

The perception of symmetry in architecture: an eye movement study

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I. EXTENDED ABSTRACT

I.1. BACKGROUND

Based on Salingaros theory of architecture, symmetry is a simple yet powerful tool for creating a visual order and a stable balance, and as a result, it reduces the time needed for visual perception of a space (Salingaros, 2006). In many psychological experiments, it has been proved that symmetry is detected more quickly in patterns or visual compositions concluding it, in comparison to ones that do not contain any kind of symmetry (Locher and Nodine, 1989). There are strong evidences that symmetry affects eye movements. Experiments have shown that people discern symmetry or asymmetry " in a single brief fixation". It is believed that it can be detected quickly within about 0.05 second over all regions of the retina (Eberhard, 2008; Koostra et al., 2008; Locher and Nodine, 1989). About the axis of the symmetry, there is a general agreement that "Eye fixations are usually concentrated along the axis of symmetry or the symmetrical center of the patterns" (Kootstra et al., 2008).

That symmetry has a high perceptual value was first discovered by ancient artists. It could be seen in symmetric patterns found many times in ancient architectures and arts even in objects like Persian rugs (Tyler, 2000; Locher and Nodine, 1989). These arts suggest that symmetry and repetition were among the earliest properties of an art which gives them high value. It could have different reasons. First, it could be due to the existence and repetition of symmetry in nature around us. Second, it is possible that because of the circular symmetric structure of human visual system, when viewing mirror symmetric patterns such as the ones in Persian rugs, the resonance occurs and makes them appealing (Tyler, 2003). In ancient houses of Iran, we could see these recurrences of symmetrical patterns. Those houses are still magnificent in the eyes of people, while nowadays we could see that people are not satisfied with their homes. So in this study, we focus on symmetry and the way it is understood.

I.2. METHODOLOGY / PROCEDURE

To find out the visual patterns of attention when viewing symmetrical interior of houses, we used eye tracking method. Five photos of ancient houses of Kashan city which include symmetry, have been selected. Each photo was being showed for 10 seconds on video projector to ten university students who were selected by cluster sampling method (5 left handed and 5 right-handed ones) in IUST. The Pupil Eye-Tracker- Dev with 0.6 degree accuracy is used in this experiment.

I.3. OUTCOME / DISCUSSION

Based on the results, two patterns of eye movements are recognized in visual confrontation with symmetry in buildings. The participants who were right-handed ones, were focusing on the left half of the photos with one or three fixation points on the axis of the symmetry. Also it should bear in mind that these photos have local symmetries too. So we could see that in right half of the photos which has local symmetry, the fixations are more concentrated on the axis of the local symmetry. The experiment shows that left-handed participants were looking at the axis of symmetry and the points around it on its both sides. In other words, the concentration of fixation points is located in the middle of the image around the main axis of the symmetry (Figure 1). A cartoon comparison of these two patterns is shown in figure 2. In second phase of the experiment, we repeated the process by 5 asymmetrical photos from the same houses. The number of fixations and the length of saccades were slightly higher than symmetrical photos.



FIGURE 1: ONE OF THE PHOTOS VIEWED BY LEFT HANDED (A) AND RIGHT-HANDED (B) STUDENTS; DOTS REPRESENT FIXATION LOCATIONS OF THE EYE AND THE LINES REPRESENT SACCADES

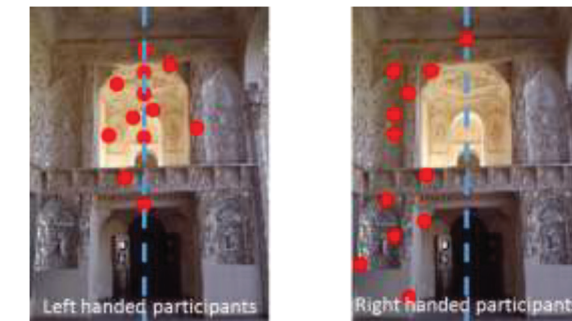


FIGURE 2: A CARTOON COMPARISON OF TWO ACHIEVING PATTERNS; THE BLUE LINE SHOWS THE AXIS OF THE SYMMETRY, AND THE RED CIRCLES ARE A GRAPHICAL PRESENTATION OF EYE FIXATIONS

I.3. CONCLUSION

Human beings perception is highly sensitive to symmetry. Symmetry is detected and discerned rapidly in symmetrical scenes. Over all, the patterns for symmetrical scenes demonstrate the perceptual value of the axis of symmetry. For right-handed students, it acts as the separator of two halves of the scene and carries their attention towards the left half of it while for left handed ones it is like an anchoring line which eye movements are in a back and forth movements between the axis and the other parts.

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3. AUTHOR BIO

Sharareh Ghanbari Azarneir, is a research assistant in Iran University of Science and Technology where she has obtained her master degree in architecture. Her M.Sc. thesis mainly involves the Interior Architecture of houses and its effects on human brain, entitled "Solutions for improving the interior architecture of residential buildings with a neuroscience approach". Currently, she is working in a Green Housing Lab in IUST as a research assistant. The focus of their team is on architectural perception and cognitive neuroscience in architecture.

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