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Landscape Architecture in Video Games

– A Design Experiment of a Virtual Landscape

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Foreword

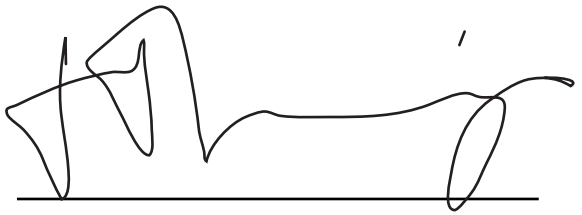
To write a master thesis alone is to learn how amazing people around you are. I wrote every word in this thesis by myself but there are some people that gave me advice how to write them.

Rebecka ”Queen Be’xi” Persson. You are the Queen.
Tamar ”Literally” Maljian. You are the Eagle, watching over my language.
Leni, Ida, Helmi, Natalie (and many more). You are the Magicians, giving me energy and inspiration whenever I needed it.
Cissi. You are the Camel.

I want to give an extra big thanks to my supervisor, Anders Westin, for taking time (,time you did not really have,) to help and advice me all through this journey.

Thank you my dear parents and Susanne for support and kind words (oh and food!).

Now that I am done with this thesis, I can finally enjoy the new expansion of World of Warcraft.



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Abstract

The video game industry is growing and is by some considered a strong actor in the field of architecture. Virtual landscapes, in particular those in video games, can be considered architectural as they are a simulation of physical space in a virtual realm. They can benefit from spatial theories such as those from urban design and landscape architecture, however, these theories are rarely brought up in literature regarding the design of virtual landscapes in video games.

The purpose of this thesis is to contribute to the discussion of the link between virtual and physical landscapes and how theories regarding landscape architecture can be incorporated in the design of virtual landscapes in video games. This paper features a theoretical framework concerning navigation, orientation and spatiality as well as the structuring and symbolism of a city. The theoretical framework are then interpreted and converted to design patterns, which are then applied in a design experiment of a virtual city for a video game.

The design experiment was carried out through analog sketching and 3D modelling and resulted in a design intended to suggest how some spatial theories can be translated into design patterns. Designing a virtual landscape is a balancing act of applying spatial theories from physical landscapes while still considering the effects the virtual setting has on the perception of landscapes. Virtual landscapes could potentially be designed by landscape architects but it forces them to somewhat approach landscape design in a different way.

Sammanfattning (Abstract in Swedish)

Spelutvecklingen går snabbt framåt och vissa anser att den har en stor inverkan på arkitekturfältet. Virtuella landskap, i synnerhet de som återfinns i spel, kan anses vara en sorts arkitektur då de är en simulering av det fysiska rummet i ett virtuellt plan. De virtuella landskapen kan gagnas av att de som som ansvarar för designen har teorier om landskapsarkitektur i åtanke under designprocessen. Trots detta tas dessa teorier sällan upp i litteratur ämnad åt blivande spelutvecklare och speldesigners.

Syftet med den här uppsatsen är att bidra till diskussionen gällande förhållandet mellan virtuella och fysiska landskap samt hur teorier om landskapsarkitektur kan appliceras på de virtuella landskapen. Uppsatsen innehåller ett teoretiskt ramverk som tar upp generella teorier om navigation och orientering i landskapet, rumslighet samt symbolik och strukturering av arkitektur. Det teoretiska ramverket har sedan tolkats om till olika designverktyg som i sin tur applicerats på ett designexperiment.

Designexperimentet togs fram genom analoga skisser samt 3D-modellering och resulterade i en virtuell stad vars intention är att påvisa hur landskapsarkitekturteorier kan appliceras på virtuella landskap. Att designa virtuella landskap handlar delvis om att applicera dessa teorier samtidigt som effekterna av perception i ett virtuellt plan hålls i åtanke. Virtuella landskap kan designas av landskapsarkitekter men erfordrar att landskapsdesign i sig tacklas på ett annat sätt.

Terminology

Presented below are the definition for several words in the context of this thesis. The reason for this has been to achieve a coherent text and understandable to people without earlier experience of virtual landscapes.

Spatial theories - This is used as a term for theories regarding navigation, spatiality, urban design (structuring of architecture)

Landscape - To avoid confusion and construct a coherent text, landscape has been used as an overarching word regarding spaces. In this paper words such as environment or to some degree city, as used in the literature studied, are written as landscape.

Virtual landscape - For the sake of this paper these words refer to landscapes confined within virtual settings with high emphasize on those within 3D video games (similar to World of Warcraft). It is used as an equivalent to 3D video game environments.

Physical landscape - This is a synonym to real world landscapes or outdoor landscapes.

MMORPG - Massive Multiplayer Online Role-Playing Game. A game confined to a virtual world where a large number of people or players can interact with each other. The player controls an avatar, assuming the character of it.

Observer/Navigator/Player - The character experiencing either a physical or a virtual landscape. The use differs depending on the type of landscape.

NPC - Stands for Non-Player Character and act as the inhabitants within video games, controlled by the game itself. May be of both hostile or friendly nature. The NPC is not necessarily interactable.

UI - Is an acronym for User Interface, referring to the interface within video games which is the space in which the interaction between the human and the machine occur.

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1. Introduction

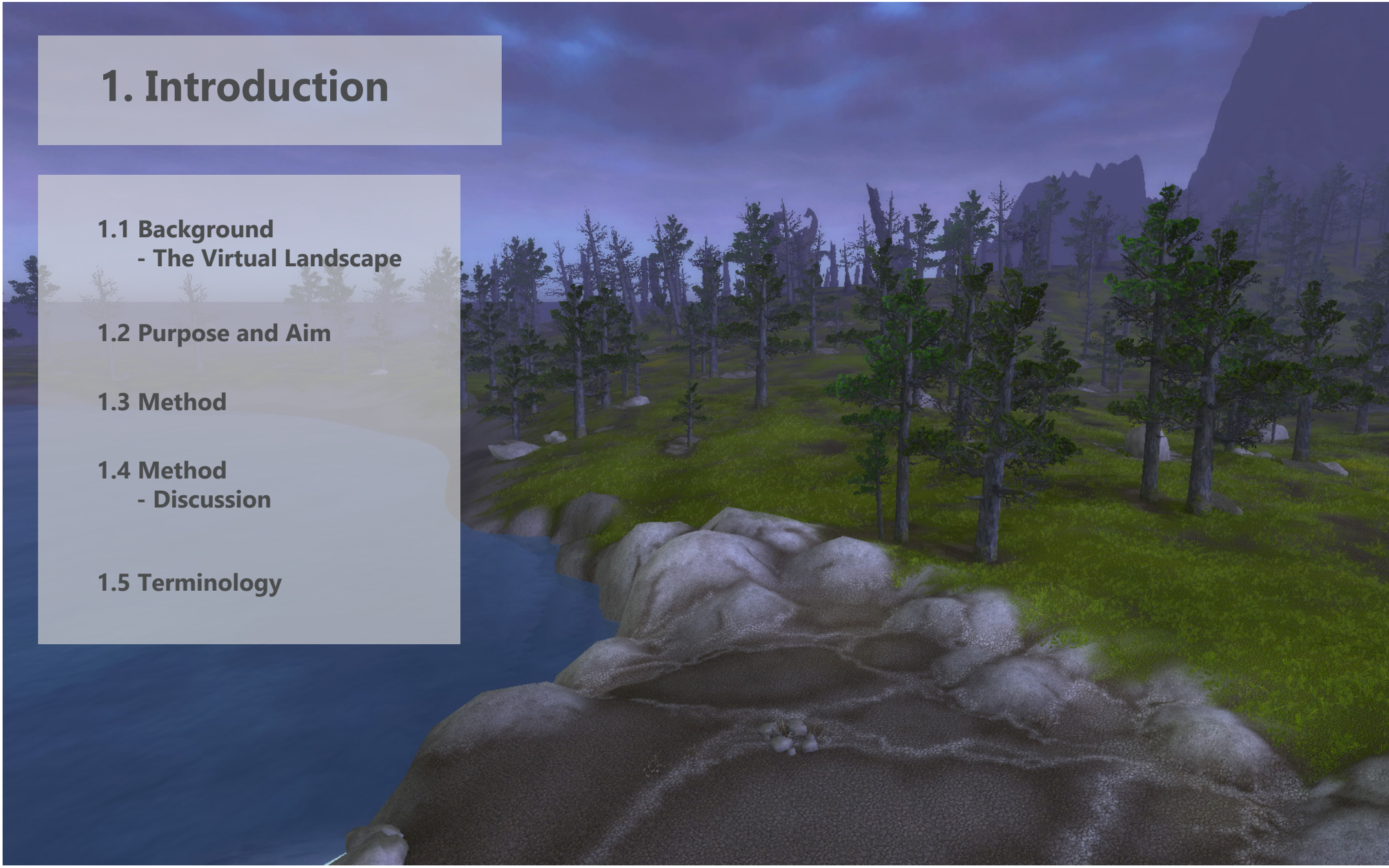


Image 1: Screenshot of Twilight Highlands in World of Warcraft.

1.1 Background - The Virtual Landscape

The video game industry is fast growing, being twice the size of the recorded-music industry in 2010 and is today a billion-dollar business. It is considered a strong actor in the fields of technology and economy, resulting from a wide range of entrepreneurship, creativity and computer science expertise. The industry is tapping into entertainment, computer science, cultural expression and lately also education (Styhre, 2018). The sheer size and popularity of the video game world emphasizes the relevance for looking into this subject.

The average player spends around 25 hours per week playing inside a virtual world. Surveys (from 2005) imply that some players even consider the virtual world their "real" home and the physical realm just a place for food and sleep (Castronova, 2005). Castronova (2005) even claims that the virtual worlds emerging in the video game industry are becoming increasingly important as a host of ordinary human affairs and interactions.

I have been playing video games for a large portion of my life and the video game World of Warcraft in particular for 13 years. World of Warcraft is a 3D role-playing video game where the player controls an avatar within a vast virtual world full of different cities, towns and landscapes. However, having sometimes experienced difficulties when nagivating the virtual environments of the game, I recently pondered if there was anything in the field of landscape architecture that can be applied when designing virtual landscapes for video games, to e.g. reduce the feeling of disorientation. Is it perhaps possible to design virtual landscapes using the skills of a landscape architect?

Video games, as simulations of reality, are artificial constructs made entirely by humans. They are designed within limits and rules set out by the designer, rather than nature. These virtual worlds often share more characteristics with the built environment and architecture rather than nature itself (McGregor, 2006). 3D game worlds are spatial, meaning that a Z-axis is added to the graphic. A third dimension in a virtual setting means that surfaces are turned into solids (Egenfeldt-Nielsen et. al, 2016) within the void that is a virtual world. Video game worlds are, as they are virtual and fictional, human constructs. They can therefore be considered architectural (McGregor, 2006).

A wall, as an architectural element, in the physical realm works as an object holding things up, it realizes and symbolizes its function. In a virtual landscape however, the realization of a function is not always necessary, hence making the need for the object itself negated. (Beckmann, 1998).

Building upon that same principle, virtual landscapes can be considered real landscapes. Real landscapes confined to a virtual world, a world that is non-physical but that can still be explored and interacted with. Georgia McGregor wrote *Situations of Play: Patterns of Spatial Use in Videogames* (2007), where she studied the different ways virtual landscapes are used. She explains how it is apparent that designing virtual landscapes means taking concepts of spatial use and qualities from physical landscapes and applying them to the spatial structure of the virtual landscape. These patterns may guide, support, impede or suggest various types of activity and use (McGregor, 2007).

Video games do in fact enable the player to play in both a physical space and in a virtual, constructed space. Spatiality within the video games is crucial for the understanding of the virtual landscapes (McGregor, 2007) and is what separates virtual landscapes in video games from those of other media such as film and television (McGregor, 2006). The spatiality within the virtual landscapes is defined by the architecture of the space. Architecture in this context refers to the structure and organization of elements that together make up a space (the solids within the void that is a virtual setting), as well as social interaction, encompassing the activities that occur in between or within those elements.

The spatial use of the architecture within virtual landscapes is determined by looking at the link between game spaces and gameplay as an overarching configuration. The assigned qualities of the landscape and its architecture directly affect gameplay and the enabling of interaction (McGregor, 2007).

As a result of the interactivity, availability and multi-player engagement, video games with these 3D virtual environments have attracted millions of players globally (Dalgarno & Lee, 2010).

The most common spatial representation of virtual landscapes within video games is through projection on a display, known as a desktop-virtual landscape. The player accesses the virtual landscape visually by a screen and aurally by either speakers or headphones. Interaction is enabled by various devices (keyboard, joystick, etc.) and acts as a kinesthetic link from the physical to the virtual space, hence making the virtual space disconnected yet dependent on the physical space (McGregor, 2007). The virtual landscape is therefore experienced and interacted with differently compared to the physical, though some do argue that they benefit from the same spatial theories, e.g. navigation and orientation in a landscape.

In their article *Navigation and orientation in 3D user interfaces: the impact of navigation aids and landmarks* Parush and Berman (2004) argue that concepts such as navigation and orientation, which traditionally are concepts exclusively of physical landscapes, should be used also when designing virual landscapes. There are, however,

studies proving that people have a more difficult time navigating in virtual landscapes than physical landscapes (Zacharias, 2005; Vinson, 1999). These studies only further stress the need for spatial theories to be applied when designing virtual landscapes; It also begs the question why it in some cases is harder to navigate in a virtual landscape and where changes can be made to shift this.

Level designers, known as the architects of the game-design world, take on the process of building a game environment, or level, in which the gameplay takes place. (C. Byron & S. Byron, 2005). Books such as *Beginning Game Level Design* by Fiel and Scattergood (2005), *Patterns in Game Design* by Björck and Holopainen (2004), *Introduction to Level Design* by Clayton and Clayton (2003) and *Game Level Design* by Byrne (2004) all aim to educate future level designers. However, none of these books deeply explore spatial theories and concepts regarding landscape architecture, spatiality or navigation. The lack of using said theories is something that Hullett and Whitehead (2010) identified and address in their work *Design Patterns in FPS Levels*. They explain that most level designers mainly use their previous knowledge of existing games when designing new environments. When it comes to level design, there is currently a lack of a structured system passing on experience and guidelines from experienced designers to novices (Hullett & Whitehead, 2010).

In fact, in order for a player to be able to take on or complete challenges within a game, such as navigation to goals or artifacts and visual tracking of enemies, they need to perceive visual cues or elements related to their surroundings (Milam et al., 2011) They need to be able to navigate and create mental images of the virtual landscape. Thus, gameplay could benefit from the application of spatial theories for navigation. There are numerous ways in which the designer can aid the player with navigation of the landscape.

World of Warcraft, which is a video game within the MMORPG genre, uses a lot of different methods to support navigation, however, a large amount of the tools are confined to the user interface (UI), so called discrete navigation tools (see chapter *2.1 Navigation*). There are a lot of different indicators, signs and symbols to interpret. This can be compared to how Lynch (1960) refers to research claiming that too many distinct and contrasting signs along a path may lead to e.g. unprepared navigational decisions. He also implied how directional signs make spaces less memorable as the navigators tend to rely on signs more than their perception and memory of a space.

In some games, guides have been merged into the landscape itself. Signs such as arrows or lines are examples of these guides. By incorporating the signs with the actual style of the environment, signs can be very visible without seeming out of place (Nerurkar, 2009). Nerurkar (2009) refers to this way of designing

as immersive navigation tools (further explained in *2.1 Navigation*) and it is a way of working with navigation whilst designing the virtual landscape without using the interface of the game. C. Byron and S. Byron describe it as: "[...] coax a player through a level without ever letting them know they're being led by the hand." (C. Byron & S. Byron, 2005 p.90)

Martens & Antonenko (2012) authors of *Narrowing gender-based performance gaps in virtual environment navigation*, claim that the design of virtual landscapes should be heavily influenced and adjusted to eventual individual differences among users. Gender differences is considered one of these user differences, as the environmental perception differs between men and women. Women report their experience of anxiety and spatial confusion in an environment as higher than men do. This risks obstructing women's construction of spatial knowledge, diminishing their orientation, leading to navigational problems (Martens & Antonenko, 2012).

The main difference in navigational strategy between men and women is that men tend to use a Euclidean based strategy while women tend to use a strategy connected to landmarks (Martens & Antonenko, 2012, Parush & Berman, 2004). Martens & Antonenko (2012) claim that design guidelines for virtual landscape can be used to minimize the performance differences based on gender differences in navigation strategy. The importance of applying spatial theories in the design of virtual landscapes are affirmed.

Image 2: Video game player.

1.2 Problem, Purpose and Aim

This thesis is a study of virtual landscapes, their connection to physical landscapes and how theories regarding physical landscapes can be applied to the design of virtual landscapes.

Image 3: Screenshot of the network of paths and stairs in Dazar'Alor, World of Warcraft

This is a screenshot from the city of Dazar'Alor in World of Warcraft. The city is a beautiful city with great pyramids located in the jungles of Zuldazar, however, it is rather hard to navigate in. This is just one example of places in video games that I have found hard to navigate.

The city seems at first sight, like it would be easy to navigate with its orthogonal network of paths but it turned out to be rather hard to understand. I have visited

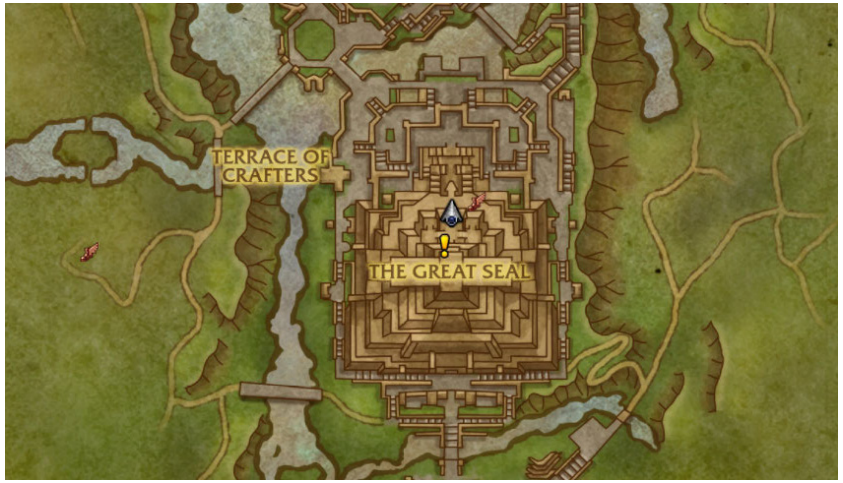


Image 4: Screenshot of the map of Dazar'Alor (above)

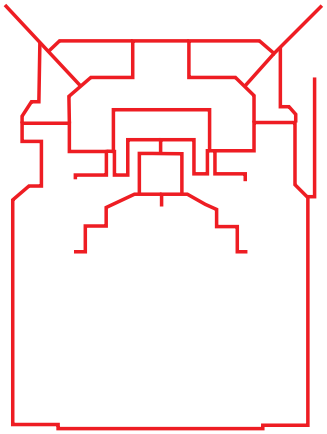


Figure 1: Graphic of the path network of Dazar'Alor.

the city multiple times (as it is one of the new capital cities in the new World of Warcraft expansion) but I still have problems finding objectives that I have visited before.

Without the navigational support in the UI it is hard to get a sense of orientation and direction due to the lack of hierarchical structure among paths and architecture. It is also rather monotone in its aesthetic expression making relevant architecture hard to distinguish from its surroundings.

Some games have even taken steps to reduce the amount of navigation tools in the UI by giving the player the option to turn this off, resulting in e.g. NPCs giving directions to important places instead.

This will demand a higher focus on the immersive navigation tools of the game but might perhaps lead to a more memorable landscape as the player will have to get to know the space in order to find their way.

The problems at issue ,when it comes to virtual landscapes in video games, are the lack of research regarding the perception of virtual landscapes within video games as well as the lowered game experienced due to navigational problems.

The purpose of this paper is to contribute to the discussion regarding similarities and differences between the design of physical and virtual landscapes and the landscape architect's potential role in designing virtual landscapes for games.

The aim of this paper is to carry out an experiment on how landscape architecture theories can be applied to the design of virtual landscapes.

The main questions asked for this thesis are:

- *What are some of the ways in which physical and virtual landscapes relate to each other?*

- *How and to what extent can spatial theories, in particular those concerning navigation and orientation, be applied when designing virtual landscapes?*

1.3 Method

This thesis consists of two parts, a theoretical framework and a design experiment.

As stated in the introduction, virtual landscapes benefit greatly from applying theories regarding navigation and orientation. The framework for both the theoretical framework and the design experiment in this thesis has been derived from these two aspects resulting in the four chapters: *Navigation, The Network and Paths of a City, The Symbolism and Structuring of Architecture* and *The Perception and Spatiality of Architecture*.

The paper is written in English, instead of Swedish (the author's native language), mainly because of a lack of translation (from English to Swedish) for many of the keywords presented in the paper, but also to further contribute to an international dialog of landscape architecture and game design.

Furthermore, in this thesis, the use of the term landscape architecture should be considered to be synonymous to urban design. The reason for this lies in how the term landscape architecture in Swedish in most cases encompass the field of urban design as well, hence making the thesis easier to understand for Swedish readers as well.

Design Experiment

To reach the aim of the paper, a design of a virtual landscape in an urban context has been created. Using design in the context of research has been done multiple times before and Lenzholzer, Duchhart and Koh (2013) argues that it can be approached in three different ways. Firstly, research can be carried out upon a design, with the goal of achieving an improvement to that specific design. The second way is to research the process of design and the third consists of looking at designing as an act and how its result can be employed as a research method. The design in this thesis has been approached by the third method.

The design experiment has been simultaneously created through analog sketches and 3D modelling. The digital tools used were mainly Rhino 3D in combination with Vray for Rhino and post-production were done in Adobe Photoshop. The thematic map for the design proposal was created in Adobe Illustrator.

Calleja (2011) stresses the importance of the narrative in the design of virtual landscapes. As a response to this, a narrative was composed, which will be further explained in the chapter *3.1 Narrative*. The narrative can be summarized as a city in a fantasy setting named Awil'ma which is located in a desert next to an oasis. To be in line with the narrative, inspiration to the architectural style has been extracted from pictures of real cities located next to oases in combination with the classic Hellenistic architectural style. Some props and patterns have also

been inspired from Arabic cities such as Marrakech and Teheran making the architectural style a combination of various styles. Inspiration from these places has been derived solely on photos from the Internet.

World of Warcraft as Inspiration

To be able to focus on the four parts of the framework without getting lost in the vast quantity of genres and games within the video game industry, the game World of Warcraft® has been used as an inspiration from the video game world for the design experiment. There are multiple reasons as to why this game was chosen. Firstly, it is a game that I have a lot of experience with and that I feel familiar with. Secondly, the virtual landscapes within the game share similarities to the physical world as basic gravity laws, and such, are applied to the game environment. Lastly, it is largely considered a well-designed game in the context of the virtual landscapes (McGregor, 2007; Nerurkar, 2009; Ljungström, 2005)

World of Warcraft is created and administered by Blizzard Entertainment® and belongs within the MMORPG genre. The player controls an avatar, assuming the character of it. The lore of World of Warcraft stems from the Warcraft®-games released, by the same company, in the early 2000s. World of Warcraft was first released in 2004 and has since released several expansion-sets to the game, introducing new features and areas to explore (Blizzard Entertainment, 2018). World of Warcraft is the most populated out of all MMORPG games with around 7 million active players (AltarofGaming, 2018).

Actions within World of Warcraft are carried out by an avatar created by the player. As a role-playing game, the players themselves decide what they want to do; however, the use of the virtual landscape could still be considered to be confined to the narrative of the game. World of Warcraft offers the capability to travel through space in an environment with architecture consisting of voids and solids. Basic laws of physics, such as gravity, are adhered to on the terrain. This way, e.g. mountains or steep hills can be used as barriers since players are not able to climb them without falling down. Movement is carried out either by the avatar walking, running or riding a mount that provides either increased ground (or swim) speed, or the ability to fly.

Theoretical Framework

The design of a virtual landscape in this thesis was carried out by using a literature study as theoretical framework. The literature features subjects such as landscape analysis, landscape architecture, spatiality, urban design and navigation which then has been discussed and applied in relation to theories regarding level design (the act of designing virtual landscapes within video games) as well as literature regarding subjects such as virtual reality and virtual communication.

In order to acquire literature for the thesis, the web pages

Image 5: The dwarven city of Ironforge within World of Warcraft.

of the SLU library and ScienceDirect has been the main sources. In some cases, other theses have been used to find relevant references. The articles found has not always been centered around the desired subject but has contained applicable resources within either their background or discussion pages.

The main literature regarding landscape architecture in this thesis is "*Image of the City*" by Kevin Lynch (1960), "*The Pattern Language*" by Christopher Alexander, Sara Ishikawa and Murray Silverstein (1977) and "*Townscape*" by Gordon Cullen (1961).

Image of the City, written by Kevin Lynch (1960) is a book regarding the look and design of cities. The book dissects and discusses human perception of cities and what elements a city consists of. In this paper, Lynch's theories are explained and discussed in contrast to other literature as well as how one perceives virtual landscapes, and an attempt to apply his theories to the design has been made. Lynch's theories are chosen as they look into how a city can be structured and perceived by the people within it.

A Pattern Language by Christopher Alexander et. al. (1977) is a book aimed for the general public to give an increased understanding of architecture and design. The book can be used as a kind of cook book where the presented patterns can be compared to recipes. Just like how virtual landscapes are built up from nothing, the patterns presented in this book are calculated and explained as if a completely new town/building is to be built hence giving the same "start-from-scratch" perspective as game design. Some of the patterns from the book are described, discussed and in some cases applied to the design in this thesis. Ljungström (2005) found multiple similarities between the patterns found within *A Pattern Language* and the design of the virtual landscapes within World of Warcraft.

Townscape is a book written by Gordon Cullen (1961) and investigates the spatiality within landscapes with an emphasis on cities and towns. A shortened version of *Townscape*, called *The Concise Townscape*, is used in this paper. In his book, Cullen (1961) examines both the implications of spatiality on both social and aesthetic functions. *Townscape* has been included as a reference in the theoretical framework since it brings a wide perspective of the visual perception of landscapes/cities.

Darken and Peterson's (2001) article *Spatial Orientation, Wayfinding and Representation* has been used as a framework of the definition of navigation in general and the components impacting its success. Navigation in virtual landscapes will also be explored and compared to navigation in the physical world.

In addition to the literature referenced to in this thesis, a lot of the initial research was aimed at gaining further insight of the virtual landscape. Literature regarding the video game world, virtual reality and similar themes were studied.

1.4 Limitations

This paper does not delve deep into gameplay aspects of the virtual landscape but instead focuses on the spatial use and architecture of an urban site within a virtual landscape. By narrowing down the focus on an urban setting, design principles regarding e.g. vegetation have received less attention. Principles regarding those of spatiality and built environment have been favored instead.

The audio within virtual landscapes (music, sounds, ambience etc.) has not been studied or included in this paper due to author inexperience and the lack of overlap with landscape architecture

The matter of realism and how it affects the perception of virtual landscapes is not to be discussed in the thesis. This is not included mainly because of the diversity within the video game industry when it comes to the level of realism. There are 3D virtual landscapes with more stylized graphical style.

As this thesis concerns the design of virtual landscapes and not games themselves, discrete navigation tools (explained in *2.1 Navigation*) have not been a part of the design experiment. Furthermore, maps, as a discrete navigation tool, can be regarded a key aspect of the image of a city (Lynch, 1960; Nerurkar, 2009). Their potential and effects on navigation and perception of a city have however not been explored in this thesis.

1.5 Method - Discussion

The limitations set forth may have had both positive and negative consequences for the outcome of the design experiment. The decision to use World of Warcraft as a sole inspiration for the design experiment was essential to get a solid framework. However, limiting the thesis to only include virtual landscapes similar to those within World of Warcraft greatly diminish the possibility to draw general conclusions regarding the concept of virtual landscapes as a whole.

The same goes for the limitation of emphasizing the design of an urban site within a virtual landscape. Looking at World of Warcraft as an example, the majority of the game consists of non-urban landscapes that have not at all been explored in this thesis. The focus on the urban setting and in particular the themes chosen was necessary due to time constraints. Complete city design is a lengthy process.

Furthermore, very low emphasis has been put upon the fact that World of Warcraft is mainly navigated through a third person perspective, meaning that unlike how humans experience the world through their eyes, a kind of first person perspective, the virtual landscapes in World of Warcraft are experienced through an angle slightly zoomed out from the character. This likely affects navigation in the virtual landscape but has not been discussed in this thesis due to the lack of research on the area as well as the fact that there are other games with a similar framework navigated through a first-person perspective.

Gameplay is very important, and it would be very rewarding to look into how it affects the design of virtual landscapes and vice versa, however, as every game has its own unique gameplay it was decided that it would be a too big scope for this paper. In a way, gameplay has been considered when creating the design experiment as McGregor (2007) mentions the positive impact on gameplay of spatiality and Milim et al. (1999) the use of navigational theories.

The design experiment consists of a 3D model of an entire city. The decision to design an entire city detailed to the degree necessary has been very time consuming. To shorten the time of designing the city, most of the buildings consists of similar copies of one source building/ module. As mentioned by Fiel and Scattergood (2005) regarding the design of virtual landscape, it is a device used when adding vegetation to the virtual landscape as it is very time consuming to create multiple unique pieces. This decision has led to a much more consistent and perhaps easier-to-read virtual landscape but at the cost of

the organic feeling of a physical landscape where nothing is completely identical.

The design experiment has benefited strongly from the flexibility of 3D modelling. It has enabled an iterative design process where the result of the design in the context of spatiality and navigation has been subjectively studied in real-time.

Designing such a large area (an entire city) with a high amount of details might have led to a weaker design on a smaller scale due to the sheer vastness of the whole city but potentially led to a more consistent design for the whole city with strong concepts.

A case could be made that the literature framework could benefit from more recent research and theories regarding landscape architecture, which is a legitimate argument to make, however, a decision was made to focus on a selected amount of proven classic landscape architecture theories to avoid getting lost in finding the ultimate design for an urban space. Furthermore, it can be argued that the scope of this thesis centers around the connection between physical and virtual landscapes rather than a comparison of various spatial theories.

The theories of Jan Gehl was first considered to be studied for this thesis but after further exploration, the decision was made that they were too focused on social human behavior in the context of landscape architecture which felt less applicable to the design of virtual landscapes as those feature another kind of social interaction and communication.

There are also more self-evident differences between the physical and virtual landscape e.g. the need of benches to avoid or reduce fatigue or parks to experience recreation are not as crucial in most games. The reason why this has not been discussed further in this thesis is because the importance of factors like these can be programmed into a game or left out, meaning that it is not entirely up to the level designer to solve.

Image 6: Screenshot with UI, World of Warcraft.

2.1 Navigation

Navigation should be seen as a flexible function of the three components: environment, task and people. It is unachievable to create a design solution with only one or two out of these three components (Darken & Peterson, 2001).

Definition

To be able to discuss and analyze differences and similarities between navigation in physical and virtual landscapes, navigation in itself needs to be defined. To start off, exploratory spatial behavior and navigation are not the same thing. Navigation in the context of this paper refers to the act whereby cognitive and behavioral abilities are used by a person to find their way from point A to point B. While navigation calls for a search of necessary information and navigational cues to find/reach a specific objective, exploration however, calls for a continuous update of the search for information (Zacharias, 2005).

Zacharias (2005), author of *Explanatory spatial behaviour in real and virtual environments*, explains how humans have an inner drive and desire to understand where they are (Zacharias, 2005) and navigation through a landscape is essential when we move over large spaces. However, despite its importance, navigation is usually just a way to reach our main task. Navigation itself is seldom (if ever) the main task (Darken & Peterson, 2001).

If a navigator struggles with navigating a landscape, they may become disoriented. Disorientation is an uncomfortable state of mind where people may experience anxiousness and general unhappiness (Darken & Peterson, 2001). To make sure that they are not lost in an environment, some people are in need of reassurance that they are not lost. If instead, the navigator can successfully navigate the landscape avoiding disorientation, it opens up the possibility for discovery and exploration (Darken & Peterson, 2001).

Essential to navigation is to maintain a mental image of the spatial relationship between objects and places as well as a general concept of the space itself. This is referred to as spatial comprehension and is connected to how a navigator perceives and remembers information for future reference (Darken & Peterson, 2001). Spatial comprehension and visualization abilities are closely tied together. Visualization abilities in this context refers to the ability to remember e.g. how objects and places look like, are arranged, and the ability to recreate these as if on a map (Zacharias, 2005).

Spatial comprehension is also similar to the concept of orientation which refers to the navigator's ability to know and understands their own location within an environment but also the relative position of other objects, such as landmarks and paths. Orientation is a vital part of successful navigation (Parush & Berman, 2004).

The process of navigation can be boiled down into three stages, mental extraction of landmarks being the first stage (Vinson, 1999). Landmarks in the context of navigation will be further explained in the section *Navigational Elements*.

As the understanding of the environment increases, the navigator develops a route knowledge, or procedural knowledge (Martens & Antonenko, 2012) of the environment, enabling the navigation between one point to another. Route knowledge acts as the second stage. Route knowledge is derived from the navigator linking a navigational action to a landmark, where the landmark acts as a reference point (Vinson, 1999). It is not a fixed state but rather fluent where new landmarks and paths are added as they are learned.

The third stage is survey knowledge, also known as configurational knowledge, where the spatial properties and the objects in an environment are much more precisely encoded (Vinson, 1999). The survey knowledge suggests that the navigator is able to plan their way between known nodes or landmarks even though the path itself has not been transversed before. A complete survey knowledge gives the navigator the ability to complete a good estimate of distances and relative positions and directions of landmarks and nodes (Martens & Antonenko, 2012).

Navigational strategies can be divided into two distinct categories: spatial strategy and response strategy. Spatial strategy involves the creation of a cognitive map by the navigator, where numerous landmarks have their position in space encoded as the navigator travels. The cognitive map is supported by the hippocampus, the area of the brain associated with memory, emotions, and motivation. The response strategy refers to how a navigator remembers and connects body movements, such as turning one's head, torso, walking etc., to a specific location in the environment (Andersen et. al., 2011). Oman et. al. (2002) argues that this strategy is superior to the spatial strategy when it comes to learning the environment (Oman et.al., 2002).

Large-scale environments refer to large enough environments where the entirety of it cannot be encompassed by the navigator's viewpoint (Vinson, 1999). All large-scale virtual environments will possess navigational problems of some sort (Darken & Peterson, 2001) which makes navigational support a necessity when designing (Vinson, 1999).

The extent of a large-scale environment demands the navigator to put together the information presented in successive viewpoints into a cohesive mental portrayal. This mental portrayal, like the aforementioned cognitive map. The cognitive map is then used by the navigator to navigate in the environment (Vinson, 1999).

The creation of a cognitive map usually starts with

identifying the current scene which is the boundaries of the local environment. As the navigator moves, more scenes are added which eventually makes spaces hard to both perceive and integrate to each other. The number of scenes and spaces experienced is why landmarks are important, as they establish a connection between spaces and put them in cognitive memory. Perceiving landmarks as navigational elements in the cognitive map also correlates with human propensity for details (Zacharias, 2005).

Charles M. Oman et. al researched the spatial memory in their work *Three dimensional spatial memory and learning in real and virtual environments* (2002). The basis of their work is that spatial cognition and orientation is somehwat dependent on how multiple landmarks are remembered and how the spatial relationship between a navigator and landmarks changes with new viewports (Oman et.al., 2002).

The cognitive map should not be compared to mental images but rather a collection of hierarchical and categorical structures and spatial distortions (Vinson, 1999), an understanding of spatial relationship between different features.

The distortions are prevalent but predictable and can therefore be reduced by designing for a navigator's mnemonic predispositions. They also diminish as the navigator obtains navigational experience. It is the hierarchical nature of the cognitive maps that causes distortions in relative directions and distances, as objects contained within identifiable boundaries are clustered into districts (Vinson, 1999).

Navigational elements

Landmarks can be referred to as distinctive environmental elements. A navigational action can be associated to a landmark, easing navigation. This further establishes the importance of landmarks in both virtual and physical landscapes. Landmarks are vital for a successful navigation and orientation (Parush & Berman, 2004).

Lynch (1960) mentioned five different elements that our cognitive maps are made of: paths, edges, districts, nodes and landmarks (Lynch, 1960). In the context of navigation however, all of these could be considered landmarks as a more general meaning where they represent elements that provide intelligence as to the navigator's position and orientation. They can all be distinctive environmental elements.

Landmarks that are noticeable and well planned/designed enhances the development and use of spatial knowledge and orientation. If the landmark's position is known by the navigator, they can determine their own position in the environment by considering the spatial relation to that specific landmark. The design of the landmarks, such as making it memorable, enhances the effectiveness of them as navigational support (Vinson, 1999).

For a landmark to be efficient it needs per definition, to be distinctive not only from adjacent objects and structures but also nearby landmarks. If the landmark is not distinctive from other landmarks there is a risk that the navigator will be misled, leading to a navigational error (Vinson, 1999).

Vinson (1999) mentions several different features that can be used to design distinctive landmarks including significant height, complex body, bright, colorful and unique surface, noticeable signs, surrounded by landscape and free standing. He also points out the advantages of a landmark with sides that differ from each other. This way, the navigator may orient themselves in relation to the direction of the landmark (Vinson, 1999).

Landmarks enables different strategies for remembering path structure. The different strategies include, as mentioned before, local landmarks that works as a reference point, but also the triangulation of landmarks (three or more) where the navigator may attain their relative position to the landmarks (Zacharias, 2005).

In addition to the appearance of a landmark (distinctiveness), the placement and location may be equally important. It is easier to remember a landmark when placing it along a major path or at a path junction. The visibility from major paths is also important for the memorability of the look and location of a building (which in this context is classified as a landmark). If the navigator is able to see at least two landmarks at all times, they may create a mental route between the two, eventually leading to a string of landmarks to move between (Vinson, 1999).

Paths are a way to minimize the number of landmarks as they in themselves can be used as navigation support and even be considered landmarks, guiding the navigator to important locations or other landmarks. Landmarks along routes can also be used as a distance measurement and orientation indicator (Vinson, 1999). Landmarks as navigational elements are useful in both the physical and the virtual landscape.

Navigational Differences between Physical and Virtual Landscapes

A virtual landscape does not offer the same navigation opportunities as physical landscapes, it can also be considered harder to navigate (Zacharias, 2005; Vinson, 1999). As mentioned earlier, the response strategy refers to the relationship between body movements, proprioceptive cues and an environmental feature (Andersen et.al., 2011). The response strategy, along with the human peripheral vision, are absent when experiencing a virtual environment (Vinson, 1999). Something else to consider is how navigation in physical landscapes is something that humans are more accustomed to (Darken & Peterson, 2001).

Calleja (2011) actually mentions how players can use the

different camera angles offered in some games to opt in a different view of the landscape.

Smith and Marsh (2004) also mention restricted field of view as well as different motion control techniques and cognitive load as causes of the lesser navigational performance within virtual landscapes (Smith & Marsh, 2004). These are some of the reasons why the consideration of navigation should be highly valued when designing a virtual landscape.

The lack of peripheral view as well as the lack of proper navigational cues in the environment can however be avoided by increasing the navigator's knowledge and awareness of the virtual off-screen (the surrounding space not visible from the current viewport, see *Image 5*) (Smith & Marsh, 2004). In MMORPG's, the off-screen is comparable to the physical world as it is active and persistent, meaning that the player only experiences the part of the world in their direct surrounding and that even when the player themselves is not active, the world 'lives on' as other players play within the world (Egenfeldt-Nielsen, 2016).

Despite these differences, the strategies we use when we navigate through an environment, physical or virtual, are the same. Based on preliminary research, Vinson (1999) argues that techniques and principles regarding real-world navigation can be applied to virtual environments and their design as well (Vinson, 1999).

Our navigational actions are evidently affected by architectural design decisions. With that said, there are other factors that also play a big part when designers take these actions. Sound is something that not only aids our perception of distance and direction (Dalgarno & Lee, 2010), but that may also change our environmental preference. Other tactile perceptions affecting our navigational actions include ambient factors such as heat and wind (Zacharias, 2005).

When in a virtual environment, however, it is harder to use most of these factors to change environmental preference or even use as navigational cues. Hence, a higher focus on visual communication is prevalent in theories regarding navigation and design of virtual landscapes.

Navigational Tools

Navigational support may be addressed with two different approaches: either by giving the navigator a tool or device that simplifies navigation or by organizing and design the virtual environment so that it is easier to navigate (Martens & Antonenko, 2012). These approaches may be compared to what Nerurkar (2009) refers to as discrete and immersive navigation tools.

Nerurkar (2009) discusses this in his article *No more wrong* turns posted on Gamasutra, a website focusing on video game development. Nerurkar himself is an architecture

graduate with multiple years of experience within the game development field. Regarding the navigation tools, both immersed and discrete navigation tools have the same purpose, to guide the player in different ways such as what to expect from the surrounding landscape or possible interactions with characters (Nerurkar, 2009).

Discrete navigation tools are separated from the environment and could instead be considered a part of the User Interface (UI) (Nerurkar, 2009). These tools emerged as a way to approach navigational problems within complex virtual environment. Examples of discrete navigation tools are presented in *Image 5*.

Discrete navigation tools are an easy way for the navigator to determine their relative position to its surroundings and in the environment however an over-constrained interface of discrete navigation tools might disrupt the natural flow of exploration and discovery (Darken & Peterson, 2001).

Parush & Berman (2004) studied the impact of navigational aids in relation to navigational performance in their work *Navigation and orientation in 3D user interfaces: the impact of navigation aids and landmarks*. In their study they found that learning an environment without a map meant that the navigator became more dependent on landmarks for navigation. Learning an environment with the aid of a map appears to increase orientation performance in tasks like estimating relative location in the environment.

By instead learning the environment by direct navigation, without the aid of a map, the navigator's performance increased in tasks such as navigating to unseen targets and estimating route distances. The direct navigation also appears to result in more survey knowledge for the navigator (Parush & Berman, 2004).

Three examples of discrete navigation tools are maps, markers and compasses. Markers are a 2D or 3D highlighting of objects, characters or areas. Visibility of them can be different from game to game. Sometimes markers can be seen through walls or other obstacles while in other cases the associated object must be visible for the marker to be visible. A marker highlighting an area of interest that can be seen through walls can assist navigation by letting the player know what direction to aim for in order to reach the area (Nerurkar, 2009).

A compass can be compared to a marker but where a marker displays the absolute position of an object, the compass displays the player's position in relation to the object. The compass also moves in line with the player (within the UI) while the marker is fixed to the world. A compass can also act as an extension of a marker where it can display directionality when the marker itself is not visible on the screen (Nerurkar, 2009). Darken & Peterson (2001) argue that discrete navigation tools should be a last recourse when designing a virtual landscape (Darken & Peterson, 2001).

Immersive navigation tools are the alternative to the mediators that are discrete navigation tools (Darken & Peterson, 2001) and refers to the use of visual elements like geometry, textures, lights, characters, etc. to guide players within a 3D environment (Nerurkar, 2009).
It is also the organization of a space, its patterns and scale (Darken & Peterson, 2001). Milam et al. (2011) describe visual cues as an equivalent to immersive navigation tools. The use of visual elements and visual cues in level design can be called visual design. Visual design can be perceived as a way for the designer to communicate with the player through the landscape itself (Milam et al., 2011).

Milam et al. (2011) emphasizes the importance of visual design in level design. If visual cues are used correctly they can channel the attention of the player or even direct their movement through the environment (Milam et al., 2011). Visual cues are not as apparent as the discrete navigation tools, as they are meant to be a subtle instrument guiding the player. Since they are more subtle

Image 7: Examples of discrete navigation tools used in the game Overwatch.

Virtual off-screen

Virtual off-screen

they risk being overlooked by the players (Nerurkar, 2009).

Just like in the film industry and among other visual arts, game designers use theories about visual composition when designing their game; however, there is a big difference between games and other types of visual art, interaction. Due to games being interactive, the importance of deciphering the communication within the visual cues increases (Milam et al., 2011).

The design regarding virtual off-screen (mentioned earlier in *Navigational Differences Between Physical and Virtual Landscape*) is a part of immersive navigation tools. Smith and Marsh (2004) set out two guidlines to lead the attention of the navigator outside of the current viewport Their studies verified that the guidelines not only reduced navigator's disorientation but also aided them into avoiding situations where they might have become disoriented.

The first guideline regards entry and exit points. Smith and Marsh (2004) stress the good influences of designing so that it is clear for the navigator that there is an option to exit the space contained within the viewport. Exit and entries in this context may refer to doors but also roads and paths etc.

The second guideline points out the importance of placing objects so that at least one, but preferably more object are only partially within the current viewport. These objects can then work as navigational cues for the navigator, that there is something beyond what they can see, in the virtual off-screen (Smith & Marsh, 2004).

Immersive navigation tools is the responsibility of the level designer. Nerurkar (2009) further divides the immersive navigation tools, or visual cues, into 3 subcategories: attract, guide and identify.

Attract is referring to the act of attracting the attention of the player to a certain element or space. Attracting attention can be done either fairly subtly or with more blatant means. To attract a player, the designer needs to catch the player's eye (Nerurkar, 2009).

Within painting and other visual arts, contrast is used to attract attention. The higher the visual contrast, the higher the chance of the object or area to be noticed. Light contrast is probably the most common use of contrast in video games. For example, by lighting up a certain area within a rather visually dark level, the player gets drawn to the light (Nerurkar, 2009). Cullen (1961) mentions the use of maws, which are open doorways that during a sunny day appear very dark and contrast the bright surroundings of it.

In addition to light contrast, both shape and color contrast can attract the player's attention. Examples for this can be a round shape in an area based on vertical lines or a red

object in a green surrounding (Nerurkar, 2009).

Nerurkar (2009) also mentions the use of weenies which is referring to environments with a clear reference point in the background. The reference point can be a landmark that is higher than the rest of the structures in the landscape, making it attractive to the eye. Another method of attraction is using theories about composition, similar to the ones in other visual arts, where lines or object direct the eye towards a certain focus or area (Nerurkar, 2009).

Guide refers to how symbols such as arrows and lines are incorporated into the landscape itself, without seeming out of place (Nerurkar, 2009).

Identify in Nerurkar's (2009) context refers to either a homogeneity of symbols or patterns to increase the ability to identify a space, thus aiding the navigator in grasping their relative position. In addition to that, both Alexander et. al (1977), Lynch (1960 and Cullen (1961) argue for how having clear boundaries of an area is helpful for the identification of a space. Identify in this sense will be explored further in *2.3 The Symbolism and Structuring of a City*.

Image 8: Screenshot of the UI map of Gilneas City, World of Warcraft

2.2. The Network and Paths of a City

The paths are the most potent element in the creation of an overall image of a city (Lynch 1960)

What defines a city? Lynch (1960), author of *Image of the City*, describes a city as being constructed from five different elements: paths, edges, districts, nodes and landmarks. The elements are highly affected by the observer's perspective or viewpoint. A street may act as a path for one person and an edge for another. A transportation hub may be seen as a district on a lower scale and a node when considering the whole transportation network. Alexander et. al. (1977), authors of *A Pattern Language*, instead focus on less general definitions of the parts of the city. Their book focuses on communities of people, neighborhoods, streets, open spaces and buildings. As a third voice regarding the elements of the city, Gordon Cullen (1961) regards a city as not a set pattern of streets but rather a sequence of rooms framed by various kind of architecture.

Lynch (1960) concluded that a lot of people perceive paths as predominant elements when establishing a mental image of a space, possibly since a whole city can only be observed by moving through it. Both Booth (1983) and Loidl and Bernard (2003) agree that paths are the most important element when designing landscapes as they give us a direction in our movement (Booth, 1983; Loidl & Bernard, 2003). Paths are avenues of which people move along, either often, seldom or potentially. They can take various forms and therefore encourage or enable different kinds of movement, such as streets, canals and railroads (Lynch, 1960).

Despite Loidl and Bernard's (2003) claim that the path is the most important element in landscape design, they emphasize that it is the elements along and at the end of the paths that promotes movement in the first place. It is partly these elements that aid people in creating a mental picture of the path network (Loidl & Bernard, 2003).

When planning a public environment Zacharias (2006) suggests beginning with designing the path network prioritizing clarity and order (Zacharias, 2006). A space with a clear structure that is also easy to perceive and understand will have a positive effect on navigational strategies and performance (Darken & Peterson, 2001).

Manhattan can be used as an example both of the pros and cons of a space with a consistent pattern. If there is a knowledge and understanding of the grid pattern, it makes navigation easier. Broadway, however, acts as a distinct violation to the grid like pattern as it cuts the grid in an angle. This can easily confuse a navigator, especially since Broadway shares the same type of urban fabric and identity as the rest of the grid. Darken & Peterson (2001) advice that when there is a violation to a pattern, it should

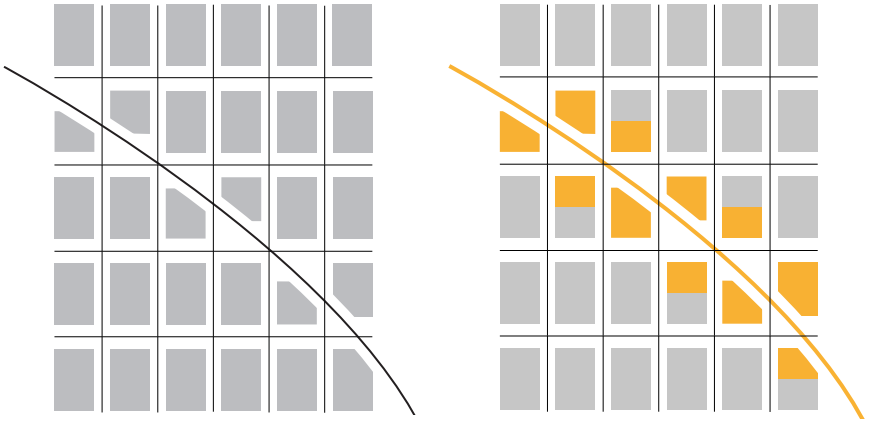


Figure 2: By emphasizing the violation in a grid, the disruption of the pattern is easier to perceive.

be designed in a way so that the navigator instantly recognizes it as a violation (Darken & Peterson, 2001).

Even though people in general like patterns and structure, there needs to be a distinction within the pattern. This is a great example of how landmarks can be used to give the navigator a sense of their relative position within an environment. If a space is structured this way, it might consequently make visual cues easier to perceive and understand (Darken & Peterson, 2001).

Our mental heuristics, concerning those that assist the remembrance of objects layout, may cause distortions. This refers to how people falsely align main axes of objects (with similar direction) to each other or rotate objects so that their main axes are aligned relative to that of the background. These specific distortions are called rectilinear normalization which is when people distort their surrounding and its features to either fit or form a grid (Vinson, 1999).

Distortions like these can be reduced by aligning the main axes of landmarks both with each other and paths and edges. The paths and edges may also be arranged in a grid to further minimize distortions. A consistent grid pattern results in an easier time for the navigator to estimate spatial relationships and distances within the environment. Studies show that navigators in street grids give a more accurate judgement regarding distance and direction (Vinson, 1999). Paths can have various qualities that should be considered to avoid a street grid to get too homogenic or monotonous.

One of these qualities brought up by Lynch (1960) is the directional quality. Paths that have a clear origin point and a clear destination tend to have a clearer identity which makes it easier for people to tie a city together. This also aids the observer to get a sense of their relative position within the city. The directional qualities may also be complemented with scaled attributes. This enables the observer to be able to know how far along the path they have moved. Nodes and landmarks are excellent to use as elements to promote the scaling of a path. This gives people the perception of being positioned on the path either before or after that specific feature hence scaling the path into segments (Lynch, 1960). This is perhaps of

Perceived division of a path without scaling qualities.

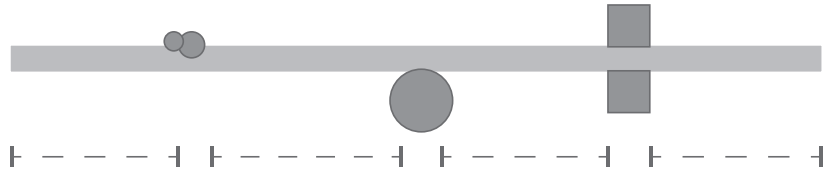


Figure 3: Perceived division of a path with scaling qualities.

higher importance when it comes to virtual landscapes as movement in video games often is quicker (Adams, 2005). Scaling qualities in a path could therefore increase the player's estimation of their relative position on the path quickly.

Abrupt directional deviations in a path provide adjacent spaces with opportunities for placing landmarks. These landmarks heighten the image of the path, making it more memorable (Lynch, 1960). Loidl and Bernard (2003) describe the scaling of a path in a similar matter but instead calls these elements milestones. The milestones indicate a progression along a path and can also be used to indicate a direction of movement (Loidl & Bernard, 2003).

There are several other qualities that makes the image of paths enhanced. Regular transportation seems to be predominant in influencing the importance of a path. A high concentration of activity or a special use also showed prominence in making a path an important feature (Lynch, 1960). Zacharias (2006) compares the movement of people in a mall and the movement of people in a virtual representation of the same mall. One of the results showed that people tend to prefer the forward option in path intersections in both the virtual and the real-world mall. It was also noted that a well-lit up pathway was a preferred option. In general, it can be said that people tend to avert cul-de-sac and instead choose paths with multiple options (Zacharias, 2006).

People also tend to move towards a central point, both to get a better overview of an environment's layout and to get more options for movement choices (Zacharias, 2006). These results are in line with the authors of *Beginning of Level Design*, Fiel and Scattergood's (2005), claim that paths in virtual landscapes should be rewarding, they should lead to something or connect to paths that do. Hidden paths (such as narrow alleyways) should be used sparsely, as people tend to not like them (Fiel & Scattergood, 2005).

Visual and spatial characteristics also showed to strengthen the image of paths. Extremes such as very narrow or wide paths as well as interesting or unique facade characteristics are example of this. The name of the street/path can actually provide both continuation and identity to a path by giving the observer the possibility to create a relationship with a path/street (Lynch, 1960).

Paths that are regularly confused with each other, or in other way lacks a clear identity tend to affect the image of the whole city. Another big factor regarding the city image is the feeling of continuation of a path (Lynch, 1960). Darken and Peterson (2001) refers to paths with these qualities within virtual landscapes as handrails as they can guide a player and hence support navigation (Darken & Peterson, 2001). Though, sudden changes in spatiality or materiality may confuse the observer which may cause them to not extend paths as they should (Lynch, 1960).

This is something that Cullen (1961) considers a quality in a path, as it will give the city a more dramatic appeal with living streets. He describes a city as often being experienced as a series of views, a serial vision. As a street is cruised, new views are constantly experienced as the architecture along the street reveals new sights. A long straight road risks being perceived as monotonous as it will be grasped quickly. It is the juxtaposition between e.g. open and closed, narrow and wide that our brain reacts to (Cullen, 1961).

Lynch (1960) instead emphasizes creating a path hierarchy when designing a path network. Key paths should be differentiated with features or qualities that separates them from other channels. This can take shape as special textures, high concentration of activity, planting design etc. By having one or more of these features or qualities along the full extent of a path, it gives the path continuity. The features do not need to be linear, instead it can be designed as a rhythm, a homogenic repetition. By ordering the city after paths and separating key paths from smaller or not as important ones, a clear hierarchy is created, acting as the skeleton for the city.

Humans, as social beings, tend to go where there are a lot of people. A high concentration of people can be achieved by grouping facilities and communities into nodes. These nodes should however be spread out to avoid being too crowded and instead enabling squares with different identities and activities. These need to inherit the following characteristics: major pedestrian paths converging at the node, public squares (small) to and/or facilities that support each other's activity such as evening activities groped together etc (Alexander et. al., 1977). This is thus Alexander et. al.'s (1977) definition of nodes. It is a space defined by people.

Lynch (1960) on the other hand describe nodes derived from the geometry and connectivity of a space. Nodes are connecting points in the landscape that people can enter. They are used when traveling as targets or focal points of which to either reach or depart from. The path network, or the skeleton of the city, is held together by nodes, the anchor points of the city (Lynch, 1960).

Junctions, intersections between paths, convergences of paths or crossings can all work as nodes. This links the concept of nodes with paths. They may also take shape of concentration of e.g. activity and be associated with

cores, hence connecting them with the concept of districts (explained in the next chapter: *2.3 The Symbolism and Structuring of Architecture*). A node is hence, according to Lynch (1960) a distinct place connecting paths, circulation and movement. It should be clearly separated as a space from surrounding paths by distinct edges in order for it to be successful (Lynch, 1960).

When arriving at a junction that acts as a node, people's perception of nearby elements needs to be heightened as decisions are to be made. Elements at a junction should therefore preferably be a reference from their location/ direction (Lynch, 1960).

The second type of node, alongside the junctions, is the thematic concentration. The concentration may act as a core within a bigger space, or a symbol or focus of an important area. A node may consequently be both a junction and a thematic concentration. The form of the node is not essential, but a distinct form increases its impact and makes it more memorable. By having a distinct shape, it may also assist with orientation and navigation at a junction with multiple options (Lynch, 1960).

A promenade can be considered an example of paths and nodes being connected. Promenades are a place to just stroll, walk up and down, stare at strangers or let other stare at you. They are a meeting place but also a street, they mix people. Promenades are primarily used by people living nearby. It is critical that the promenade contains people, otherwise it is not attractive. By putting main attractions or nodes at the ends of a promenade they can act as connections while at the same time benefiting from people moving between them (Alexander et. al., 1977).

When it comes to virtual landscapes, Fiel and Scattergood (2005) reinforce the importance of nodes, especially the entrance to a site. It sets the tone for the whole space the player is about to visit and should display major landmarks and if possible, give the player a sense of the structure of the space. The entrance should also indicate the next step in regard to navigation. (Fiel & Scattergood, 2005). The architectural quality in a node may hence indicate what to expect from the architectural elements surrounding it.

Image 9: The port-city Boralus in World of Warcraft. Notice the contrasting pieces of purple architecture. They do not look like they fit in with the rest of the architecture.

2.3 The Symbolism and Structuring of Architecture

Architecture in a virtual environment tells you where you are, what to expect from the environment and what is to be done there according to Ernest Adams (2005), author of the article *The Role of Architecture in Video Games*.

Reading Architecture

McGregor (2007) explains and discusses the similarities and differences between spatial use of virtual landscapes and physical landscapes. As one of the patterns of spatial use, McGregor (2007) describes nodal spaces as a way for people to structure and organize spatial use and activities. Nodal spaces are described as how humans spatially separate activities and expect architecture to house various activities depending on its look, style, size etc. Nodal spaces do not directly affect gameplay but instead creates boundaries of activities; making gameplay site specific. These spaces will therefore imitate the physical world since they are dependent on us recognizing the relationship between architecture and activity or spatial use. For example, an inn needs to be recognizable as an inn if we were to be asked to find one (McGregor, 2007).

McGregor (2007) describes architecture in this context to act as containers of activity. The architecture itself concentrates the activity and sets its boundaries. An example of this is how a bank in World of Warcraft is used as a bank and that specific activity is confined to a bank building. Action and use/gameplay are tied to a location (McGregor, 2007).

On a larger scale, this is similar to the way Carter (2007) described what he called the ecology of game design in his article *Living Worlds: The Ecology of Game Design*. The inhabitants of the virtual world (creatures, races etc.) are a part of their world hence, they shape it. He mentions environmental associations as a way for the design to tie an activity or a concentration of e.g. a creature to a specific site. When repeating the use of the same or similar environmental associations, the player may learn to associate architecture to a specific use/gameplay (Carter, 2007). World of Warcraft is highly esteemed for this.

It is important, as mentioned by Fiel and Scattergood (2005), the authors of *Beginning Game Level Design*, to be aware of people's preconceptions of the landscape. Relative to Carter's (2007) theory of environmental associations, they emphasize that architectural props and vegetation should be placed in a way so that it does not subverts people's popular conception of how architecture and landscapes look like. They use the example of how a palm tree should not be placed in a tundra (Fiel & Scattergood, 2005). This does not, however, needs to be definitive.

As some virtual worlds differ from our own, McGregor (2007) mentions that some games use nodal spaces to create a new database, a new set of preconceptions of architecture and space, within that specific game (McGregor, 2007). By repeating patterns of architecture and creating its own database of architectural types/

styles, a game may make it feel less unnatural for a palm tree to be placed in a tundra, the palm tree in this context may even act as an environmental association. An environmental association communicating what is to come or how surrounding architecture is to be read.

A game specific database is present in World of Warcraft. As the player advances in the game they can learn to identify and distinguish the various architectural styles of the races within World of Warcraft. By having architectural styles that vary between the races of the two opposing factions, players can quickly identify a city as friendly or hostile to them, hence affecting the spatial use of that place for the player (McGregor, 2006). The architecture is, through its appearance, communicating how to perceive the space.

Harland (2015) discusses the importance of graphic objects as elements in urban design in his article *Graphic Objects and their Contribution to the Image of the City*. Graphic objects play a big part in a city's success and a lot of thought should be put into these when designing urban spaces. Graphic objects share similarities with the previously mentioned environmental associations. Examples of graphic objects include street signs, billboards, timetables etc., all derived from graphic design. These objects will enable graphic communication within urban spaces, which generates a considerably more legible city. Depending on what message the designer wants to convey, graphic objects may either be defined to

Image 9 and 10: The architecture in the screenshot on the previous spread is actually an environmental association. These are in fact pieces of architecture from the Ethereals, an alien species presented in an earlier expansion. By putting these pieces outside the shop, the player, if familiar with the ethereals, knows what to expect from that shop. The second screenshot shows an encampment of the Etherals.

fit or misfit the situation. An example of this is how e.g. warning signs misfits a situation by having strong radiant colors to attract attention and alert the observer (Harland, 2015).

Graphic design may in fact play a big part in aiding people in the creation of a city image. Alexander et. al. (1977) discusses the importance of ornaments and decoration. They claim that the function of decorations and ornaments is equally as clear and definite as other functions of the same building. Decorations and ornaments as graphic objects (Harland, 2015) can be used to unify two separated, individually working objects, creating a coherence between the two without affecting their individual strength (Alexander et. al., 1977). Unlike physical landscapes, virtual landscapes are rarely as chaotic when it comes to the number of components that complete the landscape. Creating a virtual landscape is a balancing act of chaos and structure. It is important to keep in mind not to overwhelm the terrain with colors and patterns in details and textures. On the other hand, since objects placed in a virtual environment are completely designed by the designer, it is important to think about repetition of objects. In nature, two trees would never look the same. With that said, due to time constraints it is nigh impossible to create multiple unique looking trees (and other organic objects such as rocks) (Fiel & Scattergood, 2005).

Figure 4: Two separates that through their relationship may be interpreted into something else.

Alexander et. al. (1977) argues that the power in graphic objects are not confined to such small scale as the pattern in the image to the left. In fact, bigger architectural structures could be considered a part of the graphic communication. The important factor here is not scale but rather the communication (Alexander et. al., 1977). In the physical world, the following example can be used to explain this: One white rectangle placed perpendicular on a street does not communicate much, however, when repeated, in a particular shape, they may form the recognizable zebra lines indicating a pedestrian right-of-way crossing. The repetition in this case unifies the individual objects and conveys the message. On a larger scale this is similar to how nodal spaces are explained by McGregor (2007). Large graphic objects, when in a particular relationship to each other, may convey various messages from the designer regarding things such as spatial use.

The communication of architecture may consequently

enable the observer to get a sense of in what part of the city they are positioned as different districts represent different graphic objects or environmental associations. A connection between nodal spaces and Lynch's (1960) theories regarding districts can therefore be made. Districts are described as a way for people to divide the city (Lynch, 1960) similar to how nodal spaces are described as a way for people to organize and structure spatial use (McGregor, 2007).

Districts and Edges

Districts are two-dimensional segments of a city. They are easily recognizable from the inside with common, coherent features. These districts can be compared to what Cullen (1961) defines as enclosures, which can be considered similar to districts but on a smaller scale. They also offer a distinct feeling of being either inside of or outside of, or hereness and thereness as Cullen describes it. Cullen (1961) describes the boundaries, or edges, of enclosures to being able to possess different qualities; either abrupt, preserving the enclosure and confining its qualities or letting the sense of hereness leak out into the enclosure's surroundings.

This is comparable to the way that Lynch (1960) describes edges, how they can be either well-defined or less defined. Edges are described as linear boundaries that can be used to organize features within the landscape. Naturally, they mark the boundary between two phases, disrupting a cohesion. Edges possess a disruptive power. They can act as both impenetrable barriers, confining a space or more like seams that demonstrates the transitioning or joining of two regions.

A well-defined edge is both visually standing out, semi or fully impenetrable and has a form that is continuous. Rivers, water edges and steep topography are great examples of well-defined edges. In certain cases, these are the first defining forms that a person uses as they draw a map of their city. A railroad, although not a completely impenetrable barrier, can also be considered a well-defined edge in the right context.

Seams are, as mentioned earlier, of a more uniting nature. These connect instead of isolate. An example of this would be a street between two contrasting neighborhoods. The street in this case may act as both a path and an edge. Just like paths, edges may possess directional qualities by having two very distinct sides. This gives the observer the feeling of being on one side or another which may aid in navigating (Lynch, 1960).

Alexander et. al. (1977) explains that in order to preserve the identity of a district, clear boundaries are needed. Lynch (1960) on the other hand claims that the boundaries of districts do not necessarily have to be hard or definite, they may also be softer and uncertain (Lynch, 1960), similar to how Cullen (1961) described a hereness to leak out. Alexander et. al. (1977) argues that the zone next to the boundary should be designed in a way so

that it encompasses activity and connectivity to adjacent neighborhoods (Alexander et. al., 1977), which could be considered a way to soften the edge to a district.

It is really the continuous theme of physical characteristics that gives a district its identity. These physical characteristics include everything from textures and details on buildings to topography and spaces of the architecture. The theme needs to be in contrast to other districts/spaces in order for it to easily be distinguishable (Lynch, 1960). One way to design distinguishable districts may be to include different environmental associations depending on district, hence creating an identity for a district partly based on these. Once these factors have been established in a district, the homogeneity within the district is of less importance, especially if there are predictable recurring patterns of other elements (Lynch, 1960).

Cullen (1961) wants to stress however, that without a thereness, the feeling of hereness is greatly diminished. Being inside an enclosure, or a district, with a clear hereness, the possibility to observe an adjacent space with a thereness should be present. Thereness can be described in different ways. It can be a space that feels out of reach or a great emptiness. Cullen (1961) uses the example of an apparent countryside next to a countryside road. In that case, the countryside is vast and gives a sense of there while the road offers a sense of here, with its clear boundaries. It can also be a large gateway that gives a distinct feeling of being inside or outside of it (Cullen, 1961). In relation to this and Lynch's (1960) theories regarding distinguishable districts, Nerurkar (2009) argues that dividing a site into different segments, easily distinguished from each other, enables a player to easier create an overall idea of their position within a virtual landscape (Nerurkar, 2009).

One way to enhance a district's boundaries is to restrict the access to it, designing only a few major entrances (Alexander et. al., 1977). This will also funnel the circulation through smaller bottlenecks, perhaps enabling spontaneous meetings between people. Another way to create boundaries to districts is to turn building faces inward (Alexander et. al., 1977).

The entrance to a neighborhood, precinct or district should be reinforced by a gateway of some kind according to Alexander et. al. (1977). As mentioned by Cullen (1961) earlier, a gateway emphasizes boundaries (Cullen, 1961). Gateways may take shape in multiple ways but they all have similar functions, indicating where a path crosses a boundary and as starting points for circulation. They should incite the feeling of a transition. Their shape should be visible and act as distinct elements in the urban fabric (Alexander et. al., 1977). Furthermore, district names are also a good way to sustain or emphasize the identity of the district (Lynch, 1960).

Image 11: View of an energy farm from the game Destiny 2.

2.4 The Perception and Spatiality of Architecture

Loidl and Bernard (2003) point out that perceiving spatiality and creating images of spaces in our head lies in our human propensity.

The statement above by Loidl and Bernard (2003) is perhaps why Cullen's (1961) definition of a city as being made up by a sequence of rooms and spaces, should not be discarded. The sense of place, of feeling either inside or outside of something, is an important part of experiencing a city. These feelings change a lot depending on context. As an example, a person will perceive its surrounding different depending on whether they are located within a deep cave or on top of a mountain. It is a human instinct to relate its body to its surroundings, its place. This should be considered when designing a landscape (Cullen, 1961).

In line with Cullen (1961), Loidl and Bernard (2003) argue that the creation of perceived spatiality and the boundaries of these spaces, is what give a sense of being inside or outside; it is what separates "us" from "them". Spatiality may be created through different means. Furthermore, height differences of the ground and surrounding elements have particularly huge potential in this context. The perceived spatiality is greatly affected by the observer's position in relation to the space (Loidl & Bernard, 2003).

Topography is a great way to induce such feelings regarding spatiality. Cullen (1961) uses the example of a building being placed on higher ground. From the lower ground, only the top of the building is visible however as the observer climbs the hill, the whole building is revealed. Booth (1983) also emphasizes how topography may generate sequences of hidden and revealed focal points (Booth, 1983). A sense of fulfillment fills the observer as it reaches the same plane as the building. Being above ground gives a feeling of exhilaration and command while ascending to the higher ground gives a sense of moving towards the unknown. Being below ground on the other hand gives a feeling of intimacy and even claustrophobia. In opposite to ascending uphill, descending gives a sense of moving towards the known (Cullen, 1961). Topography is also mentioned by Lynch (1960) as a factor influencing people's image of a city.

It is not only the topography that affects the perceived spatiality. Alexander et. al. (1977) mentions that the height of surrounding buildings should preferably exceed the width of a pedestrian street to achieve a comfortable scale. Buildings along the streets should offer many entrances to encourage a living street (Alexander et. al., 1977). As mentioned before regarding paths, the movement within video games is often faster, which also affects the way architecture is perceived. Adams (2005) therefore argues that the scale of architecture should be slightly exaggerated to compensate for this (Adams, 2005) which might come in conflict with the suggestion of Alexander

et. al. (1977) regarding the scale of a street.

Alexander et. al. (1977) argues that it is preferable with a four-story scale throughout a town but emphasizes that occasional higher buildings are important for orientation and navigation. One of our fundamental human instincts is to climb high places to be able to look down and survey our surroundings (Alexander et. al., 1977). These high places need to be somewhat frequent in order for them to fully function as landmarks (Juliani et. al., 2016). They should preferably be able to be climbed and therefore offer a bird's-eye perspective of the surrounding (Alexander et. al., 1977). This bird-eye perspective could be crucial in a city that is hard to perceive and understand from a ground perspective.

Fiel and Scattergood (2005) argue that topography in games are of big importance, especially since people are accustomed to terrain in physical landscapes. Once again, they emphasize that our preconceptions of physical landscapes are important to keep in mind when designing virtual landscapes. Humans know how topography is supposed to look like and what feeling it induces.

Topography in virtual landscapes can preferably be used to create edges to a space and keep players from either leaving or entering a specific place. However, caution should be taken with placing something behind an impassible edge, as it will only frustrate the player. Hills are a part of terrain structuring that gives an organic feel to an environment. It is however important to not obscure potential landmarks with the topography of a hill. A designer should be careful with using topography that obstruct movement where there should be movement, such as a steep bank to a river. They also mention how topography can be used to direct movement, like how ravines and canyons can funnel players to a specific place (Fiel & Scattergood, 2005).

Another important part of the perception of spaces and surroundings includes the views and visual comprehension of architecture. The sense of sight is the most prominent form of sense (Milam et. al., 2011) and the visual comprehension of the landscape/city could be considered the predominant one. Lynch (1960) agrees that the visual scope of sites is of great importance. It can explain the direction of paths and movement, the position and distance to landmarks, nodes and edges etc. An important edge connected both visually and by circulation to the rest of the city, enables it to be used as an aligning feature, similar to a landmark (Lynch, 1960).

An example of visual comprehension of architecture is how an isolated building does not invoke the same emotions as when it is placed together with other buildings. Cullen (1961) describes how people might experience the scale of e.g. a temple as grander when it is placed beside smaller houses compared to if it were to stand alone. The temple towers compared to the other buildings. It is the relationship between buildings that

enables towering instead of simple bigness.

Cullen (1961) also describes multiple ways of using sightlines, or vistas, in order to create an interesting and memorable city. A long vista can increase the feeling of omnipresence and the separation between here and there (Cullen, 1961), which should consequently also aid the observer with creating their image of the city. Furthermore, screened vistas are a way of using the serial vision to create curiosity. The background element is not entirely visible as objects in the foreground block part of the view. When the observer reaches past the said block, they may experience the background element in its full glory (Cullen, 1961).

Vistas are mentioned in the book *In-Game* by Gordon Calleja (2011) as a way to use architecture and spatiality to induce emotions, referring to interviews from players experiencing World of Warcraft.

Deflection is a way to capitalize on the angle of the vista. By having an angled building at the end of a street, it gives a sense of anticipation, that there is something else facing the building at the end of the street; a yet to be discovered space in front of the building (Cullen, 1961). This claim partly collides with the distortions such as rectilinear normalization as explained by Vinson (1999). It should be made very obvious that the angled building breaks the pattern (the normalized angle) in order to avoid this.

Regarding how architectural shapes are arranged, Cullen (1961) argues that even minor setbacks of buildings in plan or small deviations of a set grid have powerful effects in the three-dimensional plane. Once again, it could be considered a balancing act to include both Vinson's (1999) theories regarding the importance of a clear and easy grid and the way that Cullen (1961) favors spatiality and deviations from the grid.

Image 12: The port-city Boralus with its distinct architectural style.

2.5 Theoretical Framework - Reflection

This section is a reflection of the theoretical framework in relation to the questions in *1.2 Purpose and Aim.*

- *What are some of the ways in which physical and virtual landscapes relate to each other?*

- *How and to what extent can spatial theories, in particular those concerning navigation and orientation, be applied when designing virtual landscapes?*

- *What are some of the differences between physical and virtual landscapes to acknowledge when designing a 3D game landscape?*

- *How do humans navigate in a physical landscape/virtual landscape and what can be done, design-wise, to support navigation?*

The Virtual Landscape

Virtual landscapes can be considered architectural as it is a simulation of a physical space in a virtual realm. McGregor (2007) connects the two by underscoring how both architecture and virtual landscapes are human constructs. Furthermore Parush and Berman (2004) asserts how navigational strategies regarding physical landscapes can be applied to virtual landscapes, further connecting the two.

The virtual landscape is disconnected yet linked to the physical realm, however, the tactile and proprioceptive responses humans experience in the physical landscape, are not present in the same way when navigating a virtual landscape. Navigation is hence much more dependent on visual communication rather than the response strategy mentioned to be more apparent when navigating physical landscapes according to Vinson (1999).

McGregor (2007) mentions that spatial use of physical landscapes can be translated to virtual landscapes when designing. It is still important to recognize the diversity in virtual landscapes and game genres resulting in spatial use that might not at all be present in physical landscapes, meaning that a new set of design patterns regarding the landscape architecture might need to be developed.

Despite the diversity in virtual landscapes, the theoretical framework affirms the importance of considering spatial theories when designing virtual landscapes. Without proper regards to these theories the player risk having navigational difficulties.

Recognizable architecture offers a sense of reality to the virtual landscape, making it easier to read. Human preconceptions and what humans are accustomed to are mentioned multiple times in the literature and seem to be

very important for how a virtual landscape is perceived, further emphasizing and reinforcing the connection between physical and virtual landscapes. This can also be seen as another argument for applying spatial theories regarding physical landscapes to the design of virtual landscapes.

Navigation

Navigation is carried out through an extraction of elements in a navigator's surrounding followed by an estimation and linking of said elements into a mental depiction of a space. More details are added as the space is further experienced.

Navigational support for virtual landscapes can be designed in two different ways, either through game design by embedding tools within the UI, so called discrete navigation tools, or through level design by designing the virtual landscapes in a way that supports navigation, which by some are called immersive navigation tools.

The description of immersive navigation tools and visual design of virtual landscapes are in some ways similar to how physical landscape design is approached when it comes to how the designer intend the space to communicate with its user.

The navigational behavior of navigators in virtual landscapes is affected by the structuring of architecture. The most important element regarding navigation in a virtual landscape seems to be the landmark as it, with its preferrably visual distinctiveness, is the initial element present in the mental creation of an image of a city. For a landmark to be successful it needs to be distinctly separated from its surrounding architecture. There are various methods to create this contrast between landmarks and its surrounding including color, shape and size. When knowledge of landmarks has been extracted from the landscape, the navigator uses these as a reference point and paths as elements to link landmarks to each other.

Cullen (1961) describes the city as being a series of scenes rather than consisting of different elements like Lynch (1960) describes it. Viewing the city as a series of scenes puts a higher emphasize on the sense of sight, meaning that visual communication becomes more important. Describing a city with scenes might lead to a loss of understanding of the relationship between the city's elements. On the other hand, however, the high emphasis on visual communication is interesting in the context of virtual landscapes, as the visual communication is the main link between the player and the landscape.

The dependency on visual communication is a reason mentioned for the differences in navigational success between virtual landscapes and physical landscapes. Though, virtual landscapes can use discrete navigation tools to facilitate the visual communication in a way that is not possible in the same way in a physical landscape.

An easy and quick access to a map through the UI is an example of how discrete navigational tools can be used to support navigation in a virtual landscape.

Visual communication through environmental associations and graphic objects are ways to communicate architecture in virtual landscapes without the use of discrete navigation tools. Theories regarding these can be connected to Lynch's (1960) theories regarding how a city is perceived. By putting high emphasis on environmental associations and graphic objects when designing virtual landscapes, it could perhaps lead to another kind of city image where symbolism is prioritized. The use of environmental associations and graphic objects could potentially lead to the shaping of an image of a city where symbolism is put in the same hierarchical level as the elements mentioned by Lynch (1960).

On the other hand, looking at the series of sequences described by Cullen (1961), environmental associations and graphic objects could perhaps support further cohesion within the scenes, aiding the navigator in compiling scenes in orientational relation to each other.

3. Design Experiment

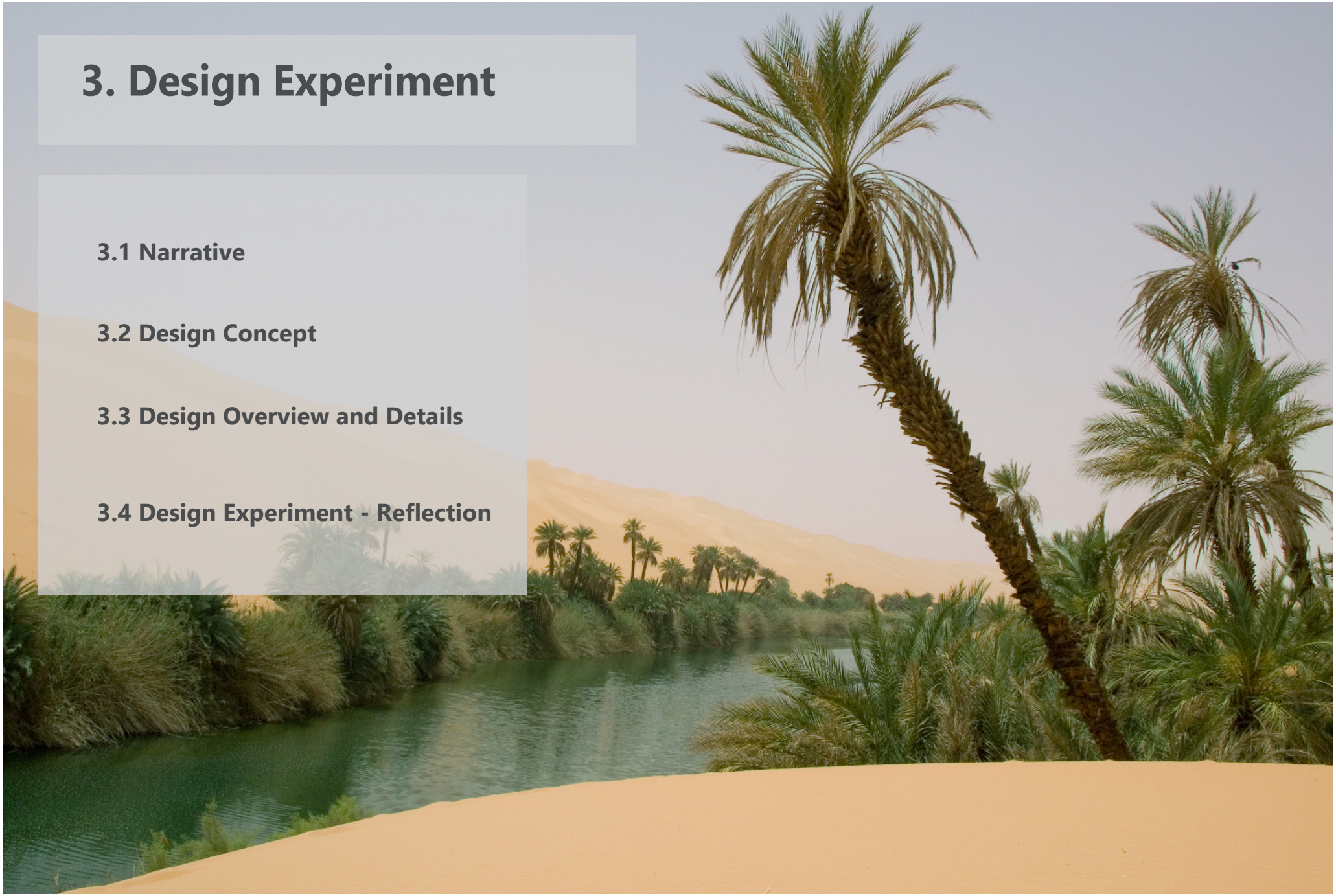


Image 13: Inspiration for the narrative.

3.1 Narrative

Awil'ma, the city of gold.

The inhabitants in this virtual, magical city is a group descendants of human settlers that built a city next to an oasis in a barren desert. The city consists of stone houses with small windows to protect against the scorching desert sun. Various fabrics are also used to create shady spaces throughout the city.

Due to its harsh location in a desert, the people of Awil'ma care for and train various animals to support the living there. Birds of prey have been companion pets for the people since generations. They are used for hunting as well as lookout, scouting out potential enemies approaching the city. The birds use the adjacent mountain as nesting ground. Camels and goats are kept in the city and share a special relationship to the people of Awil'ma as they provide both food, skin and textile (fibers from the fur) for the people.

The magicians of Awil'ma also learned how to tap into a mystical magic power, enabling a ritual where sand can be turned to gold. This gold has since been incorporated in their architecture as ornaments as well as trading goods for travelling merchants visiting the city.

The city is run by Queen Be'xi together with a company of six wise women and men. Be'xi and her court are located in the Towers of Seven.

Figure 5: Silhouette of a falconeer.

View 2: Towers of Awil'ma.

3.2 Design Concept

This design experiment attempts to apply theoretical framework to a virtual city, hence leaving the concept heavily emphasized on navigational support and the players' knowledge of their relative position

Path Network

The goal with the path network was to achieve an easy-to-learn network of paths. As suggested by the literature (Darken & Peterson, 2001), the path network was the first to be designed. The path network features a small orthogonal grid with an attempt to a path hierarchy among the paths. The resulting intersections between paths are then used as the main nodes within the design.

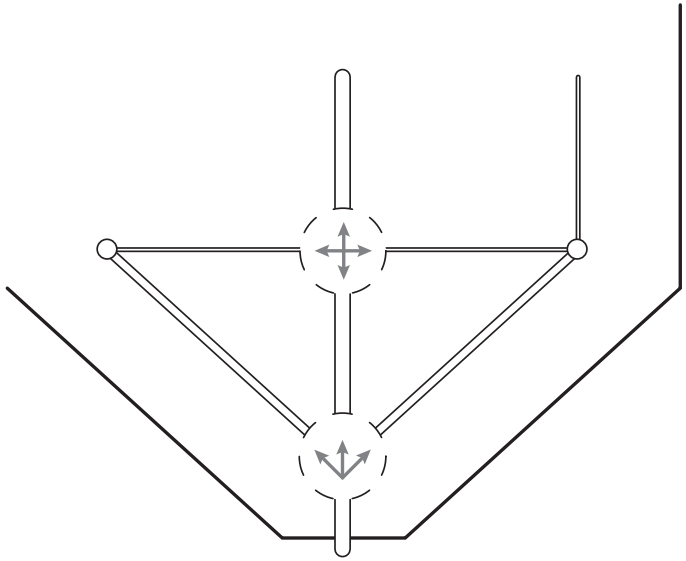


Figure 6: The path network with its two major junctions. Hierarchy is indicated in the graphic through thickness where a thick path means higher in the hierarchy.

The center axis in the path network is intended to be highest in the path hierarchy. It starts at the city's main entrance and ends at the other end of the city. It is supposed to clearly separate the city into a western and eastern part, making it an aligning feature when navigating.

Second in the path hierarchy is the two angled paths that have their starting point at the junction by the main entrance. Even though they break the orthogonal pattern they are parallel to the walls in hope of reducing rectilinear normalization. An attempt has also been made to make them very distinct in their character to contrast the center axis and each other.

The paths lowest in the path hierarchy are the paths perpendicular to the main axis. They are narrower and their main function is to strengthen the grid and act as edges to the districts surrounding them.

Landmarks and Nodes

Three important buildings are set out to be the main landmarks in the city. These buildings are strategically placed so that all of them are visible from two major nodes in hope that a navigator can use them for navigational purposes in addition to an eventual gameplay aspect. This is also an attempt to use Zacharias' (2006) conclusion that people move towards a central location of a space to get an overview, as the center node offers views of all three main landmarks. Another intention with the placement of

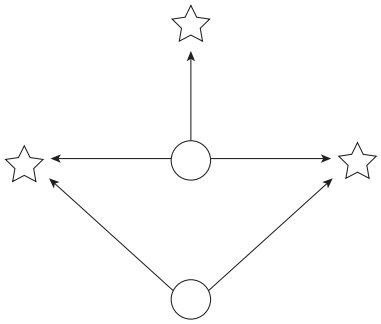


Figure 5: High emphasize on the visibility of the three main landmarks from nodes

the landmarks is to make them more memorable, as Vinson (1999) mentioned how placing landmarks along a path (or junctions) make them easier to remember.

The design concept also features the separation between important buildings/structures and other architecture within the city through contrasting shapes. The contrasting shape is an attempt to be in line with how Nerurkar (2009) points out how the shape of the objects is one way to attract a player's attention. This is experimented with by letting every "non-important" part of the city's architecture share the same shape and letting the important structures contrast this.

Figure 8: The contrast of shape within a homogenous pattern

Districts

The ambition regarding districts is for them to be an obvious part for the player's image of the city by separating their styles from each other. This is to be carried out similar to how important buildings are separated through a disruption in a cohesive pattern.

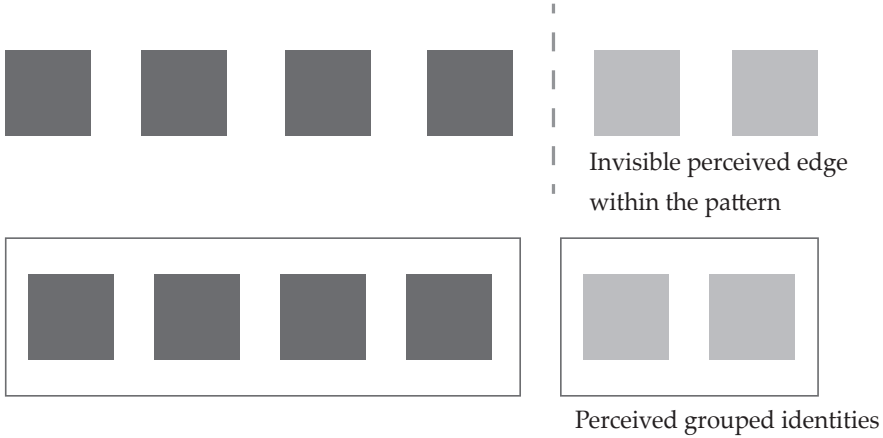


Figure 9: The contrast of color within a homogenous pattern

Instead of separating through shape, the districts are mainly separated through a change in a homogeneous color pattern. The path network is intended to act as an edge between the districts, completing the separation between the districts.

Figure 10:

To the left: The districts are separated mainly through a disruption in the color pattern.

To the right: Two perpendicular gradients are added in an attempt to make the four districts even more distinguished.

An attempt to further emphasize the location of the districts hence also the relative position of the player has been made by using two gradients perpendicular to each other. A sloping topography is the first gradient and the second is quantity of vegetation. By having the gradients perpendicular to each other, they can be read in correlation to the districts with the intention of further strengthening the identity of every individual district.

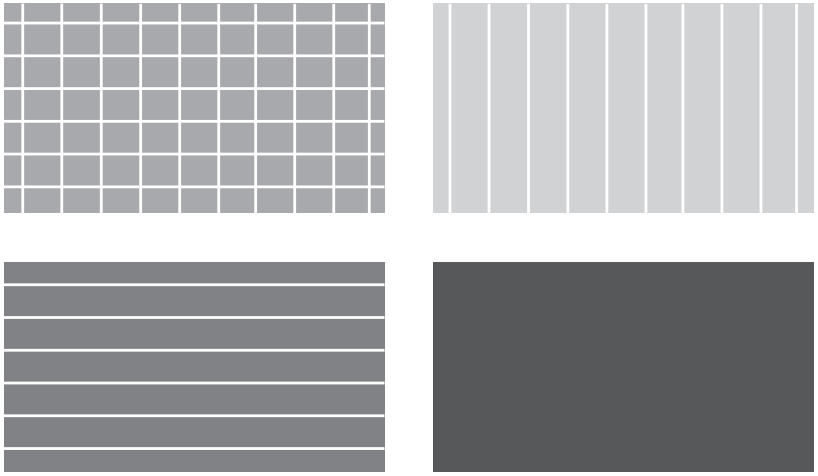


Figure 11: The gradients are intended to add another layer of identity and separation between the districts.

City Boundary

The city boundary consists of three different elements: the city wall, a mountain and a lake. All three disrupt the urbanity of the city which is their main role however, instead of having a city wall around the whole city, a mountain and a lake was chosen in an attempt to complete the two gradients mentioned in the last paragraph. The mountain symbolizes the pinnacle of the topography whereas the lake symbolizes the culmination of the oasis vegetation.

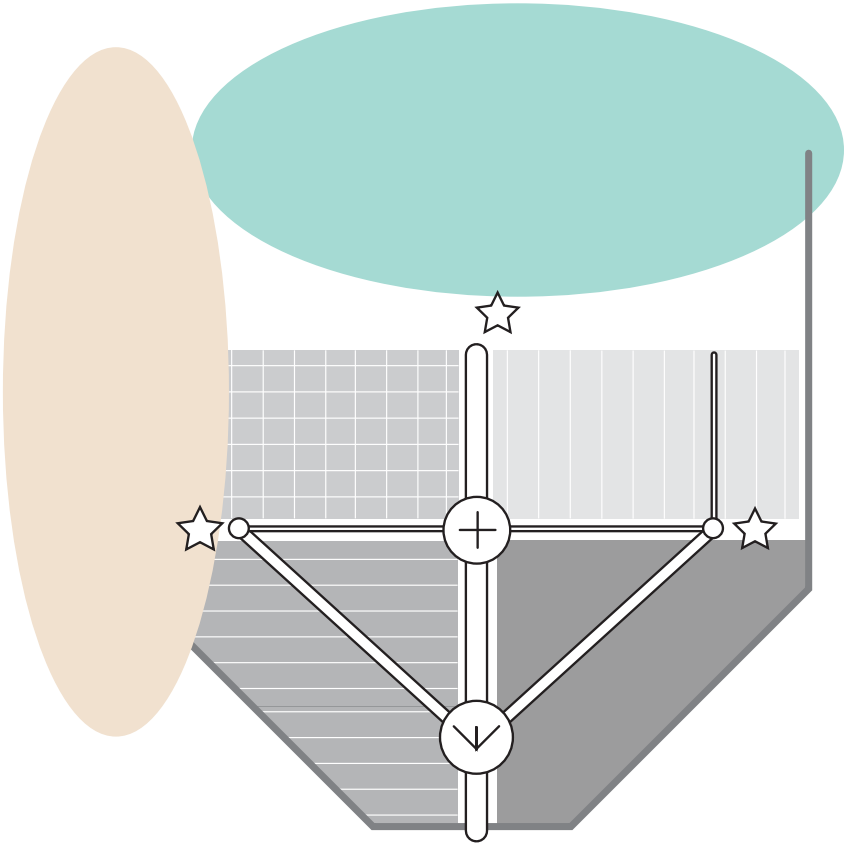
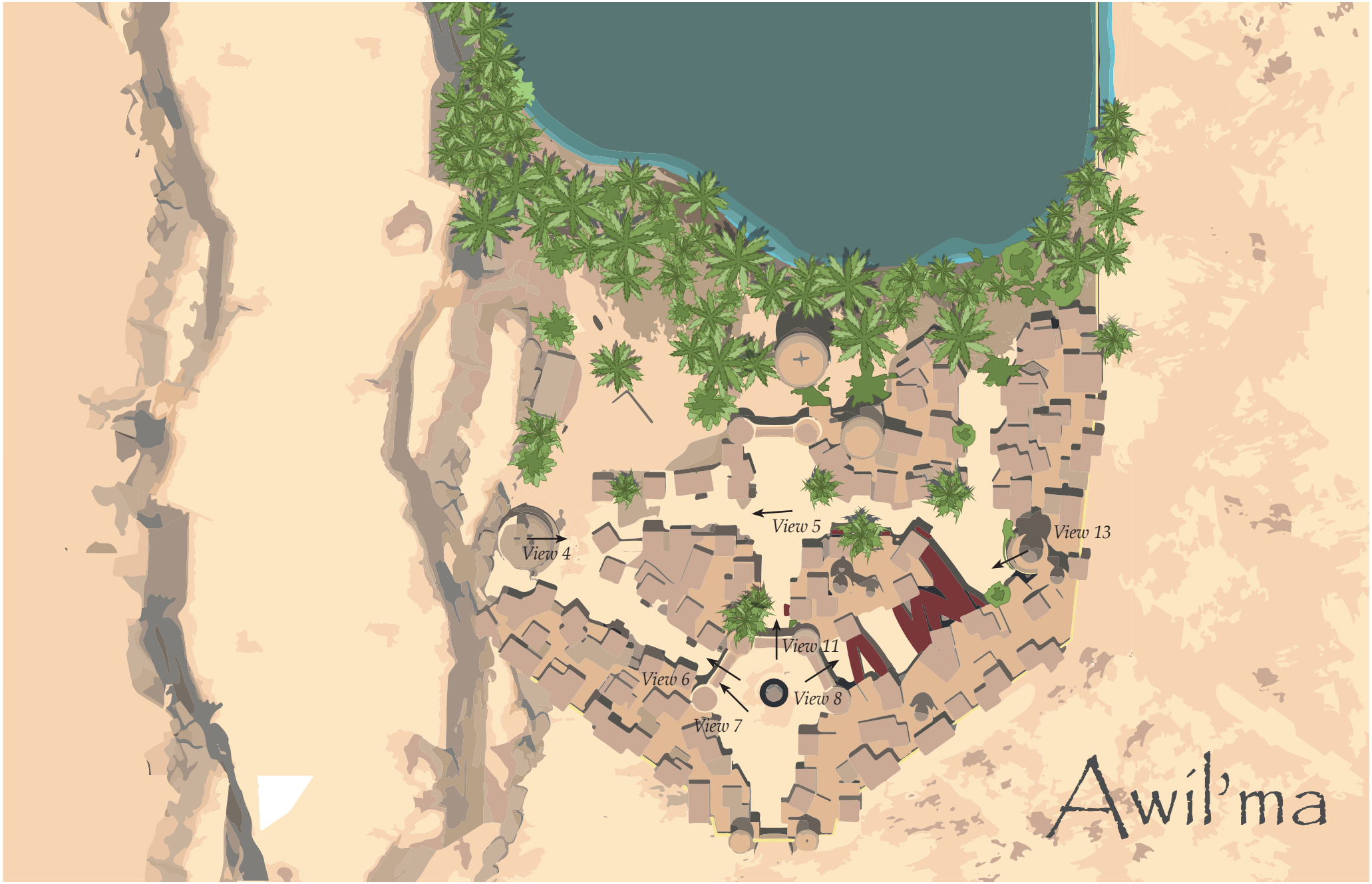


Figure 12: Complete graphic of the Design Concept



View 3: Map of Awil'ma.

3.3 Design Overview and Details

Combining the Narrative and the Design Concept

Overview

Awil'ma consists of four districts. 1) District of the Eagle 2) District of Magic 3) Court District 4) District of the Hoof.

District of the Eagle is located in the south-western part of the city. Here dwells the falconers, tending and training their companions. The mountain in the district provides nesting opportunities for the bird of prey. The main building in the district is The Eagle Shrine, a building with a huge eagle statue on the roof.

Opposite the District of the Eagle, in the south-east, lies the District of Magic, home and base for the city's magicians. They reside in the various spires located in the district. The main building in the district is The Red Spire.

North of the District of the Eagle lies the District of the Hoof which is filled with pastures and stables for the livestock. Here dwells the farmers of Awil'ma.

To the north-east lies the Court District. This is the home to Queen Be'xi and her court, as well as the base of operations of Awil'ma. The main building in the district is The Tower of Seven.

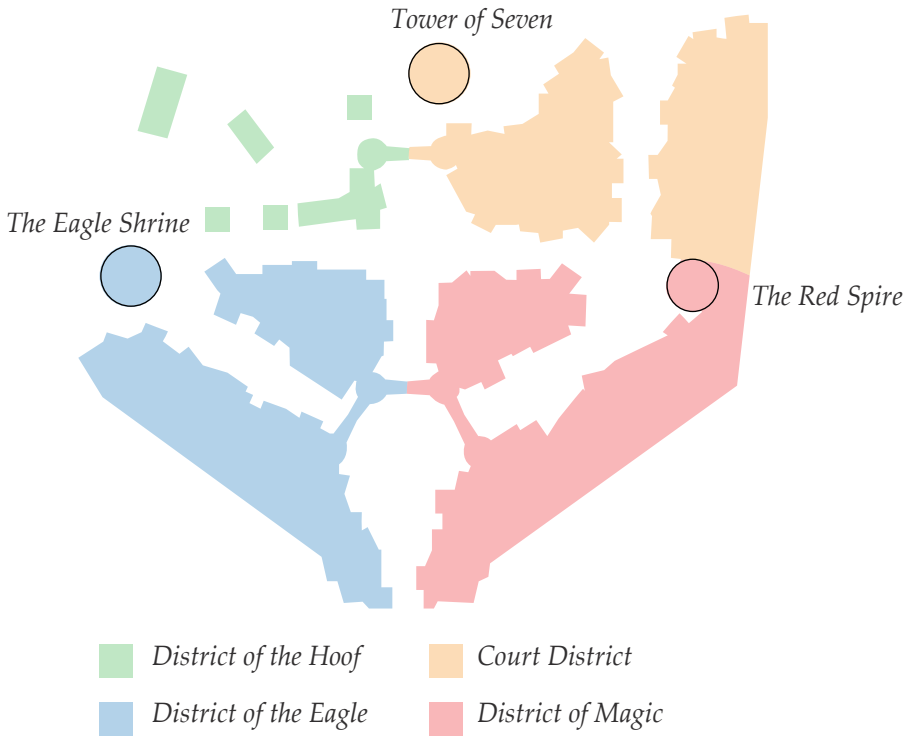


Figure 13: Graphic of the four districts and the three major landmarks of Awil'ma

View 4: The towering landmarks clearly separated from the rest of the buildings through their height.

Landmarks

As mentioned in the *Design Concept*, the shape of important structure within the city are separated through their shapes. Important buildings share a cylindrical shape with round features while the other architecture predominantly feature straight orthogonal lines.

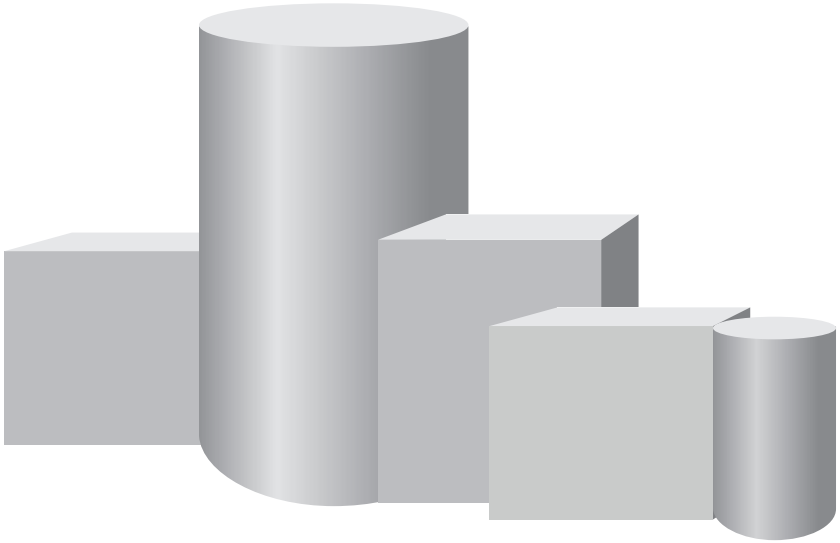


Figure 14: The round shapes of the important structures are suppose to contrast the rectangular buildings.

In addition to the shape patterns, some buildings with the intention to act as landmarks also contrast the rest of the city's architecture through their height, as can be seen in the image to the left (*View 4*).
The Eagle Shrine, The Red Spire and The Tower of Seven are the three main landmarks. In addition to these three, other elements may also act as landmarks, such as the red fabrics hanging from the rooftops in the District of Magic or the golden bird perches in the District of the Eagle. All of the three main landmarks are, in line with the concept, visible from the central node as well as the entrance node.

The two main landmarks in the District of the Eagle and the District of Magic are designed in a way so that they

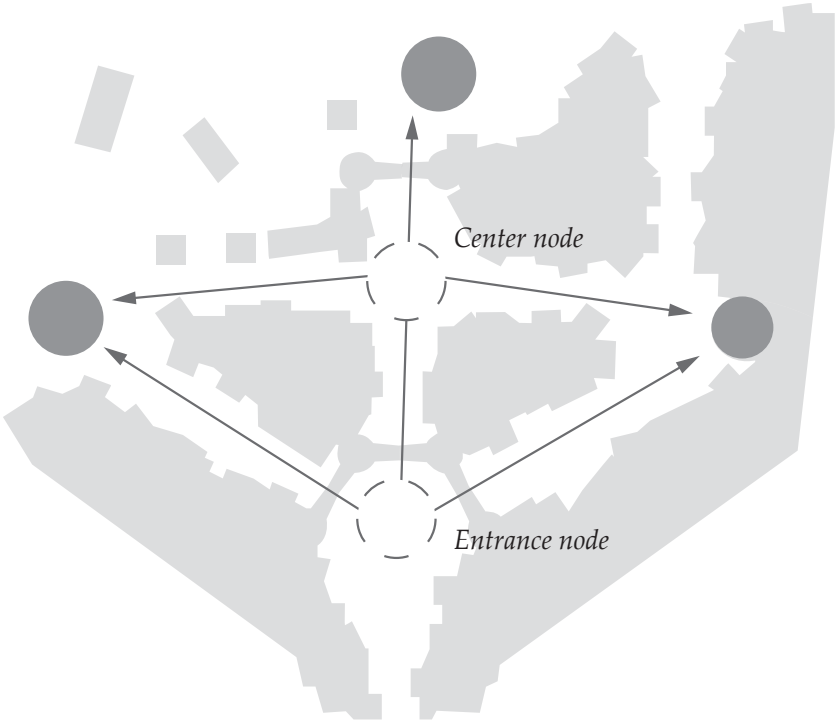


Figure 15: The landmarks are visible and accessible from both the major nodes.

View 5: View from the center node towards the District of the Eagle. Notice how the eagle statue faces the observer from this path.

appear different depending on the player's viewport. This is done in an attempt to increase the readability of the paths leading to the landmarks. The aim is that the player may compute the location of the path in relation to the landmark by perceiving the landmark's direction.

Furthermore, the direction of the Eagle Shrine is aimed away from the major path leading up to it, see below (*View 6*). It is designed this way to try to achieve what Cullen (1961) referred to as deflection, indicating the connection of the Eagle Shrine to the central perpendicular path.

View 6: View from the entrance node towards the Eagle Shrine. Notice how the eagle statue faces away from the observer.

Figure 16: Plan view of the facing of the eagle.

View 7: View from the entrance node towards the District of the Eagle. Notice how the eagle statue is not visible from this angle.

Topography

Other elements have been added to the design of the city that supports navigation and orientation. Topography is one of these elements. To simulate the organic nature, the city slopes downwards from the mountain and eastwards. As a part of the concept, the intention is that the player is able to use their surrounding spatiality in form of topography to deduce an approximation of their relative position within the city, hence offering orientational support for the player.

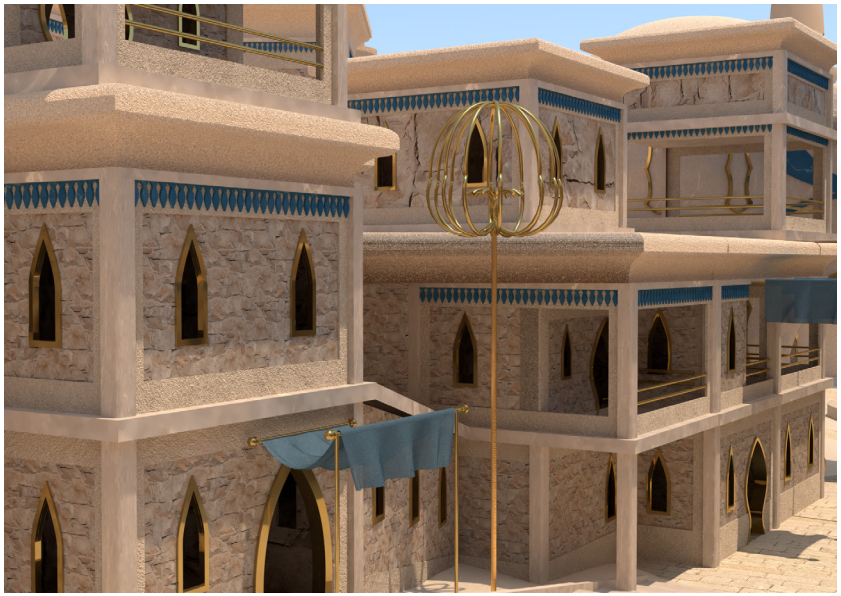
An attempt has been made to emphasize the effects of topography through various design decisions. The focus on the animal bond and domestication of animals within the District of the Eagle and the District of the Hoof, which are both situated on higher ground, are to emphasize the feeling of command that Cullen (1961) mentioned is induced when on a higher topography. Furthermore, Cullen (1961) mentioned exhilaration as another feeling generated from a higher topography. In both districts, this is pursued to be emphasized by having fewer floors on the buildings, leading to a lower architecture which increases the connection to the sky.

On the contrary, lower topography is described as sometimes causing feelings of intimacy and even claustrophobia by Cullen (1961). The District of Magic is given more shady spaces through the fabrics hanging from the rooftops to try to amplify the feelings mentioned. The intention is also that these hanging fabrics will make the district more memorable as well, through their distinct appearance. Both the District of Magic and the Court District consist of higher buildings than the western districts to increase the feeling of being small even further.

Topography is also used in hope of creating memorable views of different elements of the city. Cullen's (1961) example of a building being more and more visible as someone ascend a hill has been used for The Eagle Shrine. Furthermore, the huge eagle statue on the roof features the use of a screened vista as described by Cullen (1961). The eagle statue is not instantly visible due to it being covered by the gateway but is revealed as the player approaches the district.

Figure 17: The topography within Awil'ma. Stairs are outlined with white.

View 8: View from the entrance node towards the Red Spire. The red color of the district is emphasized with fabrics hanging from the roof tops.



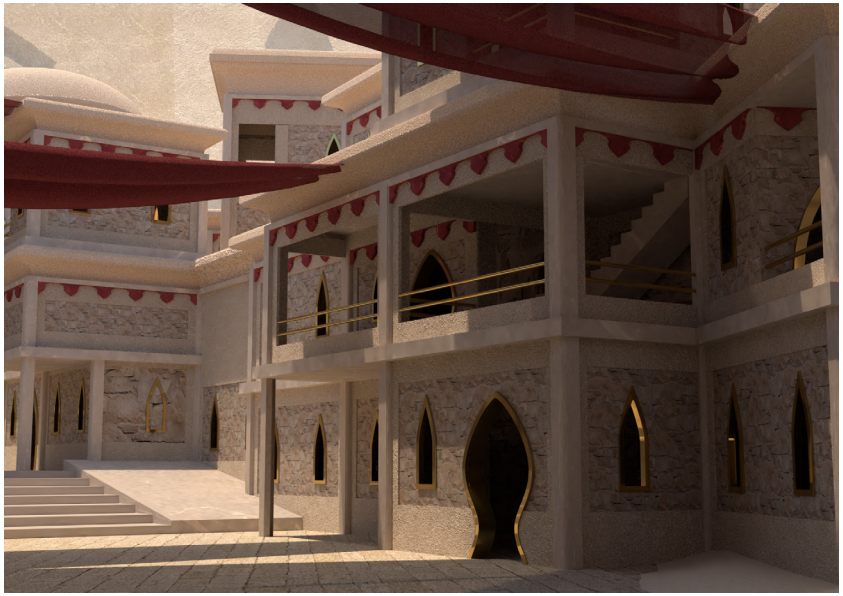
View 9: Blue details in the District of the Eagle.

Districts

As mentioned in the *Design Concept*, the districts are mainly separated through a disruption of a homogenous color pattern. This color pattern appears in ornaments on the 'non-important' buildings in the various districts as seen in *View 9* and *View 10* as well as the various fabrics within the districts. The color is also complemented by having the shape of the ornaments to differ depending on their respective districts. The intention is that the districts and their color supports orientation and the image of the city by giving the players an easy way to divide the city into colors and therefore giving them a quick way to orient themselves.

Another attempt to differentiate the districts is by adding objects (or props) in the District of the Eagle with the intention of them acting as environmental associations. The object in the case is golden bird cages that can be seen in *View 5*, *7*, *9*. By repeating their appearance throughout the district and also placing some right by the beginning of the district, the intention is that players will use these as a symbol for the district, in combination with the color, when creating their image of the city.

Figure 18: The ornaments of District of the Eagle (blue), Court District (orange) and District of Magic (red).



View 10: Red details in the District of Magic.

View 11: View of the Market Row. The end of the Market Row is emphasized by a gateway leading to the oasis lake.

Gateways

The gateways are a recurring theme throughout the city. The shape of their foundations are cylindrical, suggesting their importance. Their main function is to signal the origin or the end of important paths within the city. The intention is that, by having all the gateways looking almost exactly the same, players can quickly learn to understand and connect the appearance of the gateways in relation to their location, recognizing their function.

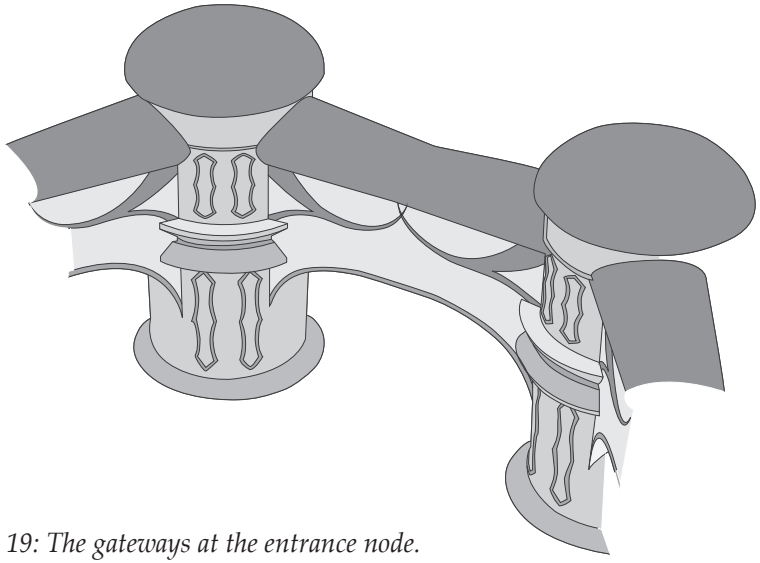


Figure 19: The gateways at the entrance node.

What separates the different gateways are the colored symbols on the vaults. These do not communicate anything in particular on their own. The goal is that when matched with the colors of the districts, they gain a communicative potential similar to those explained by Harland (2015) and Alexander et. al. (1977) concerning graphic objects. They are to communicate what districts are adjacent to the path connected to the gateway.

Gateways are also used to promote the change in spatiality that Cullen (1961) argued stimulates living streets and a dramatic appeal to the city. The width of the gateways are lesser than the the width of their respective connected path resulting in the gateways altering the perceived spatiality.

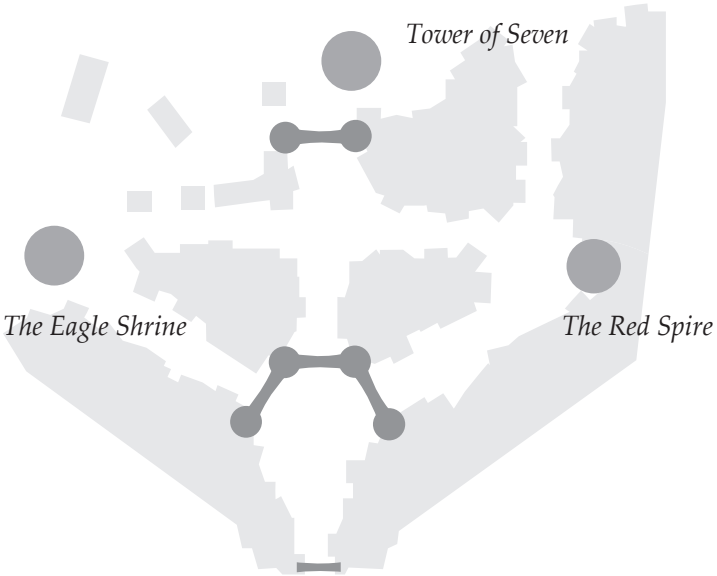


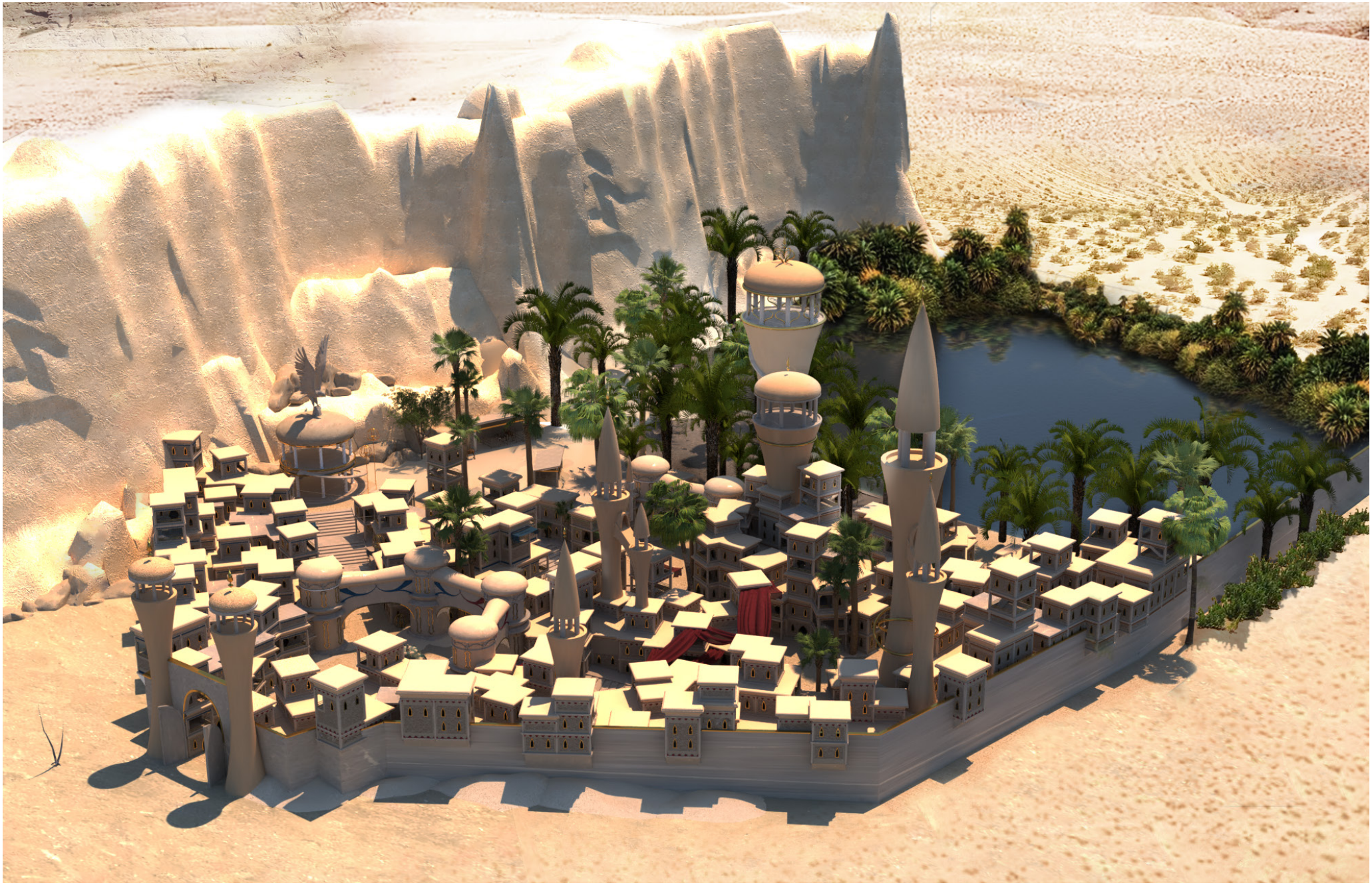
Figure 20: Graphic showing location of the gateways in relation to the three major landmarks.

View 12: Bird's-eye view of the narrow perpendicular path starting at the Red Spire and ending at the Eagle Shrine.

Paths

The intention of a perceived path hierarchy is approached in several ways. First of, the length of paths has been used to indicate their place in the hierarchy. The longer the path, the higher up in the hierarchy. Secondly, spatiality and in particular width of the paths has been used to illustrate importance in an attempt to be in line with how Lynch (1960) described how a path hierarchy are structured. The center axis is the widest and its perpendicular path is the most narrow.

To make the paths more readable in line with Lynch's (1960) theories, the paths have been designed in a way to include elements promoting directionality and/or scaling qualities. Stairs and intersections are some of the attempts at scaling elements along the paths. Directional qualities have been pursued through the previously mentioned gateways.



View 13: Bird's-eye view of Awil'ma

3.4 Design Experiment - Reflection

This section is a reflection of the design experiment in response to the theoretical framework.

It is hard to ratify or evaluate the design experiment in the context of navigation and orientation because of the format of the design. The presentation of the whole design experiment in itself is hard to do in a two-dimensional paper. By presenting maps and graphics of the design, the readers of this thesis get a kind of navigational support for the city, something that the player would not receive.

The conversion of the theoretical framework to design patterns can be considered naive as the city itself is rather small and fairly simple in its structure. Though, the design experiment is not intended to propose a complete design rather an example of how the theories can be interpreted and converted to design patterns.

The size of the city is perhaps something that may affect some of the theories. The importance of scaling qualities along the paths can be disputed as they are all relatively short meaning that they are transversed rather quickly.

Navigation itself should also be easier due to the small size of the city as there are relatively few paths, landmarks and districts to experience.

Another aspect that could be disputed is whether the districts are easily distinguishable from each other, especially for color blind people, as much of the identity relies on the color of the district. An attempt to reduce this potential problem is by having different shapes of the colored ornaments on the buildings.

Another consequence of the districts looking very similar except for the colors could be that the ”hereness” and ”thereness” described by Cullen (1961) is lost or greatly dimished. It may also affect the orientation of a player as there might not be enough round structures to use as references within the city.

It should be considered however that the architectural style created for this experiment is rather distinct meaning that it may now work as an environmental association by itself. If elements of the style were to be used again in another setting, the player can hopefully connect the elements to Awil’ma and therefore quickly know what to expect from e.g. round shapes or a certain color.

4. Final Reflections

View 14: View from inside the ground floor of the Red Spire.

4.1 Discussion

It was hard to find a good perspective on the relationship between virtual landscapes and physical landscapes for this thesis, however, I really felt that it is an important subject for the future of landscape architecture nevertheless. In hindsight, the chosen method with a design experiment based entirely on landscape architectural theories might not have been the most conclusive first step into the virtual realm as a landscape architect student. Instead, a method based upon deep analyses of existing virtual landscapes could perhaps be a good step before moving into designing a virtual landscape.

Analyzing existing virtual landscapes could perhaps make it easier to pinpoint with more precision where the need for application of spatial theories are the greatest. On the other hand, choosing to undertake a design experiment gave a lot of personal knowledge regarding the design of virtual landscapes such as the importance of a well developed narrative and the 3D modelling skills required to complete a design of a virtual landscape.

Looking at the design experiment created it can be considered to be very similar to a physical landscape and this might be a result of me being a landscape architect first and foremost. The choice to not look into gameplay as a factor when designing has probably affected the design in a negative way. Since the gameplay and narrative are of big importance when designing of virtual landscapes, these factors should perhaps have been included in the design experiment even though I have a lack of experience in game design. The design experiment features a city that can be easily navigated, however, without gameplay it is merely an empty husk, needing to be filled with a function.

I learned from the design experiment that it is rather hard to avoid a homogenous looking city in a virtual landscape due to the time consuming process of creating multiple unique architectural expressions. In my design I tried to turn this into an advantage by making the very important architecture be visually striking compared to the architecture of lesser importance.

The design created could easily be mistaken for a visual representation of an existing landscape. This is perhaps a consequence from the lack of a gameplay perspective in the design process. It is also the natural result of designing nodal spaces as the main focus for spatial use of the virtual landscape. A higher focus on e.g. challenge spaces would perhaps result in the design being perceived as more “game-like”.

Another reason for the design feeling very similar to a physical landscape is, of course, since the whole point of doing the design experiment was to apply theories regarding physical landscapes to the design of a virtual landscape. It is, however, a bit problematic that the design experiment in itself did not bring about a possibility for more conclusions. In its current state, it acts merely as an illustration of how theories can be applied to a virtual landscape.

So could the design be applied to a video game in its current state? The short answer is no. The design would need to go through several more iterations concerning game play aspects, narrative and further detailing.

Even though designing virtual landscapes means approaching landscape design in a new matter, where narrative plays a bigger role and where the initial phase of the design is a void instead of a site, it could in a greater context be considered a kind of landscape architecture. In fact, the design of virtual cities, such as the one in the design experiment, can be considered to in some degree fall under the definition of urban design, as the concern regarding appearance, function and arrangement of urban constellations.

Virtual landscapes should not be discarded by architects, landscape architects and urban planners. As stated in the introduction and the theoretical framework, architectural theories can be applied to virtual landscapes. Let us revisit World of Warcraft again. It is a video game played by millions of players meaning that some cities in World of Warcraft are visited by more 'people' than many cities in the physical world.

Another important question to ask regarding this thesis is: Why it is important to consider navigation and orientation when designing, both virtual and physical landscape? Virtual landscapes can be layered with discrete navigation tools indicating direction, relative position of both the player and other objects, enemy players and spaces within the virtual landscape. In the same sense, GPS techniques in the physical realm can be consider a kind of real-world discrete navigation tool, consequently being able to show the same information as those within the virtual landscape. Is the need for design decisions to support navigation necessary?

I would argue that it is necessary, that there is a risk that the scope of spontaneous exploration is diminished if navigation is dependent on a digital interface, either in a virtual or a physical setting, rather than navigation based on the perception of the landscape. Furthermore, navigation is, like other skills, something that can be practiced and developed, but if it would be dependent on a digital interface, how would that skill develop in the future?

As a direct opposition to Darken and Peterson's (2001) claim that successful navigation opens up for discovery and exploration, Calleja (2011) claims that the risk of

getting lost is essential to not risk a diminished scope for exploration. This could to some degree be legitimate since a landscape designed entirely with intent of easy navigation might end up stale due to straight lines and obvious symbols. However, as Darken and Peterson (2001) describe how navigation seldom, if ever, is the main task, it is perhaps the balance between allowing a player to get lost and then being able to navigate back into a known location, that is desirable when designing virtual landscapes.

On another note, recognizable architecture could perhaps be considered the force bridging the physical and the virtual world, inducing the perception of reality into the virtual realm. This however opens up a new problem: How about virtual landscape in an alien setting? The architecture in an alien setting should induce an alien feeling to be in line with the narrative however, the need for the architecture to have recognizable functions are probably necessary for the understanding of that particular landscape.

The landscape architects role in designing virtual landscapes is an interesting discussion. On one hand, the landscape architect brings important knowledge and experience of designing spaces and applying theories regarding the function and aspect of environmental elements. On the other hand, the design of virtual landscapes concern subjects that are unfamiliar to most landscape architects and may even challenge the way landscape design is approached.

The physical landscape is dependent on far more parameters e.g. infrastructure, ecology etc.than the virtual landscape. This could be interpreted as if virtual landscapes are easier to design due to the fewer amount of parameters. However, the aspect of gameplay is a contradictory aspect in this case as that alone creates a whole new set of design problems which might not at all be present in the design of physical landscapes.

This thesis has given so much inspiration on what future research can be done upon the relationship between virtual landscapes and landscape architects. One continuation of this subject is to look at how the structuring and design of the virtual landscape affects gameplay further and not only regarding navigation and hence how design decisions can improve user experience.

Another continuation would be to further compare how humans' experience and how they perceive the spatiality of physical landscapes and virtual landscapes in order to get a clearer picture of the differences between the two realms.

4.2 References

All "views" and "figures" in this paper are created by the author.

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