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Identifying "puff" characters in the figure-ground formation of the simulated patient's visual experience

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Abstract

This study addresses the limitation of patients' visual experience in a healthcare environment. Clarity of visual experience occurs within the visual sphere that represents the seeing capacity defined by focus and peripheral view. The visual sphere is formed by the collections of "puff"- the unidentified parts as the components that create the wholeness of form in visual perception. This paper argues that the characters of puffs and their relationship could play an essential role in the formation of figure and ground. A simulation study was conducted by capturing the perceived scenes in a simulated patient room and then analyzing the character of regions in the scenes and their level of relationship. The study displayed the relationship between the region's position and the region's characters that form the integrity of the whole visual scenes. Knowledge of this relationship indicates that puff identification can be useful for evaluating the potential architecture elements within the visual capacity.

Keywords: Puff, Figure-ground, Seeing experience, Visual scenes, Visual capacity

1. Introduction

Gestalt theory suggested that form recognition is achieved through wholeness [1]; however, there is not much discussion about the recognition of the unknown parts as the basic components in the formation of a form. Understanding of space from a gestalt perspective means reading the space and its elements as a composition of figure and ground that form a whole scene. Space tends to be perceived as ground when solid figures surround the area, but it can also become a solid figure or even a collection of standalone solids [2]. Perceiving the whole based on the composition of the figure-ground is a common way of reading space. In the formation of space perception, the essential aspect of wholeness is the continuity of the composition of figure and ground that form the wholeness of the spaces.

However, the discussion on the role of wholeness in spatial perception, in general, does not acknowledge the limitation of the visual experience that could reduce such wholeness. The limitation of seeing experience occurs as a result of the limited capacity of the human visual system. Within such limited capacity, some visual objects are not perceived as a whole but as separate parts. This paper addresses the limited capacity of visual experience through the exploration of parts that form the wholeness of visual objects, which is called as "puff." The term "puff" is used to explain the parts of the physical system, which cannot be defined and interpreted yet [3]. This study used the concept of puff as a region that has an unknown performance in the formation of a scene within the visual capacity. The perception of puffs is not considered by a separated process. Thus, the relations between puffs in a visual scene becomes essential in the process of identifying the formation of figure or ground.

Studies on the process of identifying shapes tend to consider parts of the whole of the visual information of the object [4]. This limitation may explain how the visual appearance does not represent visual objects as a whole picture of itself [5]. This raises a question on the extent to which the region identification could indicate the amount of visual information registered by the perceiver. In particular, this will be studied through the simulated visual experience of patients in a healthcare environment, to uncover the role of the patient's surrounding environment in providing visual information from the arrangement of the space elements. This knowledge becomes essential since some visual information received by the patients could serve as a positive distraction [6]. Seeing becomes a way of healing when the visual sensory experience could be controlled by the spatial elements in the environment [7-9]. However, the limitation of visual information in a healthcare environment may influence patients' recovery, especially for immobile patients. This study will simulate the visual experience of patients and analyze the formation of the whole through the limited seeing capacity and the role of puffs in such formation.

1.1 The role of puffs

Gestalt principle emphasizes the continuity of elements to form the whole in the process of visual perception. Max Wertheimer, Wolfgang Kohler, and Kurt Koffka as the adherents of the Gestalt principle explained that there was a tendency to separate and unite the visual elements through several laws of simplicity consisting of figure-ground, similarity, proximity, closure, continuity, symmetry, and order [1, 10, 11]. This study applies the principle of continuity in the analysis of puffs that have several similarities of structure in the formation of the wholeness. A group of puffs that have been combined can turn into no more groups. Thus, it is necessary to identify the principle

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of unity to clarify the uniqueness of the whole [12].

There are homogeneous and inhomogeneous properties of puffs in the principle of the relation of visual order [1]. These properties explain that there is an intensity level affected by eye sensitivity in focusing the view and the intensity level of the elements in a visual sphere. The degrees of intensity are based on the level of retinal capacity and the level of the element capacity. The level of retinal capacity is affected by the ability to focus and see comprehensively. In contrast, the level of element capacity is affected by the capacity of the element in distributing the light and by the surface boundary of the perceived element [13].

Puffs as the basic components in a visual structure can have different levels of visual information, which eventually determines the clarity of the perceived form. It becomes crucial to understand these levels since higher levels of information play a role as a good predictor in the recognition of visual objects [14-16]. In rendering the visual information in a puff, the level of information can change its meaning along with the addition or reduction of entities that are related to other information that forms a relationship. The clarity of visual features can increase or decrease based on the presence of the entity with a more considerable amount of the entities associated with it. By analyzing the characters of a visual element, it is possible to identify the level of the relationship among elements. A higher level of relationship will construct more complex patterns and provide an image of elements with higher clarity. Therefore, the characters attached to a visual feature become more understandable in the image perception as a representation of a visual element [17-19]

A visual image can consist of parts that cannot be modified, which are called ground, and another, called figural element, that can be recognized by several identifiers. There is also the mediation parts, which remains unchanged when a specified transformation of image is applied [20]. The clarity of boundaries among puffs can be recognized by several identifiers of the region, which will determine whether the puffs form a figure, a ground, or appears as ambiguity. There are several principles of combination that indicate how partial shapes can form a figure or a ground [21]. These principles include the formations that show figures above or inside another figure (also called overlapping); representation of a smaller figure inside a larger figure; comparison of figure-ground magnitude, figure-ground difference, relative size, relative area or enclosed area; and the relationship between the structure of the part and the whole. By looking at these identifiers in each puff, it is possible to identify the role of the puffs in forming the figure and ground in a particular perceived view. Based on these identifiers, particular puffs can be identified as forming a figure or a ground. When the clarity of the puff as a figure or a ground is determined, the connectivity among the puffs naturally creates the whole form of architectural elements or spaces.

This paper argues that the role of puffs in the formation of figure and ground can be understood by identifying the regions as puffs, determining the clarity of boundaries, determining the levels of clarity (as figure, ground or ambiguity), and returning the puffs go back into the whole system of the visual image. This includes the role of puffs as predictors, activators, connectors, and constraints of meaning between regions. Puff can change or set limits of the region through its properties. Setting limits on the level of clarity of puff becomes essential in the formation of figure-ground categories.

1.2 Puffs within the human visual range

This research emphasizes the role of puffs when they have resulted from a focused view in establishing the visual experience of architectural space. It is based on the belief that parts of sight play an essential role in building the entire architectural space experience. The essence of the seeing experience is represented in the peripheral view and the role of the focused view is less important [22]. Meanwhile, another view stated that the entire visual object is captured as a whole [1]. This study extends both views of visual experience by looking into parts of visual image, or the puff capacity, as the basic component that builds the wholeness of perceived architectural space. [1, 22]

In particular, this study emphasized the role of puffs in building the wholeness of the architectural space within the capacity of the users' visual field. In studying the experience of seeing the puffs within the limited visual range, it is necessary to understand the human visual range and the seeing capacity. In the physiology of the eyes, there is a variety of human visual range, yet the differences among individuals are not significant [23]. In general, the human visual range consists of vertical and horizontal views. The visual range in the vertical view consists of a superior vertical view that ranges from the view straightforward eyes of 0° to the upward view of 60°, and an inferior vertical view that ranges from the view of straightforward eyes of 0^0 to the downward view of 75° [24]. Meanwhile, the visual range in the horizontal view consists of the leftward and rightward view, up to 105° in each direction [25]. The understanding of the human visual range is essential to break the assumption of eye domination in perceiving the wholeness of the visual environment. In fact, the eyes cannot experience all the visual elements at once, and the overall space cannot be perceived only within one glance. This fact leads to the further question of how the visual environment can provide meaningful visual information based on the arrangement of the space elements.

In particular, this study attempts to reveal the formation of visual information within the context of the patient's visual experience. Several studies have found that some architectural elements can serve as positive visual distractions that can divert the patients' attention from the perception of pain [26-28]. However, there are no studies that explore the extent of size and clarity of parts of architectural elements, which are contained in the patient's seeing experience and how such perceived parts are forming the whole of architectural elements. This study takes an approach to unpack the smallest parts of perceived elements, regions, or puffs, in the formation of the figures and ground, by revealing the role of those parts in providing a meaningful form. The limitation of the seeing capacity could reveal the parts of architectural elements that are located within the patient's visual range, and how they form the figure and ground could become the basis to understand the wholeness of the visual environment.

2. Materials and methods

This study simulated the experience of the eye in experiencing space by capturing images seen by the camera in a 3d model. The modeling of space was done in Rhinoceros by creating a replica of the patient's room, including its interior elements. The simulation of the eye view was performed by setting the camera view at the position of eye point of a patient lying on the bed. The wide-angle of the camera was set in the 30° view as the optimal angle in recognizing the shape [29] and the image capture was set within the angle of 0°-60° upward, 0°-75° downward [24] and 105° to the left and right direction [25]. Each view captured by the camera produces a series of scenes that are arranged in a visual coordinate system that represent the perceived view. A system coordinate was established to organize the relationship among the regions in each scene. The image capture from the camera resulted in thirteen series of vertical scenes and eight series of horizontal scenes, creating a total of 108 scenes.

Each of these scenes consisted of several regions that represent the most essential elements that are within the patient's visual range. Further analysis was conducted to identify the role of regions by measuring each region's criteria identification as an indication of how the observer absorbs significant visual information. In this analysis, puffs are referred to as regions

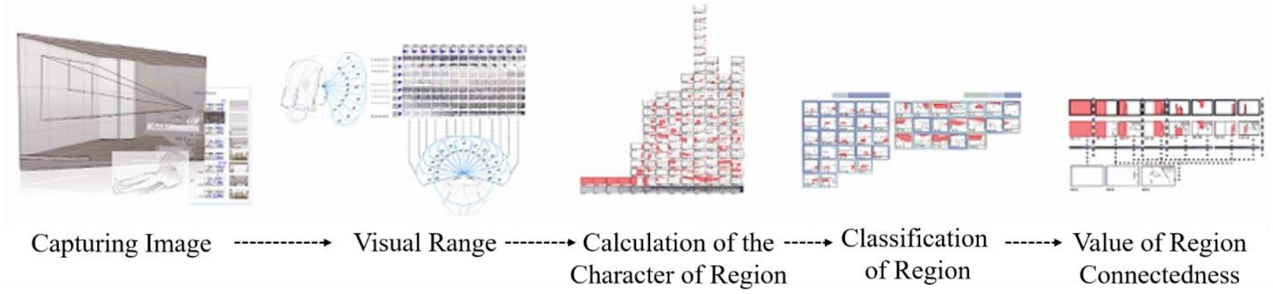

Figure 1 Methods of analysis

during the process of identification, and regions are referred back as puffs when finding out how they give meaning as a part of the whole. The calculation was performed by the Mat lab region calculation to identify the region characteristics. The identifiers used in this study consisted of the Area, Major Axis Length, Minor Axis Length, Eccentricity, Equivdiameter, Perimeter, Euler Number, and Orientation.

The Area indicates the ratio between the region area and the whole scenic area. Major Axis Length indicates the ratio between the distance from the region centroid to the furthest point of the region and the distance between the scene centroid to the furthest point of the scene. Meanwhile, Minor Axis Length indicates the ratio between the distance from the region centroid to the closest point of the region and the distance between the scene centroid to the closest point of the scene. Eccentricity indicates the tendency of major and minor axis lengths. Orientation is represented as the degree angle that indicates the orientation of the x-axis and the major axis length of a region. Euler Number is calculated from the number of region objects subtracted by the number of holes in that object, to indicate the object solidity or cavity. Equivdiameter indicates the diameter of a circle that could fit into the region. Perimeter indicates the perimeter distance of the region. The calculation produced the values of region characteristics, which became the basis for categorizing the puffs as figure, ground, or ambiguity. The higher value indicates the tendency of the region to form a ground, while the lower value indicates the tendency of the region to form a figure. The region with intermediate value will be categorized as ambiguous, in which the puff can form either a figure or ground.

Further analysis was conducted to explore the connectedness of regions in the perceived images. A collection of representation is considered complete when the contents sufficiently fitted to one another [30]. Content has a binding trait that depends on other contents. In this study, the relationship between the regions was calculated as an indication of how one region relates to others in forming the whole image. The analysis of the region character and the region position was performed using Somers'd method to calculate the relations between regions with SPSS Version 25. The result of the calculation revealed the levels of relationship between the regions.

The use of computational simulation approach to capture and display the spatial experience has some limitations. There may be some differences between the simulated visual experienced and the real human experience of seeing. The human visual experience may involve subjective interest in certain parts of the environment. This could not be identified in the computational simulation, which assume equal possibilities to all areas. Nevertheless, the simulation allows the captured view to display all elements within the visual range to be analyzed in detail.

3. Results

3.1 Identification of puffs into figure, ground and ambiguous categories

The following is the result of the analysis of puffs found in a horizontal series of views from the visual sphere captured from the simulation. This series is taken from axis x = 0 and y = 1 and consists of 13 scenes marked (1,1) to (13,1). The 13 scenes contain a total number of 118 sub-scenes, each representing a puff (Figure 1). The calculation of region character identifier, consisting of Area, Major Axis Length, Minor Axis Length, Eccentricity, Equivdiameter, Perimeter, Euler Number and Orientation, indicates the levels of relationship between regions. The levels of relationship range from the highest values (Level 1) and the lowest (Level 5). These levels indicate the clarity of each puff. The clarity further helps to reveal the role of puff as a basic component in the forming of architectural elements as figure and ground. The five levels can be categorized into three degrees of relationship, namely strong, moderate, and weak relationships.

Figure 2 illustrates the distribution of the region character levels from the highest to the lowest. The regions with the highest value are represented by the series of regions of the left wall with the highest average values: Area = 0.90, Major Axis Length = 1.00, Minor Axis Length = 0.91, Eccentricity = 0.91, Equiv Diameter = 1.00, Perimeter = 0.95, Euler Number = 0.80, Orientation = 1.00. These highest values of region characters indicate the domination of the characters of the parts in the formation of the whole and the clarity of separation of the region. The clarity of boundaries becomes clear when a strong relationship is identified by the relations of the continuity between the scene and its neighboring scenes. The relations describe the nature of the changes in the region's criteria characters as the view move from one scene to other scenes within the coordinates of the visual system.

The data above demonstrates the sub-scenes that provide a higher level of information that becomes a good predictor in the perception of the visual object [14, 15]. The study found that several elements appear in the visual environment with the relationship value at Level 1 and Level 2, indicating the strong continuous integrity on the wholeness of the view. These elements are the railing (Perimeter = 0.59, Minor Axis Length = 0.52), the main door (Major Axis Length = 0.80), and the rear wall (Area, Major Axis Length, Eccentricity, Equivdiameter, and Perimeter each with the value of 0.66).

The architecture elements that are categorized into Level 3 are those that are identified as having a moderate relationship between regions. The formation of relations in this category is not influenced by the changes in region coordinates. These elements consist of: the front wall, the left wall, and the front wall. The moderate relationship indicates the absence of

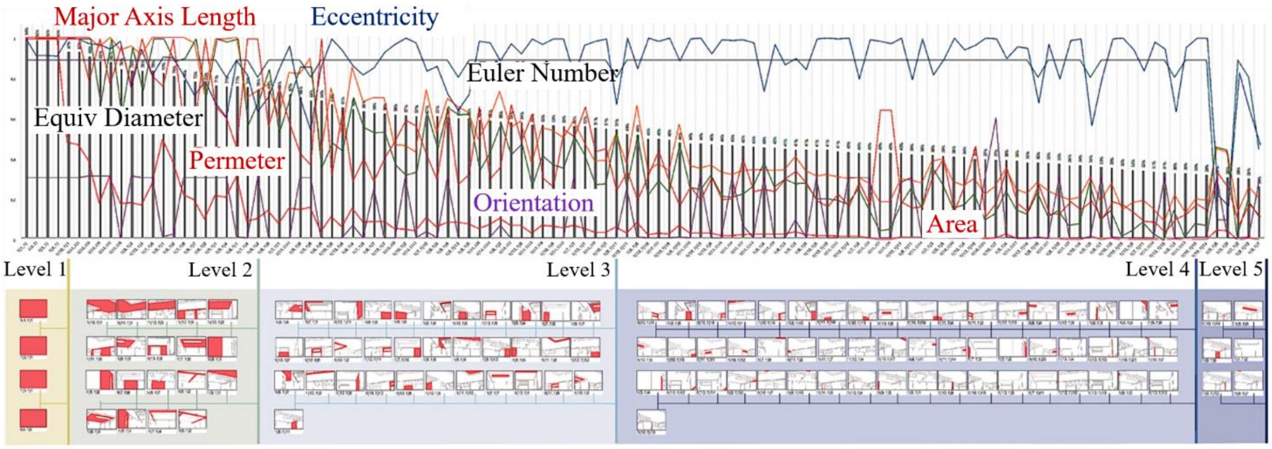

Figure 2 Categorization of regions as figure and ground

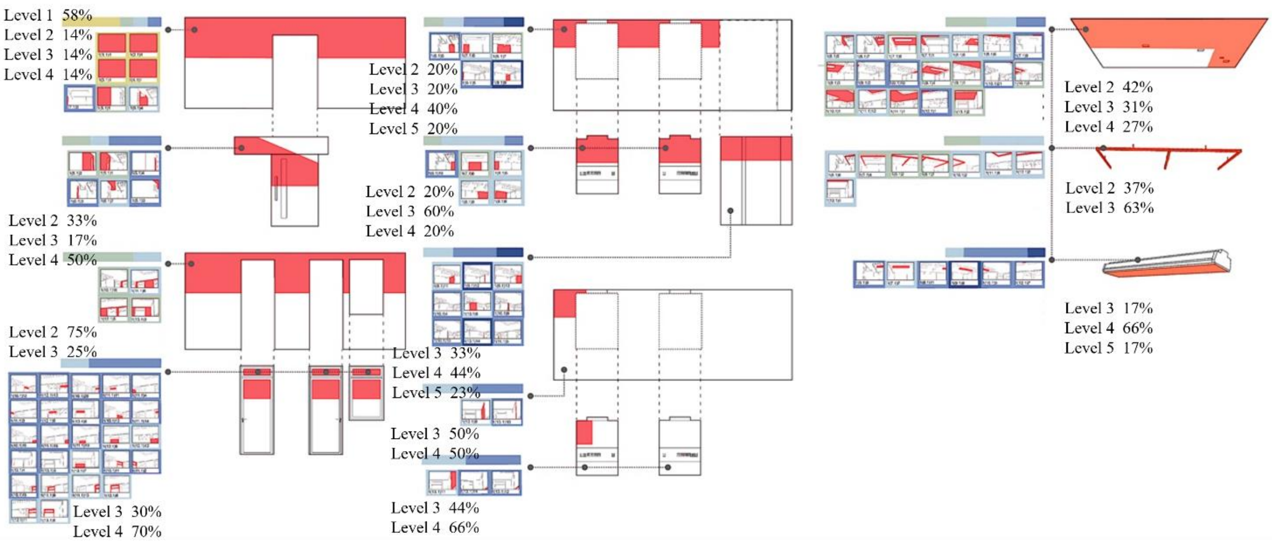

Figure 3 Categorization of puffs as forming elements

character changes in the element identifier criteria in the region; therefore, the neighboring scene still demonstrates a similar character from the previous scene [31]. It also explains that the legibility of a relationship follows the changing views and the introduction of other elements emerged from the background elements. The elements with moderate relations tend to have the fixed value, suggested a tendency to be monotonous, and lack the distinctive character of the elements

The regions with a lower value of region character are categorized into Level 4 and Level 5, which represents a weak relationship. The elements with weak relationships demonstrate the separation of the region with others. The examples of elements with weak relation are the right wall (Area = 0.00, Major Axis Length = -0.83, Minor Axis Length = 0.00, Eccentricity = -0.50, Equivdiameter = -0.17, Perimeter = -0.17) and the railing (Area = 0.33, Major Axis Length = -0.11, Minor Axis Length = 0.52, Eccentricity = -0.22, Orientation = -0.11, EquivDiameter = 0.26, Perimeter = 0.59). There is an absence of dependency on each region's criteria. The minus value describes the significant absence of dependency of one region character to others.

3.2 The formation of figure-ground from puffs

Puff character identification explains that each region has a particular level that reveals its independence in shaping the integrity of the element. It demonstrates how the homogeneous and inhomogeneous properties determine the principle of the relation of visual order [1]. It explains whether a region is seen as an independent entity without considering its relationship with other regions as a whole. The limitation of the visual capacity of the focused view in the patient's visual range explains that the region functions as a part that forms the whole in the visual coordinate system.

The image is captured by the retina as an integrated and whole seeing experience [32]. This study found that the regions in the scene has a distinction from one another and could be identified when they are integrated and absorbed as the whole figure. The relationship between regions establishes the whole element of space. The whole is formed by the elements that are known not as separate entities, and the wholeness is captured in a series of scenes. The finding of this study also indicates that the essence of the formation of elements requires the configuration of complex integrity that builds multiplicity without having to be divided [33]. Complex integrity, as found in this study, suggests that regardless of the level of relationship, each puff has roles in the system of physical structure perceived.

Figure 3 illustrates that the architectural element as a whole is formed by several regions with different levels of character, which only represents a part of the whole element. An element in a scene is represented by several sub-scenes consisting of parts of the element. Each scene has a relationship value that indicates the connection between scenes in terms of position and character,

Table 1 The levels of region character and the levels of region relationship

Elements	Number of sub-scenes	Area character average	Figural character average	Character average the role of puffs	Level of region relationship	Level of character figural relationship	Puffs' category
Left wall	4 sub-scenes: 1(1,1)1; 1(2,1)1; 1(3,1)1; 1(4,1)1	100%	83%	93%; Level 1	Strong	Strong	Ground
	1 sub-scene: 1(5,1)1	50%	76%	77%; Level 2	Moderate	Strong	Ambiguous
	1 sub-scene: 1(6,1)4	16%	66%	60%; Level 3	Weak	Strong	Figure
	1 sub-scene: 1(7,1)3	4%	48%	39%; Level 4	Weak	Strong	Figure
Main door attached to the left wall	2 sub-scenes: 1(5,1)2; 1(6,1)1	36%	74%	73%; Level 2	Moderate	Strong	Ambiguous
	1 sub-scene: 1(6,1)2	11%	61%	55%; Level 3	Weak	Strong	Figure
	3 sub-scenes: 1(5,1)4; 1(6,1)3; 1(5,1)3	3%	48%	40%; Level 4	Weak	Moderate	Figure
Right wall	3 sub-scenes: 1(10,1)16; 1(12,1)5; and 1(13,1)3	13%	73%	69%; Level 2	Weak	Strong	Figure
	1 sub-scene: 1(11,1)6	18%	82%	79%; Level 3	Weak	Strong	Figure
Openings (door, window) attached on the right wall	8 sub-scenes: 1(12,1)8; 1(12,1)12; 1(13,1)7; 1(11,1)9; 1(11,1)13; 1(12,1)6; 1(12,1)11; 1(13,1)6	6%	63%	Level 3	Weak	Strong	Figure
	18 sub-scenes: 1(10,1)12; 1(12,1)13; 1(10,1)20; 1(11,1)11; 1(11,1)4; 1(11,1)3; 1(12,1)9; 1(13,1)8; 1(10,1)13; 1(11,1)14; 1(10,1)19; 1(11,1)15; 1(11,1)10; 1(13,1)4; 1(13,1)5; 1(10,1)11; 1(11,1)2; 1(10,1)18	2%	51%	42%; Level 4	Weak	Moderate	Figure
Front wall	1 sub-scene: 1(8,1)7	20%	76%	73%; Level 2	Weak	Strong	Figure
	1 sub-scene: 1(7,1)5	9%	70%	73%; Level 3	Weak	Strong	Figure
	2 sub-scenes: 1(6,1)8; 1(9,1)5	5%	54%	41%; Level 4	Weak	Strong	Figure
	1 sub-scene: 1(9,1)9	4%	49%	28%; Level 5	Weak	Strong	Figure
Bed head attached to the front wall	1 sub-scene: 1(7,1)8	22%	76%	74%; Level 2	Weak	Strong	Figure
	3 sub-scenes: 1(8,1)5; 1(8,1)9; 1(9,1)6	13%	70%	62%; Level 3	Weak	Strong	Figure
	1 sub-scene: 1(6,1)10	7%	54%	44%; Level 4	Weak	Strong	Figure
Toilet wall	3 sub-scenes: 1(9,1)11; 1(10,1)8; 1(9,1)13	9%	66%	56%; Level 3	Weak	Strong	Figure
	4 sub-scenes: 1(10,1)4; 1(10,1)10; 1(10,1)9; 1(11,1)5	1%	47%	33%; Level 4	Weak	Strong	Figure
	2 sub-scenes: 1(9,1)12; 1(10,1)14	1%	41%	29%; Level 5	Weak	Strong	Figure
Rear wall	1 sub-scene: 1(13,1)9	7%	66%	54%; Level 3	Weak	Strong	Figure
	1 sub-scene: 1(13,1)10	2%	47%	37%; Level 4	Weak	Strong	Figure
Bed head attached to rear wall	1 sub-scene: 1(13,1)11	16%	77%	67%; Level 3	Weak	Strong	Figure
	2 sub-scenes: 1(13,1)14; 1(13,1)12	1%	49%	36%; Level 4	Weak	Strong	Figure
Plafond	7 sub-scenes: 1(7,1)6; 1(8,1)3; 1(9,1)4; 1(9,1)1; 1(10,1)3; 1(10,1)1; 1(11,1)1; 1(13,1)2	28%	77%	76%; Level 2	Weak	Strong	Figure
	6 sub-scenes: 1(6,1)5; 1(6,1)7; 1(7,1)1; 1(8,1)8; 1(8,1)6	9%	68%	62%; Level 3	Weak	Strong	Figure
	5 sub-scenes: 1(7,1)9; 1(9,1)3; 1(9,1)10; 1(10,1)21; 1(12,1)1	2%	49%	38%; Level 4	Weak	Strong	Figure

Table 1 (continued) The levels of region character and the levels of region relationship

Elements	Number of sub-scenes	Area character average	Figural character average	Character average the role of puffs	Level of region relationship	Level of character figural relationship	Puffs' category
Railing	3 sub-scenes: 1(7,1)4; 1(8,1)2; 1(9,1)2	10%	74%	71%; Level 2	Weak	Strong	Figure
	5 sub-scenes: 1(6,1)6; 1(10,1)2; 1(11,1)8; 1(12,1)2; 1(13,1)1	6%	63%	57%; Level 3	Weak	Strong	Figure
Lamp	1 sub-scene: 1(7,1)7	7%	59%	52%; Level 3	Weak	Strong	Figure
	4 sub-scenes: 1(6,1)9; 1(8,1)11; 1(10,1)5; 1(12,1)7	2%	50%	39%; Level 4	Weak	Strong	Figure
	1 sub-scene: 1(9,1)8	5%	41%	29%; Level 5	Weak	Strong	Figure

and the relationships formed between scenes together form the part of the whole architectural element.

There are five levels of region character with three categories of relations, namely strong, moderate, and weak. The study found that there are certain elements with certain dominant characters that revealed the formation of architectural elements as ground and figure. The calculation of the criteria characters indicates that there are two types of region characters, the characters dominated by area criteria and the characters dominated by figural criteria. A region dominated by an area found in a region has a high ratio between the area of the region and the area of the scene, meanwhile regions that are dominated by figural criteria are found in regions that have a low value on the area ratios but high values on other character identifiers. A region that has a high area ratio cannot have high values on other identifiers since the greater the area, the less likely it is to have direction or shape that extends or shortens in certain parts.

Elements dominated by the area criteria are found in architectural elements with dominant surface properties; therefore, the region that represented the element identified as ground, as found in the elements of the left wall, right wall, toilet wall, and ceiling. Elements that have a low value of area criteria but have a high value in figural criteria are categorized as figures.

These are the elements attached to the surface, such as the main door, opening area (doors and window), head bed, railing, and lights. (Table 1). Meanwhile, the architectural elements identified as ambiguous are elements that have regions with an area character level close to half of the scene and are not influenced by the figural characters. In the ambiguous category, puffs are found both in the figural and ground elements. Puffs as a figural element are found on the main door and the bed head on the front wall. While puffs as ground elements are found on the left wall, front wall, toilet wall, back wall, and ceiling (Figure 3). These elements are ambiguous because both the area and figural characters do not dominate in every scene or the relationships between scenes. Ambiguous elements form the region between architectural elements that are perceived as ground and figures and become the transitional boundary connecting the coordinates of the region as the ground to the region as figures.

4. Discussion

This study presents an analysis of the recognition of figures and ground based on the separated parts by calculating the region characters. The principle of figure-ground recognition was first developed in the classical view of visual perception that emphasizes on proximity, similarity, common fate, good continuation, closure, symmetry, and parallelism [1, 10, 34]. Later development also emphasizes some new principles of visual perception such as synchrony, common region, element, and uniform connectedness [10, 35-38]. The development of visual perception principles suggests a fundamental shift of approach from subjective to objective.

This study is in line with the idea that object recognition occurs through the character of the object itself. By calculating the values of the region character, it is possible to identify the role of the regions or puffs in building the overall images of the physical environment. The value of the region's criteria character and their positions reveal the clarity of the regions in the visual environment experienced by the observer. The different levels of relationship in this study reveal the mechanism in the formation of figure and ground. They explain how within one observer's view, images can appear as figure, ground, or ambiguity, including the possibility of errors in recognizing figures as ground, and vice versa. This finding of this study has also related the idea that giving meaning to visual objects as visual information is not something that could be taken for granted, but it is built from a variety of factors that influence the possible variants [39].

The discussion on visual perception tends to consider the identification of visual elements through figures and ground as an overall visual object [40], and there is a lack of explanation on how figures and ground may have an ambiguous nature. This study attempts to explore the visual perception that is not only based on a view in one glance. By dismantling the part on the formation of figure and ground, this study unpacks the character of the regions. This explains that each level in the cognitive mechanism could have multiple Interpretations. Thus, each part does not carry a single meaning in forming a figure but should be seen continuously as a series of views [41].

The diplays of this study suggest the need to consider the role of each part of the process of the seeing mechanism. This suggests that meaning is not formed through the overall view but is revealed from the region character through the levels of the relationship of those parts. Concerning the specific context of visual experience that can support the recovery of the patient, by revealing the region's character, it is possible to know which elements are seen as a figure, as a ground, or as figure and ground perceived simultaneously. Thus it is possible to control the visual experience of patients that are meaningful for patient recovery.

This study also reveals, in particular, the formation of the ambiguity of figure and ground. The strength of the relationship between the region's criteria and the region's position could create a gradual change in the formation of figures and ground. As a consequence, the level of region relationship reveals the potential of the elements that are perceived as the focused views. Gestalt thinking explains the necessary process of the formation of relations by uniting the interaction of the visual contact zones of visual objects and producing various integrations called regional relations variants [42]. The regional variant reduces the tendency for misinterpretation from the direct view. Through a variant of the region level, the process of forming regions into figures and ground can be detected earlier through the character

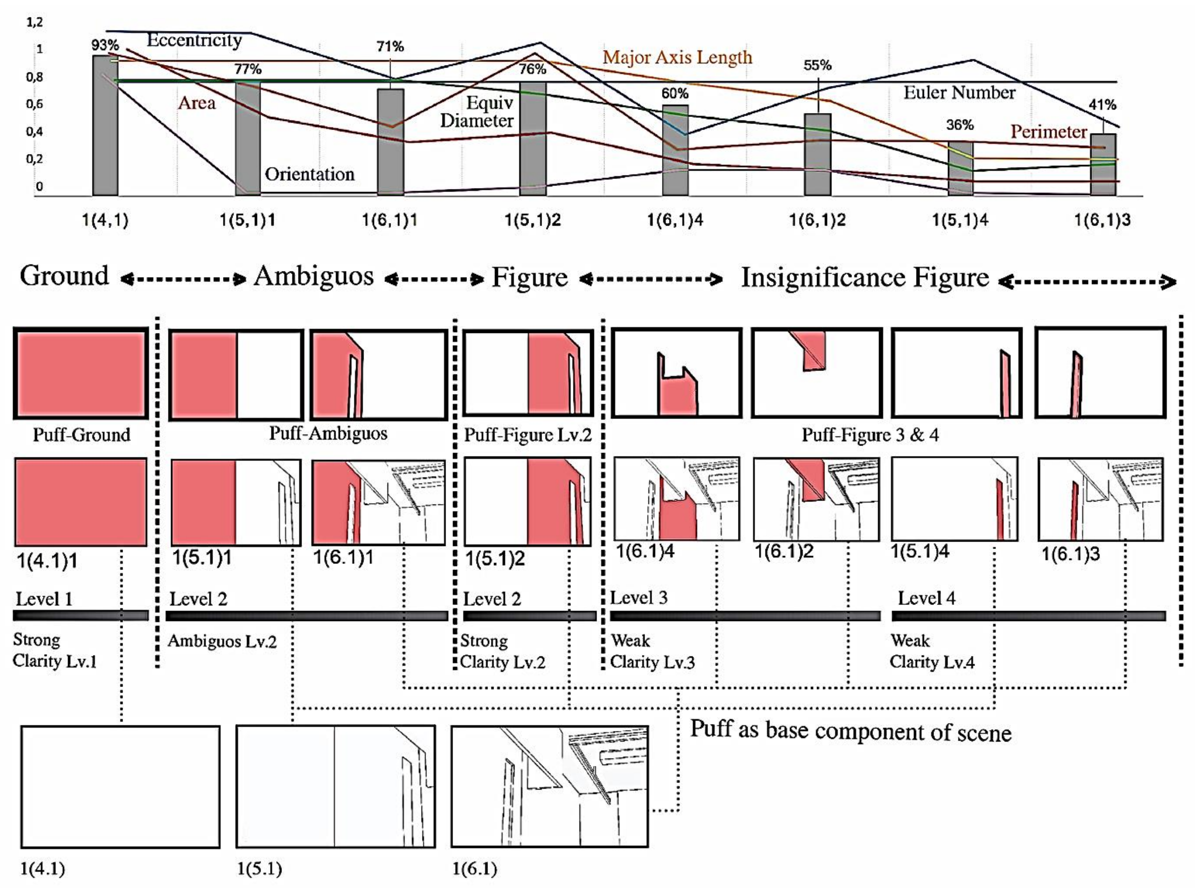

Figure 4 An example of revealing the clarity of figure and ground

of the relationships that exist among regions. Based on the levels of relationship, the regions are no longer considered as separate parts but they become interrelated parts in the formation of a whole within the limitation of the view.

The dismantling of the figure and ground components reveals how the puffs are perceived as part of a whole that can have its meaning. However, puffs cannot stand alone as separate parts; they still need the relationship to other puffs within the framed views. The level category appears to be internally structured along a gradient in defining features that constitute a well-defined category boundary called a relation [43]. Figure 4 illustrates an example of how the level of relationship of a region reveals the character of a region. Relationship with strong characters provide strong clarity in forming the figure and ground. Meanwhile, the relationship with balanced value suggests an ambiguity relation, in which the regions tend to become a figure and a ground at the same time. Weak relationships suggest the weak clarity in the differences among the region. The more insignificant value, the weaker the level of clarity of the region in becoming a figure or ground.

However, the classification of puffs into figure, ground, and ambiguity does not always work directly based on the five levels of puff relationship. The formation of puffs as the basis for forming the elements occurs through a combination of levels of puffs' criteria character levels. This study found that strong relations can still become an ambiguous category in shaping architectural elements, depending on the highest value of a particular character by the region.

The ambiguity of the figure and ground can be clarified by disassembling parts of the figure and components and finding the relationship structure between the components within a scene. The levels can detect early changes from a figure into the ground. Revealing puffs as a figure or ground could help to add a new perspective in how parts of the image are seen as figure and ground, through the identification of the region character and the description of the character criteria of puffs as the primary forms of an element.

5. Conclusions

This study attempts to reveal the role of visual information in the healthcare environment in the visual experience of the patients. In particular, this study confirms the differentiation of regions perceived by the patients into the categories of the figure, ground, and ambiguous, thus identifying the clarity of the region in shaping the whole seeing experience of space. The study reveals five levels that indicate the degree of relationship among puffs. Level 1 and 2 indicates a strong relationship that forms the figure; level 4 and 5 indicates a weak relationship that forms the ground; level 3 indicates a moderate relationship that forms the ambiguous image. The three categories of puffs become the basis of the spatial elements in building visual experiences. Each category has a different level character, which clarifies the distinction between figure, ground, and ambiguous. These categories of puff reveal how the physical environment is perceived within the visual capacity of the patient.

This finding suggests the importance of reading architectural space by dismantling visual structures of the users' visual experience, as a way to reveal the mechanism of visual experience and the relationship between perceived scenes. Each scene contributes to the connecting or dismantling of puff in forming the image of architectural elements in the patient's visual experience. By understanding the role of puffs, it is possible to describe the limited performance capacity of the visual experience of architectural space.

This study suggests the possibility to know how the arrangement of space elements provide visual information for the patients, in particular, how visual images are perceived as parts of the whole image. The study indicates the need to explore further the potential areas within the limitation of visual capacity to provide meaningful information to support the healing process. Further research can be conducted by exploring the characters of the region that can be arranged to improve the quality of visual information from the architectural elements within the view of the observer. Such exploration will be useful to enhance the quality of patient visual experience in space.

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7. References

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