Middle East Journal of
Scientific Publishing
Vol. (7) Issue (3)
Edition 23th
2024(1 - 8)

A new visual structure in architecture

Zahraa A.Hafedh,
Hassan Al-Guesbi
University of Babylon, Collage of Engineering,
Department of Architecture, Hilla, Babil, Iraq.
Published on: 6 September 2024

Abstract

Visual language is the most effective language in the world. Our eyes are the window that we are discover our surroundings. Eye tracking technology reads our eyes movements, and analyze them to understand the psychology of humans by its fixations and saccades. VAS is a new tool of eye tracking technology that could be used to describe buildings, samples, or products before construction stage. It makes an initial prediction which help to find strong and worst points in designs, through new visual structures like heat maps, gaze sequence, ect. This prediction Characterized by complete objectivity, because it simulates the pre-attentive vision at 3-5 seconds.

Key words: Visual language, Eye tracking, prediction, visual structures, pre-attentive vision, VAS/Visual Attention Software, Heat Map.

* Introduction

Visual language is a global means in our current time because it has a strong impact on the recipient by sending easy-to-capture signals. Body movements or eye movements, as well as images or videos and silent theatrical performances, have many connotations and meanings that can be captured and communicated away from linguistics. The visual image is more influential in the recipient than speeches, where it is considered the fastest and most concise means of communication (Al-Bahrani et al, 2017).

Given technological development and technologies such as virtual reality that combine real reality with virtual vision, environments that provide an opportunity for humans to discover

themselves in new ways interact with the real world with virtual tools. Such as reflecting information that is difficult to understand and convert into virtual reality and enriching the real world with virtual data to facilitate the recipient's access to information. Augmented Reality Technology (AR) is a help to understand things more realistically in all areas (Aydin et al, 2022).

Augmented Reality (AR) is an overlay of computer-generated content in the real world that can superficially interact with the environment in real time. Where there is no barrier or special rooms for interaction between computer-generated content and real-life content. In most cases, computer-generated content is displayed by smartphone or tablet devices (Ijmtst, 2021). Also there are different types of technologies that used human sensations to measure effects of architecture on humans like eye tracking technology or heart beats ect. These show patterns of analyzing called structures.

Christopher Alexander defines patterns as not limitations that restrict design, but as a general framework that defines work and encompasses a wide range of design choices, and then gradually narrows those choices to keep the determinants associated with man and his built environment, spatial and temporal context. Human beings have different needs that must be met in the design process to enhance their sense of comfort, satisfaction and convenience. These patterns are suggested, sustainable and successful solutions in everyday life, (Alexander,2001). Living patterns promoted the well-being and health of society through their sustainable designs and could be applied in time of modern technology in order to create a new language that mimicked those patterns.

There are two types of patterns can be distinguished, Design Patterns and Visual Patterns, Visual patterns are new invented structures that are arbitrarily imposed on architecture, such as the implementation of some interesting art images as a building or city. Although this principle is flawed, it has become a standard practice used by some designers without reference to the test of that design sample to see whether it is successful or not and how it affects humans (Salingaros, 2021). These type of designs are simulated the structure of nature creature and analyzing that structure to reflect on architecture, figure(1).

Several attempts have been made to exploit natural phenomenon systems and to apply them in building

designs, such as in the Beijing National Olympic Centre Building derived from the simulation, functioning and interconnectedness of water bubbles, where water bubbles are considered to be sunscreen and heat-insulating, ETFE material, which is considered heat-insulating, figure (2). This type of design pattern falls under the title (Bio-mimicry) which involves adopting or installing the function of natural phenomena and reflecting them in the design of the building (Osama, 2019).

fig.1: Images of some visual patterns in nature.

Figure2: Photos of Beijing's National Olympic Stadium.

Anew language have been appear to integrate technology with architecture by using humans eye movement. Eye tracking technology are so useful to understand human beings behaviors. This technology have developed with new structures that helped to analyze architecture projects before construction them, to find the strong and worst points in designs. By using Visual Attention Software (VAS), which it has many structures could be used like heat map, gaze sequences, hot spots, ect. VAS is a new tool that used for predicting to any products, even architecture. It has a prediction at pre-attentive vision through (3-5) seconds, which it has an objectivity for all humans even animals involve with it, (Lavdas and Salingaros, 2021). The predicting that VAS has made for products are useful and sustainable, especially at architectures' facades. It makes an analyzing to discover the strong and worst points at facades design before construction stage, that will make a sustainability in time, efforts, and materials.

*** Eye tracking technology**

This technique is a new way of helping to understand the visual aspects of architecture experience by people who are not architects. Furthermore, it refers to the justification for obtaining knowledge about how architectural design communicates with the public, client

and professionals, as well as the usefulness of this knowledge in teaching architectural theory, architecture history and architectural design (Małgorzata and Michał, 2020). It is also used to understand the detailed structure of how people read texts, as psychologists consider eye-view tracking a valuable analysis tool (David et al, 2007). Eye tracking technology is used to more accurately capture eye movements and combinations in response to different designs (Ju and Michael, 2021). This process is carried out through special glasses worn by the person and then images are shown, and the glasses begin to calculate and record unconscious eye movements. The camera tracks and records where the person's eye looks. Points of view are mapped for a particular text to follow the behavior of reading topics, where eye tracking analysis revealed how the eye moves during the reading process (David et al, 2007). Studies have also shown that eye tracking can be an effective tool in developing and evaluating design, and therefore analysis of eye tracking data can contribute to human computer interaction research as well as design science, (Soussan et al, 2011).

*** Visual Attention Software (VAS)**

VAS/Visual Attention Software was developed by Minnesota Mining and Manufacturing Company for advertising applications to determine the quality of visual advertising observation. It relies on actual eye tracking data and uses the results to find out what affects human visual attention before paying attention within the first 3-5 seconds of view. This analysis applies to billboards, web pages and store screens (Lavdas and Salingaros, 2022). VAS relies on more than 30 years of research by 3M vision scientists. It is designed to map the areas to which the eye is attracted within the image. Neurological treatment seeks features in the environment and compares them with an internal reference. The image is not stored in long-term memory, and this simulation has a strong correlation with the results of direct analysis of real-life eye tracking. So it's a good tool for this kind of work. The simulation does not purport to cause us to abandon eye trackers, but it is a valuable tool for obtaining information about human perceptions before mindfulness or attention (Lavdas and Salingaros, 2021).

The image to be analyzed is uploaded after selecting the product type such as a product, web page or other, and then determines the image area and sends the analysis which takes only a few seconds to give the

result in the form of an integrated report that can be uploaded and stored at the user. The report shows a heat map of the image, hot spots, gaze sequences, and visual elements, (Lavdas and Salingaros, 2021).

*** Methods**

VAS uses comparison between two models, to discover the relation between prediction of VAS and the reality decision by using ROA and results of questionnaire. The samples was local, regional, and global modern residential buildings, similar in design and different in dimensions, figure3. Samples A,B and C,D are compared together fig. 3.

These samples are analyzed by VAS, the heat map of them shows the positive and negative points in design.

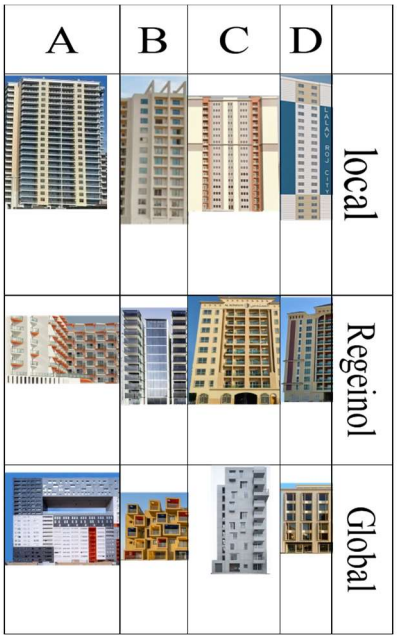
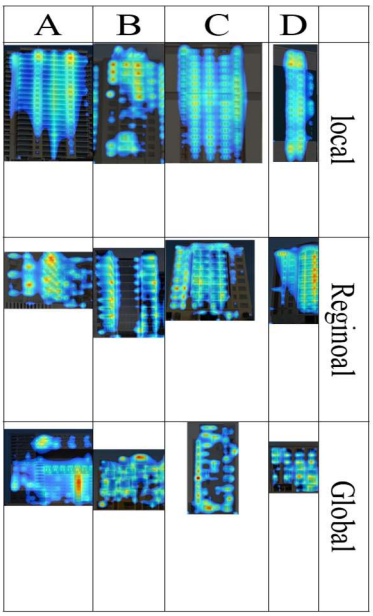


Fig.3: samples of local modern residential buildings.

*** Results**

Samples are analyzed by VAS that shows results of heat maps in fig, 4.



Local Samples: -

A- The heat map appears as one block coherent with some scattered areas and the attractions on the vertical axes of the facade appear contrary to horizontal elements.

B- The map is distributed on the top of the facade and on the side balconies with high attractions on the windows of the building.

C- The middle area attracts the eye in the pre-attention phase more than the silent aspects due to the distribution of windows to the central area, and the middle mass forms a homogenous block.

D- The heat map is positioned in the middle part with its extension along the building and in one block monolith on the middle vertical axis

of the facade with neglect of the silent sides as well as for the first looks and hot areas it extends over a few parts of the middle vertical axis.

Regional Samples: -

A- The thermal map is spread along the facade with a highly focused part on the side balcony side and the cohesion is reduced towards the front part.

B- The heat map is divided into two parts based on the aspects of the building and the central area did not receive attention.

C- The thermal map is homogeneous and coherent as a single block with focal points on the middle grid.

D- The thermal map is coherent in the form of a single piece heading to the right of the building.

Global Samples: -

A- The thermal map is coherent and in the form of one piece in the lower half of the building and the upper part has not received any attention.

B- The thermal map is coherent and stretched along the building with few gaps.

C- The thermal map is coherent and stretched along the building with few gaps, red points are Heading to windows that represent areas of transition between hardened materials to transparency.

D- The thermal map is spread over the boundary of the building with large gaps within it.

Table 1: the compression of samples results

A	B	C	D		
70	78	63	69	ROA	Local
46.9	53.1	34.35	65.65	Q	
77	65.6	80	80	ROA	Regional
74	34.4	39.1	60.9	Q	
81	85	86	98	ROA	Global
43.75	56.25	71.9	28.1	Q	

* Discussion

After presenting the results for the analysis of local, regional and global samples in the VAS program, we review the discussion of those results, which represent the relationship between the results of the attraction ratio (ROA) (which represents the forecast of the proposed design while identifying the positive and negative aspects before implementation), and the questionnaire (Q) which represents the view of the viewer in the building after its implementation. The results showed an estimated match rate of 83%.

* Conclusion

1- Language is a message with which the recipient interacts and responds with a reaction, whether that language is verbal, visual or vocal, or its symbolic, kinetic or formalistic value. Visual and graphic language is the most influential of speech or vocal language.

2- VAS (Visual Attention Software) is the means to measure pre-attention by the results of its visual structures.

3- VAS results contain the heat map structure through which the coherence (coherence factor (C)) can be measured while determining the strengths and weaknesses of the shape, symbolizing the red color of the strong areas and coming after the yellow (medium) green, blue (weak) and then black (worthless).

4- Pre-attention is an objective and measurable stage that helps in the knowledge of objective beauty by studying human eye movement.

5- Vertical axes work to attract more attention than horizontal.

6- Deaf blocks do not work to attract attention.

7- Color has a great effect on attracting the attention of the opposite.

*** Recommendations**

1- We suggest using VAS to analyze architectural designs and know their pros and cons to avoid design errors.

2- Deepen the study of neuroscience and its relationship with architecture to understand human behavior and the impact of architecture on it by receiving external stimuli.

3- Avoiding monotonous and boring designs that do not attract attention.

4- Ensure the design of interfaces characterized by cohesion and balanced attractions to keep away from distraction.

*** References**

3M Company, VAS, Www.3M-VAS.Com .

Al-Bahrani, Rana Hameed, And Al-Azzawi, Shifaa Mohammed Abdullah; Visual Language As A Source Of Creative Cognition; AIJLLS; VOL 1 ISSUE 3; 2017.

Aydin Unal, Onur Celen,And Gizem Ozgure;, The Use Of Visual Reality Application In Destination Marketing: A Study On Museums; 2022.

Ijmtst, Editor; A Review On Virtual Reality And Augmented Reality In Architecture, Engineering And Construction Industry; 2021.

Alexander, Christopher, Ishikawa: Sara, Silverstein: Murray; A Pattern Language; Oxford University; 1977.

Osama Yousef Mohamed, Parametric Design As An Approach To Inspire Nature In Product Design, Helwan University,2019.

Salingaros, N.A.; Why Christopher Alexander Failed To Humanize Architecture; 2021. Available Online: Https://Thesideview.Co/Journal/Why-Christopher-Alexander-Failed-To-Humanize-Architecture.

Małgorzata Lisi ´Nska-Ku´Snierz, Michał Krupa; Suitability Of Eye Tracking In Assessing The Visual Perception Of Architecture—A Case Study Concerning Selected Projects Located In Cologne; buildings, 2020.

David Beymer, Peter Z. Orton, And Daniel M. Russellan), Eye Tracking Study Of How Pictures Influence, Online Reading; 2007.

Soussan Djamasbi, Marisa Siegel, And Tom Tullis; Visual Hierarchy And Viewing Behavior: An Eye Tracking Study; 2011.

Lavdas Alexandro, Salingaros N., And Sussman A.; Visual Attention Software: A New Tool For Understanding The "Subliminal" Experience Of The Built Environment; Article; applied science; 2021.

Lavdas Alexandros A., And Salingaros Nikos A.; Architectural Beauty: Developing A Measurable And Objective Scale; challenges; 2022.