

## Evaluating the relationship between logo and corporate reputation with psychophysiological data harvesting technique

### Psikofizyolojik veri hasadı tekniği ile logo ve kurumsal itibar ilişkisinin değerlendirilmesi

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#### Abstract

Logo design is the most powerful visual instrument that indicates how brands seem to their stakeholders and determines the brand's reputation. In the past, corporations focused only on the graphic design of logos, and this situation has changed over time and included many intangible features such as the institution's culture, stance goals, and the position that individuals want to be in the content of the logo. In this context, the current research looks for similarities of linear effects in logo designs belonging to brands with strong corporate reputations. It investigates the relationship between the character traits and emotions reflected by these effects and the perception of reputation. We employed an artificial intelligence-based "Psychophysiological Data Harvesting" technique for this research and used a multi-method. While conducting the research, the visual identities of the world's top 10 brands with the strongest corporate reputation (2016-2020), according to the Global RepTrak® 100 Research, were examined. As part of the Psychophysiological Data Harvesting technique, participants' logos, facial expression analyses, and eye-tracking data were compared with the participant's responses to the survey questions. Thirty-nine people participated in the research. As a result, valuable findings were obtained about which linear effects and emotions should be applied for a strong perception of corporate reputation. It is thought that the results of the linear effect, character traits and emotional states in the logo production processes will be beneficial and will guide the designers to create the strength of the corporate reputation in the dimension of visual identity.

**Keywords:** Corporate Reputation, Eye Tracking, Facial Expression Analysis, Psychophysiological Data Harvesting, Visual Identity

**Jel Codes:** L14, M31, M37, O39, Z10

#### Öz

Markaların paydaşlarına karşı nasıl görüldüğünü ortaya koyan ve marka itibarını belirleyen en kuvvetli görsel enstrüman olarak logo tasarımı ön plana çıkmaktadır. Eskiden kurumlar logoların sadece grafik tasarımına odaklanarak hareket etmişlerdir ve bu durum zamanla değişerek kurumun kültürü, duruşu hedefleri, bireylerin gözünde olmak istediği konum gibi birçok somut olmayan özelliği de logonun içeriğine dahil etmiştir. Bu noktada araştırma, kurumsal itibarı güçlü markaların logo tasarımlarında yer alan çizgisel efektlerin varsa benzerliklerini arayarak, çizgisel efektlerin yansıttığı karakter özelliklerinin ve hissettirdiği duyguların itibar algısı ile ilişkisini, (kurumsal itibarı oluşturan diğer unsurların değerlerini yadsımadan) ortaya çıkarmaya çalışmıştır. Araştırma yapay zekâ temelli, "Psikofizyolojik Veri Hasadı" tekniği ve karma yöntem yaklaşımı ile gerçekleştirilmiştir. Bu araştırma tekniğindeki temel amaç, katılımcının herhangi bir uyarın (stimuli) ile girdiği etkileşimde yaşamış olduğu deneyimin her yönüyle analiz edilmesi, böylelikle olgunlaşan deneyim verisinin hasat edilmesidir. Global RepTrak® 100 araştırmasından kurumsal itibarı en güçlü ilk 10 markanın logoları çizgisel efektleri ve karakter özellikleri bağlamı ile değerlendirilmiş ve 12 çizginin (%66,6) yansıttığı karakter özelliklerinin doğrudan veya eş/yan anlamları ile benzerlik gösterdiği görülmüştür. Diğer yandan kurumsal itibarı güçlü markaların logolarının çizgisel etkilerinin açık bir sonucu olarak güvenilir, güçlü ve istikrarlı olarak algılandıkları tespit edilmiştir.

**Anahtar Kelimeler:** Kurumsal İtibar, Göz Takibi, Yüz İfadesi Analizi, Psikofizyolojik Veri Hasadı, Görsel Kimlik

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## Introduction

As indicated in numerous studies in the literature, there is a clear relationship between corporate identity and corporate reputation (Fombrun, 1996; Van Riel & Balmer, 1997; Fombrun & Van Riel, 1997; van den Bosch, Jong & Elving, 2005; Chun, 2005). Corporate identity has been defined as a conscious and planned brand presentation by the brand to achieve a positive corporate reputation (Van Riel & Balmer, 1997; Alessandri, 2002). A positive reputation is influenced by all elements of the identity mix (behaviour, communication, and symbolism) (Van Riel & Balmer, 1997). Research has emphasized that identity is shaped by the visual presentation and corporate behaviour formed in line with the brand's mission; it affects how the brand is perceived and creates the corporate reputation and image. Image, on the other hand, creates a corporate reputation. As a process that connects corporate strategy to image and reputation (Dowling, 1994), corporate identity is undoubtedly the most strategic element brands use to create a positive corporate reputation (Fillis, 2003, p. 243).

Among the elements of corporate identity, visual identity constitutes, by nature, the most transparent aspect of identity. Corporate identity is often synonymous with visual identity and traditionally associated with corporate symbols (Melewar & Jenkins, 2002; Salgado-Montejo et al., 2014). Corporate visual identity is an extensive structure. The logo is the origin of corporate identity and the main component in this structure (Balmer, 2001; Melewar & Saunders, 2000; Erjansola et al., 2021; Meiting & Hua, 2020). Furthermore, the logo functions as a badge of corporate identity (Hagtvedt, 2011) and is the brand's symbolic face. The logo is the most tangible instrument that serves various functions, including forming the first interaction between the consumer and the brand (Banerjee, 2008; Cian et al., 2014; Coker et al., 2013; Luffarelli, Stamatogiannakis & Yang, 2019), recognizing the brand's products and services (Pittard, Ewing, & Jevons, 2007), creating familiarity (Van der Lans et al., 2009), brand visibility (Van den Bosch et al., 2005), awareness (Olins, 1989), differentiation (MacInnis, Shapiro, & Mani, 1999), and drawing attention (Henderson & Cote, 1998).

This study discusses the relationship between corporate reputation and logos in the context of linear effects, the character traits they reflect, and the emotions logos evoke. In this sense, the study provides rich data that can be used as a guide on which linear effects and emotions should be used for a strong perception of corporate reputation. At the same time, its methodological approach has a genuine high-impact value. Unlike the dominant literature, where perceptions are based entirely on the "utterance" of the participants, this study obtains data on people's psychophysiological reactions to a certain stimulus simultaneously with a biometric tool or multiple biometric tools.

## Literature review

The logo is defined as a crucial structure associated with visual identity and corporate reputation in the corporate identity background. Again, as one of the most important structural elements that form the corporate identity, the linear effect and value of the logo need to be discussed. However, it would be useful first to examine the corporate culture and the corporate memory, which circle the concepts of logo and identity.

### How do logos build a corporate memory and impact the perception of corporate reputation?

Corporate reputation is a multifaceted component that focuses on what organizations do and how they do it and is based on perceptions based on stakeholders' experiences (Bennet and Kottasz, 2000). According to Fombrun (1998), these components are a history of stakeholders' experiences. This history, in turn, depends on the effectiveness of the stakeholders' communication with the organization, the content of its services, the organization's understanding of quality, their appreciation of the organization, and their wider impact. Fombrun and Van Riel (1997, p.10) state that corporate reputation is a concept that evaluates the organization's ability and potential to communicate in these actions. Corporate reputation is the impression that an organization's activities and decisions evoke in the minds of stakeholders. Corporate reputation is explained with desired images and identity (Fombrun, 1996; Fombrun & Van Riel, 1997; Van Riel & Balmer, 1997; Alessandri, 2002; Fillis, 2003). Corporate identity can be defined as a consciously planned presentation of the organization to gain a positive corporate reputation. Following in this footsteps, corporate reputation is the intangible element that affects how the organization is perceived (corporate image) and shaped by the visual presentation of identity. Therefore, in this inside-out orientation, the sum of the images in the eyes of all desired stakeholders and the consistent reflection of identity points to corporate reputation. In this sense, reputation first requires a valuable identity to be shaped for many years. The most visible of these elements is the logo within the visual identity elements. Logos are the elements that create the first bridge between the consumer and the brand and simultaneously create a perception of the brand's image at the first

encounter. In this sense, logos offer a direction to contribute to corporate reputation in building corporate memory.

Assmann (2001) argues that figures regarding remembering are intended to materialise at a certain space and time. This raises the need for a concrete space and time for the collective memory, even though it may not always be geographical or temporal (Aytekin, 2018). Given today's distributed corporate networks, the common ground of the need for a concrete space and time is shaped around the logo, the greatest interaction value of the corporate culture that symbolizes it. The perception of concrete space and common time has first become online. Quite recently, this has shifted towards metaverses, the newest proposition of distributed networks. The physical walls have vanished, and the global COVID-19 pandemic has become a catalyst for our practice of working shoulder to shoulder rapidly transforming it. In these new conditions, the only common interaction value that can bring together the collective corporate culture, corporate identity, and the expectations of customers and employees under the same roof is naturally considered to be the logo, given that it has the greatest power for corporate representation.

Given what we know, the commonality is based on a structure that provides spatial and temporal unity. "The house for the family, the village and the valley for those living in the countryside, the cities for the urban nobles, and the geographical region for those living in that geographical region constitute the framework of spatial memory" (Assmann, 2001:42). Every corporate network that wants to consolidate its structure as a community wishes to create and protect these spaces that Assmann mentions as the symbol of its corporate identity and the anchor of its collective memory (Aytekin, 2018). Social collective memory coexists with the community that carries it and serves as proof of inclusion for those involved (Connerton, 1999; Halbwachs, 1992). When we consider the perspectives of traditional community structure, the logo becomes the common concrete space of yesterday and the symbolic value of today. At the same time, cultural memory is our data, which we transfer online. Hence, the distributed network community structure does not threaten corporate identity and memory. On the contrary, Assmann (2001) argues that memory is reorganized based on new conditions, and the fundamental community structure is preserved (Aytekin, 2018).

As stated above, in today's corporate structure, the logo is one of the most important symbolic values that hold corporate identity and culture together. As we claim in this research, the logo should go beyond establishing a mathematical, functional, and aesthetic balance by the graphic designer; it should be designed to contain calculated and predicted meanings with an impact that can be predetermined. Understanding the linear values gains significant importance as the starting point of this calculated effort, known as the logo design.

### **Linear values of corporate logos**

Adır, Adır & Pascu (2012) divide the elements of graphic design that affect the memorability of a logo into two categories: the first being "symbols, signs, pictograms, and isotypes," and the second being "pictures, illustrations, words, and colours." Foroudi, Melewar, and Gupta (2017) frame these elements as "font, name, colour, and design." Hence, linear effect and colour seem to be the foundation of both classifications. In the present study, we evaluate the logo's linear configuration and impact, perceived as a shape or form at first glance. In one of the approaches regarding this concrete instrument, Adır et al. (2012, p. 652) break the production of a corporate logo down into two stages. Accordingly, the first stage is research and market projection, and the second is creative graphic work. Table 1 below shows these stages in detail. If somebody wants to develop graphic advertising, there are two necessary stages: research and prospect the market and the second is to realize the graphics. For the first stage, there are five steps. These ideas of Adır, Adır & Pascu (2012) are tabulated below.

**Table 1:** Logo Production

<p><b>Stage One:</b> Research and Market Projection</p> <ul style="list-style-type: none"> <li>• To set the theme;</li> <li>• To identify existing logos in the gainer domain;</li> <li>• To realize a competition study of existing logos in the market;</li> <li>• To fix the target public of the presumptive logo;</li> <li>• To specify the support elements of the logo;</li> <li>• To analyse the creative graphic possibilities in the demanded domain.</li> </ul>
<p><b>Stage Two:</b> Creative Graphic Work</p> <ul style="list-style-type: none"> <li>• To sketch some examples for the demanded logo;</li> <li>• To achieve a brainstorming session to obtain 2-3 solutions;</li> <li>• To develop a SWOT analysis;</li> <li>• To set the best graphic-visual logo solution;</li> <li>• To convey a first graphic print to the gainer;</li> <li>• To create the computer graphic design logo;</li> </ul> <p>To show this solution and to obtain the OK from the gainer.</p>

**Source:** Adır, V., Adır, G., & Pascu, N. E. (2012). Graphic advertising as a specialized tool of communication. *Procedia - Social and Behavioural Sciences*, 51, 645-649.

Choosing the best design solution with this approach does not exceed subjective taste. Thus, discovering the similarities in the linear effects of logos belonging to brands with strong corporate reputations can be useful in producing a guideline for “how to design a corporate logo.”

Previous research has discussed the strong relationship between graphic shapes and emotions (Abegaz, Dillon, & Gilbert, 2015; Bar, 2003; Henderson & Cote, 1998; Liu & Kennedy, 1993); these studies put forth a strong belief that a logo's "likability" is linearly correlated with the graphic shape of the logo (Machado, Lencastre, Carvalho, & Costa, 2012; Torbarina, Čop, & Jelenc, 2021). Jiang, Gorn, Galli and Chattopadhyay (2016) have highlighted that consumers judge a brand “only by the shape of its logo.” In the study, the researchers showed participants two logos: one with a square on a white shoe and another with a circle on a white shoe. Those with a square were considered more durable, while those with a circle were perceived as more comfortable.

The building block of the logo and the main element that creates the feeling of “hard” or “soft” is the line. According to Barnes (2011), the main impact of the line is associated with the dots merging and transforming into something else. Besides, a single dot can draw the eye towards different focal points under a visual identity (İcil Tuncer, 2019). The dots that make up the line are one-dimensional, but when they come together, they shape and indicate location, direction, and movement. Moreover, the characteristics that the dots bring to the line can create a reference to one or more emotions (Jiang et al., 2016). So, the junction, volume, direction, and movement of these dots should be designed to reflect the corporate personality and form a strong reputation in the eyes of the stakeholders. Table 2 shows a matching of character traits and lines, which we will use as a guiding tool to explain the relationship between visual identity and reputation in the context of linear effects. The table is adapted from the ideas of Joannès (2008).

**Table 2:** Characteristics and Lines

Characteristic	Line
Prescriptive, Prestigious, Authoritarian	 Vertical line
Positive, Calm, Responsible, Cautious	 Horizontal line
Idealistic, Innovative, Assertive, Open	 Vertical line up
Daring, Future-oriented, Moderate, Upward prone	 Upward slash
Weak, Depressed, Withdrawn	 Vertical line down
Flexible, Withdrawn, Weak	 Downward slash
Protecting, Benevolent, Inclusive, Sympathetic	 non-directional curved lines
Frivolous, Cool, Indecisive, Changeable	 wavy line
Prescriptive, Prestigious, Authoritarian	 Square

Sturdy, Grounded, Stable		Rectangle
Remarkable, Egocentric, Focused		Circle
Calm, supportive, overshadowed		Ellipse
Demanding, Arrogant, Rich		Diamond
Guiding, expert, curious, dynamic		Triangle
Protective, Traditional, Fearless		Pentagon
Soft, Cooperative, Compliant		Organic shape

Joannès (2008) matched the linear effects in logos with human character traits, where a trait described each effect. Other researchers then added new shapes to Joannès' (2008) work, including an organic shape, a bidirectional curved line, a rectangle, an upward and downward curved line, and a wavy line, as well as the character traits associated with these new lines.

## Methods

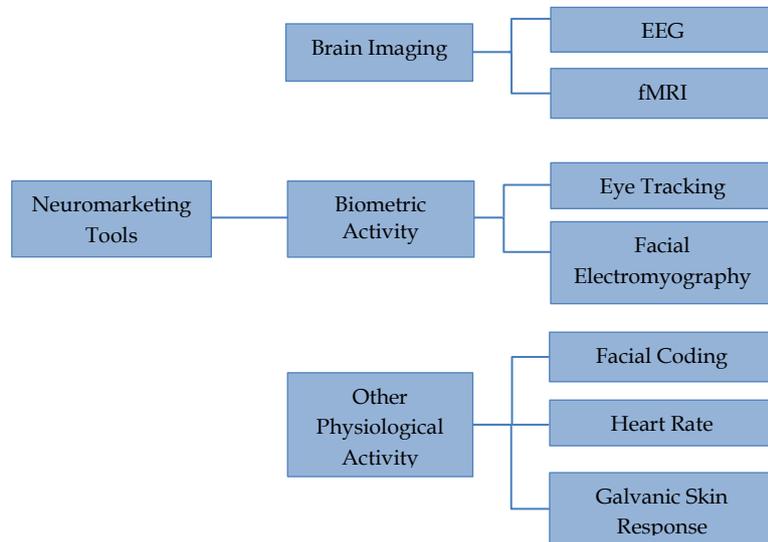
Here, we used the "Psychophysiological Data Harvesting" technique and employed qualitative and quantitative methods. Given the adopted method, we believe the current research has an original, high-impact value.

### Psychophysiological data harvesting technique

Psychophysiological Data Harvesting (PDH) is a technique developed and applied for the first time by researchers in the Advanced Media Technologies Research Laboratory (AMT-LAB), Faculty of Communication at Adnan Menderes University, Aydın ([www.amtlab.org](http://www.amtlab.org)). PDH techniques can be evaluated under human-computer interactions (HCI). Psychophysiological measurements are classified according to nervous systems in various studies (Garczarek-Bąk, 2019; Pierański, 2019); facial expression analysis and eye tracking take place in the somatic nervous system, while electrodermal activity (EDA) and cardiovascular activity (ECG) take place in the autonomic nervous system. The somatic and autonomic nervous systems are components of the peripheral nervous system. Because the data is obtained from the autonomic sympathetic nervous system, each participant can harvest unique

findings, free of the participant's cognitive efforts and without intervention (Aydın, Depboylu, & Erdem, 2021). Even if our first research (Aydın et al., 2021) was immaturely called biometric data harvesting to this explained technique before, we transformed the biometric keyword to psychophysiological for broader data harvesting objectives and meanings.

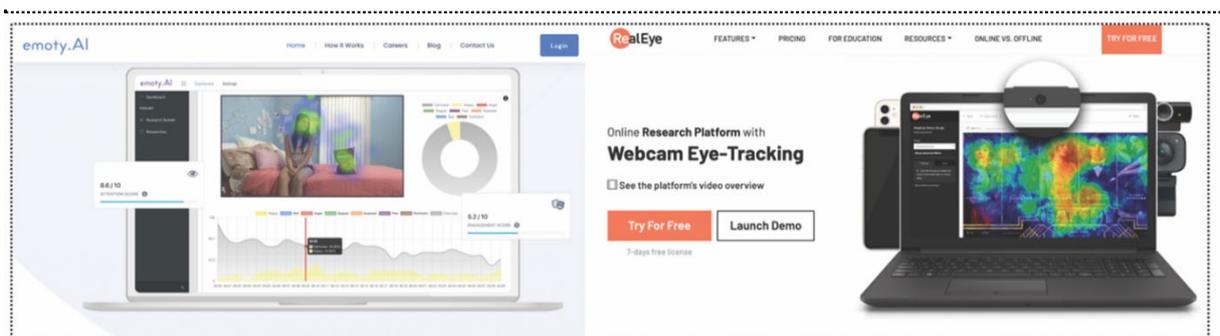
PDH techniques are often used for neuromarketing research and are considered almost central to this sub-discipline under HCI, as seen in Figure 1. With these properties, PDH techniques are accepted as valid and reliable data with over 95% confidence, according to the international HCI discipline (www.imotions.com, 2022).



**Figure 1:** Classification of Neuromarketing Techniques

**Source:** Bercea, 2012; Ćosić, 2016; Gill and Singh, 2020; Aydın, 2021.

PDH adopts all these data collection techniques and combines psychophysiological data with artificial intelligence analysis and remote data collection skills for the first time. During the COVID-19 outbreak, the physical distance domain has become the biggest problem of field research, halting most field research. In such conditions, collecting psychophysiological data remotely via a single research link with the support of artificial intelligence has made the PDH technique much more powerful and preferable. As seen below in Fig. 2, this technique adopts the technologies of some initiatives like Emtoy.AI and RealEye, pioneers in remote PDH based on artificial intelligence.



**Figure 2:** Technologies with remote psychophysiological data analysis (emoty.ai, 2022; realeye.io, 2022)

Rather than a method, PDH is a research procedure, a technique that involves using traditional qualitative and quantitative data collection tools together with PDH tools. The main purpose of this technique is to analyse every aspect of a participant's experience in interaction with any stimulus, thus collecting the maturing experience data. In this context, the PDH technique is, in a sense, an integrated form of "experience harvesting." To better understand why this procedure is called experience harvesting, we first need to understand the concepts of experience and harvest and discuss the fundamental components that makeup experience.

The concept of experience has different meanings and no single, agreed definition. For example, Dewey (1916) defines experience holistically, referring to cognitive states that shape human life (Hohr, 2012, p.2). On the other hand, the Merriam-Webster dictionary defines experience as "practical knowledge, skill, or practice derived from direct observation of or participation in events or a particular activity"

(www.merriam-webster.com, 2022). In terms of experience harvesting, it is synonymously with “interaction.” While making this definition, we followed the classification by Hornbæk & Oulasvirta (2017). Researchers have classified the concept of interaction in seven different ways (Table 3); one of the points emphasized here was “interaction as experience.” In this context, the Encyclopedia of Information Sciences (www.igi-global.com, 2022) defines the concept, which is discussed as knowledge harvesting, as “an integrated set of processes that allow capturing and disclosing internalized, implicit knowledge and experience, transforming them into content for a customized action.” This effort to disclose such information from implicit to explicit and transform it for specific actions is the theoretical root of the approach aimed at constructing the PDH technique.

**Table 3:** Main Concepts of Interaction in the Human-Computer Interaction (HCI) Literature

Concept	View of interaction	Key phenomena and constructs	Good interaction	Example support for evaluation and design
<b>Dialogue</b>	a cyclic process of communication acts and their interpretations	mappings between UI and intentions; feedback from the UI; turn-taking	understandable; simple, natural; direct	methods/concepts for guessability, feedback, mapping; walkthroughs
<b>Transmission</b>	a sender sending a message over a noisy channel	messages (bits); sender and receiver; noisy channels	maximum throughput of information	metrics and models of user performance
<b>Tool use</b>	a human that uses tools to manipulate and act in the world	mediation by tools; the directness of acting in the world; acting as a unit of analysis	useful and transparent tools; amplification of human capabilities	compatibility in instrumental interaction; break down analysis
<b>Optimal behaviour</b>	adapting behaviour to goals, tasks, UI, and capabilities	rationality; constraints; preferences; utility; strategies	improves or reaches the maximum or satisfactory utility	models of choice, foraging, and adaptation
<b>Embodiment</b>	acting and being in situations in the material and social world	intentionality; context; coupling	provides resources for and supports fluent participation in the world	studies in the wild; thick description
<b>Experience</b>	an ongoing stream of expectations, feelings, and memories.	non-utilitarian quality; expectations; emotion	satisfies psychological needs; motivating	metrics of user experience; experience design methods
<b>Control</b>	interactive minimization of error against some reference	feedforward; feedback; reference; system; dynamics	rapid and stable convergence to the target state	executable simulations of interactive control tasks

**Source:** Hornbæk, K., Oulasvirta, A. (2017). What is interaction? CHI '17: Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems, USA, May 6.

The premise of this view is that human experience is a key factor in how interaction arises. According to Hassenzahl, experience is “an instant and primarily evaluative (good-bad) feeling that emerges when interacting with a product or service.” This emotion is a part of the whole interaction; it shapes the interaction and is shaped by it (Hornbæk & Oulasvirta, 2017, p. 6).

The use of harvest in PDH is adapted from the agricultural sciences. In agricultural sciences, this concept is the name for harvesting from a field. The harvested fruits are then stocked, stored, processed, and reused to generate added value. Like this post-harvest cycle of agricultural products, in the PDH technique, the experience undergoes similar stages and is reused for academic purposes. In this regard, PDH is the simultaneous acquisition of humans’ psychological responses to a certain stimulus using one or more psychophysiological tools.

### Scope of the research

Most methods used to answer questions about corporate identity come from “traditional” consumer behaviour research, using questionnaires to determine a brand’s image (Gray & Smeltzer, 1985; Poiesz, 1989). However, studies with traditional methods often leave the perception of identity in a conceptual dimension (Kapferer, 1986; Balmer, 1998; Cornelissen, 2000; de Chernatony, 1999; Melewar, 2003; da Silveira, Lages, & Simões, 2013; Barros, 2014). This is because, in these studies, the perceptions of corporate identity are based entirely on the participants’ “reports.” Questionnaires are often carried out

through online tools, which also magnifies this effect. Because such research is not conducted face-to-face, the researcher cannot fully determine the participants' true feelings (www.cookmyproject.com, 2022).

PDH involves a combination of quantitative data collected from autonomic nervous system reflexes and data collected from qualitative methods like questionnaires during and after psychophysiological data harvesting, participatory action research (PAR), retrospective think-aloud (RTA) protocol, in-depth interviews, and focus group work. The PDH technique is thus a multi-method approach. Table 4 below gives the procedural requirements of PDH in three steps.

**Table 4:** Psychophysiological Data Harvesting Procedure

	<b>Psychophysiological Data Harvesting Technique - Multi-Method</b>
<b>Step 1</b>	<p>Adaptation to Human-Computer Interaction (Preparation for PDH)</p> <p>PDH can be performed at this step based on physical field procedures and remote psychophysiological data collection. Regardless of the selected structure, this step is required to complete the preparation processes for participants and allow them to adjust to the technological stage. This step involves waiting for the participant's biological rhythm to be ready for psychophysiological measurements, controlling the environmental conditions for stimuli like light, sound, et cetera, and, if measurements are done remotely, completing procedures like technical eye and face calibration:</p> <ul style="list-style-type: none"> <li>• Determining Basal Metabolic Rate</li> <li>• Eye calibration for eye tracking</li> <li>• Face calibration for facial recognition</li> <li>• Preparing and testing computer, camera, and sound recording equipment</li> <li>• Procedural actions to ensure appropriate conditions for remote PDH</li> <li>• Signing the relevant permission and consent forms</li> <li>• Informing and guiding participants about the procedure</li> </ul>
<b>Step 2</b>	<p>Autonomic Nervous System Data Collection</p> <p>At this step, the data is collected from the participants using the preferred PDH tools and within the appropriate timing. This step can be configured for physical harvesting or remote harvesting. The techniques for this step are listed below:</p> <ul style="list-style-type: none"> <li>• Eye-Tracking</li> <li>• Electrodermal Data Analysis (GSR)</li> <li>• Face Recognition and Facial Expression Analysis (FEC)</li> <li>• Heart Rate Analysis (ECG)</li> <li>• Heart Volume Analysis (PPG)</li> <li>• Functional Magnetic Resonance Imaging (fMRI)</li> <li>• Electroencephalography (EEG)</li> <li>• Other Psychophysiological Indicators (Temperature, Blood Pressure, Blood Oxygen, et cetera.)</li> </ul>
<b>Step 3</b>	<p>Cognitive Data Collection</p> <p>After completing the PDH procedure, this step involves collecting cognitive responses from participants to allow in-depth findings and data analysis using the preferred qualitative and quantitative techniques. This step can be configured as a scale-based quantitative process, a qualitative-based interview process, or a structure that adopts both approaches. Example techniques include:</p> <ul style="list-style-type: none"> <li>• In-Depth Interview</li> <li>• Focus Group Work</li> <li>• Questionnaires</li> <li>• User Research Methods (Card Sorting, Think Aloud, et cetera.)</li> <li>• Mouse Tracking</li> <li>• Tasks and Orientation</li> <li>• Other Quantitative Methods</li> </ul>

According to the procedural requirements of PDH, in this study, in the first stage, eye calibration for eye tracking, face calibration for face recognition, preparation and testing of computer, camera and voice recording equipment, procedural procedures for ensuring appropriate conditions for Remote Biometric Data, signing of relevant permission and consent forms, and participant information and guidance on the procedure were completed. In the second stage, a questionnaire survey was conducted.

In the current research, the first stage involved sharing information about the research with the participants via e-mail and WhatsApp. In the second stage, we harvested psychophysiological data through the research link. The brand logos were shown to the participants in black and white because the colours could draw visual attention or distract them. This way, the logos turn into marks in the context of graphic design, making it possible to detect the linear effect aimed here.

For example, Osberger & Rohaly (2001) suggest that some colours, like red, attract more attention, causing greater masking (Osberger & Rohaly, 2001, cited from Galesca, Tomasic, & Ebrahimi, 2005, p. 3). However, according to Galesca et al. (2005, p. 4), regions that display high contrast in brightness or colour have a stronger effect on visual attention. Still, the key design factor for this research is the “line.” Hence, we included black and white logos to allow the participants to focus only on the linear effects. We first showed the participants black and white logos belonging to 18 brands with a strong corporate reputations. We then revealed what the linear effects and the character traits meant for the participants through questions, adhering to Table 2, which was prepared by expanding Joannès’ (2008) research.

Another question we sought answers for was the emotions evoked by the logos. Many theorists studying emotions have been interested in the number of basic emotions and their descriptive criteria (Plutchik, 1980; Ekman, 1992; Izard, 1992). Zelenski and Larsen (2000) focused on the experience of basic emotions in daily life. The authors investigated the experiences of basic emotions using an “Experience Sampling Method.” This method asks participants to report how much they experience daily basic emotions. We found the perspective offered by Zelenski and Larsen (2000) to be very suitable for our research, which aims for experience harvesting. Therefore, we included 15 emotions from the researchers' procedure as references for the participants to explain what the logos evoke in them. The form also included a group of questions for demographic characteristics. The procedure took 20-22 minutes to implement for each participant. Finally, the procedure included a participant consent form and an introductory video about the steps and how PDH is carried out.

The qualitative and quantitative data obtained through the multi-method technically verify each other and are tested by the procedure, maximizing precision. Combining this methodological strength with the saturation threshold that can be reached with a small number of participants, per the nature of user research, makes collecting in-depth, valid, and reliable data by rapid fieldwork possible.

While this methodology has produced high added value in academic research, implementation has recently been difficult, especially with the COVID-19 pandemic as of 2019. With many physical distance challenges, PDH bases its high-tech deep machine learning and artificial intelligence on software that can remotely collect data ([www.emoty.ai](http://www.emoty.ai), [www.realeye.io](http://www.realeye.io)). With the use of this artificial intelligence-based technology, the current research tries to determine the character traits reflected by the logos belonging to brands with strong corporate reputations while seeking answers to three questions:

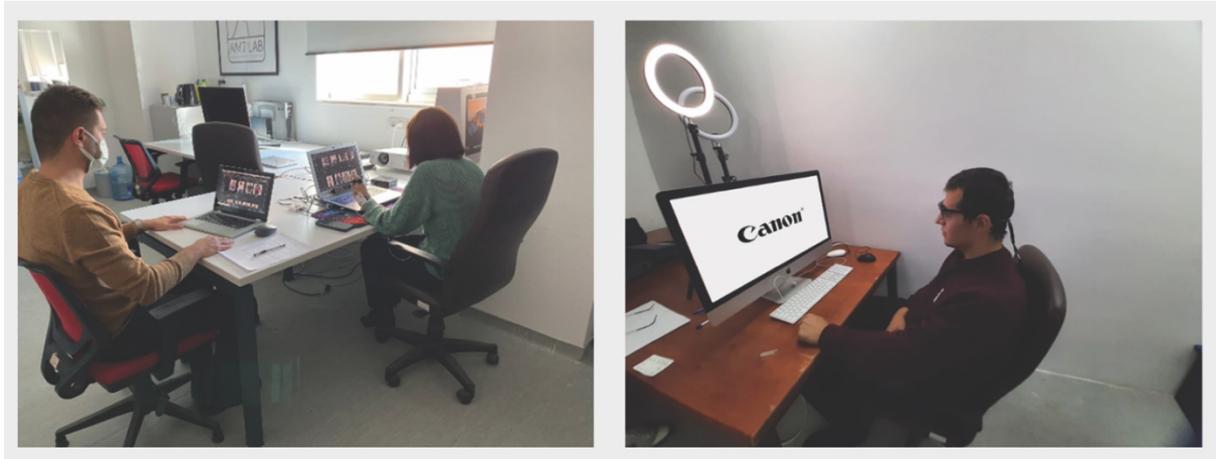
**Research Question 1:** Do the logos belonging to brands with strong corporate reputations have similar linear effects?

**Research Question 2:** If so, are these similarities correlated with the brand’s position in the reputation ranking?

**Research Question 3:** What emotions do the logos of brands with strong corporate reputations evoke?

#### **Pilot field study**

Before the actual research, as seen in Fig. 3 below, we conducted a pilot study for the black-and-white logo display time. We showed 18 logos to 15 participants for 10 seconds. Still, our findings revealed that the logo display time had to be halved due to eye movements and retinal repetitions that surpassed the attendance zone. Based on the data obtained from the pilot study, we prepared a new procedure for the actual research, allowing the participants to interact with each logo for 5 seconds. Previous research also highlights that 5 seconds is sufficient for a good design to convey its primary message (Usabilityhub, 2021). To allow the participants to refocus their attention before moving on to the next logo and to obtain productive findings of the first field of view (FFD), we had them look at X marks on a white background for 2 seconds between each logo (the X marks were placed randomly).



**Figure 3:** Examples of AMT-LAB Pilot Field Study Practices

**Choosing corporate logos**

Using the last five-year data of the "Global RepTrak® 100," created by an online survey of over 100,000 participants from 55 countries, we included 18 brands with a strong reputation. Global RepTrak® is a large reputation comparison database covering different countries with its participants and overall structure. In this context, we included the logos belonging to the top 10 brands with the strongest reputation in the "Global RepTrak® 100" for 2016, 2017, 2018, 2019, and 2020 (Rolex, Lego, Disney, Google, BMW Group, Canon, Adidas, Ferrari, Daimler, Bosch, Sony, Levi's, Adidas, Netflix, Rolls-Royce, Apple, Intel, Microsoft, and Michelin). Figure 4 gives a list of these brands.

	2016	2017	2018	2019	2020
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
10.					

**Figure 4:** According to the Global Reptrak® 100 Research, The World's Top 10 Brands with the Strongest Corporate Reputation (2016-2020)

### Participant profile

We included 39 participants (19 males and 20 females) from Turkey. According to the user research by Pernice and Nielsen (2009), this number agrees with the threshold criterion for participant saturation. Pernice and Nielsen (2009, p. 20) report that eye-tracking studies based on heat maps require at least 39 participants for over 90% reliability. Because heat maps are one of the main tools used to interpret our findings, we selected 39 participants aged between 18-76 years (19 males and 20 females) by convenience sampling for high reliability. Table 5 shows the age range and age distribution of the participants.

**Table 5:** Demographic Data of Participants

18-25 age	4 Women and 4 Man	26-35 age	5 Women and 5 Man
36-50 age	5 Women and 5 Man	51 years and older	6 Women and 5 Man

### Limitations

One limitation of our research is that we examined the logos belonging to brands among the top 10 with the strongest reputation in 2016-2020, according to Global RepTrak® 100. Also, as mentioned before, the logos were black and white. This may result in ignoring emotions and impacts that may have been conveyed through the colours and textures of the logo. Besides:

- The only different brand was Harley Davidson, given the top 10 brands in the Global RepTrak® 100 in 2021. Because it only offered a single brand variable, the year 2021 was excluded.
- The current research is limited to the possibilities provided by Emoty.ai, a tool that collects data through a computer camera.

### Results and discussion

The present research aimed to explain the linear effects of logos belonging to brands with strong corporate reputations. In this context, we obtained our results with the PDH technique. Below we discuss the findings for each research question.

**Research Question 1:** Do the logos belonging to brands with a strong corporate reputation have similar linear effects?

Given the characteristics reflected by the linear effects (Table 2), 16 lines provided consistent data (except for 4: upward curved line, diamond line, circle, and organic shape). We also observed that the characteristics reflected by eight linear effects directly correlated with the meanings of the character traits. Four lines (upward curved line, diamond line, circle, and organic shape) correlated with other characteristics to form synonyms and connotations of the character traits in Table 2. Ultimately, the additions to Joannès' (2008) work seem to be confirmed by PDH findings. Table 6 below shows the lines and character traits found in the matching study.

**Table 6:** Lines and Character Traits Detected with PDH

Logos with Overlapping Lines and Characteristics		
Logo	Line	Characteristic
		Prescriptive, Prestigious, Authoritarian
		Prescriptive, Prestigious, Authoritarian
		Weak, Depressed, Withdrawn
		Positive, Calm, Responsible, Cautious
		Positive, Calm, Responsible, Cautious
		Positive, Calm, Responsible, Cautious
		Prescriptive, Prestigious, Authoritarian

		<p>Frivolous, Cool, Indecisive, Changeable</p>
		<p>Flexible, Withdrawn, Weak</p>
<p>Logos with Overlapping Lines and Characteristics by Connotations</p>		
<p>Logo</p>	<p>Line</p>	<p>Character</p>
		<p><b>Primary Meaning:</b> Protective, Traditional, Fearless  <b>Connotation:</b> Prescriptive, Prestigious, Authoritarian</p>
		<p><b>Primary Meaning:</b> Sturdy, Grounded, Stable  <b>Connotation:</b> Reliable, Strong, Stable, Mature</p>
		<p><b>Primary Meaning:</b> Sturdy, Grounded, Stable  <b>Connotation:</b> Reliable, Strong, Stable, Mature</p>
		<p><b>Primary Meaning:</b> Sturdy, Grounded, Stable  <b>Connotation:</b> Reliable, Strong, Stable, Mature</p>
<p>Logos with Non-Overlapping Lines and Characters</p>		
<p>Logo</p>	<p>Line</p>	<p>Character</p>
		<p><b>Primary Meaning:</b> Daring, Future-oriented, Moderate, Upward prone  <b>Connotation:</b> Positive, Calm, Responsible, Cautious</p>

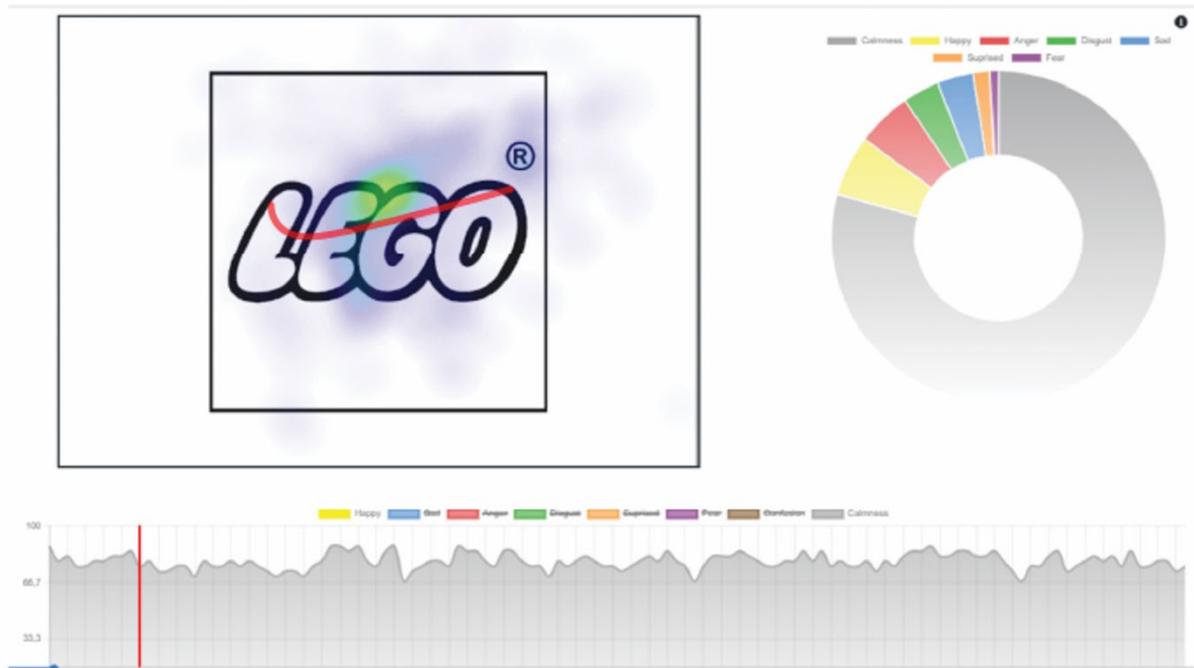
		<p><b>Primary Meaning:</b> Daring, Future-oriented, Moderate, Upward prone</p> <p><b>Connotation:</b> Positive, Calm, Responsible, Cautious</p>
<p>The WALT DISNEY Company</p>		<p><b>Primary Meaning:</b> Demanding, Arrogant, Rich</p> <p><b>Connotation:</b> Reliable, Strong, Stable, Mature</p>
		<p><b>Primary Meaning:</b> Remarkable, Egocentric, Focused</p> <p><b>Connotation:</b> Positive, Calm, Responsible, Cautious</p>
		<p><b>Primary Meaning:</b> Soft, Cooperative, Compliant</p> <p><b>Connotation:</b> Frivolous, Cool, Indecisive, Changeable</p>

As seen in Figure 5, 9 (50%) of the 18 brands in the Global RepTrak® 100 had square, rectangular, pentagram, and diamond lines running along a horizontal line in their logos. This finding indicates similarities in the linear effects in the logos of brands with a strong corporate reputation. Thus, most brands with a strong corporate reputation displayed reliable, strong, and stable character traits in their logos based on positive, calm, and responsible linear effects.

**Figure 5:** Logos of Brands with Strong Corporate Reputation Designed on the Axis of Horizontal Lines

The participants defined the upward-curved line as “positive, calm, responsible, and cautious” (13). Although, given the heat maps produced by the PDH technique, we found that the participants captured the upward-curved line in Lego and Levi’s logos according to the gaze plot seen in Figure 6. In the visual design domain, this created an intellectual output for “daring, future-oriented, modest, and rising” in the subconscious, as expected from the upward curved line. In the visual identity domain, this line moved towards the cognitive side with more positive, calm, and responsible traits. This finding is consistent with the literature. Because as shown in Figure 7 on page 24, the characteristics brought to the line by the dots can indicate one or more of the same emotions (Jiang et al., 2016).



**Figure 6:** Upward Slash Effect on the Lego Brand Logo

Using the PDH technique, the current research revealed that design outputs work subconsciously without ignoring the other elements that make up a corporate reputation. The findings for Adidas were particularly remarkable in this regard. Despite being among the top 10 brands in Global RepTrak® 100 from 2018 to 2020, the Adidas logo was perceived as a “vertical downward line,” described as “weak, depressive, and introverted.” The PDH findings and the participants’ perceptions of “weak, depressive, and introverted” characteristics appear consistent. Moreover, according to the facial recognition findings obtained by PDH, the Adidas logo made the participants feel “disgusted.” The logo appears to change from a vertical downward line to a rectangular logo over a horizontal line, with which Adidas ranked 7th in Global RepTrak® 100 in 2021.

**Table 7:** Change of Adidas logo

	
<p>Logo used in 2016-2020 Global RepTrak® 100</p>	<p>Logo used in 2021-2022 Global RepTrak® 100</p>

**Research Question 2:** Are these similarities correlated with the brand’s position in the reputation ranking?

Since 50% of the brands had square, rectangular, pentagram, and diamond linear effects running on a horizontal line in their logos, the linear effects in these logos seem similar among brands with a strong corporate reputation. However, we observed no findings to suggest a correlation between these similarities in logo design and the brands’ position in reputation ranking.

**Research Question 3:** What emotions do the logos belonging to brands with a strong corporate reputation evoke?

Rolex, Lego, and Disney have kept their places on the Global RepTrak® 100 for five years. As brands in the entertainment industry, Lego and Disney make the participants feel “happy” with their logos. This is not surprising, given the nature of the industry; likewise, the design characteristics and the logo of Rolex evoke a different emotion. For the participants, the Rolex logo evoked a “calm” feeling. The Pentagon defines the character traits as “prescriptive, protective, fearless, and traditional.”

As can be seen in Figure 7, we also observed that the participants had difficulties expressing their feelings about the logos. Especially when they could not express their emotional experiences, they were often closer to answering “none.” For further research, we believe that the expressions in the “Experience Sampling Method,” where Zelenski and Larsen (2000) focused on the experiences of basic emotions in daily life, warrant re-evaluation as a limitation when used together with PDH.

	Concerned	Curious	Excited	Angry	Upset	Calm	Scared	Exhilarated	Disgusted	Bored	Guilty	Happy	Alone	Sad	Comfortable
						X (8)									
												X (12)			
Google		X (18)													
												X (18)			
Canon		X (8)													
SONY						X (8)									
															X (14)
						X (14)									
BMW GROUP			X (14)												
Microsoft						X (14)									
			X (14)												
Levi's															X (9)
intel						X (8)									
												X (19)			
			X (10)												
DAIMLER		X (4)													
			X (12)									X (12)			
NETFLIX			X (17)												

Figure 7: Dominant Emotions of Logos

Note: \*The numbers represent the number of participants expressing emotions.

The emotions that the logos evoke were calculated according to the most frequently expressed emotions. The relaxed (9) and calm (8) emotions evoked by Levi’s logo could be considered a close emotional duality. The close association of these emotions is associated with the reference feelings proposed by Zelenski and Larsen (2000). We also revealed the intensity of the emotions evoked by the logos. Figure 8 shows these findings.

	47		54		51		44		43	DAIMLER	39
	45	Canon	40		47		46		45		58
Google	43	SONY	47	BMW GROUP	50	Levi's	40		49	NETFLIX	77

Figure 8: Emotional Intensities of Brands with Strong Institutional Reputation

Note. \* The option for “none” was excluded from emotional intensity. The numbers in the table are the sum of each emotion marked by the participants.

Excluding the option for “none,” the Netflix logo was the strongest brand regarding emotional intensity (77). Despite being on the list for the last five years, Rolex (47) and Lego (45) ranked behind Apple (58) and Netflix (77) in terms of emotional intensity, unlike Disney, which has also been on the list for the last five years. With this finding, we revealed that the logos belonging to brands with a strong corporate reputation evoked feelings of “curious,” “excited,” and “happy” in the participants.

### Conclusion and recommendations

A significant part of our findings by PDH overlaps significantly with the corresponding findings for linear effects in the literature. We evaluated the logos of the top 10 brands with the strongest corporate reputation in Global RepTrak® 100 regarding their linear effects and character traits. We observed that 12 lines (66.6%) displayed character traits similar to their synonyms/connotations. This is a striking finding for the logos belonging to brands with a strong corporate reputation, indicating that the PDH technique works effectively.

Due to their linear effects, the logos belonging to brands with a strong corporate reputation were perceived as reliable, strong, and stable. Also, 9 (50%) brand logos had certain linear effects (square, rectangle, pentagram, diamond) running on a horizontal line. Still, we found no correlation between the

design characteristics of these logos and the brands' reputation rankings. Thus, we cannot conclude that the linear elements in logo design affect brands' reputation rankings.

The logos belonging to brands with a strong corporate reputation made the participants feel "curious," "excited," and "happy." Maintaining their place in the Global RepTrak® 100 for the last five years, Lego and Disney evoked a sense of happiness in the participants. Another brand that maintains its place on the list, Rolex, made the participants feel "calm." Thus, in logo design, choosing humble, closed, and solid shapes like square and Pentagon, vertical lines that evoke excitement, upward curved lines, and vertical lines that evoke happiness or curiosity will support corporate reputation in visual identity.

Another remarkable finding was about emotional intensity. The Netflix logo had the strongest emotional intensity, followed by the Disney and Apple logos. On the other hand, being on the strong corporate reputation list for five years (2016-2020), the Disney logo lagged behind Apple and Netflix. This could be associated with transforming certain social life practices, particularly during the COVID-19 pandemic. Erdem and Aytakin (2021) report that over 50% of positive comments suggest that Netflix gained much awareness as a digital broadcasting platform during the pandemic. Their participants stated that they began using Netflix more frequently than before the pandemic, consuming more content during the quarantine. Besides, the participants' prominent binge-watching preferences during this period could be interpreted as a sign of increased emotional intensity with the brand. With the COVID-19 pandemic, Netflix gained about 18 million new subscribers, which supports this idea (Cook, 2022).

For further research, we are considering evaluating linear effects and character traits in the context of cross-country cultural differences. This way, we expect to reach more comprehensive findings on the correlations between visual identity (logo), reputation, and culture. Furthermore, obtaining clear results about linear effects, character traits, and emotional states during logo production would be beneficial for establishing a strong corporate reputation in the visual identity domain. Therefore, we believe the findings obtained here can guide designers as the source and illuminate how to design a corporate logo.

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