A Case Study on Formative Elements and Visual Perception Theory Expressed in Virtual Art Contents

Chang Yong Jung

Western Chung-Ang University Seoul City, Republic of Korea.
E-mail: artmywood@cau.ac.kr

Abstracts: With the development of media, the form of expression has rapidly grown into the field of virtual art. The trend of development and generalization of virtual space art through virtual space and virtual reality is forming interest in virtual art using computer graphics, such as information and material, space and time, reality and virtuality, and active participation. The purpose of this paper is to analyze the image contents expressed in virtual art based on the Gestalt theory of form, and to study the aesthetic characteristics of the formative elements and principles of visual perception expressed in virtual art contents. As a result, the aesthetic expression of formative elements and principles of visual perception can feel illusion or virtual expression. In addition, it was confirmed that virtual art was applied with free spatiality that is not limited by space. It was found that the Gestalt theory could play a role in identifying and understanding the meaning expressed in virtual art.

Keywords: Virtual Art, virtual Reality, Content Storytelling, Formative Arts, Visual Perception sequence, New media.

1. INTRODUCTION

Recently, advance of digital technology has a considerable influence on art and technology making it possible for us to realize myth and legend as exiting movie or drama and to save current life and figures as photo or video for long and simulate or experience future dream like world through virtual reality. Virtual art has been positioned as visual communication through new non-language element and its use has been expanded. Development of IT and digital media has led to studies in terms of art and commerce using simulation and virtual experience.

Virtual art used as visual communication is based on virtual reality and needs immersion and combination with real contents for implementation of perfect virtuality. According to visual perception theory, when humans look at an object, they perceive overall characteristics of such object first. Gestalt visual perception principle will be helpful in presenting basic theory for effective virtual art. Expression of virtual art has developed revolving around technical implementation using immersion and presence and video contents. Most studies have focused on physical elements and implementation methods of characteristics of media. Understanding video contents of virtual art which are suitable for characteristics of three-dimensional artworks and human perception is needed because approach to virtual art failed to fully consider formative characteristics of an object and communication process in diverse aspects in terms of psychology and approach has been made based on one dimension.

The purpose of this study analyses video contents expressed in virtual art through previous studies based on universal characteristics of human perception and examines virtual art works that show characteristics of formative elements through principle of visual perception. Also, this study examines advantages of relationships between virtual reality, formative elements and the principle of visual perception which has not been discussed before to induce formation of immersion and presence of diverse participants.

2. VIRTUAL ART AND FORMATIVE COMPOMENTS

2.1. Theoretical Considerations

Five main models for work-life balance

Virtual art is based on combination of art and technology and includes all previous media as subset and is created with media technology. Virtual art includes man-machine interface such as visualization casks, three dimensional glasses and screen, digital painting and sculpture, three-dimensional sound generator, data gloves,

data clothes, position sensor, tactile sense and electric feedback system.

The most significant change which virtual reality technology has brought to virtual art is implementation of presence that allows viewers to feel as if they are in artwork and interactivity that artwork reacts to participant's movement. This needs for virtual reality technology to create artwork contents that cover upper and lower sides and right and left.

Virtual art based on virtual reality has an advantage that allows participants to be immersed in artwork freely and see a place which they want. Freedom of sight which participants have allows them to feel presence and third dimension escaping from restriction of camera angle and frame. Such freedom of sight allowed virtual art to have objectivity (Shin, H, J. 2016).

Virtual artworks need to reproduce contents in a realistic way, sense movement of participants and react to such movement in real time. Such virtual reality technology allows participants to interact actively through movement of body beyond a change in sight and above-mentioned interaction not only maximizes presence among participants(viewers) but it also changes a way that they experience virtual art.

It is not possible to use grammar of video such as composition, camera work, editing which visual media has developed revolving around movie in producing virtual reality video. As the concept of frame in virtual reality video means the frame of upper and lower sides and 360 degree space, composition that fills all space should be considered. It is difficult to apply lighting that is suitable for space and atmosphere outside frame. If existing images are composed considering arrangement, composition, line of flow etc. within frame of four corners, artworks based on virtual reality become space open to participants (Kang, J. Y, 2017).

2.2. Meaning of virtual Art in terms of Aesthetics

VR image contents expressed in virtual space play a significant role in configuring virtual art. Meaning and characteristics of VR image contents expressed in virtual space in terms of aesthetics can be considered to understand and communicate with viewers and as visual communication.

VR image contents are visual thinking between artists and viewers in other words, a kind of visual communication forming complementary and close relationship with viewers through visual message. This is the most basic element in visual communication between visual art and viewers because visual message of VR image contents is the most important attribute in increasing immersion of participants and highlighting illusion and aesthetic characteristics which media have. As described above, visual message or information in visual thinking delivers aesthetic feeling to viewers and aesthetic expression influences viewers. Aesthetic function of information or visual message needs to be interpreted and understood as media for effective delivery of visual message because it plays an important role in composing visual communication process and like other components, in delivering visual messaged.

VR image contents expressed in expanded space of virtual art have characteristics of immersion, agency, and transformation in terms of media aesthetics (Janet H. Murry, 2017) and illusions which visual beauty and space give is complementary and interactive and form close relationships.

Aesthetic range which visual art has can be considered to be whole of aesthetics of visual communication system delivering aesthetic message through expanded space and illusion. Aesthetics of visual communication in VR image contents can be considered to a process clarifying meaning or philosophy effectively through various experience of artworks and highlighting and interpreting it

3. FORMATIVE ELEMENSTS

'Plantlike' and 'plasno' that are origin of modelling have a meaning of 'making a shape' and 'composing a shape' and can be interpreted as a meaning of completing a shape or an image. Above mentioned origin of word have been mainly used in sculpture art and in 20th century, they have been used as a meaning of 'behaviour of making a shape'(Oh, J. G, 1991). Formative art is described as a concept of covering art of painting, sculpture, architecture,

handicraft, and design which create visual beauty on special shape by using various materials as creative artistic activities that combine 'visual formative components' according to formative principle which is grammar of fine art (Yoon, M. H, 2008).

According to Popper, F, (1974), issues of plasticity of reified or strengthened digital based artwork is closely related to aesthetic problem, which is related to graphics, painting, design, sculpture, photograph, architecture, line, colour, shape, pattern, composition, movement, rhythm, lighting effect and space performance. Artists of this section use digital technology to obtain a new result by using his/her own ways of creating artworks combining with formative problems which selected digital methods.

Virtual art using formative elements and principles is expressed as shapes, planes, mass etc. according to artist's intention and acts as a guideline by which artworks are composed and interpreted. As mentioned above, formative elements allow viewers to be satisfied with an object in terms of visionary sensation through visual information and viewers' perception that makes it possible for us to perceive things or surroundings as well as artistic expression and this can be interpreted as visual communication. Formative elements are visual basic elements that compose virtual space.

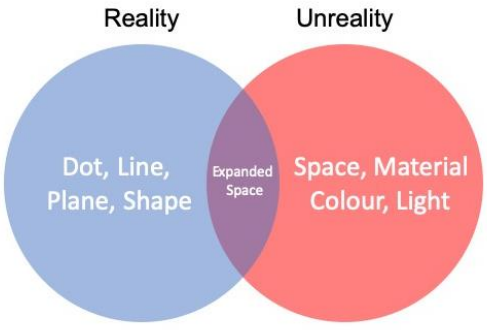
Formative principles are visual principles that combines various visual formative elements into artworks and they are like grammar of formative art. Basic elements of formative art are classified into 'dot, line, plane, shape, space, material, colour, and light'(Yoon, M. H, 2008) and among them, dot, line, plane become representative basic elements.

3.1. Composition of Formative Elements in Virtural Art

Virtual art induces viewers to be immersed through optical illusion by making static object changed to dynamic one. Such experience allows viewers to feel amusement for immersion by inducing them to perceive confused space and making physical shape look like other space.

Expandability of space shown in virtual art is expansion in space without restriction on space rather than expansion of physical range and provides an opportunity to recognize space as new one by making the depth of space infinite to overcome limit of time and space on the assumption that space is visible even if it is not visible in physical space.

Artworks based on virtual reality excludes heterogeneous disharmony by reducing or removing a difference in space, time and visionary sensation that occurs between actual reality and virtual one and can be a process of combining actual reality and virtual one. Such process allows viewers and artworks to communicate with each other through the role of intermediate media (Lee, W. C. & Jung, C. Y. & Kim, H. G, 2014; Bashir, M. N., Naseer, M. N., Quazi, M. M., Wakeel, M. S., Ali, I., Soudagar, M. E. M., & Bhatti, 2021) and it is an important element that



composes mobile space between reality and unreality.

Figure 1. Composition of space in Virtual Art(Lee, W. C,2014).

Basic components of three-dimensional artworks that implements virtual reality in virtual art are classified into ‘dot, line, plane, shape, space, material, colour, and light’ and among them, dot, line, plane and shape are basic representative elements that compose space.

‘Dot, line, plane, shape’ serve as basic frame that composes space by creating concrete visual composition and pursuing a shape (Yoon, M. H, 2008) and they are realistic expression areas. Meanwhile, space, material, colour and light are unrealistic expression areas which virtual art creates. In virtual art, artists create virtual space with formative components and compose expanded space by using space which artists create realistic expression areas and unrealistic expression areas. Such formative components allow us to find connection of immersion formed between participants and virtual three-dimensional artworks. In addition, Formative elements can be considered connected with visual thinking which participants have.

Composition of formative elements for visual effect is an important element in forming clear order of artwork. All formative elements have visual nature, and such nature has basic relationship which composes any surface and serves as a material that is used to create a shape.

Category		Components	Contents
Characteristics of expression	Plastic expression	dots	simplicity, infinite expandability, various shapes, sum of patters and light and darkness
		lines	expression, direction, dynamics, outline of shape, light and darkness and composition of patterns
		planes	infinite expandability of planes, two dimensional, three dimensional, frame of outline
		shapes	combination of dots, lines and planes, one or more planes, two dimensional and three dimensional formation
	Spatial expression	spaces	positive and negative, width and depth, depth of two dimensional and three dimensional shapes
		materials	tactile sensation, quality of materials, property of materials
		colors	characteristics of sensation, composition of hue, brightness and chrome, basis of perceptual characteristics
		lights	composition of source, color, strength, direction, feel, basis of visual characteristics

Figure 2. Basic Composition of Virtual three-dimensional Structure.

4. FORMATIVE VISUAL PERCEPTION PRINCIPLE AND COMPONENTS ELEMENTS

Gestalt visual perception principle has been studied based on human visual information processing and verified through experiments. Visual perception theory was raised in the field of perceptual psychology which studies characteristics and principles of visual perception. Rudolf Arnheim who applied Gestalt visual perception principle based on logics and science to art actively said “concept of a shape determines what an object means is created by perceptual process” which tends to create regular and stable shapes. Accordingly, certain perception principle appears as principle of composition in creation and there is a certain relationship between above mentioned principles in other words, there is a relationship which reacts as a whole by certain shape or Gestalt (Chun, B. b, 2008).

Gestalt visual perception principle refers to a theory of tendency to interpret information in a specific form to make it easier to memorize in the process of image being interpreted in a brain from human visual perception. Gestalt visual perception principle is presented as more exciting visual principle in the process of a shape being

perceived in a brain through reinterpretation by viewers beyond a concept that visual sensation perceives a shape on eye's retina at a biological level (K. Koffka, 1955). Visual perception theory has been classified with a similar context. Five laws are proximity, similarity, completeness, continuation and commonness. Such laws provide basic guideline for structural combination of objects in a screen or a subject.

Such visual perception laws provide users with information and clear and consistent conceptual structure preventing disorder and confusion. Visual perception law can strengthen an organization by using space, outline, and colour (Rudolf Arnheim, 1974). Several visual perception laws recognized as a shape based on simplicity, regularity, symmetry and easiness of memory through Gestalt visual perception theory were published and among such visual perception laws, elements which are used most commonly in images are proximity, similarity, continuation and closure.

Law of Proximity

Proximity refers to phenomena that when shapes of several three-dimensional structures are placed in one space, elements that are located close each other look like one group. Proximity also refers to tendency which produces relationships according to combination of shapes or humans intend to perceive them as one classification or mass.

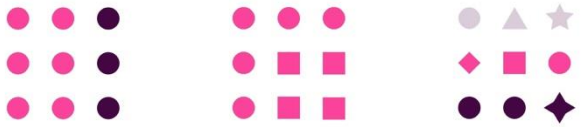


Figure 3. Visual Elements According to Proximity.

Law of Similarity

Similarity refers to tendency that humans intend to see visual elements such as shapes, sizes, colours, and directions with similar nature as one patterns with them grouped and if other elements are same, shapes look as if they are grouped according to similarity and tendency that shows coherence.

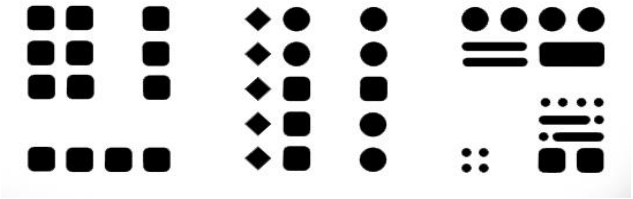


Figure 4. Visual Elements According to Similarity.

Law of Continuation

Law of continuation tends to be perceived according to rhythm, waving line as continuous curve. Continuation of lines is a simple order and helpful in forming images and forms patterns or shows shapes which form types like direction.

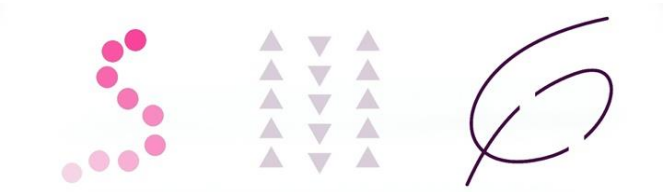


Figure 5. Visual Elements According to Continuation.

Law of Closure

Closure can be considered as a kind of image restoration phenomena and gives association of shapes through

visual elements based on psychological stability.

Figure 6. Visual Elements According to Closure.

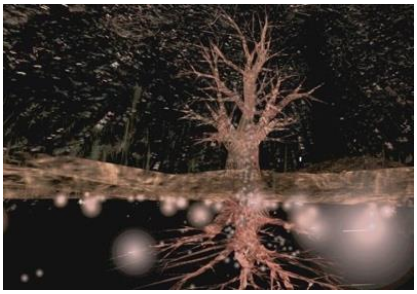
category	characteristics	effect
proximity	perceive as if elements placed close or similar natures form one shape even though they are located apart	composing shapes, attention, legibility
similarity	perceive as if shapes with similar nature are one shape grouped	coherence, clarity of classification when combined with other characteristics
continuation	nature that shapes of several natures intend to troop together with direction	clarification of overall shape
closure	incomplete shape is perceived as complete one	psychological stability, formation of depth perception

Figure 7. Characteristics and Effect of Visual Perception Laws.

5. CASE STUDY OF ARTWORKS

5.1. Osmose, 1995

Charlotte Davies, pioneer of virtual reality produced Osmose, immersion type virtual reality artwork. This artwork which interacts with participants consists of twelve spaces with a motif of nature and text and uses technique of slowly overlapping images.



Category	Osmose, 1995							
plastic element	dots	lines	face	shapes	spaces	materials	colors	lights
	○	○	○	○	○	×	×	○
visual perception laws	proximity		similarity		continuation		closure	
	○		○		○		○	
characteristics of expression	Similarity and proximity which animation gives as pattern of shape expresses sense of depth.							

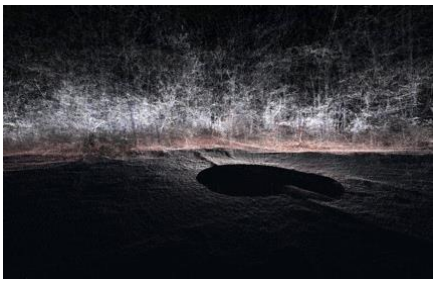
Figure 8. Charlotte Davies, Osmose, 1995 and Analysis by Visual Perception Elements.

Formative elements of this artwork which are translucent planes, lines and dots allow participants to feel as if they swim in space which is not completely representational and abstract. This artwork is characterized as

outstanding expression of image contents which space implemented by object expressed translucently changed to space with the nature of amusement. In this artwork, illusionary atmosphere is created with visual beauty of contents which are viewed as laws of splendid continuation and similarity which appears as emphasis of closure coming from structural aspect. In this artwork, expression of closure, visual perception element tells the fact that various expressions of space and implementation of virtual space reality highlight the law of closure by emphasis of characteristics of object. Similarity and proximity which animation gives as pattern of shape expresses sense of depth.

5.2. To Notice and Remember, 2016

"To Notice and Remember (2016)" by Seth Cluett, Ricky Graham and Christopher Manzione leads participants to silent and isolated space in a forest**.**



Category	To Notice and Remember, 2016							
plastic element	dots	lines	face	shapes	spaces	materials	colors	lights
	○	○	×	○	○	×	×	○
visual perception laws	proximity		similarity		continuation		closure	
	○		○		○		○	
characteristics of expression	Expressing space with unified shape through grouped shapes expressed by sum of each object rather than individual expression.							

Figure 9. To Notice and Remember, 2016 and Analysis by Visual Perception Elements.

Visual formative elements in this artwork form space expanded through expansion or increase from surrounding space recombined as dots and lines of countless lights. In this artwork, proximity and similarity, visual perception elements are expressed continuously, and similarity is suitable and closure is expressed differently. This artwork shows characteristics of expression shown in space which is an element of visual three-dimensional structure. Expressing space with unified shape through grouped shapes expressed by sum of each object rather than individual expression**.**

5.3. Notes on Blindness, 2016

Notes on Blindness by Peter Middleton and James Spinney was 360 degree 3D animation and was produced based on audio diary written by a person with visual impairment and won several awards at film festivals.

Category	Notes on Blindness, 2016							
plastic element	dots	lines	face	shapes	spaces	materials	colors	lights
	○	○	×	○	○	×	×	○
visual perception laws	proximity		similarity		continuation		closure	
	○		○		○		○	
characteristics of expression	Proximity and continuation are expressed at the same time due to phenomena that humans tend to perceive dots and lines as grouped shape and continuous image contents.							

Figure 10. Notes on Blindness, 2016 and Analysis by Visual Perception Elements.

This artwork leads viewers to feel reality-presence from the viewpoint of a person with visual impairment by animation consisting of dots and lines which are formative elements. Movement of animation consisting of dots and lines allows viewers to see laws of similarity and continuation but closure to express depth lacks in expression. Laws of similarity and continuation expressed from characteristics of contents based on daily life's storytelling allows intuitive expression approach. Proximity and continuation are expressed at the same time due to phenomena that humans tend to perceive dots and lines as grouped shape and continuous image contents.

5.4. Virtual Artworks Case Analysis Result

This study revealed that formative components such as dots, lines, planes, shapes and spaces are used a lot in a repeated way. Among components of contents, dots, lines and planes which are the most basic components gave the greatest influence in expressing expanded space and created diverse contents expressions and new meanings by using shapes, directions and positions of contents.

Table 1. Result Analysis by Visual Perception Elements.

Category	Plastic elements		Visual perception laws		Characteristics of expression
Osmose	Dots	○	Proximity	○	Similarity and proximity which animation gives as pattern of shape expresses sense of depth.
	Lines	○			
	Face	○	Similarity	○	
	Shapes	○			
	Spaces	○	Continuation	○	
	Materials	×			
	Colors	×	Closure	○	
	lights	○			
To notice and re member	Dots	○	Proximity	○	Expressing space with unified sh ape through grouped shapes expr essed by sum of each object rathe r than individual expression.
	Lines	○			
	Face	×	Similarity	○	
	Shapes	○			
	Spaces	○	Continuation	○	
	Materials	×			
	Colors	×	Closure	○	
	lights	○			
Notes on blindness	Dots	○	Proximity	○	Proximity and continuation are expressed at the same time due to phenomena that humans tend to perceive dots and lines as grouped shape and continuous image contents.
	Lines	○			
	Face	×	Similarity	○	
	Shapes	○			
	Spaces	○	Continuation	○	
	Materials	×			
	Colors	×	Closure	○	
	lights	○			

As a result of analyzing virtual artworks, continuous and repetitive phenomena are shown in contents which can be viewed as the laws of similarity and continuation and such laws are repeated in contents continuously and tend to be grouped. Law of closure is mainly shown in structural characteristics filling upper and lower sides and space of 360 degree. When implicative or symbolic expressions are made based on visual perception principle, it was possible to deliver meanings of artwork to viewers(participants)effectively.

In addition, it was found that not only the characteristics of the visual perception theory analyzed in this study, but also the expression of other theories exist. In virtual art, the combination with objects and the overall expression composition of contents are important. Based on the result analysis, virtual art contents should have a clear meaning transmission and a visual communication role that can convey implicit methods and abstract meanings by harmonizing objects and audiences

6. CONCLUSION

This study analyzed principles and components of visual perception theory shown in virtual art based on above mentioned theory used in the field of psychology frequently and perceptual and expressive characteristics of formative elements with regard to contents reproduced in a realistic manner. Findings of this study imply that formative elements of virtual art influence composition of images in video contents as well as viewers(participants).

As a result, it was found that when viewers(participants)perceive presence that allows them to feel as if they are in artwork rather than they perceive parts, they receive overall characteristics such as visual sensation, auditory sensation, and surroundings first and makes effective and diverse communication possible.

Suggestions which can be made for effective visual communication based on analysis of virtual artworks are as

follows. Firstly, producing artworks by considering characteristics of contents that cover upper and lower sides and right and left is needed. It is necessary to analyse visual perception theory according to various components to form senses of immersion and presence sooner or later. Secondly, studies on various techniques which formative elements and visual perception components can be expressed are needed. Analysis of whether psychological stability can be obtained for presence that allows participants to feel as if they are in artwork using visual perception theory is also needed. Thirdly and lastly, roles of visual perception components using analysis of virtual reality contents should be able to produce and provide in-depth and various video contents to participants.

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