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NEUROMARKETING AND EYE TRACKING IN WOMEN'S FASHION BUYING DECISION MAKING

Neuromarketing e Rastreamento Ocular na Tomada de Decisão de Compra de Moda Feminina

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Abstract
In recent years, the combination of research methods in neuroscience and neuromarketing and their applications has resulted in a large body of academic and marketing work in an explosion of opportunity for in-depth studies of the brain. The purpose of this article is to provide academic marketing researchers and professionals in the private sector with a methodological reading grid so that they can assess the feasibility, implementation

Resumo
Nos últimos anos a combinação de métodos de pesquisa nas neurociências e neuromarketing e suas aplicações resultaram em um grande corpo de trabalhos acadêmicos e mercadológicos em uma explosão de oportunidade de aprofundamento de estudos do cérebro. O objetivo deste artigo é fornecer aos pesquisadores acadêmicos de marketing e profissionais do setor privado uma grade de leitura metodológica para que possam avaliar

conditions, relevance or even the added value of using consumer neuroscience through the use of tracking. eye on choices and preferences in women's fashion purchase decision making. Marketing and consumer behavior constitute fields of investigation for which understanding the brain dynamics underlying attention, motivation and decision making represents an added value. For this reason, it is essential to understand what it means to use tools to investigate brain activity in an ethical, technical, methodological and financial way, as well as at the level of data analysis and interpretation.
Keywords: Neuromarketing; Eye Tracking; Psychology of Fashion.

a viabilidade, a condições de implementação, a relevância ou mesmo o valor agregado do recurso à neurociência consumidor através do uso do rastreamento ocular sobre escolhas e preferências na tomada de decisão de compra de moda feminina. Marketing e o comportamento do consumidor constituem campos de investigação para os quais a compreensão da dinâmica cerebral subjacente à atenção, motivação e a tomada de decisões representa um valor agregado. Por este motivo é essencial entender o que significa usar ferramentas para investigar a atividade cerebral de forma ética, técnica, metodológica e financeira, bem como no nível de análise e interpretação dados.
Palavras-chave: Neuromarketing;
Rastreamento Ocular; Psicologia da Moda.

INTRODUCTION

The consumer market for women's fashion has become more varied due to the rise of designer brands, stores, personalization, customs and advertising in today's global market. A clear understanding of consumer preferences will help the marketer to attract and retain their target audience group through applied consumer neuroscience (Ramsøy, Michael & Michael, 2019).

When purchasing a product, consumers are faced with a series of information presented to them. However, this information can only affect buyers' choices if they pay attention. Eye tracking can measure visual attention to information. More recently, research in women's fashion markets has combined eye tracking and assessment methods to provide insights into the relationship between visual attention, preferences, and choices (Plassmann et al., 2015).

We present an overview of the eye tracking literature and discuss theory and applications. In addition, information is provided on how to measure attention and visual choice. While eye tracking has its challenges, there are interesting avenues for future research that marketers and fashion professionals can explore using eye tracking.

When studying the impact of providing information on the choice of apparel and accessories, it is often assumed that all information is met. However, consumers may not understand or understand all of the information presented. If the information is not met, it will not be able to inform the choice. As a result, it is important to assess whether and how consumers pay attention to information and the factors that influence this attention or inattention (Harris, Ciorciari & Gountas, 2018). One method of measuring consumer attention is eye tracking. With eye tracking, it is possible to analyze which product attributes and information about attributes that consumers attend most visually and how visual attention relates to product evaluation and choice (Ramsøy et al., 2017).

The perception of consumer attention to information such as patterns and textures of garments is relevant to several stakeholders in the fashion sector (Solomon & Rabolt, 2004). For marketing purposes, it is useful for designing marketing programs, but also for the digital realm (social networks, blogs and videos). For example, for fashion marketing analytics, it is important to know what consumers cater to, and what they value at the end of the information (and related product features). Therefore, the purpose of this article is to provide an overview of studies and issues related to the use of eye tracking in consumer research on women's fashion choices and preferences.

We provide information on measuring consumers' preferences and choices while also considering their visual attention. We focus on (a) eye tracking studies related to attention to clothing print information and its visual aspects, and (b) preference studies that investigate the relationship of visual attention, choice, and evaluation (Smith & Marci, 2016).

In the women's clothing and accessories space, a lot of information is communicated to consumers (usually through the store's fitting room), about the psychology of fashion (for example, affectivity of one's own image and the impression it transmits to others), differentiation (for example, example, becoming more attractive), homogeneous style (hiding individuality), cultural values of society (qualities associated with a certain color), combination of pieces (image conditioning), (Solomon & Rabolt, 2004).

Although studies have investigated the influence of fashion psychology on consumer choices, more research is needed on the impact of providing information through neuroscience (Caruelle et al., 2019). As mentioned, consumers do not necessarily pay attention to all the information presented on mannequins, store layouts, store windows and point of sale (POS) and store displays. Therefore, the inherent assumption made by many women's fashion choice studies that consumers pay attention to all information is not always valid (Clement, Aastrup & Forsberg, 2015).

This can generate biased results and lead to substantially different conclusions. Information can only impact consumers' clothing choices if it attracts their attention. Attention is a first step in the decision-making process and a prerequisite for conscious information processing. Visual attention, in particular, allows individuals to selectively use information that can aid decision making (Javor et al., 2013).

Obviously, lack of attention can be a major bottleneck that prevents information from influencing consumer choices. This could result in consumers being unable to make informed decisions and thus preventing them from making food choices based solely on their preferences. Therefore, having insights into attention to information provisions is important for marketers as well as fashion professionals (Smidts et al., 2014). In this sense, it is important to know what kind of information (e.g. production method, brand, value) and formats (e.g. labels, sizes, textures) receive attention and how this influences consumer preferences and choice behavior (Walla, Mavratzakis & Bosshard, 2013).

So far, most research that has investigated attention to information about women's fashion and its impact on style choices has relied on self-reported measures of attention (eg, "Did you pay attention to price?"). However, self-reported measures can be biased because consumers may overestimate or underestimate their share of information. For example, they may not remember whether they paid attention to certain information or not, or they may have unconsciously perceived certain attributes (Karmarkar & Plassmann, 2019).

An alternative to using self-reported measures is eye tracking, which objectively collects visual attention data. Several studies have shown a link between eye movement and visual attention. Therefore, it allows researchers to objectively study attention and stop relying only on self-reported measures (Clement, Aastrup & Forsberg, 2015). In the fashion market, the incorporation of eye tracking is a relatively new experimental method. Applied to consumer research, it allows researchers to record the gaze of respondents (ie what one is looking at) and monitor their visual attention when evaluating products or making product choices (Javor et al., 2013).

Research is scarce on the relationship between attention, preferences, and choice. However, with the use of eye tracking, researchers can answer more applied research questions such as: What information are consumers paying attention to, and in what order? What information or visual elements are noticed and which are ignored? What products are perceived on a store mannequin? Which brands are most seen? What information format or design best attracts the buyer's attention?

Using eye tracking, one can study how changes in Fashion Psychology format affect consumers' attention and their decision and purchase behaviors. Eye tracking can also be combined with stated preference methods such as choice experiments to better understand consumer choice behavior (Ramsøy, Michael & Michael, 2019). In this regard, eye tracking data can be used in combination with choice and willingness-to-pay (DPP) data derived from choice experiences to provide additional

insights into the relationship between preferences and attention (Plassmann, Ramsøy & Milosavljevic, 2012).

Eye tracking research can also address methodological issues related to decision-making strategies and information processing strategies. For example, one can investigate the involvement of respondents with the information presented. One can investigate decision making in a choice experiment scenario and assess whether one or more attributes or alternatives in a set of options were ignored (Smidts et al., 2014).

Discrete choice models generally assume that participants take into account all the information presented. However, other decision strategies or heuristics may have been applied, resulting in a phenomenon known as attribute no-show (Smith & Marci, 2016). Respondents visually overlooked certain attributes and how this influenced choice behavior. Given these opportunities, eye tracking offers a promising avenue for future research in the fashion market (Caruelle et al., 2019).

Psychology of Fashion

The psychology of fashion is commonly defined as the study of the impact of clothing choices on the way we perceive and judge ourselves. However, the term fashion psychology is a bit misleading, as the market actually looks far beyond the impact of clothing on the individual. And its focus transcends clothing to also consider the impact of many other products that express their own identity and are influenced by the same forces that drive change in the clothing industry, such as home furniture, cosmetics, and even automobiles (Hawkins & Mothersbaugh, 2018).).

Fashion psychology is very important for marketers who need to understand the factors that make it likely that a product will be adopted by a group of consumers and who need to predict how long that product will remain in fashion (Plassmann et al., 2015). So part of fashion psychology focuses on changes in acceptance over time. For example, a classic is a fashion with an extremely long acceptance cycle, adopted by a very large group. On the other hand, a fad is a short-lived fad. Relatively few people adopt a trendy product, but it can spread quickly. Adopters may all belong to a common subculture, and fashion “runs through the limbs” but rarely leaves that particular group (Javor et al., 2013).

Let's distinguish between some confusing terms in fashion psychology. Fashion is the process of social diffusion by which some consumer groups adopt a new style. On the other hand, a fashion (or style) is a particular combination of attributes (eg, arrow-print jeans that women wear with a tunic top). Fashion is a complex process that operates on multiple levels. For this reason, there are many perspectives on the origin and diffusion of fashion (Solomon & Rabolt, 2004).

Many psychological factors help explain what motivates us to be fashionable. This includes conformity, desires for variety, the need to express personal creativity, and sexual attraction. For example, many consumers seem to have a need for exclusivity: they want to be different (though not necessarily very different). As a result, people can adapt to the basic contours of a fashion, but still improvise to make a personal statement within these general guidelines (Walla, Mavratzakis & Bosshard, 2013).

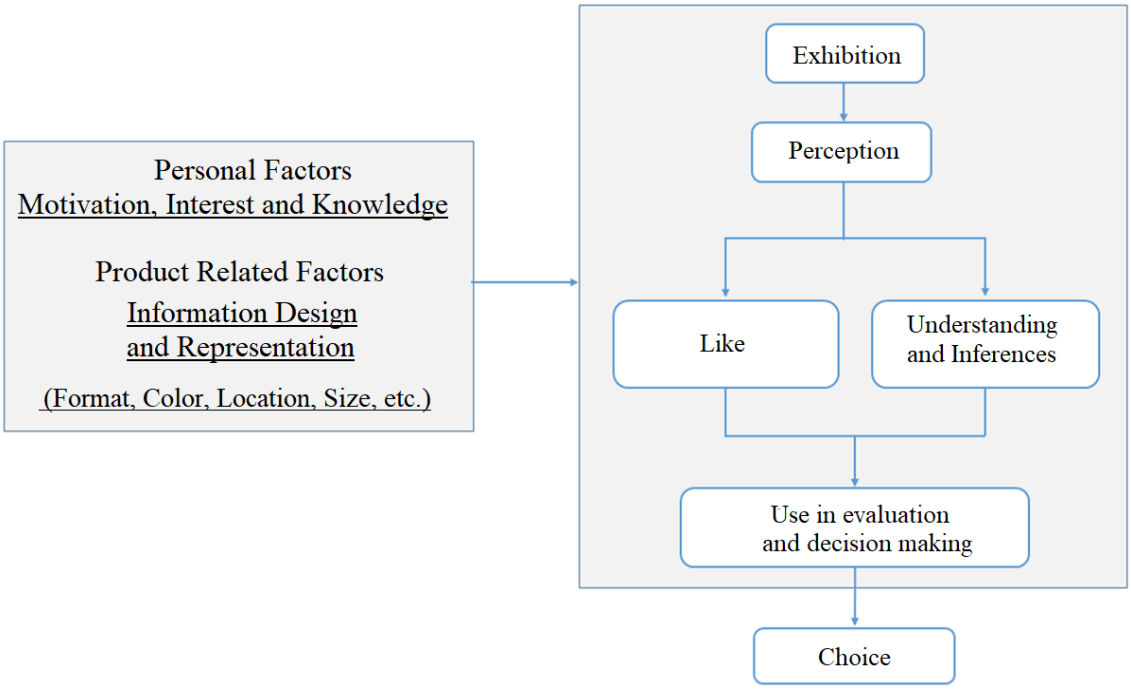
One of the first theories in fashion psychology argued that "changing erogenous zones" (areas that sexually arouse the body) explained fashion changes and that different zones become objects of interest because they reflect societal trends. For example, it was common for Renaissance-era women to drape their abdomens in fabrics to give a bloated appearance; successful pregnancy was a priority in the 14th and 15th centuries, affected by the disease (Banov, 2020). Lin et al. (2018) analyzed several studies on how variations in clothing influence observers' responses. For example, one study found that men tended to leave higher tips for waitresses who wore red blouses. The “dress for success” phenomenon illustrates the widespread belief that appearance directly affects the way people are treated.

Theoretical context on attention and decision making

Attention is defined as “the degree to which consumers focus on a stimulus within their exposure range” (Solomon et al. 2014). Only information that is at least minimally attended to and

perceived can influence consumer choices (Engel, Blackwell, and Miniard 1995). Therefore, attention is an essential step in the decision-making process, because it is a prerequisite for information processing.

Attention is part of acquiring information before making a decision and also plays a role in making a decision. Consumers go through several consecutive steps before reaching a purchase decision, and this includes considering the information presented. For example, Ramsøy et al., (2017) suggested a "hierarchy of effects" framework to explain how exposure to information can affect product choice based on research related to decision making (Solomon et al. 2014) and information processing. Banoy (2020), although information about women's fashion products can affect the choice, there are many steps that consumers need to take, starting with exposure and ending with the actual choice as shown in Figure 1 below:



Source: Banov (2020)

Figure 1. Decision Making

First of all, consumers need to be exposed to information. Exposure will only have an effect if the individual perceives the information(Rainatto et.al 2019). This is most likely to happen when consumers are actively searching for this information and when they are stimulated by the message design, increasing attention to the information. After perceiving the information, individuals can follow two different paths to process it (figure 1). In shopping situations where engagement is low and only peripheral processing occurs (eg, habitual purchases; Petty and Cacioppo 1986), message attractiveness is important. For example, it matters how information is represented in terms of format (text, figure), color, size, and dummy location.

When using this so-called "peripheral route" of information processing (Petty and Cacioppo 1986), choices can be affected by an affective response due to the attractiveness of the information provided. This can lead to a more positive evaluation of the product without any in-depth processing, even when the information is poorly understood. In the case of high-involvement purchases (eg, luxury apparel), in-depth information processing takes place and consumers attach meaning to it. This happens when consumers' motivation and ability to process information are high, resulting in "central route" information processing (Petty and Cacioppo 1986).

The effects of information on the purchase decision will depend on the consumer's understanding of what this entails. For example, consumers can infer meaning by relating perceived

information to their pre-existing knowledge (Engel, Blackwell, and Miniard 1995). Their inferences enter the evaluation and decision-making process, where they can be traded against other product characteristics, including price and taste. It is possible that information enters the decision-making process by being traded against other characteristics and, therefore, can influence the final decision.

The entire process is influenced by personal factors such as motivation, goals and knowledge. Visual attention is driven by top-down and bottom-up processes. The top-down process refers to goal-directed attention and is based on the principle that decision makers prefer to look at goal-relevant stimuli. Goal-directed attention is caused by the voluntary search for specific information. It is based on pre-existing preferences, personality traits, interests, decision goals, involvement, and task instructions. It also refers to utility effects; that is, "the observation that participants tend to look at information that is most useful or important to their decision."

There are many factors that impact women's shopping behavior such as organized retail stores, malls, fit, appearance, style, rising income, generation, and various brands available in the market. Bottom-up process refers to stimulus-directed attention. It is caused by characteristics of the stimulus itself and occurs without specifically looking for it. Visual salience, surface size, location, visual clutter, and stimulus position are stimulus design factors, also called bottom-up factors. These factors influence the attention paid to the stimulus during the decision-making process, increasing or decreasing the probability of stimulus fixation. The mechanisms that cause these upward factors to lead to biased attention are discussed in detail in Norberto et al., (2019).

Orquin, Perkovic and Grunert (2018) report that it is impossible not to influence decision makers to attend to or ignore certain information and, in this way, affect their choices, which highlights the importance of investigating attention to information. Visual attention can also have priority effects on consumer choice, that is, the causal effects of visual attention on decision making. This effect is based on a combination of two stimulus-directed attention processes.

First, alternatives that attract more attention lead to more exposure, resulting in a higher probability of choice due to the mere exposure effect (i.e., a longer exposure leads to a higher probability of choice). Second, alternatives or attributes that receive bottom-up attention are less likely to be ignored during the decision-making process and more likely to enter the consideration set.

Although visual attention and choice are related, the direction of the relationship remains unclear. It is often difficult to separate the effects of reference points of attention in decision making from the so-called utility effect. The utility effect, that is, attending more to information that is most important or of high value or utility to the individual, depends on goal-oriented attention, attributed to pre-existing preferences or goals. Refers to decision makers who pay more attention to alternatives or attributes of high utility or high value. Thus, alternatives with a higher probability of choice will receive more attention. On the other hand, the downstream effect of attention on decision making suggests that increasing attention to an alternative increases the probability of choosing that alternative.

Solomon et al. (2014) sought to unravel the reasons for this “bias of view” and reported that the objective mainly draws attention. Likewise, the results of Ramsøy et al., (2017) support the goal-oriented causality argument, according to which "attention depends on stable values that each respondent brings to the task", which corroborates the effect of utility. The latter study also reports little influence of stimulus-directed attention on choice in repeated-choice tasks. There is also an interaction between visual attention and working memory that depends on whether it is more efficient to retrieve information from the environment or from memory. If the decision maker is facing a familiar visual situation, he/she can rely on memory.

This interaction between attention and working memory can be influenced by several factors, such as information complexity and time pressure. For example, visual information can be temporarily retained in working memory and can allow for daily routines and behavior patterns. This means working memory is vital for controlling attention. Given that attention is related to choice and the amount of factors influencing attention is multiple, researchers investigating decision making are interested in unraveling the effects of visual attention on choice behavior.

Measuring Visual Attention Visual

Attention occurs when the decision maker physically directs his gaze (eye movements) to information. Eye movement consists of fixations and reference points. Fixations are crucial for visual attention (Caruelle et al., 2019). During fixations, the eye is unyielding and information is processed. Fixations range from 20 milliseconds to more than 1 second, and recent technological developments with eye trackers have made it possible to more accurately measure visual attention (Plassmann, Ramsøy & Milosavljevic, 2012). Eye trackers can record eye movements using measures such as fixations (eg, where the eye is relatively still) and saccades (eg, rapid eye movements between two fixations). Information processing usually takes place during fixations. The eye tracker discovers: (a) Location - where participants look at a specific time; (b) Duration - how long they look at it; and (c) Movement - which path your eyes follow (Ramsøy, Michael & Michael, 2019).

Setting Up a Visual Study

To use eye tracking in a study, the first decision to be made is what type of eye tracker to use, given the experimental method being used in the study. In this sense, Plassmann et al., (2015) provide an overview of available eye trackers. For example, when performing a classic laboratory study, stationary eye trackers are best suited. If a study is to be performed outside the laboratory, eyewear, i.e. mobile eye trackers (also called head-mounted eye trackers) are particularly useful.

Next, it is necessary to design a study that combines the chosen experimental method with eye tracking. When testing the impact of attention on preferences and choices, stated preference methods such as choice experiments are suitable. In this case, different high resolution stimuli need to be created. For example, images of food products that participants will need to choose from or a table with information on the different attribute levels of alternatives to choose from (or bid if an auction mechanism is used), (Ramsøy et al., 2017).

This experimental setup can be created in the respective eye tracking software. Commercial eye tracking software is available from eye tracker manufacturers for experiment design, data collection and analysis. In addition, open source software is also available. The stimuli can be images or a website, such as an online survey platform. However, when using a website, each of the stimuli presented to the participant must have a unique URL to allow the eye tracking software to identify the different stimuli presented to the participants (Smidts et al., 2014).

To obtain specific information from the respondent, such as beliefs, attitudes, behaviors or personal characteristics, a survey instrument can be developed to complement eye tracking. To set up a real study, it is advisable to have two bedrooms (Smith & Marci, 2016). A room can be used to welcome participants, distribute incentives, and have participants complete consent documents and related questionnaire(s). The second room can be used to perform eye tracking. This room should be kept as neutral as possible to avoid distortions, that is, free from distractions such as bright colors and clutter (Walla, Mavratzakis & Bosshard, 2013).

It is also helpful to have at least two researchers, one for each room, to handle incoming participants, supervise completion of questionnaires, and perform eye tracking. It is vital that the eye tracking researcher receive training because eye tracking requires specific skills (Plassmann, Ramsøy & Milosavljevic, 2012).

From raw data to visual tracking metrics and further analysis

Finally, the type of analysis needs to be determined. The raw gaze data collected during the experiment contains raw eye movement data points, identified by a timestamp and the x and y coordinates. These data points (also called landmarks) are then aggregated into fixtures based on an algorithm that determines whether two datum points belong to the same fixture or not (Walla, Mavratzakis & Bosshard, 2013).

After the experiment is performed, various analyzes with the eye tracking data are possible. An important feature is the use of Areas of Interest (AI), which indicates important areas of the image. AI can be set in eye tracking software to get eye tracking metrics for each specific area. Different eye

tracking metrics can then be obtained related to fixations or deviations that occurred in an AI (Smidts et al., 2014).

Examples of eye tracking metrics are total fixation count (the number of fixations that occur in the AI), total fixation duration (the total time of fixations within the AI), the total duration of visits (the total time of fixations and saccades occurring in the AI), time to first fixation (the time from the onset of stimuli display to the first fixation in the AI), and duration of first fixation (Smith & Marci, 2016). These metrics can be obtained for each individual and can then be merged with other datasets, such as choices or bids made during the experiment, as well as data from pre- and/or post-eye tracking questionnaires. In addition to eye tracking metrics, eye tracking data can also be used to visually represent the degree of attention and eye movements using heat maps or observational graphs (Javor et al., 2013).

Heat maps are attention maps that can show aggregate fixations (counts or durations) for groups of respondents, highlighting the "hot spots" in the stimulus image. Gaze plots show eye movements with a scan path and illustrate gaze positions and eye events (fixations and saccades) from the selected dataset plotted on the stimulus image (Ramsøy et al., 2017). In recent years, eye tracking research using settings similar to those described has been applied to the fashion marketThe next sections discuss examples of research focusing on (a) the use of mannequins, (b) window dressing, and (c) information processing and decision-making strategies regarding garments (Caruelle et al., 2019).

Research on the use of clothing and accessories

Clothing and accessories are sources of information and signal quality to consumers. Patterns, textures, sizes and colors can convert experience and credibility quality attributes into research quality attributes, allowing consumers to make an informed decision, but this does not imply that consumers pay attention to it (Harris, Ciorciari & Gountas, 2018). Eye tracking has led to useful insights into consumers' attention to apparel information. Several studies have evaluated the impact of bottom-up factors on attention, ie, stimulus-oriented attention (Plassmann et al., 2015).

Purchasing impulsiveness can also affect consumers' attention. It was found that consumers who buy more impulsively are less fixated on store signs and more on store displays (Walla, Mavratzakis & Bosshard, 2013). While investigating attention to information about women's fashion, such as window dressing, mannequins, colors, prints, textures, and other attributes, are important in their own right, it is also necessary to analyze how the information served affects the actual choice (Clement, Aastrup & Forsberg, 2015).

Women's Fashion Choice and Evaluation Research

Eye tracking can be used in evaluation studies to provide information on the relationship between visual attention, evaluation, preferences, and choice behavior. For example, eye tracking can be used to examine how visual attention relates to choice and PPD measures (Karmarkar & Plassmann, 2019). Recent consumer research in the fashion market has combined eye tracking with choice experiments and experimental auctions to investigate the influence of visual cues on consumer choice and evaluation (Caruelle et al., 2019).

Visual attention and its relationship to choice behavior

Several studies have investigated the relationship between attention and choice. In general, the options chosen tend to receive more attention (longer duration of fixation, greater number of fixations, longer duration of the first fixation) than the options that are not chosen. However, only a few studies have specifically focused on clothing choice (Ramsøy et al., 2017). For example, Ramsøy, Michael & Michael (2019) investigated attributes of attraction and rejection and found that visual attention to price and quality information in women's brands is related to lack of desired and appropriately sized product.

Similarly, Smith & Marci (2016) found that visual attention and fashion choice are related. Grebitus, Roosen and Seitz (2015) studied the effect of visual attention on accessory choice using

choice experiments with different complexity tasks, i.e. different numbers of attributes. Their study revealed that visual attention (observation time) in experiments with less complex choices predicted choice, having only a small effect in design experiments with more complex choices. Furthermore, Clement, Aastrup & Forsberg (2015) reported that visual attention to yogurt is related to choice probability.

Their results also indicate that the effect of nutrition labels on choice is mediated by attention. However, Ramsøy et al., (2017) also found that the more information on clothing labels, the less likely consumers are to choose the related product. In addition to the fashion choice survey, the accessory choice survey also combined eye tracking with sustainability-based conjoint analysis, and some authors have reported a correlation between visual attention and the likelihood of purchasing accessories. Visual attention was also found to be a predictor for choosing products by similarity (Harris, Ciorciari & Gountas, 2018).

Visual attention and its relationship to consumer assessment

Studies have evaluated whether eye tracking can reveal meaningful information about the value consumers place on product attributes when making fashion and style choices (Smidts et al., 2014). Studies of visual attention in evaluation studies, such as choice experiments and experimental auctions, have examined the relationship between attention and importance and evaluation (Javor et al., 2013). For example, Clement, Aastrup & Forsberg (2015) used experimental auctions and found that visual attention to the brand, brand attributes and product information had an impact on bids for some branded accessories.

Paying more attention to one of the brands had a negative impact on the offer, while more attention to product attributes was related to a higher offer (Plassmann et al., 2015). Other studies show a positive relationship between attention and the importance or valuation of attributes, noting that more visual attention refers to greater importance or attribute valuation (Ramsøy et al., 2017). Increased visual attention to price was associated with greater price sensitivity. Smith & Marci (2016) reported that consumers in a choice experiment spent more time on brand attributes that were relatively more important to them. However, in contrast to these studies, Harris, Ciorciari & Gountas (2018) found no evidence that longer duration of fixation, that is, more attention, is related to attribute importance.

Overall, the studies discussed above suggest that eye-tracking measures can reveal significant information about the value consumers place on product attributes when making fashion choices and can contribute to explaining choice behavior. However, the direction of the relationship remains uncertain (Smidts et al., 2014). For example, results from a choice experiment by Ramsøy et al., (2017) suggest that goal-oriented values, rather than stimulus-related factors, are the main factors of attention and choice. This result is supported by Caruelle et al., (2019), who established, based on a drift diffusion model, that color-coded labels influence the evaluation of products, rather than just creating a stimulus response.

Information Processing and Decision-Making Strategies

In addition to investigating choice and evaluation, eye tracking can be used to provide more information about specific decision-making strategies. Eye tracking measures the degree of visual attention to information received during the decision-making process. Consumers can apply non-compensatory decision-making strategies where not all information is met, and the inclusion of this process can impact important behavioral outcomes, such as DDP estimates, elasticities, and predicted choice outcomes.

The study of visual attention patterns can also help to analyze how and how much information is acquired and processed. For example, as early as 1959, Easterbrook (1959) investigated the visual attention of individuals under time pressure and could show that the search for information was more selective and also that more information was ignored under time pressure. More recently, Reutskaja et al. (2011) conducted a study using eye tracking to provide information on decision making,

considering option overload and time pressure. Not using choice experiments, the authors were not able to measure whether the decision was not compensatory.

Pieters and Warlop (1999) showed that situational factors affect the acquisition of information. Theoretically, when an individual is not fixated on a stimulus, it cannot be processed and used to make decisions (Orquin and Mueller Loose 2013). However, studies have found that this only holds true for unknown situations. Individuals familiar with a visual situation may be able to use information stored in memory without needing to actively fixate on a stimulus (Orquin and Mueller Loose 2013). Therefore, those who are familiar with certain products already know a lot about them and may not need to perceive the information at the point of sale, for example, as they assume their presence after previous experiences.

Eye tracking and feature non-attendance

An example of consequences when using a non-compensatory decision strategy is attribute non-attendance (NCA), which has recently gained greater attention in the literature on choice experiments (Hensher 2014). NCA is an attribute processing strategy in which respondents ignore some of the attributes described when evaluating alternatives in a choice task (Hensher 2006; Kragt 2013; Scarpa et al. 2013). When respondents ignore the information presented in the choice experiments, the coefficient and related DPP estimates can be biased because an attribute ignored during the decision does not contribute to the preference of one product over another. However, the model will treat it as part of the decision process.

Accounting for the NCA is relevant because it influences the performance of the model. The NCA can be approached in option modeling by asking respondents whether they ignored the attributes (ie, the stated NCA) or inferring the NCA based on observed choices (ie, the inferred NCA) (Alemu et al. 2013; Caputo et al. 2018). A third method for approaching NCA in choice experiments is through the use of eye tracking (ie, visual NCA). One of the reasons respondents may ignore an attribute may be that it is irrelevant or unimportant to them; in that case, they have zero preferences for it. However, the visual NCA refers to not looking at the information and does not reveal the reason why the information is not being met.

Eye tracking can provide relevant information about the prevalence of visual NCA. For example, Balcombe, Fraser, and McSorley (2015) used a discrete measure of serial visual attendance based on eye fixation counts to indicate whether a respondent visually met an attribute or not. More specifically, a person was identified as not participating in an attribute if they had a fixation count of less than two for the attribute on more than half of the choice tasks. As suggested by Balcombe et al. (2017), eye tracking can also be used in designing choice experiments (i.e. appearance of the survey instrument) that can minimize the prevalence of NCA. The use of eye tracking to identify NCA, however, faces several challenges, as discussed in Van Loo et al. (2018).

Eye Tracking and Choice Uncertainty

Another example of the application of eye tracking to decision-making research is related to choice uncertainty. In addition to the assumption that study participants pay attention to all information presented to them, choice experiments also assume that respondents make choices that maximize their utility and are certain about those choices.

Eye tracking can be used to investigate choice uncertainty. For example, several studies have evaluated whether choice uncertainty, as indicated by scale heterogeneity, can be explained by total visual attention on a choice task in terms of fixations (Balcombe, Fraser, and McSorley 2015) and gaze deviation (moving eyes) from one fixation to another, Uggeldahl et al. 2016), as a proxy for uncertainty. Balcombe, Fraser, and McSorley (2015) did not find a relationship between visual attention to a person's product and choice uncertainty.

However, Uggeldahl et al. (2016) reported that eye-tracking measures can give an indication of choice uncertainty, because respondents' changes in visual attention between alternatives are related to stated choice certainty and model-based choice certainty. However, the latest study also revealed

that response time was a better proxy for choice uncertainty than changes in visual attention between alternatives in a set of options.

Future Research Prospects for Eye Tracking

While the previous sections highlighted the research carried out on eye tracking, there is much more to be explored, particularly in the fashion sector domain, because it can help explain choice behavior or DPP estimates derived from studies involving evaluation methods, such as choice experiments and experimental auctions. This line of literature is still relatively sparse, leaving room for several future research areas that researchers could consider. For example, while previous studies have examined bottom-up factors that draw attention to nutritional information, such as the influence of clothing design features, colors, prints, sizes, and context, few studies have examined bottom-up factors that are important in design of experiments, eg experimental auctions and choice experiments. For example, Balcombe et al. (2017) suggested using eye tracking to assist in the visual design (color, size, relative position of attributes, tables, figures versus text, etc.).

The use of eye tracking in choice experiments and experimental auction studies can also highlight the importance of how product appearance and visual attention contribute to explaining PPD. Furthermore, the use of eye tracking has implications for the design of choice experiments and experimental auctions, because product representation can influence brand values. A representation that mimics the appearance of the product as in a store can be an important factor to consider, as the density of information on a product package is a bottom-up factor that can influence attention. Furthermore, including more attributes in a choice experiment may result in shorter observation time for certain attributes, suggesting that information density can influence visual attention to certain attributes.

As mentioned by Hensher (2014), there is a need for much more research on processes to complement the results in modeling choices. Eye tracking research, for example, can be used to study decision-making strategies and can also help understand attribute processing strategies. While most research on decision-making strategies in choice experiments relates to NCA as an attribute processing strategy, other non-compensatory decision-making strategies could also be investigated using eye tracking, such as lexicographical strategies. The links between visual attention and decision making also require more research into modeling attention as part of the choice process (Orquin & Mueller Loose 2013). If attention and choice are an expression of motivation and evaluation, treating attention as exogenous to preferences can result in biased estimates.

While there may be a relationship between preferences and visual attention for various attributes, the direction of causality often remains insufficiently investigated (e.g., utility effects that explain the values of attributes that direct attention versus the causal effect of attention on preference and in choice (Balcombe et al., 2017). It is possible, for example, to have a feedback loop because liking something can lead to more attention, but more attention can also lead to greater liking. However, eye tracking also has limits and challenges (Balcombe et al. 2017; Van Loo et al. 2018). An important limitation is that eye tracking measures attention in foveal vision, ignoring a person's parafoveal and peripheral vision (Bergstrom and Schall 2014; Orquin, Ashby, and Clarke 2016).

There is no standard method for defining areas of interest (AI) for decision-making research, although eye tracking data can provide information about how often and for how long people look at certain information, it cannot tell us whether the information was processed or understood or the extent to which the information was used in decision making (Miller and Cassady 2015). Balcombe et al. (2017) also warns researchers that collecting data using eye tracking is a time-consuming and financially resource-intensive method, with the implication of achieving limited sample sizes in many cases. Therefore, researchers should carefully consider whether the costs of implementing this resource-intensive method outweigh the benefits.

As suggested by Meißner, Musalem, and Huber (2016), future studies may combine eye tracking with neuroscience methods to improve our understanding of the decision-making process, how tradeoffs are made during choice, and how it relates to assessment. Examples are the use of electroencephalography (EEG) and functional magnetic resonance imaging (fMRI; Lusk et al. 2015;

Crespi et al. 2016). Neuroscientific methods focused on consumer behavior could be used with eye tracking to examine the mechanisms behind non-attendance behavior and many of the context-dependent behaviors evident in choice experiences and luxury brands. An interesting area of future research is the combination of eye tracking data with other biometric data related to neurophysiological and psychological reactions (Duerrschmid and Danner, 2018).

Eye tracking and other biosensors can also be combined to improve our understanding of consumers' experience and behavior in the face of women's fashion choices. Examples are the integration of eye tracking with other biosensors that measure facial expressions, galvanic skin response, respiration, heart rate, electrocardiogram (ECG), electroencephalogram (EEG) and electromyogram (EMG).

CONCLUSION

Understanding what the consumer wants is becoming the most important element of retail success. Numerous consumer studies are being carried out to get the elusive direction of what will or can sell. Among the most appreciated applications of marketing research in the current scenario is the science of neuromarketing.

The importance of learning the cognitive aspects of customer decision-making has been valued by several sectors, one of which is fashion electronic retail. Leaders of international e-com giants such as Amazon, Forever 21, eBay and other e-com retailers are adopting advanced practices such as brainwave-based thermal mapping and eye-tracking data in place of traditional surveys to maintain emotional bonding with diverse segments. market they serve.

A common retort you hear from consumers is 'I didn't want to buy this, but I thought it was a good deal' - this is a typical paradigm of how customer decisions are driven by emotional reactions. Using these very emotional and often irrational customer behaviors, neuroscience is introducing new ways to understand the complex subconscious aspects of buying behavior.

This is very important in the current context, as an increasing number of market research and social psychology studies have revealed that traditional surveys and self-reports are not reliable resources for predicting consumer preferences; therefore, fashion retailers are jumping on the bandwagon of advanced neuromarketing tools to create innovative strategies and reach the hearts of their customers.

In various experiments based on conventional data combined with neuroscientific tools, for example thermal mapping through EEG, fMRI and eye tracking data, it is being embraced by e-retailers who used to rely only on market research answers that left us in ambiguity of whether they would generate better results or not. To conclude, eye tracking is a promising method that can help researchers study the effect of attention on information processing, preferences, choice and evaluation behavior.

The multitude of studies discussed above is a testament to the growing usefulness and popularity of this methodology for the fashion market. While more research is needed, eye tracking data has the potential to help us assess the reliability of data obtained in economic experiments, particularly in studies involving choice experiments and experimental auctions, where respondents may be more or less attentive to attributes or products considered in the study.

This issue is important because properly addressing attention to attributes (i.e., non-attendance) could potentially provide researchers with a baseline to assess the reliability of the data and findings they obtain from these experiments. This is crucial for business applications as well as digital data analytics.

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