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RESEARCH ARTICLE

Visual Attention Software: A Novel Instrument for Analyzing Iconic Buildings

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ABSTRACT

Visual Attention Software (3M-VAS) is an artificially intelligent application created with eye-tracking data sets. It can generate fixated point probability maps and fixation point sequencing projections to assess audience responses to visuals in their surrounding environment. The primary objective of this study was to apply this neuroscience-based software to analyze people's visual behavior toward iconic buildings. This study attempted to discover an adequate response to the following questions: Which types of iconic buildings attract the most attention, and why? A case study experiment was conducted to evaluate 3M-VAS's effectiveness for analyzing the visual perception of architectural facades. The selected cases include both historic and contemporary iconic buildings. This work investigates the practicability of employing a single computational method to investigate potential visual stimulus-sensation correlations in facade design. The method explains how to effectively use VAS in architecture by identifying the most focusable variables. The findings revealed that contemporary tall buildings in Erbil city are more visually attentional than historic buildings due to their visual features and proportional articulation, such as significant height.

Keywords: Eye-tracking, façade, neuroscience, iconic buildings, visual attention

INTRODUCTION

In recent years, the use of artificial intelligence has increased in many aspects of life, which contains a variety of applications. However, when compared to a large amount of software, only a few software are utilized in architectural research. The primary goal of all programs is to provide results in a more sophisticated and time-consuming manner.[1,2,19]

Previous research indicates that 3M Visual Attention Software (3M-VAS) is one of the software programs that characterize artificial intelligence. It was designed to utilize a massive amount of experimental eye-tracking data, and it can predict early human responses to visuals.[3] It works for forecasting early user responses to visuals,[4] and the ability of software to predict human behavior that becomes increasingly crucial to the architecture and design sectors.[5] Furthermore, previous studies express the role of facade design, which is an essential aspect of the building, not only for esthetic reasons, but because the facade is essential to the interaction between visual identity and human reaction. It is considered the initial physical contact that most people see as they approach a building, providing key visual cues regarding its characteristics. The design of a facade significantly influences the physiological and behavioral responses of individuals.[6] The application of analytical tools to predict the visual outcome of a facade has not been formally investigated, revealing a significant knowledge gap in the field. Consequently, the primary objective of this study is to establish a method for measuring the visual attention of building facades. The study chooses Erbil as a case study location because of the city's extensive history and modern architecture; for a more thorough investigation, it has chosen an iconic building that is regarded as a defining feature of the city.

This article seeks answers to the questions, "which façade type of iconic architecture is more visually appealing? What factors are causing the greater visibility of building facades?" it is also an attempt to bridge the gap between human behavioral science and the architectural field, by utilizing neuroscience-based software, such as (3M-VAS). This research analyzes

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the software's utility for architecture and encourages its widespread use as a practical tool to promote human-centered design. Erbil, Iraq, was selected as the research location after the selection of eight iconic buildings (from historic and contemporary cases). The results of the simulation are presented, together with an explanation of their applicability and limitations.

LITERATURE REVIEW

Neuroarchitecture, Neuroscience, Eye Tackling, and 3M-VAS

Neuroscience, the field of neuroscience had a significant impact on the evolution of artificial intelligence; it has inspired the creation of human-like artificial intelligence.[7] Neuroscience influences the development of AI systems in two ways. The first objective is to create neural networks that mimic brain structure, while the second is to simulate human intelligence.[8] While Neuroarchitecture is a developing field that analyses medical data to discover what people find most alluring in their surroundings and patterns, Neuroarchitecture seeks to predict human responses to patterns and forms by utilizing existing neural activity.[8,9]

Eye tracking as a research instrument is more accessible than ever before, and it is gaining popularity among academics in a variety of subjects. Multiple disciplines are interested in eye tracking, including usability analysts, sports scientists, cognitive psychologists, neurophysiologists, and engineers. Eye tracking promotes the study and contributes to technical improvements.[11,18] This potent technology can identify a person's presence and track their gaze in real-time. The pupil position, gaze vector for each eye, and gaze point information are translated from ocular movements to a data stream. The technology decodes and translates visual cues into data for use in a range of applications or as an additional input modality.[12]

Based on a computer model of visual attention, 3M VAS predicts where the initial fixations will occur in a picture. Validation studies are performed on the same set of images, with eye-tracking findings compared to those predicted by 3M VAS. The model performs at roughly 90% of the theoretical maximum when using signal detection response-operator-characteristics (ROC),[13] Both advances in Behavioral Vision Science and Computational Vision, serve as the foundation for computational models of human visual attention that take an image as input and determine wherever individuals will concentrate within the first 3–5 s of watching. It is important to note that VAS does not address sentiments. However, it is important to know that it is just for indicating and assessing visual attention, which directly affects building familiarity. In addition, further analysis between the architectural field and human behavioral science is still required. Electroencephalography (EEG), galvanic skin reaction, heart rate, or a combination of these to express the emotional experience correctly, because humans are emotionally based creatures.[14]

Building Familiarity and Visual Attention in the Built Environment

Familiarity with a building is regarded as a key element in the creation of an iconic structure, and visual attention is the primary element that contributes to familiarity Ref. According to Bonenberg and Ujang, familiarity is essential for the social acceptability of architecture because it evokes residents' strong ties to their homes, streets, neighborhoods, and cities. Moreover, the facade of the building is regarded as the visual focal point.[15,16] The building's front is essential in determining the structure's image. It is considered the most important element receiving visual attention. Therefore, it is necessary to investigate how facade images of a building are generated to comprehend how building images are generated.[6] While visual attention refers to cognitive processes that enable people to process large amounts of information, auditory attention refers to the perception of sounds. Due to the limited capabilities of the perceptual system, focusing on a particular component of the visual field enables us to prioritize useful information and ignore irrelevant information.[17]

METHODOLOGY

- The 3M-VAS program chooses as a research tool for this investigation. An expert interview is undertaken for case study selections. The eight photographs of Erbil's most significant iconic buildings have been selected for analysis. Due to the background situation of the case location (Erbil city), the case studies are classified into two categories: (Historic and Contemporary cases).
- Here the usage of 3M-VAS is expressed. generally, the program produces five distinct representations of each image,[13] as seen in Figure 1.[18]

Case Selection and Research Design

To investigate visual attention patterns in architectural façades, this study uses a comparative analytical technique. A methodical comparison of various architectural styles and eras is made possible by the chosen cases, which feature both ancient and modern buildings in Erbil city.

To guarantee that the selected buildings reflect important architectural, cultural, and visual features, case selection was carried out based on expert review. Eight case studies in all were chosen and divided into two groups: (Historical structures, and Modern structures).

This categorization offers an organized framework for examining differences in visual attention among various design strategies.

Image Acquisition Protocol and Dataset

Eight façade photos, each of which represents a single case study, make up the dataset. Every image was prepared in accordance with a defined procedure to guarantee consistency and dependability:

Pictures were taken at the level of the human eye, the framing and viewing angle were kept constant.

In every instance, comparable lighting and image quality were guaranteed.

Maintaining contextual features improves the accuracy and realism of visual attention prediction, according to preliminary tests.

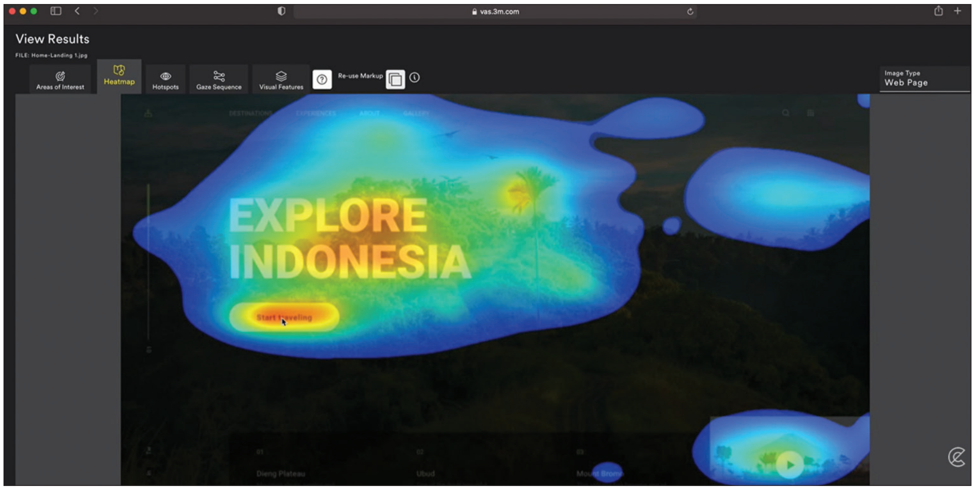

Figure 1: Main window 3M-VAS software analysis

3M VAS is an Analytical Tool

The 3M Company's 3M VAS was used for the analysis. This device is a predictive eye-tracking system that uses computer models from visual cognition and neuroscience to mimic human visual attention. During the pre-attentive stage of visual exposure, which is about the first 3–5 s, 3M VAS predicts which portions of an image are most likely to draw attention. Without the need of actual eye-tracking equipment, the program makes it possible to assess visual attentiveness.

The "outdoor (macro)" mode was chosen for this study because it is most suited for examining large-scale visual compositions and building façades.

Analytical Parameters and Output Metrics

This research software has nine components for analyzing images, but (outdoor macro) is more applicable to the study's objectives. The others are useful for graphic designers. And the following terms are related to an image analyzing icons:

1. Area of interest: These can be specified by the user, and each of them has a numeric score, which is the probability that a person will look somewhere within that area.
2. A heatmap: This is a color-coded probability map indicating which parts of the picture will catch the viewer's attention during the pre-attentive stage. This feature was employed in all of the scans since it was the most straightforward and effective diagnostic tool for our study.
3. hotspots: A quick summary of the heatmap findings display just the places most likely to be viewed during the pre-attentive scan, with a numeric value reflecting the likelihood that a person would gaze anywhere within that region during the pre-attentive phase.
4. Sequence of Gazes: This illustrates the four greatest likely gaze places arranged in the most likely viewing order.
5. Visual elements: This graphic demonstrates how the algorithm works by identifying the features that drive pre-attentive processing in our visual systems, specifically edges, intensity, red/green color contrast, blue/yellow color contrast, faces, and contrast.
6. This study examines both types of architecture (historical buildings and modern buildings) to determine the level of visual attention and the reasoning behind it. Importantly, when implementing this tool, we conducted a variety of scanning tests to acquire a thorough understanding of visual contact and to identify how it changes under different conditions. Through a series of test photographs, it was found that surrounding features, such as vehicles, people, etc., must be represented to accurately depict the position of a building. These tests demonstrated how to realistically and technically optimize the analytic parameters to boost the realism of the approach and the results.

Analysis Procedure

The following procedures were used to carry out the analysis:

A. Standardization and preparation of façade photos
B. Using the outside (macro) option to upload pictures into 3M-VAS
C. Using architectural features (such as windows, doors, and façade details) to define Areas of Interest (AOIs)
D. Producing analytical results (visual element maps, heatmaps, hotspots, and gaze sequences)
E. Quantitative data extraction, such as focus hierarchy and attention probabilities
F. Comparing situations from the past and present
G. To ensure neutrality and clarity, the results are presented through organized comparisons.

Validity and Limitations

The results of the exploratory investigation are believed to be typical of patterns of visual attention in general. While 3M VAS provides strong predictive analysis, its proprietary computational model may not precisely replicate genuine human eye-tracking behavior.

The limited quantity of case studies and the potential influence of environmental elements, such as illumination and adjacent objects are further disadvantages. It is advised that empirical eye-tracking experiments be included in future studies for validation.

RESULTS

Figure 2 depicts the whole analytic output of the 3M-VAS method using an image captured in the historic zone of Erbil city. Here is a photograph of the Grand Bazaar building Façade in Erbil, Iraq, which has been known as a local historical landmark. Built-in the early 13th century AD. The analysis of the photographic image indicates that the structure has an overall visual attention value of %, 74 as depicted in the image (a). This investigation was undertaken by an area of interested

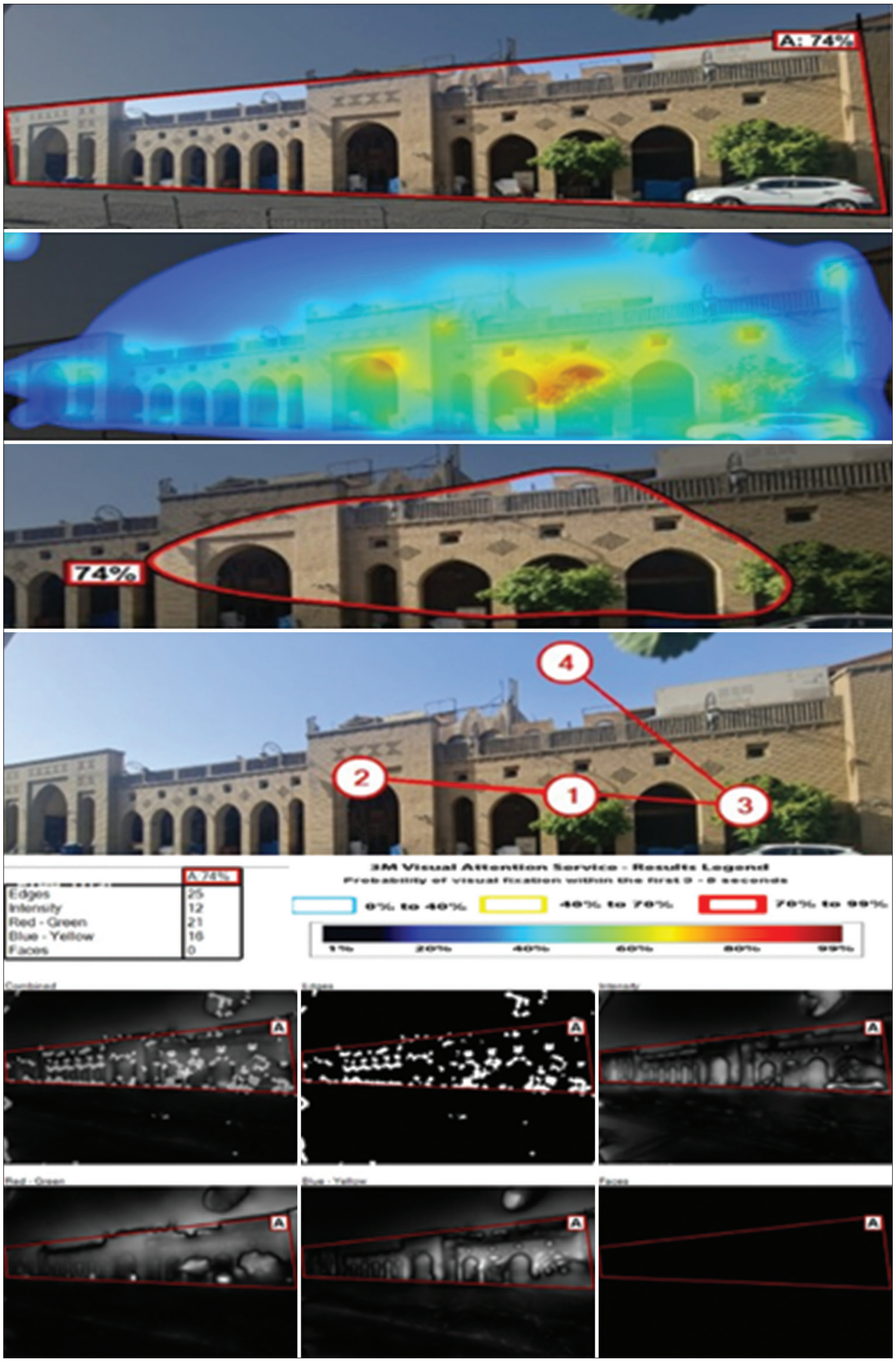

Figure 2: The visual attraction analysis of the Erbil Grand Bazaar as shown in Image (a). Image (b) shows the most notable features in this image that are related to arcade uses, image (c) shows the hotspot analysis to show the percentage of attention by features, and image (d) shows the expressed gaze sequences, where the first gaze is related to repeated arches and the second gaze is related to them. Ultimately, picture (e), Explained the importance of each element in achieving (74%) visual attention[14]

command (each area has a numerical score that represents the probability that a person would search somewhere within the area). The two command heat maps and hot spot (focuses on the arching use in the building's facade and expresses only the content most likely to be observed in this image) reveal that the most visible element in these images is the use of arcades that enhance the visual quality of the façade, as depicted in image (a-c). However, according to the gaze sequences command (which displays the sequence of most attractive areas), in this situation, the first gaze, which focuses on a group of arcades, and the second gaze, which focuses on huge arches, are required for visibility. It focused on the fact that repetition of elements and emphasis on size attract people's visual attention. In addition, the examination of visual elements (image e) reveals the fraction of qualities that generate curiosity. In this example, the edge of the building got the maximum value, which increased the percentage of attention.

In Figure 3, we used a snapshot of the Erbil Citadel, which is one of Erbil City's most iconic landmarks and is perched on a 98-foot-tall archeological mound in the center of Erbil City, Iraq. Approximately 6000 years old. In image (a), the software indicates that 93% of buildings attract people's attention, yet image (e) illustrates the most significant building trait. In this instance, the edge parameter. While (hot spot, heatmap, and gaze sequence) analysis indicates that entrances to balconies and windows are the most attractive features, as shown in Figure 3b-d.

Figure 4 illustrates the Khanzada castle, one of the most historically significant buildings in Erbil, Iraq, which is situated on a hilltop in the city's northern region. It was constructed in the sixteenth century A.D. The building scored 88% for its visual impact, suggesting a high level of esthetic appeal. The heat map and hotspot identified the entire structure as the hill's focal point. In addition, the gaze sequence described the intricacies of the roof's first attraction value, as seen in image (b-d). Image (d) highlighted the building's edges, which have the greatest weight in the overall appeal.

Figure 5 is a photograph of the Muthafarya minaret, one of Erbil, Iraq's most recognizable historic buildings. Icons. It was constructed between 1190 and 1230 A.D. As demonstrated, 70% of people's visual attention was attracted by the minaret (a and d), and 30% of this percentage can be attributed to the minaret's edge characteristics. While the heatmap and spot analysis focus on the minaret's primary texture and its offset base, respectively. As seen in images (b and c). It is essential to note, however, that the building's gaze sequence findings show that the surrounding environment distracts people from the minaret owing to color contrast, as demonstrated in (Image (d)]), for iconic buildings to be more visually appealing, the surrounding environment must be in harmony with the building itself.

Based on the examples provided above, the spectator is drawn to a high level of structural complexity afforded by layered symmetries, which is one of the most noteworthy

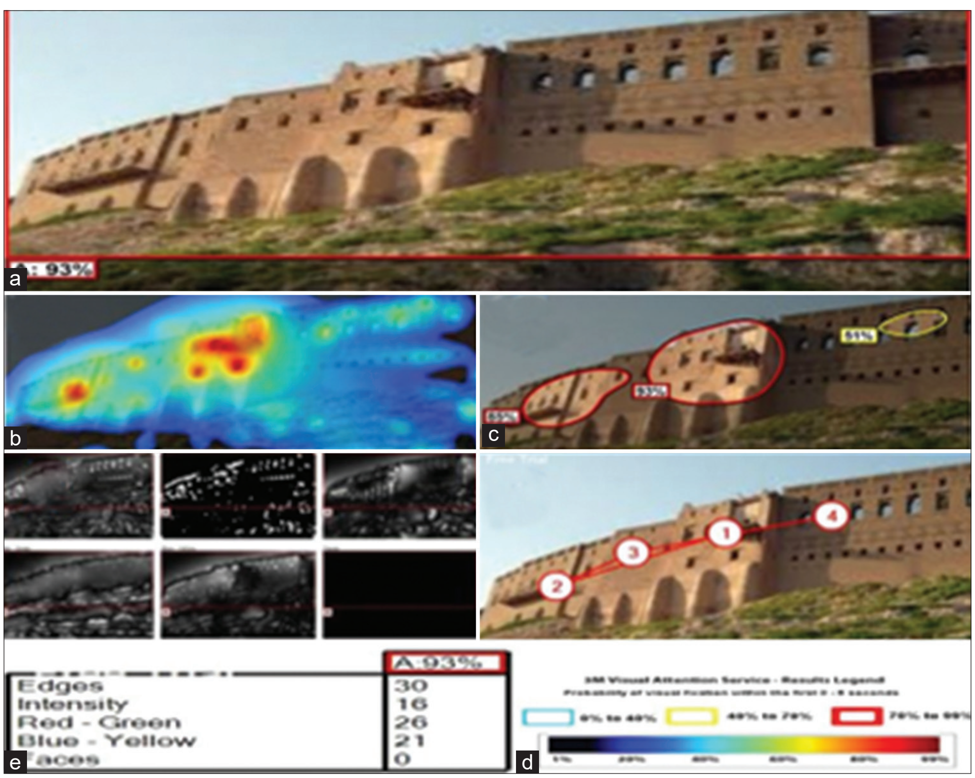

Figure 3: Depicts a visual appeal examination of the Erbil citadel. Image (a) shows the overall visual interesting percentage of 93, which is considered a highly visually appealing structure, image (b) shows the arcades that are used as façade details to attract people's attention, and image (c) shows the hotspot analysis to show the percentage of each visual attractive feature, and image (d) shows the expressed gaze sequences, where the first gaze is focused on the balcony, the second, third, and fourth gazes are focused on the windows. Finally, Figure (e) expresses the components of visual attention and their importance

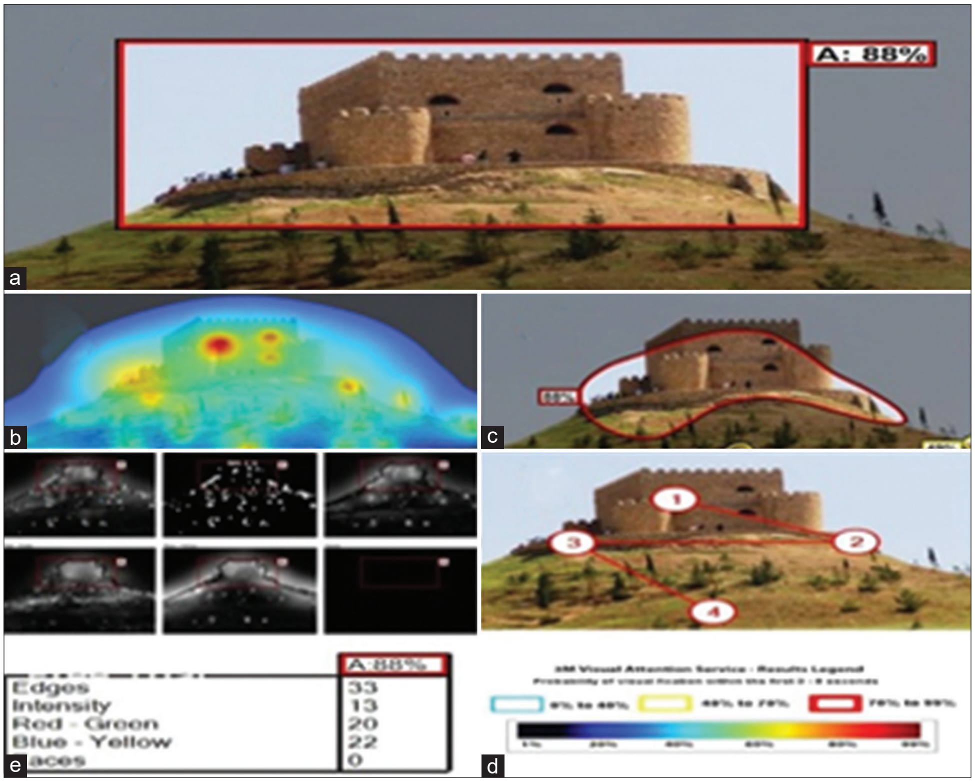

Figure 4: Depicts a visual appeal examination of the Khanzad. Image (a) shows the overall visual interesting percentage of 88, which is considered a highly visually appealing structure, image (b) shows the usage of detail on the face has visual attention significance with red color. Image (c) shows the hotspot analysis; in this case, the whole focus is on the main building, and image (d) shows the expressed gaze sequences, where only the first gaze is focused on the building. Finally, Figure (e) expresses the components of visual attention and their value.

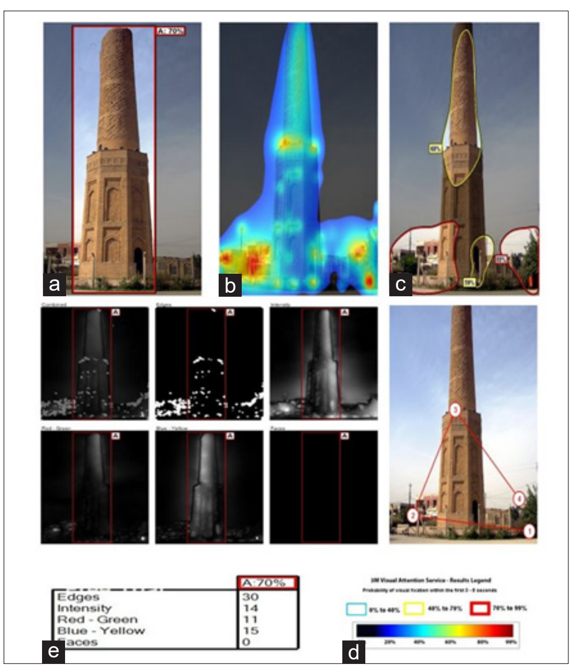

Figure 5: Depicts a visual appeal examination of the Erbil minaret. Image (a) shows the overall visual interesting percentage of 70, and the over images related to analyzing the image (b-d) and the visual features image (e), shows the detailed feature value that affects the overall visual attention value

findings of these scanning investigations. Unconscious audience attention is lost when a logical requirement is violated by a lack of order, complexity, or both, according to a subsequent study. Moreover, based on these findings, [Figures 2 and 3] illustrate that a building's visual appeal increases with its site height.

Figure 6 is a photograph of the Erbil divan hotel (a-e), which was constructed in 2009 and is regarded as a prominent, modern building. The uniform height articulation of the divan's modernist construction is appealing. The principal squire in the center of the facade is quite attractive. The building's front windows draw a large amount of pre-attentive gaze probability because of their regular spacing. With an aggregate score of 87%, the structure had a high degree of esthetic value. Moreover, the majority of this is related to the building's color contrast, then, the massive structure, and the complexity and symmetry of the building.

Figure 7 illustrates a view of the Empire Towers in Erbil, Iraq. This combination of towers on the project site comprises a towering modernist-style office structure with a glass facade and extremely minor elements that are visible from across the street behind it. Images A and B, expressing (87 %) visual attraction value, due to the edge value, which positively about the building's height. According to the heat map and hot spot analysis (images c and d), the tested area receives no visual attention. The entire focal point pertains

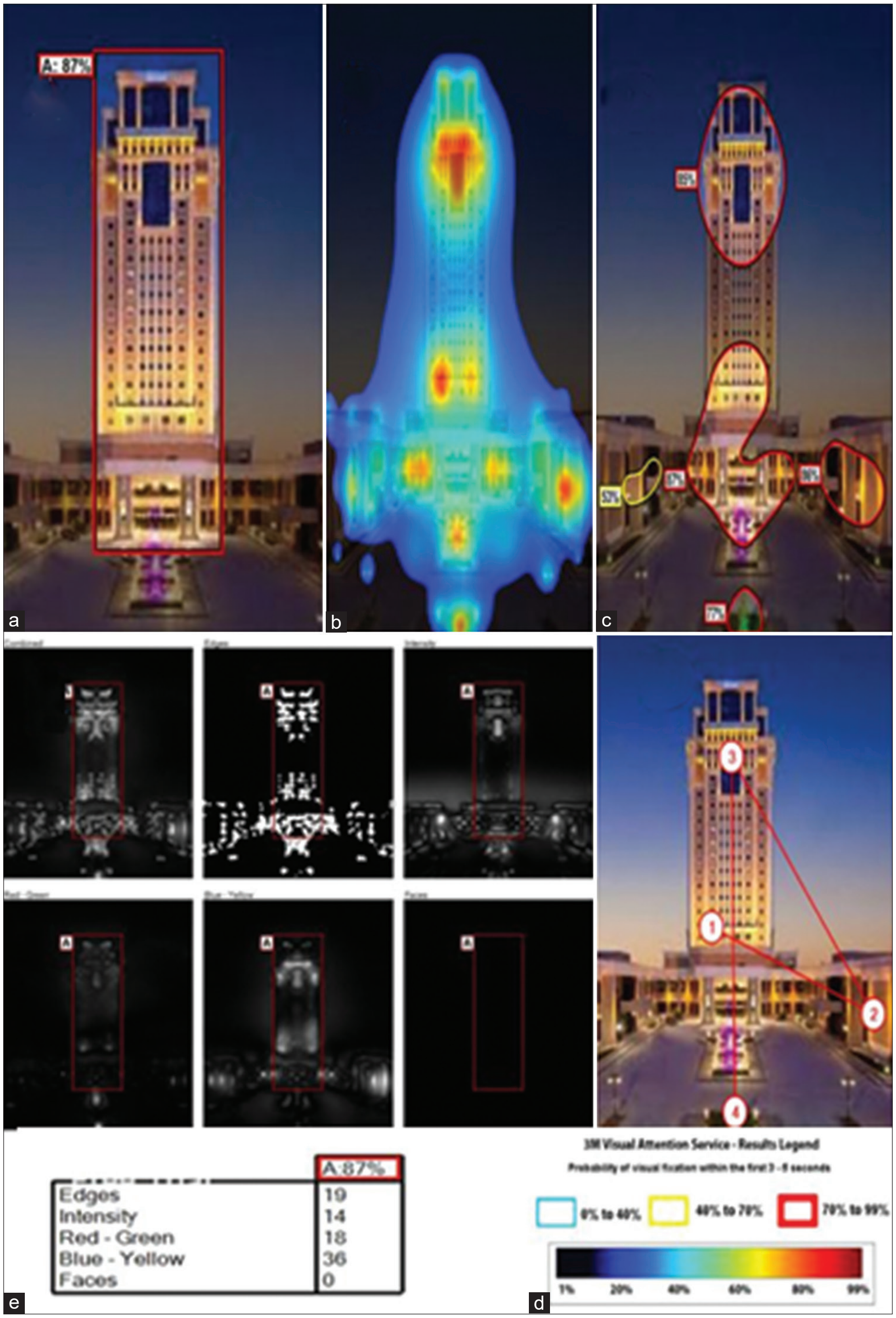

Figure 6: Depicts a visual appeal examination of the Erbil citadel. Image (a) shows the overall visual interesting percentage of 87. Image (b) shows the main square and the detailed use, image (c) shows the hotspot analysis to show that the top and the base of the building have strong visual attention, and image (d) shows the expressed gaze sequences. Finally, Figure (e) expresses the components of visual attention and their importance

to the building's main entrance, which symbolizes the truth that a glass building's visual attention is ineffective, yet it has attained visual attention significance due to its size. As stated earlier.[11] In each instance, the older structure is the most eye-catching. As the modernist building is approached, the absence of detail renders it less prominent and more fragmented on the heatmap.

Figure 8 is a photograph of the tallest structure in Iraq, the Zaniery tower in Erbil, Iraq. Whose construction is still not finished. The visual attention value of this image (95%) indicates that it has a substantial visual appeal. The other analysis (b) utilized a heat map to depict the overall structure, which revealed a high visual attention value. According to images (c and d), the original structure behind the building

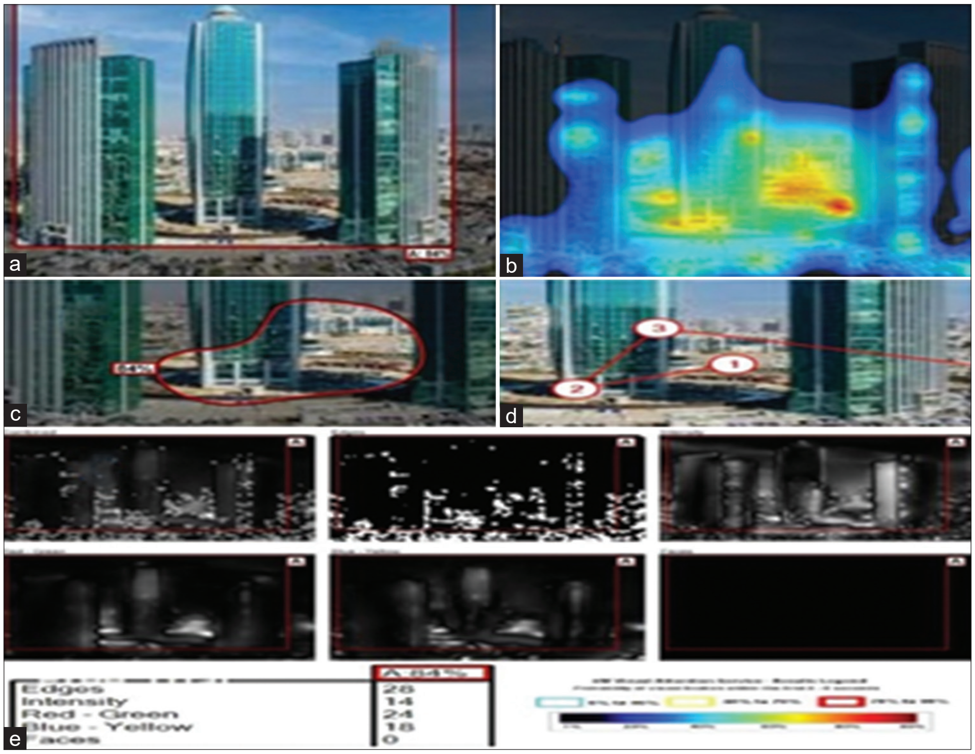

Figure 7: (a) The visual attention analysis of the Empire Towers. Images (b and c), and image (d) show the expressed detailed analysis. Image (e), Explained the importance of each visual element in achieving (84%) percent visual attention

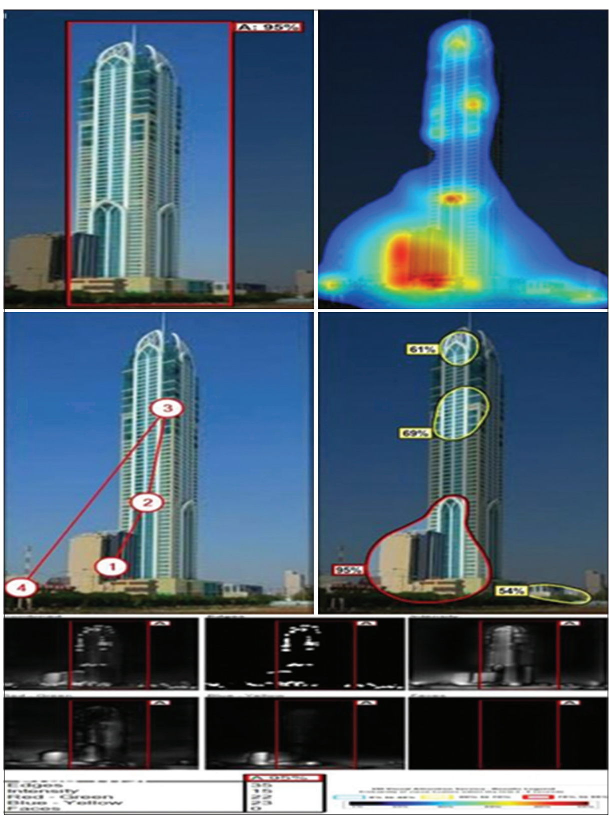

Figure 8: (a) The visual attention analysis of the towers. Images (b and c), and image (d) show the expressed detailed analysis. Image (e), explained the importance of each visual element in achieving (95) percent visual attention

and the entry arch have assumed a more important visual significance. As a result of the structure's size and attention to detail, the building is more esthetically pleasing and recognized in Erbil.

Figure 9 illustrates the Jalil Khayat masjid in Erbil, Iraq, which is recognized as an archetypal masjid. Khayat and his son constructed the constructed date. Due to its construction date, this Othman-style masjid is recognized as a modern iconic building. According to the 3m-VAS program, the building's visually interesting percentage value of 86, and the visual attention analysis (image e) indicate the most impactable feature of the building's edge feature. The heat map analysis of the entire construction demonstrates that the minaret, the entryway, the use of details, and the dome attract the most attention (image b). As seen in photos (c and d), significant visual detail value and the strongest visual impact are due to their overall size and color contrast.

DISCUSSION

Eye tracking identifies the regions of pre-attentive concentration on a visual scene and offers the overall rate of visual attention in a building, which directly influences the familiarity function of the building. It is ideal for comparing objects and determining relative coherence. This article presents a two-group examination of eight separate buildings (contemporary and historic iconic buildings). In addition, eye tracking can give us a good idea of human responses to specific structures, indicating the source of attention and identifying the most visible features. Here is a list of the key findings of the analysis.

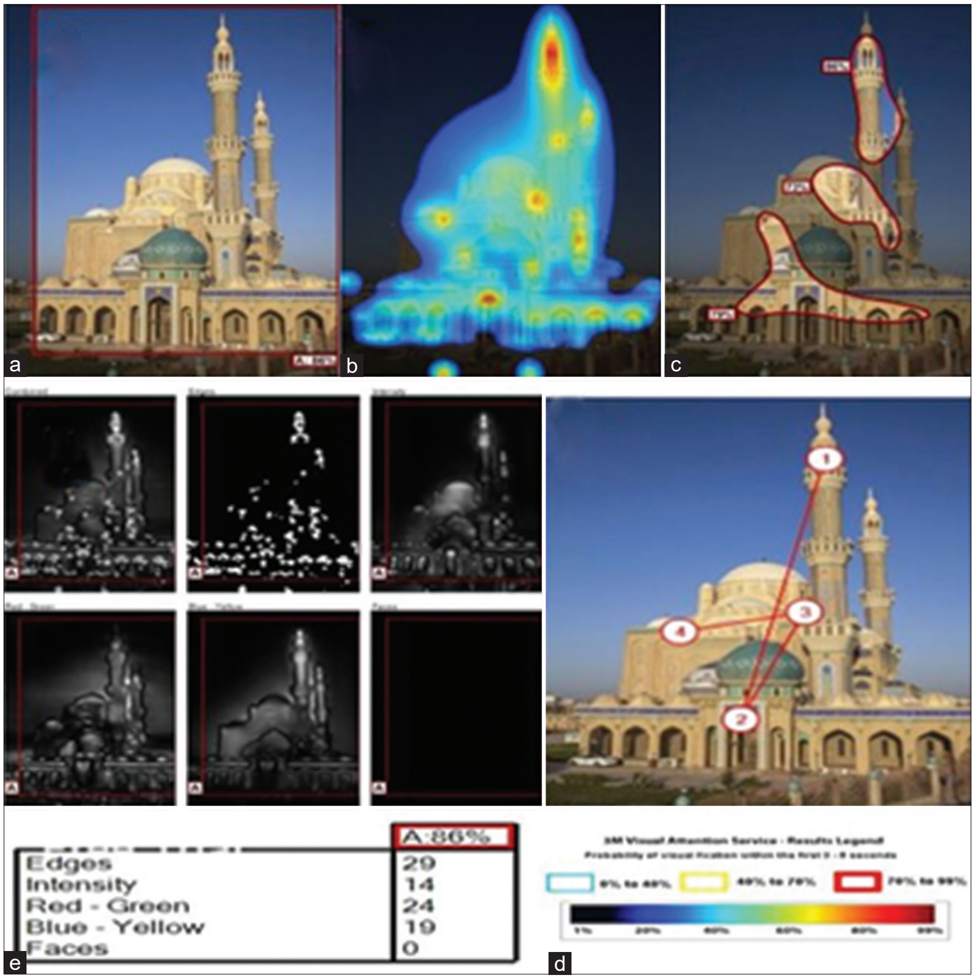

Figure 9: The visual attention analysis of the Jalil khayat masjid. Image (a) shows the overall visual interesting percentage (86), image (b) shows the most notable features in this image that are related to arcade uses, image C shows the hotspot analysis to show the percentage of attention by features, and image (d) shows the expressed gaze sequences, where the first gaze on the minaret, then main entrance, details, and finally the dome. Image (e), Explained the importance of each element in achieving (86%) percent visual attention

1. A high level of structural complexity, characterized by layered symmetries, inspires the viewer's visual interest.
2. The proportionate articulation of a building, particularly its vertical articulation, had a significant impact on increasing visual attention.
3. The software validated that repetition, rhythm, and constant all affect individual focus.
4. According to the analysis, Erbil's ancient icons have substantial esthetic appeal; nevertheless, this visual attraction value is higher in contemporary buildings due to their proportional articulation. The whole is greater than the sum of its parts
5. The visual attraction of historical examples is enhanced by their complexity and symmetry. Nonetheless, the proportional articulation of contemporary icons increases their visual attention.
6. An important factor is the percentage of the building's visual attention value based on the total of the visual features' values; in all cases, the edge feature achieved the highest value of the visual feature.

The presence of ordered complexity with tiered structures attracts the calculated pre-attentive gaze with increasing uniformity in all of the images tested in this study. While the Glass-façade buildings with low detail are not considered during the pre-attentive processing step [Figure 7]. This also validated the findings of the research [5]. Furthermore, overall proportions, such as height are more successful than detail usage for increasing familiarity value and visual attention in buildings, as demonstrated by contemporary cases in Erbil City (3M-VAS). The program cannot give an absolute measure of the coherence of a design or structure, but it can provide semi-quantitative information about it. It is particularly convenient to compare photographs of two distinct structures (as in this article, comparing historic and contemporary buildings). It is a significant new attempt to cover the gap between human behavioral science and architectural research.

CONCLUSION

To create a better-built environment, it is vital to establish a strong connection between human behaviors and the architectural field. However, quantifying the value of architectural products for humans is extremely difficult. The study focused on the visual attention of humans for building products. By using 3M-VAS, architects can now "see" and forecast human mental perception of buildings. Using such neuroscience software in the architectural industry enhances research accuracy, makes real human perception easier to comprehend to design the environment, and saves time. By analyzing the photographic assets of iconic buildings. The study found that historic buildings are primarily attention-grabbing due to the features utilized in their facade design, but contemporary buildings, especially towers, have a more attention-grabbing propensity for increasing visual attention value. Therefore, based on these analyses, contemporary cases attain a greater visual attention value due to their high edge value. Hence, this shows the use of detail, the location, and the number of elements utilized in a facade are vital for enhancing visual appeal, but the proportionate composition is the most important factor to examine when analyzing the visual attention in buildings. In addition, the research focuses solely on visual behavior, but more analysis is still required for a full comparison between the architectural field and human behavioral science. As an expression of emotional experience, EEG, galvanic skin response, or heart rate, can be used for future research.

REFERENCES

1. N. Ujang. “Place attachment and continuity of Urban place identity”. *Procedia Social and Behavioral Sciences,* vol. 49, pp. 156-167, 2012.
2. K. B. Wright and S. Bafna. “Structure of attention and the logic of visual composition”. *Behavioral Sciences*, vol. 4, no. 3, pp. 226-242, 2014.
3. W. Bonenberg. “Brand visual identity in architecture”. In: *Universal Access in Human-Computer Interaction.* Springer, Cham, Switzerland, pp. 143-152, 2014.
4. *What is Eye Tracking? How Eye Tracking Works*. Tobii, 2015. Available from: https://www.tobii.com [Last accessed on 2022 Aug 31].
5. H. Cho. “A study on the comparison of the visual attention characteristics on the façade image of a detached house due to the features on windows”. *Journal of Asian Architecture and Building Engineering*, vol. 15, no. 2, pp. 209-214, 2016.
6. K. Batista-García-Ramó and C. I. Fernández-Verdecia. “What we know about the brain structure-function relationship”. *Behavioral Sciences*, vol. 8, no. 4, p. 39, 2018.
7. D. Bridger. “*Neuro Design: Neuromarketing Insights to Boost Engagement and Profitability*”. 1st ed. Kogan Page, London, U.K., 2019.
8. N. A. Salingaros and A. Sussman. “Biometric pilot-studies reveal the arrangement and shape of windows on a traditional façade to be implicitly “engaging”, whereas contemporary façades are not”. *Urban Science*, vol. 4, no. 2, p. 26, 2020.
9. A. A. Lavdas, N. A. Salingaros and A. Sussman. “Visual attention software: A new tool for understanding the “subliminal” experience of the built environment”. *Applied Sciences*, vol. 11, no. 13, p. 6197, 2021.
10. J. B. Hollander, A. Sussman, P. Lowitt, N. Angus, and M. Situ. “Eye-tracking emulation software: A promising urban design tool”. *Architectural Science Review,* vol. 64, no. 4, pp. 383-393, 2021.
11. D. E. L. Lockhofen and C. Mulert. “Neurochemistry of visual attention”. *Frontiers in Neuroscience*, vol. 15, p. 643597, 2021.
12. H. F. Mallgrave. “*Mind in Architecture: Neuroscience, Embodiment, and the Future of Design*”. Available from: https://caareviews.org/reviews/3142 [Last accessed on 2022 Aug 31].
13. H. Thamik and J. Wu. “The impact of artificial intelligence on sustainable development in electronic markets”. *Sustainability*, vol. 14, no. 6, p. 3568, 2022.
14. *Predicted Eye-Tracking Tool Comparison: 3M VAS (Visual Attention Software) vs. Attention Insight.* Attention Insight, 2022. Available from: https://attentioninsight.com/predicted-eye-tracking-tool-comparison-3M-VAS-vs-attention-insight [Last accessed on 2025 Aug 31].
15. *The Fascinating Relationship between AI and Neuroscience*. Towards Data Science, 2022. Available from: https://towardsdatascience.com [Last accessed on 2022 Aug 31].
16. *3M Visual Attention Software* (VAS). 3M, 2022. Available from: https://vas.3m.com [Last accessed on 2025 Aug 31].
17. L. S. Ahmed and S. Y. Baper. “Place branding assessment through factors affecting iconic value in Erbil city of Iraq”. *International Transaction Journal of Engineering Management and Applied Sciences and Technologies*, vol. 13, no. 12, pp. 1-12, 2022.
18. K. Holmqvist and A. Andersson. “*Eye-Tracking: A Comprehensive Guide to Methods, Paradigms and Measures*”. Available from: https://www.researchgate.net [Last accessed on 2022 Aug 31].
19. S. H. M. Alzuhairy. “*Comparison Analysis of Seepage through Homogeneous Embankment Dams using Physical, Mathematical, and Numerical Models*”. Swiss Consortium. Available from: https://springer.com [Last accessed on 2025 Aug 31].