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Research article

THE ROLE OF VISUAL BRANDING IN DRIVING INVESTMENT ATTRACTIVENESS IN THE DIGITALISATION ERA: PSYCHOPHYSIOLOGICAL DATA ANALYSIS

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Abstract. In the digitalisation era, visual branding has become a key driver of investment attractiveness, particularly for institutions seeking to differentiate themselves and appeal to diverse stakeholders. This study investigates the role of visual branding through the analysis of logos from universities and companies located in Sumy, Ukraine. Using psychophysiological data analysis, the research integrates galvanic skin response and facial expression recognition to assess the emotional and cognitive impacts of visual-branding elements such as forms and lines. This study employs a mixed-method approach that combines biometric data and subjective surveys to evaluate logo perception. Paired t tests and chi-square analyses were conducted to determine the relationships between logo design elements and perceived traits such as stability, inclusivity, and professionalism. Comparative analysis with global corporate branding benchmarks highlighted the alignment and gaps of local logos against global design standards. The results reveal significant variations in emotional engagement and perception across different logos. University logos, while emphasizing inclusivity and harmony, lack the geometric precision and structured linear elements associated with global branding success. Similarly, company logos demonstrated limited alignment with traits of professionalism and trust. Galvanic skin response peak detection further highlighted low emotional arousal for most stimuli, suggesting a need for stronger visual impact to enhance investment appeal. This research emphasizes the importance of integrating global design principles into local branding strategies. By incorporating structured forms, balanced compositions, and emotionally resonant elements, organizations can enhance their visual identity and foster greater investment attractiveness. Future studies should explore the long-term impact of branding adjustments in regions facing economic or geopolitical challenges, such as those faced by Ukraine.

Keywords*:* visual branding; logo perception; psychophysiological analysis; galvanic skin response; facial expression recognition; emotional engagement

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1. Introduction

In the digitalisation era, visual branding has become a cornerstone of driving investment attractiveness. With businesses increasingly operating on digital platforms, visual elements such as logos, typography, colors, and design aesthetics are crucial for shaping perceptions among investors and stakeholders [1]. These elements communicate trust, professionalism, and innovation, making them essential for attracting and retaining investment. In a competitive global market, visual branding differentiates businesses and amplifies their reach, helping companies build strong financial relationships [2]. The role of visual branding in investment attractiveness is multifaceted and viewed through various lenses. From an investor's perspective, visual branding signals credibility and stability. A cohesive and well-designed brand reflects organizational maturity and a commitment to quality, instilling confidence in potential investors [1]. Furthermore, advanced technologies such as augmented and virtual reality are increasingly integrated into branding strategies, creating immersive brand experiences that engage investors and enhance a company's competitive advantage [3–5].

Cultural and global appeal is another critical aspect of visual branding. In an interconnected world, brands must cater to diverse cultural preferences while maintaining global consistency [6]. Elements such as color symbolism and design choices significantly influence how a brand is perceived across regions. In tight cultures with strict social norms, structured logos communicate reliability, whereas in loose cultures, spaced-out designs convey creativity and flexibility [6,7]. Visual branding also plays a powerful role in signalling sustainability and ethical practices, which are increasingly prioritised investors focusing on environmental, social, and governance (ESG) criteria [8–13]. Studies [14–18] emphasize that digital transformation supports sustainable branding practices by addressing critical environmental concerns and fostering societal trust. Furthermore, studies [19–30] have illustrated the role of digital public services in enhancing organizational transparency and accountability, both of which are essential components of successful branding campaigns. By integrating these insights into their branding strategies, organizations can enhance their public image and attract investments more effectively. Companies that emphasize these values through branding—using green logos, eco-friendly designs, and transparent communication—are more likely to attract long-term, impact-focused investments [31]. In crowded markets, distinctive visual branding is essential for standing out. Unique visual elements convey creativity and innovation, which are key factors for attracting investors in technology-driven sectors [1,3,32–36]. However, the emphasis on visual branding is not without challenges. Critics argue that branding alone may not reflect a company's actual performance or long-term potential. Overreliance on branding without substantive business practices can attract short-term interest but may harm trust in the long run [2; 37]. Furthermore, the rapid pace of technological change necessitates constant updates to branding strategies, which can strain resources [1].

Previous studies have focused largely on established global brands, leaving potential insights from psychophysiological tools (galvanic skin response and AFFDEX) to analyse emotional and cognitive responses to local branding elements. Moreover, the ongoing conflict in Ukraine presents unique challenges and opportunities for organizations aiming to refine their branding strategies to remain competitive and appealing on an international stage. This study aims to fill

this gap by employing innovative methodologies that combine psychophysiological data with subjective evaluations to provide a deeper understanding of logo effectiveness in the digital era.

This study contributes to the literature by employing a multimodal psychophysiological approach to analyse the effectiveness of visual branding in the context of Ukrainian universities and companies. This study provides insights into how local organizations can align their visual branding strategies with global best practices, leveraging data-driven emotional and cognitive analyses to attract investment in a challenging economic and geopolitical environment. This study seeks to answer the following questions: How do form and linear elements in local branding logos affect emotional engagement and investment perceptions among stakeholders? What are the key design elements that local organizations can integrate to align their branding strategies with global best practices?

The paper is structured as follows: the introduction establishes the research problem, highlights the existing gaps in the literature, and specifies the study's objectives and research question. The methods section details the experimental design, including the stimuli, data collection methods, and analytical techniques used. The results section presents the findings, with a focus on the physiological and emotional responses elicited by different logo design elements. The discussion section interprets these findings in the context of previous research and explores their implications for branding strategies. Finally, the conclusion summarizes the key insights, addresses the limitations of the study, and suggests directions for future research.

2. Literature Review

2.1. Branding and investment attractiveness

Research has demonstrated that positive brand perceptions enhance investor confidence and optimism, as highlighted by Aspara [38], whereas Fischer & Himme [39] emphasize the tangible financial benefits generated through enhanced customer-based brand equity. However, Biong and Silkoset [40] caution that branding does not always lead to price premiums, as its effectiveness depends on market competition and consumer sensitivity. Past studies [41,42] underscore the value of intangible brand capital, built through sustained marketing efforts, as a long-term competitive advantage that fosters customer loyalty. The studies [43–47] further illustrate how strong brand capital enables more efficient resource allocation and improves financial outcomes. Similarly, Crass et al. [48] demonstrate a dynamic relationship between brand equity and profitability, showing that branding efforts yield financial benefits over time. Davcik [49] and Wang et al. [50] explore how marketing investments in differentiation and optimal branding strategies support premium pricing and sustained competitiveness. Mishra et al. [51] and Kim & Yoon [52] highlighted the importance of aligning branding efforts with clear financial goals to ensure marketing accountability and higher returns. Additionally, Zhou [53] underscores the impact of technology-driven branding efforts in boosting brand visibility and financial performance in digital markets.

Bose et al. [54] emphasized that strong place branding can significantly improve a region's investment attractiveness by leveraging customer-based place brand equity. Similarly, Kalamova & Konrad [55] argue that nation brands play a critical role in influencing foreign direct investment (FDI) decisions, as positive brand perceptions reduce investor uncertainty and enhance market confidence. Studies [56–62] provide an integrative review that underscores

how cohesive branding strategies align national resources and policies with investment promotion goals, making them crucial for long-term economic development. Matiza & Oni [63] further explore the strategic use of nation-branding as a means to position African nations as competitive FDI destinations, emphasizing the importance of aligning branding efforts with sustainable development frameworks. From a practical perspective, Kaefer [64] highlights the success of branding efforts in India, where nation-branding initiatives have been used effectively to promote investment opportunities. Similarly, Mohib & Carroll [65] showcase Qatar's nation-branding as a case study, demonstrating how strategic branding initiatives attract global investors and strengthen the country's economic image. Metaxas [66] identified the interplay between place marketing and branding in local economic development, emphasizing their role in fostering regional competitiveness. Schoeneman & Fullerton [67] provide evidence of a positive relationship between nation-branding and FDI, particularly when branding strategies highlight unique cultural, social, and economic attributes. FDI and brand development are closely interconnected, as strategic branding initiatives can significantly influence a country's ability to attract and retain investments. Aruna & Abdul Gafoor [68] highlight the potential of FDI in the retail sector to stimulate brand development, arguing that opening markets to foreign investors not only enhances competition but also encourages the creation of stronger domestic brands. Similarly, Jamaluddin [69] identified the challenges and opportunities presented by FDI in India’s multibrand retail sector, emphasizing the need for robust branding strategies to balance local market dynamics with global investment flows. Kumar [70] explores the implications of FDI in multibrand retail, pointing out that foreign investments can lead to brand proliferation and improve consumer access to quality goods. However, he also stresses the importance of protecting domestic brands from being overshadowed by international players. Matiza & Oni [71] take a broader perspective, discussing nation branding as a strategic tool for attracting FDI. They argue that branding initiatives can improve a country’s global image, positioning it as a competitive destination for foreign investments. In addition, Matiza & Oni [72] propose a sustainable framework for leveraging nation-branding to attract FDI, particularly for African nations. They emphasize the need for branding strategies that align with national development goals, integrate cultural and economic strengths, and promote long-term partnerships with investors.

Consumer–brand relationships significantly influence behavior, loyalty, and engagement, with trust, satisfaction, and commitment driving repurchase intentions [73,74]. Emotional ties and perceived quality play critical roles in fostering long-term loyalty [75,76]. Relationship-building strategies, especially on social media, enhance satisfaction and deepen brand connections [77]. Even in cases of dissatisfaction, strong emotional investments keep consumers committed to brands [78]. Corporate and service branding further strengthens consumer trust and differentiation, particularly in industries such as financial services. Robust corporate branding efforts, such as P&O, cruise significant investment and enhance reputation and market positioning [79].

Dzogbenuku et al. [80] highlight the mediating role of financial service branding in shaping investment decisions in emerging markets, emphasizing its potential to bridge trust gaps. Joshi [81] analysed India’s "Make in India" logo, showcasing how visual branding can enhance investment branding and create a compelling narrative for market growth. Kam & Tse [82] explored the unintended effects of national legal systems on FDI flows and demonstrated that branding efforts must align with institutional strengths. Moloi et al. [83] examined corporate

social investment (CSI) in South Africa and reported that strategic branding through CSI enhances trust and improves financial institutions' brand image. Similarly, Yesiana et al. [84] highlighted the use of city branding to promote urban investments, highlighting its role in driving regional economic growth. Effective branding can amplify the success of investment strategies by aligning financial goals with market perceptions. Fee et al. [85] examined how branding changes during acquisitions impact advertising investments, revealing that consistent branding enhances postacquisition integration. He et al. [86] linked CEO characteristics to brand equity investments, showing that leadership plays a critical role in strategic branding decisions. Jensen & Cobbs [87] modelled return on investment (ROI) in sports sponsorships, highlighting how branding visibility directly correlates with financial returns. Mao & Han [88] explored the interplay between service investments and branding in dual-channel supply chains and reported that balanced investments maximize returns. Treynor [89] emphasized the long-term investment value of brand franchises, underscoring the importance of branding as a sustainable financial strategy. Digital and social media branding have transformed how firms engage with consumers and drive investments [90]. Chatterjee [91] linked preacquisition e-branding activities to customer profitability, emphasizing the importance of online branding in financial success. Hamadi et al. [92] showcased how universities use social media branding to enhance return on investment (ROI) and institutional image. Ren et al. [93] explored branding strategies for EV battery-swapping stations and reported that digital branding improves consumer trust and adoption. The studies [94–98] highlighted the role of branded apps in fostering consumer engagement, loyalty, and behavioral outcomes, demonstrating their importance in the digital-first world.

Hayakawa [99] highlighted the interaction between branding and international law. Potočnik [100] emphasized that trademarks, often protected under investment treaties, serve as vital assets for global branding efforts. Case studies provide practical insights, such as Callingham & Baker's [101] brand measurement system, which aids strategic investment decisions, and Haxthausen's [102] review of brand valuation techniques for maximizing ROI. Lee & Lee [103] showed how a Korean nation brand attracted foreign direct investment by aligning national identity with market needs.

2.2. Visual branding: core dimensiosns

Aagesen & Heyer [104] highlight the importance of interaction aesthetics in expressing brand personalities, demonstrating how design elements resonate with consumer emotions. Davison [105] explored iconography, using the bowler hat as a symbol of trust and tradition in banking, illustrating how cultural and historical references strengthen brand identities. Sustainability in visual identity, as emphasized by Elkotbi [31], aligns brands with eco-conscious values, appealing to modern consumers. Klint et al. [106] address the challenge of maintaining visual brand consistency over time, proposing systems to preserve brand integrity. For younger audiences, Lopez & Rodriguez [107] revealed that visual elements such as mascots and colors significantly impact emotional connections with brands. Forms, colors, and lines further amplify these connections, with specific shapes evoking different psychological responses; rounded forms suggest friendliness, whereas angular shapes convey strength and modernity. Colors play a vital role in influencing consumer emotions and perceptions; for instance, blue often symbolizes trust, whereas red conveys passion and urgency. Lines, whether

dynamic or static, guide the viewer's attention and establish tone; curved lines evoke softness and approachability, whereas straight lines represent structure and professionalism.
Cultural implications are explored by Medeiros [108], who criticizes the use of visual branding in perpetuating stereotypes, underscoring the ethical responsibility of brands. In emerging markets, such as the cannabis industry, Mundel et al. [3] demonstrated how innovative visual cues influence consumer trust and market positioning. Phillips et al. [1] focused on the role of art directors in crafting visual identities that align with organizational goals. Presutti [109] and Thurlow & Aiello [110] delve into the cultural semiotics of visual branding, examining elements such as the Spanish tilde and transnational airline branding to showcase how visuals project identity and unity across global audiences.

Bernhardt et al. [111] compared television fast food advertisements targeted at children and adults, revealing significant differences in content and appeal. Advertisements aimed at children often employ bright visuals, engaging narratives, and mascots to build emotional connections, whereas adult-targeted ads focus more on product attributes and lifestyle benefits. This underscores the tailored strategies advertisers use to influence different demographic groups. Williams et al. [112] explore how modern data analysis identifies creative drivers of advertising effectiveness. Their research highlights the importance of integrating data-driven insights into advertising strategies to enhance message delivery and consumer engagement. By analysing elements such as imagery, tone, and placement, advertisers can optimize campaigns to resonate more deeply with target audiences, ensuring a stronger impact on brand perception.

Brand names and the cultural context are equally critical in shaping consumer attitudes. Gupta & Hagtvedt [6] examine the role of interstitial space in text logos, revealing its impact on brand attitudes in different cultural settings. In "tight" cultures, characterized by strict social norms, structured and cohesive text logos foster positive perceptions of unity and reliability. Conversely, in loose cultures, where norms are more flexible, spaced-out logos evoke creativity and approachability. This study highlights the necessity of aligning visual elements with cultural expectations to enhance brand appeal. Klink & Athaide [2] delve into the brand name–mark relationship in emerging markets, demonstrating how linguistic and visual congruence influences consumer trust and recognition. Their findings emphasize the importance of considering phonetic and cultural appropriateness when creating brand names for diverse markets. For example, a name that aligns with local language norms and integrates culturally relevant visual imagery can significantly enhance brand resonance in emerging economies.

3. Materials and methods

3.1. Data collection

On the basis of past studies [113–116], this investigation employs psychophysiological data analysis (PDA) as its primary research methodology, integrating tools such as the GSR for measuring emotional arousal, the AFFDEX for facial expression analysis, and surveys to collect subjective evaluations. PDA involves the collection, analysis, and interpretation of physiological and psychological data to assess emotional, cognitive, and behavioral responses to stimuli. This approach uses noninvasive technologies to measure real-time physiological signals, such as changes in skin conductance (GSR) or facial muscle activity (via AFFDEX), enabling a detailed understanding of participants' reactions.

In this study, PDA provides a multimodal framework to combine objective biometric data with subjective survey responses for a comprehensive evaluation of the emotional and cognitive impact of stimuli. The stimuli used include logos of local universities and companies from the city of Sumy. The selected organizations have the highest level of investment attractiveness and are city-forming enterprises. Moreover, they represent the different economic sectors (Table 1).

Table 1. The list of the selected organizations for analysis

Stimuli	Organizations	Sector
Stimulus 1	Sumy National Agrarian University	Education
Stimulus 2	Sumy State University	Education
Stimulus 3	Sumy State Pedagogical University named after A.S. Makarenko	Education
Stimulus 4	Kusum Pharm	Pharmaceutical industry
Stimulus 5	Manufactura	Trade
Stimulus 6	Kerameiya	Nonmineral industry
Stimulus 7	Horobyna	Trade

Source: Developed by the authors.

These logos of the organizations were chosen as the stimuli. These logos serve as visual branding elements, enabling the analysis of their effectiveness in eliciting emotional engagement and cognitive responses. By integrating biometric and survey data, this research aims to uncover insights into how visual branding influences perception and decision-making. Considering the studies [117,118], all stimuli (logos) were explained within the meaning of dominant emotions for relevant forms and lines. Thus, the characteristics of dominant lines and shapes in visual design are closely associated with specific emotional and psychological responses, influencing how investors perceive and connect with a design. Vertical lines, often described as prescriptive, prestigious, and authoritarian, evoke emotions such as calmness, responsibility, and cautiousness, reflecting stability and structure. When vertical lines are directed upwards, they suggest daring, future-oriented qualities, and upwards progress, whereas downwards vertical lines convey flexibility and sometimes withdrawal or weakness. Horizontal lines, on the other hand, represent project openness, idealism, and assertiveness, symbolizing innovation and receptivity. Curved lines introduce a sense of frivolity, indecision, and changeability, reflecting a playful or cool demeanor, whereas wavy lines blend prescriptive and authoritarian traits. The emotional influence of shape complements these lines. Squares convey sturdiness, groundedness, and stability, whereas rectangles, with their elongated form, add a focus on egocentrism and a remarkable presence. Circles exude calmness, supportiveness, and a sense of being overshadowed, whereas ellipses suggest arrogance, richness, and demand for attention. Diamonds stand out as dynamic, curious, and guiding, whereas triangles emphasize protection, tradition, and fearlessness. Pentagons introduce cooperative and compliant emotions, and organic shapes soften the design by conveying cooperation and flexibility.

3.2. Analysis of forms and lines

At the first stage of the investigation, a paired t test was employed to explore differences in respondents' perceptions of their general appearance and form across the analysed logos. This method aimed to determine whether specific design elements, such as form and line, were perceived as more impactful than the overall visual integration of the logos. In the subsequent stage, chi-square tests were conducted to evaluate the specific traits associated with each logo

on the basis of respondents' impressions of form and general appearance. This analysis sought to identify the predominant associations linked to each stimulus, offering a detailed understanding of how various design elements contribute to the perception of character traits. Finally, the respondents' impressions of the form and line characteristics of university and company logos were compared with findings from the study [118] on top brands featured in the Global RepTrak 100. The comparative analysis highlighted the utilization of square, rectangular, pentagram, and diamond shapes with horizontal linear effects in the logos of these top brands. These design elements are associated with qualities such as trust, stability, and professionalism, which are pivotal in building corporate reputation and attracting investment. This methodological process facilitated a comprehensive assessment of the logos, aligning their characteristics with globally recognized branding practices.

3.3. Value of the GSR

The GSR measures changes in the electrical properties of the skin, primarily caused by activity in the sweat glands. These changes are linked to emotional and cognitive arousal, making GSR a widely used tool in psychology, neuromarketing, and human–computer interaction studies.

The signal–to-noise ratio (SR) values measure (Table 2) emotional responses, with higher scores indicating stronger engagement, whereas MS tracks instances of missing physiological responses. The data show consistent SR values for university logos (especially Stimulus 2), suggesting strong emotional resonance, whereas business logos exhibit greater variability in engagement, with some notable peaks (e.g., Stimulus 7 and Stimulus 4).

Table 2. Results of the quality of the GSR signals among the respondents

R	P	Stimuli							R	P	Stimuli						
		1	2	3	4	5	6	7			1	2	3	4	5	6	7
R 1	SR	23.57	7.27	6.2	6.19	13.93	17.91	7.27	**R 15**	SR	13.13	12.18	11.08	11.49	9.78	18.31	12.18
	MS	0	0	0	0.13	0	0	0		MS	0	0	0	0	0	0	0
R 2	SR	23.67	26.48	26.64	27.27	21.01	19.01	26.48	**R 16**	SR	15.52	25.05	3.37	5.84	1.94	1.71	25.05
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0
R 3	SR	16.1	28.01	25	30.85	21.01	16.68	28.01	**R 17**	SR	-1.28	3.18	-7.26	-6.34	-10.9	-7.35	3.18
	MS	0	0	0	0	0	0	0		MS	0	6.58	0	0	0	0	6.58
R 4	SR	27.59	21.44	28.24	30.04	24.75	25.04	21.44	**R 18**	SR	-7.16	21.31	10.4	14.82	5.49	-0.39	21.31
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0
R 5	SR	12.22	23.78	0.33	31.63	16.07	1.78	23.78	**R 19**	SR	-7	7.38	10.85	11.14	1.48	2.36	7.38
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0
R 6	SR	-5.23	12.09	-14.37	-15.34	-4.92	-14.5	12.09	**R 20**	SR	11.16	24.95	16.44	16.11	10.32	8.89	24.95
	MS	0	28.81	0	0	0	0	28.81		MS	0	0	0	0	0	0	0
R 7	SR	28.48	26.59	27.55	29.16	29.51	27.2	26.59	**R 21**	SR	17.12	26.24	19.33	21.56	9.38	17.59	26.24
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0
R 8	SR	19.12	22.5	16.61	13	16.03	25.14	22.5	**R 22**	SR	14.92	12.38	19.08	11.49	4.89	6.53	12.38
	MS	0	0	0	0	0	0	0		MS	0.13	0	0	0	0	0	0
R 9	SR	19.64	7.9	26.97	17.6	21.55	7.05	7.9	**R 23**	SR	7.93	4.54	13.52	19.91	17.24	16.73	4.54
	MS	0	0	0	0	0.13	0	0		MS	0	0	0	0	0	0	0
R 10	SR	15.29	27.88	0.44	-3.15	-7.6	-4.74	27.88	**R 24**	SR	26.62	28.47	29.81	28.19	27.68	31.42	28.47
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0
R 11	SR	23.39	21.76	10.41	31.36	1.43	5.32	21.76	**R 25**	SR	18.66	23.16	20.47	27.58	18.71	1.22	23.16
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0
R 12	SR	15.97	27.5	28.49	26.88	27.23	21.36	27.5	**R 26**	SR	29.98	32.85	14.84	27.7	24.52	21.74	32.85
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0
R 13	SR	28.82	22.68	27.68	29.47	24.33	21.14	22.68	**R 27**	SR	26.73	27.99	11.92	0.77	-5.33	-2.12	27.99
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0
R 14	SR	24.22	17.94	22.44	20.49	5.83	25.03	17.94	**R 28**	SR	27.53	16.72	23.7	19.8	1.53	-5.34	16.72
	MS	0	0	0	0	0	0	0		MS	0	0	0	0	0	0	0

Note: MS – missing signals; SR – signal-to-noise ratio; R – respondents.

Source: Developed by the authors.

A positive SR indicates that the signal strength is greater than the noise. This means that the GSR data reflect meaningful physiological responses with minimal interference. A signal with an SR of +20 dB means that the signal is 100 times stronger than the noise, making it highly interpretable for emotional analysis. A negative SR indicates that the noise level exceeds the signal strength. In this case, the recorded data are overwhelmed by background activity or measurement artefacts, making it difficult to interpret physiological responses accurately. A signal with an SR of -10 dB means that the noise is 10 times stronger than the signal is, making it difficult to identify emotional arousal. Missing signals are negligible, confirming reliable data collection across all stimuli. This dataset is valuable for assessing the emotional effectiveness of each logo and identifying opportunities for improvement.

GSR peaks indicate moments of heightened arousal, reflecting the level of attention and emotional engagement elicited by specific stimuli. In the context of logo perception, a greater number of peaks typically demonstrates increased responsiveness, suggesting that the design elements of the logo have successfully captured attention or evoked an emotional reaction. Conversely, the absence or low frequency of peaks may indicate a lack of impact or engagement, suggesting that the logo's design elements fail to resonate strongly with the audience.

3.4. Affective detection

AFFDEX (affective detection) is a facial expression analysis technology designed to detect and analyse emotional responses in real time. Using computer vision and machine learning algorithms, AFFDEX identifies subtle changes in facial muscle movements and maps them to specific emotional states, such as joy, anger, sadness, surprise, contempt, disgust, and fear. The system relies on video input from a webcam or camera to capture facial expressions, which are analysed frame-by-frame to measure the intensity, frequency, and duration of emotions.

AFFDEX operates on the basis of the facial action coding system (FACS), a psychological framework that links facial muscle activity, known as action units (AUs), to emotional expressions. Each detected emotion is assigned a confidence score, indicating the likelihood that the observed expression corresponds to that emotion. This makes AFFDEX a powerful tool for understanding emotional engagement with various stimuli, such as advertisements, product designs, digital interfaces, or educational content. In iMotions, AFFDEX data are synchronized with GSR, creating a multimodal framework for studying emotional and cognitive states. This synchronization allows researchers to explore how facial expressions correlate with physiological and behavioral data, providing a comprehensive understanding of participant reactions.

4. Results

The paired t test results in Table 3 demonstrate differences in respondents' perceptions of general appearance and form across the logos. For Stimulus 1, a statistically significant difference ($t=-2.260$, $p=0.0321$) indicates that respondents perceive form-related elements, such as shape and lines, as more impactful or better aligned with their expectations than the overall aesthetic or design integration of the logo. In contrast, for Stimuli 2 and 3, the p values

(p=0.4756 and p=0.3438, respectively) suggest no significant differences between these two aspects, implying that general appearance and form are similarly perceived for these logos.

Table 3. Paired t test

Stimuli	t	Ha: mean(diff)!= 0 Pr(|T| > |t|)
1	-2.2601	0.0321
2	0.7238	0.4756
3	-0.9637	0.3438

Source: Developed by the authors.

The respondents' perceptions regarding the general appearance and form of the university logos are summarized in Table 4.

Table 4. Chi-square results for universities: form and general appearance

Stimuli	Form, line, color	Teoretical character	Experemental output		
			chi2	Prob	Character
1	organic shape	soft, cooperative, compliant	14.0848	0.119	soft
2	rectangle	sturdy, grounded, stable	8.6540	0.194	grounded
3	ellipse	calm, supportive, overshadowed	29.9327	0.000	calm, supportive, overshadowed

Source: Developed by the authors.

The chi-square statistic for Stimulus 1 is 14.0848, with a p value of 0.119, indicating no statistical significance but revealing a clear trend where respondents frequently aassociated the stimulus with “Soft”, suggesting perceptions of approachability and harmony. Stimulus 2 demonstrates the strongest alignment with corporate traits among the analysed universities. Stimulus 3 has a chi-square statistic of 29.9327 with a p value of 0.000, indicating a statistically significant result; however, the responses do not reflect a clear or dominant association with a single characteristic. This suggests that while the design elements of the stimulus evoke certain impressions, they lack the clarity or focus needed to establish a strong and consistent identity. Such ambiguity could limit the effectiveness of the logo in fostering trust and reliability, key traits for attracting investments and partnerships in the global educational landscape.

Figure 1 illustrates respondents' perceptions of the line characteristics of logos. For Stimulus 1, the majority of respondents (over 50%) associated the logo with “Benevolent” and minimal associations with other traits such as “Protective" and “Sympathetic”. This finding indicates that the line characteristics of Stimuli 1 evoke perceptions of kindness and inclusivity. For Stimulus 2, the predominant association is also with “Benevolent”. “Inclusive” and “sympathetic” are less frequently associated, suggesting that while the logo still conveys benevolence, it does so with less strength than Stimuli 1 does. For Stimulus 3, the associations are more evenly distributed across “Other”, “Protective”, and “Authoritarian”, with no dominant characteristic emerging. This suggests ambiguity in respondents' perceptions of the line characteristics for this logo, which lacks a clear consensus or strongly defined trait.

Compared with global corporate stimuli, none of the university stimuli fully align with the horizontal linear effects and structured forms associated with trust, stability, and professionalism. Stimulus 1, with its organic shape and curved lines, lacks the angularity and horizontal elements typical of corporate stimuli, limiting perceptions of stability and reliability. Stimulus 2 partially aligns with corporate stimuli due to its rectangular form but is weakened by the presence of curved lines that reduce perceptions of strength. Stimulus 3's elliptical shape and vertical orientation diverge from the horizontal linear effects commonly associated with trust and stability.

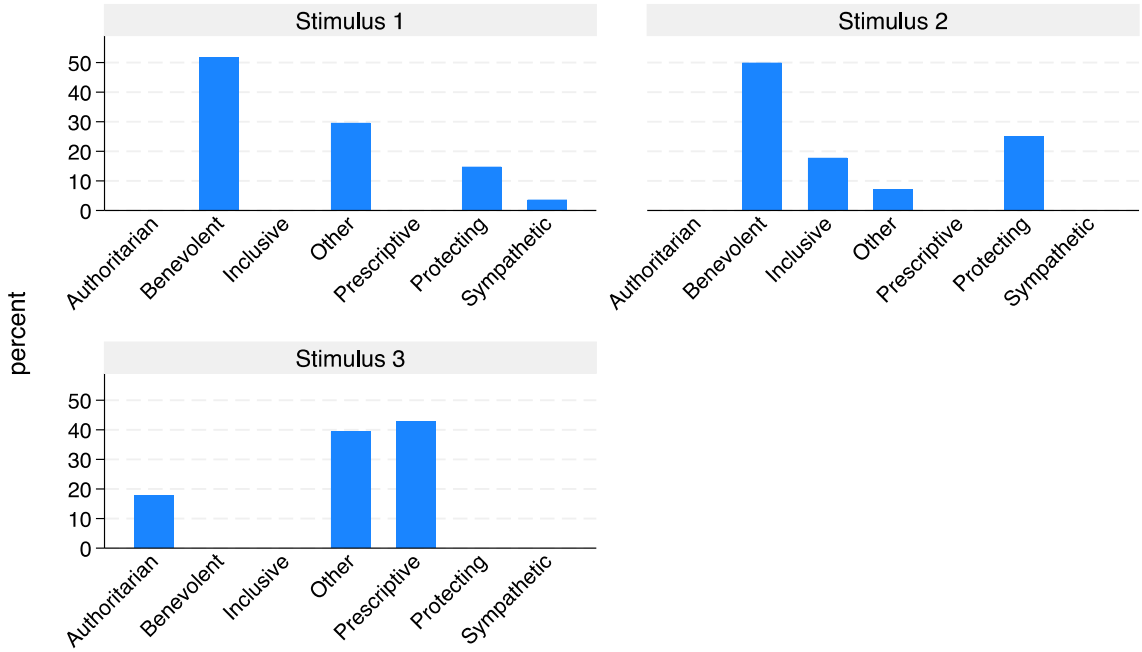

Figure 1. Respondents' perceptions of the line characteristics of university logos
Source: Developed by the authors.

The paired t test results in Table 5 highlight differences in respondents' perceptions of general appearance and form across companies' logos. Stimulus 4 demonstrates a statistically significant difference (t = −2.7514, p = 0.0105), suggesting that respondents perceive form-related elements (e.g., shape and lines) as more impactful or better aligned with expectations than general aesthetic or design integration does. Similarly, Stimuli 5 and 6 reveal highly significant differences (t = −13.9525, p = 0.0000; t = −6.5306, p = 0.0000, respectively), indicating a stronger preference or impact of form elements over general appearance. In contrast, for Stimulus 7, the p value (p = 0.4341) suggests no significant difference, implying that general appearance and form are similarly perceived.

Table 5. Paired t test

Stimuli	t	Ha: mean(diff)!= 0 Pr(|T| > |t|)
4	-2.7514	0.0105
5	-13.9525	0.0000
6	-6.5306	0.0000
7	0.7940	0.4341

Source: Developed by the authors.

Table 6 shows the respondents' perceptions regarding the general appearance and form of the companies' logos via chi-square analysis.

Table 6. Chi-square results for universities: form and general appearance

Stimuli	Form, line, color	Teoretical character	Experemental output		
			chi2	Prob	Character
4	organic shape	soft, cooperative, compliant	9.8000	0.133	compliant
5	rectangle	sturdy, grounded, stable	4.8711	0.560	stable
6	square	prescriptive, prestigious, authoritarian	11.1566	0.265	prescriptive
7	organic shape	soft, cooperative, compliant	8.6025	0.197	soft

Source: Developed by the authors.

Stimulus 4's chi-square value of 9.8000 (p = 0.133) suggests no statistical significance; however, it indicates that respondents predominantly associated the logo with the characteristic "Compliant," setting it apart from other traits. Similarly, Stimulus 5 (chi2 = 4.8711, p = 0.560) reflects that respondents identified "stable" as the primary characteristic, whereas Stimulus 6 (chi2 = 11.1566, p = 0.265) shows "prescriptive" as the most highlighted trait, despite a lack of statistical significance in both cases. For Stimulus 7, the chi-square statistic of 8.6025 (p = 0.197) demonstrates no statistical significance, but the trend suggests a predominant association with the characteristic "Soft."

Figure 2 illustrates respondents' perceptions of the line characteristics of companies' logos.

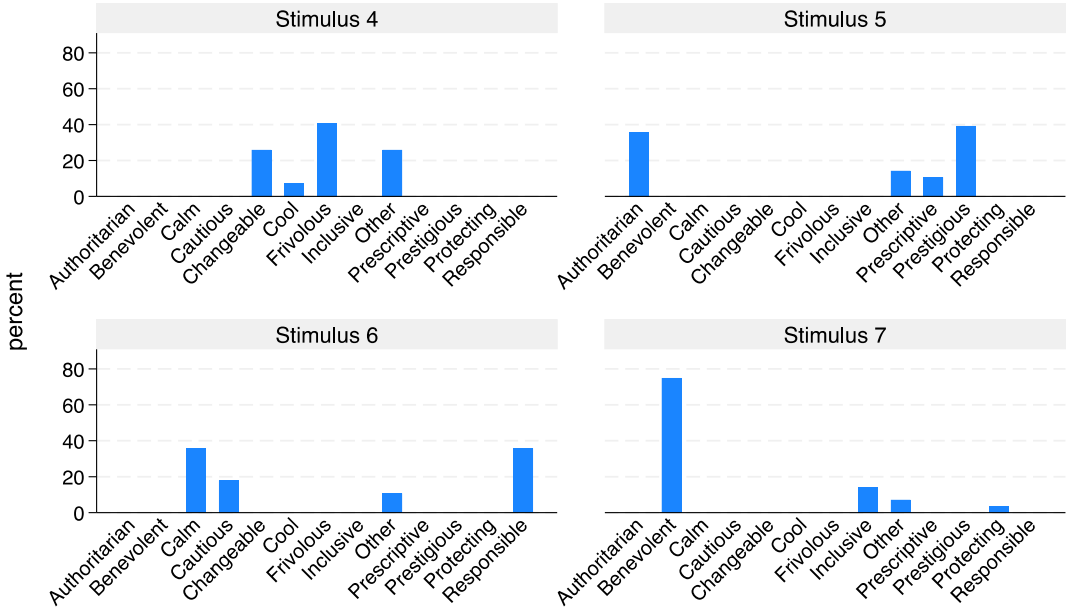

Figure 2. Respondents' perceptions of the line characteristics of companies' logos
Source: Developed by the authors.

For Stimulus 4, the dominant characteristic identified by respondents is "Frivolous", with more than 40% of the responses highlighting it as a defining trait, whereas other characteristics, such

as “Changeable” and “Cool,” are less prominent. Stimulus 5 has a strong association with “Prestigious”, which is the primary trait identified by nearly 40% of the respondents, while other characteristics are minimally selected. Stimulus 6 shows a more even distribution of perceptions, with “Calm” and “Responsible” emerging as the most recognized traits, although no single characteristic strongly dominates. For Stimulus 7, the characteristic “Benevolent” is highlighted by respondents, accounting for the majority of responses, whereas other traits are less frequently associated.

Compared with global corporate stimuli, Stimuli 4, 5, 6, and 7 reveal distinct alignments with the design characteristics associated with top corporate logos. Stimulus 4 is associated primarily with "Compliant," and Stimulus 7 is associated with "Soft," both reflecting traits of inclusivity and harmony. However, their lack of structured linear effects, such as horizontal alignments or angular shapes (e.g., rectangles or pentagons), limits their ability to convey strength and reliability—key characteristics identified in top corporate logos. Stimulus 5 aligns with "Stable," suggesting a degree of groundedness and reliability. However, it lacks the angular and horizontal linear effects that are prominent in top corporate designs, reducing its perceived structural clarity and impact. Similarly, Stimulus 6 is associated with "prescriptive," reflecting a sense of authority, but its lines and form do not strongly align with the traits of strength and stability typically conveyed by the geometric and structured designs seen in successful global logos. The absence of clear structural elements, such as horizontal lines and closed, solid shapes, in all stimuli underscores a design gap compared with the top corporate logos. These elements are critical in enhancing perceptions of professionalism, trust, and reliability.

Table 7 presents the results of the galvanic skin response peak detection for each stimulus, focusing on two parameters: “Has Peaks” and “Peak Count”. “Has Peaks” is a binary indicator indicating whether a respondent exhibited any physiological response peaks during the interval, with “1” indicating the presence of peaks and “0” indicating their absence. “Peak Count” measures the total number of GSR peaks detected during the interval.

Table 7. GSR peak detection

Stimuli	Has Peaks		Peak Count
	0	1	
1	17	9	9
2	18	12	14
3	17	11	11
4	16	12	12
5	21	7	8
6	21	7	7
7	22	6	6

Source: developed by the authors.

For Stimulus 1, 17 respondents presented no peaks, and 9 presented peaks, with a total peak count of 9. Stimulus 2 showed greater engagement, with 18 respondents showing no peaks, 12 exhibiting peaks, and a total peak count of 14, indicating stronger engagement than Stimulus 1 did. Stimulus 3 included 17 respondents with no peaks and 11 with peaks, with a total peak count of 11. For Stimulus 4, 16 respondents presented no peaks, 12 presented peaks, and the peak count was 12, similar to Stimulus 3. Stimulus 5 showed the least engagement, with 21 respondents showing no peaks, 7 exhibiting peaks, and a total peak count of 8. Stimulus 6

mirrored Stimulus 5, with 21 respondents showing no peaks, 7 exhibiting peaks, and a total peak count of 7. Stimulus 7 had the highest percentage of respondents with no peaks (22), with only 6 exhibiting peaks and a total peak count of 6. The majority of respondents did not exhibit peaks, indicating a low level of emotional or cognitive engagement with the logos. This suggests that the designs lack elements that effectively capture attention or evoke a physiological response.

The analysis of the AFFDX results for company logos (Table 8) highlights their potential to influence investment decisions by evoking specific emotional and cognitive responses. Using Damasio Somatic Marker Theory [117], this analysis underscores the critical role of emotions in decision-making and identifies which logos are most likely to trigger favourable investment decisions.

Table 8. Frequencies of emotions

Emotions			Stimuli						
			1	**2**	**3**	**4**	**5**	**6**	**7**
Positive	Joy	Exictence							
		Frequencies	15	15	7	3	3	4	4
	Engagement	Exictence							
		Frequencies	22	18	13	10	7	11	10
	Positive Valence	Exictence							
		Frequencies	17	14	7	4	3	4	4
	Sentimentality	Exictence							
		Frequencies	3	1	1	0	0	1	0
Negative	Anger	Exictence							
		Frequencies	–	–	–	–	–	–	–
	Contempt	Exictence							
		Frequencies	–	–	–	2	–	1	3
	Disgust	Exictence							
		Frequencies	–	–	–	–	–	–	1
	Fear	Exictence							
		Frequencies	–	–	1	–	–	–	–
	Sadness	Exictence							
		Frequencies	–	1	–	–	–	–	1
	Negative Valence	Exictence							
		Frequencies	–	–	–	1	0	0	1
	Confusion	Exictence							
		Frequencies	1	2	0	0	0	0	2
Neutral	Neutral Valence	Exictence							
		Frequencies	27	22	28	27	27	27	28
	Neutral	Exictence							
		Frequencies	27	22	27	27	27	27	28
Triggers	Surprise	Exictence							
		Frequencies	–	–	1	–	–	–	–
	Attention	Exictence							
		Frequencies	28	27	28	28	28	28	27

Note: Red indicates that the emotion is not fixed; green indicates that the emotion is fixed.
Source: Developed by the authors.

The results revealed that Stimulus 1 emerged as the most influential stimulus, with the highest level of engagement (22 occurrences) and strong frequencies of joy (15) and positive valence (17). These emotional triggers create positive somatic markers, subconsciously guiding investors toward favourable decisions by fostering associations with trust and success. Stimulus 2 also demonstrated a significant impact, with high levels of engagement (18), joy (15), and positive valence (14), making it a strong competitor. Both stimuli minimized negative emotions, avoiding adverse somatic markers that could discourage investment. In contrast, Stimuli 3–7 showed weaker emotional resonance, dominated by a neutral valence (27–28 occurrences) and occasional negative emotions, limiting their effectiveness in shaping investor perceptions. To maximize investment attractiveness, Stimulus 1 should be prioritized for investor communications because of its ability to generate strong emotional and cognitive connections. Stimulus 2 also remains a valuable tool, whereas Stimuli 3–7 would benefit from redesigns to evoke stronger positive emotions and reduce neutrality.

5. Conclusions

This study examined the role of visual branding in driving investment attractiveness, focusing on the logos of universities and companies located in Sumy, Ukraine, during the digitalisation era. The findings highlight significant differences between the visual branding strategies of these local organizations and the established practices observed in globally successful corporate logos. Specifically, while some logos convey traits such as inclusivity, compliance, and stability, they lack geometric precision, structured linear effects, and visual impact, which are typically associated with global branding success. This aligns with prior research emphasizing that strong geometric forms, horizontal alignments, and balanced compositions are critical for projecting trust, reliability, and professionalism in visual branding [118,119].

Previous studies [118,120] have demonstrated that top global brands effectively leverage specific design elements to evoke positive associations such as trust, stability, and professionalism. For example, square, rectangular, and pentagram-shaped logos with horizontal lines are strongly associated with these traits. However, the logos analysed in this study did not fully incorporate these elements, resulting in limited alignment with global standards. Stimulus 1, representing a university logo with an organic shape, successfully conveyed traits of softness and inclusivity, resonating with perceptions of approachability and harmony. However, it lacked the geometric precision and structured linear effects typically associated with trust and professionalism, which are key attributes for attracting investment. Similarly, Stimuli 2 and 3, while partially aligned with traits of groundedness and calmness, respectively, did not exhibit the clarity or visual impact needed to create a strong institutional identity. For company logos, Stimuli 4 through 7 demonstrated varying levels of alignment with desirable branding traits. Stimulus 4 suggested compliance, Stimulus 5 reflected stability, and Stimulus 6 displayed authority. However, none of these logos incorporated the horizontal alignments, angular shapes, or geometric precision crucial for projecting strength and reliability—qualities that are foundational in global corporate branding. Stimulus 7, which emphasized inclusivity, also lacked the necessary design elements to strongly convey professionalism and trustworthiness. These findings contextualize the role of visual branding within the broader theoretical framework of corporate identity and its impact on stakeholder perceptions [121].

These findings emphasize the need for local organizations to enhance their visual branding strategies to align with global standards. Strong geometric forms, balanced compositions, and clear linear elements are essential for building a professional and credible image, particularly in the context of digital communication where visual impressions dominate initial interactions. Aligning the visual branding of Sumy's universities and companies with these global principles can significantly increase their investment appeal, fostering trust and engagement among stakeholders.

The study's limitations include the influence of ongoing conflict in Ukraine, which affects respondents' emotional and cognitive responses to visual branding elements, skewing the results. The ongoing war and its economic consequences influence the context in which the study was conducted, limiting the relevance of these findings to conditions in a stable, postconflict environment. Future research could expand the geographical scope to encompass a wider range of logos from various industries and regions, facilitating an in-depth exploration of the cultural and economic factors influencing branding perceptions. Additionally, future studies should investigate psychological and sociological dimensions, including the effects of stress levels and cultural identity shaped by conflict, to provide a comprehensive understanding of branding perceptions in such contexts.

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