; and analyze the basic logic and implementation of Eye Tracking technology combined with valence and in-depth interviewing.

In terms of the company, the experience allowed its market research department to obtain an external viewpoint that contributed to the solving of their challenge, with the support of a high-tech laboratory inside a university. Thereby, proving once again the value that conveys the fostering of university-business linkages to both academic and practice-oriented challenges.

For the university, the above exercise implied an opportunity to benefit from extending its curriculum and offering a novel didactic approach not only for Costa Rica, but in general. Also, in terms of reputation and references in the scientific community and applied research markets in Costa Rica and beyond, the potential benefits are indisputable.

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