The Influence of Visual Perceptual Constancy on Attracting Attention to Digital Images on Advertising Posters

Dr. Tarek Bahaa Al Deen Hamd Allah
Scientific College of Design, Department of Graphic Design, Murtafa'a Street, Muscat, Sultanate of Oman, Postal Code 114

Abstract. This paper aimed to study how to attract more attention to the digital images used on advertising posters, by applying the visual perceptual constancy.
To achieve this goal, the study used the descriptive and experimental, methods to analyze the nature of visual perception and visual perceptual constancy. Then, experiments were designed to employ the perceptual constancy, which extends its influence to the ability to produce a digital image used in advertising poster, beyond the boundaries of the visually familiar.
The results measured the audience' exposure time and analyzed it. They indicated that there was an increase in the audience' exposure time when using perceptual constancy as the main design concept in the digital images on advertising posters, and they led to recommendations to expand the use of perceptual constancy in the digital image on advertising media to get more audience' attracting attention.

Keywords: visual perception; digital image; advertising poster; perceptual constancy; photography.

1 Introduction

How to increase the attracting attention in advertisements in general, and particularly in advertising poster is a highly important issue in advertising. When the advertising objects are remarkable, they can attract attention compulsory and immediately, depends on the contrast with other objects on basic perceptual constancy, such as size, shape, color, and luminance. This perceptual constancy defines the salience of the advertising objects. The surface size, area, of advertising objects, is a perceptual feature with "a premium status" in visual attention [1].

Digital images have exceptional status on the advertising poster. The image advantage, from the message sender viewpoint, is the persuasion, which is the ability to create perceptual images in the receiver's brain. Especially, when the image content has unusual representation forms, that increase the ability to retain the final perceptual image in the receiver's memory [2].

Perceptual images are the final result of the visual perception process. Thus, the principles of visual perception influence the final message of a digital image on the advertising poster.

DOI:10.12816/0044320

One of the most important visual perception principles is perceptual constancy, particularly regarding the visual experience of the humans and their ability to change the reality they attach to it. Therefore, marketers can take advantage of it to get better results from photographs, create a different visual perception of reality, or render the viewers unable to identify the truth in the image, thereby increasing the exposure time of the advertising poster and the attention it attracts.

Consequently, the study will explore the definition of visual perception and perceptual constancy and the ways to take advantage of both when shooting photographs and editing them using digital image processing software. It will also explore how to increase the visual attraction of the images and their applications in poster advertising.

This paper aims to study how to attract more attention with digital images in advertising posters by using the principles and mechanisms of visual perception, especially perceptual constancy. Through the study and experiment the hypothesis: the exposure time, thus the attracting attention of the advertising poster is increased by employing the visual perceptual constancy in digital image used in advertising poster.

This paper uses descriptive methods to study visual perception and its actual impact on the vision process. Then, it focuses on the visual perceptual constancy, clarifying the role of each of size, shape, color, and lightness constancy in the final perception of the image and its impact on the attention of the viewer.

Then, it uses the experimental method to create different design applications for the digital image in advertising poster using visual perceptual constancy for poster already designed before. Then, a comparison and measurement procedure is conducted with the data collected using an exposure time measurement presentation, and, afterward, the analysis of data is statistically extrapolated to get results.

2 Visual Perception

Visual perception is the ability of the human brain to perceive the ambient environment through processing the reflected visible light from the objects to the retina. To understand and recognize the surrounding environment, the brain gathers and processes the information it receives from the five senses. Visual perception is responsible for collecting and processing the information it receives from the visual system [3].

Decades of research in psychology has undermined the hypothesis that the ability of people to see or hear is an exact repetition for surrounding environment in two different paths. Visual perception is selective processing; the human could not pay attention to the vast amount of visual stimuli around of them [4]. For example, the audience may not see someone who passes through the players while they are watching the game. Or when some person meets his friend in a shopping area, he can't see him, even though he exists within the borders of his vision because he focuses on another goal. Second, perception is often biased because people are biased to their experience and knowledge and tend to explain all of their vision to their experience [4]. For example, the ratio between the areas and volumes may not be a reality.

Thus, the human visual perception is not an exact depiction of what is actually there as much as a depiction of what we expect to see in reality. Perception is based on three factors: the human experience (the past), the current context (the present), and personal goals (the future) [5]. This means that visual perception is not merely a passive recording of visible objects in the surrounding environment; it is the interaction between the vision of a subject as it is and what it is supposed to be. In other words, it is the intellectual interpretation of what the subject should be.

3 Perceptual Constancy

Perceptual constancy refers to the fact that the perceived properties of objects remain relatively constant despite changes in the conditions of viewing [6]. Perceptual constancy enables humans to preserve a stable visual perception for a stimulus, although the image on the retina may change (in color, lightness, size, shape). The more humans observe a known object, the more likely it is that they will maintain perceptual constancy of it. The perceptual system reacts to objects differently, depending on how they contrast with other perceived subjects, and this occurs because the visual perceptual system tends to respond to magnitude differences, as opposed to magnitudes themselves [7].

The ability to perceive the properties of objects as unchanging in the face of changing stimulation is an important adaptive property of perception because it is important for organisms to be aware of the stable features of the environment. The real world would be a confusing place if we perceived everything as constantly changing [6].

3.1 Size Constancy

Size constancy occurs when an object's perceived size stays constant even though the object is observed from different distances [6]. It is the perception that the object remains unchanged in size despite the change of its size in the retinal image when the distance between the object and the human eye changed. Any single object will project differently sized images on the retina at two different distances. When human senses are misled by the same information that usually helps perceive size constancy, some amazing visual illusions can be achieved [8].

Retinal image size along with the distance provide the basis for size constancy. This relationship is manifested in two different ways. The first way is that an "object of known physical size determines the unique relationship of visual angle, coupled with a clear distance." Secondly, often called Emmert's Law, is that the apparent size of the object will be proportional to the

distance when the size of the retina is constant [9]. One explanation for the size constancy is "taking into account," the mechanism that suggests that the perceptual system considers the distance. The idea of a link between size constancy and distance perception has led to a proposition that size constancy principle is based on a mechanism named size-distance scaling. Another source of information that can lead to an accurate size perception, independent of the size of retinal image size, is the relative size, compared to the common known object size [6].

3.2 Shape Constancy

Shape constancy is the perception that the object remains unchanged in shape despite the change of its shape in the retinal image when changed the viewing angle of the object to the human eye [10]. Shape constancy occurs when a perceived shape remains constant as viewing angle changes; for example, a door is viewed from different angles as it opens, and its retinal image changes shape from a rectangle to a trapezium, but we easily maintain our perception of a rectangular door. Robert Thouless called this constancy of shape perception “phenomenal regression to the real object" [6]. One explanation for this phenomenon demonstrates that the perception of object direction have an impact on the shape perception of this object [11].

An object is perceived to keep its known shape despite changing perspective or any other geometric from which it is observed [12]. It's possible to handle neuropsychological imaging to localize parts of the brain that are used in this shape analysis. They are in the region of the occipital cortex called the extrastriate cortex [8]. It is a learned skill; a toddler may have difficulty perceiving a popular toy if it is viewed from an unusual angle [12]. Objects that are familiar to us can be accurately interpreted when viewed from any direction. The shape constancy importance is correlating to the human interacting with objects in the world. Because in the absence the shape constancy, the human will face a serious difficulty in interacting with different objects in the ambient environment if they did not always maintain their familiar shapes. This

phenomenon cannot be explained just as an example of the Law of Priignanz, namely, that we have a natural tendency toward certain favored simple forms and that objects seen in perspective tend to appear as circles, etc. because these are the forms with which we are most familiar [13].

3.3 Color Constancy

The color is not one of the objects attributes that linked to them, but color is a mental perception of stimulus that occurs in the human eye retina because of falling of different electromagnetic wavelengths on it. However, The human visual system can define the object color despite change of light source spectrum source [14]. Color constancy is the perception of consistent colors of known objects even though the wavelengths reflected by them change [15]. Neural circuits and double-opponent cells are responsible for this [16].

Color constancy is an important biological mechanism, in the absence of color constancy, the objects cannot define by their color. The human eye photoreceptors able to measure the spectrum of light reflected by an object, and the light spectrum reflected by an object in different illuminant spectrum [14].

Color constancy is enhanced by a process called selective adaptation. For example, when objects are illuminated by a yellowish light bulb, the responses of retinal receptors that are sensitive to long wavelengths decrease. This prevents objects from taking on a yellowish hue. Another mechanism of color constancy is memory color, which causes the color of familiar objects to adapt to color perception [6].

3.4 Lightness Constancy

First, lightness should not be confused with brightness. Lightness is a subjective impression of the intensity of light reflected from an object's surface (it describes the appearance of the

surface). Brightness is a subjective impression of the intensity of light coming from a source of radiation (it describes the intensity of light sources such as the sun or a candle).

According to the definition of lightness constancy, a change in the illumination intensity of a field containing objects does not change the apparent light of the objects in the same way that it changes the lightness perception [13]. In other words, lightness constancy is perceiving an object in surrounding environment having the same lightness despite the change of its lightness in the retinal image when changed the object conditions of illumination to the human eye.

In general, object color and lightness tend to approximate to their color and lightness in normal illumination. Thus, if the achromatic illumination of a white surface gradually decreased, a white surface in a red light may, up to a point, appear less red than a red surface in white illumination, even when the former reflects more red light than the latter [13]. The visual system uses several forms of contextual information to disentangle surface lightness from the other factors that affect luminance, to achieve lightness constancy [6].

Lightness constancy is an important consideration for choosing backgrounds and surroundings for visualization, depending on what is important. If the outlines of objects are essential, the background should be selected to maximize the contrast of illumination. If it is important to see subtle gradations in gray level, choosing a background in the mid tone of gray levels will help in the vision of the important details [17].

4 Methods

To attracting attention to the digital images on advertising posters, many design strategies aim to achieve this in general, such as mixing and matching, comparative juxtaposition, exaggeration, omission and suggestion, paradoxes and optical illusions, changes of perspective, etc.

However, to achieve these strategies, one needs to employ the principles of visual perception, especially perceptual constancy, which extends its influence to produce a digital image beyond the boundaries of the visually familiar and thus confuse the viewers, which stops their vision for a longer time span. Thus, achieves a longer exposure time for the advertising poster, which gives a greater chance for the designer to deliver his message.

Attracting attention can be imagined as a brain operation producing a priority to focus on information processing for selected attentional signal by feature detectors in the primary visual cortex, that improves the speed of processing visual image. Then, when any aspect of a stimulus size, shape, color, or lightness), the brain automatically directing and fixing the eyes to the location of the stimulus or stimulus element. So, eye fixations can be used as measures of visual attention. The measure of eye fixation defined as the sum of fixation durations on the stimulus as a whole, or one of stimulus elements. Research demonstrates that eye look duration is a suitable indicator of attracting attention [18].

So, to achieve this goal four experiments were designed to study the influence of perceptual constancy on attracting attention of digital images in advertising posters. By redesign advertising posters are already published, using the influence of size constancy, shape constancy, color constancy, and lightness constancy as the independent variables, one in each experiment. And fixing all other constancy to be controlled variables, except for the one under experiment.

After redesigned all posters with perceptual constancy principles, the Audiences exposure time, as dependent variable, were measured by presenting the posters (two posters for every constancy) to a sample of the public (65 people). The exposure time measured by using Apple Keynote software to create a presentation for all posters. The viewers have controlled the display of every slide by themselves. Where viewers were asked to click on the button to move between the slides contains posters. Considering, put the viewers in a closed environment to

prevent any external factors from disturbing their viewing. Then recording the viewers' transfers from one poster to another in the video file through screen recording in QuickTime; using Adobe Premiere to define the exposure time of each poster; and analyzing it by converting it to percentages and collecting comparisons using Apple Numbers software for quantitative analysis. Then using a quantitative analysis to extrapolate the descriptive results.

4.1 Size Constancy Experiment

When creating confusion in the distance, it will appear as misleading in size. So, the elements of an image that help judge distance such as perspective, texture gradient, and focal plane adjustments will be manipulated to confuse the viewer. Thus, the sizes of the objects in the image can be misleading and impossible to estimate. Figure (1) explains the 4.1 experiment, an earlier poster design (poster 1) for a product (Kinder Surprise) was selected, and then redesigned using the size constancy to produce a pure photograph of a child coming out of the egg as the main concept in the poster.

Poster 1 Poster 2

Fig. 1 Experiment 4.1. Size Constancy.

4.2 Shape Constancy Experiment

Because of the shape constancy, the mind interprets changes in shape as a change in the view angle. Thus, when confusion regarding the view angle is created, an object will have a misleading shape, this can be used to confuse the viewer. Thus, the shapes of objects in the image become misleading and cannot be estimated. As shown in Figure (2), which explains the experiment 4.2, an earlier poster design (poster 3) for a product (iMac) was selected, and then redesigned using the shape constancy to produce the digital image of a woman coming out of the computer screen at a different angle than the angle of the screen itself, as the main concept in the poster (poster 4).

Poster 3 Poster 4

Fig. 2 Experiment 4.2. Shape Constancy.

4.3 Color Constancy Experiment

In color constancy, the mind interprets the change in color as a change in the illumination alters the wavelengths reflected by the object. Thus, when it creates confusion in the colors of the surrounding environment, it is realized as misleading in color. So, the elements are manipulated to judge the wavelengths reflected by the object, such as a background color, light source color, and hue adjustment, so that their impact on the digital image disappears and does not enable the viewer to judge the wavelengths reflected by the object and the surrounding

environment. Thus, the colors of objects in the image become misleading and cannot be estimated correctly. Figure (3) explains the experiment 4.3, which selected an earlier poster design (poster 5) for the Janique fashion house and then redesigned it again (poster 6) using the color constancy principle to produce a digital image with different two-color backgrounds, as the main concept in the poster.

Poster 5 Poster 6

Fig. 3 Experiment 4.3. Color Constancy.

4.4 Lightness Constancy Experiment

In lightness constancy, the mind interprets the change in lightness as a change in the different conditions of illumination, and thus confusion in conditions of illumination of the surrounding environment will be realized as misleading in lightness. Therefore, manipulate the elements to judge the conditions of illumination, such as shadows, a brightness of the light source, and intensity of background tint so that their impact on the digital image disappears, and do not reveal what enables the viewer to judge the conditions of illumination reflected by the object and the surrounding environment. Thus, the lightness of objects in the image becomes misleading and cannot be estimated correctly. As shown in Figure 4, the experiment 4.4, selected an earlier poster (poster 7) for the MacBook Air, then redesigned it (poster 8) using

the lightness constancy to produce a digital image of the MacBook Air with the same background illumination, as the main concept in the poster.

Poster 7 Poster 8

Fig. 4 Experiment 4.4. Lightness Constancy.

5 Results and Discussion

The results indicate that there was an increase in the audience exposure time when using perceptual constancy principles to attract attention to the digital images on advertising posters. Table (1) shows the exposure time average for each poster for the experiments sample of viewers that was tested. It shows a definite increase in viewers' exposure time for posters that were redesigned using the principles of perceptual constancy.

Table 1 Exposure Time Average.

No	Poster No	Exposure Time Average
1	Poster 1	04.337 Sec
2	Poster 2	08.270 Sec
3	Poster 3	06.092 Sec
4	Poster 4	08.730 Sec
5	Poster 5	05.043 Sec
6	Poster 6	09.630 Sec
7	Poster 7	05.015 Sec
8	Poster 8	08.342 Sec

It was noticed that some viewers showed a tendency to examine posters at a slow pace while others examined the posters at a faster pace. Hence, in order to be more accurate, there was a need to calculate the average time spent by each viewer on examining each poster with respect to the total time spent on viewing all the posters. Table (2) shows the proportion of the time spent per poster with respect to the total time spent on all the posters.

Table 2 Proportion of the Exposure Time.

No	Poster No	Proportion of the Exposure Time
1	Poster 1	05.017 Sec
2	Poster 2	10.092 Sec
3	Poster 3	07.247 Sec
4	Poster 4	10.244 Sec
5	Poster 5	05.850 Sec
6	Poster 6	10.970 Sec
7	Poster 7	05.665 Sec
8	Poster 8	09.914 Sec

Figure (5) shows the highest exposure time was poster No (6), which was redesigned using the color constancy, with an average exposure time of 10.970 sec. The second-highest exposure time is poster No (4), which is redesigned based on the shape constancy and has an average exposure time of 10.244 sec. The third-highest exposure time is poster No (2), which is the redesigned based on the size constancy and has an average exposure time of 10.092 sec. The fourth-highest exposure time is poster No (8), which is the redesigned based on the lightness constancy and has an average exposure time of 9.914 sec.

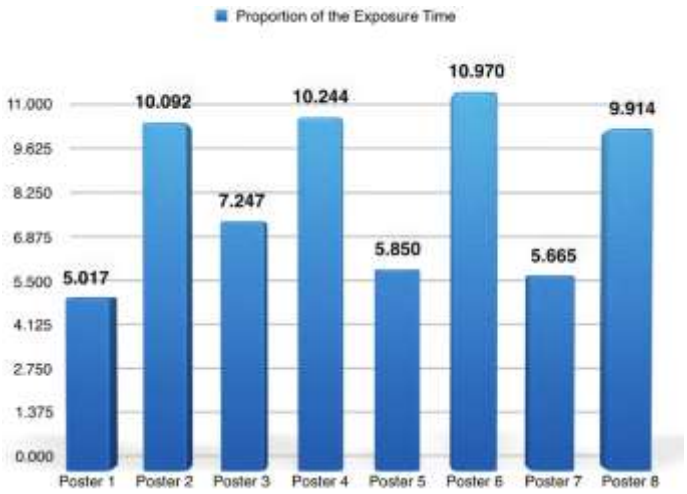

Fig. 5 Proportion of the Exposure Time.

Which means that all redesigned posters through the principles of perceptual constancy have more eye fixation that used as measures of attracting attention. However, when analyzing the results through the comparison between the original posters and the redesigned posters through proportion of viewers' exposure time in table (2), they are as follows:

The poster that has been redesigned using the size constancy, as shown in the diagram in figure (6), has increased its ratio of the exposure time, and thus the ratio attracting attention to be 1: 2.012, which means it improved by 101%.

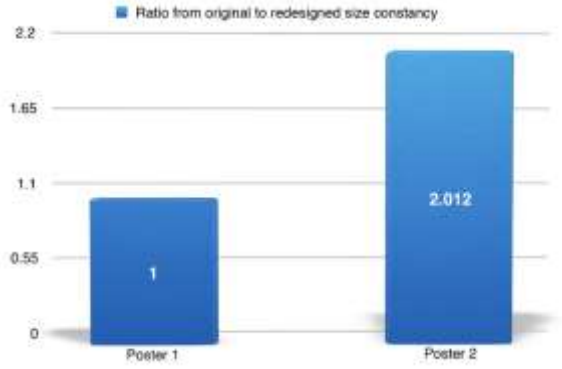

Fig. 6 Size Constancy Exposure Time.

The poster that has been redesigned using the shape constancy, as shown in the diagram in figure (7), increased its ratio of the exposure time, and thus the ratio attracting attention, to 1: 1.414, which means it improved by 41.1%.

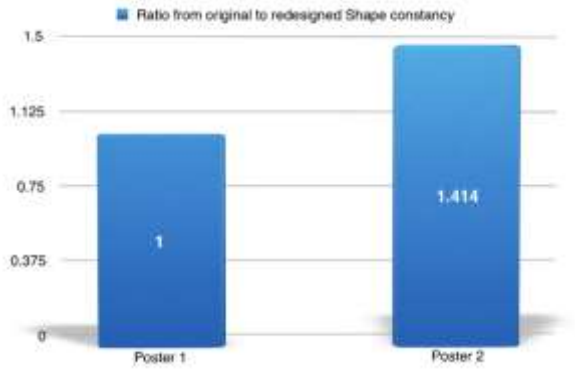

Fig. 7 Shape Constancy Exposure Time.

The poster that has been redesigned using the color constancy, as shown in the diagram in figure (8), has increased its ratio of the exposure time, and thus the ratio attracting attention, to be 1: 1.875, which means it improved by 87.5%.

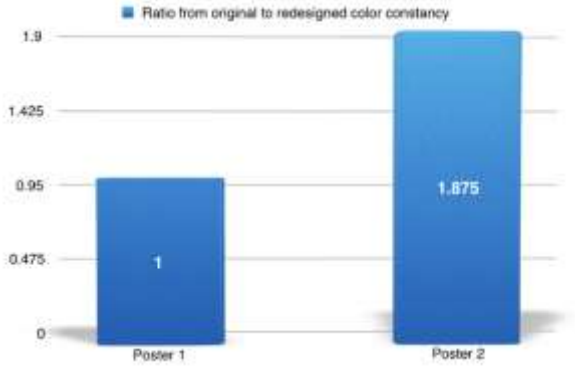

Fig. 8 Color Constancy Exposure Time.

The poster that was redesigned using the lightness constancy, as shown in the diagram in Figure (9), increased its exposure time ratio, and thus its ratio of attracting attention, to 1:1.75, which is a 75.0% improvement.

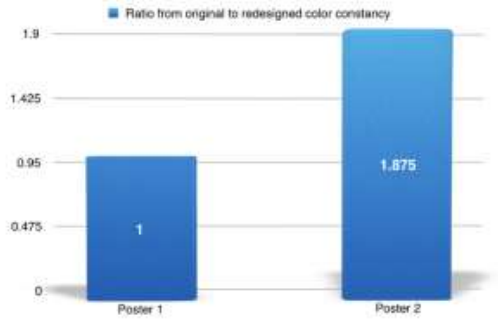

Fig. 9 Lightness Constancy Exposure Time.

Consequently, there are increasing in attracting attention for the digital images on advertising posters when using perceptual constancy as the main concept in design. The influence ratio varies from the size constancy as the biggest impact on attracting attention of audience, followed by the color constancy, and follows by the lightness constancy, and finally the shape constancy

Conclusion

The concept of perceptual constancy is in some cases too broad. Therefore, the objective of the paper was towards a better understanding of the relation between using the perceptual constancy and its Influence on increasing the audience' attracting attention for the digital image on the advertising poster. The paper confirmed that the perceptual constancy is a factor that can revive the impact of the digital image and increases viewers' exposure time (attracting attention) to advertising posters.

Using size constancy in digital images is the most attractive principle to advertising posters (101%), followed second by color constancy (87.5%), third by lightness constancy (75.0%), and finally by shape constancy (41.1%).

Using perceptual constancy in the digital images on advertising posters to increases the viewers' attracting attention to the posters, which is a normal response when using perceptual constancy to create images that contradict with the images stored in the visual memory with their familiar "sizes, shapes, colors, or lightness". This leads the human brain to spend more time to perceive these images as it tries to extrapolate their reality; therefore it gets more visually attracted to these images than the stereotype images that are familiar to human visual perception

Disclosures

Conflicts of interest: none.

Acknowledgments

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

تأثير الثبات الإدراكى البصرى على زيادة جذب الإنتباه للصورة الرقمية فى الملصق الإعلانى

د. طارق بهاء الدين حمدالله

الأستاذ المساعد بقسم التصميم الجرافيكى - الكلية العلمية للتصميم – مسقط – سلطنة عمان

الملخص:

تقوم الصورة الفوتوجرافية بدور رئيسى في زيادة جذب الإنتباه للملصق الإعلانى وذلك لما لها من مصداقية، وثراء لونى، وبناء طبيعى. ويزيد جذب الإنتباه مع إستخدام الصورة الرقمية وذلك لقدرة المصمم على إعادة إنتاج الموضوعات بها بأشكال ومشاهد غير مألوفة سابقا للعين البشرية.

ولما كان من أهم أسس الإدراك البصرى هو الثبات الإدراكى البصرى Visual Perceptual Constancy والذى يؤثر في تفسير الكائن البشرى لما يراه من حيث الحجم، والشكل، واللون، والإستضاءة تبعا لخبراتهم البصرية، وليس لما يرونه فعلا. فإنه يمكن توظيف الثبات الإدراكى البصرى للحصول على جذب إنتباه مرتفع للصورة الرقمية في الملصق الإعلانى مقارنة بمثيلتها غير الموظف بها الثبات الإدراكى البصرى.

وتهدف هذه الدراسة إلى إدراك كيفية تطبيق الثبات الإدراكى البصرى للحصول على مزيد من جذب الإنتباه للصورة الرقمية في الملصق الإعلانى وبالتالي للملصق الإعلانى ككل.

ولتحقيق هذا الهدف إتبعت الدراسة المنهج الوصفى وكذلك المنهج التجريبى لوصف وتجليل طبيعة الإدراك البصرى، والثبات الإدراكى البصرى، ودوره في تفسير الشكل النهائى للإشارة البصرية كصورة فى العقل البشرى، وتصميم التجارب العملية لتوظيف الثبات الإدراكى البصرى في إعادة إنتاج ملصق مصمم سابقا، وقياس مدى تأثير ذلك على الجمهور.

وتم الحصول على النتائج عبر قياس وتحليل زمن تعرض الجمهور عينة البحث لكل الملصقات العادية والمعاد إنتاجها عبر الثبات الإدراكى البصرى، كمعيار لجذب الإنتباه.

وأظهرت النتائج زيادة فعلية في زمن تعرض الجمهور عينة البحث للملصقات المعاد إنتاجها بإستخدام الثبات الإدراكى البصرى كمفهوم رئيسى في الصورة الرقمية المستخدمة، مقارنة بمثيلتها بدون توظيف الثبات الإدراكى البصرى، مما أكد فروض الدراسة.

وتبعا لهذه النتائج، فإن توصيات البحث تؤكد على وجوب زيادة الإهتمام بتوظيف الثبات الإدراكى البصرى في الصورة الرقمية المستخدمة في الملصق الإعلانى، وذلك لزيادة جذب الاهتمام للجمهور المستهدف وزيادة وقت تعرضه للرسالة الإعلانية فى الملصق.

References:

1. Pieters, R. & Wedel, M. Goal Control of Attention to Advertising: The Yarbus Implication. *J. Consum. Res.* **34,** 224–233 (2007).
2. Liu, S. S. Picture-Image Memory of TV Advertising in Low-Involvement Situations: A Psychophysiological Analysis. *Curr. Issues Res. Advert.* **9,** 27 (1986).
3. Choudhury, A. K. R. *Principles of Colour and Appearance Measurement*. *Principles of Colour and Appearance Measurement* (Elsevier, 2014).
4. Balcetis, E. & Dunning, D. See what you want to see: motivational influences on visual perception. *J. Pers. Soc. Psychol.* **91,** 612–25 (2006).
5. Johnson, J. *Designing with the Mind in Mind*. *Designing with the Mind in Mind* (2010). doi:10.1016/C2009-0-20318-7
6. Goldstein, E. B. *Encyclopedia of Perception Vol. 1 & 2*. (SAGE Publications, Inc, 2010).
7. Matthen, M. *The Oxford Handbook of Philosophy of Perception*. **12,** (Oxford Universty Press, 2016).
8. Sternberg, Robert J. ; Sternberg, Karin; Mio, J. *Cognitive Psychology*. (Cengage Learning, 2012).
9. Capó-Aponte, José E.; Temme, Leonard A.; Task, H. Lee; Pinkus, Alan R.; Kalich, Melvyn E.; Pantle, Allan J.; Rash, C. E. Visual perception and cognitive performance. *Sensation, Percept. Cogn. Issues* 335–390 (2009).
10. Pizlo, Z., Li, Y. & Steinman, R. M. Binocular disparity only comes into play when everything else fails; a finding with broader implications than one might suppose. *Spat. Vis.* **21,** 495–508 (2008).
11. Cohen, Dale J.; Jones, H. E. How Shape Constancy Relates to Drawing Accuracy. *Psychol. Aesthetics, Creat. Arts* **2,** 8–19 (2008).
12. Strauss, M. Description of illusion. Available at: http://physicsism.blogspot.com/2012/09/measure-relativity-illusion.html.
13. Vernon, M. D. *A Further Study of Visual Perception*. (Cambridge University Press, 2013).

14. Ebner, M. *Color Constancy*. (John Wiley & Sons Ltd, 2007).

15. Myers, D. G. *Psychology*. (Worth Publishers, 2010).

16. Hubel, D. . & Torsten, N. . *Brain and visual perception*. (Oxford University Press, Inc., 2005). doi:10.1017/CBO9781107415324.004

17. Ware, C. *Information visualization: perception for design*. *Information Visualization* (2004).

18. Rosenbergen, E., Pieters, R. & Wedel, M. Visual Attention to Advertising: A Segment-Level Analysis. *Oxford Univ. Press* (1997). doi:10.1086/209512

Author is an assistant professor at the Scientific College of Design. He received his BS, MAA, and PhD degrees in Applied Arts from the Helwan University in 1993, 2001 and 2006, respectively. He is the author of more than 5 journal papers and 6 books. His current research interests include Digital Image, Digital Image Editing, Visual Perception, Graphic Design, and Color and Visual Appearance. He is a member of Design Ergonomics Information Center, Adobe Education Exchange, Adobe Education Trainer Group, Adobe Campus Leaders Group and Creative Career and Technical Education Group.

Caption List