Sentimentality and the Digital Expanse

An Exploration of Virtual Environments and their Emotive Impact on Virtual Inhabitants

James De Bono

Victoria University of Wellington, New Zealand

debonjame@myvuw.ac.nz

Tane Moleta

Victoria Unitversity of Wellington, New Zealand

Tane.moleta@vuw.ac.nz

Abstract

This paper explores the use of atmosphere within a digital space to evoke complex emotional response from virtual inhabitants of the space. Within architectural representation a shift to architectural visualisations in digital mediums have lost the prominence of the sensual communication of atmosphere and emotion in the abstract component of space. Sentimentality and the Digital Expanse constructs a methodology to reintroduce this sensuality into digital space, that draws from knowledge of both the unfamiliar atmosphere and the technical *Presence* to allow an iterative articulation of objective atmospheric design within digital space.

Keywords: Complex emotional impact; Atmospheric design; Digital space; Architectural representation; Virtual presence

Introduction

As a discipline where one of the primary goals is to design spaces for the inhabitants, the intimate and dynamic details of interior space are lost during the process of design leading up to the presentation of the final product due to the limitations of representation. Virtual environments contain the possibility to enhance the representation of architectural space through a shift from two dimensional renderings of key spatial shots to the construction of space within a three dimensional virtual engine. This shift minimises the loss of valuable details that are intrinsic to a complete spatial experience therefore improving on the final outcome because a better understanding of the architectural space is acquired earlier in the design process. Virtual space is being used more as a representation tool as seen in the "Vineyard Challenge" that was held in 2015 by Ronen Bekerman: Architectural Visualization Blog (Bekerman, 2015). This challenge along with the architectural visualization (ArchViz) community have embraced this shift to and are pushing technology to their extents to better represent these literal architectural spaces. What this focus on literal representation of space misses out on are the complexities of atmosphere and emotion where other digital mediums have explored.

The focus of *Sentimentality and the Digital Expanse* is in exploring the ramifications of using virtual space as an unconventional method to trigger complex and intimate emotional responses in virtual inhabitants. One of the significant factors of persuasive virtual space is the implementation of atmosphere within it to induce a sense of sentiment in the inhabitant through an interactive environment. This is measured by the phenomenon of *Presence*, the relocation to a virtual environment where simultaneous experience of two existences, both physical and virtual, occurs (Birkenbusch & Christ, 2013). *Presence* is integral as a measure of success as ideally a higher degree of *Presence* implies a deeper understanding of space that is being conveyed to the inhabitant. The research is therefore able to be separated into three major components; defining what virtual space is and how it is experienced, defining common atmospheric qualities that can be successfully translated into virtual environments, and defining common emotional response that is independent of narrative to focus the application of research to a specific goal for design.

Aims/Objectives

Aims

Generating a knowledge base for use in understanding how atmosphere affects virtual space. This body of knowledge's purpose is to be built on iteratively so that over time the design of atmosphere within virtual space becomes more in depth and comprehensive with each iteration.

Create a set of guidelines to inform a base methodology that designers can follow, enabling easy construction of a targeted and complex atmosphere or emotional quality.

Objectives

The generation of virtual toolsets that enable swift adjustment of defined atmospheric qualities to improve the breadth of atmospheric design in virtual space.

Application of the toolsets in combination to construct an environment that contains a deep and intricate atmosphere to invite a targeted, complex emotional response.

The guidelines for a methodology will have its core components specified and detailed so that they can be easily reused, or adjusted for different mediums.

Theoretical Grounding

Atmosphere and emotion in contemporary theory

With the focus of this study on crafting a spatial experience that invites a complex emotional response, it is a natural assumption to make that atmosphere is intrinsically connected with the emotional quality of space that control of spatial atmosphere is key to this outcome. Since the goal of this study is to design space in an objective fashion it is essential to first define the relationship between the two intangible qualities. "Atmosphere seems to start precisely where the construction stops." is how Wigley describes the relationship between the physical form of architecture and gaseous space permeating throughout, or as further described as "some kind of sensuous emission of sound, light, heat, smell and moisture; a swirling climate of intangible effects generated by a stationary object." (1998, p.18). The idea that atmosphere permeates through the tangible environment but is still as much part of the environment as the tangible objects within gave rise to the conclusion of an undeniable connection between the two, that "Atmospheric effects cannot be avoided. They permeate architecture. Architecture is defined by atmosphere." (Wigley, 1998, p. 27) If it is accepted that atmosphere is pervasive then the tangible qualities are determined by the goal for an intangible effect. This is evident in sound, or specifically music, where it is an art form to craft sound into an impactful force on the recipient(s) and is proven by the real possibility that this impact could cause such emotive impact that they are brought to tears. (Pallasmaa, 2014) As a result of these conclusions a relationship between atmosphere and emotion can be seen on two separate levels; on the surface they both are abstract in their existence but atmosphere is the source of the affect and emotion is the end result. On a deeper level it is seen that tangible components of atmosphere that are used in specific ways have the ability to create that end result, being the emotive impact on the inhabitant. Given this relationship it can be stated that the tangible components of atmosphere can be designed in conjunction with one another to craft a space that generates a specific and complex emotional response from the inhabitant.

The definition formed outlines a specific area where the role of the designer becomes involved to influence the outcome of space, the area being the *tangible components* of atmosphere. This narrowed field allows a sensual discrepancy to further reduce the field as the medium of virtual space can at present only be experienced primarily through sight and sound, with touch featuring minimally and taste and smell aren't possible. If sight is selected as a primary sense, then the sense can be broken down into the smaller components of light, material and space. Applying these components to space to construct an atmospheric experience is often an area of specialty and found more commonly within artistic fields than architectural. Pallasmaa explains this as a result of the intent behind the medium, where fine arts/theatre/film aim to portray a specific mood or ambience that it can outweigh the setting (2014). In the field of architecture, the weighting

of atmosphere's importance varies with the focus residing in the form and geometry, therefore turning the resulting ambience into a
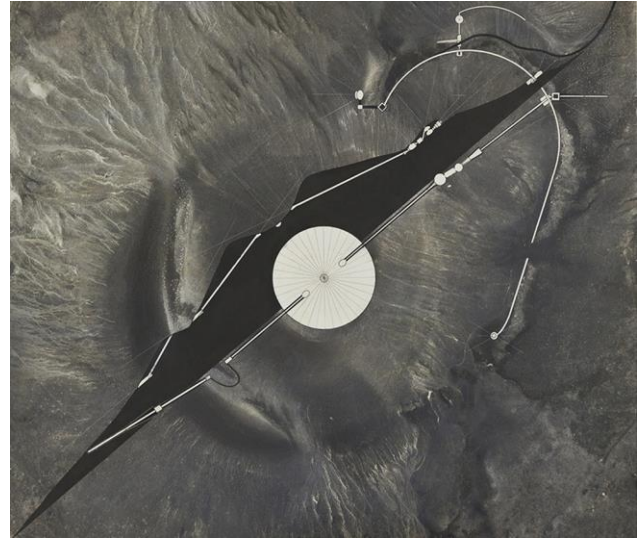

Figure 1: Plan view of the work done at Roden Crater, Arizona.

Figure 2: View from within the structure at Roden Crater, looking towards the sky.

consequence of their work. Due to the nature of the research, analysing the work of artists that specialise in a specific component of the visual sense will best provide insight on how to study and apply each objectively to an environment.

As each specified component is delved into, the nuances of each appear both in the work of the artist as well as the understanding of how each is built up. For example, light can be broken down into colour/hue, intensity, uniformity and contrast, where changing one of these details can influence the overall experience of light. Turrell states on a flight "you can see the light reflected in the moon change. The colour changes as the light glides by, you can know things without touching them, without handling them, without even being there, you can feel things with your eyes." as his way of describing the experience flight during dusk (de Wilde, 1985). Turrell dedicated a life of studying the power light has over the experiences we encounter and culminating in the ongoing work of Roden Crater (Figure 1). This work encapsulates Turrell's ideal that working with light "is to create an experience of wordless thought, to make the quality and sensation of light itself something really quite tactile" and that light "is itself the revelation" in the installations he produces (Brown, 1985). Roden Crater is an art installation that spans over and inside a volcano in Arizona, changing the landscape into an experience that is controlled by the artificial structure but embraces light from its source, the sun, moon and stars. The shifting of the sky creates the dynamic shifting within the installation that each space has been crafted to fully draw out the potential of light, such as the richness of colour in the sky that is attained by purposefully eliminating the white light of the horizon (Schielke, 2013; Figure 2). The colour of light is one of light's elements, as mentioned before, and in addition to this Turrell's work utilises the intensity, uniformity and contrast of light in his work to alter the perspective of inhabitants.

Like Turrell and his study of light, there have also been artists dedicating their work to the study of materiality and visual depth. In the case of materiality, Rachel Whiteread's sculptural work is iconic which uses casting to extract form from the voids in everyday objects (Figure 3). Whiteread uses her cast sculptures as a means to explore the idea that inhabitants take for granted the everyday objects/furniture and is therefore a need to "reclaim the familiarity" or reinvigorate the once ignored object (Hornstein, 2004). One of the ways in which it is described that she achieves this is in heightening the materiality of it, where a familiar topographical quality obtained from the physical object, yet the inversion of it as well as the shift in hue and material gives a familiar form the excitement of the unfamiliar (Lawson, 2004). The communication of this familiar yet new materiality leads to the dichotomy between absence and presence that is enhanced by the control of material; Whiteread is able to choose base materials that will give a specific level of detail of the original object while retaining the base material's texture. The underlying core to Whiteread's works simplifies to the choice of material and the method of casting the chosen material, as the choices inform the colour of the result, the base texture of

the material and the roughness/sharpness of the detail to the overall form.

Figure 3: Piece of Whiteread's work, Untitled (stairs), which displays the overall theme and art direction of her work.

Figure 4: Example of Sugimoto's work on emptiness through photograph, Notre Dame du Haut, Le Corbusier.

The last component to a visual and sensual experience functions through a combination of light and form to give deepness beyond physical reality, an implied characteristic which enhances the spatial experience through implying a hidden abstract quality to form that unshackles the imagination. Hiroshi Sugimoto captures this component via his photography and the "pictures of emptiness" that are the objective of his artwork (Schwabsky, 2000). The most surprising and effective method of capturing emptiness within a photo has been the style of photography shown in figure 4 that reimagines the context of modern and contemporary architecture. Sugimoto has constantly maintained that the "trace of time" will be the instrument through which the void will be revealed beneath appearances, which has evolved into an active controlled factor which he can vary through the exposure of his photography (Schwabsky, 2000). Time and, by correlation to the medium, exposure in turn influence the extremes of contrast that are displayed and allowing focus on the dynamic between light and shadow. To further unravel this dynamic all saturation of the image is removed and blurriness/focus removes the intrusion of form so that distraction from the relationship is removed.

From the analysis of Turrell, Whiteread and Sugimoto's philosophies and work, the elements of three separate components of the visual sense can be specified. Lighting conditions are formed from colour, intensity, uniformity and contrast; and material conditions are formed from colour, texture and roughness; depth conditions are formed from time, saturation, focus and contrast. An initial commonality across the analysis occurs in these elements, where the different conditions utilise the same element therefore placing that element at a higher priority to control. For example, colour is essential in light and material, and arguably depth as desaturation is the removal of colour, the difference only occurring in implementation. Where the colour of light is an external influence, the colour of the material is what the influence is interacting with. In addition to trends in the derived elements the goal of the artists' themselves contain a similarity. This is the idea that the designed atmospheric conditions can inspire an abstract physicality or space beyond what exists, the spark the evokes the imagination of the inhabitant to consider more than what lies before them. Overall this being the goal of crafting atmosphere, that you search or ask for more than what exists physically, it shows that while each artist may be searching via different methods but ultimately the search is the same.

Digital spaces and virtual presence

With the focus of Sentimentality and Digital Expanse on the goal of creating virtual spaces which virtual inhabitants respond with emotionally in a targeted manner, a primary concern for the design of a methodology which enables this is how traditional techniques can be successfully applied to the modern digital medium. Successful implementation of a digital medium requires creating a connection between the virtual inhabitant and the space, or requires invoking the phenomenon of *Presence*. This phenomenon is explained as the degree to which inhabitants are located in the physical environment but also, due to digital space, being placed in a virtual environment simultaneously (Witmer & Singer, 1988). More recently this theoretical construct has been connected with Csikszentmihalyi's *Flow*, along with *Immersion* and *Involvement*, where these three concepts are used as a way of defining the success of *Presence* within a virtual environment (1990; Birkenbusch & Christ, 2013). Therefore, *Presence* can be used as a measure of the overall outcome for the virtual inhabitant, and *Flow*, *Immersion* and *Involvement* are quantifiable areas which inform the total of *Presence*.

A line of research similar to Sentimentality and the Digital Expanse is the concept of embodied space, where the movements of the human body are used to spatially generate the architecture and manipulate the elemental parameters (Ferreira, de Mello & Duarte, 2012). The core ideas of this thinking rest on the theory that the movement of the human body reflects the emotions of the individual, and that if this movement is used to generate architecture then the resulting space will have an emotional effect on an inhabitant through an empathetic response. The same goal is desired, which is the generation of space which objectively has a specific emotional effect on inhabitants, simply sought through means of a generative design method. Also similarities are apparent in the "elemental parameters" specified by Ferreira, de Mello & Duarte where an overall sensory experience is desired which encompass what has been specified as essential in design of atmosphere (2012).

Kendra Smith suggests that the use of digital processes is limited in the extent the architect's imagination can be interpreted, where a less intimate connection is formed than when sketching with pencil and paper for example (Smith, 2005). However, Smith considers digital design only in terms of the form but through examination of video games such as Panoramical, which is a virtual environment that simulates different abstract qualities of space based on parametric functions, digital space and the tools to create them have evolved to grant the user control over more dynamic and atmospheric qualities of design and enable the development of a more intimate design (Finji, 2015; Figure 5). The interactive environment

Panoramical is based entirely around creating your own experience, enabled by the creation of a base environment or level and given nine separate parameters which can be adjusted to craft form, colour and light. The interesting feature that is relevant to Sentimentality and the Digital Expanse is the set of parameters where if the multiple essential qualities of space are quantified in a set of parameters then space can be experimented with in a constructive manner. This feature can be applied to research by a set of parameters that are established based on traditional theory, that can be adjusted to quickly generate iterations on the atmospheric design within an environment.
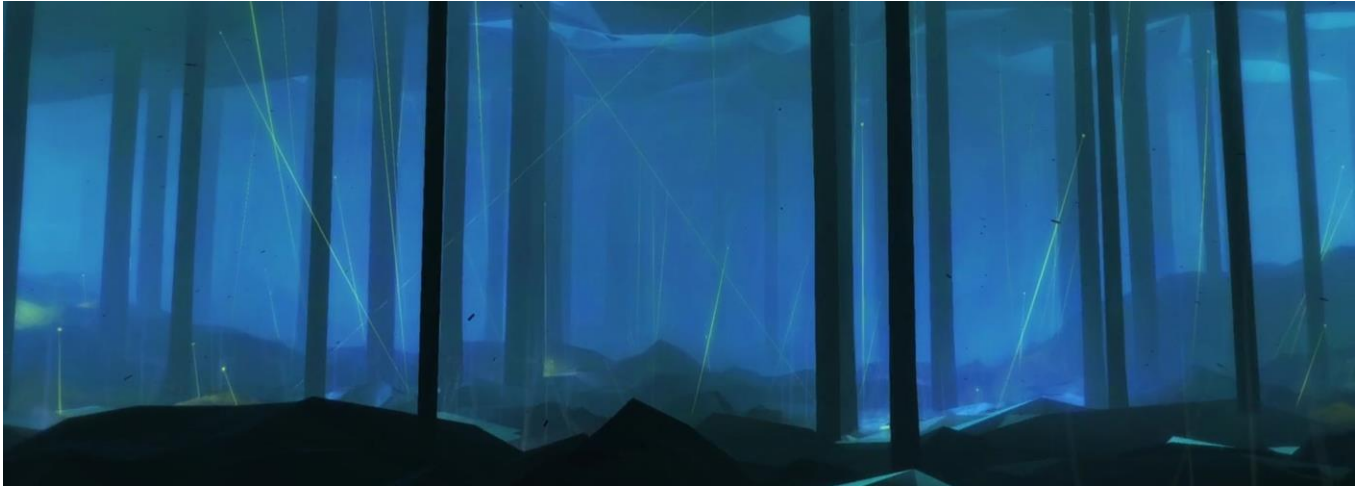

Figure 5: Interactive environment of changeable parameters in Panoramical (Finji, 2015).

Methodology

Proposition

One of the aims of Sentimentality and the Digital Expanse is to use the compiled theory to outline a methodology that can be reused and tailored to individual purpose, where desired emotion, setting, and digital medium may vary. Due to the individual's goals, these variables should be established initially so that the conglomerate of knowledge can be filtered for what is necessary. This is because setting and digital medium will determine factors such as the quality of light that is reasonable to use, what materials will be more or less effective and most importantly the perspective which the space will be experienced from. Perspective is integral as although normal circumstances would dictate a standard first person view is used to experience the space, all virtual environments are capable of perspective adjustment.

Once these individual variables are chosen, the elements of atmosphere can then be attributed to features of the setting and within the digital engine toolsets that can easily adjust these elements can be built. With a toolset for each component of atmosphere the adjustable qualities can then be applied to setting/environment specified inside of the digital space, allowing rapid iteration to occur. These iterations are being produced for the purpose of obtaining feedback from external sources of trusted groups of people via simple questioning about their spatial experiences

(Qualitative), as well as a broader range of less specifically chosen people (Quantitative). The feedback will then direct the process of iteration towards the final goal of a specific emotional response. In addition to directing the process the feedback is also intended to accumulate for a knowledge base that will build up across multiple designs and speed up the iteration to reach an objectively atmospheric stage.

The technical knowledge of *Presence* is used as qualitative evaluation in conjunction with external feedback to evaluate whether the digital space created is allowing the relocation of the inhabitant's self or hindering it, keeping the direction of the iteration along the correct path.

Iterative Experiment

In addition to establishing the proposed base methodology, the author is carrying out an individual version of the method where the author has established personally chosen variables to test the proposal above. The chosen emotion is melancholy which by definition is a pervasive sadness that lacks obvious reason, the cause of the choice being that the emotion should be purely generated from the spatial experience. Melancholy implies that the feeling should come from an indeterminate source which can be related to the sensuous qualities of atmosphere, therefore a choice that focuses the experiment to a goal that provides information relevant to the research.

The chosen digital medium is Unreal Engine 4 (UE4) the programme used in the "Vineyard Challenge", a medium which is designed for the creation of video games yet being used for ArchViz due to the accessibility of the programme and the ability to craft dynamic real time environments with minimal effort. This specific game engine is chosen over the two competitors of CryEngine and Unity as CryEngine lacks the community support of the other two, and in Unity it is more difficult to create a high fidelity aesthetic. As part of the choice in medium the author has decided to work in a two dimensional view within a three dimensional environment.

The final choice of setting is in theory an arbitrary decision in an experiment, the goal is to make choices which will

of how the results are achieved and therefore be able to knowledgeably draw conclusions. A basic method is outlined through stating what the variables are, as well as what variables are used for the phase, then how the outcome is tested.

Phase 1

Table 1: Variables of Phase 1 Method.

Variable	Choice
Digital Medium	Unreal Engine 4
Setting	Forest
Perspective of Inhabitant	2D Side Scrolling
Target Complex Emotion	Melancholy
Narrative Guide	Memory
Test	Qualitative
Toolset(s) Developed	Interactive Node

Results - Qualitative

There is a primary issue of focus, the environment feels aimless and comes down to the resolution of the various elements being to primitive. Due to this a limitation is imposed on future design to entirely leave out the aural sense and focus attention on the three visual elements.

In addition to the conglomerate of elements, narrative was investigated as to its necessity to design since the goal of the digital space is to convey a targeted complex emotion to the inhabitant and not to tell a story that will inform the emotion to the inhabitant, that without context the space could still convey the effect.

> *e.g. Melancholy is an ideal emotional quality to provoke as by definition it is the feeling of a sadness without any obvious cause and the narrative is attempting to create an obvious cause*

The introduction of mechanics does in theory increase the level of the involvement by offering a goal and end stage to the space, except flow and immersion are also essential to the overall quality of presence. This is an issue as the two both detriment the space heavily (lack of direction impeding progress and implementation of a character that attempts to emulate human form but due to limitations in animation fails to successfully immerse). Overall an issue similar to what is described earlier where certain tasks have been undertaken that can only have limited success

help provide relevant results on the validity of the methodology. So in contrast to the previous choices the setting of a forest gives a broad range of possibility in atmospheric intervention. The broader range is chosen with the thought in mind that the wider setting will allow more innovation in the application of atmosphere to it, while maintaining the focus of the atmosphere.

Results

Results are broken into different phases due to the nature of the iterative process, where each phase is representative of an iteration. For each phase the basic method used for design and measurement of results is explained for context

with current knowledge and in conjunction with other elements.

Figure 6: Screenshot of Phase 1 output.

Phase 2

Variable	Choice
Digital Medium	Unreal Engine 4
Setting	Forest
Perspective of Inhabitant	3D Side Scrolling
Target Complex Emotion	Melancholy
Test	Qualitative
Toolset(s) Developed	Procedural Lighting

Results - Qualitative

In relation to the aims/objectives, this phase encapsulates the idea of creating tool sets to easily change environments drastically. Focussing entirely on the use of light and colour within a scene these tools don't utilise all of the visual sense, but it steps in the right direction for further development.

With the targeted emotion of melancholy, the environment was dropped into the realm of Sugimoto's 'emptiness', but without the use of narrative to provoke the reaction.

In terms of presence the shift from a sprite based environment into polygonal meshes has served to increase the immersion factor and involvement also benefits from the interactivity of the dynamic adjustment tools. Flow however is lacking as this space is entirely without any form of progression or direction.

A comprehensive visual experience shouldn't be restricted to a singular colour scale without reason, the addition of multiple colours and the movement away from grayscale and blue could benefit iteration.

Figure 7: Screenshot of Phase 2 output.

Phase 3

Table 2: Variables of Phase 3 Method.

Variable	Choice
Digital Medium	Unreal Engine 4
Setting	Forest
Perspective of Inhabitant	3D 1st/3rd Person
Target Complex Emotion	Playful (Happiness/Joy)
Test	Qualitative and Quantitative
Toolset(s) Developed	Depth and Hue

Results - Qualitative

Progress from previous phases of study is evident, while the target 'Playful' is not necessarily achieved the digital environment is irrefutably implementing a higher level of visual quality than 'Memory' and 'Melancholy'.

The digital space 'Playful' still exhibits a generic quality to it in a lack of aim or focus, but as discussed from Phase 1 narrative was a detriment. A target emotion was defined by an adjective which helped to refine the emotion to a more succinct description, instead of the previous use of a complex emotion or narrative as guidance.

In relation to precedent, Phase 3 also attempts to emulate the cases of mentioned artists Turrell and Sugimoto, with a focus on the two defined elements early on. Successful in moments but not as an overall space.

Results – Quantitative

Q. 1: What is your emotional response to the environment on viewing it?

Q. 2: On a scale of 1 - 10, how much interest in the space was provoked?

Table 3: Feedback on Iteration 1.

Response	Interest (1-10)
It was pretty serene	-
Relaxed and curious	-
It was calming and relaxing	-
Seemed peaceful, blurred or foggy, well-toned	-
Curiosity	-
Peaceful but adventurous, reminiscent of going to the aquarium	-
Playful	-
Positively excited	9
Loneliness	9
Fantasy	8
Mysterious intent	8

Figure 8: Screenshot of Iteration 1 output.

Table 4: Feedback on Iteration 2.

Response	Interest (1-10)
Was spooky, am spooked	-
Dark, spooky, hiding place, well focused on places and unfocused in others	-
Apprehension/wonder	-
Curiosity, but mystical. It feels like there is a bit of myth to it	-
Sense of mystery	-
Negatively tense	5
Excitement/anxiety	8
Dreamy	7

Figure 9: Screenshot of Iteration 2 output.

Table 5: Feedback on Iteration 3.

Response	Interest (1-10)
At first I was spooked, by the end I was not so spooked	-
Deep meaningful, sad. Night-time	-
Apprehension/wonder	-
I feel more trepidation and hesitation; the lights feel more watching rather than illuminating	-
Brooding	-

Negatively tense	5
Fear in dark and relief in light	8
Eerie	5

Figure 10: Screenshots of shift in Iteration 3 output.

Conclusion/Reflection

In the progress from the formation of a base method in conjunction with the methodology to the post Phase 3 analysis, refinement has been occurring across the board in the method to fix what isn't working or to improve on what has been effective. The most important key learning points being the importance of applying narrative with care; designing spatial experience using techniques that a level of understanding has already been achieved; defining the target response clearly. That last learning point is the most important factor, where looking at each phase from the role of the designer I can definitively say that at the beginning of a phase I had a more precise view on what the goal of design was for that phase. To summarise, as the definition of the targeted emotion was explored and eventually specific adjectives chosen to further refine the emotion the process of designing spatially an experience would come closer to the ultimate goal. This leads to the overall importance key definitions have within the context of this research, *Atmosphere, Presence* and *Emotional Response. Atmosphere* and *Presence* were defined early in the theoretical analysis as a starting point for defining the scope of Sentimentality and the Digital Expanse. *Emotional Response* is the term to be defined that is equivalent to the impact on the inhabitant but cannot be equated with specific emotion due to the nature of people's description of experience. As can be seen in the responses to Phase 3, rarely can you see what one would consider precisely an emotion. When you look at these responses in relation to the trend of more description of the targeted complex emotion influences stronger design, the reason for this is that the target is being phrased in closer terms to how inhabitants tend to respond to spatial experience.

Across the formulation of a methodology and the process of carrying it out, the results are quite limited at this stage for the individual experiment. However, the methodology outlined is detailed enough to proceed with the initial stages and the construction of the discussed toolsets is reminiscent of parametric or generative design through programmes and plugins such as Grasshopper, but due to the visual quality of UE4 opposing the form focussed Rhino, the toolsets end up being closer to generative atmospheric tools. The main takeaway from this is that toolset is an apt word for what was constructed as without focus and a goal, like Grasshopper, the generated atmosphere lacks the detailed depth that comes with reason and objective behind decision.

The theoretical context of the methodology feels lacking considering the aims of this paper's research outlines a detailed summation of the traditional and digital knowledge and implies a depth and breadth beyond what is discussed in the paper. This isn't due to a lack of existing knowledge but more that the paper is an overview and a beginning, the methodology outlined allows for the individual who follows it to carry out additional research which ideally would happen each time and then over time the knowledge base will have grown to contain the depth and breadth that was implied. This pushes the idea that not only is the methodology pushing an iterative process, the guidelines themselves will iterate when necessary based on the updating knowledge. Adding to this idea of iteration is the issue of a sensual and spatial experience which only embraces the single sense. The reasoning behind this was simply focussing on a single sense will be more effective than splitting the focus across multiple, as well as the medium limits the amount of senses that can be affected. Sight was chosen over sound as a pragmatic choice based on field of expertise, but again as an iterative methodology there is nothing limiting exploration into the other senses in contribution to the discourse, or reintroducing other senses once a sufficient level of understanding of sight has been met.

Acknowledgments

References

Bekerman, R. (2015, June). *"The Vineyard" Challenge*. Retrieved from Ronenbekerman: http://www.ronenbekerman.com/challenges/the-vineyard-challenge/

Birkenbusch, J., & Christ, O. (2013). Concepts behind Serious Games and Computer-Based Trainings in Health Care: Immersion, Presence, Flow. In K. Bredl, & W. Bosche, *Serious Games and virtual Worlds in Education, Professional Development and Healthcare* (pp. 1-14). Hershey: Information Science Reference.

Brown, J. (1985). Interview with James Turrell. In J. Turrell, J. Brown, & C. E. Adcock, *Occulded Fronts* (pp. 13-48). Los Angeles: Fellows of Contemporary Art, The Lapis Press.

Csikszentmihalyi, M. (1990). *Flow: The Psychology of Optimal Experiences.* New York: Harper Perennial.

de Wilde, E. (1985). Light Spaces. In J. Turrell, & J. Brown, *Occulded Fronts* (pp. 53-60). Los Angeles: Fellows of Contemporary Art, The Lapis Press.

Ferreira, M. P., de Mello, D. C., & Duarte, J. P. (2012). Embodied Emotions. *eCAADe 30*, 589-594.

Finji. (2015, September 17). Panoramical. Austin.

Hornstein, S. (2004). Matters Immaterial, On the Meaning of Houses and the Things Inside Them. In C. Townsend, & R. Whiteread, *The art of Rachel Whiteread* (pp. 51-67). London: Thames & Hudson.

Lawson, S. (2004). Sensitive Skin, infra mince and difference in the work of Rachel Whiteread. In C. Townsend, & R. Whiteread, *The art if Rachel Whiteread* (pp. 68-84). London: Thames & Hudson.

Pallasmaa, J. (2014). Space, Place and Atmosphere. Emotion and Peripheral Perception in Architectural Experience. *Lebenswelt 4*, 230-245.

Schielke, T. (2013, June 4). *Light Matters: Seeing the Light with James Turrell.* Retrieved from Archdaily: http://www.archdaily.com/380911/light-matters-seeing-the-light-with-james-turrell

Schwabsky, B. (2000). Hiroshi Sugimoto. In G. Moure, T. Riley, & C. A. Arte, *Architecture without shadow* (pp. 105-131). Barcelona: Ediciones Poligrafa.

Smith, K. (2005). *Architects' drawings : A selection of sketches by world famous architects through history / Kendra Schank Smith.* Oxford: Architectural Press.

Wigley, M. (1998). The Architecture of Atmosphere. *Daidalos 68*, 18-27.

Witmer, B. G., & Singer, M. J. (1988, June). Measuring Presence in Virtual Environments: A Presence Questionnaire. *Presence*, pp. 225-240.