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Primary Perceptual Field in Visual Materials

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Abstract: This study aims to determine the field (s) that students tend to perceive first in an instructional material. It employs the scanning model and its study group consists of 378 sophomore students attending the Faculty of Education at Ahi Evran University. The data has been obtained by collecting the student responses to a visual material designed by the researchers. The results have been interpreted through the frequency, percentage, Kendall's tau_b and the Kolmogorov-Smirnov Z-test applied on the collected data. For the differences and relationships, a significance level of $p<0.05$ was deemed as sufficient. The analysis yielded the following conclusions: the field including the primarily perceived message in a visual principally focuses around the center of the visual or in the first point of interest according to the rule of thirds. In the subsequent visuals as well, students tend to look at the point where the message they primarily perceived is located. Finally in a visual containing informal balance, the primarily perceived message concentrates more on the center of the visual when compared to the formal balance.

Key words: Material development, message design, the rule of thirds, balance, integrity, perception

INTRODUCTION

Design is the process of specifying conditions for learning (Seels and Richey, 1994). Specifically in this context, instructional material design could be defined as the process of visualizing conditions for learning by specifying them. While, presenting information on the issue, several studies in the study underline that the use of visuals is of utmost importance for an easy and efficient recall of any piece of information (Alessi and Trollip, 2001; Chi *et al*., 1989; Dale, 1969; Morrison *et al*., 2001). The process of information visualization naturally requires several considerations.

The main purpose in designing a visual is expressed as attractiveness as well as capturing the audience's attention and creating a communication environment enabling the audience to easily grasp the information for easy recall of information (Szabo and Kanuka, 1998).

There have been several attempts in the field of education technology to specify universal criteria for more effective and successful visual materials. In preparing visual materials, the rule of thirds is one of the crucial rules that contribute to achieving visual balance (Barlow, 2006; Gary, 2004; Greenzweig, 2001; Gooch *et al*., 2001). This rule offers suggestions on how to make the audience instantly perceive a certain subject (s) or in other words, how to design on the screen the subjects of primary perception. Design rules are in general intended to ensure that the design guides the audience and makes them perceive and notice at first hand the important subjects of priority. In this context, the most important point that design rules need to consider is to demonstrate how the eye naturally move or tend to move, while looking at a certain image (George, 1992).

With the aim to determine the natural movements of the eye, while looking at a visual, several researches have been conducted since the early 1960s (Land *et al*., 1999; Nesbit, 1981; Newman, 1971). These studies experimented instruments and methods of various kinds. For instance, through the device he designed and named 'direct reading eye movement monitor system, which could record the eye movements of the viewers while, looking at a visual, Newman (1971) attempted to record the natural movements of the eye. Furthermore in their research, Land *et al*. (1999) attempted to identify the eye movements of viewers, while they were performing the very familiar tasks of daily life. To identify, the eye movements, they used in their research a head-mounted eye movement video camera, which was able to record the eye movements of the viewers with a only 1 degree error. At the same time, a second video camera recorded all the movements of the objects located in the research room. Analyzing each frame in the video records, which were associated with each other, the study attempted to identify the natural eye movements.

Preparing an attractive visual requires choosing an interesting subject and making an eye-catching design. In order to arouse, the curiosity of the audience and to stimulate their learning motivation, visuals in instructional materials could be prepared using various photography

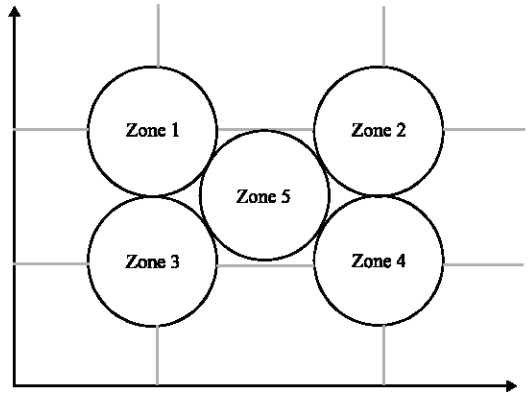

Fig. 1: Point of interest according to the rule of thirds

techniques (Oman, 2002). Art theories provide substantial information regarding the fact that the main theme should be located close to the center in a particular design (Solso, 1999; Gooch *et al*., 2001). However, the available research shows that the main theme should be driven out from the center towards the corners. Especially visuals placed parallel to horizontal or vertical lines in top-down or left-to-right direction provide a much more dynamic perception of the design (Clifton, 1973; Gooch *et al*., 2001). In this context, the rule of thirds is one of the crucial rules suggested to create an eye-catching design (Heinich *et al*., 2002) and is a rule commonly used for visual design in photography in particular (Barlow, 2006; Greenzweig, 2001; Golub, 2007; Lister, 2005).

The idea behind the rule of thirds is that if a visual is placed on the points of interest or along the lines formed by the points of interest, this will result in a much more balanced design and by the very nature of eye movements, the design would provide a much more natural perception (Barlow, 2006). The same rule also puts forward suggestions on how to identify and organize the points of interest in a visual. Points of interest could be defined as the areas where the viewers perceive visual stimuli best, where they perceive the visuals located in areas of focus earlier than the other visual objects and where they like viewing the visual as a whole (Greenzweig, 2001). In this respect, using two pairs of horizontal and vertical lines, the rule of thirds divides the visual into three equal horizontal and vertical parts and defines the intersection points of these lines as four separate points of interest (Banerjee, 2004; Barlow, 2006; Greenzweig, 2001; Gooch *et al*., 2001; Lister, 2005). According to the rule, these points are defined as the best areas of focus. Figure 1 shows the points of interest suggested the rule of thirds.

The relevant research reveals that while, looking at a particular visual, the eyes of the viewers tend to move towards one of the points of interest rather than the exact center of the visual. In this context, it could be suggested that for the visual and perceptual nature of the viewers, it would be more appropriate to make a design according to the rule of thirds, or in other words, to locate in one of the points of interest the visual pertaining to the main emphasized theme (Barlow, 2006).

As shown in Fig. 1, the first four areas (areas I-IV) are critical points of interest in a visual design. However although, there are no definite conclusions, on which area outweighs others as the potential focal point in a visual, which point of interest is perceived earlier than others, or the visual located in which point is more important than the ones located at other points in a design (Greenzweig, 2001), the message that is expected to be perceived first in the visual should be placed around point I. Nonetheless, according to the rule of thirds, the following points should be taken into consideration in the design of a visual (Golub, 2007; Oman, 2002). While, placing the main theme or the most important message to be perceived first in a visual, the points of interest should be considered. Vertical visuals should be placed along the vertical lines. Horizontal visuals or borders like the horizon should be placed along the horizontal lines.

The rule of thirds is not only important in identifying the potential focal points in a visual; but also in that it provides four guiding lines that could be used for an appropriate insertion of visuals in a visual design. To put it another way, it serves as an important rule for creating the balance in the design (Barlow, 2006; Gary, 2004; Greenzweig, 2001; Gooch *et al*., 2001). At first sight, one might think that it could create an unbalanced design to place the visual along vertical or horizontal lines. However, taking the design as a whole, establishing a layout appropriate with the structure of the visual might help a holistic perception of the design, which in turn allows establishing an informal balance within this integrity (Lister, 2005).

Consequently, there is not yet an exact answer for the question of where to place the main theme in a visual. In this context, while designing an instructional material, determining the fields, which students primarily perceive is important in placing the messages of particular emphasis into fields with a high likelihood of perception. The main problematic of the present study is to determine the field (s) that students tend to perceive primarily in an instructional material.

Research questions: The research basically aims to find answers to the following questions:

- Where is the primary perceptual field in an instructional material?

- Is there a relationship between the perceptual fields of the first and the subsequent images?
- Does the formal or informal balancing of objects bring about a change in the primary perceptual field?

MATERIALS AND METHODS

This study employs the descriptive scanning model. As is known, descriptive studies are intended to describe the situation of interest. In addition, scanning models aim to describe a current situation as it is and with an objective approach (Roscoe, 1975). Similarly, this study attempts to describe students' primary perceptual fields in instructional materials.

The study includes two different applications in its scope. The study group of the first application consists of a total of 150 sophomore students attending the Faculty of Education at Ahi Evran University, 53 of which attend the Department of Elementary Teaching, 73 the Department of Turkish Language Teaching and 24 the Department of Science Education. The study group of the second application consists of a total of 228 sophomores, 93 of which attend the Department of Elementary Teaching, 46 the Department of Turkish Language Teaching and 89 the Department of Science Education. Thus, the sample group of the study makes a total of 378 students.

Procedures: In the presentation that was used in the first application, the students were presented with 9 different screens to identify what they have first seen in each screen. As shown in Fig. 2, the first two images were symmetrically organized to constitute a formal balance with 9 two-digit numbers in each line and 6 two-digit numbers in each column, with a total of 54 two-digit numbers located in different spots. On the other hand in the third image, these numbers were asymmetrically placed to make an informal balance. In the subsequent, 3 images symbols and in the last 3 images upper and lower-case letters were organized in a similar configuration. While, this configuration included symbols in the 4th-6th images; image 7-9 organized upper and lower-case letters in a similar manner.

Prior to the application, a pilot study was carried out to determine the duration that the students were able to see a single number, letter or a symbol in each image and the minimum duration of perception was determined to be 2 sec in images containing letters and numbers and 2.5 sec in images containing symbols. During the presentation, the students were firstly informed about the type of knowledge (number, letter or symbol) to be presented on the screen and the related image was displayed for 2 sec

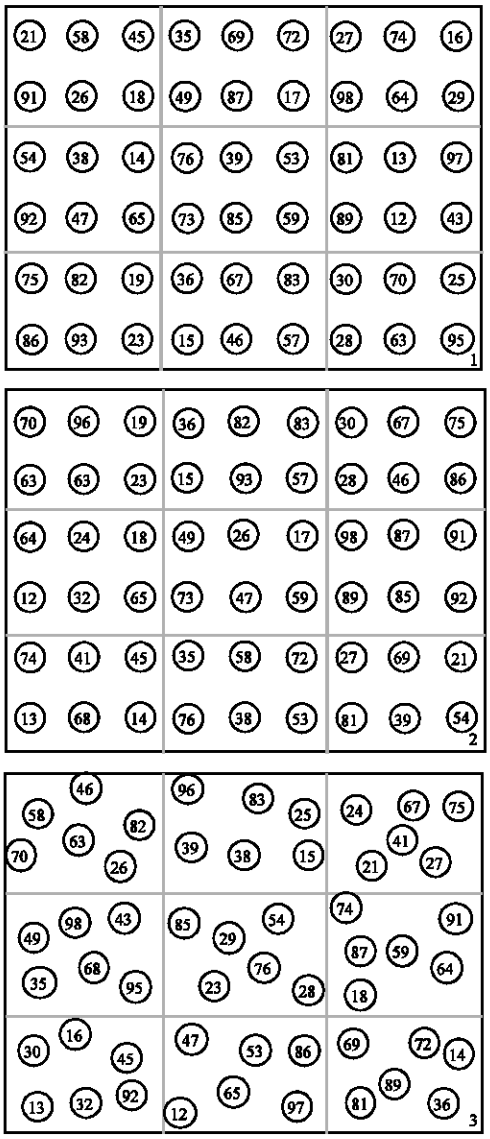

Fig. 2: Sample images from the presentation used in the first application

for images containing letter and numbers and for 2.5 sec for images containing symbols. After each images, different landscapes were displayed. While, the landscape was being displayed on the screen, the students were asked to write down the first number, letter or symbol they had seen in the forms they were given. In order to prevent the first image to affect the perception in the subsequent images, the landscapes were kept on the screen for a while and short conversations were made with the students regarding the landscape.

At the end of the first application, it was observed that in the images with differently encoded messages, the area containing the first perceived message was often the

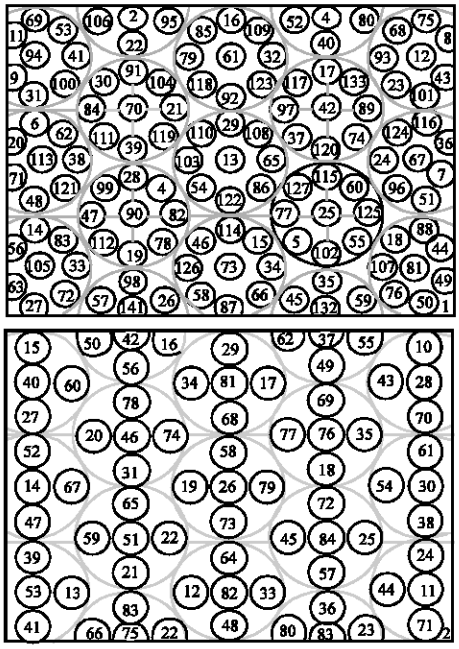

Fig. 3: Sample images from the presentation used in the second application

center of the visual, which is according to the rule of thirds, around the first point of interest. Nevertheless, the researcher experienced difficulties with calculating the exact rates of first perception for the reference fields as the messages used in the presentation were a little distant from each other and there were messages on the border lines of reference fields. Thus in order to achieve more accurate data on the rates of first perception for the reference fields regarding the first subproblem, the study was repeated with different groups with similar characteristics and with a different presentation.

In the presentation, used in the second application, the students were presented with two screens with different message layouts as shown in Fig. 3 to determine what they first saw in each screen. In this presentation, only numbers were used as messages and 2 sec were allowed for each screen.

Before each application, the students were given handouts, in which they could write down what they first saw in each of the images during the presentation and any kind of guidance was avoided so as not to affect the students' perception. Moreover, the researcher concealed from the students the guiding lines seen in Fig. 2 and 3 during the presentation.

Data collection: The study data was collected through a literature review and from the source groups by observing the student responses to two different PowerPoint presentations prepared by the researcher.

Analysis: While encoding the data, the images were divided into 3 equal rows and 3 equal columns. The upper left piece was named as the 1st field and the subsequent parts were named as the 2nd, 3rd … fields successively with a total of 9 fields. The data was encoded by determining the field containing the letter, number or symbol that the students first perceived in the visual. Moreover, these images were subjected to a different encoding, considering the points of interest of the rule of thirds, as the upper-left (I field), upper-right (II field), lower-left (III field), lower-right (IV field) and center (V field).

For the first subproblem, each student response to the nine images was independently analyzed, which increased N to N = 1350. In the second and the third subproblems, student responses to a group of three images with the same characteristics were independently analyzed, which increased N to N = 450. The results were interpreted through the frequency, percentage, Kendall's tau_b and the Kolmogorov-Smirnov Z-test applied on the collected data. For the differences and relationships, a significance level of $p<0.05$ was deemed as sufficient.

RESULTS

Primary perceptual field in instructional materials: Table 1 summarizes the findings on the fields in which the first perceived message concentrated in a total of nine separate visuals organized as a 3×3 matrix and presented to students as an instructional material.

Table 1 shows the fields including the first perceived message in 9 different images with differently encoded messages in the first application and in two different images with messages only encoded as numbers in the second application. An examination of these fields reveals that the 5th field located in the center of the visual was the most primarily perceived field in both applications (1st application: 50.0%; 2nd application: 51.5%). The least primarily perceived field in the first application was the 9th field (2.2%) in the lower-right-hand of the screen, while in the second application; it was the 7th field (1.2%) located in the lower-left part of the screen. Moreover, both applications yielded similar results.

Pertaining to the presentations used in the first and the second applications, Table 2 summarizes the findings about the fields, which were organized according to the rule of thirds in which the first perceived messages concentrated.

Examining the points of interest according to the rule of thirds, Table 2 demonstrates that the fields containing the most primarily perceived message in both applications are again the 5th reference field located in the center of

Table 1: The primary perceptual field in an instructional material organized as a 3×3 matrix

Applications	1	2	3	4	5	6	7	8	9	Total
Frequency	105.0	114.0	40.0	200.0	674.0	62.0	55.0	69.0	31.0	1350
Percent	7.8	8.4	3.0	14.9	50.0	4.4	4.1	5.2	2.2	100
Frequency	47.0	60.0	16.0	43.0	235.0	17.0	5.0	18.0	15.0	456
Percent	10.3	13.2	3.5	9.4	51.5	3.7	1.2	3.9	3.3	100

Table 2: The primary perceptual field in an instructional material organized according to the rule of thirds

Applications	1	2	3	4	5	Others	Total
Frequency	256.0	96.0	151.0	68.0	406.0	373.0	1350
Percent	19.0	7.1	11.2	5.0	30.1	27.6	100
Frequency	103.0	24.0	25.0	27.0	165.0	112.0	456
Percent	22.6	5.3	5.5	5.9	36.2	24.5	100

Table 3: The relationship between the perceptions in the first image and the perceptual fields in the subsequent images

Image	Image 1	Image 2	Image 3
Kendall's tau_b			
Image 1			
r	1.000	0.134	0.062
p	-	0.001	0.108
N	450.000	450.000	450.000
Image 2			
r	0.134	1.000	0.132
p	0.001	-	0.001
N	450.000	450.000	450.000

the screen (1st application: 30.1%; 2nd application: 36.2%) and the 1st reference field in the upper-left corner of the center (1st application: 19.0%; 2nd application: 22.6%). On the other hand, the least primarily perceived reference fields are the 4th reference fields in the lower-right corner of the center (5.0%) in the first application and the second reference field in the upper-right corner of the center (5.3%) in the second application. It was observed that in the first application 27.6% of the students and in the second one 24.5% of the students first perceived the numbers located in the fields other than these five points of interest according to the rules of third. Moreover, another observation is that the primary perceptual fields are similar in both applications. Figure 4 and 5 show, the primary perceptual fields in both applications.

As shown in both scatter diagrams in Fig. 4 and 5, the field containing the most primarily perceived messages is observed to be the center of the visual and around the 5th and 1st reference fields according to the rule of thirds in images with differently encoded messages. Hence, it follows that in a visual containing >1 message, arguably, placing the message to be primarily perceived in the center of the visual or around the first point of interest increases the likelihood of the message to be primarily perceived.

The relationship between the perception in the first image and the perceptual fields in the subsequent images: Table 3 summarizes the findings on the relationship between the primary perceptual field in an image in an instructional material and the primary perceptual fields in the subsequent images.

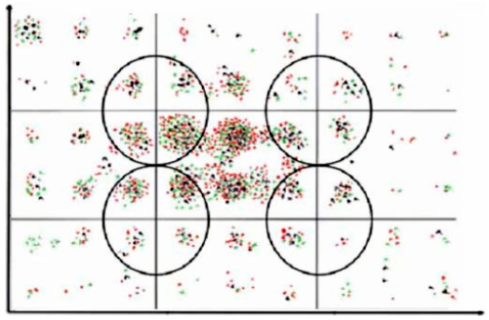

Fig. 4: The scatter diagram of the primary perceptual field in the first application

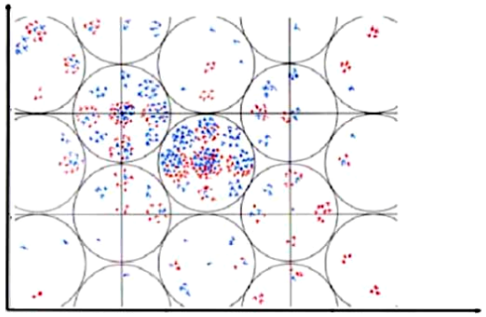

Fig. 5: The scatter diagram of the primary perceptual field in the second application

An examination of Table 3 reveals that there exists a positively significant relationship between the first and second images ($r = 0.34$, $p<0.01$) as well as between the second and the third images ($r = 0.32$, $p<0.01$). With this finding, it could be interpreted that there is a significant relationship between the primary pe rceptual field of an image in an instructional material and the primary perceptual fields in the subsequent images. To put it another way, it could be suggested that in the subsequent images, the students are inclined to look at the point where, the message they primarily perceived in the previous image is located.

From this point of view, arguably, there should be a consistency between the locations of the messages to be primarily perceived in different images in an instructional material.

Table 4: The findings on the primary perceptual field in formal and informal balance according to the fields organized into a 3×3 matrix

Applications	1	2	3	4	5	6	7	8	9	Total	Z-score	Balance
Formal											**Most extreme differences**	
Frequency	57	52	11	80	204	10	13	14	9	450	Absolute	0.160
Percent	12.7	11.6	2.4	17.8	45.3	2.2	2.9	3.1	2.0	100	Positive	0.160
Informal											Negative	0.000
Frequency	14	35	17	62	231	32	21	27	11	450	Kolmogorov-Smirnov Z	2.400
Percent	3.1	7.8	3.8	13.7	51.3	7.1	4.8	6.0	2.4	100	Asymp. Sig. (2-tailed)	0.000

Table 5: Primary perceptual field in formal and informal balance according to the fields organized by the rule of thirds

Balance	1	2	3	4	5	Others	Total
Formal							
Frequency	122.0	27.0	50.0	18.0	102.0	131.0	450
Percent	27.1	6.0	11.1	4.0	22.7	29.1	100
Informal							
Frequency	69.0	35.0	46.0	22.0	154.0	124.0	450
Percent	15.3	7.8	10.2	4.9	34.2	27.6	100

The effect of formal and informal balance on the primary perceptual field: Table 4 summarizes the findings on whether the primary perception field changes with formal or informal balance created by the messages in a visual according to the fields organized into a 3×3 matrix in an instructional material.

An examination of Table 4 reveals that in a screen organized into a 3×3 matrix, a formal or an informal balance created by the messages in an instructional material brings about a significant difference in the primary perceptual field ($Z = 2.0$, $p<0.01$). As shown by Table 4, in both images with formal balance and images with informal balance, most of the students first perceived the message in the 5th field located in the center of the visual. However, the concentration in the 5th field in the visual with informal balance (51.3%) increased in comparison with the visual with formal balance (45.3%). As is shown the second primarily perceived field after the 5th field was the 4th field located in the middle-left part of the screen. In both of the images, the field containing the least primarily perceived messages was the 9th field located in the lower left corner of the screen.

Pertaining to the fields organized according to the rule of thirds in an instructional material, Table 5 summarizes the findings on the effect of formal or informal balance created by the messages in a visual upon the primary perception field.

An examination of Table 5 reveals that, drawing upon the fields organized according to the rule of thirds, both in the images with formal and informal balance, the most primarily perceived field is again the 5th field located in the center of the visuals. However in the image with informal balance, the concentration on the 5th field located in the center (34.2%) is much higher when compared to the image with formal balance (22.7%). After the 5th field, the center of the visual, it is shown that the most primarily perceived field is the 1st reference field

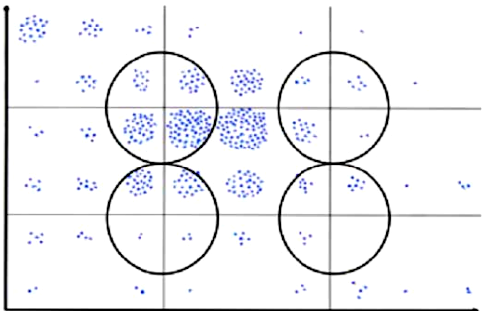

Fig. 6: Formal balance scatter diagram

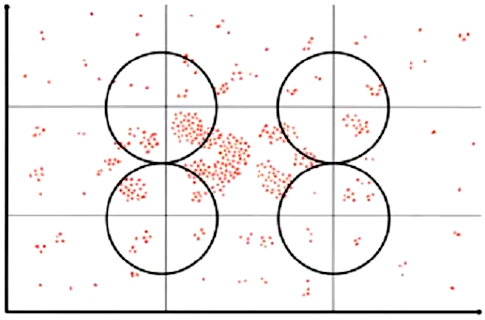

Fig. 7: Informal balance scatter diagram

located in the upper-left corner in both of the images. As observed, the concentration in the first reference field increased in formal balance (15.3%) when compared to informal balance (15.3%). In both images, the point of interest with the lowest level concentration is the 4th point of interest located in the lower-left corner of the center.

Figure 6 and 7 show the scatter diagrams of the primary perceptual field according to formal and informal balance.

An examination of the scatter diagrams in Fig. 6 and 7 reveals that the primarily perceived message in the visual with informal balance concentrates much more on the center when compared to the visual with formal balance. In contrast, the concentration on the 1st reference field is less than the visual with formal balance. On the other hand, according to the rule of thirds, the number of students who did not concentrate on any particular reference field, but were rather distracted by the

other parts of the visual was higher in the visual with formal balance (29.1%) than it was in the visual with informal balance (27.6%). In both images, according to the rule of thirds, the students, who were distracted by the other parts of the visual and did not concentrate on any particular reference field are not strikingly concentrated around any specific point. As a result, it might be stated that creating informal balance in an instructional material design focuses the primary perception on the center and prevents the perception from randomly dispersing over the visual when compared to informal balance. From this point of view, it could be argued that creating informal balance in an instructional material is more useful than creating formal balance.

DISCUSSION

In a visual with multiple messages, the field containing the most primarily perceived message is the center of the visual and the region around the first point of interest according to the rule of thirds. Thus, it could be stated that, in a visual containing messages, placing the message to be primarily perceived in the center of the visual or near the first point of interest increases the possibility that the message is primarily perceived.

This finding is compatible with other research results. For instance, a study by Oman (2002) demonstrated that placing visuals in the center of instructional materials attracts more attention and it would be more difficult for viewers to comprehend the subject of emphasis if the visual is placed in points other than the center. On the other hand, a study conducted by Lister (2005) argues that the images placed on one of these four points of interest are perceived as the main theme of the visual.

The studies emphasize that while, looking at a particular visual, the eyes of the viewers tend to move towards one of the points of interest rather than the exact center of the visual and it could be suggested that for the visual and perceptual nature of the viewers, it would be more appropriate to locate in one of the points of interest the visual pertaining to the main emphasized theme (Barlow, 2006). Thus, they perceive the visuals placed in the reference fields earlier than other visual objects (Greenzweig, 2001). It is also, stated that applying the rule of thirds and placing the main theme according to the vertical and horizontal axes, one could achieve a holistic perception of the design, which might enhance the effectiveness of the instructional material (Gooch *et al*., 2001; Lister, 2005). On the other hand, if a visual is placed on the points of interest or along the lines formed by the points of interest, this will result in a much more balanced design and by the very nature of eye movements, the design would provide a much more natural perception (Barlow, 2006). The studies show that aesthetically well-designed visuals attract more attention and significantly contribute to learning levels and that one of the general rules to be observed to achieve attractiveness for a visual design is balance (Lee and Boling, 1999).

As stated above, most studies in the study, which argue that the message to be primarily perceived in a visual should be placed near the first reference field do not recommend placing the message to be primarily perceived in the center of the visual. Nevertheless, the present study obtained findings regarding the fact that the likelihood of a message to be primarily perceived is higher if it is located in the center of the visual.

There is a significant relationship between the primary perceptual field of an image in an instructional material and the primary perceptual fields in the subsequent images. To put it another way, it could be suggested that in the subsequent images, the students are inclined to look at the point where the message they primarily perceived in the previous image is located. From this point of view, arguably, there should be a consistency between the locations of the messages to be primarily perceived in different images in an instructional material. This finding is compatible with the results in the study.

Brooks (1993) suggests that simplicity and consistency is among the important design principles in a visual design. He also asserts that when the images change in a visual material, the basic design of the visual should remain the same and only the information on the visual should change, allowing the viewers to decide intuitively on where to look at in the visual. Similarly, Milheim and Lavix (1992) state that an instructional material could contain various kinds of messages in each of the images and that the organization of these messages in accordance with their types should not change throughout the material in other words, providing consistency is important to attract attention. Rambally and Rambally (1987) argue that the questions and important messages in a screen should be located in the center of the screen and that this should be maintained consistently in all the images in the instructional material.

The primarily perceived message in the visual with informal balance concentrates much more on the center when compared to the visual with formal balance. In contrast, the concentration on the 1st reference field is less than the visual with formal balance. On the other hand, according to the rule of thirds, the number of students who did not concentrate on any particular reference field, but were rather distracted by the other

parts of the visual was higher in the visual with formal balance than it was in the visual with informal balance. In both images, according to the rule of thirds, the students who were distracted by the other parts of the visual and did not concentrate on any particular reference field are not strikingly concentrated around any specific point.

CONCLUSION

As a result, it might be stated that creating informal balance in an instructional material design focuses the primary perception on the center and prevents the perception from randomly dispersing over the visual when compared to informal balance. Furthermore, Arnheim (1974) and Heinich *et al.* (2002) emphasize that as informal balance, when compared to formal balance, provides a much more dynamic attractive perception, it is more commonly preferred in designs.

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