Techniques for Designing Puzzle Shapes and their Role in Children's Learning

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Abstract

This research aims to study designing puzzle shapes techniques and their use in teaching children. Puzzle games contribute to developing cognitive, sensory, and motor skills that require concentration and logical thinking, which can be effective in stimulating learning in children and developing their mental skills. The design idea was studied in terms of simplicity, complexity, types of traditional and digital puzzle games, and their use. Structural elements in design, such as drawings, shapes, and typographic elements, according to the Gestalt theory in designing puzzle shapes that aim to teach children, and verifying their effectiveness in stimulating their learning. This study also included an analysis of some of the techniques used in designing puzzle shapes and some mechanisms and theories of learning through games.

Keywords: *History of the Puzzle, Techniques of Puzzle Shapes, Teaching Children*

This research is the first step for the Graphic designer of Puzzle games for the success of educational designs for this type, highlighting the need for to be interested in the psychological and mental aspects of the recipient by age group, before starting the design

INTRODUCTION

The Design is still one of the channels that contribute to the development and progress of societies, , the graphic designer has his own methods. This appeared in the field of design through means of expressing form and content, and here expressive design forms emerged that are understood by the eye reading them, and contributed these designs are widely used in education, especially in teaching children, as some branches of graphic design specializations focus on developing perception skills, improving concentration and enhancing learner's abilities to solve problems, as well as raising the level of creativity and positive thinking, and stimulating learning and exploration. Among these designs, the "puzzle" design is the first educational tool and an effective means of supporting children's learning activity.

Modern learning theories have contributed to integrating mental activity and thinking with the diversity of physical and motion activity through the interaction of the two sides, which produced advanced results in achieving a high level of response and speed of learning by virtue of the use of interactive "puzzle" games, and this is reflected through the use of shapes in bright colors and various images that arouse desire and stimulates participation in the game, as it highlights the study of "puzzle" design techniques and their role in educating children. By actively contributing to clarifying the features of "puzzle" designs, as well as the importance of the topic to what "puzzle" achieves as a means with intellectual dimensions that stimulate the mind.

Through a field visit to some educational institutions, it was revealed that these educational means are not being used correctly and that they lack such design areas for children's self-development, which necessitated that the current research be determined by its research problem in employing designs that contribute to raising the level of education and improving the learning experience for children as educational means and have fun together. The problem of research lies in this question:

- What are the techniques for designing puzzle shapes and what is their role in educating children?

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THEORETICAL FRAMEWORK

History of the Puzzle:

The emergence of the puzzle played a role behind the global passion for this game, from an educational standpoint on the one side, and from an entertainment standpoint on the other side.

The origins of pictures riddles "puzzles" go back to 1760 when European mapmakers glued maps onto wood and cut them into small pieces. The virtue returned to John Spilsbury, an engraver and mapmaker, is credited with inventing the first panorama's riddle in 1767. Where the cut-up map was a successful educational game and since then children have learned geography by playing with puzzle maps around the world (Williams, 2004, p. 18). As in Fig. 1:

Figure 1. kingdoms_london_ spilsbury

https://blog.souqfann.com

The accelerating revolution towards puzzle games began in 1880, with the introduction of the treadle saw, formerly known as the jigsaw, where a major revolution occurred in the world of the "puzzle" industry, towards the end of the eighteenth century, that cutting by hand was initially done using a "Frets saw", as in Fig. 2:

Figure 2. Frets Saw.

https://robcosman.com/products/fret-saw

Puzzle Basics and Techniques:

The interest of puzzle game designers is to adopt the foundations, elements and relationships in graphic design, to achieve the functional and aesthetic goal at the same time, (the entrance through the design work gates that

specialized with education which not voiding from entertainment phase in the same time, need to get out from those gates, the get out here is to achievement the aim and the purpose from the design, by the perfect complete for the design idea and then creation it, the designer completes his design work with variations that he achieves through multiple means) (Al-Nouri, 2002, p. 11). The following are the most important of these foundations and elements:

1.Color:

Color is one of the most important sources of attraction and drawing attention to the eye of the recipient through contrast and harmony. The designer working in the field of designing educational "puzzle" games was keen to choose the appropriate color, as (color plays an essential role in the designs of puzzle games because of its effectiveness in showing ideas and increasing attention-grabbing, In addition to the importance of using color as a powerful design tool that can in many cases solve design problems, where color in sometimes used to define the shape of a space, and to give a sense of scale, dimensions, volume, and depth through its psychological and physiological effects, along with the aesthetic value that adds through the diversity of the color relationships) (Taha, 2007, p. 25).

The use of colors in practical life and in the field of print design, especially "puzzle" designs, requires arranging them in objective ways, and this was helped by placing color circles as in Fig. 3:

Figure3. Munsal Circle

http://arta661.blogspot.com/2011/04/blog-post

In designing puzzle games, the graphic designer uses reference to these color circles to identify the different points and distinguish between the color gradations occurring in adjacent colors. The effect of color in the design of the "puzzle" achieves color attraction and draws the child's attention to the "puzzle" by deducing the colors and their mixtures from this color circle and its operation to achieve visual communication between the design and the recipient child, it also achieves an aesthetic and functional dimension that contributes to raising the level of thinking. This visual communication leads to achieving interactivity, the purpose of which is to convey the educational idea to the recipient.

The difference in light reflection of color and the contrast in tones between dark and light is one of the important works adopted by the designer of "puzzle" games to achieve attraction and awareness among children. In addition, this shows that the contrast is far from being a familiar contrast, as clear differences emerge between the design component according to the rule of shape and ground. For example, there are two shapes that may appear similar in some elements and different in others, so their differences become apparent when contrast occurs (Al- Sultan, 1996, pp. 53–54).

2. Typography:

The designer of the "puzzle" games used the typographic element in conjunction with the design process to achieve a visual communication purpose by mixing color and shape with the letter or text to suit the child's age group and by method of formal simulation that he accepts and is in harmony with the learning situation, (as

each visual text has its own design theme that agrees with the meaning of that text that includes its elements that distinguish it from other texts, in form and content, and working on them) (Al-Dulaimi, 2012, p. 68).

Where is (the strength and beauty of the typographic composition directly reflects the level of mental organization of the designer, his vision, and his ability to bring together elements in a compatible combination) (Al-Husseini, 2003, p. 73). For the graphic designer, typography (means the form of writing and design with letters to create a visual effect and obtain innovative creative work characterized by expressive, plastic, and aesthetic capabilities in letters and writings) (Hassan and Hani, 2013, p. 2). As in the following Fig. 4:

Figure 4. Alphabet shape learning puzzle

: https://www.amazon.sa

There are three forms of typographic text, which are as follows:

A) Head Line:

The designer uses it to show the general content of the topic of the "puzzle" game, and it is of a large size, where (titles are defined as a few easy-to-understand words that contain the essence of the topic. They are tasked with determining the quality of the topic presented, and they attract the recipient to continue learning about the content, which is one of the most important typographic elements) (Muhammad, 2012, p. 15).

(The title requires special typographic treatment, such as choosing the shape and size of the letter and the size of the white space next to it, which affects, in one way or another, the clarity of the title in front of the eye of the recipient so that it can perform its required typographic and editorial role) (Al-Sawy, 1965, p. 141).

B) Secondary Line subtitle:

The designer uses it to support the content more and its size is medium (it comes in second place from where the importance after the main title and plays an explanatory role for the content of the material presented in the "Puzzle") (Musa, 2004, pp. 22–23).

(The text is an extension of the main title and aims to expand the presentation of the idea presented in it and is used to gradually guide the reader to reading the essential point of the design message) (Fathi, 2006, p. 72).

C) Text writing (content):

Written texts are among the basic elements through which the message is conveyed to the recipient in order to achieve the basic purpose, and the content is the most important (which is where the topic lies, and through which the design message is conveyed and the recipient is guided. The topic may be long or short, or it may be a brief description, the main point to be taken into consideration at this level is that it should be easy to read, as the font size is rather small) (Kliever, 2015).

Typography plays a prominent role in attracting the eye of the recipient and determining the general structure of the "puzzle" design regardless of its location. It achieves attractiveness, arouses attention and attracts the recipient, as in Figure.9:

Figure 9. Space Cross Word

https://www.alamy.com

Where (the puzzle designer highlights the important (Headlines) first, then the (Subheads), then the smaller ones, until he ends up with the (Body Text), which is the smallest in design, and thus in attracting the recipient. However, this method relies on variation in size, presenting written elements is not the only way, may be the hierarchy can also be achieved by type, color, spacing, weight, and underlining) (Al-Atwani, 2020, p. 76).

3. Graphics and Forms:

Drawings and graphic shapes are among the important elements in designing "puzzle" shapes because of their importance that contribute to activating the child's visual cognitive activity by enhancing the visual communication of the idea, whereas (what children actually do when they explore drawings and pictures is practically similar, but different from the processes that good readers use when they reading words, as the oldest recorded illustrations in cave paintings created in Lascaux, France, California, showed pictorial graphic formations that narrated important events and scenes that occurred in ancient civilizations. With the advent of the Industrial Revolution in the mid-1700s, the English Wood Engraver and Publisher - Thomas Buick presented studio for creating and printing commercial illustrations used for a variety of purposes, including works for children, educational materials for schools, natural history illustrations, and book titles) (Muhammad and Neame, 2022, p. 2).

While working on "Basel" designs, the Karavik designer relies on two basic types of drawings and shapes as follows:

A.2D drawings and Forms:

The designer adopts two-dimensional forms in traditional "basal" games where (the two dimensions mean length and width shared together are his floor without depth. This floor is abstract or image or drawing, explains the world of the two dimensions that vary according to our experiences. This method is important for the designer in the stages of his permanent innovation of his fields of use such as drawing, photography, decoration and printing) (https ://www.paigk/ 2023/gaps/

B.3D drawings and Forms:

The designer has been working on 3D shapes and drawings in the design of the "Basel" games in order to give a more dynamic effectiveness than 2D design (It is different from the two-dimensional design in its formats where the ease of vision and sense of magnitude, because of its ability to be seen in more than one corner and from different sides, and therefore less complex than the two-dimensional design seen on the space without space) (Al Arabi, 2008, pp. 86-87).

The researcher believes that the Karavik designer can manipulate these elements and offer a lot of useful designs from the "Basel" toys for children by designing, attracting attention and using colors and interesting shapes of different sizes.

Modern Learning Theories

Scientists have been studying the nature of the human mind through its response to the sensory perceptions surrounding it, and they have worked to measure the interaction that occurs between them, through several studies, some of which are represented by theoretical trends, these trends can contribute to the development of "puzzle" game designs as a basis when starting the design process, and they are as follows:

1.The Behaviorism Trend:

The concept of behaviorism appeared in the United States of America in 1912 AD, it focuses on behavior as the key to understanding the mind and learning, and it uses experimental measurement and avoids ideas that are not observable and measurable. This concept can be summarized in the learning process, as behaviorism indicates that any knowledge presented to the student must arouse his interest, inclinations and motivations, by breaking down the academic material into parts that can be related to each other, and presenting it to the student in a logical and gradual sequence that suits his level of physical and mental development (Talawati, 2014).

2.The Cognitive Trend:

Learning occurs as a result of a connection between a stimulus and a response, and results in the formation of habits, where cognitive theories have emphasized the importance of perception and understanding in the learning process, and that learning occurs as a result of the organism's awareness of the multiple relationships that exist between the components of the overall educational situation or field, and the importance of the role played by perception processes and mental and cognitive thinking processes in this process, such as thinking, remembering, and analysis. (Cognitivists avoid the complexity faced by relationalists when they explain learning that occurs in a situation contains a large number of stimuli, and this requires the many connections that arise between these stimuli and the multiple responses that arise" (Selim, 2003, p. 227).

3.The Social Trend:

The social learning model focuses on the social and environmental factors that affect an individual's learning, and considers the individual as part of his community and influenced by the behavior and actions of others in his surroundings. This influence extends to the behaviors, beliefs, and values that the individual adopts, so the learning environment must be consistent with the needs of the individual and with what he learns, from his surroundings, and encourages social interaction, active learning, and building on a knowledge, as (the social trend agrees with the behavioral trend that much of human behavior is learning behavior, whether through conditional processes or through observation... However, the social trend focuses on how he interacts the individual with the environment) (Al-Zaq, 2009, pp. 263–264).

4. Humanistic Attitude:

This trend is a reaction to behavioral theory, as its followers believe that the behavioral school views a person on the basis of his response to environmental stimuli that govern his behavior without regard to his will and freedom of choice, as well as his ability and power to make important decisions in his daily life (the followers of the humanistic trend see that the negative aspects which appear among some are nothing but a product of the imbalances that individuals may be exposed to during their development, and the individual can take responsibility for his life and enhance his development process, and they emphasize on the latent power in human for providing positive opportunity to development (Abu Jado, 2004, p. 150).

5. (Form Theory) Gestaltism:

The principles of learning according to the Gestalt school are summarized in insight, that is, understanding and the ability to comprehend information and its interconnection. Learning must be linked to results, and mechanical memorizing and application of various knowledge is considered negative because it does not give

room for creativity. Insight is a strong incentive for learning, while external reinforcement is a weak incentive to learn, (Guestlist's view the phenomenon of learning as a phenomenon closely related to perception, and therefore they define learning as the reorganization of the learner's perception or psychological world, and this is what they call the "Learner's Field". Given the lack of an accurate translation of the German word Gestalt (theory of form), perhaps the closest word in English word is "Configuration") (Nassef, 1983, p. 29).

6. Constructivism Theory

The term "Constructivism" comes from the English words "Construction" and "Structure", which come from the Latin word "Sturere", which means the way buildings are built. The theory of childhood learning and development based on this theory posits that children are active creators in Building their thinking patterns, where they interact naturally with the experiences available to them. In addition, constructivism in its simplest form means that knowledge is actively constructed by the learner, and not passively received from the environment (Talawati, 2014).

Research Methodology

The researcher followed the descriptive analytical method (content analysis) for analysis purposes, as it is: (a research method for making inferences by diagnosing specific characteristics within the content in an objective and systematic manner) (Al-Qadri and Al-Bawalis, 2004, p. 36), this makes it possible to reach the research goal.

Previous Studies

This modest research is considered a pioneering study of its kind, as no study in the field of graphic design preceded it.

Research Community

The research community included various forms of "puzzle" games characterized by sober design construction and the diversity of their topics, objectives, and functions, in addition to the use of modern techniques in their production, the research community is represented by (6) models.

The Research Sample

The researcher adopted the research sample in an (intentional) manner and specific (Badr, 1979, p. 331), characterized by characteristics and advantages, to give results that the researcher could reach by surveying the entire community. Thus, the number of samples in the sample reached (2) models produced for analysis purposes, at a rate of (33.3%) of the total research community.

To achieve the objectives of the research, an analysis form was designed, the researcher based its design on the basic indicators that emerged from the research, which represent a summary of the specialization's literature and included details that meet the requirements of the research to achieve the desired objectives.The researcher sought the opinions of experts to ensure the integrity and stability of the analysis tool, after presenting it to them, in order for the analysis to be scientific, logical, and appropriate to the approach taken by the researcher after consulting specialized experts, this procedure is to ensure the validity of the tool, as there was consensus on the validity of its component and its virtually rightfulness gain from a research standpoint.In order for the researcher to achieve the required reliability, he analyzed a model of samples that represent the research community, in addition to seeking the help of external analysts, to analyze the model itself and obtain the percentage of conformity and agreement with the researcher. The percentage of agreement between the first analyst and the researcher and the second analyst and the researcher were up to acceptable ratios are rates that the researcher found to meet the purposes of the research, which enabled the researcher to carry out the analysis and extract results.

Analysis:

Product name: Clock. Year: 2022.

Puzzle size: 35 x 35 cm.

Figure 10. The Clock Model

Melissa & Doug

The puzzle game contained three-dimensional shapes of geometric pieces bearing the numbers of the clock distributed on a large circle representing the shape of the clock, the designer took the shape of the clock as a vital element in order to work on developing the child's educational skills, where the clock included colors and shapes that created a diverse design environment that worked to attract and pulling the child's attention is drawn to its attractiveness, to become visual nutrients formed part of the learning process that motivates the child to learn numbers, shapes, and the relationships between them. Multiple geometric shapes were distinguished in the design of the clock numbers that indicate the time, they were placed on a uniform ground in the shape of a circle, these three-dimensional shapes were included with a second circle placed in the middle includes the clock hands, which indicate the hours, minutes, movement, and direction according to the length of time that the state of the time will be, while employing design elements such as color and shape in a harmonious way that revolves around the center of the circle, some of the geometric shapes of the clock time simulate time through the shape, so the number three, the designer borrowed the shape of the triangle formed of three sides with the number three to show the recipient and increase the awareness of the number of three sides, and the number four, the designer used the square, likewise, the number five, the designer used the pentagon shape. Thus, the designer tended toward complexity more than simplicity and direct understanding, this is due to the large number of elements and the multiplicity of pieces used in completing the final outcome of the game, he helped the recipient can read the time easily. The varied use of colors in the design of the watch in order to refresh the children's memory and make them distinguish the locations of the numbers on the watch according to the color and shape of the background, which helps in treating and stimulating memory and memorization in a color-changing style that helps attract the child's attention to the different colors that are distinguished by placing them on a circular floor in a light color and surrounded by a red line on the outside and a red line on the inside. The designer also used the typographic element, which is the numbers of the hour, and specified the hour hands with a different title for the second hand, as well as the clarity of the hour numbers in a bold font as a main title representing the time of the hour.

The design of the clock contained various geometric shapes, and the designer used the color value of the white color in the process of highlighting numbers and letters, color contrast achieves helps children to distinguish between the background color of the shape and the printed number, in a way that addresses the child's visual memory.

Analysis

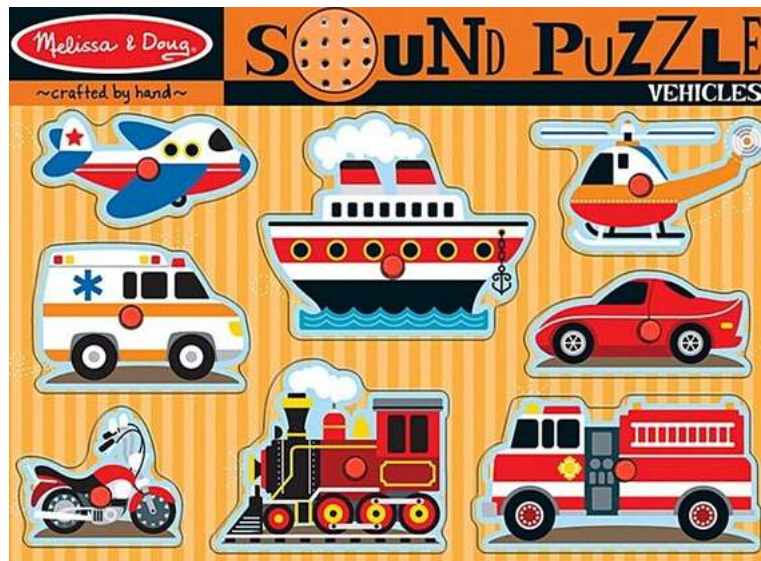Product name: Vehicles. Year: 2022.

Puzzle size: 25 x 35 cm.

Figure 11. The Vehicles Model

Melissa & Doug

A rectangular-shaped game with painted forms of varied modes of transportation that can be moved in an interactive way by having a digital magnifier on top of the game for aiming and teaching.

The design contained eight diverse compounds that the designer distributed on a rectangular floor in consistency and symmetry in distribution. The design is very simple away from complexity in all its details. The designer resorted to simulating the child's wishes and tried to attract him by occupying the design space of the game with a number of modes of transport with various functions painted in a manner endearing to the children making these forms mobile and lifting them from their specific location, To increase effectiveness, a loudspeaker confirms the validity of the selection by making a particular sound. This type of basal game is both traditional and digital, because it contains an intelligent electronic sensor associated with a magnifier whose function is to guide the player by defining the names of shapes and their functions when placing images in the right place.Through design, the designer made a convergence between the graphic elements when he distributed them into the space in symmetry form and achieved similarity of the painted forms. It also achieved continuity according to the way the designer directed these images in opposite directions. These expressive images highlighted a consistent interaction on the background in order to draw attention to the recipient as all the formats were clear and integrated through background consistency.

RESULTS

Through the analysis, the researcher obtained many results, which are as follows:

Puzzle games achieve sensory and motion interaction, and mental awareness that stimulate children's memory by employing the three-dimensional and moving shapes that the designer used.

The first model was more complex as a result of the condensation of the elements.

The second model was simpler as a result of image clarity in shape and function.

The use of structural elements in the model has been achieved well, which leads to the interaction of the learning child and an increase in his concentration and mental awareness.

The principle of convergence in the Gestalt form theory was achieved in the model.

Achieve harmony between the figure and the background in the model.

Verify similarity in the model in size and color.

Check symmetry and order in the model.

CONCLUSIONS

Puzzle game designs develop children's cognitive, sensory, and motor skills and improve their concentration, attention, and problem-solving abilities by motivating them to learn and explore.

There are many techniques and methods that a designer can use in the field of designing puzzle games for children, relying in their completion on the Gestalt theory of form.

The designer's use of bright colors for shapes, images, backgrounds, and simple and direct design ideas is interesting for children.

The educational institution's use of puzzle games in the field of education and entertainment can have positive results for children.

Design ideas for puzzle games can be developed by following children's needs and the nature of their interaction with the games.

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