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## THE APPLICATION OF WEBCAM EYE-TRACKING METHOD TO PREDICT CONSUMER BEHAVIOR

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**Abstract:** *The application of the eye tracking method is widespread in the global FMCG industry, as it becomes one of the important approaches to study cognitive processes underlying consumer choices and decision making. The paper displays the information about the application of webcam based eye – tracking, for understanding and predicting consumer choices and thus, helping business decision to be more competitive. The hypothesis is that for pack and design studies, deeper and more reliable insights are provided applying eye tracking compared to insights gained by survey. The aim of the research is to investigate the marketers satisfaction with insights and recommendations provided when applying webcam eye tracking as implicit method compared to when using only survey, as explicit method. Obtained findings concur with a hypothesis that predicting consumer behavior is more relevant by using eye tracking methodology, for pack and redesign studies. The cost of the eye tracking study, expected to impact marketers expectation and satisfaction level, is not confirmed. The present study provides important managerial implications, confirming advantages of eye tracking approach for testing new products and redesigns.*

**Keywords:** *Eye tracking, Consumer behavior, Neuromarketing, Implicit method, Marketing research.*

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### INTRODUCTION

Two contemporary trends to marketing research are incorporated in webcam based eye tracking approach and those are: neuroscience inclusion into consumer research and marketing research data collection digitalization. It is not strange that industries seeks for better and faster ways of understanding and predicting consumer choices in order to make wiser business decisions. Growing globalization and competitiveness have impacted business as well as consumers (Pavicevic, 2021; Krmpot and Gajdobranski, 2019). Consumers are becoming more sophisticated while at the same time confused with so many choices and stimulations (Bogosavljevic-Jovanovic & Radojicic, 2016). It has a lot of influence on their behavior (Ratkovic, et al 2016). Also, if we want to make their wishes come true, we have to build relationships with them (Ilic, et al 2021; Ratkovic, et al 2017; Ratkovic, et al 2014). Furthermore, main marketing principle dilemma, if marketing is

answering to consumer needs or also creating them, receives a deeper perspective - the fact is that consumers do not always know what they want and the impact of sub consciousness is important. The subconscious or even unconscious factors in consumer behavior are tackled by neuroscience in marketing research - aiming for implicit consumer answers (Bridger & Noble, 2015).

The popularity of eye – tracking in marketing research rises in many marketing areas - from packaging designs through merchandizing, advertising to trade and website testing, in global FMCG industry. The paper displays the information about the application of webcam based eye – tracking, for understanding and predicting consumer choices and thus, helping business decision to be more competitive. The aim of the research is to investigate the marketers satisfaction with insights and recommendations provided when applying webcam eye tracking as implicit method compared to when using only survey, as explicit method. The present study provides important practical implications, proving the advantages of eye tracking approach for testing new products and redesigns. Furthermore, the paper has scientific and social contribution by using contemporay marketing research approach that relies on technology. The ethical, methodological and technical constrains and limitations of applying eye tracking in marketing research in this study are overcome and controlled: the research agency complies to GDPR (The General Data Protection Regulation) and all the respondents signed the agreement to participate in the project, aware that their eyes will be tracked through a webcam; there was controlled light in the background and process of calibration of each respondents was included. The agency gave the consent for analyzing marketers responces (client satisfaction survey) to the authors. The most important thing marketers acquire from marketing research agencies after conducted projects are insights and recommendations, which derive from researchers expertise and the methods used. In the research paper, the factor of different researchers or different agencies and markets is controlled as the collected satisfaction results derived from the same agency, same researchers and same countries. The only difference between the new products and redesigns tests analyzed in the papers is if they used only online survey or eye tracking method as well. The limitation of the study is that it cannot show exact case studies and insights as well as examples of the delivered projects due to confidentiality of the new products and redesigns tested. The benefits of eye tracking in testing new products and redesigns, in collecting further knowledge about the rules that drive successful new launches would be beneficiary for the marketing practice and marketing as a discipline.

## 1. CONTEMPORARY APPROACHES TO CONSUMER RESEARCH

Marketing as a discipline is developing fast, always trying to find better ways to persuade consumers. Marketing research is following the same trend, trying to better understand consumers and predict their behavior, in traditional as well as in digital environment (Ljubojevic, et al 2021). They cover various research subjects, that are directly or indirectly related to consumer behavior. (Ratkovic, et al 2012; Vujc, et al 2020; Ratkovic, et al 2020; Raletic, 2015). But, consumers' choices are driven by complex set of factors, many of them being in the subconscious mind. A consumer may want to help researchers and marketers and share his purchase drivers, but he is not able to delve into his subconsciousness (Sola, et al 2021; Bogosavljevic-Jovanovic & Dejanovic, 2021).

Neuromarketing and Application of Scientific Methods in Measuring Consumer Behaviour is the new area of marketing research (Bulley, et al 2018). Barden (2016) investigates the underlying mechanisms, rules and principles of consumer decision making, emphasizing an implicit system that works like an autopilot, naming it neuro-logic of a purchase decision. Neuromarketing can be defined as the application of neuroscience to solve the problems of marketing, having foundations in psychology, neuroscience, psychiatry, cognitive and brain sciences, economics, business, etc. (Sebastian, 2013; Cosic 2016; Fortunato, et al 2014). Also, "neuromarketing is defined as the set of techniques that use neuroscientific tools to develop Marketing applications in order to understand the decision-making process that occurs in the consumer's brain" (Cohen, et al 2017). It has gained significant interest from academics and practitioners, while it was firstly defined in 2002. as a study of cerebral mechanism to understand consumers behavior in order to improve marketing strategies (Cosic, 2016).

The human brain is incredibly complex, and when analyzing how and why consumers make the decisions, marketers have just begun to scratch the surface. "While many of the applications of the ongoing research on the human brain relate to medicine, marketing researchers in the field of neuromarketing are making great use of psychology to make marketing campaigns more scientific – and more effective – than ever" (Page, 2015, p.10). The way people make purchase decisions is a complex process as the human brain actually consists of three brains: the old brain is the most primitive part of our brain, and it primarily focuses on survival; the middle brain is more evolved, but still not particularly rational, having a focus on emotion; the new brain is highly evolved and rational, focusing on evaluating quantifiable facts using logics (Page, 2015).

Ramsay (2015) collects up-to-date knowledge explored by consumer neuroscience researchers globally, providing a neuromarketing toolbox about eye

tracking, galvanic skin response (GSR), electroencephalography (EEG), steady state topography (SST), magnetoencephalography (MEG) and functional magnetic resonance imaging (fMRI). Functional magnetic resonance is a measure of oxygen rich blood influx to the active brain parts and thus it is possible to see which parts of the brain are active while receiving stimuli or decision making. EEG measures neurons electrical activity and can measure arousal, cognitive workload and motivation (Cosic, 2016). These methods and few more are very complex to handle, require specific knowledge and raise ethical issues (Oliveira,, et al 2015; Dwivedi, et al 2020). The techniques used in neuromarketing can detect the focus of our attention, probe our memory and learning, tap into emotions and motivation and also measure sensory experience. Neuroscience can deliver new insights to marketers (Sola, et al 2021).

## **2. BENEFITS OF EYE TRACKING IN MARKETING RESEARCH**

Our senses are important in consumption decision, activating neural processes in our brain when we process the stimulus through them (Ramsay, 2015; Cosic, 2016). Ramsay (2015) states that eye tracking might be useful and insightful as functional Magnetic Resonance Imaging (fMRI) to study visual attention. The author used mobile eye tracking and EEG to extract neural responses when looking at some stimulus. The conclusion of the study is that less than half a second is needed to make prediction whether the consumer will buy the product or not. If we want to measure where someone is looking, what grabs their attention or how they scan the environment, eye tracking is the best choice. The interest in humans eye movements has a long history but only lately it has become possible to follow it and analyze it. Tracking eye movements arose as a result of the desire to learn about the relationship between the brain and visual system. The eye - mind connection means that eye movement recordings can provide a dynamic track of cognitive processes. Eye tracking method involves eyeglasses or stationary tracker with infrared cameras, measuring pupil dilation. It allows to observe and analyze in detail the way we look at something, the central direction of the gaze and to follow the path of the visual attention (Andrychowicz-Trojanowska, 2018; Białowąs & Szyszka, 2019; Husic-Mehmedovic, et al 2017). Eye tracking is a objective way to observe human behavior, getting subjects' real response, unlike questionnaire survey which depends on subjects' self report (Yang & Wang, 2015; Koller, et al 2012). "The greatest advantage of eye - tracking is that it collects data on consumer behavior directly, thus solving the traditional problem of the discrepancies between what an individual says and what an individual does. Eye movements are direct indicators of an individual's attention, which is difficult to control consciously" (Franken, 2020, p. 353).

Eye tracking is widely used method when testing packaging, new products and redesigns. The importance of packaging is rising in the competitive markets; the design is an inherent component of one of the “Four Ps” – product (Kumar & Garg, 2010). Over 60% of purchasing decisions are based on packaging, having between 2 and 3 second to convince the buyer. Packaging is an “active communication on the shelf, an advertising medium and a mute sales person” (Franken, 2020, P. 347). The design communicates products' attributes and the overall impression is presented through elements: illustration, color, typography and shape (Clement, 2007; Ampere & Vila, 2006; Husic-Mehmedovic et al, 2017). Results of the study (Kumar & Garg, 2010) show that harmony and typicality interact, affecting pleasantness and attentional activity - consumers prefer designs that have balance of the attention levels and pleasantness .

Without eye tracking, comparison between designs and their elements became irrelevant (Franke, 2020; Ampuro & Vila, 2006). Husic-Mehmedovic et al (2017) emphasize that “product and package design play important functions such as “attention grabbing”, categorization and communication as aesthetic, symbolic and functional information” (p.3). Their eye tracking study shows that package design besides being important attention grabber, plays important role in communication and should be aligned with sub-category and brand positioning strategy. Eye tracking study of fictive products (not known to respondents) shows the importance of where the product, no matter the design, is placed on the retail shelf, both online and offline. Centrally located brand within product category is chosen more often even when it is not placed in the center of the shelf or the visual field (Atalay, et al 2012). Clement (2007) concludes that marketing can benefit from better understanding of visual impact from packaging design and in-store buying decision process, emphasizing the advantage of eye tracking research approach.

### **3. WEBCAM EYE-TRACKING METHODOLOGY AND APPLICATION**

Combining two trends happening in marketing research – examining implicit bases of consumer behavior (neuromarketing) and using Internet as faster way to collect data – a neuromarketing research studies are being conducted online. Digital marketing research has many advantages over traditional: lower costs, speed, flexibility as well as easier access to respondents. Speed and flexibility of any process are becoming the most important factors in modern business and that is the main advantage of digital versus traditional marketing research. There are some constraints regarding digital research – it is not possible to test sensory experiences such as taste, smell or touch (Wilson & Laskey, 2008). And there are constrains in online neuromarketing techniques – not all can be applied online as direct contact is needed. Eye tracking is the neuromarketing method that widely uses Internet for data

collection, using Webcam and specific software. There are some important ethical constrains that need to be noted: research agency needs to comply to GDPR (The General Data Protection Regulation) and all the respondents have to sign the agreement to participate in the project, aware that their eyes will be tracked through a webcam. Furthermore, methodological and technical limitations need to be controlled - to have controlled light in the background and to include process of calibration of each respondent (Table 1.).

**Table 1.** Advantages and disadvantages of webcam eye tracking compared to stationary(Source: Authors)

WEBCAM EYE TRACKING COMPARED TO STATIONARY EYE TRACKING	
Advantages	Disadvantages
Can reach a huge number of people	Very sensitive to movement
Can reach nearly any market in the world	Dependent on light conditions
Offers fast turnaround time Respondents are in their homes	Less precise

Webcam based eye tracking uses the same research methodology and procedures as stationary eye tracking and as any other research approach. Starting with research objectives, experimental design, sample definition, screener and questionnaire development, but includes preparing stimuli in an online format and programming questionnaire. Sample definitions can be the same as for the traditional research, even allowing more specific quotas but with a constraint in some markets with lower internet and webcam penetration. The questionnaire that supports eye tracking needs to be short and clear. The data analyses goes relatively fast as the data collection goes online (Duchowski, 2017)

Webcam eye tracking in consumer research can be used when testing new products, new concepts, redesigns, planograms, advertising materials, POS materials, leaflets and digital materials. In any of those studies it uses the same indicators: heat maps, gaze points, fixation time, 1<sup>st</sup>seen element, attention, areas of interest (AOI), order of fixation (fixation sequences), etc. (Andrychowicz-Trojanowska, 2018; Page, 2015; Atalay, et al 2012).

#### 4. RESEARCH METHODOLOGY

The quality of consumer research insights gathered through implicit methods, in authors' practice, has inspired this research paper. It displays the information about the application of webcam based eye – tracking, for understanding and predicting consumer choices and thus, helping business decision to be more competitive. The aim of the research is to investigate the marketers satisfaction with insights and

recommendations provided when applying webcam eye tracking as implicit method compared to when using only survey, as explicit method. The hypothesis is that for pack and design studies, deeper and more reliable insights are provided using eye tracking compared to insights gained by survey. It is measured and analyzed by marketers satisfaction.

Client satisfaction survey was distributed online to the marketers (clients) of the neuromarketing research agency EyeSee (Belgium), that conducted research projects, from April 2018 to April 2021. In those 3 years, the agency has developed and delivered a lot of online research studies with a great number of respondents, covering shopper, advertising and digital objectives and stimulus, using different implicit methodologies (eye tracking, facial coding, virtual shopping etc.) as well as online surveys. Total of 294 responses from marketer was collected, through client satisfaction survey. Only shopper studies dealing with redesigns or new products developments that included eye tracking and/or survey method in their project were extracted and analyzed - total of 108 responses. The marketers (client) satisfaction survey included many indicators but for this paper, indicator named insights and recommendations provided by the study (likert scale, scoring from 1 - very unsatisfied to 5 - very satisfied) is analyzed. Following that score, marketers provided their rank to the study, compared to other studies they have been doing, as well as other vendors, based on their satisfaction level (1 being the best rank). Furthermore, clients were asked to provide some advice, as comments, explaining their scores and ranks. Besides that, the cost of the project is included.

The EyeSee research agency complies to GDPR (The General Data Protection Regulation) and all the respondents of the research agency signed the agreement to participate in the project, knowing that their eyes will be tracked through a webcam so that they need to turn on the camera on their computers and to install the software. The agency conducted package and redesign research studies for several global marketers of global FMCG companies and the studies, for which they filled the satisfaction surveys, covered different markets and respondents from those markets (Table 2).

**Table 2.** The markets where the included studies were developed

THE MARKETS INCLUDED IN THE STUDIES		
Most often	Medium	Least often
USA	Mexico	Russia
UK	Germany	South Korea
France	Netherlands	Spain
Brazil	Belgium	Switzerland

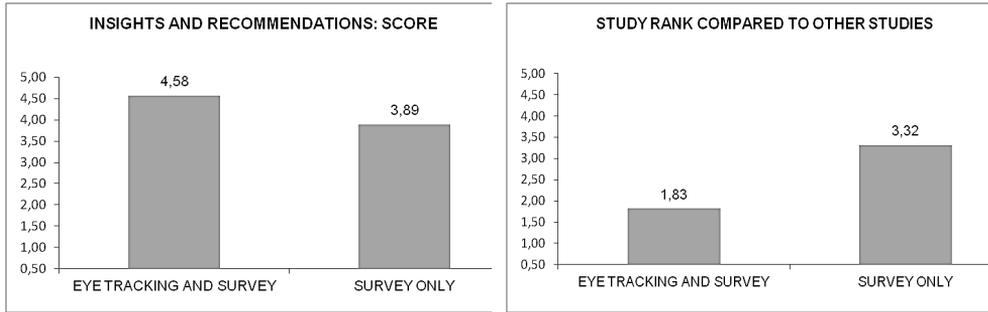
(Data source: Research agency EyeSee, Belgium)

The research sample for this research paper consists of marketing managers, brand managers or insight managers of the global highly recognized FMCG companies, clients that developed pack and design studies with EyeSee – global neuromarketing research agency, by filling the client satisfaction survey. There is a one response, one client satisfaction survey per research project developed in three years, covering 108 pack redesigns or new products development projects. The agency gave the consent for analyzing marketers responses for the research paper purposes, while not showing actual case studies and designs tested ( due to confidentiality issue). Quantitative descriptive analyses was undertaken on marketers satisfaction responses, scores and ranks. The analyses was undertaken based on the information if the eye tracking was used (70 projects) or only online survey (38 projects), as well as based on the cost of the project. Furthermore, qualitative analyses was undertaken on clients comments about satisfaction levels, focusing on possible differences in answers if eye tracing was included in their project or not.

## **5. FINDINGS**

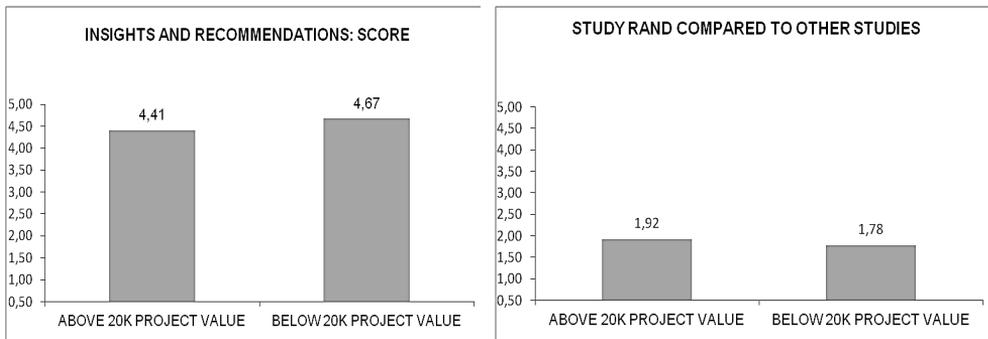
### **5.1. Clients satisfaction results**

Satisfaction with insight and recommendation of all studies analyzed is generally high and ranges between 4 and 5; the perception of rank as well – around second place, compared to other studies. The difference in scores and ranks is evident when comparing satisfaction results on pack redesigns based on the fact that eye tracking is used. All the studies that used eye tracking as methodology (supported by survey) for pack redesigns scored on average 0,7pp higher, on insights and recommendations score, than studies that did not use eye tracking (Figure 1). The average score on insights and recommendation, when eye tracking is used, was 4.6 (out of 5 maximum). The same score for the same objective of the study, but without using eye tracking scored 3.8. Furthermore, the rank clients gave the study compared to other studies and vendors differs depending on using or not using eye tracking – with eye tracking method the rank is higher by 1,5pp - with eye tracking the rank provided by clients is 1.8 ( the best is the 1st rank) while for survey only, without eye racking, it is 3.3. The level of satisfaction with insights impacts the clients perception of the overall quality of the study and the vendor, compared to other studies and vendor – leveraged by eye tracking benefits



**Fig.1** Marketers scores and ranks given to eye tracking studies and non eye tracking studies, (Data source: Research agency EyeSee, Belgium)

There is a slight difference between scores, on satisfaction about insights and recommendations from clients that used eye tracking, based on the cost of the project (Figure 2). Those that spent less than 20 000€ on the project gave higher scores while those that spent more than 20000€ on the project gave lower scores. Although they both used eye tracking, the difference goes up to 0,3pp on insights and recommendation score, emphasizing that the price of the project impacts expectations and thus satisfaction. The difference between these two groups is less evident when ranking, they are nearly similar (0,1pp) (Figure 2.).



**Fig.2** The difference in marketers scores and ranks given to eye tracking studies based on the project cost (Data source: Research agency EyeSee, Belgium)

## 6. QUALITATIVE ANALYSES OF CLIENTS' COMMENTS

Following the scores and ranks, marketers also provided their verbal feedback about their expectations and satisfaction in the form of a advice to make it better. Besides generally satisfied comments, the comments from clients that used eye tracking were about good quality of insights, consumer relevance, clear and to the point findings and help for clever decision making. On the other side, comments from clients that did not use eye tracking emphasized caution, lack of actionable insights and of an answers why (Table 3).

**Table 3.** The difference in client comments about satisfaction with and without eye tracking method

CLIENT COMMENTS ABOUT SATISFACTION WITH INSIGHTS AND RECOMMENDATIONS	
Study with eye tracking	Study without eye tracking
Useful to know the relevance of our designs to the consumer	Lack a nice story flow that tells the story of the data. We had queries about why 2 of our brands , the team was not able to answer this for us. We had to ask for a lot of extra runs to be able to answer this question
The quality of insights are great. Helps clearly articulate a story on the WHY behind a recommendation.	
Continue to deliver clear, short and to the point findings	Enhance actionable insights
Eye See helped protect us from potentially losing sales dollars and we will move forward with making small, modern changes to the current design.	Would have appreciated more caution on changing from current packaging.

(Data source: Research agency EyeSee, Belgium)

## CONCLUSION AND DISCUSSION

Integrating an implicit, neuromarketing level into marketing practice provides entirely new perspective of managing brands, as it enters into unconscious levels of consumers behavior. By understanding and predicting deeper consumers motivation and purchase decision drivers, it provides superior net value to consumers besides increasing sales. New product developments and pack redesigns are important part of marketing practice and marketers are often unsure whether some products and designs would be accepted or not by consumers. We are witnessing great new product redesigns that undergone traditional research but failed to succeed in the marketplace, on the shelf.

The integration of eye tracking, EEG or other neuromarketing research approach is not bringing an end to traditional research but rather creates an upgrade, offering higher level of reliability, that still needs a support by questionnaire and stated responses of consumer. The mix of marketing research approaches (whether online and offline, qualitative and quantitative or implicit and explicit) is highly appreciated, each providing valuable insights for understanding and predicting consumers behavior. The application of eye tracking method is widespread and extensive in the global FMCG industry, as it becomes one of the important methods to study cognitive processes underlying consumer choices and decision making. Organizations value the benefit of eye tracking for new product developments and redesigns, performing rounds of testing, and including many designs. These testing and insights are property of the clients and kept very confidential so not much of the eye tracking integration into marketing practice and its benefits is shared with academics.

The study shows the benefits of using eye tracking method for testing new products and redesigns by the satisfaction levels of marketers, clients of research agency. In particular, the most important thing marketers acquire from marketing research agencies after conducted projects are insights and recommendations, which derive from researchers expertise and the methods used. In the research paper, the factor of different researchers or different agencies and markets is controlled as the collected satisfaction results derived from the same agency, same researchers and same countries. The only difference between the new products and redesigns tests analyzed in the papers is if they used only online survey or eye tracking method as well. Although, having overall high satisfaction score for all the studies, the difference in clients satisfaction scores for insights and recommendations provided is 0,7pp higher when using eye tracking. This difference is treated as high, impacting overall ranking of the study conducted compared to other studies and vendors – resulting in 1.5pp difference in ranking depending on using eye tracking or not. As eye tracking market research studies in the global market are not cheap, the effect of the cost of the project was analyzed as well. Results shows that when using eye tracking, satisfaction scores on insights and recommendations get slightly higher when the project value is below 20000€ while those clients that spent more than 20000€ while using eye tracking had higher expectations (but still giving score 0,54pp higher than those conducting only survey). The overall rank of the eye tracking study, among other studies and vendors, is not affected by the cost of the project. The qualitative analyses, based on clients comments, reveals that eye tracking method ensures satisfaction with good quality of insights, consumer relevance, clear and to the point findings and help for clever decision making, while some of the comments when not using eye tracking were about needed caution, lack of actionable insights and of an answers why.

The present study provides important managerial implications, proving the advantages of eye tracking approach for testing new products and redesigns. Furthermore, the paper has scientific and social contribution by using contemporary marketing research approach that relies on technology. The hypothesis was that for pack and design studies, deeper and more reliable insights are provided using eye tracking compared to insights gained by survey. It is measured and analyzed by marketers satisfaction. The research paper confirms hypothesis and concludes that understanding and predicting consumer behavior is more relevant by using eye tracking methodology, resulting in more reliable insight and recommendation from the research study. The cost of the eye tracking study, expected to impact expectation and satisfaction level, is not confirmed. The limitation of the study is that it cannot show exact case studies and insights as well as examples of the delivered projects due to confidentiality of the new products and redesigns tested. The ethical, methodological and technical constrains and limitations of applying eye tracking in marketing research in this study are overcome and controlled: the research agency complies to GDPR (The General Data Protection Regulation) and all the respondents signed the agreement to participate in the project, aware that their eyes will be tracked through a webcam; there was controlled light in the background and process of calibration of each respondents was included. The agency gave the consent for analyzing marketers responses (client satisfaction survey) to the authors. The benefits of eye tracking in testing new products and redesigns, in collecting further knowledge about the rules that drive successful new launches would be beneficiary for the marketing practice and marketing as a discipline.

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