The Expansion of Virtual Landscape in Digital Games
Classification of Virtual Landscapes Through Five principles

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Abstract. This research established classification system which contains five principles and variables to classify the types of the virtual landscape in digital games. The principles of the classification are *Story*, *Space Shape*, *Space and Action Dimension*, *User Complexity* and *Interaction Level*. With this classification system, our research group found the most representative types of virtual landscape in the digital game market through 1996 to 2016. Although mathematically there can be 288 types of virtual landscape, only 68 types have been used in the game market in recent twenty years. Among the 68 types, we defined 3 types of virtual landscape as the most representative types based on the growth curve and a number of cases. Those three representative types of virtual landscapes are *Generating / Face / 3D-3D / Single / Partial*, *Providing / Chain / 3D-3D / Single / Partial* and *Providing / Linear / 2D-2D / Single / Partial*. With the result, the researchers will be able to establish the virtual landscape design framework for the future research.

Keywords: Digital Game, Virtual Landscape, Game Design, Game Classification

1 Introduction

Numerous terms such as virtual landscape, virtual land, cyberspace, digital landscape and so on have been used to describe a virtually designed space or an environment. However, those terms have been used sporadically, without enough attempts of defining them with consensus. Therefore, instead of simply adopting the definition of the *virtual landscape* from previous researches, this paper defines it by comprehending the dictionary definition of both *virtual* and *landscape*. Following the dictionary definitions, the word "virtual" contains 'temporarily simulated or extended by computer software' in its definition, and "landscape" means 'the land's forms of a region in the aggregate' [1-2]. In a combination of those two definitions, a *virtual landscape* means 'landforms and components of a region in aggregate, that are temporarily simulated or extended by computer software.' Unlike any other media

describing an unreal space such as novel, painting and stage design, a virtual landscape can drive interactive action to the player. Because of this unique characteristic, designing virtual landscape requires designers to understand "space." Painting a picturesque drawing or writing an article describing utopia doesn't require the artists or authors to consider the interactive activity between the user and environment. Unlike those media such as painting and so on, designing a virtual landscape, just like designing space, asks skills to design the space considering interactions between users and the space itself. However, yet it is impossible to find any standard and specific methodology nor procedure to design a virtual landscape so far. Numerous studies and researches have been covering only technical ways to develop backgrounds of games; none of them suggested the meaningful design method of virtual landscapes. As the virtual landscape shares its characteristic of interactive space with the *real space*, it is convincing to adopt the design methodology or procedure from real space to virtual landscape. Numerous area of studies such as landscape architecture, architecture, and urban planning have a deep understanding of the interactive space and retained several confirmed design methodologies. If it is possible to adopt those methodologies successfully to the area of virtual landscape, new and efficient way to design the virtual landscape can be rise.

Moreover, as the complexity of virtual landscapes in video games increases, a need for a unified design methodology rises. Rollings & Morris (2004) mentioned that if the developing game requires a certain amount of assets, an unified design methodology is needed [3]. Unlike the conventional design methodologies for real space, the new virtual design methodologies differ due to diverse and various methods of interactivity regarding the spaces. Which means, though there are several different conditions such as weather, the height of the region, every real space shares same condition of dimension, laws of physic and time flow. Not like those real spaces, virtual landscapes in various digital games has their own characteristics of space. Different gravity, various dimensions, and other natural conditions. Therefore, a modular design methodology is required to adjust and adapt to the various types of virtual landscapes; an effective classification system will be needed to establish such a modular design methodology.

Furthermore, based on such classification system, the goal is to seek and verify a proper design methodology for specific types of virtual landscape. Also, analyzing the data in chronological order, the research will allow projecting the upcoming types of virtual landscapes in order to establish corresponding design methodologies. For the last, by combining the principles of virtual landscapes, designers will be able to design virtual landscapes those have never been developed so far.

2 Methodology

In order to understand the landscape in digital games, this research extracted design requirements of the virtual landscapes, built them as principles and verified the principles through analyzing the landscapes of existing digital games. The first step to do so was the establishment of the classification principles. Through the literature

reviews of game-design books, we extracted the five mandatory principles of virtual landscape design. On the second step, our team conducted a validity test of established classification principles. Lastly, this paper chronologically analyzed virtual landscapes of 385 digital games with those five principles.

2.1 Establishment of the Classification Principles

Establishing the classification principles was the first step of this paper. As we mentioned previously, clear and accurate principles are required to figure out the types of virtual landscapes in digital games. In order to stand those practical principles, we tried to verify the requirements of designing digital games landscape through literature review. Our research team thoroughly researched existing books and papers concerning *video game design* to extract the mandatory elements of virtual landscapes in digital games. Five principles were derived as the most commonly and importantly discussed in previous researchers or designers in the field of landscape design in digital games. In other words, the frequency of the appearance of design requirements – here called the principles – represents their importance.

As these principles are the most important and considerable for the designers, at the future research, design methodology for the landscape design will be established based on these five elements.

2.2 Examination of Established Classification Principles

In order to verify the acquired five different principles of virtual landscapes, this research built a database of 19,752 items. Our research team gathered those digital games from two major platforms; 7,229 games from the PC game platform STEAM (http://store.steampowered.com), and 12,523 games from the console game platform Play Station 1-4 (Table 1).

Afterward, fifty games were randomly sampled from each platform, and a classification test was conducted for the total of 100 digital games. Two researchers were asked to categorize the virtual landscape from the games into five different categories. The number of unable-to-be-classified games would reflect the validity of the classification principles.

Table 1. Description of the database our experiment

Platform	Market	Number of games
PC	STEAM	7,229
Console	Play Station 1,2,3 and 4	12,523

2.3 Chronological Analyzation of the Virtual Landscape Types in Games

Based on the five verified classification principles, virtual landscapes shown in digital games in recent 20 years, from 1996 to 2016, was tested. Digital games were extracted from the website Game Rankings (www.gamerankings.com) where games

are scored based on review scores from both offline and online sources. Game Rankings, owned by CBS Interactive, has rated more than 14,500 games through the calculation of the review sites that are determined reliable. Three hundred eighty-five games were extracted based on the most highly rated by Game Rankings in recent 20 years and was tagged by the team member for the types of spatial conditions. The tagging process was revised twice by our research team member, and the data was extracted enough to be analyzed. The extracted games mean that they were popular and received the most reviews in each era.

3 Acquisition of Five Principles

Based on the information from twelve books, there existed five different elements that compose various forms of virtual landscapes: *Story*, *Space shape*, *Space and action dimension*, *User complexity*, and *Interaction level*. Such principles can be described as in Table 2.

Table 2. Principles of virtual landscape design mentioned in books

	Story	Space Shape	Space and Action Dimension	User Complexity	Interaction Level
Fullerton (2003) [5]	O	O	O	O	-
Rogers (2014) [6]	O	O	-	O	O
Schell (2014) [7]	O	O	-	O	-
Crawford (2003) [8]	O	-	-	O	O
Apperley (2006) [9]	O	-	-	-	O
Ervin (2001) [10]	-	-	O	-	O
Kalay & Marx (2005) [11]	-	-	O	-	-
Lecky-Thompson (2003) [12]	O	-	-	-	-
Rollings & Morris (2003) [13]	O	O	O	O	O
Adams & Blandford (2003) [14]	O	O	O	O	O
Kim et al. (2013) [15]	O	-	-	O	-
Jang (2015) [16]	-	-	O	-	-

Each reference described the importance of each principles to design the virtual landscape. Numerous authors of the books considering game design have been continuously mentioning and emphasizing the importance of a *story* in game design. For example, Fullerton mentioned the story is one of the most important resources one should consider before designing the digital game and its environment [5]. Rogers, Schell, Crawford, Lecky-Thompson, and Apperley also made the same statement that story requires the deepest consideration when one try to design the terrain at the digital games [6-8], [9], [12]. Rollings & Morris mentioned that at the

very early time in video game industry, the game designers were separated into two factions [13]. One insisted the game story is the most important in digital game design and the other insisted the opinion that story never effects to the player and it is not needed at all. However, with the success of game titled 'DOOM (1993)', designers realized that story is the key elements in a digital game design [13]. Also, Schell pointed out if one can design the story of the game with a structure of ludology by using the plot point, the quality of games will be raised [8]. Adam & Blandford and Kim also described the story is a counter resource to consider at game design [14-15].

Space shape was also one of the key factors when designing a virtual landscape. Fullerton used the term of 'edge' to classify the shape of spaces [5]. By reading the edge of space, they can be classified as linear, agent, or network (p.177). Rogers simply classified the shape of a 3D game to corridor and island (p.267). Schell classified shape of space in five conditions, *linear*, *grid*, *web*, *spot* and *face* [7]. Rollings & Morris spared a lot of pages on space shapes. They questioned whether the typical side-scroll game is linear because of the degree of freedom to the players [13]. They mentioned sports games are good examples for the *spot* typed space (p.380). Also, they suggested several design tips design the *linear* space in a digital game more efficiently.

Space and action dimension was also described essentially in those books. Fullerton tried to classify the dimension of the game by the types of viewpoints [5, p.307]. Ervin, who approaches the realistic 3D simulation games in his writing, mentioned that the dimension in games is crucial when designing digital games. Kalay & Marx wrote the importance of dimension in digital games and tried to classify them with their style and flexibility [11]. Rolling & Morris classified the space in digital games with 'dimension,' 'edges' and 'axis and the time flow' [13]. Jang (2015) also described the importance of dimension in digital game numerous times. As this principle decides the movement of the character and the viewpoint and effects to the whole design process, one should consider deep enough before start designing (p.29).

Fullerton, Crawford, and Rogers tried to classify the *user complexity* with the behavior of the user. Rodger classified those behaviors to competition and cooperation [6]. Also, he mentioned that if one game contains a certain amount of players in one place, the designer should consider about the housing and the habitat space (p.467). Schell suggested designing the social community and its territory space based on the sociology and anthropology from the real world [7].

For the *interaction level*, Roger mentioned that the medium *video game* had been developed its interaction level from an island to sandbox as a metaphor [6]. Apperley described the interaction level between the environment and the user in detail [9]. He tried to classify the interaction level of the virtual landscape in three levels. At the first level, the user remains as an observer to the world and can't cause any interactions. Second, like labyrinth and maze, users are trapped in the sealed space and only can interact with limited level. For the last level, users can interact with space freely [9]. He also mentioned that a virtual landscape is a scheme to manipulate the user with interaction (p. 168).

With those researches, we could verify those five principles are the most important principles when one is designing the virtual landscape in digital games. However, those references only suggested principles very ambiguously, and it is needed to be organized with more precise details. Therefore we arranged the design variables of each principle (Table 3).

Table 3. The five principles and their variables

Principle	Story	Space Shape	Space and Action Dimension	User Complexity	Interaction Level
Variable	Representing Generating	Spot Linear Chain Face	2D-2D 2D-3D 3D-2D 3D-3D	Single Group Massive	None Partial All

First, "Story" is a component of a virtual landscape that provides a story to a character in a narrative manner. Stories in digital games can be categorized into two types: *representing* and *generating*. *Representing* story means that the developer actively provides the designed story to the users, while a *generating* story only provides an environment to the user, and the user has to generate stories by their own. Depending on rather the game contains the fixed ending or not; it can be classified as a *Representing* or *Generating* story. As the *Representing* contains a strong story line, it has a fixed ending with it. However, the *Generating* doesn't have any certain ending nor fixed one. For example, until the end of the game player can't know how the sports game ends.

"Space Shape" means structures of implemented virtual landscape. The structures can be divided into *spot*, *linear*, *chain* and *face*. This later determines the overall structure and masterplan of the form while designing the virtual landscape. Each condition can be determined by the edge of the space and the flexibility of player's direction. *Spot* contains fixed edge of the space and free movement of the players. It means that the game players can move freely in the limited area. A *Linear* shaped space contains fixed edge of the space with forced movement to the players. Players are forced to move in certain directions in a limited space. Super Mario Bros. (1985) is a case with *linear* space type. The player only can manipulate the character in a fixed direction, left to right. A *Chain*-shaped space is a combination between *Spot* and *Linear*; players can run both activities of spot and linear in order. Technically, a *Face* shaped space has a boundary of the game playing space. However, players cannot recognize the boundaries that limit the game space. Also, players do not have any forced direction in a *Face*-featured space.

"Space Dimension" and "Action Dimension" means corresponding implemented dimensions and movement dimensions required for the user to control the character within the space. It can be divided into four types: *2D-2D*, *2D-3D*, *3D-2D*, *3D-3D*. These elements determine the vertical resource factor for the future design methodology implementations. If the environment at the game requires two axes (XY) for the designer to build and requires 2 axes (XY) for the players to play, it will

be categorized as *2D-2D*. If the game contains more than 2 layers of 2 axes filed together and requires 2 axes for the players (XY), that game can be categorized as *2D-3D*. The game with 3 axes (XYZ) for the designers to build the game and 2 axes (XY) for the players to manipulate will be categorized as *3D-2D*. For the last, the game with 3 axes (XYZ) for the design and 3 axes (XYZ) for the manipulation will be defined as *3D-3D*.

"User Complexity" means the simultaneous occupancy of the users within the space. This can be separated into *single*, *group* and *massive*, and will determine the feasibility of the public space within the virtual landscape design. The *Single* game runs with single player only and doesn't need designers to consider about applying any community or public space. If the game holds more than two players sharing same or facing goals, it can be categorized as *Group*. In this case, designers should consider how to apply public and community space in the design. The game runs by more than two groups of players and holding various goals in the game is *Massive*. As the *Massive* contains a large number of players at one time, designers need to consider about community, public and even habitat space to design.

Lastly, the "interaction level" means the rate of interaction between the virtual landscape and the user. Classified into *none*, *partial*, and *all*, this element forms the interaction layer for future design methodology. *None* is a type player can't cause any interaction with environment resources. In this type, the environment resources are covered with so-called the 'invisible wall' and only works as a boundary of void space. If the player can interact with only designed resources, is *Partial*. To design this type of game, designers need to consider about the characteristic and depth of interaction on each environment resources. Players can interact with every environment resources in type *All*. In this case, the game is built in particle level which means the world is based on unified units and designers are building the environment by filing them. In this case, designers need to consider the condition and spread of particles in the world.

These five elements will set-up for an overall design approach for the future virtual landscapes. Future developing design methodology will be based on the Layer-cake method by Ian L. McHarg from the area of landscape architecture [17]. Each of the five principles will be adopted as layers to fabricate the masterplan. Following Table 4 contains summarized descriptions about the principles and variables conditions.

Table 4. Classification Conditions

Principles	Variables	Description
Story	Representing	Player follows the given story line (close ending).
	Generating	Player generates a new story (open ending).
Space Shape	Spot	Player freely moves around in a limited space that has boundaries.
	Linear	Player is guided to a move toward certain direction in a limited space.
	Chain	Combination of Spot and Linear. The player is allowed to move freely in a spotted space, and moves to the next

		spotted space to play further.
	Face	Unlimited space with player's free movement
Space and Action Dimension	2D-2D	Requires two axises (XY) to build the world, and requires two axises (XY) to the players to play the game
	2D-3D	Requires 2 axes (XY) to build the world and requires more than 2 layers of 2 axes (XY) to the players to play the game
	3D-2D	Requires 3 axes (XYZ) to build the world and requires 2 axes (XY) to the players to play the game
	3D-3D	Requires 3 axes (XYZ) to build the world and requires 3 axes (XYZ) to the players to play the game
User Complexity	Single	Player is the only one in the game (a single player at a time)
	Group	More than two players play the game together, sharing same goals.
	Massive	More than two groups of numerous players play the game simultaneously, with various goals.
Interaction Level	None	No interaction between the player and the environment except as the boundary of a void space
	Partial	Player can interact with designed limited environment resources in the space
	All	Player can interact with every environment resources in the space

4 Validity of the Classification Principles

The validity of the proposed classification principles can be verified according to the result that every one-hundred-randomly-selected-games were able to be classified without failure. The details are in Table 5.

As shown in the table, none of the cases was classified as 'etc.' This means every sample – the games randomly retrieved from STEAM and the series of Play Stations – was able to be classified with those five principles and their variables. This fact that there was no exception when classifying those games with our five principles and their variables shows the effectiveness of five principles we suggested to classify the virtual landscape in digital games. Furthermore, these classification principles classify digital games without any overlap, therefore it will be possible to classify digital games without any confusions in the future research.

Table 5. Results of the classification test

Principles	Variables	Percentage (%)
Story	Generating	47
	Representing	53
	etc	0 *

Space Shape	Spot	49
	Linear	30
	Chain	12
	Face	9
	etc	0 *
Space and Action Dimension	3D-2D	41
	2D-2D	41
	3D-3D	18
	2D-3D	0
	etc	0 *
User Complexity	Single	75
	Group	24
	Massive	1
	etc.	0 *
Interaction Level	Partial	51
	None	44
	All	5
	etc.	0 *

* No overlap among variables of each principle

5 Chronological Analysis of Virtual Landscapes

5.1 Chronological Analysis of Five Principles

Fig. 1. shows the trend of the *story* in virtual landscapes represented in video games in recent 20 years. Thanks to the technical advance, games could carry rich data, and therefore the game industry built *story-representing* game intensely during 2007 to 2014. However, recently two sorts of story – *generating* and *representing* – are both equally balancing together with stabilized market needs. This tells the users in digital games are equalizing balance, and future design methodology for the virtual landscape should be able to consider both of types together.

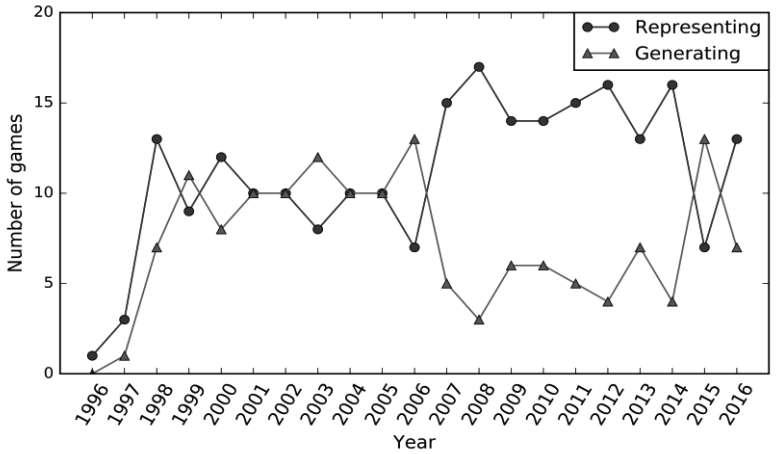

Fig. 1. *Story* in video games

Changes in *space shape* from 1996 to September of 2016 are shown in Fig. 2. Compared to stark differences of the popularity of *space shapes* in the 1990s, the types of *space shapes* in early 2000s seem to be distributed because of a limitation of the hardware; developers were only able to construct spot typed virtual landscape in the early period. With technical advance, spot typed virtual landscape in decrease and facial space has been raised. This phenomenon shows the complexity of virtual landscape in future will be raised and will require a more systematic approach to design them.

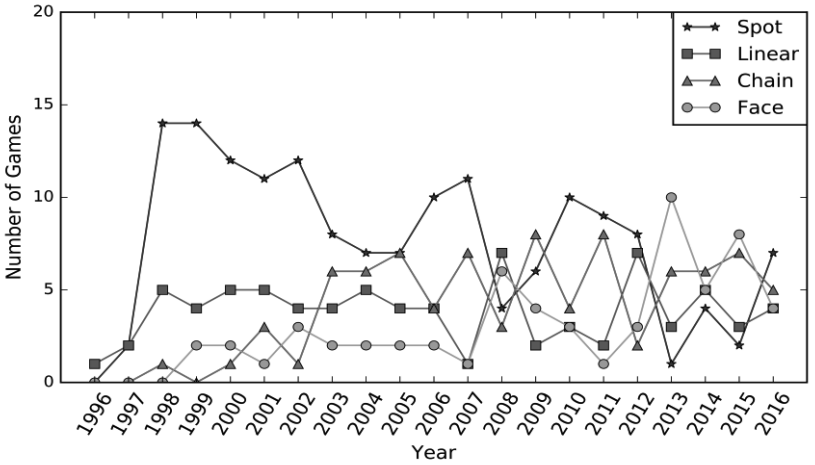

Fig. 2. *Space Shape* in video games

In terms of *space and action dimension* in a video game (Fig. 3.), the needs for the 3D-3D game always has been high on the market through the time. On the other hand,

the amount of 3D-2D game has been decreased with time, and it is possible to think those type has been evolved to 3D-3D type.

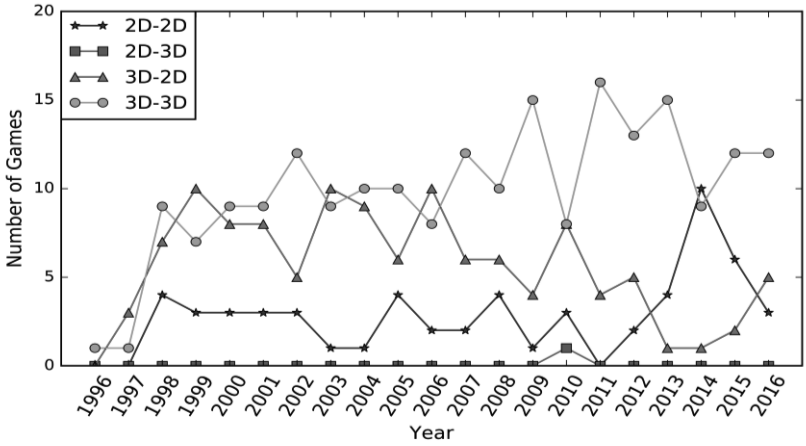

Fig. 3. *Space and Action Dimension* in video games

Fig. 4. described the trend of *user complexity* in video games. Though with advancing network technology through the early 2000s, still most of the digital games are in single play. However, it is true that single games are decreasing and massive, group games are rising. Which means in future, designers need to consider how to add the complicated social spaces in the virtual landscape.

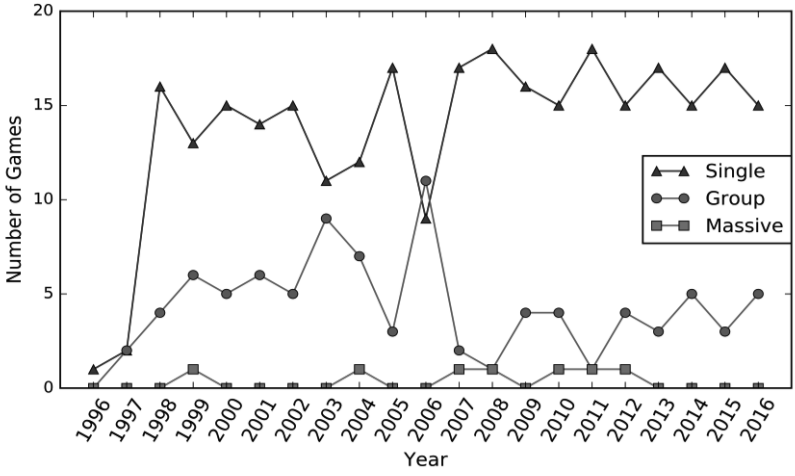

Fig. 4. *User Complexity* in video games

The *interaction level* shows clear evidence of technical advance (Fig. 5.). With technical advance, *interaction level* keeps rising, and non-interaction leveled games are on a consistent downtrend. However, still, it is a burden to interact with every aspect of the virtual landscape, type all is still in low level. If the hardware of

computer develops at a high level in future and able to describe the particle based model, not the rendered model, it will be possible to generate all interactive virtual landscape.

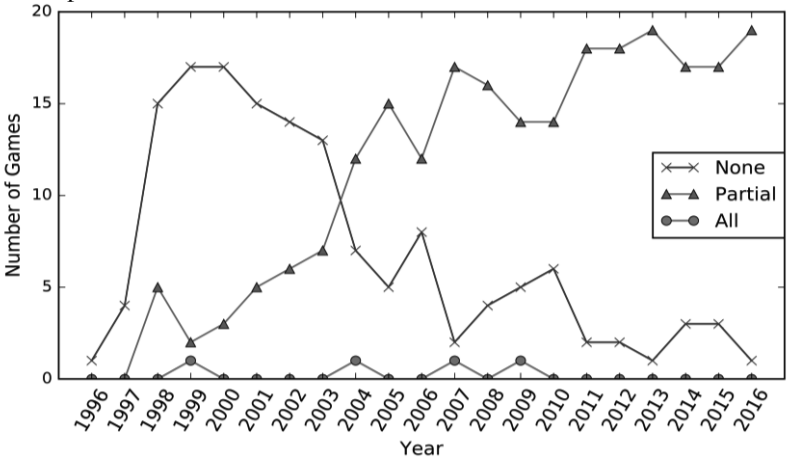

Fig. 5. *Interaction Level* in video games

5.2 Trend of Virtual Landscapes Types

Theoretically, based on the five classification principles, 288 spatial types of virtual landscapes can be created in games. However, only 68 variations of those have been appearing repetitively from the 385 games released within last twenty years. The ten most commonly appearing combination addressed in as chronological manner are shown in Fig. 6.

Through the figure, it is possible to read the trend of the virtual landscape through time in the market and also to find the representative types of virtual landscape. There have been only five to seven types of virtual landscape commonly used in the market through the time since 1998. This phenomenon implies that the game company and the designers prefer to use a qualified type of virtual landscape only. Also, this implies that various types of the virtual landscape have not been introduced to the market and there is rich potential to develop in the near future.

List on the right in Fig. 6. contains the most common types of virtual landscape in the order. But the list only delivers the sum of all cases and needed to be analyzed with time flow. For example, the first case; *Representing/Chain/3D-3D/Single/Partial* has the largest amount of all but is decreasing dramatically since 2013. On the other hand, *Generating/Chain/3D-3D/Single/Partial* type is growing its size aggressively and indicates the potential in the near future. For the last, the case *Providing/Linear/2D-2D/Single/Partial* never showed any dynamic growth but also the demand for this type in the market never died. The condition for this type can be said as a steady seller.

One of the most interesting part with the ratio between each type is that after 2015 the ratio is becoming stabilized to an equal amount. This movement shows the

demand of market is bringing adhesion and need to consider those cases as representative types of virtual landscape in the near future.

5.3 Three Representative Types

This research claims that the three representative types of virtual landscape are "*Generating / Face / 3D-3D / Single / Partial,*" "*Providing / Chain / 3D-3D / Single / Partial,*" and "*Providing / Linear / 2D-2D / Single / Partial*". Table 5 shows the characteristics of those three types of virtual landscape in digital games. Because of type 1, which is "*Generating / Face / 3D-3D / Single / Partial*", is showing the most aggressive growth among the others, deserved to be a representative type. The type 2 (*Providing / Chain / 3D-3D / Single / Partial*), which is in a downtrend, still has the biggest volume of all and could be a representative type. For the last, *Providing / Linear / 2D-2D / Single / Partial* (type 3) has a steady need for the market and could be one of the representative types of virtual landscape.

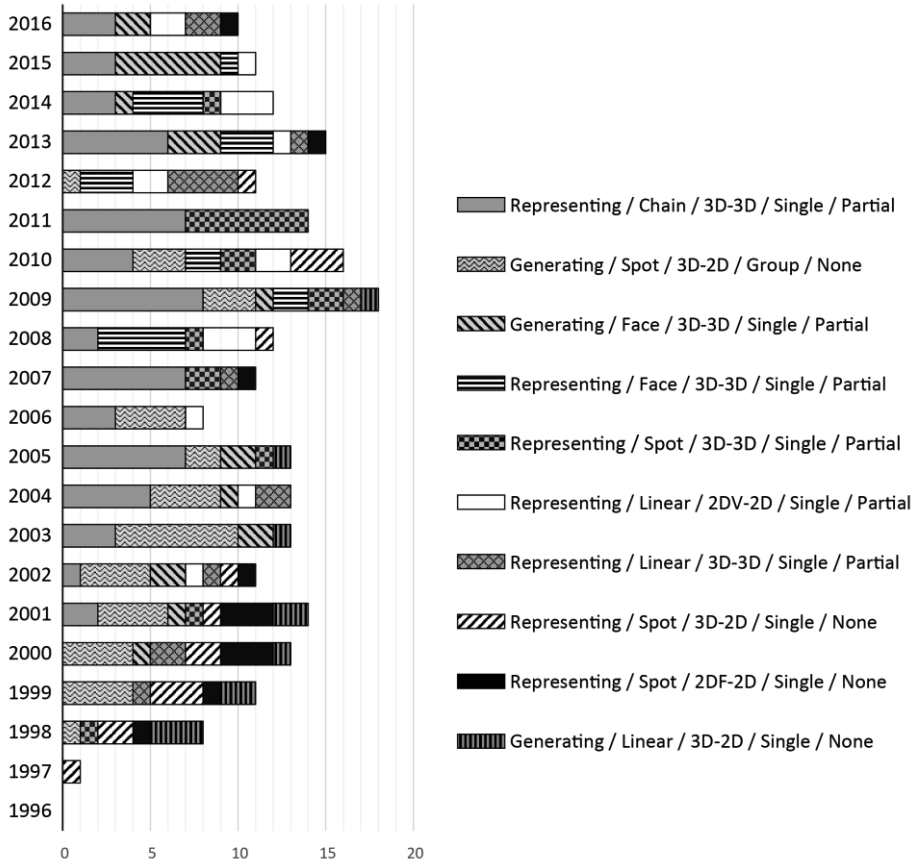

Fig. 6. Trend of 10 types of the virtual landscape in video games

Table 4. Representative types of virtual landscape in digital games

	Story	Space Shape	Space and Action Dimension	User Complexity	Interaction Level
Type 1	*Generating*	*Face*	*3D-3D*	*Single*	*Partial*
Type 2	*Providing*	*Chain*	*3D-3D*	*Single*	*Partial*
Type 3	*Providing*	*Linear*	*2D-2D*	*Single*	*Partial*

There are numerous examples of digital games in each type. For example, GTA 5 (Rockstar Games, 2013) is a good example of type 1 (Fig. 7). This game, which became a multi-playable online game with the additional upgrade and downloadable contents, was originally designed as a single player.

Story	Space Shape	Space and Action Dimension	User Complexity	Interaction Level
Generating	*Face*	*3D-3D*	*Single*	*Partial*

Fig. 7. GTA 5 (2013) as an example of Type 1

The player in such condition of virtual landscape, they can make their own game story with environments resource on the terrain freely and can access wherever they want. In GTA 5, the player can hang freely around the virtually designed city and is capable of doing based on the designed interactive objects and characters. With the advance of the computer, this type of virtual landscape is evolving network based multi-playable virtual landscape. Shortly, this type of virtual landscape will be replaced by "*Generating* /*Face* /*3D-3D* /*Massive* /*Partial*" type.

For an example of type 2 (*Providing* / *Chain* / *3D-3D* / *Single* / *Partial*), Naughty dog designed 'Last of us' on 2013 with Play station 3 platform. This game carries a deep story through the game and having typical chain shaped space with it. With

several updates and downloadable contents this game became an online playable multi-game, however, was originally designed for a single player. With a partially interactive interaction, the user can only manipulate designed objects on the virtual landscape. As this type of virtual landscape is story based and requires many props and actors to be placed in order, a precise design methodology is needed.

Virtual landscapes of both type 1 (*Generating* / *Face* / *3D-3D* / *Single* / *Partial*) and type 2 (*Providing* / *Chain* / *3D-3D* / *Single* / *Partial*) require various resources to the designers to consider in the design process. Unlike designing a landscape architectural plan in the real world based on the naturally existing environment, game designers have to consider about every resource in the terrain to design these virtual landscapes. In other words, naturally-created geographical features such as hills, cliffs, valleys, and even the law of physics such as gravity should be planned in designing virtual landscapes. The game designers even need to plan the brightness of the sun, sounds of rain drops and the pattern of the constellation at the night sky. As those kinds of works are both delicate and time-consuming, only few game design companies with enough manpower can develop the game.

Story	Space Shape	Space and Action Dimension	User Complexity	Interaction Level
Providing	*Chain*	*3D-3D*	*Single*	*Partial*

Fig. 7. Last of us (2013) as an example of Type

Providing/*Linear*/*2D-2D*/*Single*/*Partial* (type 3) (Fig.8) is one of the oldest types of virtual landscape in digital game history, and it has never vanished during the past 30 years. Like a steady selling books, this type of virtual landscape always had a certain amount of market looking for it. Super Mario Bros. (Nintendo, 1985) is a good example of this type of virtual landscape. The virtual landscape of type 3 contains a simple combination of environment resources. Therefore, it doesn't ask for advanced and delicate consideration to the designers compared to type 1 and 2. However, as it is a linear space and rhythmical flow is required, design methodology based on the

human cognition from the field of landscape architecture can be adopted in future research.

Through the examples of the three representative types of virtual landscape, it was possible to find the reason to establish the virtual landscape design framework for the future research. The three types of virtual landscapes had different design requirements depending on their variables of each 5 principles. Therefore, this paper suggests that the elements of each variable should be defined to form a firm design framework as our future work. Moreover, we expect the framework that includes the 5 principles, their variables, and related landscape elements to be a concrete guideline for game designers to plan the exhaustive virtual landscapes.

Story	Space Shape	Space and Action Dimension	User Complexity	Interaction Level
Providing	*Linear*	*2D-2D*	*Single*	*Partial*

Fig. 8. Super Mario Bros. (1985) as an example of Type 3

6 Conclusion

The interesting fact is that, during the mid-2000s, as the GPU Fill rate speed increased and the 3D rendering technologies advanced, the advanced visual effect played the most important role to lure the market, providing only a very specific type of spaces. This, however, changed as time passes by; now the various types of spaces are gradually balancing evenly. This means that each type of spaces has established markets of their own, and is now stabilized. Such development of various types of spaces reminisced when post-modernism was accepted by the modern art and architecture. This raises the needs for a balanced establishment of design methodology for future virtual landscape.

The results of this research are expected to provide insights in detail to the game designers and other researchers as follows. First of all, this classification methodology provides the main structure for construction of systematic design method of a virtual landscape in digital games. By combining the classification principles, game designers will be able to clarify the detailed characteristic of a landscape in their designing digital games. With an understanding of their landscape, they can comprehend which design methodology is needed to run the systematic design process. For the future research of this study, the research of adopting the design methodology from the area of architecture, landscape architecture, and city planning to the digital game will be run based on this classification research.

Secondly, the designers could develop digital games in diverse and novel forms by simply making combinations of variables from our classification method. As this research refers, even though 288 types of digital games are possible according to the classification theory, there have been only 68 types of digital games developed since today. In other words, we can insist that more than 200 types of games are yet developed. This approach of systematic classification method, our research team expect our method to expand the scope of novel digital games.

Finally, we expect our classification method, elements as variables and game types derived from the method to be referred by further researches. According to Apperley [9, p.154], a classification of computer games can be based on how they represent – or, perhaps, implement – space. It means that the classification of space and landscape in the digital game can directly lead us to the classification of the digital game itself. Since now the classification of digital games has been unclear and inconsistent by utilizing keywords without enough consideration of certain standards. The lack of systematic approach toward elements and types of digital games has been an obstacle to many researchers to study digital games. Therefore, this research provides the possibility of systematic classification of digital games relatively clear and rigorous enough to be used in diverse research of digital games.

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