EXPERIMENTAL TESTING OF CONSUMER BRAND ENGAGEMENT: EVALUATING HIGH-VALUE TECHNOLOGY BRANDS THROUGH EYE TRACKING METHODOLOGY

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Abstract. This study examines the impact of brand recognition on consumer decisions in the technology sector, using the eye-tracking technology to assess engagement with top technology brands. In an increasingly saturated market, brands play a crucial role in differentiating products and services, guiding consumer choices by offering trust, quality, and emotional engagement. By categorizing brands and examining their functions – ranging from recognizability to differentiation – the research highlights the significance of technology brands in the global economy. Employing the SMI Eye Tracking System REDn, the study analyzes the visual engagement of young consumers aged 15 to 26 with the logos of the 20 most valuable technology brands. Metrics such as dwell time, average revisits, and fixation rates indicate a marked preference for brands like Apple, Adobe, and Cisco, demonstrating the strong influence of brand strength on technology consumers' behaviour and preferences. The findings emphasize the critical importance of branding in the technology sector and its role in shaping consumer acceptance. The use of the eye-tracking technology offers innovative insights into consumer preferences, suggesting strategic implications for technology brands aiming to attract and retain the influential demographic of digital natives.

Keywords: technology brands, eye-tracking, brand acceptance, eye-camera.

Introduction

In the contemporary market, overwhelmed with an abundance of products and services, the clarity in consumer decision-making has significantly diminished. This clutter has magnified the importance of branding for companies, as they seek to navigate through the noise and connect with their customers [1]. Historically, brands have been instrumental in differentiating the offerings of one seller from those of another, a principle that remains central to competitive market strategies [2; 3]. Defined by the American Marketing Association as any feature distinguishing one seller's goods from another's, brands encompass a range of elements including names, logos, and designs that collectively build a brand identity and reputation.

The concept of branding extends beyond mere differentiation, playing a pivotal role in consumer perception and loyalty. Brands are classified into various categories such as product, line, assortment, shipper, and luxury brands, each serving unique purposes and targeting specific consumer demographics [5]. This classification not only helps in strategic marketing but also in aligning the brand's promise with consumer expectations. Furthermore, the distinction between "brand-driven" and "product-driven" strategies emphasizes the varying emphasis companies place on marketing versus the inherent quality of their products. This distinction further bifurcates into "associative" brands, which foster an emotional connection, and "functional" brands, which appeal to the consumer rational needs [6].

Brands fulfil multiple roles in the consumer's journey, from enhancing recognizability among a plethora of choices to providing a guarantee of quality and establishing a unique identity. They also enable personalization, add an element of gamification to the shopping experience, and offer a means for consumers to distinguish between seemingly similar products [7-9]. Beyond these functional roles, brands evoke emotions, confer status, and foster a sense of community and belonging among their customers, thereby playing a critical role in building loyalty and advocacy [10-13].

Brand awareness is a crucial metric, segmented into top-of-the-mind, spontaneous brand familiarity, and supported brand familiarity, each reflecting the degree of consumer recognition and recall of a brand [14]. The evolution of technology brands, highlighted by their dominance in the 'Global 500 2024 Report' by Brand Finance, underscores the shifting dynamics in the global economy. The increasing valuation of technology brands not only indicates their economic significance but also their growing influence in shaping consumer preferences and behaviours [6; 15-18]. As the technology sector continues to expand, the strategic importance of branding within this space becomes increasingly apparent, with technology brands poised to lead in innovation, consumer engagement, and market dominance.

Fig. 1. **TOP 10 most valuable brands, source: BrandFinance**

The acceptance and recognition of technology brands by digital natives, a demographic born into an era of digital technology, are deeply influenced by the brand ability to innovate and resonate personally. This demographic values not just functionality but also a brand's commitment to privacy, sustainability, and societal impact. Brands that engage with their audience on social media, provide customizable experiences and uphold ethical standards are particularly favoured among digital natives. Their recognition of a brand extends to an appreciation of its narrative and values, which play a crucial role in their connected lives. Consequently, technology brands that align their offerings and values with the expectations of digital natives can cultivate a level of loyalty that goes beyond conventional marketing, becoming integral to their everyday digital experience. There are several methods for assessing brand acceptance or the recognition a brand receives [19; 20]. This article delves into the utilization of the eye tracking technology to determine which technology brands capture the most interest from participants. Eye tracking is based on analyzing eye movements, providing a sophisticated means to monitor where and how long a person gazes at various elements within a visual environment. This approach employs an eye-tracking device, commonly known as an eye camera, akin to instruments used in vision assessments [21]. Such devices intricately track the user's eye positions, gaze directions, and movements through state-of-the-art imaging technologies and optical infrared sensors [8].

Objective and methodology

This study aims to evaluate the recognition and appeal of high-value technology brands among consumers. To do this, we selected the top 20 technology brands based on their market value from an annual report ranking the world most valuable corporations. These brands' logos were displayed in a structured collage, organized into four rows and five columns, to be viewed by our participants.

Fig. 2. **TOP 20 tested technology brands**

Our participant group consisted of individuals aged 15 to 26 years with experience in Information and Communication Technology (ICT), chosen to represent a demographic familiar with technology brands. They were shown a composite image (in full screen mode) containing the logos of these technology brands (Fig. 2) for a duration of 20 seconds, during which their eye movements and the length of time spent looking at each logo were meticulously recorded. The experiment was conducted in the Human-Machine Interaction Laboratory located in the University Science Park of the University of Zilina. The distance between the participant's face and the 15-inch screen was 650 mm on average,

with artificial lighting in the test room. The study used the SMI REDn eye tracking system with a sampling frequency of 60 Hz. This system setup is sufficiently effective at detecting eye movements to be suitable for conducting research studies on visual attention and cognitive processes.

The study data was analysed using the SMI REDn Scientific System, which includes the REDn Scientific Eye Tracker, a mobile eye-tracking device, and an SMI-certified laptop. The setup is connected via USB and is equipped with iViewRED software for configuring the eye camera [22]. The analysis was conducted using SMI BeGaze software, enabling a comprehensive examination of how participants engage visually with the technology brands presented to them. This approach allows us to deepen our understanding of consumer brand perception and enhance brand acceptance and appeal through detailed consumer behaviour insights.

Results

Testing was conducted on a sample of 17 respondents within the age range of 15 to 26 years. This specific age group was chosen as they are likely to possess a high level of technological knowledge, having been exposed to ICT devices since childhood. The test group was composed of 12 males and 5 females. The results of the eye-tracking camera measurements were analysed using a range of metrics, with the most popular being the heat map. The heat map is a graphical representation that displays the time spent fixating on a particular area (Fig. 3). This method is often used to determine the effectiveness of visual designs and to provide insights into user behaviour [11; 19; 21].

Figure 4 demonstrates that the most accepted brands are Apple, Adobe, and Cisco, as evidenced by the significant attention their logos received from the test subjects. A more precise way to measure consumer acceptance of the brands is to gauge the amount of time spent observing the logo, a metric which is referred to as “dwell time” and is calculated as the average percentage of the total time (20 seconds) allocated to a particular brand. Table 1 displays the measured dwell time values, with Apple logo receiving 4.9% of the total time, Adobe logo receiving 4.5%, and Amazon logo receiving 3.9%. These results indicate that Apple is the most accepted brand among the test subjects, followed by Adobe and Amazon respectively.

Fig. 3. **Heat map of TOP 20 tested technology brands**

By analysing the eyetracking results of the Dwell Time (%), Average Revisits and Average Fixation tests across different companies, we uncover interesting patterns of user engagement and behaviour. Apple stands out with the highest dwell time of 4.9%, indicating that users spend a significant portion of their browsing time on its site. This high engagement is further underscored by Apple leading average revisits (1.8) and a strong average fixation rate (2.8), suggesting both frequent returns by users and a high level of visual engagement. On the opposite end, Samsung shows the lowest dwell time at just 1.1%, coupled with the lowest average revisits and a relatively low fixation rate, pointing to quicker, less engaged browsing sessions. Facebook captures users’ visual attention the most, with the highest average fixation rate of 2.9, alongside a substantial dwell time and revisit frequency. Conversely, Oracle records the lowest in both average revisits and fixation, hinting at brief and less engaging interactions with its site. This comprehensive analysis reveals not only the variance in how users interact with these companies’ digital presences but also highlights the differing levels of engagement and attention each company commands online.

Table 1

Measured dwell time, revisits and fixations values

Brand	Dwell time, %	Average revisits	Average fixation
Adobe	4.5	1.4	2.3
Amazon	3.9	1.4	2.4
Apple	4.9	1.8	2.8
AT&T	2.7	0.7	1.6
Cisco	3.8	1.1	1.9
E-bay	2.6	1.1	1.6
Facebook	3.7	1.7	2.9
Google	3.4	1.3	2.4
HP	2.4	0.9	1.8
Oracle	1.6	0.5	0.9
IBM	2.2	0.6	1.4
Intel&T	2.2	1	1.5
Microsoft	3	0.8	1.6
Netflix	2.8	0.8	1.8
Huawei	3.5	1.3	2.3
Panasonic	2.1	0.5	1.3
Samsung	1.1	0.5	1
SAP	2.5	0.8	1.6
SONY	1.9	0.8	1.4
Verizon	3.1	0.8	1.6

We calculated standard deviations for each dataset – dwell time (%), average revisits and average fixations - to give a better insight into the variability and consistency of the data. The standard deviation of 0.967 for Dwell Time (%) indicates that the time users spend (as a percentage) typically varies by about 0.967% from the average dwell time across all companies listed. This relatively low standard deviation suggests that there is not a very wide variation in dwell times between different companies, implying a degree of consistency in how long visitors engage with the content of these companies on average. The standard deviation of 0.388 for Average Revisits means that the number of times users revisit a site is typically about 0.388 revisits away from the average number of revisits. This is a very low standard deviation, indicating that the revisit behaviour is fairly consistent across companies. There is not much variation in how often users return to these companies, suggesting either similar user engagement strategies across companies or uniform user behaviour. The standard deviation of 0.550 for average fixation shows that fixation durations (how long a user's gaze remains fixed on a particular element) typically vary by about 0.550 seconds from the average fixation duration. This is a moderate level of variability, suggesting that while there are some differences in how long users fixate across companies, they are not extremely different. This may indicate differences in the attractiveness of the content or the effectiveness of the layout between companies. The insights garnered from eye-tracking testing focused on technology brand logos offer a fascinating glimpse into consumer engagement with branding elements. High dwell times and fixation rates on logos, notably those of Apple and Facebook, suggest not only a strong brand recognition but also an effective design that captures and retains consumer attention. This indicates successful branding strategies that resonate deeply with viewers, making certain logos not only recognizable but also emotionally compelling. The effectiveness of a logo design, as suggested by these eye-tracking metrics, speaks volumes about its visual appeal and the brand's ability to leverage design principles to create memorable and appealing symbols. In essence, the application of the eye-tracking technology to study consumer interaction with technology brand logos yields critical insights into brand recognition, emotional engagement, and the effectiveness of logo design. These insights are invaluable for companies aiming to enhance their brand strategy, ensuring their logos not only stand out visually but also encapsulate the brand identity, resonate with consumers on an emotional level, and maintain a competitive edge in the digital landscape.

Discussion

The analysis of the eye-tracking data from this study conclusively shows that brand strength and design significantly influence consumer preferences, especially among young technology-savvy

consumers aged 15 to 26. Notably, Apple logo commanded the highest dwell time of 4.9%, indicating that participants spent nearly 5% of the viewing time focused on this brand alone. Adobe and Amazon followed with dwell times of 4.5% and 3.9% respectively, underscoring their strong appeal among the demographic. The study empirical data, highlighting substantial differences in engagement metrics such as dwell times, revisits, and fixation rates across brands, suggests a clear correlation between brand design, recognition, and consumer engagement in the technology sector.

Our findings on the impact of visual branding on consumer engagement are consistent with similar research using eye-tracking technologies. The high dwell times observed for brands such as Apple in our study are consistent with Boerman [23], who found that explicit disclosure of brand placement significantly increased the brand recognition and viewer attention. This suggests that distinct and appealing visual identities, similar to those used by Apple, can effectively capture and maintain consumer attention, thereby enhancing the brand recognition. Chowdhury [24] demonstrated that visual attention deficits can lead to increased recognition errors for brands with mutated names. Our findings complement this by showing that robust visual branding can mitigate such risks, ensuring that brands are not only noticed but also correctly identified amidst market confusion. This underscores the importance of strong visual branding in promoting accurate consumer recognition and decision making. These comparative findings underline the consistent role of strong visual identities in driving consumer engagement across studies. By using the eye-tracking methodology, these studies collectively highlight the strategic value of effective visual branding in navigating competitive markets and optimising consumer interactions.

The main limitation of the research is the fixed position of the logo images in the tested collage. Unfortunately, the software used by SMI did not allow for variable positioning of the logo on the screen. We hope to solve this problem by using the new software and equipment from Tobbi (Tobii Pro Lab), which allows variable placement of stimuli on the screen. Another problem may be the different sizes of the company logos. However, the relationship between the size of the logo and the observation of the subjects is not clear. Despite these shortcomings, this approach provides valuable insights into the subconscious preferences that drive consumer behaviour and is a powerful tool for brands to fine-tune their marketing and interaction strategies.

Conclusions

The study findings reveal a clear preference among young consumers for brands that are not only technologically advanced but also carry a strong brand value. Brands like Apple, Adobe, and Cisco emerged as particularly engaging, indicating that these brands successfully resonate with the demographic preferences. This suggests that brand strength, encompassing factors like trust, familiarity, and perceived quality, plays a significant role in shaping consumer behaviour and decision-making processes in the technology market. Moreover, the use of the eye-tracking technology in this research marks a methodological innovation, providing a sophisticated means to capture the subtle nuances of consumer interaction with brand elements.

Author contributions

Conceptualization, R.M.; methodology, R.M. and L.M.; validation, P.S. and G.N.; investigation, R.M., L.M., P.S. and G.N.; writing – original draft preparation, R.M and L.M; writing - review and editing, P.S. and G.N.; funding acquisition, L.M. All authors have read and agreed to the published version of the manuscript.

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