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Perception in Human Psychology and Landscape Prioritised Visualisation of Space with Artificial Intelligence

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Abstract

Psychology examines individuals' behaviors, investigating the underlying motivations and their individual and social orientations. Individuals exhibit specific behaviors to adapt to social life. Landscape spaces, integral components of society, provide social environments. Individuals in these spaces perceive and interact with both others and objects. This study explores perceptual errors and processes, which are key topics in psychology. Concepts were translated into concrete space designs. These concepts were classified and integrated with spatial elements to create cohesive designs. During classification, combinations were identified to visualize the concepts. Space designs were generated using descriptive sentences with AI support. These designs were evaluated for psychological errors and processes. Suitable designs were illustrated with reference lines. The study also assessed the effectiveness of AI on visuals, achieving innovative designs through precise concept definitions with AI assistance.

Keywords: *Artificial intelligence, psychology, space design, perception, landscape design.*

İnsan Psikolojisinde Algı ve Mekânın Yapay Zekâ ile Peyzaj Öncelikli Görselleştirilmesi

Öz

Psikoloji, bireylerin davranışlarını, bunların altında yatan motivasyonları ve bireysel ve sosyal yönelimlerini incelemektedir. Bireyler, sosyal hayata uyum sağlamak için belirli davranışlar sergilerler. Toplumun ayrılmaz bir parçası olan peyzaj alanları, sosyal ortamlar sağlar. Bu alanlardaki bireyler, hem diğer insanları hem de nesneleri algılar ve onlarla etkileşime girerler. Bu çalışma, psikolojinin ana konularından olan algısal yanılmaları ve süreçleri araştırmaktadır. Kavramlar, somut mekân tasarımlarına dönüştürülmüştür. Bu kavramlar, uyumlu tasarımlar oluşturmak için mekân unsurlarıyla sınıflandırılmış ve birleştirilmiştir. Sınıflandırma sırasında, kavramları görselleştirmek için kombinasyonlar belirlenmiştir. Mekân tasarımları, yapay zeka desteğiyle tanımlayıcı cümleler kullanılarak oluşturulmuştur. Bu tasarımlar, psikolojik yanılmalar ve süreçler açısından değerlendirilmiştir. Uygun tasarımlar, referans çizgileriyle gösterilmiştir. Çalışma ayrıca, yapay zekanın görseller üzerindeki etkinliğini değerlendirmiş ve doğru kavram tanımlamalarıyla yenilikçi tasarımlar elde edilmiştir.

Anahtar kelimeler: *Yapay zeka, psikoloji, mekan tasarımı, algı, peyzaj tasarımı.*

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1. Introduction

In recent years, the success of artificial intelligence has increased significantly. The correct and effective use of artificial intelligence supports and accelerates scientific research. Thanks to its different usage areas, various disciplines benefit from artificial intelligence efficiently. In this context, the potential of using artificial intelligence in landscape architecture discipline is attracting more and more attention.

Although there are studies on the use of artificial intelligence in landscape architecture alone, this research focuses on the intersection of artificial intelligence with landscape architecture and psychology. This research aims to explore how interdisciplinary work can be produced through artificial intelligence.

Psychology is a science that studies behaviour. Human behaviour is complex, multifaceted and determined by various processes. For this reason, psychologists examine the processes that determine behaviour separately. Among the basic processes that determine human behaviour, motives and senses are emphasised.

Behaviours are performed by individuals during the day in line with a certain goal. In the psychological discipline, the initiation and progress of behaviour in line with the goals are examined through the concept of motive. Motive is considered a personal power necessary for the initiation and continuation of behaviours. In order for motivational behaviours to be revealed, goals must also be present (Aydın, 2009; p.207). Orientations that emerge as a result of behaviours may differ from socially and individually.

People need to socialise in order to continue their lives in society. Thanks to their role in society, they are affected in various ways. It changes over time with environmental factors. Individuals act by paying attention to the rules of society in order to maintain an appropriate life in society. It is more necessary to adapt in urban areas with high intensive use (Demirkaya, 2012).

Human behaviours also reveal different orientation movements in the physical environment where the individual has to live. Orientations and motivational behaviours in the space, supported by senses and perceptions, maximise the presence of individuals in the space. Sociologically, individuals who want to maintain their social and individual existence in space move by perceiving the surrounding objects with their senses.

The perception level of individuals is affected by the positioning of the elements in the space and features such as distance, colour and form. The space consists of various components and elements, each assuming distinct roles. These elements perform different tasks within the space. These tasks may involve determining, limiting, unifying, emphasising, and focusing (Gür, 1996; Açıcı, 2006).

Perception is a process in which events in the environment are analyzed by interpreting sensory data. The receptive organs that interpret perception incorporate events and elements in data production based on their types. Their properties are classified in line with coldness, temperature, speed, weight, colour. In the later stages of perception, the receptive organs provide the sensory sense to be converted into neurophysiological energy and initiate the perception process (Cüceloğlu, 2002, p. 98).

The theories formed by the individual socially and individually in the external world are shaped according to the individual's perception of objects and the current characteristics of events. The spatial theory also varies depending on the perception forms. The synthesis of perception and space is included in the process and plays a guiding role in the design of the space. Thus, appropriate spaces are created in urban area designs as a result of individuals' perception styles and sensory gains.

Within the scope of the study, considering the perceptions and sensory data of individuals, certain definitions are made with the concepts revealed by the perception styles in artificial intelligence environment. As a result of the definitions, the suitability of the spaces created with the support of artificial intelligence is evaluated.

With the help of intelligent behaviour, the products created by the sensory perception forms defined in the study content in an integrated manner are examined. As a result of the evaluation of the products, while examining how landscape priority designs might be created in artificial intelligence environment in urban spaces depending on the perception levels of individuals, the competence of artificial intelligence in creating space is also examined.

This study addresses how artificial intelligence can be widely used in visualization stages. It aims to create an example that will contribute to the effective expression of designs with artificial intelligence in the discipline of landscape architecture. At the same time, it pioneers making landscape architecture more efficient with AI-supported visualizations. Thus, it brings innovation to existing practices in the discipline of landscape architecture.

Artificial intelligence offers a significant potential to increase the visual creativity of the designer (Liu, 2023). In this study, increasing the design potential of landscape architecture is a priority. Thus, it becomes possible to create sustainable and user-oriented landscape designs that comply with design criteria.

2. Material and Method

Perception errors and perception processes that determine individual orientations in space formation in urban landscape areas were evaluated. The subjects obtained under the titles of perception errors and processes were accepted as necessary tools for space formation. Literature researches were carried out within the scope of the materials for the concepts accepted as the main factor of space formation.

2.1. Perception Errors

Perception errors demonstrate that perceptual patterns may be distorted, leading to an imperfect representation of the perceived object. Perception errors may examine the functions in the perception process. Perception processes are based on perception errors. Thus, in order to distinguish perceptual processes, perception errors are first analysed (Cüceloğlu, 2002, p.119).

2.1.1. Ponzo Illusion

When distance variations are considered, intersecting lines in space are utilized as reference points for comparison (Cüceloğlu, 2002, p.119). Two lines approaching each other represent two walls of a corridor in real observation (Yıldız et al., 2021). In other words, it is the illusion created by the convergence of the two-sided lines at the horizon point (Figure 1), which is reminiscent of single-point perspective drawings.

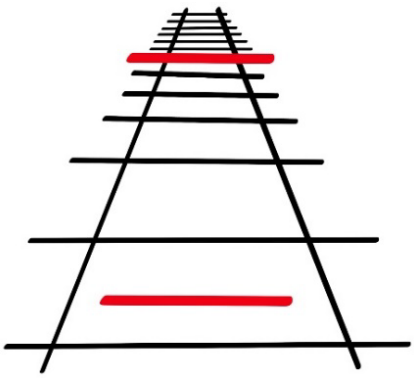

Figure 1. Linear representation of the Ponzo illusion (original)

2.1.2. Müller-Lyler Illusion

The space appears smaller due to its invisible, roughly defined boundaries. Squares with open boundaries are perceived larger than a square area with closed boundaries. A circular area with outwardly open borders is perceived larger than one with inward borders (Yılmaz, 2008) (Figure2).

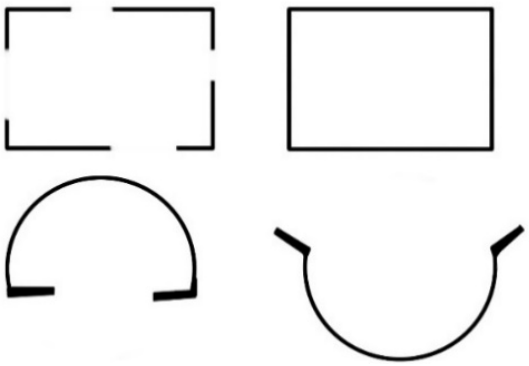

Figure 2. Linear representation of Müller-Lyler illusion (original).

2.1.3. Wundt Illusion

Vertically positioned elements in space are perceived as larger than horizontally positioned elements (Figure 3). Greater effort is required to equalize vertical distances at eye level compared to horizontal distances. Consequently, spaces with a higher density of vertical elements are perceived as larger (Yılmaz, 2008).

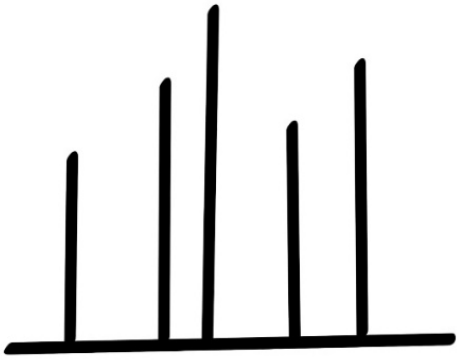

Figure 3. Linear representation of the Wundt illusion (original)

2.1.4. Lipps Illusion

In circular spaces located at the center, the perception towards the center is more intense, while perception in the peripheral areas diminishes. Increasing attention towards the centre reduces the visible size (Yılmaz, 2008) (Figure 4).

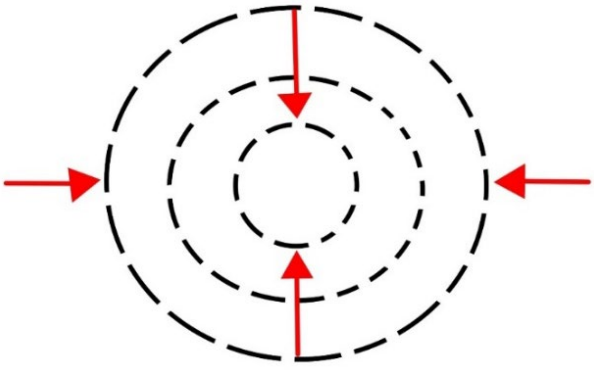

Figure 4. Linear representation of Lipps illusion (original)

2.2. Detection Processes

Titles with dominant visual effect in perception processes were accepted. In this direction, the concepts of selective attention and organisation are explained.

2.2.1. Selective attention

Individuals perceive their environment selectively. Our sense organs always selectively perceive only a part of the stimuli they capture (Cüceloğlu, 2002, p.121). The users' perception of space in landscape areas and their ability to perceive focal points faster than other areas serve as an example.

2.2.2. Organisation

Organization refers to the compositions formed by the objects within the environment. In the process of perceiving spatial components, it facilitates coherent, integrated, and meaningful visual representations.

The 'Gestalt Perception Theory,' which enhances visual impact and supports visual perception, comprises principles that affect the organization stage.

The Gestalt theory is based on the principle that the whole is more meaningful than the parts that make up the whole (Senemoğlu, 2009). The principles are divided into five classes as completion, figure-ground, continuity, similarity and proximity.

Figure-ground Principle: In all forms of perception, there is the existence of figure and ground (Cüceloğlu, 2002, p.123). For the purpose of the figure to be perceived, the ground forming the background is needed.

Completion: It supports the perception of an event formed by parts assembled in a regular and meaningful way that is unable to be perceived as a single visual.

Continuity: It is stated that the coexistence of points, stimuli and lines with the same directions supports perception (Cüceloğlu, 2002, p.123).

Proximity: Objects that are close to each other are perceived by grouping (Cüceloğlu, 2002, p.123). Thus, it becomes easier to perceive the items outside the group.

Similarity: Concepts with less distinctiveness preserve integrity. All visuals strengthen perception.

The intersections of the materials on the space design were determined and the space design was created in artificial intelligence environment. A work flow was created for the creation of the space design. The flow is shown below:

1. Firstly, material classification was carried out. The concepts to be used in the descriptions directing the formation of space in artificial intelligence environment were separated.

2. The concepts were turned into descriptions with certain combinations to support the visualisation of urban landscape spaces. Concept combinations are shown (Table 1).

3. Depending on the descriptions, the suitability of the designs created by artificial intelligence was evaluated.

4. The visuals or designs considered appropriate within the scope of perception errors and perception processes were accepted as the product of the study.

Tablo 1. Demonstration of concept combinations (original)

Concepts	*Figure-ground*	*Completion*	*Continuity*	*Proximity*	*Similarity*
Ponzo Illusion	✓				
Müller-Lyler Illusion					✓
Wundt Illusion			✓		
Lipps Illusion		✓		✓	

2.3. Creating Space Designs with Artificial Intelligence

Descriptive sentences for artificial intelligence with concept combinations were used. The definitions were tested in different artificial intelligence programmes and landscape spaces were created in the appropriate artificial intelligence programme.

'It is desired to create landscape spaces in urban areas based on the “ponzo illusion”, which is a psychological perception illusion, and also the “figure-ground principle”, which is the principle of Gestalt Perception Theory.” By accepting two concepts as the main factors with the definition, artificial intelligence was asked to create urban landscape spaces. The generated visual is given below (Figure 5).

Figure 5. Ponzo illusion and insufficient visualisation of the figure-ground principle (Microsoft Bing Copilot, 2024)

The visual encompassed landscape areas centred around structural elements. Perceptual concepts could not be easily read in the space. A different artificial intelligence programme was requested to reduce the structural elements. The resulting visuals (Figure 6) are shown.

Figure 6. Ponzo illusion and figure-ground principle landscape visualisations (Leonardo Ai, 2024)

The images created based on the ponzo illusion and the figure-ground principle are appropriate in terms of perception values. In the second image, the depth provided by the ponzo illusion created reference lines for distance perceptions. The figure-ground principle was emphasised in all images.

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‘It is desired to create landscape spaces in urban areas depending on the “Müller-Lyler Illusion”, which is a psychological perception illusion, and also the “similarity principle”, which is the principle of Gestalt Perception Theory.’ With this definition, artificial intelligence was asked to create urban landscape spaces by accepting two concepts as the main factors. The generated visual (Figure 7) is shown below.

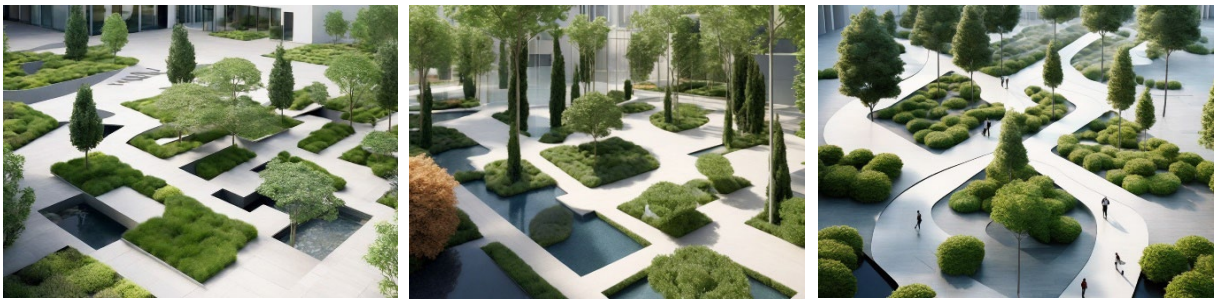

Figure 7. Müller-Lyler Illusion and similarity principle landscape visualisations (Leonardo Ai, 2024)

'It is desired to create landscape spaces in urban areas depending on the "Wundt Illusion", which is a psychological perception illusion, and also the "continuity principle", which is the principle of Gestalt Perception Theory.' With this definition, artificial intelligence was asked to create urban landscape spaces by accepting two concepts as the main factors. The resulting visuals (Figure 8) evaluated the illusion of vertical distances only through vegetative design. In other space components, a descriptive sentence was added to reinforce the vertical perception. Structural elements were also included to reinforce the illusion that the vegetative design is in focus again (Figure 9).

Figure 8. Wundt Illusion and continuity principle landscape visualisations (Leonardo Ai, 2024)

Figure 9. Wundt's Illusion and Continuity Principle Adding structural elements to Landscape Visualisations (Leonardo Ai, 2024)

'It is desired to create landscape spaces in urban areas based on the "Lipps illusion", which is a psychological perception illusion, and also the "completion principle", which is the principle of Gestalt Perception Theory.' With this definition, artificial intelligence is asked to create urban landscape spaces by accepting two concepts as the main factors (Figure 10).

Figure 10. Lipps illusion and completion principle landscape visualisations (Leonardo Ai, 2024)

'It is desired to create landscape spaces in urban areas depending on the "Lipps illusion", which is a psychological perception error, and also the "proximity principle", which is the principle of Gestalt Perception Theory.' With this definition, it is requested to create urban landscape spaces from artificial intelligence by accepting two concepts as the main factors (Figure 11).

Figure 11 Lipps illusion and proximity principle landscape visualisations (Leonardo Ai, 2024)

3. Findings and Discussion

In the content of the study, artificial intelligence created space designs in line with descriptive sentences. The designs obtained were evaluated in line with the perception processes and perception illusions and the most appropriate visuals were separated from the combination. The images (Figure 12,13,14,15,16), which are considered more appropriate within the framework of the definitions, are indicated. The explanation of the concepts in the resulting landscape spaces is presented using linear expressions.

3.1. Space Designs

In the visual created with Ponzo Illusion and figure-ground concepts, the appropriate visual was determined by creating reference lines. From the starting line depending on the perspective, the point of visual distancing was determined. In the continuation of the reference lines, the most appropriate visual for the Ponzo illusion (Figure 12) is indicated. The vegetal elements designed on a white background represent the concept of shape ground.

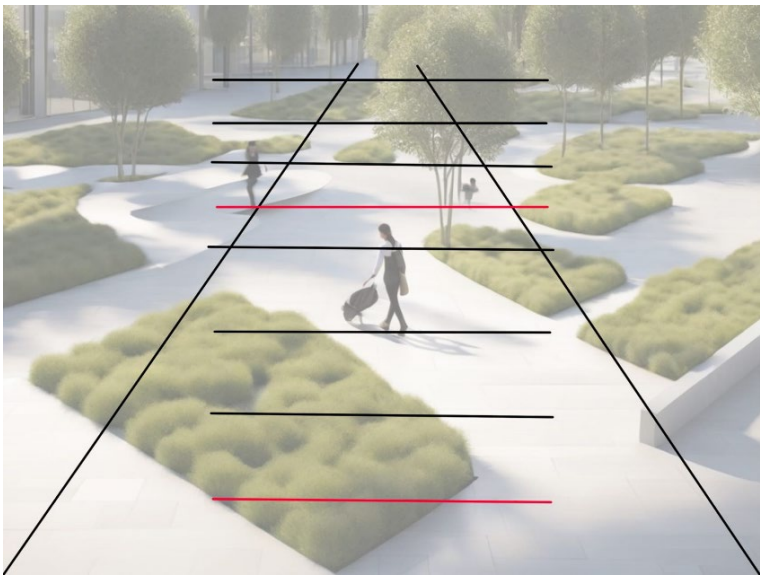

Figure 12. Demonstration of the figure-ground principle with the Ponzo illusion on space (original)

The limiting effect of the Müller-Lyler illusion appears with sharp lines separating the water elements from the hard ground and vegetal design. Plant groups, which have a softening effect on the hard floor, have created a short wall effect by standing as a whole. Plant selection and formal lines used on the ground expressed the principle of similarity. The designed landscape space (Figure 13) is considered appropriate in the focus of both concepts.

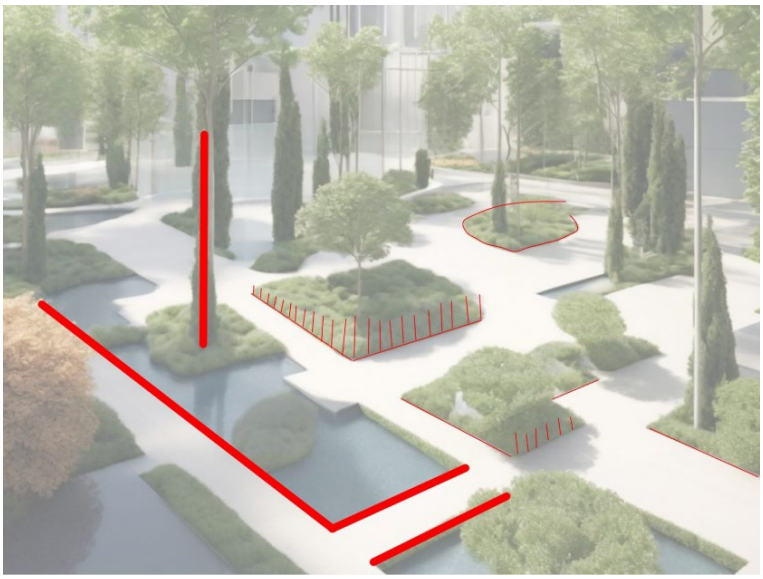

Figure 13. Illustration of the Müller-Lyler illusion and the similarity principle on space design (original)

The vertically positioned plants supporting the Wundt illusion were perceived larger, although they were positioned away from the horizontal components on the ground. When focussed on the whole, they are perceived differently from their real distance. The principle of continuity is dominant throughout the space. The informal progressing lines continued their continuity by merging with each other at any point. Although it is difficult to visually express the continuity principle in the designed landscape space (Figure 14), artificial intelligence has provided us with the desired space.

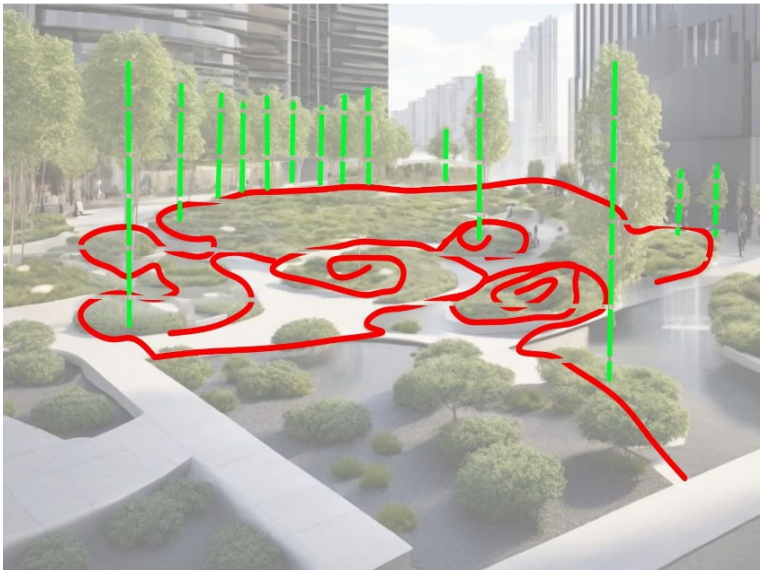

Figure 14. Illustration of the principle of continuity with Wundt's illusion on space design (original)

The feeling of withdrawal to the centre is at the forefront in the landscape area. The design includes all the elements represented by Lipps illusion. Although the circles shrinking towards the centre have different parts with different materials between them, the parts could be read as a whole when looking at the space. Artificial intelligence was especially successful in creating the image (Figure 15) where we clearly see the Lipps illusion.

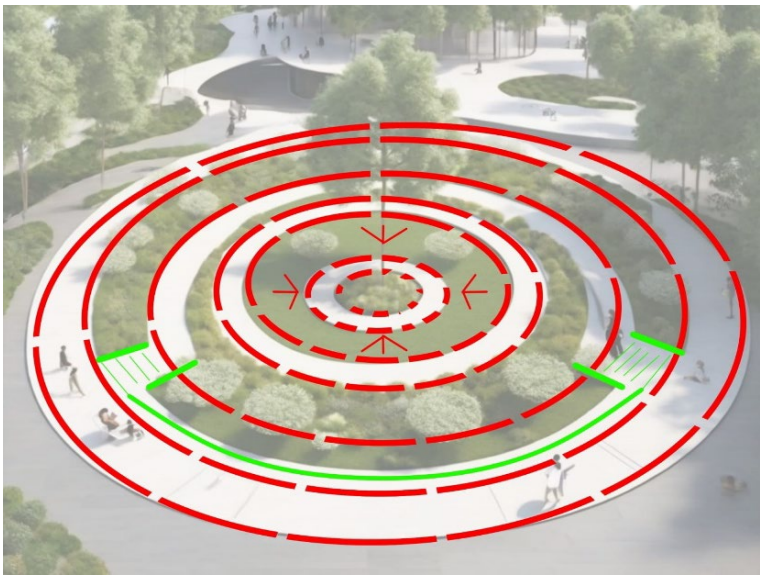

Figure 15. Demonstration of Lipps illusion and completion principle on space design (original)

The positioning of the parts in the space around the circle strengthens the perception. The effect of Lipps illusion is seen less than in Figure 15. The sense of centre is also preserved in this design. In the plant design, the trees close to the centre support the formation of a different layer in a circular manner. The spatial design (Figure 16) presents the concept definitions in a balance in general.

Figure 16. Demonstration of Lipps illusion and proximity principle on space design (original)

As a result of the evaluations for the visuals, the appropriateness of the directions given to the artificial intelligence programme was evaluated in line with the determined criteria.

3.2. Effectiveness of Artificial Intelligence on Visuals

In order to distinguish the undesirable in definitions and to present antonyms together: Although it progressed in line with the definitions, the visual in Figure 5 was far from representing the subject. After the definition of undesired elements, the visual created after the definition of undesired elements became suitable for the content and definitions of the study. Artificial intelligence was able to distinguish unwanted negative definitions within the scope of the study.

To be able to distinguish definitions from others: By analysing the perception processes and perception illusions within itself, it provided different visual formation by separating them from other concepts.

Perceiving concepts: By making the definitions of the materials, they created visuals in the same colour, line and space scale in the next definition.

4. Conclusion and Suggestions

The study 'Perception in Human Psychology and Landscape Priority Visualisation of Space with Artificial Intelligence' it has been demonstrated that user criteria may be effectively translated into practical designs by incorporating principles from human psychology into spatial configurations. With the appropriate use of artificial intelligence, a study supporting the continuity of innovative studies has been put forward. Thanks to the spaces obtained with artificial intelligence, it is ensured that the user may read the space better and perceive the elements in the space easily.

Analyzing the principles of human psychology has facilitated the diversification of orientations and targets within the space. By integrating human characteristics with all design elements, it has been demonstrated that more sustainable outcomes may be achieved.

Advancements in technology have enabled the achievement of detailed design outcomes (Sağlık & Temiz, 2019). In addition to traditional computer-aided designs, the integration of artificial intelligence-supported designs has resulted in more efficient and higher quality designs.

The success of artificial intelligence is closely related to the appropriate interpretation and transfer of values associated with work discipline. The designs obtained have been directed by appropriate descriptive sentences and the clarity of the concepts. Modifying undesired values and presenting the material to artificial intelligence within the subject has strengthened the design. It has been

demonstrated that obtaining accurate data with detailed definition is possible to maintain the applicability of studies conducted with artificial intelligence.

Within the framework of architectural disciplines, artificial intelligence has helped to produce various designs in perceiving and defining abstract concepts. Artificial intelligence has facilitated the creation of different design ideas based on variables (Hegazy and Saleh, 2023).

In addition to providing design ideas, intelligent behavior has enabled the creation of alternative designs with the feedback of integrated tasks of visual designs. These alternative designs contributed to an efficient and effective design process (Xu, 2023).

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The article complies with national and international research and publication ethics. Ethics Committee approval was not required for the study.

Author Contribution and Conflict of Interest Declaration Information

All authors contributed equally to the article. There is no conflict of interest.

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