

# The Effectiveness of Gestalt Visual Perception Laws in Designing Electronic Pages for the Delivery of First Aid Training

Saeed Shahhosseini<sup>1</sup>\*, PhD 

<sup>1</sup>Department of Educational Sciences, Faculty of Humanities, Arak University, Arak, Iran

## ABSTRACT

**Background:** Using electronic content (text) requires graphic designs; therefore, graphic organization of electronic pages is a necessity. The use of Gestalt visual perception laws has emerged as an effective principle in content design. This research aimed to investigate the use of gestalt visual perception laws in designing electronic pages, and determine its effect on learning the first aid skills.

**Methods:** This was a quasi-experimental study with pretest-posttest control group design. The experiment was conducted in the Educational Sciences Department of Arak University in 2018. The participants included 30 students aged 23-25 years. They were selected by convenience sampling and randomly assigned to two groups. The experimental group learned lessons from electronic pages designed using the Gestalt laws, and the control group learned from electronic pages designed without following Gestalt laws. Data collection was performed using a researcher-made test on first aid. For data analysis, descriptive statistics, mean, frequency, standard deviation, and covariance analysis were used.

**Results:** A significant difference was observed between the experimental and control groups in terms of applying Gestalt visual perception laws in learning the first aid. The mean scores of the respective groups were 18.33 and 15.46 for similarity ( $P=0.001$ ), 17.86 and 13.26 for proximity ( $P=0.001$ ), and 19.00 and 16.53 for continuity ( $P=0.001$ ). The results of the experimental group reflected a positive effect.

**Conclusion:** The results indicate the significant effects of applying Gestalt visual perception laws in electronic content design on the learning of first-aid skills. Gestalt Laws have increased interaction by organizing the learning content, as well as bringing graphic unity to pages and simplifying navigation. Therefore, they have improved the learning outcomes.

**Keywords:** Gestalt laws, Graphic organization, Electronic pages, Learning

\*Corresponding author:

Saeed Shahhosseini, PhD;  
Department of Educational  
Sciences, Faculty of  
Humanities, Arak University,  
Arak, Iran  
**Email:** s-shahhosseini@araku.  
ac.ir

Please cite this paper as:

Shahhosseini S. The  
Effectiveness of Gestalt  
Visual Perception Laws in  
Designing Electronic Pages  
for the Delivery of First  
Aid Training. *Interdiscip  
J Virtual Learn Med Sci.*  
2021;12(4):250-258. doi:10.30476/  
IJVLM.2021.89159.1067.

Received: 01-12-2020

Revised: 19-10-2021

Accepted: 25-10-2021

## Introduction

Serving as a vital life skill in human societies, first aid is included in the curriculums of schools and educational centers (1-3).

With the development of educational technologies, applying them to first aid training has also been taken into consideration. The media, in particular, have an effective role in improving education (4).

With the advent of e-learning and the widespread recognition of its benefits, it has been used to improve the learning of first aid concepts and skills (5). E-learning could also become a substitute for common education and an innovative form of distance learning to enhance skills and knowledge (6).

One of the advantages of e-learning is greater possibility for communication, hence enhanced interaction among learners. Multimedia and interactive electronic pages are among the major means of communication in e-learning; considerable research has been done regarding the effects of these methods of communication (7). Webpages function as hypermedia, and therefore the operators care a lot about users' actions and decisions. The efficiency of these pages depends on network routing and website ranking; any flaws could leave the visitors misguided and confused, which is a downright threat to these pages (8, 9).

Therefore, there is a unique aspect to electronic pages which distinguishes them from videos, photos, and graphics; these pages are interactive and dynamic (10).

If users have difficulty using websites, they may avoid them altogether. Website efficiency affects user satisfaction (11). Evidence shows that people have a much greater inclination to utilize user-friendly software products and applications (12).

Since the advent of multimedia, designing interfaces for better interaction has been considered as a mutual effort for learners, educational systems, and learning materials (13).

In view of interaction between users and dynamic electronic pages, navigation of

information is of utmost importance. If users cannot easily track the information they need, they will not be successful in e-learning. Users and audiences not only observe these pages but interact with them and navigate through the text. Then they start searching for content by finding the icon they have been looking for. Therefore, cohesion in these pages has a huge impact on efficiency (14). Evidence shows that facilitated interaction with electronic instructional media leads to a faster learning process and creates a positive attitude towards the media. This interaction also helps with content retention (15).

Navigation in electronic pages helps with avoiding misguidedness and saving time. It also makes it easier to search for topics and use available content. Thus, easier navigation has become an important factor in designing interfaces for electronic media (16). Users and audiences of these types of media have always been the center of attention.

A proper design of electronic pages can set the stage for better navigation and interaction. Proper cohesion of details on these pages can guide the user's eyes and mind to find the desired content (17).

Tan et al. (18) showed that adjusting users' actions in accordance with electronic page design creates a better interaction between a computer and its users. When utilizing the pages, "recalling navigation" is important. Users' memory plays a significant role in accustoming to and detecting symbols and symptoms in the real world. Similarly, they confront a new design in the virtual world that may put their memory at risk and make it hard to remember where exactly the located content is. Therefore, it is critical to factor in the possible effects of recalling navigation.

Li et al.'s findings (19) revealed the effect of designing patterns for navigation in mobile phone applications on adults' navigating behavior. They compared content-oriented design with menu-oriented design. Their study finds the advantages of design patterns supported by content as a navigation method and suggests several design considerations.

Roupe et al. (20), Lamprecht et al. (21) and

Castilla et al. (22) also declared navigation as an important feature of electronic pages.

In order to improve the navigation of the content in the design of electronic pages, the pages should be displayed in an appropriate composition. This is in view of the fact that electronic pages and multimedia are subject to visual communication laws; therefore, visual design is important in their structures (16).

Readers of various written texts and visuals are usually affected by graphic design. Organizing texts and modifying their composition would simplify the cognitive process. Shapes and colors, as the main elements in composition, affect the text comprehension, in which a difference in the geometric construct of the text can change its content (23).

Despite the advances in the methods of designing electronic media's interface, the relationship between users and content is still significant and firmly established (24). An integrated approach that includes users, content, and form is comprehensive enough to guide the design of novel and effective interfaces (25, 26).

The main stages in multimedia design are media selection, attention design, and navigation and integration design. User and media interaction still has a prominent place in research, and users' satisfaction is critical (27).

Kools et al. (28) have shown that by graphic organizing, we can understand a health education text better. Applying simple techniques can improve learning. Also, graphic organizing has had a positive impact on children with learning disabilities (29). In this regard, Ciullo et al.'s review of previous studies (30) provides sufficient evidence in support of these effects.

One of the important approaches to organizing the texts for better comprehension is to comply with the "gestalt visual perception laws". Since they were first introduced, graphic designers have applied these laws in visual organizations (31).

Wertheimer, Koffka, and Kohler were the three German psychologists who founded the psychological school of Gestalt in 1920 (32).

Since then, gestalt laws of visual perception have been put to use by visual artists and graphic designers (33). Using them reflects the psychological dimension of visual composition (34).

Accordingly, psychologists have set up laws for composing visual elements. These laws bring a proper graphic organization to the image. The most important laws are described as follows (35).

In *Similarity law*, when there are similar shapes or same colors in a frame, we are likely to consider them as a unified group (36).

In *Closure law*, our eyes tend to see incomplete shapes and orientations as complete; For instance, when we see half of a circle in a frame, our eyes see the missing half of it (37).

*Proximity* is one of the most important principles in grouping objects. When objects are closely placed, they are seen as a single shape (36).

In *continuity law*, when we put points in a direction, our eyes tend to continuously trace them as a straight, curved, or wavy line (35).

In *Figure-ground law*, the human brain tends to see a part of an image as the foreground and the other part of it as the background. Sometimes foreground and background are merged together in a way that cannot be specified (38).

As in other visual presentations, in electronic pages, rules of visual perception are applied. When designing these pages and multimedia, the use of these rules makes understanding the pages convenient and causes coherence (39).

Chiu et al. (40) used Gestalt theory to investigate the effects of color similarity on blurring the boundary of advertisement banners on top of webpages and the content in those pages. The results showed that this similarity between colors of header and content leads users to pay more attention to the advertisements. They also found that color similarity on browsing behavior was the same in the congruent and incongruent advertisement-webpage content condition.

Hence, navigation is possible when users'

eyes and mind are guided through pages with content, and this process is directly connected to the systematic design of pages. Also, Gestalt visual perception and similarity, proximity, and continuity laws can help with unity and cohesion in electronic pages (7). Similarity, continuity, and proximity can help with unifying the content and simplifying navigation. Given the limited research on the effect of these three elements on learning, the aim of this research is to study the effectiveness of Gestalt visual perception laws in designing electronic pages for learning first aid.

## Methods

### *Study Design*

This study used a quasi-experimental research method employing pretest-posttest control group design and was conducted according to the 2010 Consolidated Standards of Reporting Trials (CONSORT) criteria. This study was supervised by the research council of Arak University.

### *Participants*

The participants included 30 female students aged 23-25 years, who were selected by convenience sampling and assigned randomly to two groups. Fifteen subjects belonged to the experimental (intervention) group and 15 belonged to the control group. Each group's sample size was set at 15.

### *Eligibility Criteria*

None of the students had participated in first-aid training courses before. In order for each group to be equal, participants with the same GPAs were chosen.

### *Setting*

The statistical population included student of the Educational Sciences Department of Arak University (Arak, Iran) in 2018-2019.

### *Intervention*

To hold the test, contents related to first-aid were formed into two different types of media consisting of electronic pages. For the experimental group, the first type of media

was prepared using electronic pages following similarity, proximity, and continuance laws. The second type of media, for the control group, was prepared using electronic pages without following any of the gestalt visual perception laws.

The content was prepared by the Red Crescent Youth Organization's booklets. It included eight lessons: poisoning, wounds, burns, triage, and bandaging, splinting, and displacing the injured. Each part was presented in several electronic pages. In the first type of media, each page was organized using one or more gestalt laws. For similarity law, similarities in color, shape, and size were used, and in the second type of media, none of the gestalt laws were used.

### *Outcomes*

The main outcome was the assessment of the participant's learning level before and after the use of electronic pages. Also, comparison of two groups' learning levels was the aim.

### *Sample Size*

The participants were students in the age range of 23-25 from the Educational Sciences Department of Arak University. A class of 30 students was selected by convenience sampling in order to control the intervening variables and was assigned randomly to control and intervention groups. The sample size based on Seraji et al.'s (41), Ghaffari et al's (42), and Celik's (43) studies was specified.

### *Randomization*

Initially, a list of participants was prepared and assigned to each person, with a number in order of 1 to 30. Then, using Excel software, students were divided into two groups. Fifteen students were assigned to the intervention group and 15 students were assigned to the control group.

### *Statistical Methods*

SPSS V26 was conducted to analyze the data. In order to compare the scores of pretest and posttest taken by each group, the analysis

of covariance (ANCOVA) was used. For test validity, Content Validity Ratio (CVR) index was done by five experts, and the results were calculated. The obtained CVR value was 0/99. For test reliability, a one-week test-retest was used and the calculated coefficient was 0.89. Before holding the covariance test, necessary presupposition defaults such as data distribution normality (kms test  $P=0.200$ ), homogeneity of the variance) Levene’s Test ( $P=0.385$ ) were set.

*Ethical Considerations*

The research protocol was explained to all participants. They were assured that participating in the study would be no problem for other courses. Also, it was explained that there is no obligation to cooperate. Everyone participated in this experiment with satisfaction and interest.

*Stimuli and Procedure*

In order to run the test, a researcher-made questionnaire including 45 questions regarding first-aid content was prepared, bleeding (4), poisoning (6), burns (4), triage (3), bandage (10), splinting (8), and displacing the injured (10). The test was comprised of four choice-questions.

Each question valued one point and the final score was between 1 to 45 points. Each question had only a correct answer. The score of correct answer was “1”, and for the incorrect, the score was “0”.

First, both the experimental group and

the control group took the 45-question pre-test and the results using the analysis of variance (ANOVA) showed that there was no particular difference between the two groups’ knowledge of first-aid.

During eight short sessions, participants learned first-aid content with the media provided. In each session, each group had to learn the first lesson in 10 minutes using electronic pages, and then take the test immediately.

The test was also formed into the same three parts. Finally, the results of each test were compared (Figure 1).

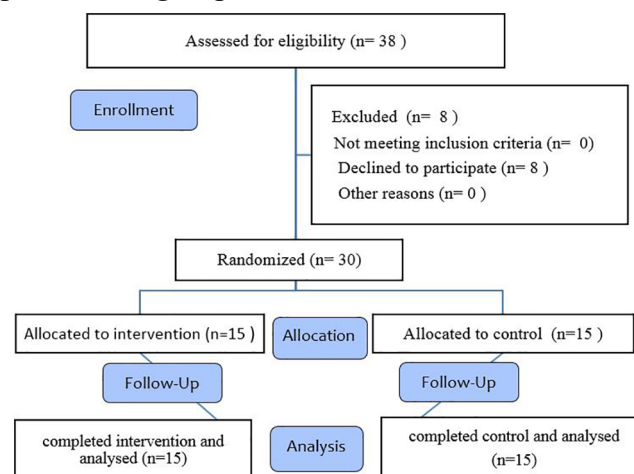
**Results**

In this research, 30 students were assigned to control and experimental groups. The results of the pre-test and post-test for learning outcome and gestalt laws are presented in Table 1.

Table 1 shows the average score of the pre-test taken by both the experimental and control groups. The means of the group after training with electronic content following the gestalt perception laws and training without the gestalt laws were different, and participants in the experimental group gained higher average scores.

In this study, the analysis of covariance (ANCOVA) was used to examine the hypotheses of the study.

The results of the ANCOVA test on learning first-aid content are presented in Table 1.



**Figure 1:** the progress through the phases of a parallel randomized trial of 2 groups

**Table 1:** Mean and standard deviation and-ANCOVA analysis of Gestalt visual perception three dimensions of pre-test and post-test experimental and control groups.

	Variable	Measurement	Groups	Number	Mean	Standard Deviation	P value
Learning	Similarity	Pretest	Experimental	15	9.20	2.73	0.325
			Control	15	8.00	1.73	
		Posttest	Experimental	15	18.33	1.49	0.001
			Control	15	15.46	1.76	
	Proximity	Pretest	Experimental	15	8.80	2.42	0.462
			Control	15	7.93	1.75	
		Posttest	Experimental	15	17.86	1.68	0.001
			Control	15	13.26	3.82	
	Continues	Pretest	Experimental	15	8.00	2.47	0.667
			Control	15	9.00	2.10	
		Posttest	Experimental	15	19.00	1.00	0.001
			Control	15	16.53	1.55	

Findings in Table 1 show that there is a significant difference between the control group and the experimental group whose electronic pages were designed following the similarity law ( $P=0.001$ ). Also, there is a significant difference between the control group and the experimental group whose electronic pages were designed following the proximity law ( $P=0.001$ ). Moreover, there is a significant difference between the control group and the experimental group in how their electronic pages were designed, following the continuance law ( $P=0.001$ ). Therefore, findings resemble the effects of gestalt laws on learning first-aid content.

## Discussion

This research aimed to analyze the effects of gestalt visual perception in designing electronic pages on learning first-aid content. Since gestalt visual laws are

important in designing and organizing electronic pages (31, 34), during this study, electronic pages were designed with gestalt visual laws in mind. In this research, proximity, similarity, and continuance laws were considered. The result of this research showed that applying these laws improves learning first-aid content. Gestalt laws cause a sort of graphic organization. To explain this effect, as we know, composition makes it easier to understand visual content (23). Composition is caused by the proper

organization of visual elements on the page (23, 28, 29). In other words, elements which are gathered following the laws cause unity and cohesion. (16) This order creates several categories in a picture, making it faster and easier to find different elements, as well as mental coherence. Moreover, in electronic pages and e-learning, interaction with provided content is important. The user takes multiple paths in these pages and non-linearly makes various choices. Interaction was another element that was used in this study to design pages. While interacting, finding content hierarchy is important. Therefore, in designing pages, we attempted to create proper navigation by applying gestalt laws, and it led to a significant increase in interaction between learners and media. Since interaction and learning are directly related (13, 15, 24), it seems learning first-aid in this study was affected by applying gestalt visual laws.

Tan et al. (18) also insisted on the effects of web pages on increasing interaction and improving memory when reading the pages. Findings from Li et al. (19) study also emphasized the effects of designing patterns on navigation. Besides, there are more results available to insist on the effects of graphic design on navigation (20-22). Applying gestalt laws creates pages that are convenient for students to use as proper design indirectly affects learner's satisfaction (11). Learners are

more interested in learning with user-friendly software (12). According to the findings, these three laws are all effective. Although the results showed the effect of gestalt visual perception laws, other gestalt laws can be examined in future research. Three gestalt laws cannot be effective completely when there is different use of shapes, colors, and filling electronic pages with several visual elements. This causes clutter and fails unity. Unity is one of the results of following the gestalt laws (16). Therefore, trying to present unity in electronic pages not only brings a sense of attraction and aesthetics, (44) but also leads to a proper graphic organization.

### Ethical Considerations

This study was conducted with the consent of the participants. Also, all participants were fully aware of the nature and confidentiality of the research and were told that their information would be kept confidential.

This study was supervised by the research council of Arak University.

### Availability of Data and Materials

The data that support the findings of this study are available from the corresponding author on request.

### Conflict of Interest

There is no conflict of interest in this research.

### Acknowledgments

The author of the present study appreciates the students of Arak University for their participation in this research.

### Funding/Support

This study was funded by Arak University.

### References

- 1 Lenson S, Mills J. First aid knowledge retention in school children: A review of the literature. *Australasian Journal of Paramedicine*. 2016;13(1) doi:10.33151/jap.13.1.233
- 2 Sharif NA, Hasan MK, Jamaludin FI, Firdaus MK. The need for first aid education for adolescents. *Enferm Clin*. 2018 Feb 1;28:13-8. doi:10.1016/S1130-8621(18)30028-7
- 3 Ekaprasetia F, Kristianto H, Susanto T. First Aid Guideline (FAG): A first aid education application for children aged 11–14 years in Indonesia. *J Taibah Univ Med Sci*. 2018 Dec 1;13(6):587-91. doi:10.1016/j.jtumed.2018.05.002
- 4 Celik S. A media comparison study on first aid instruction. *Health Educ J*. 2013 Jan;72(1):95-101. doi:10.1177/0017896911430762
- 5 Mishra A, Rani S, Bhardwaj UD. Effectiveness of e-learning module on first aid: a study on student nurses. *Amarjeet Kaur Sandhu*. 2017 Jul;9(3):5. doi:10.5958/0974-9357.2017.00060.5
- 6 Kalokairinoua OK, Kapadochos T, Tzavara C. Evaluating a health educational First Aid program with the implementation of synchronous distance learning. Integrating information technology and management for quality of care. 2014 Jul 24;202:56. doi:10.3233/978-1-61499-423-7-56
- 7 Hosseini M. The Effect of Online Interpretations via Interactive White Boards on Vocabulary Learning. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*. 2020 Mar 1;11(1):37-45. doi:10.30476/ijvlms.2020.84307.1002.
- 8 Dhalpe P, Bhardwaj D. Effective User Navigation through Website using Dice Coefficient. *International Journal of Science and Research (IJSR)*. January 2016; 5(1): 1353-1377. doi:10.21275/v5i1.nov153001
- 9 Djonov E. Website hierarchy and the interaction between content organization, webpage and navigation design: A systemic functional hypermedia discourse analysis perspective. *Information Design Journal*. 2007 Jan 1;15(2):144-62. doi:10.1075/idj.15.2.07djo
- 10 Schez-Sobrino S, Gmez-Portes C, Vallejo D, Glez-Morcillo C, Redondo MA. An intelligent tutoring system to facilitate

- the learning of programming through the usage of dynamic graphic visualizations. *Applied sciences*. 2020 Jan;10(4):1518. doi:10.3390/app10041518
- 11 Belanche D, Casaló LV, Guinalíu M. Website usability, consumer satisfaction and the intention to use a website: The moderating effect of perceived risk. *Journal of retailing and consumer services*. 2012 Jan 1;19(1):124-32. doi:10.1016/j.jretconser.2011.11.001
  - 12 Tadel F, Baillet S, Mosher JC, Pantazis D, Leahy RM. Computational Intelligence and Neuroscience, 2011. *Brainstorm: a user-friendly application for meg/eeg analysis*. 2011;8. doi:10.1155/2011/879716
  - 13 Najjar LJ. Principles of educational multimedia user interface design. *Human factors*. 1998 Jun;40(2):311-23. doi:10.1518/001872098779480505
  - 14 Burgess N, Maguire EA, O'Keefe J. The human hippocampus and spatial and episodic memory. *Neuron*. 2002 Aug 15;35(4):625-41. doi:10.1016/S0896-6273(02)00830-9
  - 15 Garzotto F, Bordogna M. based multimedia interaction as learning tool for disabled children. In *Proceedings of the 9th international Conference on Interaction Design and Children 2010 Jun 9 (pp. 79-88)*. doi:10.1145/1810543.1810553
  - 16 Costello, V. (2012). *Multimedia Foundations (1st ed.)*. Routledge. doi:10.4324/9780240813950
  - 17 Wang Q, Yang S, Liu M, Cao Z, Ma Q. An eye-tracking study of website complexity from cognitive load perspective. *Decision support systems*. 2014 Jun 1;62:1-0. doi:10.1016/j.dss.2014.02.007
  - 18 Tan GW, Wei KK. An empirical study of Web browsing behaviour: Towards an effective Website design. *Electron Commer Res Appl*. 2006 Dec 1;5(4):261-71. doi:10.1016/j.elerap.2006.04.007.
  - 19 Li Q, Luximon Y. Older adults' use of mobile device: usability challenges while navigating various interfaces *Behav Inf Technol*. 2020 Aug 2;39(8):837-61. doi:10.1080/0144929X.2019.1622786
  - 20 Roupé M, Bosch-Sijtsema P, Johansson M. Interactive navigation interface for virtual reality using the human body. *Comput Environ Urban Syst*. 2014 Jan 1;43:42-50. doi:10.1016/j.compenvurbsys.2013.10.003
  - 21 Lamprecht D, Lerman K, Helic D, Strohmaier M. How the structure of Wikipedia articles influences user navigation. *New Rev Hypermedia Multimed*. 2017 Jan 2;23(1):29-50. doi:10.1080/13614568.2016.1179798
  - 22 Castilla D, Garcia-Palacios A, Miralles I, Breton-Lopez J, Parra E, Rodriguez-Berges S, Botella C. Effect of Web navigation style in elderly users. *Comput Human Behav*. 2016 Feb 1;55:909-20. doi:10.1016/j.chb.2015.10.034
  - 23 Trummel P. Shape of concept: color percept... graphics, geometry, and gestalt. *IEEE Trans Prof Commun*. 1991 Sep;34(3):174-9. doi:10.1109/47.84111
  - 24 Bollini L. Beautiful interfaces. From user experience to user interface design. *The Design Journal*. 2017 Jul 28;20(sup1):S89-101. doi:10.1080/14606925.2017.1352649
  - 25 Blair-Early A, Zender M. User interface design principles for interaction design. *Design Issues*. 2008 Jul;24(3):85-107. doi:10.1162/desi.2008.24.3.85
  - 26 Darejeh A, Singh D. A review on user interface design principles to increase software usability for users with less computer literacy. *Journal of computer science*. 2013 Nov 1;9(11):1443. doi:10.3844/jcssp.2013.1443.1450
  - 27 Nagro S, Champion R. A method for multimedia user interface design for mobile learning. In *2017 Computing Conference 2017 Jul 18 (pp. 585-590)*. IEEE. doi:10.1109/SAI.2017.8252155
  - 28 Kools M, van de Wiel MW, Ruiters RA, Crüts A, Kok G. The effect of graphic organizers on subjective and objective comprehension of a health education text. *Health Educ Behav*. 2006 Dec;33(6):760-72. doi:10.1177/109019810628895029
  - 29 Ewoldt KB, Morgan JJ. Color-coded graphic organizers for teaching writing to students with learning disabilities.



- Teach Except Child. 2017 Jan;49(3):175-84. doi:10.1177/0040059916681769
- 30 Ciullo S, Reutebuch C. Computer-based graphic organizers for students with LD: A systematic review of literature. *Learn Disabil Res Pract*. 2013 Nov;28(4):196-210. doi:10.1111/ldrp.12017
- 31 Moszkowicz J. Gestalt and graphic design: An exploration of the humanistic and therapeutic effects of visual organization. *Design Issues*. 2011 Oct;27(4):56-67. doi:10.1162/DESI\_a\_00105
- 32 Wertheimer M. Max Wertheimer centennial celebration in Germany. *Hist Psychol*. 2014 May;17(2):129. doi:10.1037/a0035955
- 33 O'Connor Z. Colour, contrast and gestalt theories of perception: The impact in contemporary visual communications design. *Color Res Appl*. 2015 Feb;40(1):85-92. doi.org.10.1002/col.21858
- 34 McManus IC, Stöver K, Kim D. Arnheim's Gestalt theory of visual balance: Examining the compositional structure of art photographs and abstract images. *Iperception*. 2011 Aug;2(6):615-47. doi:10.1068/i0445aap
- 35 Wagemans J, Elder JH, Kubovy M, Palmer SE, Peterson MA, Singh M, von der Heydt R. A century of Gestalt psychology in visual perception: I. Perceptual grouping and figure-ground organization. *Psychol Bull*. 2012 Nov;138(6):1172. doi:10.1037/a0029333
- 36 Peterson DJ, Berryhill ME. The Gestalt principle of similarity benefits visual working memory. *Psychon Bull Rev* 2013 Dec;20(6):1282-9. doi:10.3758/s13423-013-0460-x
- 37 Hoerhan M, Eidenberger H. Gestalt descriptions for deep image understanding. *Pattern Anal Appl*. 2021 Feb;24(1):89-107. doi:10.1007/s10044-020-00904-6
- 38 Suler J, Zakia R. *Perception and Imaging*. New York:Routledge; 2018.
- 39 Hock HS, Nichols DF. Motion perception induced by dynamic grouping: A probe for the compositional structure of objects. *Vision Res*. 2012 Apr 15;59:45-63. doi:10.1016/j.visres.2011.11.015
- 40 Chiu YP, Lo SK, Hsieh AY. How colour similarity can make banner advertising effective: Insights from Gestalt theory. *Behav Inf Technol*. 2017 Jun 3;36(6):606-19. doi:10.1080/0144929X.2016.1267264
- 41 Seraji F, Bayat Z, Abbasi Kasani H, Abedi H. Comparing Two Forms of Spatial Contiguity Principle in Student Learning: 'Text Linked to Image' versus 'Text in Image Adjacency'. *Interdisciplinary Journal of Virtual Learning in Medical Sciences*. 2020 Jun 30;11(2):84-91. doi:10.30476/IJVLMS.2020.85968.1029
- 42 Ghaffari K, Yasbolaghi B, Abdolvand K. The Effect of Word Game Teaching on Dictation Problems of First Grade Primary School Students in Azna. *New Educational Approaches*. 2020 Dec 21;15(2):23-42. doi:10.22108/nea.2021.124489.1511
- 43 Celik S. A media comparison study on first aid instruction. *Health Educ J*. 2013 Jan;72(1):95-101. doi:10.1177/0017896911430762
- 44 Valencia-Romero A, Lugo JE. An immersive virtual discrete choice experiment for elicitation of product aesthetics using Gestalt principles. *Design Science*. 2017;3. doi:10.1017/dsj.2017.12