Factors Affecting Embodied Interaction in Virtual Environments: Familiarity, Ethics, and Scale.

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Title:

Factors Affecting Embodied Interaction in Virtual Environments: Familiarity, Ethics, and Scale.

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Declaration

I hereby declare that this thesis has been composed by me without any assistance and I have not used any sources or tools other than those cited. Furthermore I declare that this thesis has not been accepted in any other previous application for a degree.

Name: *Aghlab Al-Attili* Date: 2009-01-25

Signature:

Dedication

إلى

أمي و أبي

"وَاخْفِضْ لَهُمَا جَنَاحَ الذُّلِّ مِنَ الرَّحْمَةِ وَقُلْ رَبِّ ارْحَمْهُمَا كَمَا رَبَّيَانِي صَغِيرًا" الإسراء 24

Abstract

The thesis explores human embodiment in 3D Virtual environments as a means of enhancing interaction. I aim to provide a better understanding of embodied interaction in digital environments in general.

3D interactive virtual environments challenge users to question aspects of their embodiment by providing new modes for interacting with space. Designers are facing new challenges that require novel means of interacting with virtual environments that do not simply mirror the way we interact within physical environments. Much of the research in the field aims to show how such environments can be made more familiar and "realistic" to users. This thesis attempts to probe the unfamiliar aspects of the medium.

In this thesis I explore the concept, image and object of intimate space. How can an understanding of intimate space inform embodied interaction with virtual environments? I also investigate the role of familiarity by analysing and testing it in two contrasting interactive virtual environments. My contribution is to provide an account of familiarity as the driver behind embodied interaction in virtual environments based on human experience (from a phenomenological standpoint). In order to enhance the process of design for human embodied interaction in 3D virtual environments or in physical environments, I will identify tangible and intangible elements that affect human embodiment in 3D virtual environments and space, such as *ethics* and *scale*. Both examples are explored in interactive 3D virtual environments corresponding to real physical environments by subjects who are the daily users of the real physical environments.

The thesis presents *scale* as a tangible element and *ethics* as an intangible element of human embodied interaction in space in order to highlight the different aspects that affect human engagement with space, and therefore human perception of their space and their embodiment. The Subjects' accounts contribute toward informing the design of interactive 3D virtual environments within the context of embodied interaction.

Acknowledgement

The work presented in this thesis was carried out in various locations; however, most of these were within the University of Edinburgh. The 3D virtual environments that were created mirrored the reality of Minto House in the School of Arts, Culture and Environment; Alison House in the Graduate School of the School of Arts, Culture and Environment; The Playfair Library Hall in the Old College; and finally the desert palace of 'Qusayr Amra' in the eastern desert planes of the Hashemite Kingdom of Jordan. The work in each location involved many people and the contribution of each one of them was invaluable. I would like to acknowledge my debt to those who provided help and support along the way. Each contribution had an influence on the creation of these environments and my understanding of this topic, subsequently enabling this work to develop.

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Introduction

1.1 Background

This PhD work is a contribution to the field of architecture and computing, with particular concern with embodiment in the context of 3D virtual environments.

In the thesis I analyse the relationship between human intimate space and virtual space and address the lack of a detailed, in-depth reflection on concepts such as embodiment and familiarity. Thus, I identify an alternative three-way link between intimate space and virtual space within the general field of interaction in virtual environments, and I articulate the link's components as the amalgamation connecting the concepts, the familiarity connecting the images, and the interaction linking the objects. I then suggest how this link operates in the design of interactive 3D virtual environments, and present several case studies where such an approach is applied to the design and interaction of tangible and intangible cues of immersion in a 3D virtual environment corresponding to a physical environment. The case studies discuss the role of social factors such as ethics (intangible), and perceptual factors such as scale (tangible) in virtual environments.

The perspective of 'social computing', proposed by Paul Dourish[1], is based on human action and motivation; it is deployed through what he labels as technomethodology, which have made it possible to embed powerful "sociological insights into the heart of the process and fabric of design."[2] Social computing is producing a significant conceptual amalgamation that propels the *development* and *implementation* of new technology to produce familiar virtual cultures that extend the real one, and most interestingly, create a unique level of intimacy between new virtual objects (worlds) and their users. Social computing, within a given unit of space, moved from offering applications that control the environment to enhance its quality to extending the boundaries of the environment and presenting users with virtual spaces that are accessible through embodied interaction. The collective embodied interaction extended the perceptual boundaries of the environment, raising questions related to the nature of the embodied interaction; it also extended the

1 Dourish, P., 2001. *Where the action is: the foundations of embodied interaction.* Cambridge, Mass.: MIT Press, pp. 55-98.
2 *Ibid.*, p. 87.

cultural boundaries, raising questions about the social implications of this interaction, such as ethics. Most importantly, it called into question the role of embodiment in our engagement with the world. Extending space into a virtual mode requires a better understanding of the reason beyond the acceptance of this extension in the form of a more comprehensive sense of the interaction with space extension. It also requires a better understanding of the links between both.

The aim of this thesis is to offer a better understanding of the links between human embodiment and interaction, and to highlight their potential relevance for the design process involving virtual spaces corresponding to real space, and its overall influence on understanding design. This is done by developing a series of interactive 3D virtual environments designed with these concerns in mind, and discussing how subjects experienced the outcome and reflected on it. In the thesis, the term 'amalgamation' will be used to point out the conjoining of different concepts that produces an unfamiliar object but a familiar interaction; and the term 'familiarity' will be used to characterise the link between the image of a real object and its virtual counterpart, or the interaction with the virtual space. These terms, which attempt to explain the relationship between that which is 'real' and which is 'virtual', are critically examined in chapters 2 and 3 of this thesis.

The interactive 3D virtual environments presented in this thesis correspond to real spaces. The subjects of the experiments that took place using the virtual environments are the users of the corresponding real spaces. Subjects' familiarity with these spaces is the result of their daily use.

1.2 Virtuality and embodied interaction

As was briefly mentioned before, the aim of this thesis is to provide an understanding of the links between human embodiment and interaction with space. The understanding of human embodiment is grounded in the literature that focuses on a phenomenological approach to embodiment through Heidegger's existentialism and Merleau-Ponty's embodied perception. In order to examine embodied interaction, human embodiment is examined while situated in its intimate space. The reason behind this is to introduce a standard condition or contextual setting against which

difference can be created and measured. The standard condition is not based on the physical qualities of space, but on the mode of interaction and the relationship with this space. Intimate space as a concept is explored through the instance of the *home*.

The body and intimacy introduce many defining factors that treat embodiment as a continuous reflexive process. The body is the object of embodiment, but it holds many attributes that extend beyond its physicality into its mode of engagement with its surroundings. Together, embodiment and interaction form the body and assign its identity. The bodily nature of the object of the body is different from the corporeal notion which does not assume the former's mode of engagement. As an object, Giddens argues that the body "is an action-system, a mode of praxis, and its practical immersion in the interactions of day-to-day life is an essential part of the sustaining of a coherent sense of self-identity."[3] This identity is challenged and perhaps changed by introducing a different mode of praxis in which the body is practically immersed in the interactions of physical-to-virtual, material-to-immaterial, tangible-to-intangible, embodied-to-imagined. The newly attained identity is bodiless and therefore independent. Barlow declared the independence of this identity in his famous declaration:

> "Our identities have no bodies, so, unlike you, we cannot obtain order by physical coercion. We believe that from ethics, enlightened self-interest, and the commonwealth, our governance will emerge. Our identities may be distributed across many of your jurisdictions. The only law that all our constituent cultures would generally recognize is the Golden Rule. We hope we will be able to build our particular solutions on that basis. But we cannot accept the solutions you are attempting to impose." [4]

Prior to this declaration, Merleau-Ponty captures the essence of this identity when he characterises the body that performs the action as the phenomenal body: "It is never our objective body that we move, but our phenomenal body."[5] Merleau-Ponty indirectly suggests a mode of operation for cyberspace: when looking at his statement in retrospect, we identify the phenomenal body as the driver of interaction.

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3 Giddens, A., 1991. *Modernity and self-identity: self and society in the late modern age*. Cambridge: Polity Press, p. 99.

4 Barlow, J.P., 1996. A declaration of the independence of cyberspace. In J. Casimir ed., *Postcards from the net: an intrepid guide to the wired world.* Sydney: Allen & Unwin, pp. 365-367.
Available at: http://homes.eff.org/~barlow/Declaration-Final.html [Accessed 30-10-2004]

5 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, p. 121.

In the same way, "the body is the potentiality of a certain world."[6] The independent disembodied phenomenal identity is the potentiality of a certain world, a disembodied world.

The new phenomenal world is best explored through intimate space. Intimacy, after all, is the focus of any pure relationship, and although Gidden argues in favour of that concept specifically in relation to the human body, we feel justified in extending it to the consideration of space: "Intimacy is a major condition of any long-term stability."[7] More importantly, "in a pure relationship, the individual does not simply 'recognise the other' and in the responses of that other find his self-identity affirmed. Rather, as follows from the preceding points, self-identity is negotiated through linked processes of self-exploration and the development of intimacy with the other."[8] It is for that reason that the body "… can turn aside from the world, apply its activity to stimuli which affect its sensory surfaces, lend itself to experimentation, and generally speaking take its place in the realm of the potential."[9]

Accordingly, the relationship between the body and its space is based on a long-term relationship where the embodiment is negotiated through self-exploration based on intimacy. Intimate space is a cocoon which defends the individual's ontological security, and we aim to change that by introducing a different cocoon; a virtual cocoon. The relationship between the body and its space is immediate; however, virtual space features as a familiar rather than an intimate space. The relationship with the familiar space is perhaps pure because "it is a part of a generic restructuring of [intimate space where the focus is on] intimacy."[10] Familiarity as a generic form of intimacy is grounded in the concept of 'closeness of knowledge' or the very close connexion. Hence, familiarity is reflected in the body interaction with the seemingly known space.

Both the mode of space and the attitude towards this space are evolving and producing various forms of interactions with the environment. The introduction of the World Wide Web further enabled users to meet and interact thus forming virtual communities that developed corresponding to the advancements in technology. The

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6 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, p. 122.
7 Giddens, A., 1991. *Modernity and self-identity: self and society in the late modern age*. Cambridge: Polity Press, p. 94.
8 Giddens, A., 1991. *Modernity and self-identity: self and society in the late modern age*. Cambridge: Polity Press, p. 97.
9 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, p. 125.
10 Giddens, A., 1994. *The transformation of intimacy: sexuality, love and eroticism in modern societies*. Cambridge: Polity Press, p. 58.

communities thrived with a different kind of life; a life that Howard Rheingold describes as "a new kind of culture" and users that formed what he also describes as a "speeded-up social evolution."[11] The social implications of technology are far reaching beyond the physical dimensions of its tools. Cultures are extending to the new realm of the virtual through the development of new patterns of interaction based on the capacity of symbolism represented by these amalgamated concepts. This extension is triggering a new process of social learning and extending the human knowledge of its very basic human embodiment; cultures are presenting a new or parallel set of values, practices, and attitudes toward embodied interactions in vicarious virtual environments.

Technology is not only extending the mode of space and the attitude toward it into the realm of the virtual; it is also implementing these new forms of interaction ubiquitously into physical space using tangible and intangible elements, thus reversing the initial process of causality. Instead of extending our culture into the domain of the virtual, ubiquitous computing is extending the digital culture into the domain of the physical reality, thus resulting a new set of values, practices, and attitude towards embodied interaction with physical environments.

The focus of this emerging culture is the user of space in its various modes. The user in digital realms is participating in virtual worlds where embodiment is relegated in favour of the new bodiless identity. Although the initial public virtual communities were entertainment oriented, subgroups of special interests emerged according to the specific need and objective of the group. Among these groups, virtual environments adapted to the 3D techniques, creating 3D virtual environments or worlds. Embodiment was reintroduced through an avatar that performs various tasks as permitted by the world. In the new 3D worlds all the previous groups could exist using a spatial metaphor of virtual existence. The first in this series of worlds was *AlphaWorld*, which is the oldest collaborative virtual world on the Internet.12 Other examples include *Activeworlds*,13 which came as a development of its

11 Rheingold, H., 2000. *The virtual community: homesteading on the electronic frontier*. London: MIT press. 2000. Originally published in 1993 by Adison Wesely, p. xvi.

12 Active Worlds. 2003. *AlphaWorld*. [Online] Available at: http://www.activeworlds.com/worlds/alphaworld/ [Accessed 10-07-2003].

13 Active Worlds. 2003. *Home of the 3D chat, virtual worlds building platform*. [Online] Available at: http://www.activeworlds.com/ [Accessed 01-10-2007].

predecessor, and *Secondlife*.[14] Users of these worlds became residents, which implied a mode of engagement with the virtual world. Accordingly, the design of these worlds and how they relate to reality became ever more important. The new-found border between the world and its virtual counterpart is itself a confirmation of constant attempts to blur it, and weave together both realms, hence the need to develop our understanding of embodiment in virtual environment. This would reflexively enhance the understanding of embodiment in physical environment. Such an improved understanding will lead to the development of a process of design for human embodiment and embodied interaction.

The proposed approach is based on the phenomenological method of exploring human experience in space, since space is the ontological setting where this experience unfolds. Providing a better understanding of the embodiment by exploring its relationship with intimate space from the human experience point of view can improve the interaction with space and the process of design for the space.

The questions that this research will investigate and attempt to answer are:

1- How can human embodiment be informed by intimate space, and in what way does the latter affects the former?
2- How does embodied interaction with virtual space utilise familiarity as a link between intimate physical space and virtual space, and is there a thorough understanding of the definition and role of familiarity in the literature on embodied interaction?
3- Is it possible to understand embodiment and embodied interaction using various foci such as *ethics* or *scale*?
4- How can this understanding aid designers in the process and method of design for interaction in virtual environments?

The development of Human-Computer Interaction (HCI) is founded on the design, evaluation and implementation of interactive computing systems. Interaction came in many different styles that ranged from command line interface to three dimensional ones. The drive behind the development of these interfaces was the need to enhance the interaction between the user and the machine. As a result, the field of Interaction

14 Second Life. 2008. *What is Second Life.* [Online] (Updated 16-01-2008) Available at: http://secondlife.com/whatis/ [Accessed 16-01-2008].

Design (IxD) came to lay the groundwork for intangible human experiences. Many areas of research overlap with HCI, such as Personal Information Management (PIM) and Computer Supported Cooperative Work (CSCW); however, arguably the most important element in the development of HCI is the distribution of user-centred design approach to encompass multi-users. The ethnographic studies of the environments in which users participate extended to encompass human experience.[15] *Technomethodology*[16] came as a result of the amalgamation of these concepts, which in turn shifted the emphasis from the *system* to the *interaction* within the 'interactive system design'.[17],[18]

Technomethodology addresses the context with terms such as *space*, *place*, and *locale*.[19] We argue that the relevance of the approach is significant in the case of ubiquitous computing; however, virtual environments require a different approach based on the profound understanding of the concept of familiarity and its implications on immersion and interaction.

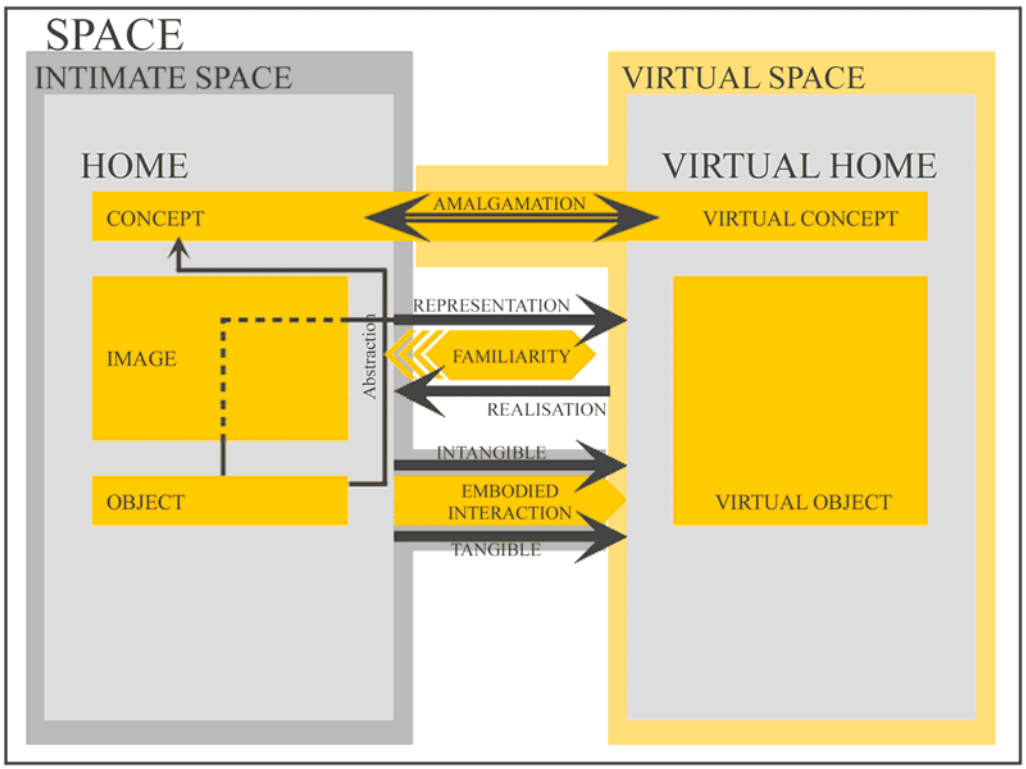
The thesis will highlight how the concept of familiarity as the basis of embodied interaction in virtual environments has not yet been addressed; and will attempt to provide a deeper understanding. It will also attempt to contribute a better understanding of the cues of immersion in virtual environments and their implications on embodiment as the major factor in the process of interaction.

1.3 Structure of this work

The structure of this thesis follows an experimental path from the outset. Chapters present the process of experimentation involved with the proposed topic. The logical sequence suggested by the introduction intentionally divided the theoretical background and literature review into sub units that paved the way to the process of experimentation within each chapter. Hence, each chapter will have an introduction that builds on the initial introduction presented here; and a conclusion that both

15 Agre, P.E., 1997. *Computation and Human Experience.* Cambridge: Cambridge University Press.
16 Dourish, P. & Button, G., 1998. *On "technomethodology": foundational relationships between ethnomethodology and system design*. Human-Computer Interaction, 13 (4), pp. 395-432.
17 Newman, W. & Lamming, M., 1995. *Interactive system design*. Cambridge: Addison-Wesley Publishers Ltd.
18 Benyon, D., Turner, P. & Turner S., 2005. *Designing Interactive systems*. Edinburgh: Pearson Education Limited.
19 Dourish, P., 2001. *Where the action is: the foundations of embodied interaction.* Cambridge, Mass.: MIT Press, pp. 87-88.

points the way to the subsequent chapters, and acts as a sub unit of the final conclusion. The diagram below provides a graphic representation of the topics of this thesis, forming a template from which a diagram in each subsequent chapter will be adapted. The adapted diagram will highlight the topics discussed in the corresponding chapter.



The introduction will be followed by chapter 2, which will present an analytical review of the account of the meaning of intimate space. As an example for this analysis, the *home* will be deployed as a concept, image (verbal or graphic) and object. The chapter will draw on phenomenologist literature to analyse and link intimate physical space to virtual space in an effort to establish the latter as a platform for the following experimentation. The analysis illustrates the conceptual relationship between physical and virtual space, and attempts to coin the term *amalgamation* to refer to any process of joining concepts that would result in introducing a new word, image or object. The analysis is followed by a small exercise in which amalgamation is deployed as an instance of space augmentation. The outcome of the discussion will provide the basis of the discussion in the

following chapter, in particular, the relationship between an object and its copy in terms of the familiarity of the image, and tangible and intangible interaction.

Chapter 3 is an attempt to better understand familiarity since it is flagged as the notion that connects embodiment in the world with tangible and social computing.[20] Although familiarity is introduced in the literature concerned with social computing as the relationship between social action and situated cognition[21],[22],[23],[24], familiarity is explored as a systematic connection between two different things. Therefore, this chapter fills a gap in the literature by eliciting the proposed structures of how familiarity operates. The argument proceeds by proposing a procedure of abstracting intimate space linguistically and spatially. This abstraction is then contrasted with virtual space on the basis that the latter is a representation of intimate space. The result of both abstraction and representation of intimate space is made available in an experiment that explores the familiarity and spatiality of embodied interaction.

Chapter 4 explores the intangible qualities associated with social interaction. Barlow[25] identifies what later became the classics of cyberspace governance, and these are ethics, enlightened self-interest, and the commonwealth. The chapter will address the unwritten codes of ethics of virtual space by attempting to analyse the system of value in the 3D virtual worlds and MMORPGs. A further experimentation will contrast ethics of real space and virtual space and finally tie ethics of intimate space to virtual space. The chapter further contributes to the literature on social computing by exploring the intangible aspects of embodied interaction in virtual space, and ethics of interaction and representation in virtual reality.[26] [27]

Chapter 5 discusses the tangible perceptual qualities associated with social embodied interaction. It explores the social action and the situated cognition in the light of dynamic scale of embodiment using structures of knowledge and

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20 Dourish, P., 2001. *Where the action is: the foundations of embodied interaction.* Cambridge, Mass.: MIT Press, p. 101.
21 Suchman L., 1987, Plans and situated action, Cambridge University Press.
22 Hutchins, E., 1995. *Cognition in the wild*. Cambridge, MA: MIT Press.
23 Nardi, B.A., ed., 1996. *Context and consciousness: activity theory and human-computer interaction.* Cambridge, Mass.: The MIT Press.
24 Clancey, W.J., 1997. *Situated cognition: on human knowledge and computer representations.* Cambridge: Cambridge University Press.
25 Barlow, J.P., 1996. A declaration of the independence of cyberspace. In J. Casimir ed., *Postcards from the net: an intrepid guide to the wired world.* Sydney: Allen & Unwin, pp. 365-367. Available at: http://homes.eff.org/~barlow/Declaration-Final.html [Accessed 30-10-2004]
26 Brey, P., 1999. The ethics of representation and action in virtual reality. *Ethics and Information Technology*, 1(1), p. 5-14.
27 Horner, D.S., 2001. Cyborgs and cyberspace: personal identity and moral agency. In S. R. Munt, ed., *Technospaces: inside the new media.* London: Continuum, p. 71-84.

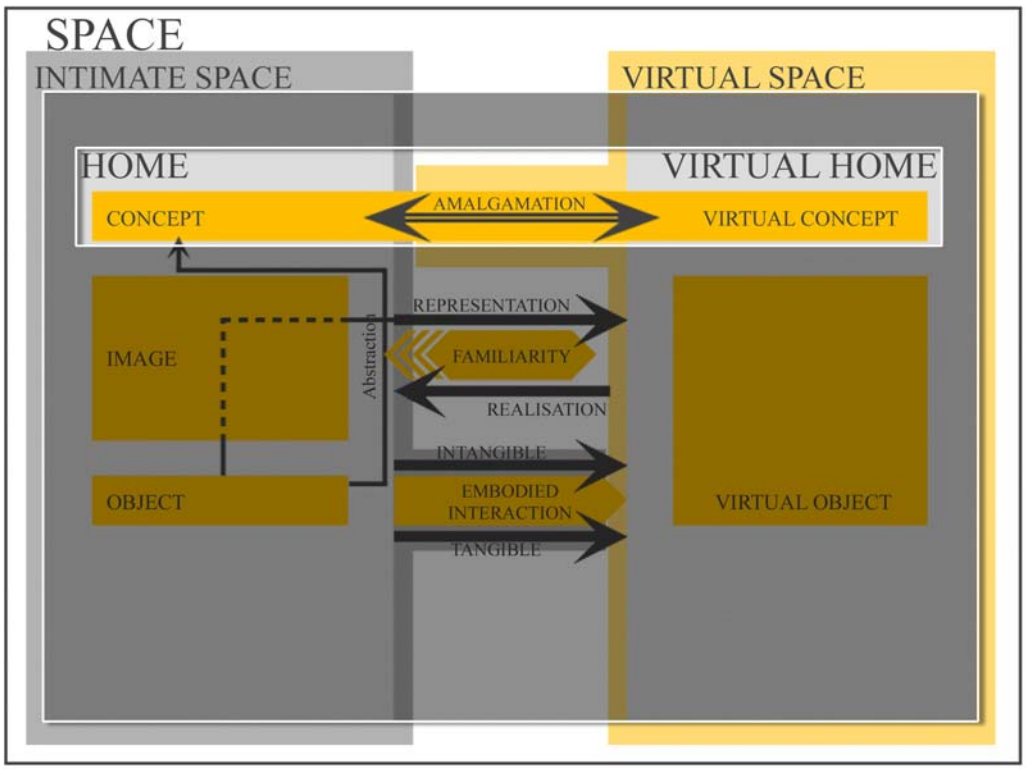
expectation. The dynamically changing embodiment due to cues of immersion in virtual environments is explored using various examples that concentrate on *scale* as the varying factor of immersion. The different qualities affected by scale change and alteration are explored using the work of designers in a multiscale virtual environment's course. The work is displayed to subjects and their insights are corroborated. The chapter fills a gap in the literature concerning cues of immersion in virtual environments, particularly, *scale*. This chapter contributes to the literature concerning *scale* in virtual environments, and in particular turns the quantitative research of Xiaolong[28] into a qualitative phenomenological exploration that contributes to the integration of the spatial knowledge and spatial action.

Finally, chapter 6 examines the outcome of the questioned proposed by the research. It also reports on the difficulties and limitations of the procedure of experimentation, and proposes future work.

28 Xiaolong, Z., 2008. A multiscale progressive model on virtual navigation. *International Journal of Human Computer Studies*, 66(4), p. 243-256.

The Modelling of Intimate Space

Linking Reality to re-enacted Imagination



2.1 Introduction

Intimate space is a common characterisation of both real and virtual space by virtue of the amalgamation of concepts and the familiarity of image and embodied interaction. This chapter attempts to provide a systematic explication of how intimate space informs the interaction with space in general and with space representations in particular. As a mode of representation of intimate physical space, virtual space will help in introducing a platform for experimentation; and using the *home* as a case study will enable us to introduce an instance of intimate space.

From the outset, this chapter will present the *home* as an example of intimate space and address its meaning analytically. The meaning of *home* will be addressed as a concept using the accounts of its everyday-being-in-the-world users. Its meaning will also be addressed as a linguistic trait through the presentation of the word meaning of home, its etymology and the way it relates to the previous concept of home. The exploration of the meaning of *home* continues by tracing the social presence of the concept and the word in simple daily human experiences.

The meaning of *home* as an instance of intimate space is further analysed through the analysis of the referent of *home*. The concept is connected through the verbal to the image of the physical. The image of *home* is analysed in terms of Sartre's knowledge affectivity and movement. The previous terms of analysis will help in linking the image and the object through human embodiment. It will also address the role of the word in building the image of the object. The connection established here is between the embodied interaction and the multiplicity of representations of the image of the *home*, one of which is the virtual representation.

The chapter will then provide the psychological descriptive account of the image of *home* in order to highlight it as independent of the phenomenological descriptive account of the image. While the psychological descriptive account concentrates on the mental reaction to the image, the phenomenological descriptive account attempts to relate the image through perception and interaction. Phenomenology is introduced as the work of Husserl's conscious reduction in human

experience, and Heidegger's intentionality of consciousness, and finally Merleau-Ponty's phenomenology of perception.

The phenomenological account of human embodied interaction with intimate space is extended to the consideration of Bachelard's *'poetics of space'* in an effort to extract his arguments about the childhood home as an example of intimate space. His arguments are then discussed, analysed and utilised in reproducing the childhood home as a 3D model available for interaction. The production of an image of *home* available for human embodied interaction based on Bachelard's account and his imagined childhood home provides an instance of intimate space presented as a virtual environment. Ultimately, this is the product of the amalgamation of concepts between intimate space and virtual space utilising the familiarity of images and interaction.

The final part of this chapter briefly discusses the accounts of users of this intimate space in order to lay the foundation of the chapters to follow.

2.2 The Home:

The concept of *home* is one of many-layered elementary patterns of meaning that signify a combination of attributes. When a random sample of individuals was asked about the first thing that comes into one's mind when the word *home* is mentioned, responses ranged from *'where I live'* to *'homework'*. However, each response signified a different *focus, scale* and *magnitude* of the same basic combination of interactive or bodily attributes. For example, the response *sleep* associates the notion of *home* with a basic human activity, or rather lack of activity. It also assumes a time-scale to this activity in addition to the underlying spatial aspect. The *focus* is placed on the type of activity taking place in a *home*, while the element of *scale* is applied to the *time* this type of activity consumes, and finally the *magnitude* reflects the importance of the activity to the individual as well as the impact of such activity on the *home* as a space. The same combination of attributes can be applied to another response, *'my bed'*; however, the focus is placed upon the physical object that

supports the activity. Another example, *'Australia*[29]*'*; the *focus* here is on a specific *place* and its attributes, whereas the *scale* is applied to the notion of *home*, as a *space*, and expands it to the large scale of Australia. Finally, the *magnitude* reflects the importance of the place which is also reflected in the scale. The *focus* of the response *'warm'* is placed on an environmental condition that provides a sense of relaxation. The condition *'warm'* also draws on the metaphorical power of association to suggest an emotional mental state. The magnitude reiterates the environmental condition in a *home* and the protective power of a home. All of the previous responses signified different values of the same attributes; each varying depending on personal experiences. One of the responses, however, demonstrated a negative value, *'I don't know where home is, I guess (it is) all over the place*[30]*'*. The response lacks *focus*, *magnitude* and *scale*. *Home*, in this case, stands for nothing. Therefore, the notion of a *home* is arguably a dynamic notion that can be applied to a combination of attributes that, although varying in importance, reflects the primary mode of being, or the aspirational one. *Focus*, *magnitude* and *scale* will be the variables we will use to explore the notion of the *home*. In our exploration we will visit the linguistic definition and origin of *home*, and use that as a basis to adjoin the phenomenological investigation.

The following section embarks on an attempt to interpret the concept of *home* taking into consideration two major points: The home as a linguistic notion, and the home as a social notion.

2.2.1 LINGUISTICALLY:

The criteria (*focus, scale* and *magnitude*) applied previously to define the concept of *home* is somehow embedded in the linguistic definition of the word *home*. The Oxford English Dictionary[31] (OED) defines *home* mainly as a physical concept. The focus of OED's definition is placed on the spatial attributes of a home; Accordingly a home is 1) A *village* or *town*, a collection of *dwellings*; 2) A dwelling-*place*, house, abode; the fixed *residence* of a family or household; 3) The *place* of one's dwelling

29 Australia came up as a response from an Englishman. When asked to elaborate, he said Australia was the place where he started his family, and had the best days of his life.

30 When asked to elaborate, the subject said: "You cannot ask an immigrant about a home".

31 The Oxford English Dictionary O.E.D., (Draft Revision June 2007). Oxford English Dictionary. [online]. http://www.oed.com/ [Accessed 09-10-2007].

or nurturing, with the conditions, circumstances, and feelings which naturally and properly attach to it, and are associated with it; 4)In various connexions, referring to the *grave*, or future state: the 'long' or 'last' home; 5) A *place*, region, or state to which one properly belongs, in which one's affections centre, or where one finds refuge, rest, or satisfaction; 6) One's own *country*, one's native land; 7) The *seat*, *centre*, or native *habitat*; the *place* or region where a thing is native, indigenous, or most common; 8) An *institution* providing refuge or rest for the destitute, the afflicted, the infirm; 9) In games: The *place* in which one is free from attack; the point which one tries to reach; the goal; 10) The accusative retains its original use after a verb of motion, as in *to go* or *come home*; 11) At home. **a.** At or in one's own *house*, or *place* of abode; **b.** In one's own *neighbourhood*, *town*, *country*, etc.; **c.** At one's ease, as if in one's own *home*; in one's element. Hence, Unconstrained, unembarrassed; familiar or conversant *with*, well versed *in*; 12) From home. Away from one's house or place of abode; not at home; abroad.

All of the definitions above, except definition 11c, attempt to define a type of space. Hence, the focus is placed on the spatial attribute of the word *home*. We have highlighted this by italicising the words that signify different types of space in those definitions. The words reflecting these spaces are: a place, place of one's dwelling, abode, seat, centre, house, household, residence of a family, dwellings, neighbourhood, village, town, region, state, country, one's native land, native habitat, the place in which one is free from attack, the grave. This establishes beyond any linguistic doubt that a *home* is a type of physical space. Hence, according to our criteria, the *focus* of the linguistic definition of the word *home* is placed on its spatial attribute. Another look on the previous words representing the spatial attribute of a *home* will conclude that the scale is, again, applied to the spatial attribute; a *home* can be of the size of a seat, house, neighbour, village, town, region, state, country or even a grave. The variation in size represents the scale of this definition. Finally, the *magnitude* of the definition of the word is placed on both the spatiality of a *home* and the activity that occurs in it i.e. nurturing, growing up, finding refuge, feeling safe, or generally living. The activity is emphasised by the verbs used in the definition. We will use the second and third definitions[32] to illustrate this point.

32 The first definition is not used since it is marked as obsolete.

A home is:

> 2.a) A dwelling-place, house, abode; the fixed residence of a family or household; the seat of domestic life and interests; one's own house; the dwelling in which one habitually lives, or which one regards as one's proper abode. Sometimes including the members of a family collectively; the home-circle or household.
>
> 3.a) The place of one's dwelling or nurturing, with the conditions, circumstances, and feelings which naturally and properly attach to it, and are associated with it. The absence of the article is prob. connected historically with the constructions *at home*, *to go home* (both in OE.), *from home* (*c*1300); but it appears also to be connected with the generalized or partly abstract sense, which includes not merely 'place' but also 'state', and is thus construed like *youth*, *wedlock*, *health*, and other nouns of state. [33]

While the first definition introduces the *home* as an abstract physical concept that is attached to the act of dwelling or abiding over an extended period of time, the second definition highlights the implications of the physical concept on its user. Both definitions also tie the *home* closely to verbs such as *dwell*, *belong*, *refuge*, *rest*, *nurture*. All of the previous verbs are signifiers of the human condition; however, the first part of this verbal signification describes the act – dwell, rest, refuge – and the second part highlights the space as the requirement of the possibility of the occurrence of this act. The salient point that has to be highlighted is the temporality of the verb. While some verbs describe bodily actions that do not necessarily implicate other objects and do not require extended time, some other verbs describe acts that require extended periods of time. If I sneeze, then the act of sneezing is carried out by myself and it would last for moments. If I sleep, then the verb will also be carried out by myself but will last for a longer period of time that would not exceed the normal limit, however, if I dwell, then the verb implies an extended period of time and, hence, assumes temporality as a strong aspect of the verb in hand. It is possible and plausible to make the following utterances:

a) This afternoon, I slept for three hours
b) I slept for 18 hours. I was so tired.
c) This is my home. I lived here for 20 years

It is however, not plausible to make the following utterances:

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33 The Oxford English Dictionary O.E.D., (Draft Revision June 2007). Oxford English Dictionary. [online]. http://www.oed.com/ [Accessed 09-10-2007].

a) I slept for 20 years. I was extremely tired.

b) This is my home. I lived here for three hours.

2.2.2 ETYMOLOGY

The etymology of the word is traced back in old English: *hám*; old Frisian: *hém*; old Saxon: *hém*; middle Dutch and Dutch: *heem*; old High-German: *heim*; middle High-German and German: *heim*; old Norse: *heimr* dwelling, world; also Swedish: *hem*; Danish: *hjem*; Gothic: *háims*; female of a village; or in conferred Lithuanian: *kẽmas*, *kaímas*, village, homestead; Prussian: *caymis* village; the English word, home, originates from Sanskrit: *kṣêmas* safe dwelling; Or *kṣêmasksi* to dwell secure.

An interesting example are the Himalayas - a system of mountains forming the northern boundary of India and containing the highest summits in the world. Himalaya is a word composed of two Sanskrit words that mean dwelling (hima) and snow (laya). The same phonetic origin of the Sanskrit word *kṣêmas* leads us to its Arabic counterpart الخَيْمَةُ (*khaima*) which means round *dwelling* erected using tree branches[34,35], or place of residence built of tree branches.[36] It also signifies the residing attributes or virtues associated with a person because they form the characters on which his personality is built.[37] The Arabic definition holds a different attitude to the word *khaima*. A home, or a *khaima*, is a construct of a human condition. While the English definition, as mentioned above, highlights the spatial nature of the *home*, the Arabic one intends the definition to signify the internal structure of human personality, thus, *home* is within the self. One might argue that the definition draws on metaphoric association, but this can be dismissed for two reasons:

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34 Al-Masri, Ibn-Manthour, 1998, Lessanul-Arab. Ed., Yousif Al-Khayyat and Nadim Marashly, Beirut: Al-Ma'arif. [Originally Published in 1311]. In Arabic:
- لسان العرب ، ابن منظور المصري (711هـ الموافق 1311م : 1998م) ، إعداد وتصنيف : يوسف خياط ، نديم مرعشلي ، بيروت : دار المعارف.

35 Al-FairouzAbadi, Madud-Dein, 1986, Alqamous ul-Moheit. Ed. Yousif Al-Biqa'ei, Beirut: Al-Fikr. [Originally Published in 1383]. In Arabic:
- القاموس المحيط ، مجد الدين الفيروزآبادي (785هـ الموافق 1383م : 1986م) ، ضبط وتوثيق : يوسف الشيخ البقاعي ، بيروت : دار الفكر .

36 Al-Jawhary, Ismael, 1999, As-Sahhahu fel-Lugha. Eds. Emile Yaqoub and Muhammad Tarifi, Beirut: Dar Al-Kotob Al-Ilmiyah. [Originally Published in 1240]. In Arabic:
- الصّحّاح في اللغة ، إسماعيل بن حماد الجوهري (638هـ الموافق 1240م : 1999م) ، تحقيق : إميل بديع يعقوب ، محمد نبيل طريفي ، بيروت : دار الكتب العلمية.

37 Zakaria, Ahmad Ibn, 1999, Maqayees ul-Lugha, Ed. Abdus-Salam Haroun, Beirut: Dar Al-Jeil. [Originally Published in 990]. In Arabic:
- مقاييس اللغة ، معجم ، أبو الحسين أحمد بن فارس بن زكريا (380هـ الموافق 990م : 1999م) ، تحقيق و ضبط : عبدالسلام محمد هارون ، بيروت : دار الجيل.

a) Embodied being precedes home as a structure: embodied being is a condition of our being in the world

b) The word *Khaima* is used in contemporary Arabic to refer to any tent-like structure, particularly ones used by nomads, which, in conjunction with the old reference to human personality, shifts the emphasis from the *home* as a fixed structure to '*home-within-the-self*'

The etymology also features the Greek word '*kome*'[38] which means village, while the word that signifies *home* in ancient Greek is ikia [οικία] which means 'house, building or family'.[39] The word that signifies the action of dwelling is keme [κεῖμαι] which means "to be or place oneself at rest in a flat, horizontal, or recumbent position, recline, to be placed on something, to be/exist."[40] Incidentally, the word for house in Greek 'ikia [οικία]' forms the origin of the word 'ikio [οἰκειῶ (-όω)]' which is 'to make somebody familiar, befriend, familiarise'.[41]

What is present here is a triangle of meanings that hosts *home* as a space on one corner, dwelling as an act on the other corner, and familiarity of spatial interaction on the third corner. The interaction between the three corners uses the basic human condition to form a continuum where the meaning shifts between the three corners to highlight one aspect of being more than the other two. The shifting meaning is manifested in all sorts of social contexts.

The following section is an attempt to shed some light on one form of manifestation that is introduced as 'amalgamation' within various social contexts. Arguably 'amalgamation' is evident in the use of *home* as a concept and word. The section will extend the amalgamation to the concept of intimate space, and ultimately, virtual space as a form of amalgamation of the concept of space.

2.3 The Social Concept of Home

38 Harper, D., 2001, *Online Etymology Dictionary*. [Online] (Updated 28 Feb 2007) Available at: http://www.etymonline.com/ [Accessed 10 April 2008].

39 Giannakopoulos, P.E., 1994. Lexiko tis Arhaias Ellinikis Glossas. Athena: Pelekanos, p. 401. In Greek: Γιαννακόπουλος, Π. Ε. 1994. Λεξικό της Αρχαίας Ελληνικής Γλώσσας. Αθήνα: Πελεκάνος, p. 401.

40 Vlahou, V.P., 1996. *Ta Rimata Omala kai Anomala tis Arhaias Ellinikis*. Athena: Gutenberg, p. 204. In Greek: Βλάχου, Β. Π. 1996. *Τα Ρήματα Ομαλά και Ανώμαλα της Αρχαίας Ελληνικής*. Αθήνα: Gutenberg, p. 204.

41 Ibid, p. 262.

On their website, the Council on Tall Buildings and Urban Habitat[42] produced an illustration, provided below (*Figure 1*), showing a line up of ten skyscrapers from different parts of the world in what seems to be a match between buildings that have been the tallest in the world since 1931's Empire State Building. While *Burj Dubai* sits at the top of the ranking at over 818m, the Empire State Building trails behind the rest at 381m. The figure instigates an immediate process of comparison between six different characteristics of each skyscraper; however, it crudely mixes certain contextual features of each skyscraper to produce a unified landline and a skyline that otherwise are unique for each respective skyscraper. This crude mix places all ten buildings on the same landline at presumably zero altitude.

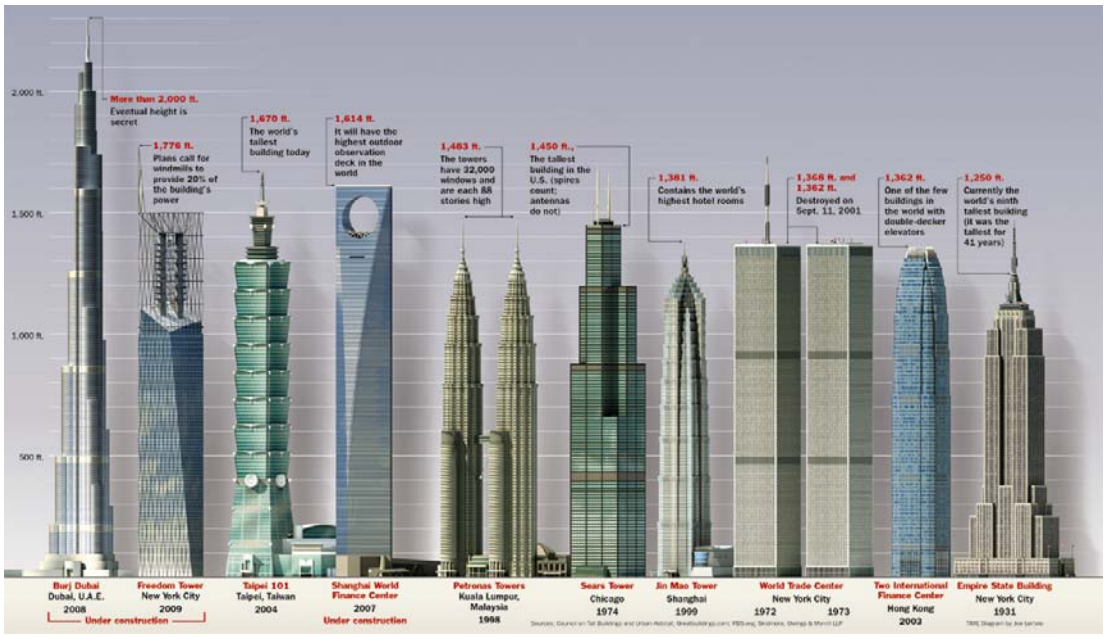

Figure 1. The ten highest skyscrapers in the world.[43]

This collage has the familiar feature of a conceptual spatial amalgamation. The Cartesian notion of space is utilised to unify the skyscrapers by mapping them and taking into consideration linking the six different characteristics of each skyscraper: 2D representation, landline, skyline, original location, detailed height, current situation, the year of completion and the country of the tower. There is a generic

42 The website of the Council on Tall Buildings and Urban Habitat regularly updates and keeps changing its lists to reflect the most up-to-date information. Hence, the diagram may possibly be updated. The URL address is http://www.ctbuh.org/

43 Lertola, J., 2004. The Diagram of the World's Tallest Buildings. [print] Available at: http://www.joelertola.com/grfx/chrt_buildings.html From home page/examples of my work/Science/ [Accessed 23 March 2009].

space containing the skyscrapers and the characteristics to be applied to all these towers, which constitutes the fairly rich frame of being the tallest skyscraper in the world. However, there is conceptual and perceptual projection to the collage from each skyscraper context; we project a uniform landline of zero altitude, but not, for example, sea-level altitude, or even hidden underground levels. Certain characteristics projected to the collage are overlapped, such as the landline, and if we consider the illustration to be an amalgamation of the proportional representations of each corresponding skyscraper, then the scale is also unified in the final outcome, however, certain other characteristics are not. There is an emergent conceptual quality in the collage that reflects the skyscrapers as facts and concepts beyond the objects conceptualised in this collage. The emergent quality is described as conceptual because a basic simplification of the illustration would leave behind 10 outlines or even lines corresponding to the ten skyscrapers. The collage is a representation for an image that communicates to the perceiver a host of facts. The amalgamation is a process of simulation of an imaginary chess board where the pieces are aligned beside each other to create a competing context, whereas in reality, each object represented in the collage enjoys an independent physical presence and qualities that are not represented in the collage. Each skyscraper exists separately in a different location, and sits at an altitude that is not necessarily reflected in the figure in question. *Burj Dubai* reaches the highest point, whereas its next competitor is at least 180m behind. None of the illustrated skyscrapers will ever be joined together in real-time, or are indeed joined together in a manner that we can describe as being *accurate*.

The representation of the conceptual amalgamation is perceptually accessible and, for some reason, familiar, nevertheless, the actual process of amalgamation is rather intricate. Projecting *Burj Dubai* as the tallest skyscraper in the world does not take into consideration the process of joining other skyscrapers alongside it. The architectural information does not contain or is not affected by the altitude of the landline on which the tower is erected. The amalgamation is made by assuming that each building sits at sea-level, although this is not the case. Therefore, the unifying or joining characteristics are fictional and not necessarily accurate.

To further clarify the point in question about the conceptual character of an object and its representation, and the process of amalgamation as a tool for highlighting certain unified characteristics between conceptually similar objects, the illustration below (*Figure 2*Figure 2. *Human Evolution*), will be compared with the first one, (*Figure 1*). Ultimately, the choice of this example is to link the architectural aspect to human embodiment.

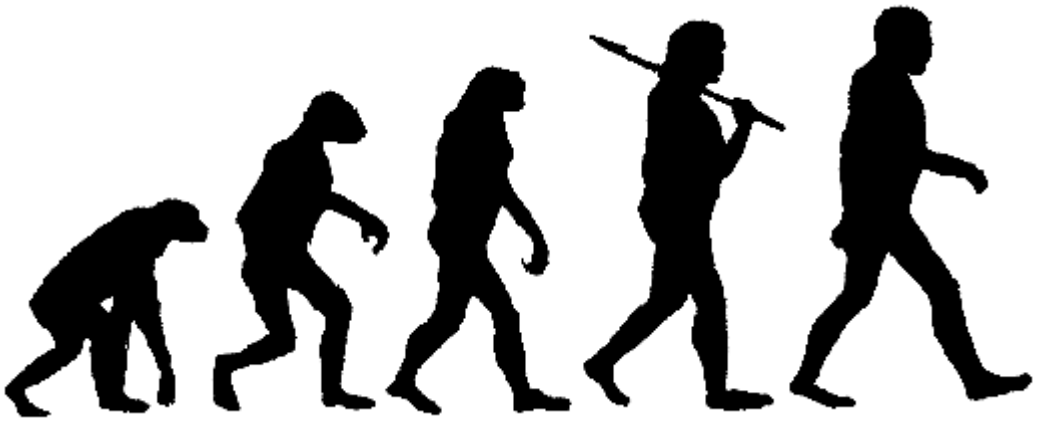

Figure 2. Human Evolution[44]

The illustration above (*Figure 2*) is another example of amalgamation, but in this case it regards human evolution. The generic space joins all different forms of embodiment throughout evolution as proposed by science. The use of the expression '*human embodiment*' may be inaccurate, as part of the illustration may be described as '*Ape Embodiment'*. The representation of the different stages of evolution is amalgamated in a similar way to that of *Figure 1*. The amalgamation eliminated all other contextual elements and kept the embodiment as the only indicator of the stages of evolution. Needless to say, the emergent conceptual quality in this amalgamation is the spatial representation of time and succession in the form of a march by cross millennial ancestors that, in fact, never walked together or, for that matter, saw or interacted with each other in any physical way. This accelerated timeline, joins all of the stages to form this march. In the standard march, landline is invariant, the stage of evolution, which is reflected in current embodiment, is

[44] The Diagram is based on the "March of Progress" in: \Howell, F.C., 1980. *Early Man*. Virginia: Time-Life Books.
The original "March of Progress" included: Pliopithecus - Proconsul - Dryopithecus - Oreopithecus - Ramapithecus - Australopithecus africanus - Australopithecus robustus - Australopithecus boisei - Homo habilis - Homo erectus - Early Homo sapiens - Neanderthal Man - Cro-Magnon Man - Modern Man. The adapted diagram includes from left to right: Dryopithecus - Early Homo sapiens - Neanderthal Man - Cro-Magnon Man - Modern Man.

arguably invariant. Homo-Sapiens achieve a higher rank by virtue of brain size and level of intelligence. For this amalgamation, we can project both the historical period to which the stage of evolution belongs, and the embodiment in question. We simply place all the stages on the same baseline of comparison, but in the first case some aggressive manipulations were required to achieve the collage. In the first figure contextual elements that may effectively change the result of the match, i.e. the tower that reaches the highest point in the sky, is eliminated and a scale is provided to allow comparison. In the second illustration, the time barrier is removed alongside all other contextual and factual elements.

In the first illustration, *space* was hugely manipulated by moving all these buildings and placing them together. As an attempt to control this manipulation, the producers of this architectural chess board provided a scale to the left side of the drawing. The exclusive function of this scale is to provide a way of reproducing the connection between the concept held by the producer of the illustration, what is represented in the illustration, and the person looking at the illustration; a way to provide a filter to enable us to understand the illustration and its conceptual structure.

In the second illustration, *time* was remarkably reduced by presenting historical stages of evolution together. While the relationship between the objects in the first illustration is that of contemporaneous equals, the one between the objects in the second illustration is more chronological. Each stage could not have happened without the previous one, and therefore, the manipulation of the time factor does not necessarily impact the spatial aspect, rather, it affects the conceptual aspect. The conceptual structure of the second illustration required no scales or filters. The reason for that is the fact that the objects of the second illustration, different stages of the evolution of embodiment, contained one representing a homo-sapiens, or a modern man. The representation of this modern man introduced a conceptual element of scale which any person looking at the illustration can use to relate or establish a connection with the illustration.

In these illustrations, both space and time went under a major process of reconstruction.

In the same manner *Figure 1* and *Figure 2* illustrate two different conceptual amalgamations, but in two different ways, it is argued that the relationship between

the concept of physical space and the concept of virtual space is moderated by a process of amalgamation, and that the concept of the image of *home*, is an amalgamation of many subcomponents. OED lists twelve of these components, and there are many others that were obtained from the random sample at the out set of this chapter. At this point, the notion of amalgamation may seem vague, but it will be sharpened up as we progress.

In order to further question the concept of *home*, a paragraph that deploys the word *home* in the same way embodiment was deployed in *Figure 2* will be produced.

> "I ran into my friend Danny in the street the other day. He was carrying his suit case. He looked like he was travelling somewhere.
>
> Me: Hey Danny. How are you?
>
> Danny: Hi… Hi
>
> Me: Travelling somewhere?
>
> Danny: No. I was in the airport and I have just arrived. So I am going *home*.
>
> Me: Ah, holiday? Where were you?
>
> Danny: Not really. I was just back *home* visiting my parents.
>
> Me: Feeling *home*-sick? But aren't you going for a holiday this summer?
>
> Danny: Well, I want to go and visit this country, but I have to check it on the *home*-office website to make sure it is safe to travel there, because the last time I went on a holiday I had some medical complications, and I could not wait until I got back here. The minute I got out of the airplane, I was so glad and remember shouting (Oh God… I am finally *home*.)
>
> Me: Was the medical care that bad!! You should always check the *Home*-Office website. Their *home*page has links that leads you to all sorts of information."

The paragraph introduced several conceptual structures, in which the concept of intimate space, exemplified by the word '*home*', was amalgamated to other concepts to provide an emergent conceptual structure.

Home-page is an example of a new conceptual structure or amalgamation induced by technology. *Home* in this case, is a part of a new paradigm. A website is a group of interlinked web-pages the structure of which does not necessarily follow a specific format. However, the main page of any website is called the *home*-page, and is usually the first page to be served when the website is visited. The conceptual connection is arguably the importance and centrality of a home to its dwellers, thus, the importance and centrality of a home-page to a website owner. A website of a

company presents various sources of information mainly about that company. If you decide to visit the physical location of the company, then you would probably head to their office. However, if you decide to visit their website, then you will most likely end up visiting their *home*-page. You would also leave a message in their guest-book. The amalgamation of these different activities renders interaction with the abstract sources of information about this company a *homey* interaction. But unlike the case of space manipulation in *Figure 1* and time manipulation in *Figure 2*, the amalgamation in this case crosses a different barrier: a physical barrier where a concept, which corresponds to an object and is represented by various forms of representations, is amalgamated resulting in the production of a new image or representation to which a new set of activities and interactions are made available. A building of a company is transformed into a website and its main office is transformed into a home-page; consequently, the way we interact with the company changes to correspond to the transformation of the company.

The power of the concept of a home extends far beyond the word and its usage reaches into unchartered areas. For example, while you could visit the physical location of the company mentioned above, i.e. their office, you will not be able to do so with an online newspaper because it simply has no physical presence. The newspaper has a homepage, but not a real home and not a real page. Home in this case belongs to a different paradigm. If the owner of this newspaper decides to produce a printout then the first page would probably be called the index, the title page, the front page, but not the home-page. The word home expresses a new meaning when joined with the word page. Although one might argue it is a metaphorical use, we maintain that the process of amalgamation is the main factor behind the transformation of the conceptual structure behind the new form of verbal representation. The distinction is made on merely conceptual grounds. The "*metaphorical systematicity*"[45] highlights one aspect of the object in terms of another, whereas amalgamation admits inappropriateness that Turbayne labels "*sort-crossing*".[46] Therefore, the form of representation is manifested in the use of the word which, in turn, renders it comprehensible in the same way it renders

45 Lakoff, G. & Johnson, M., 1980. *Metaphors we live by*. Chicago: University of Chicago Press.
46 Turbayne, C., 1962. *The myth of metaphor*. New Haven, CT: Yale University Press, p. 11.

comparison comprehensible in *Figure 1* and *Figure 2*. The same type of amalgamation applies to the expression home-banking; however, the application is not metaphoric. Home-banking is permitted by technology and is actually a form of interaction that occurs while one is at one's home. One might argue against that by saying that the expression is just an adjectival use of a noun; however, the new form of interaction is based on the amalgamation of the two concepts of "home-bank". It is the inappropriateness of crossing two different sorts, not the adjectival use of a noun, that results in the amalgamation.

Home-nursed and home-sick are another two amalgamations. The first expresses the condition where one is nursed at one's own home. The use of the word home is to refer to the place where the act of nursing occurs. To be able to use the expression home-nursed, the action should take place in one's own home. The absence of home disqualifies the use of the expression. Home-sick, however, poses a different dilemma. The cause of home-sickness is arguably the absence of one's home; in other words, someone who is at home should not feel home-sick. The presence of a home counteracts home-sickness.

As a concept and word, *home* in its different amalgamations, combinations and social contexts, perhaps like many other words, prompts a meaning, but does not necessarily hold a fixed one. So far it was established that the concept of a *home*:

a) Can solely and selectively reflect different coexisting entities by the virtue of eliminating contextual factors, e.g. I was back home visiting my parents; I am just back and on my way home.

b) Can form new meanings in combination with other concepts, where the new meaning represents a connection or a tie that does not necessarily exist outside the combination, and is accepted independently, and can jointly produce a newer hybrid concept, e.g. home-page.

c) Can introduce a reference to a new form of interaction that was un-referenced or perhaps non-existent, e.g. home-banking.

d) Can form new meanings by the virtue of its absence, i.e. its absence highlights its specific concepts in combination with other words, e.g. home-sick.

At this juncture, we would like to extend the concept of *home* and its many representations to encompass the concept of intimate space. We will also present the process of amalgamation as a process that structurally links the concept of physical space and virtual space in the same way it arguably links various concepts; however, with the distinction that virtual space is not a space in the same way physical space is. Rather, virtual space is a representation of the amalgamation of concepts. Nevertheless, the representation possesses attributes that permit embodied interaction to a level that reflects the status of an object rather than a representation. Hence, we assert that the concept of intimate space:

a) Can solely and selectively reflect different coexisting entities by the virtue of eliminating contextual factors, e.g. physical space and virtual space.
b) Can form new meanings in combination with other concepts, where the new meaning represents a connection or a tie that does not necessarily exist outside the combination, and is accepted independently, and can jointly produce a newer hybrid concept, e.g. virtual-space.
c) Can introduce a reference to a new form of interaction that was un-referenced or perhaps non-existent, e.g. virtual-environment.
d) Can form new meanings by the virtue of its absence, i.e. its absence highlights its specific concepts in combination with other words, e.g. virtual -'space'.

The previous section introduced the social implementation of the conceptual structure and the process of amalgamation that occurs. The next section will address the image and representation of the conceptual structure.

2.4 Imagination and Phenomenology

This section will address the phenomenological structure of the image of intimate space of which the example is still the *home*. The account of the phenomenology of the image of the home will be based on Sartre's account. The main aspects of this account will be the image's knowledge, affectivity and movement. The section will then be tied to the previous section by introducing the role of the word in the image.

This will also lay the foundation for the next section which addresses the description of the experience of the image.

Home as a concept or word is represented to us in many forms and associations. Linguistically, one might argue these associations are types of metaphors that permit the understanding of one concept in terms of another, however, "the very systematicity that allows us to comprehend one aspect of a concept in terms of another will necessarily hide other aspects of the concept."[47] Moreover, the role of the *home* as a concept might be over shadowed by the use of the word *home*. As a concept, *home* constitutes an ontological setting; hence, the word *home* is used in many cases as an ontological metaphor "to comprehend events, actions, activities, and states."[48]

Others may argue that *home* as a visual concept, could simply be treated as a sign that stands for something and when joined with other notions it becomes a sign "which stands for something other than itself, and the people inhabiting culture busy themselves making sense of those signs."[49] *Home* could be treated as an image that signifies what the notion of a *home* is. Such an image could possibly be handled with semiotics. "Semiology offers analytical tools for taking an image apart and tracing how it works in relation to broader systems of meaning."[50] Semiology, after all, goes beyond compositional interpretation and content analysis of the home, which permits the development of the account of the meaning of the *home*. Rose argues that "semiology attempts to answer the question of how the image makes the meaning, while compositional interpretation is simply descriptive, and content analysis relies on quantitative estimations of significance."[51]

In any case, the study of the meaning of *home* should go beyond the form of a survey to clarify the process that produces the meaning of *home* and the system that operates it.

2.4.1 THE IMAGE OF THE HOME

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47 Lakoff, G. & Johnson, M., 1980. *Metaphors we live by*. Chicago: University of Chicago Press, p.10.
48 *Ibid*., p. 30.
49 Bal, M. & Bryson, N., 1991. Views and Overviews: Semiotics and Art History. *Art Bulletin* 73, pp. 174-208: p.174.
50 Rose, G., 2001. *Visual methodologies: an introduction to the interpretation of visual materials*. London: Sage Publications, p. 69.
51 *Ibid*., p.69.

To clarify the concept of the *home* as well as the word *home*, we ought to examine its referent. Here we attempt to connect the mental through the verbal to the physical *home*. The question extends to three or four different things. The first is my actual home, which is the physical structure that I live in. The second is the thought or concept in my mind which I hold about this home. The third is the verbal description that I utter to someone else in order to communicate an image of my home to him which is the fourth.

Wittgenstein states that "sentences get their meaning by being pictures of the world"[52] –an idea that he subsequently repudiated very forcefully- where facts are the reality behind propositions. The idea behind this claim is to connect an object to its meaning. A proposition representing a meaning is a picture of that meaning and the thought in the mind of the beholder. Departing from this basic assumption, another assumption can be made that the word *home* pictures a reality. Human experience of this reality forms the thought. The word *home* pictures the reality of the home as perceived and stored by the subject. Hence, "a proposition is a picture of reality. [Also] A proposition is a model of reality as we imagine it."[53]

The strength of the word, or at least the proposition, lies in its ability to *unify* the thought behind it and its referent. The character of this process of perception is curiosity and is administered by the thoughts behind language. Heidegger argues that "the basic state of sight shows itself in a peculiar tendency of *Being* which belongs to everydayness –the tendency towards 'seeing.' We designate this tendency by the term 'curiosity,' which characteristically is not confined to seeing, but expresses the tendency towards a peculiar way of letting the world be encountered by us in perception."[54] In a way, what Heidegger implies is that Wittgenstein's reality is modelled in many different ways that Heidegger considers from the subject's point of view. To Heidegger, the metaphysical homliness which characterises Dasein's existence is modelled in different ways that Wittgenstein considers relevant to our expressions.[55] We characterise some of these ways by a certain tendency. The thought is the product of many models of the reality that it attempts to reproduce, or

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52 Wittgenstein, L., 1968. *Tractatus Logico-Philosophicus*. Translated from German by D. Pears & B. McGuinnes 1961. London: Routledge, p. 22.
53 *Ibid*., p. 23.
54 Heidegger, M., 1927. *Being and time*. Translated by J. Macquarrie & E. Roinson, 1993. London: Routledge, p. 214.
55 Mulhall, S., 1990. *On Being in the World. Wittgenstein and Heidegger on Seeing Aspects*. London: Routledge.

represent. Heidegger assigns the value of curiosity to sight as the main producer of images –thoughts. Yet, an image is not necessarily a graphical representation. "Image can signify graphic, optical, perceptual, mental or verbal phenomena."[56] However, the scope of this section is to cover the graphic and optical in order to link them to the mental and illustrate the role of the word in that.

A word like *home* is not expected to precisely signify one version of what we all consider to be a *home*. Thus, my *home*, which I verbally described to two of my friends, would be perceived in two different ways. However, "the ability to visualise something internally is closely linked with the ability to describe it verbally. Verbal and written descriptions create highly specific mental images."[57] On the other hand, and perhaps contrary to the previous statement, the verbal description is the sign of the thought held.

Images conveyed verbally, on the other hand, maintain a great level of subjectivity. A verbal description of a *home* will produce various mental images, while a drawing will arguably produce more consistent mental images. A photograph of a *home* dramatically eliminates the subjective role in conveying details. "For the first time an image of the world is formed automatically, without the creative intervention of man… photography affects us like a phenomenon in nature"[58] The photographic image, still, is a subjective way of conveying the concept, but it is significantly accurate and consistent. "Certainly the image is not the reality but at least it is its perfect *analogon* and it is exactly this analogical perfection which, to common senses, defines the photograph."[59]

The purpose of using verbal description and reproduced images of the *home* is to deliver its mental image from one to the other. In order to better understand mental images we will review Sartre's account of what constitutes the components of a mental image, then apply the home as an example for each of those components.

Sartre identifies four components of a mental image: knowledge, affectivity, movements, and the role of word.

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56 Mitchell, W.J., 1986. *Iconology: image, text, ideology*. Chicago and London: The University of Chicago Press. Cited in Jay, M., 1994. *Downcast eyes: the denigration of vision in twentieth-century French thought*. Berkeley and Los Angeles: University of California Press, p. 9.

57 Rivlin, R. & Gravelle, K., 1984. *Deciphering the senses: the expanding world of human perception*. New York: Simon and Schuster, pp. 88-89.

58 Bazin, André, 1967. The Ontology of the Photographic Image. In H. Gray, ed., *What is Cinema?* Berkeley, CA: UC Press, p. 13.

59 Barthes, R., 1977. *Image-music-text*. Translated from French by Stephen Heath. New York: Hill, p. 17.

2.4.1.1 Knowledge

Sartre maintains that "knowledge in a pure state presents itself as consciousness of relations."[60] What is at hand here is that words when reflecting an image, Sartre argues, do represent order, arrangement and system. A *home* is a concept that by virtue of knowledge can be communicated and entirely apprehended without the help of an image. Hence it exists in a free state which allows me to understand it, should I perceive it in a way other than sensual. The next step is that the knowledge of a *home* is a consciousness of it. It is the intentional act of directing one's thought to the concept of a *home* to which the thought is abstract i.e., without an image. What we are arguing here, is that the concept of a *home* could be abstracted to a minimal level and yet be perceived.

On the other hand, the image of a *home* is dependent on the knowledge of a *home*. This is rather self evident, and we can argue that the concept of a *home* was based on a knowledge. We can also argue that the embodiment of the concept of a *home* as a physical and tangible object came in a later stage, and went under many stages of evolution in the material and immaterial sense. Hence, "an image could not exist without a knowledge that constitutes it."[61]

One might argue that the precedent of a tangible *home* introduced an image that shaped the subsequent knowledge of the concept, but this is not necessarily true. The embodiment of the concept of a *home* constitutes a new knowledge of the concept of the embodiment of a *home*, but not the concept of a *home*. If the knowledge of this embodiment overshadows that of the concept, then the knowledge is characterised by anticipation and is directed towards the concept. The *familiarity* of the image or the embodiment of the concept of a *home* overshadows the intentional consciousness of the concept. Paradoxically, imagination is one of the ways to lead us back to the concept. Sartre also argues that "in the imaginative consciousness, knowledge and intention can be distinguished only by *abstraction*."[62] The abstraction, representation and familiarity will be discussed in depth in the next chapter.

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60 Sartre, J.-P., 1972. *The psychology of imagination*. London: Methuen, p. 64.
61 *Ibid*., p. 63.
62 *Ibid*., p. 63.

Unknown objects or things are presences[63], argues Sartre. We argue that the substantial qualities of things that render knowledge of them tangible are the same qualities that affect the concept of the thing. Substantial qualities of a *home* direct the knowledge of the concept towards an image that negatively affects the concept. We would like to label these substantial qualities as the source of familiarity for an object. "This empty imaginative knowledge occurs frequently in the life of consciousness. It comes and goes without becoming images, but not without having placed us on the brink of the image, properly so called. The subject is not at all sure whether he had a 'vivid image', the 'dawn of an image', or a concept."[64]

2.4.1.2 Affectivity

The second component of a mental image is affectivity. Sartre argues that certain thoughts or feelings cannot occur without reflection. Hatred has to be directed to someone or reflected on someone. He defends his position by recalling the fact that all consciousness is a consciousness of something. The importance of this component lies in its ability to further the knowledge component by applying a behavioural dimension to it. A *home* is not only knowledge I have in mind, and it is not only an image of this knowledge. I am able to reflect on this *home*, and this reflection or feeling will affect my behaviour. A *home* is an intimate or affective concept or knowledge. When home is mentioned in our earlier survey, different behaviours came back as a response, such as sleeping, good food, relax, work …etc. Hence, "reflection yields us affective consciousness. Joy, Sorrow, melancholy are kinds of consciousness. And we must apply to them the great law of consciousness: that all consciousness is consciousness of something." [65]

Affective state or reflection is independent of the image. My feeling of safety or relaxation or my desire to sleep, when I hear the word *home*, or when the idea crosses my mind, is independent of the idea –*my home*. Another example might

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63 *Ibid*., p. 74. We would like to highlight the fact that while Sartre is referring to things as presences, we will label them as phenomena. The major difference is arguably placed on the meaning of, and the perception of a presence and a phenomenon. Consciousness and the thing are two different things for Sartre in that Consciousness constitutes the phenomenon, and is the condition of its presence, whereas for Heidegger, a phenomenon is what is revealed to consciousness. Hence, Sartre applies imagination to consciousness and produces the unreal, which is the image. He refers to it as the unreal because he argues its original intention is an absent object.

64 *Ibid*., p. 75.

65 *Ibid*., p. 76-7.

clarify the idea. Instead of *home*, I propose the idea of *death*. When I hear the word *death*, the first feeling that invades me is discomfort followed by a degree of fear. The feelings above are not related to the concept of *death*, or the word *death* and not even the image of *death*, be it visual, imaginary or mental. "The image is thus considered to be a mental formation which differs radically from affective states, but most affective states are supposed to be accompanied by images, which represent or the desire that which is desired."[66]

Moreover, in the same manner, an image, sometimes, is formed by substantial qualities or familiarity rather than knowledge, feelings or affectivity highlighting the nature of the knowledge of something, which could be positive or negative. "The image is a sort of ideal for feeling; it represents a limited state for knowledge."[67] The mental image of *death* is associated with the feeling of fear, but *death* is absent at the point of mentioning. Hence, the word, mental image and feeling associated with *death* signified its absence. "Let us recall *the essential characteristic of the mental image: it is a certain way an object has of being absent within its very presence*. Here we encounter this characteristic once more and as a matter of fact, this affective-cognitive synthesis we have just described is none other than the fundamental structure of the image consciousness."[68]

2.4.1.3 Movements

The third component of the image is movement. Sartre's account of the importance of movement is based on answering the following question: "how can the movement become the analogical substitute of the object of the imaginative consciousness?"[69] In order to illustrate his account and tie it to the *home*, we will assume that the subject who uses this *home* is blind, to remove sight out of the formula of perception. A blind user's conscious imagination of her/his *home* is based on senses other than sight. Movement plays a major role in this perception. We have three components of this perception. The *home* is perceived by a blind user as a repetitive series of movements and directions. Habits and behaviours, but not visual stimuli, become

66 *Ibid*., p. 80.
67 *Ibid*., p. 80.
68 *Ibid*., p. 81.
69 *Ibid*., p. 81.

associated with spatial movement. The *home* is the first component, while the second is the motor behaviour, and the third component is the imaginative consciousness of this *home*, not its spatial movement..

In the case of the blind user, movement constitutes the user's image of the *home*, which is analogous to sight for a sighted user. The three components above are slightly different for a sighted user; the motor behaviour is replaced by sight. However, motor behaviour adds an extra layer to this imaginative consciousness, which is reflected in a muscular attitude towards the *home*. Examples of this attitude were reflected in some of the responses mentioned in the survey as being the primary characters of the *home*. Hence, "movement can play the role of analogue for an imaginative consciousness. This is so because when a movement is given by sense other than sight, the consciousness that apprehends it is already imaginative and not perceptual." [70]

Motor behaviour is much more implicated in the muscular attitude, which, arguably, renders sight or vision, just an extra enriching factor.[71] To illustrate this point, let us assume that the user is walking in his/her home. The movement in this home directly affects the muscles, hence, the effort exerted by the user to move. Whether or not the home is abstract or full with details would not affect the muscular effort, which is responsible for the imaginative consciousness. "Since the structure of the consciousness of movement is imaginative, it undergoes no modification when the image is richer. The kinaesthetic impression which already represents a visual form will simply function as *representative* of more complex: more will be *demanded* of it, since the knowledge is directed towards a greater number of qualities."[72]

2.4.1.4 The role of the word in the mental image

Finally, while earlier we considered the account of meaning of the word *home* as used on a daily basis, but not necessarily as a symbol that refers to the physical

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70 *Ibid*., p. 91.
71 O'Regan, J.K. & Noë, A., 2001. A sensorimotor approach to vision and visual consciousness. *Behavioral and Brain Sciences,* 24 (5) 939-973.
72 Sartre, J.-P., 1972. *The psychology of imagination*. London: Methuen, p. 91.

object, now it would be important to present the role of the word in producing or relating to images as predicated by Sartre.

Sartre considers the role of the word to be internal to the imaginative consciousness. The main difference between Sartre's position and what we presented earlier is that the word *home* is considered to be representative of the physical object rather than a symbol or a referent, although he states that "words are not images: the function of the acoustic or optic phenomenon which we call the word has no resemblance whatsoever to the physical phenomenon, the picture." [73] The question of this assumption is intriguing for two reasons: a) when a word is the representative of an unknown concept, be it physical or otherwise, the function of representation is not carried out as intended for the word; b) the assumption assumes verbal language, but no other, such as sign or body language.

In the case of a, there are plenty of examples for words with unknown meanings. Such words as verbal or acoustic entities would not represent any quality of the object that is presumably presented by them. The word *home* does not provoke any emotion or intimate feeling unless associated with the knowledge of the concept of *home*. In case b, sign language is a good example of a language that combines hands and lip movement. The acoustic or optic phenomena that constitute spoken and written words are not present in this language. Moreover, in body language the concepts or emotions are translated directly to body action or gestures that relates to the concept. Hence, Sartre's assertion – "the image (mental or otherwise) represents a filled consciousness which can in no way form a part of a large consciousness. But the consciousness of the sign is empty" [74]– is not as close to the function of the word.

The role of image, and therefore imagination, necessitates taking into account the concept, the word and the object of the concept. In order to be able to discuss the concept of *home* in another layer, we need first to briefly introduce to our analysis the descriptive psychology of Brentano.

2.5 Descriptive Psychology

73 *Ibid*., p. 94.
74 *Ibid*., p. 96.

Brentano challenges descriptive psychology with the task of "analysing description of our phenomena i.e. of our immediate experiential facts [*Erfahrungstatsachen*], or, what is the same, of the objects which we apprehend in our perception."[75] He, however, defines phenomena as that which exists in itself, being partly real and partly non-real and as an example he mentions feelings. His description was based on a) describing objects of experience –"Experience is a *fundamental representation with real psychical content* [of the real physical phenomena (objects)]"[76]– b) our original association, c) our superposed presentation, and d) the presentations of inner perception.

An object of *inner perception* exists in itself and, for Brentano, that is what constitutes a phenomenon. Objects of *outer perception* display intentional relations to outer objects depending on correlates that are the condition of perception, and hence, the condition of the existence of the object, although correlates are not real. Real objects depend on correlates, but correlates are not real. Brentano presents mental phenomena as "every idea or presentation which we acquire either through sense perception or imagination".[77] Sartre's imaginative consciousness finds resonance with Brentano's definition of mental phenomena. Brentano suggests two modes of presentation for mental phenomena: *modo recto*, and *modo obliquo*. The former mode refers to objects of our intentions, while the latter refers to objects attributing to the object of intentions. When I think of the *home* of my childhood, then my *home* is present in *modo recto* and my childhood is present in *modo obliquo*. Both modes clarify the way in which phenomena are presented to us mentally.

In order to further clarify the concept we would like to borrow two examples of Brentano's *Sensory and Noetic Consciousness.*

2.5.1 THE CASE OF THE HEADACHE AND PAIN

75 Brentano F., 1995. *Descriptive psychology.* Translated & Edited by B. Müller. London: Routledge, p. 139.
76 *Ibid*., p. 142.
77 Brentano F., 1973. *Psychology from an empirical standpoint*. Translated From German by A. Rancurello, D. Terrel and L. McAlister, 1924. London : Routledge and Kegan Paul. [Originally published in 1874], pp. 78-80.

> "Thus people say, 'I have a headache on the left side and a pain in my foot'. Yet the foot can be amputated and the pain is still perceived with evidence, but certainly not in the foot with evidence, since the foot no longer exists."[78]

This concept can be scaled up to include different types of interaction. The concept of *home* operates in *modo obliquo*. The mode of spatial interaction with any *home* is drawn from the first home. Although the *home* of childhood may not be still physically existent, the effect is still operational. The long lasting effect of the childhood *home* extends beyond its presence. The mental phenomenon of this *home* is present through imaginative consciousness or by perception in earlier stages.

2.5.2 THE CASE OF THE GLOWING COAL

> "If spatial phenomena follow rapidly one after the other, e.g. if a glowing coal is swung around in a circle, instead of seeing motion, we see a glowing circle. It would be a mistake to believe, however, that there is no continuum of temporal modes in this case, instead of a glowing point we see a glowing circle because the major part of the retina is stimulated, But does not change the fact that in the same way as the glowing point appeared to be in motion before, we now see the glowing circle as being at rest, where the state of the rest involves a succession of temporal modes, just as the motion did before."[79]

The *home* of childhood, as a mental phenomenon is similar to the glowing coal in Brentano's example, where the body of the user of this home takes the place of the eye retina. The continuum of temporal modes based on physical and mental actions in this home forms the glowing patterns of embodied actions that form the muscular attitude that is imprinted, and in turn, affects our embodied interaction. In this case, however, the body of the user, and namely the muscular attitude, takes the function of remembering experiences, and in this case, embodied ones.

This section addressed the phenomenological image of intimate space by introducing the phenomenological account of the image as independent of the object of this image. The phenomenological account of the image was then extended to the account of descriptive psychology to further elaborate on the perception of image. This leads to a new juncture where an account needs to be introduced, with which, the *home* as

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78 Brentano F., 1981. *Sensory and noetic consciousness: psychology from an empirical standpoint III.* L. McAlister, ed. Translated from German by M. Schättle & L. McAlister. London : Routledge & Kegan Paul, p. 59.
79 *Ibid*., p. 29.

an object of intentionality of consciousness can be analysed. The reason behind this is the apparent need to acknowledge the limits of mental phenomena in understanding the concept of the *home* based on human senses. Phenomenology, instead, deploys intentionality as a reason and condition of human embodied interaction.

2.6 Phenomenology

This section will introduce phenomenology as the tool that will be used in this investigation. The introduction will include Husserl's, Heidegger's and Merleau-Ponty's accounts of phenomenology.

According to The Oxford English Dictionary (reference) phenomenology (fɪˌnɒmɪˈnɒl(ə)ədʒi) is:

> "The metaphysical study or theory of phenomena in general (as distinct from that of being)"[80]

But generally it is:

> "The division of any science which is concerned with the description and classification of its phenomena, rather than causal or theoretical explanation."[81]

In the context of this study, phenomenology is:

> "A method or procedure, originally developed by the German philosopher Edmund Husserl (1859-1938), which involves the setting aside of presuppositions about a phenomenon as an empirical object and about the mental acts concerned with experiencing it, in order to achieve an intuition of its pure essence; the characteristic theories underlying or resulting from the use of such a method. In more recent use: any of various philosophical methods or theories (often influenced by the work of Husserl and his followers) which emphasize the importance of analysing the structure of conscious subjective experience."[82]

Phenomenology, which comes from German *Phänomenologie*, concerns the study of the essence of objects or entities. Yet, using terms such as object or entities implies a presupposition that restricts the study of these objects or entities. That is why

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80 Oxford English Dictionary O.E.D., (Draft Revision June 2007). Oxford English Dictionary. [online]. http://www.oed.com/ [Accessred 9 October 2007]
81 *Ibid*.
82 *Ibid*.

phenomenology tries to distance itself from any presuppositions by considering any object, entity or imagination as a phenomenon.

In the philosophical context, a phenomenon is defined by The Oxford English Dictionary as:

> "An immediate object of sensation or perception (often as distinguished from a real thing or substance); a phenomenal or empirical object (as opposed to a thing in itself)."[83]

A phenomenon is perceived only by our human body senses. Thus, all that is known about the phenomenon is what we experience using our senses.

This definition is limited and needs more explanation in two directions; the first to clarify the introduction and development of this concept, and the second to shed extra light on the reason for using this method of investigation.

2.6.1 HUSSERL

Phenomenology took its present shape at the beginning of the 20th century with the writings of Edmund Husserl. He intended to develop the "science of Phenomena", a method that was devoid of all presuppositions.

> It makes no difference that phenomenology has to do with "consciousness", with all types of experience, with acts and their correlates; though in view of the prevailing habits of thought, it demands no small effort to see this.[84]

His aim was to set aside the natural attitude of experience.

> … in addition to all other adjustments a new way of looking at things is necessary, one that contrasts at every point with the natural attitude of experience and thought. To move freely along this new way without ever reverting to the old viewpoint, to learn to see what stands before our eyes, to distinguish, to describe, calls, moreover, for exacting and laborious studies.[85]

His mean to achieve this was his method of "Phenomenological reductions"

> … we may set aside the limitations to knowledge essentially involved in every nature-directed form of investigation, deflecting the restricted line of vision proper to it, until we have eventually before us the free outlook upon "transcendentally" purified

83 *Ibid*.
84 Husserl, E., 1931. *Ideas: general introduction to pure phenomenology*. Translated by W.R. Boyce Gibson, 1931. London : Allen & Unwin New York : Humanities Press, p. 42.
85 *Ibid*., p. 43.

phenomena, and therewith the field of phenomenology in our own sense of the term.[86]

Starting by defining *facts* and *essences*, Husserl asserted that "acts of cognition which underlie our experiencing posit the Real in *individual* form, posit it as having a spatio-temporal existence".[87]

Later this spatio-temporal existence develops to become consciousness, and phenomenology becomes the science of the essence of consciousness; a science that uses the method of phenomenological reduction, *Epoché* or *εποχη,* and applies it to objects of "pure" consciousness, or *transcendental Consciousness*.[88] *Epoché*, however, is not to be confused with removing positivist preconceptions to create a science "free from theory or metaphysics". It is, merely, baring *Dasein* (spatio-temporal existence) from using any judgment.[89]

Husserl states that "in its *widest connotation* the expression "*consciousness*" (Bewusstsein) includes *all* experiences (Erlebnisse)"[90] and he went far, while trying to define the essence of *consciousness,* by assigning an ontological characteristic to it, "*being of its own*", that is not affected by the *phenomenological disconnexion*.[91] As an operation, to exercise full consciousness renders the *phenomenological region* accessible to us.[92] Husserl is trying to depart from Descartes' *cogito*, "I think", by proposing that a wider sense is implicated in it by Descartes himself. *Cogito*, Husserl argues, includes every case of "I perceive, I remember, I fancy, I judge, feel, desire, will"[93] and all experiences of the Ego. The objective qualities of an object (colour, texture…etc) and its objective relation with the Ego (distance, space occupied…etc) is *something which is perceived*, *cogitatum*. The perception of the object and the awareness of the perceptual experience of the object (perceiving the perception of the object) is a conscious experience *cogitatio.* Thus, Husserl redefines *cogito* as "I have *consciousness* of something", "I perform *act* of *consciousness*".[94] He also adds a different dimension to his concept by extending it from conscious awareness of

86 *Ibid*., p. 43.
87 *Ibid*., p. 52.
88 *Ibid*., pp. 112-4.
89 *Ibid*., p. 111.
90 *Ibid*., p. 113.
91 *Ibid*., p. 113.
92 *Ibid*., p. 114.
93 *Ibid*., p. 115.
94 *Ibid*., pp.115-119.

perceptual experience to conscious recollections, representations similar to recollections, and also in the free play of fancy.

2.5.2 HEIDEGGER

Heidegger developed Phenomenology. He expanded and refined its applicability. He proposed "Dasein"[95] existence, [literally "to be there"] or being, as a conscious body. Heidegger explains the entity that exists in its time: "Dasein is the entity which I myself am in each instance[96]." He suggested that we need to understand the essential structure of "Being-in-the-world" to achieve a proper account of meaning for its spatiality, and tried to analyse it from an ontological point of view, from the point of view of this entity. The fundamental character of Dasein, which is 'to be it in its each particular instance (of time),' must be maintained, therefore the first step will be to let this character be derived from Dasein itself.

The essential structure of "Being-in-the-world", Heidegger argues, is constituted in space. "Being-in-the-world" is being within space.[97] Space is constitutive for the world. It follows naturally that within the various conditions of being-in-the-world, there are subjective measures of human experience that hierarchically reintroduce or reorganise space. This thesis argues that the reorganisation of experiential space places intimate space at the top of this hierarchy. *Home,* arguably, is one instance of space characterisation which introduces a host of bodily modes of interaction. The higher the intimate space is on the scale of intimacy, the stronger its connection to the embodied mode of interaction. Hence, Heidegger's assertion that 'space is constitutive for the world' can be extended to human experience. Space is constitutive of human experience, and intimate space is constitutive of intimate experience.

As an instance of intimate space, home can be experienced in two different ways. The first is being *ready-to-hand* which describes the home as the object of human experience as revealed before any others; that which is 'close by'.[98] Hence, *home,* as an object of experience that is *ready-to-hand* has the character of

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95 Heidegger, M., 1927. *Being and time*. Translated by J. Macquarrie & E. Roinson, 1993. London: Routledge, p. 83.
96 Heidegger, M., 1985. *History of the concept of time: prolegomena*. Translated by T. Kisiel. Bloomington: Indiana University Press, p. 152.
97 Heidegger, M., 1927. *Being and time*. Translated by J. Macquarrie & E. Roinson, 1993. London: Routledge, p.145.
98 *Ibid*., p. 135.

'closeness' in terms of concern with it. Heidegger, uses the notion above, and attempts to contrast it with another notion which is '*present-at-hand*'. To Heidegger, equipment has its position in space as *present-at-hand*, and when installed and fitted it becomes *ready-to-hand*. Heidegger's example of equipment was the hammer, however, as a tool used by Dasein, a hammer occupies space and so does a *home*. We argue that *home* is an instance of intimate space, and its intimacy stems partially from the fact that it is constantly *ready-to-hand* within human experience. Space shifts from being the constitutive of being-in-the-world into becoming a tool of being characterised by intimacy; a tool that is *ready-to-hand*.

Heidegger argues that *readiness-to-hand* has the character of *inconspicuous familiarity* which implies that we act oblivious to the objects familiar to us. Intimate space is inconspicuously familiar to us with its constancy, and immediacy. Heidegger's phenomenology considers spatiality an important aspect of human experience that should not be concealed in objectivity.[99] Such concealment renders space primitive. It follows naturally that objective space cannot be intimate space. *Subjectivity* uncovers reality, and *readiness-to-hand* canvasses the experience of reality.

> *The circumspective de-severance of Dasein's everydayness reveals the Being-in-itself of the 'true world'--- of that entity which Dasein, as something existing, is already along side*.[100]

Being-in-the-world redefines the involvement with space and permits intimacy. Accordingly, virtual space is a mode concerning inconspicuous familiarity of experiential space. Dasein's subjectivity in this context uncovers reality by what Heidegger describes as spatial encounters of entities in a manner that comports itself de-severantly towards the entities.

The Heideggerian account of phenomenology addresses the basic entity of being in the world and its intentionality of consciousness, however, the phenomenology of perception is further explored by Merleau-Ponty. The next section will use his account to advance Heidegger's account on how we encounter other entities in space as explained above.

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[99] *Ibid*., p. 418-21.
100 *Ibid*., p. 141.

2.6.3 MERLEAU-PONTY

Through reading Merleau-Ponty, consciousness can be defined as a state of *being-in-the-world* in which we assign meanings to objects beyond the actual properties perceived by our senses. Any sensory data is perceived data which complies with a system of perception, with which the body can sense phenomena in the world and assign meaning to it. The projection of ideas and experiences is a key attribute of consciousness.[101]

According to Merleau-Ponty, "Our own body is in the world as the heart is in the organism."[102] In other words, our embodiment in the world constructs physical interaction because our recognition and interpretation of this interaction is embodied. Our bodies are implicated in our experiences. But most importantly, our bodies are the truth of all perceived things, and we use this truth to relate to the perception of space and of the object on one hand and the spatiality of the object and its being on the other hand.

The interaction of our bodies with other objects is the generator of our experiences which is the general frame for our conscious actions. The experience of our body teaches us that space is embedded in existence. The background of this frame is perception. We use our perception to perceive this vast field of objects that surrounds us, being aware that, in turn, we are being perceived as objects by others.

Descartes asserts "an object is all that which can be defined by a certain shape: something which can be confined by a certain place, and which can fill a given space in such a way that every other body will be excluded from it"[103]. Thus, space is an attribute of objects, which can be divided into numerous subdivisions, such as "Spatiality of situation"[104]. This attribute, we will be looking at later, is an essential notion to the construction of the argument and development of the understanding of the body's attitude in its interaction with space. However, it should be separated from the Cartesian notion that the perception of objects is by the perception of space they are in or occupy.

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101 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge. [reprint 2003], PP. 77-171.
102 *Ibid*., p. 235.
103 Wilson, M.D., ed., 1969. *The essential of Descartes*. Mentor Bk: New American Library, p. 172.
104 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge. [reprint 2003], p. 114.

Merleau-Ponty develops Husserl's notion of conscious awareness and recollection of perceptual experience in two different ways. The first is by starting from the position that the importance of human body is not in its spatiality, rather, it is in how this embodiment is inflicted on space. Therefore, to Merleau-Ponty, Heidegger's Dasein is not a body in space; rather, space is embodied by Dasein's embodiment. The second is that the bodily being or the bodily spatiality dictates the perception of 'objective space', which indirectly, renders space subjective.

Embodied space is a space of motor and perceptual habits, Merleau-Ponty argues. The inconspicuous familiar to Heidegger becomes a bodily extension from Merleau-Ponty's point of view. The immediacy between the body and its instruments renders the instruments an extension of the body. Embodied space, we argue, is an extension of the body's immediate space which when encountered with constant perceptual and motor habits becomes intimate space. Therefore, intimate space is an extension of one's own body, by the virtue of its instrumentality, the body that is.

Finally, the implications of the *home* as a physical structure have strong associations with its ontological character. The physical *home* acts as the first extension of our own physical being. Lakoff argues that "we are physical beings, bounded and set off from the rest of the world by the surface of our skins, and we experience the rest of the world as outside us. Each of us is a container, with a bounding surface and an in-out orientation. We project our own in-out orientation onto other physical objects that are bounded by surfaces."[105] The first bounding surface we project onto is our *home*. The interaction with this physical environment forms the spatial experience and, therefore, concepts that we constantly live by. Hence, the *home* is the most basic and constant phenomena -physical space- that shapes our experience.

The amalgamation of attributes, that were mentioned above, of the notion of the *home* suggests the need for an acceptable theory to discuss and clarify it. Johnson and Lakoff suggest that "any acceptable theory would need to explain, in addition to standard problems (e.g. synonymy, referential opacity, indexicals, etc.): categorisation, schemata, metaphor, metonymy, polysemy, and semantic change."[106]

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105 Lakoff, G. & Johnson, M., 1980. *Metaphors we live by*. Chicago: University of Chicago Press, p. 29.

106 Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press, p. 191-2.

Hence, the *home* could cast a shadow on the *unhomely*; the human experience of having an intimate space that is *home*, some might argue, may be replaced by "IN-OUT schemata that emerge first in our bodily experience, in our perception and movement."[107]

The next section will address the phenomenology of the *home* by resuming and developing the previous accounts of *home* as a concept and image. The phenomenological account will be extended to the consideration of Gaston Bachelard's *poetics of space* as one of the few examples of intimate experiential space.

2.7. Phenomenology of the Home

This section will discuss the phenomenology of the home as an intimate space in an effort to produce an experiential image of this intimate space. The produced image will maintain the experiential side of human experience of intimate space. The account of this experience will be drawn from Gaston Bachelard's description of the *home* in his book '*the Poetics of Space*'. Bachelard's description will be analysed to isolate his arguments concerning intimate space. The arguments will then be discussed and the discussion will be used to construct a 3D model of Bachelard's home. The model will be made available for interaction in a 3D virtual environment and will be setup for subjects in a small experiment which will lead to discussion in the subsequent section.

2.7.1 PHENOMENOLOGY OF THE HOME

The *home* is arguably a narrative device referring to the human physical being (embodiment) as perceived, memorised, and projected with relation to time, which constitutes an ontological setting in which our lives begin and unfold. Its aim is to provide a coherent, systematic account of meaning for our perception and a platform for investigating all aspects of being in all other forms of existence that may help in understanding our existence and add to our knowledge.

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107 *Ibid.*, p. 34.

In order to understand the "existential spatiality" of the body, we have to understand the structure of its being or existence. Philosophy tends to draw on many dichotomies. Rationalism, defended by philosophers like Descartes, Spinoza, and Leibniz who believe that the source of knowledge is reason, and Empiricism, introduced mainly by Bacon and supported by Locke, Berkeley, and Hume, argue that the source of knowledge is mainly the senses.

Kantian philosophy, acting as a critical philosophy, introduced what was thought to be a comprehensive theory to combine, more to criticise, the previous theories by introducing apriori / apostoriori sources of knowledge. This philosophy pushed Idealism forward by retrieving Plato's metaphysics. Idealism was developed from Kantian philosophy by Fichte, Shelling, and especially Hegel who developed what was called Hegelian Idealism and what he called Metaphysical Idealism.[108]

Inline with OED's definition, a *home* is a dwelling-place. Heidegger makes the distinction between dwelling and building in that "the latter has the former as its goal."[109] Both concepts are related to the concept *home*, but are not necessarily the same thing. To clarify the point Heidegger asserts that: "The truck driver is at *home* on the highway, but he does not have his shelter there; the working woman is at *home* in the spinning mill, but does not have her dwelling place there; the chief engineer is at *home* in the power station, but he does not dwell there."[110] Hence, the act of *dwelling*, *belonging to*, *finding refuge in*, *resting* or *nurturing* has a domain that extends beyond the built environment, in which a *truck* for a driver is a *home* because he is familiar *with* it, in his element *in* it and unconstrained *by* it. But still, it is not a dwelling place.

A home, in this case, becomes the familiar place you belong to and identify with; the familiarity that forms your frame of reference. Hence, a *home* is a frame of reference but this is not to infer that it should be fixed and unchanging. The frame of reference is, at its deep route, constantly changing an adapting new elements and components. However, a constantly changing *home* maintains a level of consistency that is always pushing boundaries into becoming something new; a hybrid of the

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108 Russell, B., 2000 *History of western philosophy.* 3rd ed. London: Routledge Classics. (First published in 1946).
109 Heidegger, M., 1971. Building dwelling thinking, in *Poetry, Language, Thought*. Translated from German by A. Hofstadter. New York, NY: Harper Colophon, p. 145.
110 *Ibid*., p.145.

home and many other things. Heidegger points out that this process might cause the disappearance of the home:

> "Emigrating from what is homely to what is unhomely. There is a danger that what was once called home will dissolve and disappear. The power of the unhomely seems to have so overpowered humanity that it can no longer pit itself against it."[111]

At this point we have to recall the process of amalgamation that was earlier applied to the concept of *home*. This process is evident through everyday life within the actual *home*. We will start with the expression *home*-banking. The expression suggests a new type of interaction that takes place in the home as a result of advanced technology. Hence, the actual home is a place where the spectrum of activities that can take place in it, is constantly increasing by virtue of technology. The amalgamation of home and technology has produced a form of interaction that is attributed to the home. A different form of activity is watching television at home. Watching the horse racing on television at home frames the real experience of being at the track of the race, and transfers it to the domain of the home. The home, in this case, becomes a type of horse racing track. Hence, the amalgamation of two different activities permitted by technology introduces a new concept that transforms the home into something hybrid. Technology permitted the introduction of websites and *home*-pages. Technology also permits virtual environments where one can *meet others*, *buy*, *sell*, *make* or *lose money*, *collaborate* and *join* teams…etc. Technology also permits virtual-homes, where one can virtually *dwell*, *belong to*, *find refuge in*, *rest* or *nurture*. In a similar way to what we find in the expression '*home*-sick', i.e., the fact that it is characterised by the absence of a home, this new form of homes, virtual homes, is characterised by the absence of home in its physical form. The interactions that occur in a home is present in a virtual home, however, the absence of the actual home results in a modified form of interaction in the virtual home. Temptation may lead us to compare both home-sick, and virtual-home to highlight the fact that the former is the impact of the absence of a physical home on human physical actions or experience, while the latter is the impact of the absence of the physical home on human virtual actions which is a different type of experience. Hence, generally even when taking into consideration Heidegger's concern over the *unhomely*, it only exists

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111 Heidegger, M., 1936-53. Gesamtausgabe. [Online] (Updated 10-11-2005)
Available at: http://www.freewebs.com/m3smg2/HeideggerGesamtausgabe.html [Accessed 10-5-2007].

because of the *home*. Therefore, the condition of the presence of the *unhomely* is the absence of the *home*. Studying such phenomena requires the science of phenomena, or phenomenology.

Phenomenology "is thus a distinctive *how of research.* Objects come to be defined just as they give themselves. What investigation is required to hold to is the task of presenting the subject matter in question."[112]

Phenomenologically, we can reduce a home to being home-within-the-self because the essence of being home is a component of the self and from the self, it extends to apply to almost anything. Its absence is also marked as having impact on the self. However, this entity is certainly initiated and affected by many factors. Questions that may arise are: what constitutes one's first home, or what constitutes a functionally affective home? The answer to which is two fold: the home as an image, and the home as imagination. What is on offer here, is a better understanding of what constitutes the image of a home, or what presents the image of a home. By image, we mean any form of representation held by human experience. In order to present a better understanding of what constitutes a home, one ought to understand how the concept of the *home* reveals itself to us, and how we encounter a home with our bodies. Thus, Gaston Bachelard's view of intimate space such as the childhood home will be presented and discussed in what follows.

2.7.2 MODELLING OF BACHELARD'S HOME

The next task in this analysis would be to present a phenomenological image of the *home* as phenomenologically daydreamt and analysed by Bachelard in his *Poetics of Space*. This process involves identifying his assertions regarding the physical *home* and interpreting them in an attempt to clarify the understanding of the concept behind the assertion and whether it is a physical or mental phenomena, the image used in the assertion and the underlying concept of embodied being from a phenomenological point of view. The last condition assumes no presuppositions.

The ideas motivating this endeavour are, first, that the concept of *home* in *Poetics of Space* should be disentangled, to permit a better understanding of the

112 Heidegger, M., 1999. *Ontology: the hermeneutics of facticity.* Translated by J. van Buren. Bloomington, Indiana: Indiana University Press, p. 59.

specific physical space in light of phenomenology; second, that the presentation of these arguments should be made in such a way that the subject is visually aided in absorbing and comprehending the concepts asserted by Bachelard by implementing virtual reality techniques. Thus, explicitness regarding the phenomenological methodology towards the content of the arguments, and informativeness in the representation of their mutual interdependence, are the two principles which the section attempts to introduce.

The aim is to introduce an understanding of Bachelard's *intimate space* to serve as a map for explorations intended in subsequent sections. Finally, understanding Bachelard's *intimate space* aims to be the ground for a phenomenological understanding of embodiment in virtual space that would be impossible otherwise, tracing the occurrence of concepts, propositions and much more regarding the nature of arguments, across virtual space and virtual environments.

The method followed in the phenomenological analysis of Bachelard texts consisting in separating various statements, and then dedicating each statement to a different aspect of Bachelard's *intimate space*. There are thus the following aspects in Bachelard's *intimate space*: original expression, the translated text, the mental phenomena of descriptive psychology –and whether or not there is a relationship between it and the image associated with the mental phenomena– and the physical phenomena from a phenomenological standpoint.

Early in the planning of this investigation it was decided that a guiding principle should be the avoidance of adopting translations. Original language holds deeper meaning, while relying on the translated version could potentially result in part of the meaning, being lost in translation as a result of using different potential translations for the same corresponding word. An example of such loss would be the translation of the word *home*. The word *home* is central in the analysis of Bachelard's phenomenological exploration. Although the words *home* and *house* are often used interchangeably, the nature of the topic demands careful use and a clear distinction between both. Hence, adopting a single translation of the word is important in forming the analysis.

For example, the following sentence on page 32 of the French version

features the expression '*la maison natale*'

> «Mais au delá des souvenirs, la maison natale est physiquement inscrite en nous. Elle est un groupe d'habitudes organiques. »[113]

To which the corresponding translation in the English version is '*the house we were born in*' which is on page 14.

> "But over and beyond our memories, the house we were born in is physically inscribed in us. It is a group of organic habits."[114]

The expression, however, appears numerous times in the French version, yet, in some cases the English version features the following translation '*the childhood home*'. For example

> «On peut faire la démonstration des primitivités imaginaires même sur cet être, solide dans la mémoire, qu'est la maison natale.»[115]

Which is translated into:

> "A demonstration of imaginary primitive elements may be based upon the entity that is most firmly fixed in our memories: the childhood home."[116]

In the previous example, the word *maison* was translated to *home* and *house*. The expression '*la maison natale*' was translated into '*childhood home*' and '*the house we were born in*', and could also be translated into '*the nativity home*'. The use of the word *house* shifts the emphasis from the notion to the physical object, while the use of the word *home* restores a general sense of the notion.

Moreover, the translation of the expression to a third language, namely the researcher's native tongue, results in even more complications, however, '*the house we were born in*' in this case appears as an absurd translation.

Accordingly the French published version will be adopted as the source of this analysis, yet, the English translation from French by *Maria Jolas, Beacon Press Boston* will be used to aid and provide a English source.

2.7.2.1 Phenomenology of Imagination

113 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p 32.
114 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 14.
115 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 45.
116 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 30.

Gaston Bachelard, in his book *"The Poetics of Space,"* examines the way our perception of our intimate space – Childhood Home – shapes our thoughts, memories, and dreams. Though he used poetry, and sometimes folktale, to shape his argument, and analysed these using psychology, they were only tools that he utilised to point out the hypothesis he wished to define. His argument had two directions. The first tried to prove that bodily experience, not only mind, is the memory keeper of space, and the second was a metaphorical one. This second argument was that the home is the first cosmos[117] of its inhabitants, and thus, is the point of reference of their understanding for all other spaces.

This phenomenological understanding of the primary world view (cosmos) creates the account of meaning of this cosmos. This account of meaning shapes the subsequent knowledge of other spaces of any larger cosmos. These two ideas work as a bridge connecting the rituals and habits that develop the intimacy to space, with imagination of our spatial experience. Though the basic description of space is based on bodily or spatial elements, this tends to dissolve into habits and actions of everyday being-in-the-world, and this level connects to Heidegger's description of the existential character of human space, yet with his rejection to the presupposition of a spiritual element to human being.

The only resonance we can find in Bachelard's *Poetics* is in the notion of changing one's nature. According to this notion, a real space and a virtual space are the same in the way we understand and analyse. A real space is a space of our usual sensibility, and changing this space introduces a new innovating space. Thus, a *home* is a physically innovating space. The state of consciousness is the state often used to describe physical awareness of being-in-the-world. Altering this state or changing the consciousness of certain relationships established in our minds and projected onto our environment is the key to define the level of intimacy. We intend to explore the level intimate interaction with *home* whether it is a physical object, verbal presentation, mental concept or a phenomenon in the broader sense of human experience.

The arguments extracted from the text will build a mental model of

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117 According to The Oxford English Dictionary, Cosmos is: 1. the world or universe as an ordered and harmonious system. b. transf. An ordered and harmonious system (of ideas, existences, etc.), e.g. that which constitutes the sum-total of 'experience'. 2. Order, harmony: the opposite of chaos. transf. stands for transferred sense.

Bachelard's experiential home. Thus, the home will start from the original corner in the world.

> "Dans toute demeure, dans le château même, trouver la coquille initiale, voilà la tâche première du phénoménologue." [118]

> "In every dwelling, even the richest, the first task of the phenomenologist is to find the original shell."[119]

Bachelard psychologically highlights the nature of the concept of the *home* as the object of the act of dwelling. The original association is with the act of dwelling, but not with the physical object. At this point, the multiplicity of representations of this physical object, or the non-real pervasive part is not to be accounted as a different correlate. A *home* as a concept is based on the act of dwelling regardless of the actual superposed forms of physical homes that exist. Inner perception of a *home* is related only to the act. Bachelard also highlights the role of a phenomenologist in discovering through all these layers of outer perception, inner perception, correlations, and acts, the original shell of dwelling.

The inner perception of dwelling is a feeling, and the original shell is the body that feels. The act of dwelling is an act of nurturing. The body is the first object of dwelling, and nurturing. Hence, a *home*'s original shell is the body. The body is the original container of the act of dwelling, and with this container starts the original boundary. This is further supported by the following statement.

> "Car la maison est notre coin du monde. Elle est --- on l'a souvent dit --- notre premier univers. Elle est vraiment un cosmos. Un cosmos dans toute l'acception du terme. Vue intimement, la plus humble demeure n'est-elle pas belle?»[120]

> "For our house is our corner of the world. As has often been said, it is our first universe, a real cosmos in every sense of the word. If we look at it intimately, the humblest dwelling has beauty."[121]

The act of dwelling develops from being associated with the *original shell* into being associated with the *immediate* world, or, according to Brentano, immediate experiential facts [*Erfahrungstatsachen*]. While Heidegger's *Dasein* (*Being*) is *being-in-the-world*, Bachelard's *original shell* is central in his *corner of the world*.

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118 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 24.
119 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 4.
120 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 24.
121 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 4.

The use of the term ‘corner of the world’ could be criticised for holding the presupposition of the existence of a bigger world, or a whole world of which our corner is only a part. However, the same presupposition is justified when assuming that this corner is the *original shell*. The attribute of originality holds the value of primacy which constitutes a reference point. In turn, this reference point develops from being experiential, which implicates human body, into being spatial, which implicates the space where the experience occurs. The *entity of being* or the human embodied consciousness extends beyond the barriers and borders of the body into the surrounding space by deploying senses in meaningful acts, the first of which is the *original* act of dwelling. The originality stems from the fact that dwelling is the condition of *being* in a space; it is also the condition of the occurrence of other acts. What needs to be highlighted here is the dynamic nature of the act. The scope of application is diverse, and the scale is multiple. Dwelling is concerned with the human body (as a reference point), the original shell, the corner of the world and the world in general; at the same time, it is concerned with consciousness, sensory perception, intentionality and conscious interaction.

Consequently, Bachelard points out the indefinite or inconclusive nature of intimate experience of being in a home.

> “On pouvait bien jadis trouver la mansarde trop étroite, la trouver froide l’hiver, chaude l’été. Mais maintenant, dans le souvenir retrouvé par la rêverie, on ne sait par quel syncrétisme, la mansarde est petite et grande, chaude et fraîche, toujours réconfortante.»[122]

> “In the past, the attic may have seemed too small, it may have seemed cold in winter and hot in summer. Now, however, in memory recaptured through daydreams, it is hard to say through what syncretism the attic is at once small and large, warm and cool, always comforting.” [123]

The nature of involvement with intimate space is one that is immeasurable. This is mainly due to the fact that intimate experience is immeasurable. What Bachelard is arguing for in his statement is that it is the very nature of experiencing space intimately that we remember, but not the details of this experience. The image of experiencing space intimately, whatever this image might be, recaptures the concept

122 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 29.
123 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 10.

of experiencing space intimately. The very act of experiencing space intimately can be applied to the cold or warm space, small and large space, or comforting space. The argument is that the act of '*being*' in '*being-in-the-world*' is the act that determines the intimacy of '*the-world*', hence, being as an entity and being as an act are combined in exerting intimacy to the world which can be any kind of object with various qualities.

However, Bachelard tries to limit the sense of generality in his account by introducing some schematic qualities of intimate space.

> «La maison est imaginée come un être concentré.» [124]

> "A house is imagined as a concentrated being." [125]

The first schematic quality is the description of *being* as *concentrated*. Intimate space possesses the quality of what Bachelard described earlier as '*la coquille initiale*'. In this shell, and as the schematic quality suggests, actions are concentrated in terms of time, as Bachelard stated earlier, and in terms of space. The very acts that ritualise the connection with any space and make it intimate are both concentrated and timeless. Thus, an intimate space is a referential and inferential space in terms of its spatial reference to human actions, and its spatial implications on human actions. Bachelard's account of intimate space, *home*, is based on the schematic centrality of this space.

However, this schematic centrality should not limit other schematic qualities of intimate space. Accordingly Bachelard suggests another quality.

> «La maison est imaginée comme un être verticale.» [126]

> "A house is imagined as a vertical being."[127]

The second schematic quality is verticality. Bachelard's account of the verticality of the *home* can be due to the general nature of human embodiment. Verticality is an indicator of directionality, which is central to the notion of orientation. As an entity, intimate space possesses a vertical quality to enable human embodiment to be maintained. The ability of a human to carryout activities in an intimate space where s/he is sheltered and protected, but still standing up, is the crux of the verticality.

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124 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 35.
125 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 17.
126 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 34.
127 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 17.

The schematic qualities of an intimate space are not limited to spatial or embodied acts. Bachelard argues that they exceed them into dreams.

> «La maison natale est plus qu'un corps de logis, elle est un corps de songes.» [128]

> "The house we were born in is more than an embodiment of home, it is also an embodiment of dreams." [129]

This statement presents conflicting messages, but the essence of this statement is perhaps better understood if one is to read them in a slightly different context. In the earlier section about the social concept of home, the idea that amalgamating two different concepts could introduce a new concept, or an image that whispers the existence of a new concept. In that case, the new concept is understood because of the amalgamation of images. In his statement, Bachelard admits to a subconscious understanding of the concept of home. A home is understood as a concept and object by the amalgamation of other images, namely dreams.

The idea behind this claim is not only Bachelard's statement, rather, rhetorically the concept that virtual space is an amalgamation of images, and some might argue that it is amalgamation of dreams, but it permits the understanding the concept of space, or it embodies dreams to form a virtual space. The way we encounter this concept or those dreams, and perhaps the way these dreams are revealed to us, determines the nature of our involvement with the space in them, be it phenomenological or otherwise. Hence, the previous statement and the following one clearly argue that the way we encounter *home* or our intimate space is not as a physical object, rather, as images of interaction and involvement because the way we encounter the home is based on our experience of it, because we are phenomenologists.

> «Cette nuance psychologique : « Nous aurions dû écrire cela », nous pose phénoménologue de la lecture. Tant que nous n'accédons pas à cette nuance, nous restons psychologue ou psychanalyste.» [130]

> "The psychological nuance: "I should have written that," establishes us as phenomenologists of reading. But as long as we have not acknowledged this nuance,

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128 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 33.
129 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 15.
130 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 38.

we remain psychologists, or psychoanalysts." [131]

We, as phenomenologists of our intimate space, embark on a Heideggerian conquest of exploring space. Dasein's involvement is based on time, nevertheless, in space that is experienced and memorised. Bachelard finds his own way of plotting the home in Heidegger's construct about being.

> «Dans ses mille alvéoles, l'espace tient du temps comprimé. L'espace sert à ça.»[132]

> "In its countless alveoli space contains compressed time. That is what space is for." [133]

The *being* of Dasein in time is compressed within its intimate space. Intimate space compresses time, and therefore compresses experience. It follows naturally, that if intimate space compresses time and experience, then it should be possible to *decompress* time and experience, and this is precisely the point that Bachelard is advocating: it is possible for Dasein to decompress time and experience in intimate space. This decompression of experience could release images of intimate space. As a result, the images of intimate space could permit the psychological study of this intimate space.

> «La topo-analyse serait donc l'étude psychologique systématique des sites de notre vie intime.»[134]

> "Topo-analysis, then, would be the systematic psychological study of the sites of our intimate lives." [135]

Bachelard's account permits the use of images of intimate space to enable the study of this space. We will use this account in decompressing the images of Bachelard's intimate space.

The arguments extracted from Bachelard's account and statements above present to us the conceptual experience of intimate space. Bachelard addressed the concepts and not the physical implications. The following part below will resume the account of Bachelard by addressing the physical aspects of the involvement with intimate space.

> «Mais au delá des souvenirs, la maison natale est physiquement inscrite en nous. Elle

131 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 21.
132 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 27.
133 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 8.
134 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 27.
135 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 8.

est un groupe d'habitudes organiques. »[136]

"But over and beyond our memories, the house we were born in is physically inscribed in us. It is a group of organic habits." [137]

This statement introduces another dimension in Dasein's experience of intimate space. This dimension relates Dasein to its intimate space through interaction. The interactive connection reproduces space as its object. Consequently, an intimate space of interaction during childhood is a space that shapes the human basic actions and interactions.

Intimate space compresses time and experience; equally, time and experience could be decompressed. Bachelard introduces another way of decompressing time and experience, through embodied interaction. Time and images although consciously compressed in space, are unconsciously compressed in the form of habits and interactions that can, arguably, decompress experience of intimate spaces.

These organic habits are most evident in the childhood home where our bodies are shaped and affected by the environment surrounding us.

«La maison natale a inscrit en nous la hiérarchie des diverses functions d'habiter.»[138]

"The house we were born in has engraved within us the hierarchy of the various functions of inhabiting." [139]

Bachelard, in one further step, argues that we reflect the childhood home in our interaction with all other spaces. The reflection is in terms of perception and interaction.

«Nous couvrons ainsi l'univers de nos dessins vécus. Ces dessins n'ont pas à être exacts. Il faut seulement qu'ils soient tonalisés sur le mode de notre espace intérieur.»[140]

"Thus we cover the universe with drawings we have lived. These drawings need not to be exact. They need only to be tonalised on the mode of our inner space." [141]

The tonalisation of space is to fit our concept of space which is formed by the childhood home. Tonalisation is akin to the sense of familiarisation. Hence, the latter

136 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 32.
137 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 14.
138 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 32.
139 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 15.
140 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 30.
141 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 12.

is one of the characterisation of the former in terms of space. Interaction is tonalised, and perception is maintained as in the original shell that became the original concept engraved in us. This perception of space is maintained in a specific manner.

> «Et l'on trouverait mille intermédiaires entre la réalité et les symboles si l'on donnait aux choses tous les mouvements qu'elles suggérent.»[142]
>
> "And indeed we should find countless intermediaries between reality and symbols if we gave things all the movements they suggest." [143]

This manner of preserving space is interaction, or perhaps what Bachelard refers to as the movement suggested by things. Space and its image, or symbol as described by Bachelard, are perceptions of habits and behaviour that preserve interaction. Even when the space is gone, its images or symbols remain.

> «Ainsi, par-delà toutes les valeurs positives de protection, dans la maison natale s'établissent des valeurs de songe dernières valeurs qui demeurent quand la maison n'est plus.»[144]
>
> "And so, beyond all the positive values of protection, the house we were born in becomes imbued with dreams values which remain after the house is gone." [145]

So the value of protection develops into the object of protection and from that object symbols and images are developed of various interactions and experiences. The perception and interaction is the essence of phenomenological perception.

> «La phénoménologie de la rêverie peut démêler le complexe de mémoire et d'imagination. Elle se rend nécessairement sensible aux différenciations du symbole. La rêverie poétique, créatrice de symboles, donne à notre intimité une activité polysymbolique.»[146]
>
> "The phenomenology of the daydream can untangle the complex of memory and imagination; it becomes necessarily sensitive to the differentiations of the symbol. And the poetic daydream, which creates symbols, confers upon our intimate moments an activity that is polysymbolic." [147]

Interaction with intimate space, or the virtual space that represents it, could explore the multi-layers of the experience of space. However, the intimacy is a factor of affection with space or attraction to it.

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142 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 30.
143 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 11.
144 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 34.
145 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 17.
146 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 42.
147 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 26.

> «Il n'y a pas d'intimité vraie qui repousse. Tous les espaces d'intimité se désignent par une attraction.»[148]
>
> "There does not exist a real intimacy that is repellent. All the spaces of intimacy are designated by an attraction."[149]

Hence, the experience of intimate space in a virtual world may first require the symbols and images of this intimate space, in order to enable their use as symbols of that intimate space. It may also require enabling interactions that are available in that intimate space. The result of extracting these arguments is to aid in re-enacting an intimate space as expressed by Bachelard.

2.7.2.2 From Written aid into visual aid

Creating 3D models is becoming a more and more standard practice. There are many applications that require these models to aid in producing enhanced outcomes, or speed up the process involving this production. Virtual environments are also permitting a new level of interaction with 3D models whereby a user can interact in a way similar to interaction with real life objects. Creating a model of an existing space may prove to be useful in more than one way.

In order to validate the use of Sartre's components of the image, decided to produce a 3D model of a corridor.[150] The purpose behind this was to build a 3D model of an existing space that is used by a group of people on a daily basis. The choice of a corridor came for many practical reasons, perhaps the first of which is that it attracts many users. The second reason is that corridors are usually narrow which results in a narrow field of vision for those using the corridor. The vanishing point in a corridor is trapped at the end of those long lines that form between the joints of walls, floors and ceiling. Finally, a corridor permits a limited number of interactions by user. Most of the corridors allow users to pass through from one point to the other. Hence, modelling a corridor would be a relatively easy task since the

148 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 30.
149 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 12.
150 The department of Architecture at the University of Edinburgh is homed in two old, but adaptively reused buildings; namely Minto house, and the Maltings. Level four of this the Maltings is the home of postgraduate researchers of architecture. The level is mainly a long corridor with doors on both sides leading into office spaces.

visual field is not wide, and users who will interact with it, will have a limited space of interaction and limited actions to carry out.

Sartre's proposed components of an image were used in constructing the model of the corridor. *Figure 3* shows the abstract 3D model of the corridor, the photo-real model of the corridor, and the photo-real model projected onto the real corridor respectively.

Figure 3. a) the abstract 3D model of the corridor, b) the photo-real model of the corridor, and c) the photo-real model projected onto the real corridor

The real corridor was entirely blocked with a big white screen at the chosen point. Sitting on the other side of the screen was a projector connected to a computer projecting the 3D virtual environment of the corridor.

The first knowledge of the corridor existed for all the users of that corridor. The affectivity for those users were not necessarily the deciding factor, since the feelings and desires are not the main factor in the image of a corridor, however, movement was a strong indicator of the level of realism.

The process of amalgamation that occurred in the third image entailed joining two phenomena that represent one object, namely the corridor. The manipulation occurred when both space and time were compromised. From the point of view of a user of this corridor, who happened to be walking there at that time, the corridor was present as an embodied phenomenon. Both space and time were the same. The strength of amalgamation is that the user of the corridor could not detect the point of amalgamation. Hence, the difference between what is known and what is new was not clear. The 3D environment of the corridor thus far introduced to us the possibility of an image being a strong representation of an idea.

We would like to consider the white screen, which blocked the corridor, and on which the 3D virtual environment was projected, to be frame zero of the virtual environment, and the real corridor. We would like to argue that this is the *original shell* that Bachelard was talking about. It is the point at which amalgamation occurs between two different phenomena. The reason behind our assertion is the fact that when the *original shell* comes into the domain of the known, reality becomes different, and embodiment loses its originality. Amalgamation is strongly dependent on Seamlessness.

2.7.3 VISUALISING BACHELARD'S HOME

Bachelard's daydream is both a tool and a method of imagining. A daydream as a tool highlights the intentionality of the act of daydreaming, and implies it is in *modo recto*. As a method it is the *modo obliquo* that is highlighted in the act of daydreaming. In order to be able to interpret this imagination and discuss it, we ought to understand the system of imagination that Bachelard deploys to produce this image. What is startling in Bachelard's imagination of a childhood home is that it resonates with Sartre's image components.

For example, Bachelard asserts that the home is a body made up of images from our memories, and according to Sartre, memories are the recorded results of experience. Hence, memories are the form of *knowledge* necessary to compose an image for a home. The knowledge Bachelard refers to is not necessarily a logical or rational one; on the contrary, the image has to reflect the *daydream* Bachelard often referred to. This knowledge of the *home* is the first knowledge obtained by our senses; hence it registers the main characteristics of the first *cosmos* from a phenomenological point of view.

According to Sartre, affective states are supposed to be accompanied by images or desires. [151] This statement assumes an active role by the subject of Sartre who is expected to exert feelings and desires, whereas for the subject of Bachelard being a *daydreamer* rejects Sartre's presupposition and escapes into a passive role where the subject experiences the home as it is revealed. Bachelard's position is in

151 Sartre, J.-P., 1972. *The psychology of imagination.* London: Methuen, p. 80.

favour of permitting the act of daydreaming to develop an affective state. Hence, an image of a *childhood home* should possess the knowledge of the home, and the feelings and desires associated with that home.

Bachelard adds another layer to this image. The layer of movement which is the same component Sartre uses for his image. The childhood home, according to Bachelard, is a group of *organic habits*[152] that we apply to all other spaces. Moreover, as we grew up, our *childhood home* shaped our bodies and therefore, our embodiment preserves this home. We exert these habits and muscular attitudes on other phenomena whether physical or mental.

The role of the word in this image is already evident in Bachelard's writings that characterises the home of being the *original shell*. Designing Bachelard's *home* should incorporate his two '*principal connecting themes*':

> "A home is a vertical being rising upward and appealing to our consciousness of verticality. A home is a concentrated being appealing to our consciousness of centrality."[153]

For example, the nature of the image is verticality which is the result of 'polarity created by the cellar and the attic'. Bachelard also assumes that the image of a *childhood home* is that of a three story building or a one with four but no more. The home will have stairways that support its verticality and gives it the sense of orientation. Such a home is capable of preserving the fundamental principles of distinguishing and classifying the values of intimacy. [154]

The image of Bachelard's *childhood home* could be something similar to the sketch in *Figure 4* It presents a cross section that explains the verticality of the home. There are three levels; the first is formed by land to reflect the nature of the cellar as a space that is mainly bound by the ground. It also captures the attempt of a cellar to connect the home to the ground. The irregular shape of the ground is often cured by having the cellar. The irregularity is mainly a feature of the ground rather than the home.

The second level is what Bachelard refers to as the ground floor. The sketch captures the characteristics of this space as being the intermediate space between

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152 Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France, p. 32.
153 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press, p. 17.
154 *Ibid.*, p. 27.

both the cellar and the attic. It is the space in-between.

The final level is the attic. In the same manner a cellar is an attempt to connect the home to the ground, an attic is a similar attempt, but to relate the home to the sky. It also protects the home by keeping it warm and by sheltering those inside from rain.

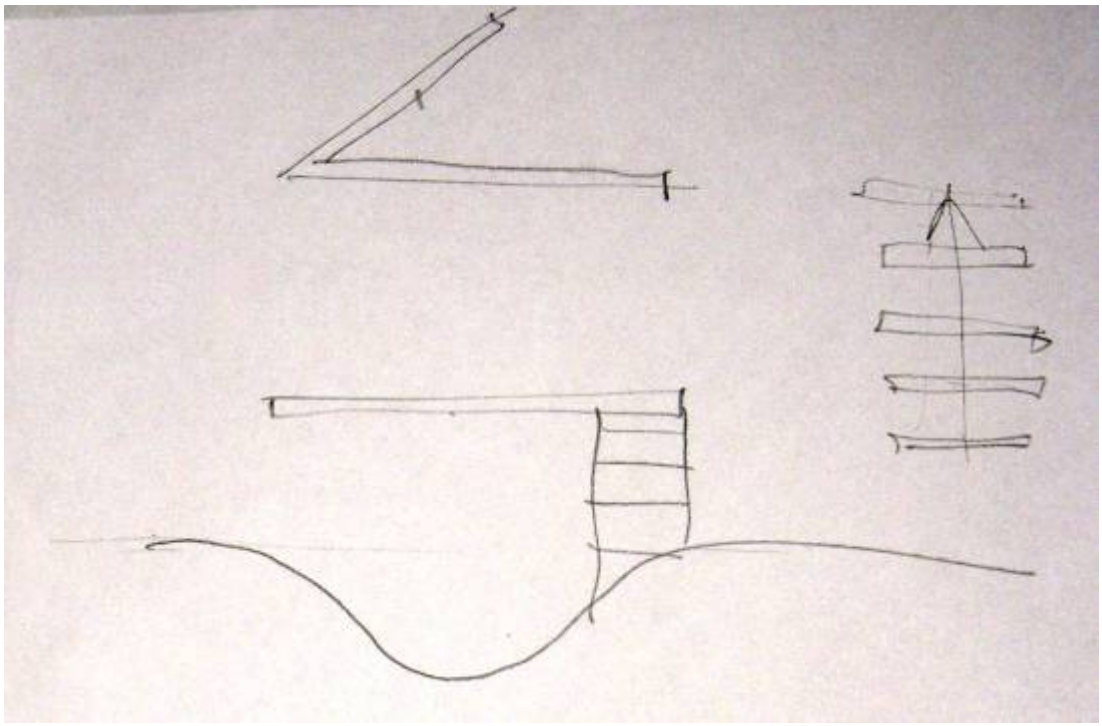


Figure 4. A sketch depicting a cross section of Bachelard's childhood home

The sketch is minimalist and abstract in a way that attempts to defy any familiar detailed image of a home. The home sketched above is an attempt to transform Bachelard's statements into visual elements, while maintaining no presuppositions other than what he uttered; hence the ground, the cellar, and the attic with its pointy roof.

At this juncture, it would be of great benefit to develop this sketch 3Dimensionally to instantiate Bachelard's idea of the home. This will take into consideration the fact that the design is meant to be used in a virtual environment (VE). Perhaps it is better not to use the term *virtual world* as it means that there are many users, and that each one of them is participating in this shared virtual world.[155]

155 Fors, A.C. & Jakobsson, M., 2000. Beyond use and design: the dialectics of being in virtual worlds. *Internet Research 1.0: the state of the interdiscipline*. Lawrence, KS, USA.

To suggest a virtual representation of a functional physical space imagined by Bachelard is not an easy task. The first logical question that comes to mind is: why do we need to model physical elements that have no function in a virtual environment such as the ceiling the wall … etc? Why do not we design it according to its utility or its functionality?

Often, designers in VE tend to create photorealistic 3D environments to prove that VEs are images or representations of real physical phenomena. The VE acts as an image of a mental phenomenon that exists in the mind of the designer. From a conceptual point of view, aiming for a target that is unachievable will always result in a compromised position. Given the state of technology, photorealistic environments seem far from true. Moreover, real environments have many restrictions and limitations that would add an unnecessary burden on VE. The multi sensory way we experience the world is hugely compromised when using a VR because technology, thus far, cannot embed more than visual or sonic elements in VE.

But Bachelard suggests the childhood home is inscribed in us, thus, any instantiation of his home should be based on the daydreamer's image of a childhood home, but this image is far from fantasy, and it departs from reference points that are inscribed in us. This view is coherent with Heim's[156] and Andres's[157] views that reference points to reality are important in virtual reality, and that the lack of such clues of how to interact with the environment will render it functional.

One might say that a virtual home in a virtual environment will not have an ecosystem that will necessitate having elements to shelter users from this ecosystem. However, Bachelard's image of his childhood home mostly conveys this home's affectivity as a shelter protecting Bachelard against this ecosystem. Sheltering is one of the main values attached to a home.

3D studio Max was used to construct the 3D model of Bachelard's childhood home. The general rule in the design of this home was to follow Bachelard's assertions, and the second was to avoid any presuppositions. Hence, the model had three levels including a cellar and a garret. The basement did not fit into a regular

156 Heim, M., 1998. *Virtual realism*. New York: Oxford University Press.

157 Anders, P., 1999. Envisioning cyberspace: the design of on-line communities. In J. Beckmann, Ed. *The Virtual Dimension: architecture, representation and crash culture*. New York : Princeton Architecural Press, pp. 218-233.

piece of land. The house has transparent glass sections as well as normal walls. The stair case is external. The roof is not a pointed roof. The three levels are conjoined and over look one another.

The medium of Macromedia Director's Shockwave 3D[158], due to Shockwave's standard specifications and the increased computational power of the average PC, exposes a series of 3D animation strategies and a real-time physics simulation engine (Havok).

Figure 5. The sketch depicting the cross section is developed into a 3D cross section.

In the 3D VE representing a corridor that was mentioned previously, the fact that it had a narrow field of vision due to its width resulted in less possible movements within the physical corridor and consequently, fewer interactions with the virtual corridor, i.e. a user standing in front of the screen that has the corridor VE projected onto, does not have many options in his movement, whereas, a user of Bachelard's home has many options that include movement up and down the floors, and also in and out of the virtual 3D model of the home.

158 Macromedia Director MX, Macromdia,Inc. 1984-2002. [http://www.macromedia.com/].

This Shockwave 3D environment works with concepts of the model, movement, interaction and frames. It is possible to "jump" from one frame to another. It is also possible to overlay frames. Hence, the interaction is controlled to create the effect of transposition movement between specific points. The outcome is a linear movement that changes the user –camera– view from one point to the other in the home. The movement is triggered by a keyboard controller.

2.7.3.1 The experimental setup

The procedure of this experiment comprised instructing 9 users of an office space to sit down in front of the window in that space. At the same time, a projection of Bachelard's home, as devised above, is made available for interaction as a virtual environment. The environment is projected onto the glass bounded by the window frame. The transparent glass is covered with a white screen fitted on the outside. Subjects are asked to navigate through the virtual space using mouse clicks that create a smooth movement through key points in the environment. The experiment is followed by a semi-structured questionnaire/interview.

The aim is to create an amalgamation in the space of the experiment that might result in the user having the illusion of being in Bachelard's home. In order to achieve that aim, the frame metaphor was extended to a consideration of a room in the Architecture building[159], data projecting the 3D VE onto a window in the room (*Figure 6*). The actual window is covered by a screen. Upon activation, a series of movements are triggered causing the camera location within the 3D VE to change. The aim of this setup is to create the illusion that the user is looking *through the window* into the home of Bachelard instead of *looking at the window* to see what is projected onto it. The 3D VE projection, meanwhile, is progressing up towards the garret of Bachelard's home to a window presented in the Shockwave 3D "attic" space. Both windows –the virtual window and the real window that holds the projection– are identical. At the precise moment of projection when both windows coincide or overlap, the projection is extended to the rest of the wall to imply that the space is being augmented into being Bachelard's attic.

159 Architecture Building, (Minto House), School of Arts, Culture and Environment, University of Edinburgh.

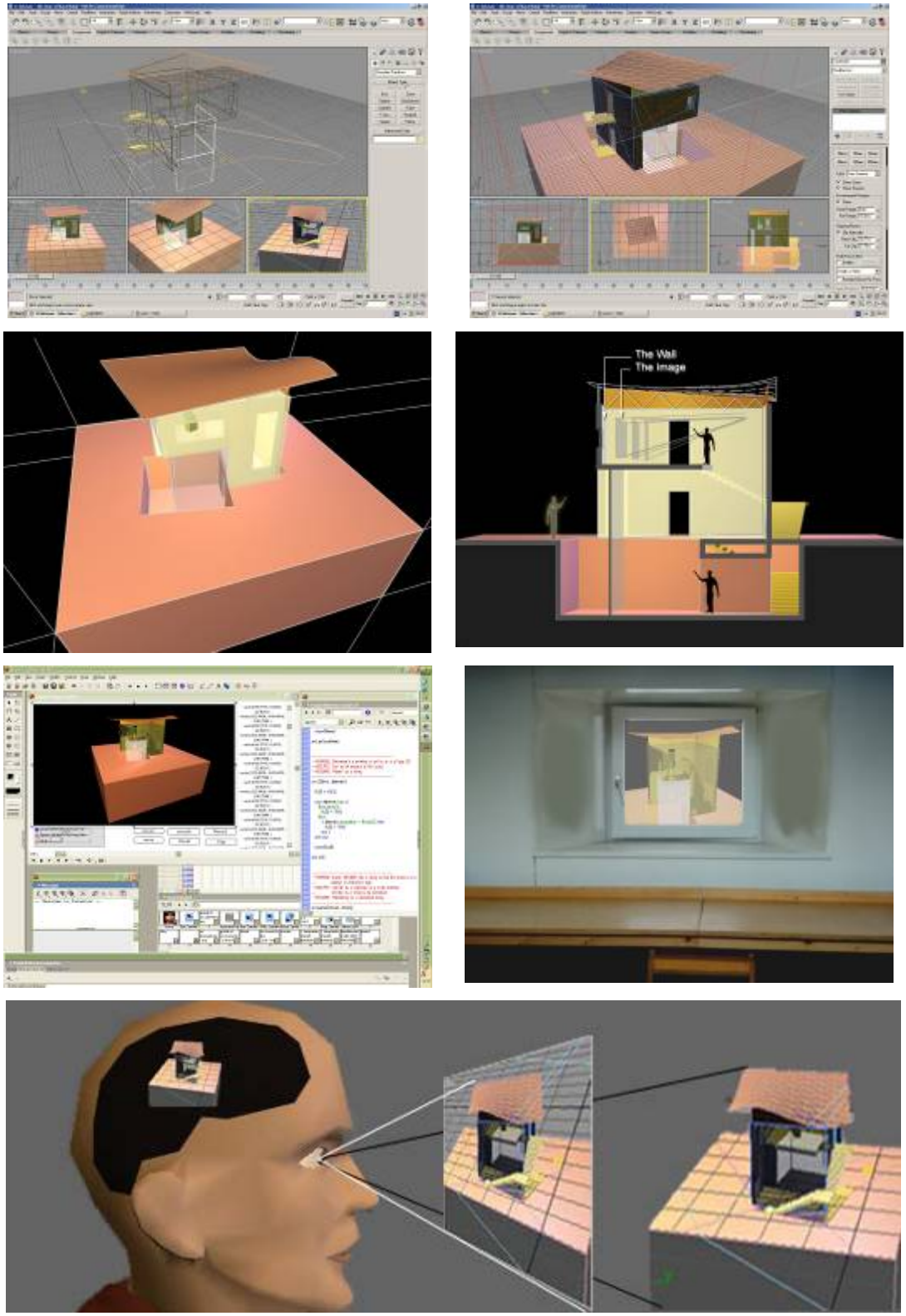


Figure 6. a & b) the 3D model is created using 3Ds Max , c & d) the model is rendered and exported as a virtual environment, e) using Macromedia Director's programming language, the model is made available for interaction, f) the model is projected into the real window, and g) the three elements of the image.

The user of this amalgamated space, which is stapled by the overlapping real and virtual window, will sense a familiarity with it, though the user is perhaps struck by the mismatch between the virtual nature of the medium and their bodily awareness. The user's physical presence is perhaps reduced and moved into hardware and software. The sense of recognition is suspended and the spatial phenomenon reduced to concepts of digital interaction.

The projected transparent visual realm animation will allow users to interact directly with their environment, drawing on the power of metaphorical association between the image (projection of a window) and the surrounding augmented physical space. Different interactions are available, such as opening the virtual window or closing it, or opening a blind — simple prototypical micro-event that we may have performed many times before, and that frames our experience and structures our space for the moment.

In this case, the window – virtual or real - is the boundary of amalgamation. What we are trying to do is to take the same perceptual act and offer different possible interpretation to it. The real window is present, and the virtual window is perceived in the same way. The corridor, in the previous case, is present and the projected corridor is equally perceptually present. What is seen through the real window could not necessarily be distinguished from what is projected onto the window. This process of baring judgement is the same process of amalgamation that conjoins factors and results in the process of comparison that maybe simplifies understanding, but makes it tangible.

This process of translating a mental phenomenon from one type of representation into another and reconstructing interaction by deploying real space into a virtual space as a type of amalgamation highlights issues of familiarity, interaction, augmentation, the virtual, narrative and metaphor. A phenomenological understanding of such interventions helps to develop an understanding of digitally mediated spaces. The emotional level of users' responses will decide the degree of their awareness of the augmentation of the space. On a different level, the way they respond verbally after using the space, will represent the way they are using this space from a psycholinguistic aspect. Narrative is a way of authorising ourselves,

and the space as a language can be discussed in the same manner.[160]

The familiar, homely event of opening a window is rendered strange, and consequently gives us a new understanding of the spaces we inhabit. The next challenge is to analyse subjects' interaction to see what narratives of augmentation (metaphors) emerge. The task will then be to apply multi-user interaction to MMPORGs, to see how such experiences are negotiated collectively, and through digitally-mediated communications.

2.8 Discussion

The power of phenomenology stems from the fact that this account of interaction and what follows from it is based on the human experience of a home. It is not dependent on the home itself, and it is definitely not dependent on a user other than the daydreamer of the home. This is the strength of the account of meaning of Bachelard.

The shift of focus from the home to the user of the home introduces to us an experiential value which is taken from the home and preserved in the user. The following analysis deploys users' accounts of this experience in order to inform the basis for discussion.

2.8.1 A COPY OF REALITY

The relationship between the real window and the virtual window is based on that between an original object and one of its copies, not its images. Although no specific terminology was introduced to subjects to use in describing objects of the experiment, almost all subjects referred to the physical window with the word 'real'. When asked about the reason subject X referred to the window as "the original 'real' window", he said: "*Because the original 'real' window is very well known to me*". Knowledge of the *original* gives it its primacy over subsequent similar objects. In the same spirit, a *childhood home* earns its originality, hence its primacy by the virtue of the early knowledge associated with it. It is the first prototypical space that humans

160 Words used in language can express how we perceive things (i.e. visually orientated people will say 'I see' and 'Picture the scene…', while audio orientated people will say 'I hear what your saying', 'it rings a bell', and 'Have you heard the news?', These responses translate human perception of space, 'space as a language'.

grow up with. When revisiting Bachelard's expression in French, *the childhood home* was the translation of '*La maison Natale*'. Perhaps another plausible translation would be the *native home*. *Native* and *original* are two concepts that are concerned with introducing objects as they are first encountered. Phenomenology, in that sense, is the science of the original or native.

Another subject R kept referring to the '*copy*' of the original window. Her reference implied strongly that her perception was hugely concerned with finding the type of connection that joins both windows. She said: "*I instantly realised that it is a 'copy' of the original 'real' window*". The process of cognition was geared towards analysing the components of the projection, and finding the connection. The original window is imagined in *modo obliquo* rather than *modo recto*. The emphasis is placed on the new phenomenon. The intentional consciousness of the virtual window is concerned with the virtual object or the copy, but not the original object.

This intentional consciousness is based on the knowledge of the object of the experience, but it does not highlight the feelings or desires invested in this object. Needless to say, Bachelard's account is hugely dependent on feelings and desires. As a result, a copy of an object does not necessarily posses the same emotional value of the original object, although it may be perceived in the same way, and perhaps sometimes it may allow the same interactions.

2.8.2 NOSTALGIA

The relationship between the real or original, and its copy develops into an interactive account of nostalgia. According to OED, nostalgia is the acute longing for familiar surroundings, especially homesickness.[161] The Greek origin of the word consists of two parts: νόστος which if written in Latin characters is *nostos* which means "returning home" or "the journey to home", and άλγος which is *algos* in Latin characters, and means "pain" and in particular, emotional pain.[162],[163] The subject's account of nostalgia brought into light an interesting account. The first feeling when

161 Oxford English Dictionary O.E.D., (Draft Revision June 2007). Oxford English Dictionary. [online]. http://www.oed.com/ [Accessred 9 October 2007]

162 Giannakopoulos, P.E., 1994. *Lexiko tis Arhaias Ellinikis Glossas*. Athena: Pelekanos, p. 257. In Greek: Γιαννακόπουλος, Π. Ε. 1994. *Λεξικό της Αρχαίας Ελληνικής Γλώσσας*. Αθήνα: Πελεκάνος, p. 257.

163 Vlahou, V.P., 1996. *Ta Rimata Omala kai Anomala tis Arhaias Ellinikis*. Athena: Gutenberg, p. 394. In Greek: Βλάχου, Β. Π. 1996. *Τα Ρήματα Ομαλά και Ανώμαλα της Αρχαίας Ελληνικής*. Αθήνα: Gutenberg, p. 394.

seeing the virtual window is "*nostalgia of interacting with that window for four and a half years of life*". The nostalgia as a form of missing interaction coincides with Bachelard's account. The "organic habits" inscribed in our bodies manifest in actions or interactions with space as and its objects. The introduction of a virtual space, or a virtual window for that matter, permits certain interactions with space, but denies us other forms of interaction. It is precisely these forms of interaction that we are denied, which provoke nostalgia. Accordingly, virtual space representation of space has two major characteristics:

1- A conceptual characteristic whereby space as a concept is amalgamated in a way that produces a new object (copy of the original) which permits specific interactions provoking the sense of familiarity with the object.
2- An emotional characteristic whereby the lack of the ability of virtual space to fully substitute the physical space provokes the nostalgia for the original space.

Intimate space provides interaction for an extended period of time which makes its absence an absence of these interactions. We argue that nostalgia is the delayed part of human intentionality. Intentionality as a character is manifested in our interaction with space. Nostalgia is the acknowledgement of the intentionality of interaction with space although the space and interaction are not there anymore.

2.8.3 FUNCTIONALITY

The childhood home had specific functionalities, acting mainly as a shelter. The virtual window in this intimate space was first acknowledged for its similarity as an object of the real window. The acknowledgement was then extended to the interactions offered by the virtual window, and interactions that are not offered anymore. However, the functionality of the window did not feature prominently in this discussion. Perhaps there was an underlying assumption that the virtual window would not function in the same way the original window did. This view might be intrinsically true in the nature of the relationship between any original and its copy; any idealised object and its instances. The childhood home offers a fundamental functionality that cannot be replaced by subsequent homes. Intimate space, accordingly cannot be copied. Creating an instance of an idealised concept will

present you with a copy that does not provoke the intimacy provoked by its original; however, it provokes nostalgia for the interaction with the original. One subject resumed his account about the virtual window by discussing its functionality: "*but the original 'real' window was more of a temperature control device than a light control device*." This acknowledgement of the functionality is triggered by the perceived limited capability of the virtual window. Another subject touched on the same issue, but by contrast, her view was that the virtual window may be more capable of certain functions than the original window: "*yes, it lets in light ... both when open and closed ... perhaps even more so than I felt the original 'real' window had done*".

The functionality of the virtual window, therefore virtual space, may be better in some aspects, and may be worse in others. The judgement is perhaps related to the output of interaction with the virtual window in terms of that specific functionality. When the virtual window was viewed as a temperature control device, it was viewed as a somewhat useless device. However, when it was viewed in terms of its light control functionality, the virtual window was a better device than the original one. The element of functionality is separate from the element of interaction. This is mainly due to the fact that interacting with an object, space in this case, does not necessarily require the use of its functions. Yet, the way we encounter space independent of the use of its functions is another idea that was evident in the accounts of users.

2.8.4 PRESENCE

The attributes of the idealised window or intimate space combine more than appearance, functionality and nostalgia to interaction. The attributes include other aspects that are present among the surroundings. It seems that the vicinity of an experience forms a significant part of this experience as much as the object of the experience does. This environ is composed of both perceptions of any sensual stimuli and interactions with any objects. For example, one of the subjects made a comment on what he perceived to be the missing element in his experience of the original window.

"*Why was there no Swiss flower box of red geraniums at the window?*"

To this subject, the experience of the original window included other objects perceived in its vicinity. The absence of these objects discounts the experience. Moreover, the presence of these objects modifies the experience of the idealised object. Perception of intimate space is modified by the perception of objects in this space. Hence, they are treated as attributes of this space, or attributes of intimacy. This is evident in other accounts as well. For example, one of the subjects expressed her feeling of the absence of another aspect of her experience. She said "*the projection does not include the sounds of music from the 'Seven Sisters' Pub and the roars of spectators celebrating a World Cup final goal*". What the subject is missing here is a sound that she perceives when sitting beside the window. This sound forms a part of the perception of the window and experience of space. Having no sound leads to an incomplete experience of the window or its surroundings. The same is possible for the intimate space. Yet, the subject's account did not merely highlight the absence of the sound; rather, it is the social context that this sound signifies. It is also the temporal and emotional experience that relates the subject through sound from the window to another crowd gathered in a pub. A window has this basic attribute of connecting two different spaces, however; in this case the window presents the best metaphor in connecting two contexts. Moreover, intimate space has this power of relating its users to each other and to other objects in its vicinity. When a virtual space is displayed out of context, it loses this element of the presence of social context. Although this is true to almost anything, perhaps this is better articulated by the account of this subject:

> *"The projection displaces my feelings and emotions away from the original 'real window' which I know so well."*

Hence, the presence of perceptual stimuli and interactive objects form the context of intimate space and presents to us another challenge in the virtual copy of space.

The account of interaction with virtual objects develops into another interesting criterion of anticipation of the known and the unknown.

2.8.5 ANTICIPATION

Intimate space presents a template for interaction with other spaces. This template is based on the anticipation of all the previous aspects mentioned above. However,

anticipation in a virtual environment extends to the unchartered area of the unknown. This is evident in the accounts of some of the subjects. For example, one subject gave rather a philosophical reflection on the nature of the interaction with the window. His reflection highlighted, among other things, the sense of uncertainty of what a copy of a known object might offer to him. The account is interesting because of the contrast between stating what is missing in a copy, and then stating the anticipation of the unknown in the same copy.

> "*The window is very similar to the threshold or entrance from Plato's cave into the realm of light above*."

The realm of light reflects the unknown territories the virtual window separates the subject from, yet, it offers him, at the same time, a chance to explore it. Intimate space is well known to us, however, the presence of virtual intimate space offers us another chance to explore it, perhaps, with a lower risk factor.

Another look at the accounts of anticipation guides us to a contrast of a different character. Embodiment features in this dichotomy in the form of the self.

> "*I would like to see and understand what is being reflected in the window pane (The reflection is most intriguing). Is it the 'I', the 'moi'?*"

The dichotomy is about whether the virtual window is a copy of the real window, or a simple reflection of the self. The reflection of the self is one of the major aspects of any intimate space. This reflection is perhaps first formed in the childhood home. The introduction of a virtual space reflects a new era in the realisation of space, however, this era does not necessarily deal with the 'I'.

The discussion highlighted several factors that subjects associated with the virtual window. These factors will inform any further experimentation that is going to take place in the subsequent chapters. However, it is important to conclude this chapter with several findings and points.

2.9 Conclusion

At the beginning of this chapter, the basic position that was put forward is that intimate space is a common feature of both real and virtual space by the virtue of the amalgamation of concepts and the familiarity of image and embodied interaction.

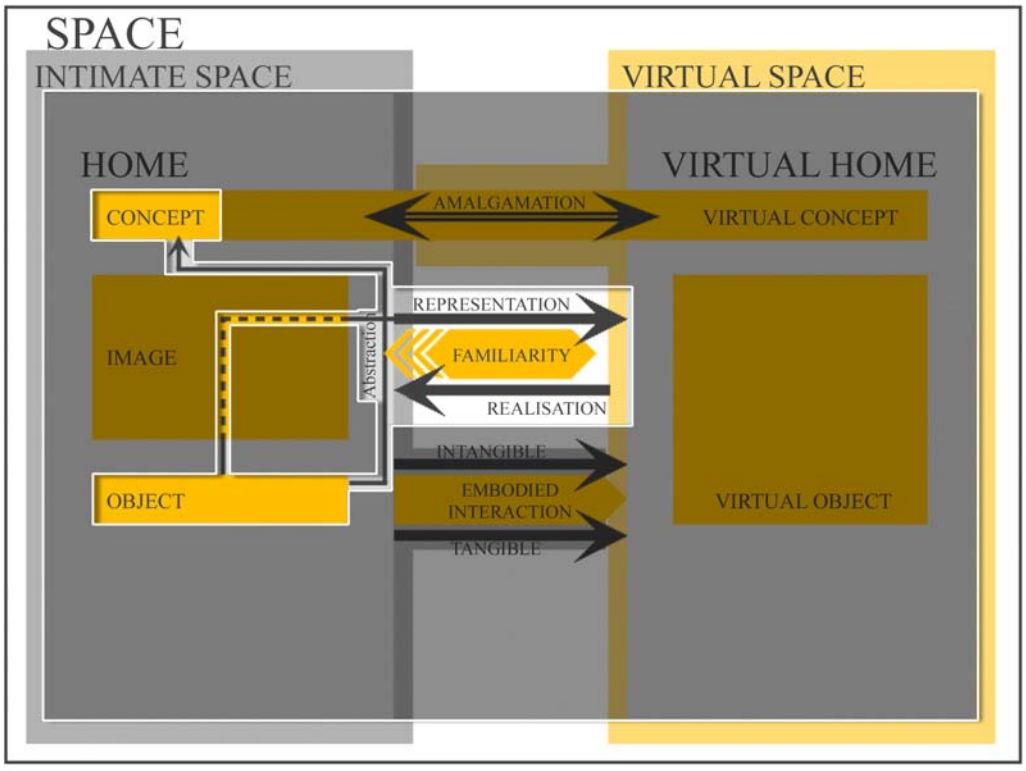
The analysis of this position demonstrated various aspects of the relationship between the intimate space and its users. The complexity of the concept was demonstrated in the responses from subjects and the scope of topics that were included. Accordingly, intimate space and virtual space are characterisations of space on the basis of perception and interaction.

Therefore, perception and interaction will form the basis of the extended exploration and research that will be carried out in the subsequent chapters. First, the perception of space, space abstraction and representation will be contrasted with the intentionality of human experience. As a result, a better understanding of the perception of familiar space will be the next step in experimenting with this perception in order to explore and identify the intangible interaction and cues of immersion in virtual space.

Ethics and *Scale* are treated as the framework that guide the cues of immersion and, thus, are explored according to this attained status. Not only is the perception of scale explored, but also the interaction with multiscale virtual environments.

Abstraction, Representation and Intimate Space

The Familiarity of the Perceptual Image



3.1 Introduction

This chapter argues that familiarity is the tool that enables the conceptual amalgamation to be introduced and understood by asserting attributes, qualities and associations using the two processes of abstraction and representation. Familiarity in this context is independent from embodied interaction, and is crudely based on the connection between the images of the amalgamated objects. The chapter proceeds by introducing the attributes, qualities and associations of the image of an object, and develops two procedures to isolate these attributes, qualities and associations in order to achieve the abstraction. Later the abstraction is used alongside the representation of virtual/space to argue for the case that familiarity operates between images, however, embodied interaction is somewhat independent of this familiarity.

Perhaps when Richard Garriott[164] first coined the term Massively Multiplayer Online Role-Playing Game (MMORPG), he did not anticipate that in less than a decade one of the role-players or participants in such a game would become the first millionaire[165] as a result of playing their role. MMORPGs are highlighted as a powerful medium for interaction through mediating between different players. To better understand the process of mediation via virtual environments, we first need to recall the definition of virtual environments, world and reality. Ellis defines "Virtual environments as interactive, virtual image displays enhanced by special processing and by nonvisual display modalities, such as auditory and haptic, to convince users that they are immersed in a synthetic space".[166] According to Chen,[167] virtual environments, although ranging from text-based to reality-enriched cyber-cities, are characterised by two major aspects: construction and interaction.[168] Both Ellis and Chen highlight the sensory quality in their definitions. Although virtual environments

164 Wikipedia, the Free Encyclopaedia. 2003. *Richard Garriott*. [Online] (Updated 21 Mar 2009) Available at: http://en.wikipedia.org/wiki/Richard_Garriott [Accessed 10-04-2008]
165 Hof, R., 2006. SecondLife's First Millionaire. *BusinessWeek*, [internet] 26 November. Available at: http://www.businessweek.com/the_thread/techbeat/archives/2006/11/second_lifes_fi.html [Accessed 20-03-2008].
166 Ellis, S.R., 1994. What are virtual environments? *IEEE Computer Graphics and Applications*, 14(1), pp. 17-22.
167 Chen, C. (1999). *Information Visualisation and Virtual Environments.* Singapore: Springer-Verlag London Limited.
168 *Ibid.*, p.175-176

and virtual worlds are generally confused[169] with each other, the later is defined by Pratt *et al* as "an application that lets users navigate and interact with a three-dimensional, computer-generated (and computer-maintained) environment in real time"[170], while Jakobsson states that "A virtual world is a synchronous, multi-user system that offers a persistent spatial environment for iconically represented participants".[171] According to the first definition, a virtual world is a system of interaction characterised by the immersion of users in 3D graphics. The second definition however, highlights the temporal and spatial nature of virtual worlds, and introduces the embodied representation of users. Virtual worlds, according to Jakobsson, represent our presence to other users in the world by introducing virtual agents that we call avatars. Spatial and temporal character of virtual worlds coupled with a level of realism is not enough, Barfield and Hendrix argue, to enhance the sense of presence. They argue that realism should be extended to include all possible interactions available for users on one hand, and the way users encounter the virtual world on the other hand.[172]

So far, the introduction establishes virtual worlds as a form of 3D virtual environments where a user's presence is registered via an avatar visible to other users. We would also like to recall the definition of virtual reality. Turban & Aronson define virtual reality as a three dimensional world where users interact by wearing stereo goggles, headset and sensory gloves.[173] Thus the presence of an avatar representing a user is replaced by "a high-end user-computer interface that involves real-time simulations and interactions through multiple sensory channels."[174] This ultimately aims to replicate human experience with an increased sense of realism associated with immediacy. Such focus on interaction is particularly important in sensitive fields within the real environment such as health care. The importance of the embodied interaction is far reaching in that it redefines virtual

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169 Virtual environments, worlds and reality are in most of the cases used synonymously. Sometimes they are confused with the term virtual reality. An example of which is elicited in page 26 of chapter 2 of *Handbook of Virtual Environments* by K. M. Stanney. In the chapter titled *Virtual Environments Standards and Terminology* by R.A. Blade and M.L. Padgett, Virtual Environments and Virtual Reality are listed as synonyms.

170 Pratt, D.R., Zyda, M. & Kelleher, K., 1995. Virtual reality: in the mind of the beholder. *IEEE Computer*, 28(7), pp. 17-19.

171 *Ibid.*, p. 17.

172 Barfield, W. & Hendrix, C., 1995. Factors affecting presence and performance in virtual environments. In *Proceedings of the Interactive Technology and the New Paradigm for Healthcare.* Washington, DC: IOS Press, pp. 21-28.

173 Turban, E., & Aronson, J., 2001. *Decision support systems and intelligence systems*, 6th ed. Upper Saddle River, New Jersey: Prentice Hall.

174 Burdea, G. & Coiffet, P., 2003. *Virtual reality technology*. New York: Wiley-Interscience, P. 3.

reality according to the need of the field. Hodges *et al* make the distinction between synthetic environments and interactive computer graphics or multimedia in that the first is characterised by immersion and a sense of presence.[175]

All of the above mentioned characterisations of virtual environments are comparable through their relationship with users. Research generally attempts to measure these relationships using different foci, the most popular being a sense of presence. Realism is also highlighted as a strong factor affecting sense of presence. Realism may be generally understood as the level of similarity and seamlessness between a virtual environment and a real environment in terms of graphics. However, Lombard and Ditton identify two types of realism which affect sense of presence: perceptual realism and social realism.[176] Both of these realisms strongly affect and are affected by a user's sense of immersion, yet they conflict. Perceptual realism bears a fatal limitation to imagination which renders any effort to explore different realisms impossible. Social realism on the other hand dictates specific protocols of interaction that restrict any possible outcomes that have no pair in real life.

What is in question here is the extent to which MMORPGs, although by definition providing a platform for interaction between users, can pose partially perceptual and partially social limitations. In order to illustrate the idea behind this claim, an example will be considered that has its origin in real life. Second Life, according to its creators, is "a 3-D virtual world entirely created by its Residents. Since opening to the public in 2003, it has grown explosively and today is inhabited by millions of Residents from around the globe".[177] The creators – Linden Labs – emphasise three aspects of their creation: The world, the creations and the marketplace.

The world, although *represented* as an infra structure of digital continents available as parcelled pieces of 3D land for users, in reality is a vast infra structure of servers, networks and archived *abstract* data that is constantly being retrieved,

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175 Hodges, L.F., et. al., 1995. Virtual environments for treating the fear of heights. *IEEE Computer Graphics and Applications*, 28(7), pp. 27-34, p. 27

176 Lombard, M. & Ditton, T. 1997. At the heart of it all: the concept of presence. *Journal of Computer-Mediated Communication*, [Online]. 3(2), Available at: http://jcmc.indiana.edu/vol3/issue2/lombard.html [Accessed 30-03-2007].

177 Second Life. 2008. *What is SecondLife.* [Online] (Updated 16-01-2008) Available at: http://secondlife.com/whatis/ [Accessed 16-01-2008].

visualised and then *re-presented* as virtual worlds. The two main operations that Second Life carries out for its users is abstracting information and representing information.[178] The two operations aim at achieving the sense of familiarity necessary to convince users that the process of amalgamation of concepts (see Chapter 1) can be applied to these virtual images to convincingly represent the desired object of perception.

The second aspect emphasised in Second Life is the creations of users. A multi-user virtual world needs to secure a minimum level of interaction to assure the success and continuation of activities. In the case of Second Life, in order to ensure a satisfying sense of productive interaction, users are enabled to create their own objects, involving mainly geometrical objects mapped with textures and programmed with a special programming language to embed behaviours. It also facilitates the sense of immersion by creating both compulsory and voluntary tasks that need to be achieved in the virtual world.[179]

The final aspect emphasised in Second Life is the marketplace. Residents' creations in-world are not merely part of a method that Linden Labs deploy to facilitate interaction, but they are also used to create content and populate the world. As is the case with any production, there is always the scope of a trade depending on demand and supply. Such cycle is rendered economically by introducing a Second Life monetary currency, the Linden Dollar. [180]

The salient point emphasised here is that all of the aspects highlighted above are no more than an attempt to duplicate a construct that has its place in reality and move it into virtual worlds; or to duplicate this construct's efficacy by applying it to a virtual object using, what we argue to be, a sense of familiarity. Thus, a typical definition of this relationship is "an analogy between 3D virtual worlds and the built environments […] based on the view that 3D virtual worlds are comprised of functional places. The designer specifies and organises meaningful places and

178 Second Life. 2008. *What is Second Life.* [Online] (Updated 16-01-2008) Available at: http://secondlife.com/whatis/ [Accessed 16-01-2008].
179 Second Life. 2008. *The creations.* [Online] (Updated 16-01-2008) Available at: http://secondlife.com/whatis/creations.php [Accessed 16-01-2008].
180 Second Life. 2008. *The marketplace.* [Online] (Updated 16-01-2008) Available at: http://secondlife.com/whatis/marketplace.php [Accessed 16-01-2008].

objects, reflecting some social and cultural needs and values in a particular form."[181] However, this analogy reproduces not spatial realism but perceptual and social limitations that effectively reinforce the embodied divide between reality and MMORPGs. It reproduces the familiar static environment, but not the embodied dynamic interaction; a reproduction that falls short of its aim of "reflecting some social and cultural needs and values in a particular form." Most importantly it falls short of duplicating the creative experimental framework that allows the introduction and development of these various representations of reality - the same creative framework that permitted the introduction of virtual environments by amalgamating the concept of intimate space and virtuality.

Perceptual and social limitations in MMORPGs are numerous, but we will give one example of each. Perceptually, although our existence in reality is embodied and governed by specific protocols, some of these protocols are not interoperable in virtual worlds. While it is understandable that the default spatial position and point of view of an avatar in Second Life is similar to that of the human body in real life, an avatar point of view cannot be set to a default position where everything appears upside down from a reality perspective. By contrast, although in real life we can walk, but we cannot fly, in Second Life an avatar can fly and walk under water and do many other things that are perceptually possible, but physically impossible.

On the other hand, the social system in Second Life duplicates almost all different aspects of real life. An example of which is the economic system represented by the Linden Dollar. In real life, the system of value and exchange is carried out via monetary means which in turn establish the economy wheel through standardising the process of exchange. While this system of bank-note exchange is replaced by a more abstract system of credit exchange, Second Life reinstates the concept of monetary exchange by using credit that represents bank notes. Avatars can exchange money valued in Linden dollars, can sell and buy and do many other things with money. The concept of credit is a familiar concept represented in Second Life in the exact way it is present in real life. However, a credit system can be depicted using any element, in our case, pertaining to virtual worlds. Credit could be

181 Ning, G., & Maher M., 2005. Dynamic designs of 3D virtual worlds using generative design agents. In *Proceedings of the 11th International Conference on Computer Aided Architectural Design Futures.* Vienna (Austria) 20–22 June 2005, pp. 239-248: p.240.

represented as an increase in the size of the avatar, or in its ability to move, or maybe an improved interaction or accessibility or any quality that captures the essence of the concept of richness, whatever it is. A different critical view may find that the economical system represented in Second Life is nothing but another extension to an already virtual system of exchange using credit.

Any game has a direct objective, represented in diverse ways, and many other indirect objectives. Second Life as a game does not present a clear objective in the form of a task, and hence the game concept is overthrown by the basic contention that disregards objectives and instead, duplicates daily spatiality. Heidegger's Dasein changes its mode of being from *being-in-the-world* where *in* is a mode of containment, into where it is a mode of involvement.[182] Players in Second Life operate with the basic intention of duplicating what they do in real life rather than manipulating content for the purpose of exploration or metaphoric interaction for the purpose of building and enhancing skills and knowledge that is applicable in real life.

This intention proves hugely limiting in that it alters the nature of the definition of a world from something within which one is contained and which is spatial, into a conscious mode of engagement or interaction. Being immersed is a quality of interaction, be it spatial or otherwise. While Second Life and similar MMORPGs offer immersive involvement with metaphoric concepts, eventually they cause disembodiment through questioning the basic contention of seemingly identical but veritably conflicting environments. Although some find that the integration of online and offline living produces an identity much closer to the self, in that the free-of-constraints self expressed in Second Life consequently starts to manifest in the self of real life,[183] integration is not necessarily achieved, rather a composite reality, that of a hybrid between real and digital environments, is created. This composition should be distinguished from that described by Doyle[184] who, in his definition, describes the overlap between the real and the virtual as a character of the real environment, whereas we attempt to accentuate the hybrid nature of behaviour that is developed.

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182 Coyne, R., 1999. Technoromanticism: digital narrative, holism and the romance of the real. Cambridge, Mass.: MIT Press, p. 148.

183 Suler, J., 2000. Bringing online and offline living together: the integration principle. *eNotAlone*, [Online]. Available at: http://www.enotalone.com/article/3208.html [Accessed: 25-6-2007].

184 Doyle, W.K., 1995. Low end augmented reality in neurosurgery: an interactive image-directed system used in epilepsy surgery. In *Proceedings of Virtual Reality in Medicine and Developers' Expo*. Cambridge, Mass., 1-4 June 1995.

Virtual worlds are platforms for experimentation of embodied and disembodied being. Thus, the process of creating these worlds should be based on designing interaction, and not duplicating reality by relying on familiarity.

At this juncture, the two concepts that were introduced before, *abstraction* and *representation*, will be defined and then connected to *familiarity* a third concept which connects both.

3.2 Intimate Space Abstraction and Representation

This section will present the relationship between *abstraction* and *representation* as signifiers of the presence or lack of presence of attributes, qualities and associations. Abstraction and representation will then be applied to space, particularly, intimate space. The result of this application will be in the form of *abstraction* and *representation* of the image of space which will be marked by communicative behaviour, or verbal communication; whereas, the result of *abstraction* and *representation* of space itself, will be discussed in non-communicative behaviour, or embodied interaction. The discussion of the abstraction and representation of space and its image will result in introducing the communicative and non-communicative behaviour, leading to the next section which will address *familiarity* and its role in conjunction with the abstraction and representation.

3.2.1 ABSTRACTION AND REPRESENTATION

The process of abstraction, of considering an object independently of its associations, or its plurality of attributes, should be reversible by the process of representation, which reasserts attributes and context. The process of representation is concerned with the action of presenting an image, a clearly-conceived idea or concept to the mind or imagination; it also is concerned with the operation of the mind in forming a clear image or concept or the faculty of doing this. The Oxford English Dictionary lists different contexts for the use of the word such as.

> "Abstraction is thus not a positive act of mind, as it is often erroneously described in philosophical treatises, it is merely a negation to one or more objects, in consequence of its concentration on another." [185]

> "The first in order of the scientific processes is Abstraction, or the generalizing of some property, so as to present it to the mind, apart from the other properties that usually go along with it in nature".[186]

Husserl defines abstraction and representation as two notions tied to each other; "a dependent essence is called an *abstractum*, an absolutely self-sustaining [independent] essence a *concretum*."[187] He then clarifies these notions through examples of 'products of abstraction' such as essences, ideas or '*Eidos*' that he considers 'mental constructions'.[188] Husserl's '*Eidos*' introduces, as a dependent essence, an instance similar to a *concept* of which the first chapter discussed several instances. The dependency of a *concept* is on an image that represents it because the image is the representation of the perception of the object, whereas the '*Eidos*' is dependent on its association with its object. "As examples of concrete genera we have real thing, visual phantom (visual shape appearing with sensory fullness), vital experience, and so forth. In contrast with these, spatial shape, visual quality, and the like, are examples of abstract genera."[189]

Space in most cases is an *abstractum* that has a historical, cultural and emotional context manifested as *concretum*. Accordingly, space is a concept that is in essence, virtual; it also has a Dasein or recipient who possesses a set of senses, upon which space sensory quality is essentially dependent. Husserl asserts that "Sensory quality […] points necessarily to some sort of difference in extensity. Extensity again is necessarily the spread of some quality united with it and 'enveloping' it", [190] which indirectly highlights space context as an *individual* instance that projects beyond the space's realm itself. "A phase of 'increase' relating, shall we say, to the category of intensity is possible only as immanent in a qualitative content, and a content of such a kind is in turn not thinkable apart from some degree

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185 Hamilton, Sir William. 1866. *Lectures on metaphysics and logic*. Boston: Gould and Lincoln. II. xxxiv, p. 469.
186 Bain, A., 1868. *The senses and the intellect.* 4th ed. London: Longmans, Green, and Co., p. 591.
187 Husserl, E., 1931. *Ideas: general introduction to pure phenomenology*. Translated by W.R. Boyce Gibson, 1931. London : Allen & Unwin New York : Humanities Press, p. 76.
188 *Ibid.*, pp. 89-90.
189 *Ibid.*, p. 77.
190 *Ibid.*, pp. 75-76.

of increase."[191] This qualitative content implies processes like embodiment, and products like intimate space or virtual environments. Both implied processes and products relate to human interaction with space and carry a wealth of information about human's embodiment. "What lies before us, in face, can be only the empirically real mental products of "Abstraction", which tack themselves on to experiences or [re]presentations in their natural reality."[192] Spatial instances like Bachelard's childhood home report specific human context which in turn reflects non-communicative practices: habitual and beyond language; the products of non-communicative practices: embodiment. It also reflects communicative practices: aspects of spatio-temporal styles of life. Hence, understanding the ways and means of people's mode of being-in-the-world is essential to ensure a full understanding of their space or *concretum* because it has a wider perceptual context. This means that space representation and, therefore, abstraction "… can also overlap each other; as, for instance, physical properties both presuppose and include in themselves spatial determinations"[193,] which calls for a meticulous interpretation of both communicative and non-communicative practices.

The space's realm is not closed because spaces are inherently related to the real world whether through direct association or via metaphorical association. Every reality is virtual. Spaces can and do bear on non-communicative processes and interactions with environments of a non-spatial realm. There are not only homes, inhabitants and everyday life, but also home detailed drawings/situations, construction/mental maps and virtual environments. When Husserl's opinion concerning judgment is deployed in our argument, a tentative claim is in order. Husserl, drawing on the concept that "The free construction of forms knows as yet no restraining contradictions"[194], which links objects to their attributes outwith any limitations, is trying to establish objects as the repository of fundamental forms of what he labels as Conscious abstraction.[195] Objects manifest these abstractions in space and time. In view of this manifestation, a speculation can be made that the body interaction, one of the most fundamental abstractions, is a frequent abstraction

191 *Ibid.*, pp. 75-76.
192 *Ibid.*, p. 89.
193 *Ibid.*, p. 76.
194 Husserl, E., 1929. Formal and Transcendental Logic. Translated by D. Cairns, 1969. The Hague: M. Nijhoff, p.70.
195 *Ibid.*, p.70

of the human condition or embodiment, while at the same time, space is the representation of this interaction.

3.2.2 ABSTRACTION AND REPRESENTATION: THE VERBAL IMAGE OF INTIMATE SPACE

One of the values acquired by abstraction, as a signifier of the state of lack-of-attributes, is incompleteness, vagueness, or lack of clarity. Ambiguity as demonstrated in what follows, proves to be a catalyst for perception and a trigger of creative thinking. Lack-of-attributes propels imagination, in an action-reaction manner, to apply two major creative processes; one belonging to the communicative behaviour (verbal communication), the other belonging to the non-communicative behaviour (embodied action).

The first process translates a subject's intentionality of consciousness with an object, space in our argument, to other subjects through the medium of language. Much of the fascination surrounding communicative behaviour emerges from the realisation that language, interaction, and common knowledge are closely tied. In his 1955 lectures at Harvard University, J. L. Austin argued that utterances are actions.[196] Some can only be verbal (apology), whereas others can be both verbal and physical (abuse, threatening). Although Merleau-Ponty argues that speech is not a 'motor phenomena', he asserts that speech and language are inherent in the body because linguistic deficiencies cannot be reduced to a unity, but stem from the bodily nature.[197] Relatedly, and in line with the thesis argued in the previous chapter, a second statement should be offered; that interaction is impossible without shared knowledge and assumptions -based on human embodiment- both of which are abstracted in language; these abstractions represent interaction as a condition of human embodiment. Both embodied interaction and language form the meaning of space and the object of virtual space. Language serves as the abstraction of embodied interaction. The dynamic relationship between both is associated with increasingly detailed modes of interaction within the notion of intentionality of consciousness. What is meant by this notion is the phenomenological concept of the constitution of

196 Austin, J.L., 1975. *How to do things with words*. 2nd ed. J.O. Urmson & M. Sbisà. Cambridge, Mass.: Harvard University Press.
197 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, p. 226.

existent and non-existent objects as held by Husserl.[198] Non-existent objects of pure reason are solely represented by language. Such objects are only to be communicated via language. When meaning is introduced into the argument another element of familiarity that operates in language is due. Husserl states that an object's attributes of perception, when analysed, are beyond truth or falsity. Verbal representation of these attributes, which encompass context, is beyond contradiction.

> "the fundamentally essential part of the doctrine stated in the main text is, in my opinion, the thesis that, as they function in the whole of formal analytics, compatibility, contradiction, … can and must be defined in a pure sense, one that contains no reference to the truth or falsity of the judgments." [199]

Husserl's notion of meaning and objects predicates on two main axioms; first, that a sign[200], as a mere sign, does not entail a connection with that for which it is a sign. Objects of our experience are pointed at but not proven by signs. Hence, the anticipation of meaning, familiarity, through human reasoning should not be confined to a mere reproduction of past experiences.[201] On the contrary, an abstraction and its representation can form a new unity that cannot be detected in the original contents of both. Familiarity, therefore, is productive, as it welds the two different things into a perceived unity. It should however be remembered that familiarity's generated sense of unity is merely experiential, but not logical or rational.

The other axiom is that the original function of language is communicating ideas.[202] Husserl attempts to differentiate between the meaning of an idea and the reference to an idea. If an idea is given in actual perception or in imagination, its reference is said to be realised, however, if it was unrealised, then it is said to be enclosed in the meaning-intention.[203] As for the meaning of an idea, Husserl argues that the attribute of ambiguity or vagueness pertains to the use of identical physical expressions rather than to the actual meaning itself.[204]

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198 Husserl, E., 1931. *Ideas: general introduction to pure phenomenology*. Translated by W.R. Boyce Gibson, 1931. London : Allen & Unwin New York : Humanities Press, p. 292.
199 Husserl, E., 1929. *Formal and Transcendental Logic*. Translated by D. Cairns, 1969. The Hague: M. Nijhoff, p.332.
200 Husserl, E., 1970. *Logical investigations (Logische Untersuchunget) Vol. I*. Translated from the 2nd German edition by J.N. Findlay. London : Routledge and K. Paul ; New York : Humanities Press. First Investigation, Ch. 1.
201 Husserl, E., 1970. *Logical investigations (Logische Untersuchunget) Vol. II*. Translated from the 2nd German edition by J.N. Findlay. London : Routledge and K. Paul ; New York : Humanities Press.
202 *Ibid.*, p. 32.
203 *Ibid.*, p. 37-38
204 *Ibid.*, p. 79-90. also read p. 18-23.

3.2.3 ABSTRACTION AND REPRESENTATION: INTIMATE SPACE

The second of these two processes comprises bodily interaction beyond any communicative processes. Dourish asserts "embodiment is the property of our engagement with the world that allows us to make it meaningful".[205] Space interconnects reality and virtuality through the mediation of embodiment, betokening its familiarity an element of immersion. Consequently, neglect of space familiarity as an element of spatial context, renders space abstraction hugely dependent and problematically disconnected from space attributes. It also highlights space, including its attributes, as an autonomous entity. However, the state of lack-of-attributes stimulates imagination into associating new attributes, or reinstating familiar attributes. To consider the autonomous entity of space as an identified fact of reality, i.e., present it independently as a concept of perception, would conflict with the very nature of familiarity. The consideration falls into objectivity whereas this research is concerned with the phenomenology of space.

Our built environments and our use of space are, as a concept, no more than just one other spatial attribute of our embodiment that can be isolated (abstracted) and *re*-presented to prove that, with it, we function in an embodied and also non-spatial meaningful world: social, virtual, abstract … etc - a world of human interaction. To see space and the architecture that bounds it independent from user and context is akin to contemplating Bachelard's home according to his vision without embracing his view as the daydreamer of this home. Bachelard's *intimate space* travelled from being an object of perception to an image of perception and then to a concept of human relationship with space; an embodied relationship which is the representation of the attributes of human embodied interaction. Dasein is Heidegger's instrument of abstracting existence of its attributes. Dasein is the *abstract* entity and its *being-in* and *being-with* constitute its context that is interconnected via its bodily interaction and its perception. Space is ready-to-hand*, but when familiar* it becomes, present-at-hand.[206] Merleau-Ponty's *abstract*

205 Dourish, P., 2001. Where the action is: the foundations of embodied interaction. Cambridge, Mass.: MIT Press, p. 126.
206 Heidegger, M., 1927. *Being and time*. Translated by J. Macquarrie & E. Roinson, 1993. London: Routledge, p.267 (224-225).

'objective space' or 'representative space' are not based on an act of thought, rather, it is an inseparable correlative built into human bodily structure.[207]

The processes of abstraction and representation introduce familiarity as a symptom to be noticed and studied. This next section will introduce the concept of *familiarity* and attempt to tie it to the concept of abstraction and representation.

3.3 Familiarity

As an introduction to this analysis, the researcher would like to offer a preliminary statement of what is meant by *familiarity* within the context of this thesis. It will be argued later that familiarity is the unintentional anticipation of meaning formed by an unconfirmed, unclear opinion, in order to establish an understanding of meaning and correlate it to another. *Familiarity* is central to the meaning and to the suppositions we make. In this context, *familiarity* as a form of unintentional anticipation, should be distinct from the formal structures of intentional expectation (frames, scenarios and schemata) that will be discussed in the subsequent chapters.

Familiarity denotes the dynamic and active relationship between interaction, perception and reasoning. It is theoretically grounded in 'conceptual metaphors' as introduced by Lakoff and Johnson, that in turn, are grounded in correlations within our experience –not only language.[208] Familiarity is a perceptual tool with which we interact with one space realm, in terms of the dynamic relationships, from a realm of a different kind. This interaction theorises an obtained knowledge that Johnson argues is relative to our understanding:

> "What counts as knowledge, therefore, is relative to our understanding that permits our more or less successful interaction with our environment."[209]

What is being said here is that logic, or at least the meaning of logic, is grounded in recurring structures of embodied human understanding and experience.

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207 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, pp.112-170.
208 Lakoff, G. & Johnson, M., 1980. *Metaphors we live by*. Chicago: University of Chicago Press, pp. 147-155.
209 Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press, p. 209.

However, familiarity in that sense is a major defect for phenomenology when considering the latter to be the "Science of Phenomena", a method that is devoid of all presuppositions, setting aside the natural attitude of experience.

> … in addition to all other adjustments a new way of looking at things is necessary, one that contrasts at every point with the natural attitude of experience and thought. To move freely along this new way without ever reverting to the old viewpoint, to learn to see what stands before our eyes, to distinguish, to describe, calls, moreover, for exacting and laborious studies.[210]

Phenomenology, driven by the search for foundations on which to ground knowledge with certainty, should be a subject of constant scrutiny in order to identify and isolate familiarity which operates by utilising structures both central to and permitted by associations and attributes of objects. As a tool for understanding intimate space and virtual space, space abstraction offers an instrumentality that will be explored in this chapter.

3.3.1 FAMILIARITY IN LANGUAGE AND ACTION

Space and its various representations and abstractions share qualities and associations that are specific to space though sometimes these are shared with other objects. Attributes can be inferred from them in most of the cases. Experimental space abstraction and representation in many literary works and cinematic films, offers an interpretation that concedes the prospect of a phenomenological exploration producing a plurality of alternative critical abstractions, and therefore, representations of space. However, for the purpose of this experiment (the consideration of a space independently of its associations or its plurality of qualities and attributes) an outcome of a process of abstracting space needs to be validated. Given the incompleteness, vagueness, or lack of clarity of spatial context, the abstraction or representation of space is sometimes somewhat flexible and subjective. However, the former statement does not imply that all abstractions and representations hold and do represent equal qualities and attributes. Although the element of subjectivity is a strong one, there is a limit to how far this subjectivity could go without being questioned.

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210 Husserl, E., 1931. *Ideas: general introduction to pure phenomenology*. Translated by W.R. Boyce Gibson, 1931. London : Allen & Unwin New York : Humanities Press, p. 42.

In order to be able to evaluate space abstraction and representation, we ought to be normative. This episode in the development of the argument is deploying Hume's concept of normativity for its ability to tie ideas, their origin and abstraction on the one hand, and Husserl's intentionality on the other hand. Hume makes the distinction between ideas and impressions according to the "degree of force and liveliness, with which they strike upon the mind and make their way into our thought or consciousness"[211]. He also asserts that both have different degrees of simplicity and complexity. [212] While simple ones admit no distinction or separation, complex ones are the opposite.

> "Having by these divisions given an order and arrangement to our objects, we may now apply ourselves to consider with the more accuracy their qualities and relations. The first circumstance, that strikes my eye, is the great resemblance betwixt our impressions and ideas in every other particular, except their degree of force and vivacity. The one seems to be in a manner the reflexion of the other; so that all the perceptions of the mind are double, and appear both as impressions and ideas. When I shut my eyes and think of my chamber, the ideas I form are exact representations of the impressions I felt; nor is there any circumstance of the one, which is not to be found in the other. In running over my other perceptions, I find still the same resemblance and representation. Ideas and impressions appear always to correspond to each other. This circumstance seems to me remarkable, and engages my attention for a moment." [213]

Ultimately, what is underlying here is that human nature is not only a neutral attribute, rather, it is a normative principle by its virtue of uniformity. Human subjectivity is uniform in a manner that permits objectivity to emerge. Uniformity of human social condition, allows the study of human praxis irrelevant of location. Thus, context implications are reduced. This uniformity in human condition spells out *familiarity*.

By contrast, Wittgenstein's work establishes a connection between intentionality and normativity through meaning. To him "the meaning of a word is its

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211 Hume, D., 2009. *A treatise of human nature*. [e-book] Scribd.com, p. 6.
Available at: http://www.scribd.com/doc/52892/A-Treatise-on-Humane-Nature [Accessed 24-04-2008].
212 *Ibid.*, p. 6.
213 *Ibid.*, p. 6.

use in the language".[214] Using a term to express a specific concept implies the acceptance of a norm that stipulates a context and a method of thinking, or decides the correctness or incorrectness of its use. Wittgenstein adds an extra layer to the meaning of a word by emphasising its *modus operandi*. He deploys Hume's prescriptive *ought-to* into his rather phenomeno-linguistic[215] approach, and transforms it into Husserl's intentionality (PhI, $ 49; BBB, 5; PhI, $ 432). He asserts, on the use of language and meaning, that "We must do away with all explanation, and description alone must take its place". [216] Contradictions can be easily detected between Wittgenstein and Merleau-Ponty. While the latter maintains that speech is the direct expression of thoughts [217], thus rendering speech a sign of intentional embodied interaction or the embodiment of thoughts, Wittgenstein states that "language is itself the vehicle of thought".[218]

Normative approach to space abstraction or representation should be led by a sort of criteria applied in a standard procedure which ultimately is capable of awarding the quality of good or bad. Every space possesses a functional value whether this be small-scale (stairwell, corridor) or large-scale (bus station, airport). Hence, any abstraction or representation should construe space including this functional value as a process but not as an outcome. Any manipulation of space message, when described by language should reaffirm the inter-subjective nature of phenomenology. Merleau-Ponty's argument on the body's expression and speech corroborates

> "When I speak or understand, I experience that presence of others in myself or of myself in others which is the stumbling-block of the theory of intersubjectivity, I experience the presence of what is represented which is the stumbling-block of the theory of time, and I finally understand what is meant by Husserl's enigmatic statement, 'transcendental subjectivity is intersubjectivity."[219]

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214 Wittgenstein, L., 1968. *Philosophical investigations*. Translated by G.E.M. Anscombe; 3rd ed. Oxford: Blackwell, part I, section 43.

215 Husserl's centre of investigation is Consciousness, while for Wittegenstein it is language.

216 Wittgenstein, L., 1968. *Philosophical investigations*. Translated by G.E.M. Anscombe; 3rd ed. Oxford: Blackwell, part I, section 109.

217 In this Phenomenology of Perception, Merleau-Ponty states: "Thought is no internal thing, and does not exist independently of the world and of words. What misleads us in this connection, and causes us to believe in a thought which exists for itself prior to expression, is thought already constituted and expressed, which we can silently recall to ourselves, and through which we acquire the illusion of an inner life." Merleau-Ponty, M., 1945. *Phenomenology of perception.* Translated by C. Smith, 1962. London: Routledge, p. 183.

218 Wittgenstein, L., 1968. *Philosophical investigations*. Translated by G.E.M. Anscombe; 3rd ed. Oxford: Blackwell, p. 107. The full sentence is: "When I think in language, there aren't meanings going through my head in addition to the verbal expressions: the language is itself the vehicle of thought."

219 Merleau-Ponty, M., 1964. *Signs*. Translated by R. McCleary. Evanston, IL: Northwestern University Press, p. 97.

This lays the ground work for the suggested criteria of abstracting or representing space according to what will follow. The aim is to achieve a better understanding of familiarity by isolating the qualities and attributes associated with an intimate space. Applying a procedure to abstract and represent the space, and then using subjects' accounts of interaction with the abstraction and the representation of this space should produce a better understanding of familiarity. This leads to the procedure of abstracting the image of a space in line with Husserl's *abstractum*. The reason behind this is that *Gestalt's principles of perception* intend to frame the process of recognition of groups of elements as one whole. These are widely considered to be the basics of design in HCI. Moreover, Gestalt's methodology highlights the productive process of thinking by stating that "we best understand phenomena when we view them as organised, structured wholes. According to this view, we cannot fully understand behaviour when we only break phenomena down into smaller parts … Gestaltists, seek to understand the unobservable mental event by which someone goes from having no idea about how to solve a problem to understanding it fully in what seems a mere moment of time."[220] We suspect that this transition in a mere moment of time is dictated by familiarity. We argue that eliminating Gestalt's principles of perception will not permit the possibility of viewing the whole as a group of elements, i.e., as an object indicated or identified by its attributes or qualities.

3.3.1.1 Abstraction of Sensory Stimuli Producing Meaningful Experiences: Gestalt

The task of abstraction or representation is to extract and reinstate attributes, qualities and associations in a dual process of contesting subjectivity and growing into objectivity. This process exemplifies how *examining* and *evaluating* possibilities must exceed the survey of *possible* qualities and attributes that can be abstracted or represented to assess which of them are inherently capable of producing the required output, i.e., objectifying space or isolating subjective elements of space which in turn highlight familiarity as the link between subjective experience and abstract space. When executing this process of isolating (disconnecting) subjective elements, we

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220 Sternberg, R., 2003. *Cognitive Psychology* 5th ed. Hove, East Sussex: Psychology Press, p. 10.

confront traditional connections between human perception and *understanding* of space; connections that formulate the modus operandi of perception. We confront Gestalt's principles of *proximity, similarity, continuation, closure, prägnanz and figure/ground*. Thus, as the first step in a proposed procedure for space abstraction, we suggest eliminating *Gestalt's principles of perception*.

Abstraction of intimate space as a physical environment can be correlated to the degree of elimination of Gestalt's principles of perception; however, this abstraction should maintain a consistent reference to the abstracted object, intimate space, in relation to its context, be it physical, i.e., the actual space in question, or conceptual, i.e., in relation to modes of being such as communicative and non-communicative practices. Context consideration is a matter of phenomenological exploration which extends to space as an isolated incident as well as part of an extended stretch of being. The process of elimination provokes an analytical view to build a sensory understanding of surrounding space by the virtue of newly obtained knowledge based on comparison between space and abstraction. It ought not to be mixed with the suggestive power of *familiarity*.

The process of phenomenological exploration of space, both as an isolated instance as well as part of an extended context, is followed by phenomenological reduction. Space abstraction and representation better inform the essence of space if they can both reflect its qualities and attributes without difficulty. The centre of this claim is to devise a phenomenological process of exploring space while assuring subjectivity does not undermine the extent to which the interests of phenomenological reduction come to be served. The ultimate attribute of abstraction is that less attributes are better, while for representation the maximum target is to prevent space qualities and attributes from transforming into structural or organisational attributes that provoke human familiar interaction, i.e. eliminating Gestalt's principles of perception. Experiencing familiar physical phenomena involves recalling which is different to remembering. This principle of abstraction involves elimination of prejudices and presuppositions in order to achieve phenomenology's main objective - to provide a descriptive explanation of a phenomenon as it is revealed to consciousness and so explain human experience, common values, meanings and practices embedded in any context - space in our

case. By eliminating attributes that are known to be triggers for Gestalt's principles of perception, we achieve phenomenology's prerequisite. Space as a conceptual notion is formed from many attributes; hence it is safe to say that it has many subdivisions of inarticulate meaning. Space as a physical entity also has a contextual environment within which space is placed; hence this environment is implicit.

3.3.1.2 Unintentional Signification through to Intentional Imagination: Metaphor

As mentioned in a previous chapter, Bachelard in '*La Poétique de l'espace'* makes the distinction between daily experience of space and the daydream of an intimate space in that the latter is detached from familiarity as a domain of interaction. Estranging familiar space morphs it into a new formation that is clearly marked by a structural change which extends to its linguistic significance. The entity of being is not Heidegger's *Dasein* anymore; it morphs into Bachelard's *des êtres entr'ouverts*.[221] The power of imagination as an attribute of the poetic image "becomes a new being of our language, it expresses us in making us that which it expresses".[222]

Any space holds a meaning or significance that is communicated unintentionally by virtue of daily use; however, a place, or a space with a meaning[223], presents attributes and merits and, more importantly, highlights communicative and non-communicative practices held by this place. Ultimately, the meaning of space is determined by those who perceive it. The value of signification lies in the fact that it highlights structural relationships between signifier and signified which shifts concentration from objects to those relationships.

More often than not, abstraction of the signified conceals its structural relationship with the signifier. It also conceals its merits and attributes. In the effort to associate new attributes we rely on metaphorical association, which countervail against the fact that *metaphorical systematicity*[224] generally exacerbates perception of abstracted space, thus, admitting spatially divergent interpretations by virtue of the multiplicity of associations that can be observed; many examples of which will be

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221 Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press. Originally published: New York, Orion Press 1964, p. 200.
222 *Ibid.*, p. 7.
223 Malpas, J.E., 1999. *Place and experience: a philosophical topography*. Cambridge: Cambridge University Press.
224 Lakoff, G. & Johnson, M., 1980. *Metaphors we live by*. Chicago: University of Chicago Press.

analysed in the chapter concerning cues of immersion in virtual environments. *Integration of diversities*[225] by metaphor's strict or logically necessary implication of one proposition by another deviates abstraction, due to lack of attributes, from its space by characterising the abstraction with a *coherent system of metaphorical concepts*[226], which, in turn, admits inappropriateness that Turbayne labels "*sort-crossing*".[227] Thus far, abstraction is based on eradicating attributes, which is the opposite function of metaphor since the latter actively associates new attributes derived from other objects. Turbayne contests this coherent system by arguing that not all attributes derived from other objects are fit for association with the original object, a process her refers to as crossing.

Spatially, within the communicative and the non-communicative domains as held by Dasein, who is both a spatial and temporal entity,[228] metaphorical systematicity is ubiquitous in design.[229] Dourish argues that the referent of the metaphor may possibly possess a set of capabilities that the metaphorical object itself does not.[230] This can be the result of the new structural relationship between the attributes of the metaphorical object and the referent of the metaphor. This can also be harnessed to the fact that virtual environments allow various interactions that are, otherwise, impossible in a corresponding physical environment. Abstraction, in this context, ought not to possess any association of a metaphorical nature which might highlight one aspect and hide another. Hence, as another step in a proposed procedure for space abstraction, we suggest eliminating *Metaphor Systematicity.*

The sum of both steps suggested in this procedure will be put to test in the following section. The test will comprise abstracting an intimate space from its verbal image, and then from its visual image.

3.4 Representation of space and assertion of qualities and attributes

225 Stanford, W.B., 1936. *Greek metaphor*. Oxford: Basil Blackwell, pp. 101-105.
226 Lakoff, G. & Johnson, M., 1980. *Metaphors we live by*. Chicago: University of Chicago Press, p. 9
227 Turbayne, C., 1962. *The myth of metaphor*. New Haven, CT: Yale University Press, p. 11.
228 Heidegger, M., 1927. *Being and time*. Translated by J. Macquarrie & E. Roinson, 1993. London: Routledge, pp.
229 Coyne, R., 1995. *Desinging information technology in the postmodern age: from method to metaphor*. Cambridge, Mass.: MIT Press. See also Coyne, R., Snodgrass, A.B. and Martin, D., 1994. Metaphors in the Design Studio. *JAE (Journal of Architectural Education)* 48(2), p. 113-125.
230 Dourish, P., 2001. *Where the action is: the foundations of embodied interaction.* Cambridge, Mass.: MIT Press. p. 142-144.

The rationale behind this exercise is to apply the previous principles to the verbal and graphical images of an intimate space. What is meant by intimate space is a space that is used by its user in a capacity that produces an attachment to this space. The intimacy of the space is determined by the user, not the researcher. The architectural space in question is the fourth level of the building that hosts the Department of Architecture at the University of Edinburgh. Thus we will refer to the space we are attempting to abstract as level 4, and this will be abbreviated to L4. In what follows, the verbal image of L4 (communicative) will be abstract, followed by the graphic image abstraction. The aim is to put the procedure devised in the previous section into a test that will help in producing the abstraction that can be used in the subsequent sections.

3.4.1 VERBAL REPRESENTATION OF SPACE

The first step in verbal image abstraction is to analyse the components of this image, in what can be described as componential analysis. However, the verbal image is not uttered by the researcher, instead, and to ensure neutrality, a first time user was asked to describe L4 spatially. What is meant by spatially is the space that is L4, rather than the emotional involvement with the space. An example may help in making the distinction. Someone might describe a space as dull or boring. This description might help the psychoanalysis of the space rather than attaining its spatial qualities. Hence, the emotional involvement, though it should not be relegated to a position of irrelevance, is not the centre point of this description of space. What follows is the paragraph that describes L4 spatially as uttered by a first time user, and the subsequent steps of abstraction.

> When you land on the *flight* of *L4* you will find a *door*. If you go through it, you will notice first thing another door on your right hand side. This is the door of the *cleaner room.* As you continue walking in the *corridor* you will find another door on your right hand side. That would be the door to the *Kitchenette*. The *corridor* turns left. When you turn left you will find that it is one long *corridor* with many doors on both sides. The first door on your right hand side is the *computer lab* of *Design* and *Digital Media students*. The *room* is full of *computers*. If you continue in the *corridor*, you will notice a *small vestibule* on your *right* hand side that houses the *lift* and a

small door leading into a *store room*. If you continue in the *corridor*, you will find another three doors; two on your right hand side, and one on your left. These are *postgraduate offices*. They consist of many cubicles with *desks*, *computers* and *shelves* full of *books*. Going back to the *corridor*, if you continue your walk through it you will find another *small vestibule*. This one has three doors two of which lead into *staff offices* with *desks, computers* and *shelves* full of *books*. The third door leads into the *postgraduate students' common room*. Back to the *corridor*, and now if we walk we will find another door on our left hand side leading into another *computer lab for Design and Digital Media students*. Like the previous lab, this one is also full of... etc.

It is clear how this paragraph can go on describing L4 by giving spatial guidance to a person navigating it for the first time. If this paragraph is to be abstracted, the first step would be to remove all the verbs, articles and prepositions in it. We then, would be left with the italicised words from the previous paragraph. Those are the referents of each space. If we write them down in rows, they will look like the first abstract below.

3.4.1.1 The first abstraction

The first very basic abstraction suggested is to verbally describe space without any verbs, articles or prepositions.

The abstraction is illustrated below:

Stair case:
Corridor
Cleaners' Room
Kitchenette
Design and Digital Media Computer Lab
Corridor
Lift Vestibule
Lift
Store
Postgraduate Office
Corridor
Postgraduate Office
Postgraduate Office
Office Room
Corridor
Small Vestibule
Staff Office
Postgraduate Common Room
Staff Office

Design and Digital Media Computer Lab
Corridor
Postgraduate Office
Small Vestibule
Staff Office
Staff Office
Staff Office
Corridor
Small Vestibule
Postgraduate Computer Lab
Staff Office
Staff Office
Corridor
Fire Escape Stair Case

Though we could remove the designation of each room, e.g. we can use the word Room instead of Staff Office, this would dissociate the space from its intrinsic functional value as a space for a human user. It is arguable that this is useful in abstraction, but we will maintain certain aspects that we will later re-examine.

If indentation was applied to the list in a way that reflects spatial relations, then we will get this result:

Stair case:
- Corridor
  - Cleaners' Room: detergents, sink, chairs
  - Kitchenette: sink, fridge, shelves
- Corridor
  - Design and Digital Media Computer Lab: Computers, tables, books, chairs
- Corridor
  - Postgraduate Office: desks, chairs, shelves, books, computers
  - Lift Hall
    - Lift
    - Store: random items
- Corridor
  - Postgraduate Office: desks, chairs, shelves, books, computers
  - Postgraduate Office: desks, chairs, shelves, books, computers
  - Postgraduate Office: desks, chairs, shelves, books, computers
- Corridor
  - Design and Digital Media Computer Lab
  - Small Hall
    - Staff Office: desk, chair, shelves, books, computer
    - Postgraduate Common Room: chairs
    - Staff Office: desk, chair, shelves, books, computer
- Corridor
  - Postgraduate Office: desks, chairs, shelves, books, computers
  - Small Hall
    - Staff Office: desk, chair, shelves, books, computer
    - Staff Office: desk, chair, shelves, books, computer
    - Staff Office: desk, chair, shelves, books, computer
- Corridor
  - Small Hall
    - Postgraduate Computer Lab: desks, chairs, shelves, books, computers

Staff Office: desk, chair, shelves, books, computer
Staff Office: desk, chair, shelves, books, computer

Corridor
Fire Escape Stair Case

We already notice that one of Gestalt's principles of perception (*similarity)* is affecting our perception because we are, arguably, forming groups according to indentation.

3.4.1.2 The second abstraction

Another plausible abstraction could be achieved through organising the words spatially according to the description (*Figure 7Figure 7. Second abstraction by spatially organising the words.*). The result would look like a cluster of apparently spatially interrelated words. The words were distributed according to the directions given in the paragraph describing the space.

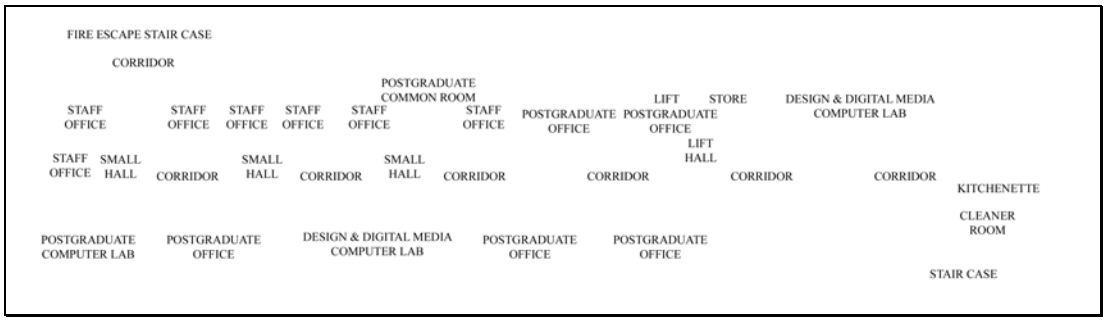

Figure 7. Second abstraction by spatially organising the words.

The verbal image of the space aided in creating a visual image based on the account of a first time user. One could argue that the spatial distribution is more accurate than would be expected from a random user, however, a less accurate spatial distribution would not harm the argument. The spatial distribution will aid in the contrast to follow later.

3.4.2 VISUAL REPRESENTATION OF SPACE

An architectural plan of L4 was obtained in order to carry out the next step (*Figure 8*). The visual representation of the spatial qualities of L4 will abstracted using the procedure as was described previously.

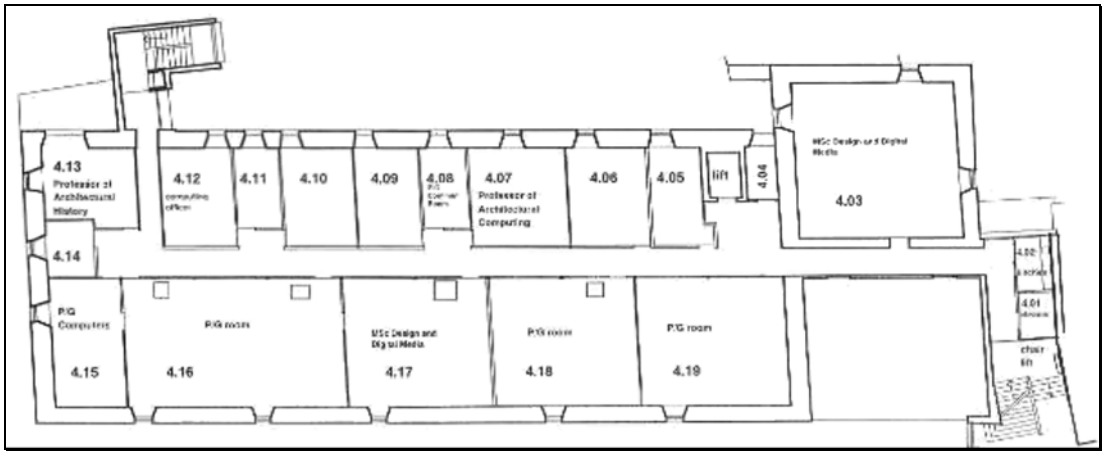

Figure 8. The plan of Level 4 of the 'Maltings' in the department of Architecture.

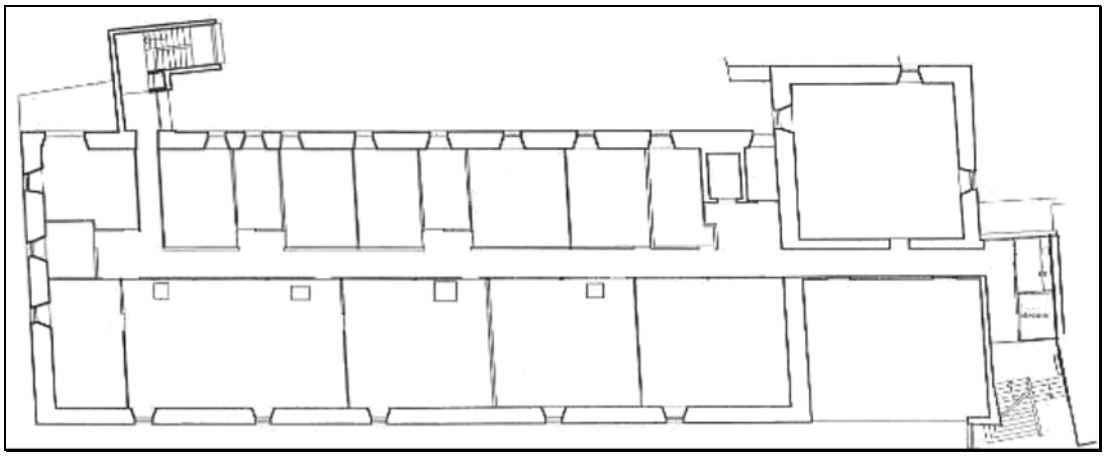

Figure 9. The word description is removed from the plan of L4 of the 'Maltings'.

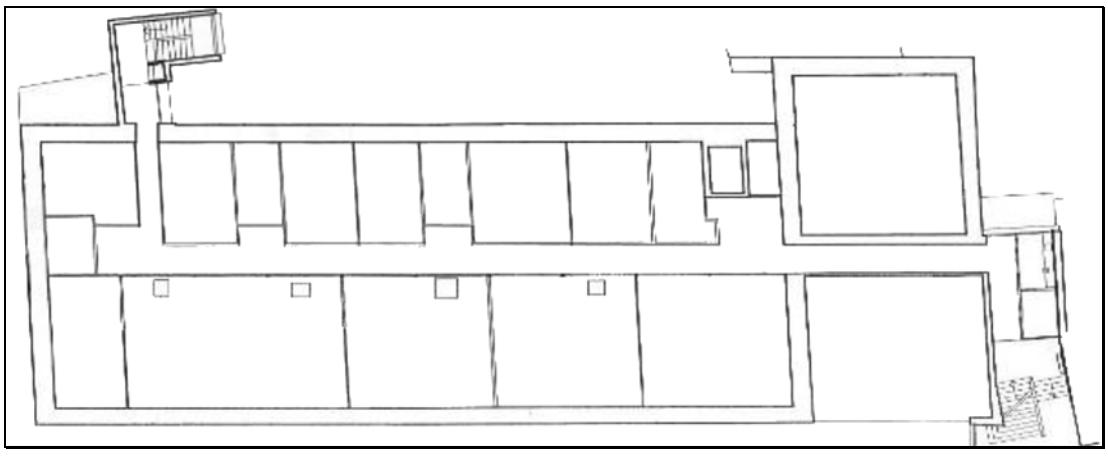

Figure 10. Architectural openings (doors/windows) are removed from the plan of L4 of the 'Maltings'.

The first step in abstracting the visual image of L4 is removing the linguistic data to dissociate rooms from their designations. This results in a blank plan with divisions, and designations, as can be seen in Figure 9.

The next step would be to remove certain architectural features in the plan such as window/door openings. The removal of those openings would concur with the Gestalt principles of continuation, closure and figure/ground. The result is Figure 10.

The Gestalt principles of perception will suffer another blow when the thickness of external walls, which specify the enclosure, is removed. This, in particular, will concur with the principles of similarity. The result is Figure 11.

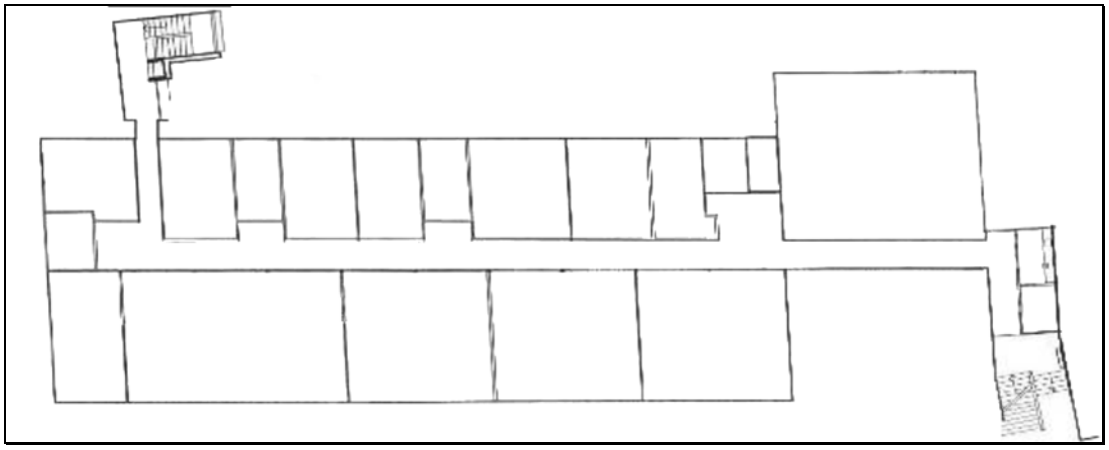

Figure 11. Wall thickness is unified for all the walls in the plan of L4 of the 'Maltings'.

3.4.2.1 The third abstraction

The next step is to unify all lines within the plan and give it all the same value.

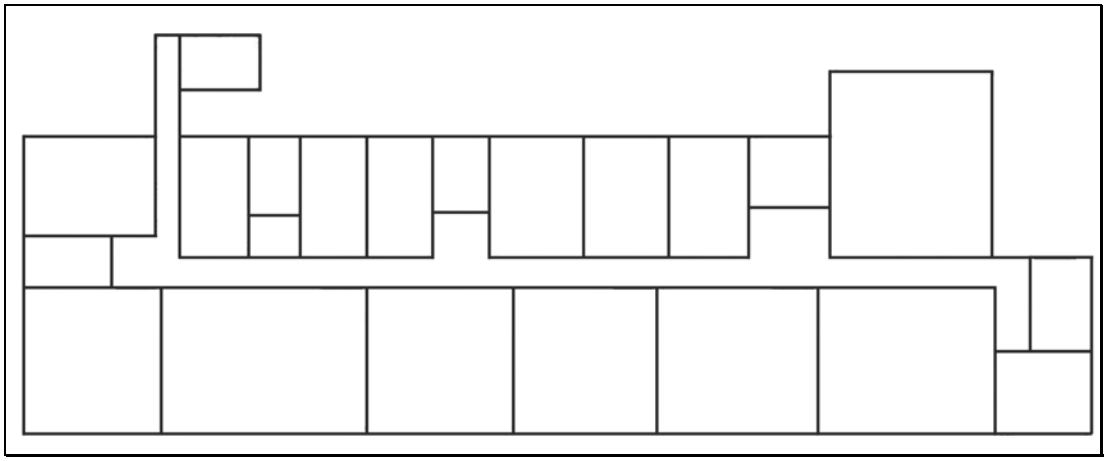

Figure 12. All the angles are changed into right angles in the plan of L4 of the 'Maltings'.

The abstraction above looks like an un-detailed plan that is missing much information about openings, thicknesses, circulation and access points. As an abstraction, it is missing all those attributes and structural relationships. Moreover, the plan looks like a diagram of some description. The diagram does not have the exclusive quality of a plan.

3.4.2.2 The Fourth abstraction

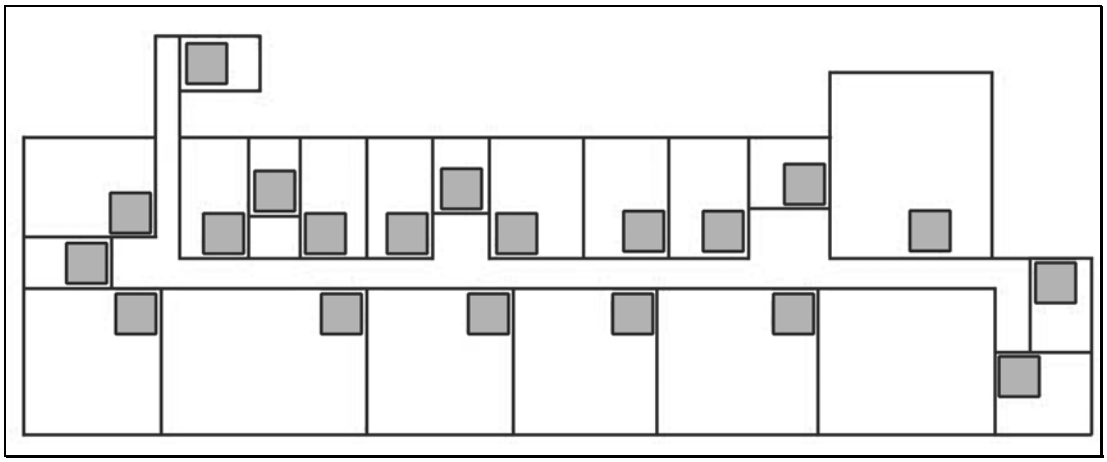

Figure 13. The final diagram used in the Abstraction of L4.

The result of this exercise was the abstraction above, which removes all attributes and merits while keeping spaces from the original plan that coincide with the nouns in the paragraph describing the space. Certain nouns that were not present in the plan were added later in the environment using a method that will be described later. In order to examine our multilayered hypothesis, we created two corresponding interactive virtual environments. The description of each follows:

3.4.3 LEVEL 4 (L4) ABSTRACT ENVIRONMENT

This interactive environment utilises the abstraction of 'Level 4' that was created using the principles devised in the previous heading. In a way, this abstraction is an abstraction of space that asserts certain visual merits. The abstraction holds no spatial attributes beyond its own. Thus, it does not intend to act as a reference to the abstracted space.

The abstraction was imported into Macromedia Flash Professional. The screen is composed of three main parts.

1- The Abstraction:

The abstraction is placed at the top part of the screen to the right. It contains a square that can be moved around within the abstraction using the navigation section.

2- Zoom-in on the abstraction:

The zoom-in section is placed at the top left side of the screen. This section scales up the part of the abstraction that contains the moving square. This section is important for two reasons; it acts as a focal point that enables subjects to have a closer look on the effect of what they click on the screen. It also serves another purpose that has to do with subjects' eye movement, which we will talk about later.

3- Navigation section:

This section is placed in the middle and lower part of the screen. It contains words that describe spatial directions, i.e., Right, Left, Forward, Backward…etc., or spatial contents, i.e., chair, shelves, books, PC…etc. The spatial elements used, are some of what is used in the real environment abstracted in this experiment.

Figure 14. Screen-shot showing 'Level 4 Abstract Environment'.

When a subject clicks a hotspot, one of a list of reactions may occur. Reactions are:

1- Changing the position of the square within the abstraction

2- Changing the view on the screen,

3- Changing the words on the screen.

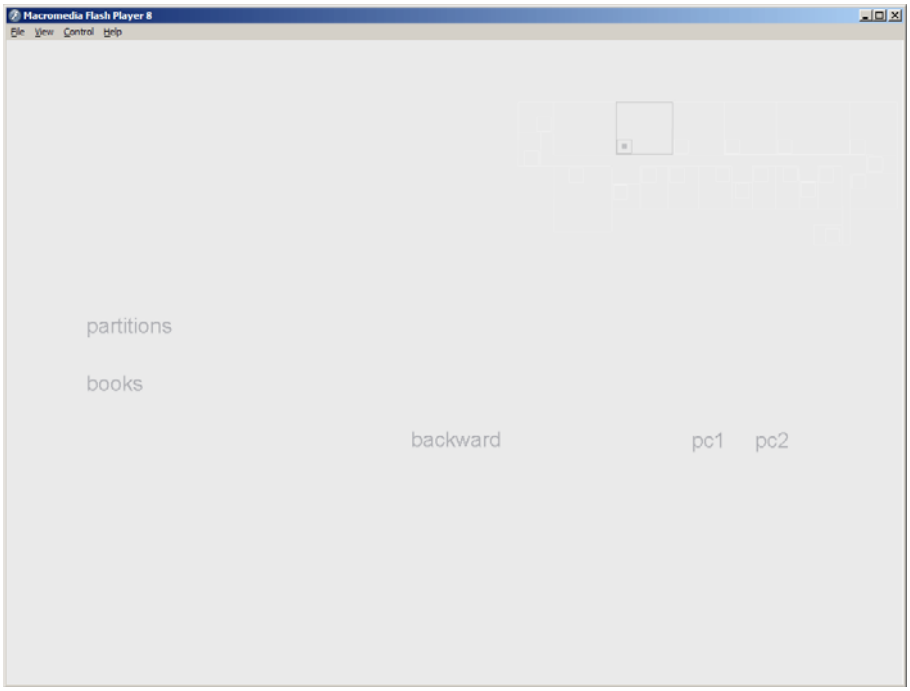

Figure 15. Screen-shot showing 'Level 4 Abstract Environment' when view or words on the screen change.

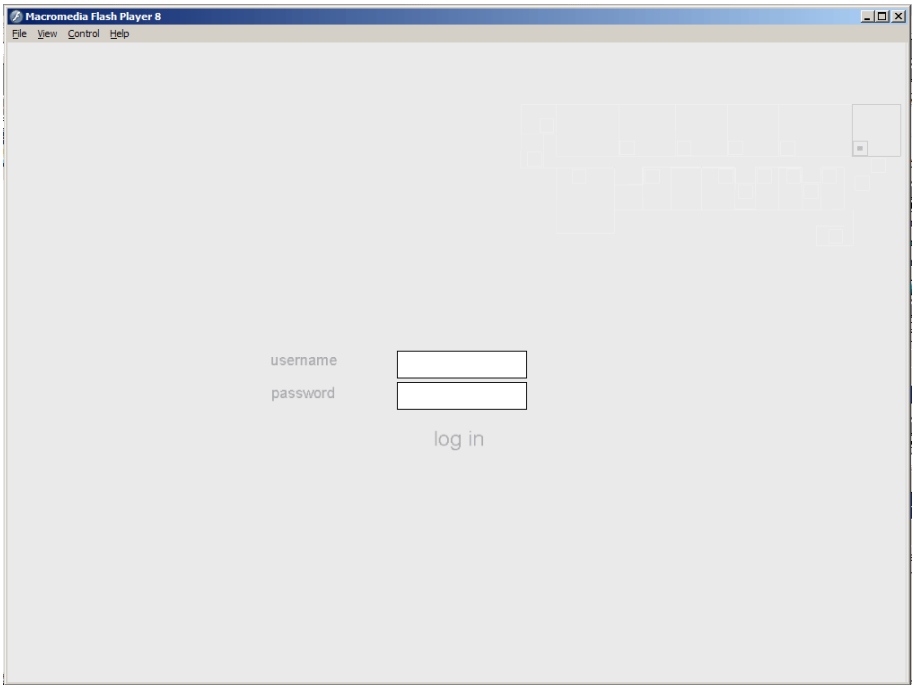

Figure 16. Screen-shot showing the 'login' window in 'Level 4 Abstract Environment'.

The task that the subject needs to achieve in this experiment is to 'login' using a username and password. In order to be able to login, the subject needs to find the login screen.

Once the generic username and password are entered and the login button is clicked, the following message will appear:

"You have accomplished the task. Thank you for participating.
Start Again"

This will signal the end of the first part of the experiment.

3.4.4 LEVEL 4 (L4)3D ENVIRONMENT

The other interactive virtual environment is a 3D representation of Level 4. The representation is created using the following steps:

3.4.4.1 Photographic Documentation:

In the first abstraction of space, we applied two principles of abstraction: *Elimination of Gestalt's Principles of Perception,* and *Elimination of Metaphor Systematicity*. By means of contrast, we will assume a different position in this exercise. Our position is that *a photograph* is *a visual language* to those who perceive it. In the same way the paragraph in the previous abstraction of L4 provided a description of L4, a photograph provides another description of the same space. A photograph is a word in a form of an *embodied visual language*. It provokes similar neural processes provoked by the represented object itself.[231] It must be made clear that this photographic documentation is meant to represent an object by capturing the essence of its sensory data, however, unlike the art of trompe l'oeil (*cheat or fool the eye*), photographic documentation is not meant to be mistaken for the object it represents.

The element of familiarity lends itself to the very concept of a photograph. A photograph represents an object, space in this case, but as an element of visual language. It is always open to personal interpretation which is hugely dependent on communicative and non-communicative practices. Hence, a photograph could represent, construct (as we will see in the next chapter), illustrate, render, depict or

231 Pearson, D., Hanna, E., & Martinez, K., 1990. Computer generated cartoons. In H. Barlow, C. Blakemore, and M. Weston-Smith, eds. *Images and understanding*. Cambridge: Cambridge University Press, pp. 46-60

even idealise a represented object. The relationship between an object and its representation in a photograph is controlled by metaphors. Surrealists' work construes objects portrayed in a way that highlights certain aspects and conceals others. In fact, different objects come to the foreground when changing the focus of perception.[232]

In the same spirit of Saussure's statements[233] we can assert that "Capturing the essence of an object and its attributes is the basic unit of our representative visual language. Visual language is a complete system of signs. Photographs are external manifestations of this language." We would also like to assert that "the connection between the object and its representation is arbitrary."

Perhaps for most, looking at a photograph is primarily intended to discover what it represents. Our intention of this photographic representation is not merely to represent its object, but rather to preserve its visual stimulation. One might dismiss the difference between both, however, an intentional review of a photograph will render photographs present-at-hand rather than ready-to-hand. This implementation of the Heideggerian position is concurrent with Goodman's view that "realistic representation, in brief, depends not upon imitation or illusion or information but upon inculcation. Almost any picture may represent almost anything; that is, given picture and object, there is usually a system of representation, a plan of correlation, under which the picture represents the object."[234]

In architecture, Pérez-Gómez, and Pelletier highlight the competing qualities of architectural representation from translation to transcription. They maintain that cyberspace lacks the depth that contains spatial and formal character. They state that "expecting architectural representation to embody a symbolic order … will seem controversial unless we revise the common assumptions about art …"[235] Elements of *Depth* locked inside a 3D world are programmatic, temporal and experiential.

In this stage of documentation, and in order to build a representation of the space, we choose to document the space by the means of taking photographs of the

232 Silvano, L., ed., 1997. *Surrealism: Surrealist Visuality*. Edinburgh: Keele University Press, p. 21.
233 Saussure's original statements are: "A sign is the basic unit of language. Every language is a complete system of signs. Parole is an external manifestation of language." And "The connection between the signifier and the signified is arbitrary."
234 Goodman, N., 1968. *Languages of art: an approach to a theory of symbols*. New York: Bobbs-Merrill, pp. 38.
235 Pérez-Gómez, A. & Pelletier, L., 1997. *Architectural representation and the perspective hinge*. Cambridge Mass.: MIT Press, p. 6.

space. The photographs are taken using a digital camera[236] mounted on a tripod 150 cm high. For each single photograph, the camera was positioned to be parallel and perpendicular to all surrounding surfaces thus, assuring photographs containing a one-point perspective. When depth distance did not permit taking one shot to cover the whole façade, the shot was divided into several shots allowing a 30% overlap between every two conjoined photos. The photos then were rejoined using digital photo processing software. The style of joining and reproducing the photos to create a whole picture primarily for the sake of documentation is nothing new. An example of documenting social contexts can be found in Robin Evans' work.[237]

Below are examples of the photographs.

First Example:

The photo below documents the projection wall in the computer lab. The computer lab houses a projector, which is apparent in the photograph, used to project data from the adjacent computer. The photograph is one of the key photographs due to the fact that subjects in this experiment were asked to sit down in the same spot from which the photo was taken. It is also the first shot subjects see when they take part in this experiment; hence, it acts as a tool of augmentation. It displaces subjects from the point where they are sitting to another point where the projection is in the screen.

Figure 17. A photograph documenting one of the walls in the computer lab.

Second Example:

236 The camera used is Fujifilm FinePix S5000 Z. Effective pixels 3.1 mega pixels. Photograph resolution is (2048 pixels x 1536 pixels).

237 Evans, R., 1997. The developed surface: an enquiry into the brief life of an eighteenth-century drawing technique, in *Translations from drawing to building, and other essays*. Cambridge, Mass.: MIT Press, pp. 194-231.

The picture below was produced using a group of photographs documenting the ceiling in the computer lab. The picture is produced using photo processing software.[238] The process of joining different photographs to produce the overall picture was done using overlaps of 30%. It is inevitable that some abnormalities and irregularities would present in the picture, however, every effort was made to correct these differences and assure that the produced picture both served the purpose and did not omit or modify the character of the space represented.

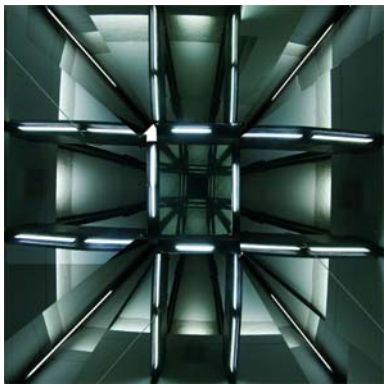

Figure 18. A picture documenting the ceiling in the computer lab.

The final product was a series of flattened pictures that represented the space. The pictures then were organised to form texture maps ready to be used for the next step.

3.4.4.2 3Dimensional Model:

Perhaps when Baudrillard first discussed the relation between the subject and the object in his book *the system of objects*, his focus was the object of everyday *being-in-the-world*, space in our case, in its *present-at-hand* state. Baudrillard's *objective* was to study objects and "the processes whereby people relate to them and with the systems of human behaviour and relationships that result therefrom."[239] To further elaborate on his objective and tie it with the theme of communicative and non-communicative processes, we recreated a 3D computer model that represents the same space documented earlier using digital photography. The element of the *depth*, lost in the first digital photographic documentation will be re-*construed* in 3D documentation. This will capture the dimensionality of our object, and will also leave

238 The software used is Adobe Photoshop the seventh edition.
239 Baudrillard, J., 1996. *The system of objects*. Translated by J. Benedict of *Le Système des objets* 1968. London:Verso, p. 4.

a sign of our embodied interaction with space. When we represent space as a 3D digital model, we "… tie together all the interlacing threads of the 'representation in the *form* of a picture'…"[240] which in turn possesses the ability to rid the mind of its rational or realist influence, and lead it to concentrate on discovering reality through its representations.

The 3D digital model was created over three phases:

1- The actual physical space's dimensions were measured using a Laser Distance Measurement Meter. The meter was used to measure vertical distances rather than horizontal ones. For the horizontal measurements, an existing plan was used to determine the layout and other measurements. The used plan was the same plan that was abstracted in the first stage of the abstraction of L4 (*Figure* 8).

2- The measurements together with the plan were used to construct a digital 3D model using the 3D software Autodesk 3ds Max V.7. In producing the 3D digital model a specific technique was followed. The model was composed of a series of screens covered with textures. All surfaces had no thickness. 3D digital space in this model was created by a series of perceptually bounding screens conjoined together. Each screen took the place of a surface of a wall in the represented real space. The output of this phase was a 3D computer model of the space composed of a series of screens that has no depth (*Figure 19*).

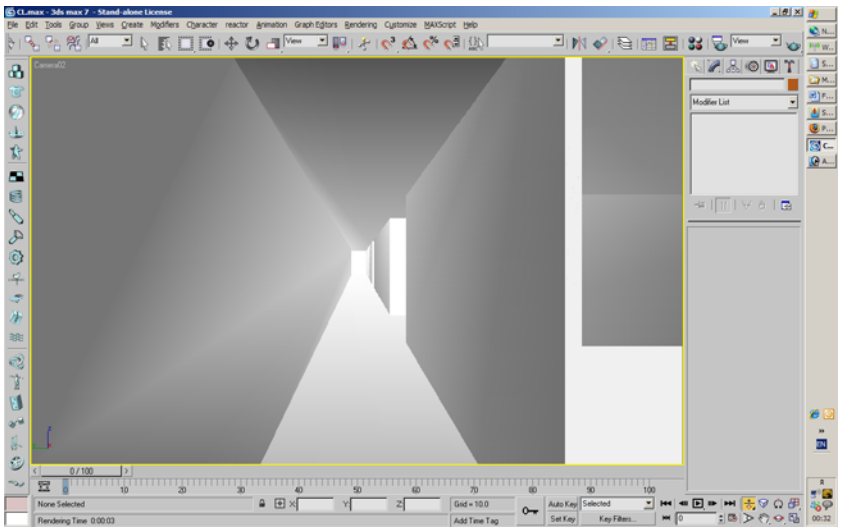

Figure 19. Using 3ds Max V.7. a 3D model was constructed using a series of flat screen corresponding to the Abstraction of L4.

240 Foucault, M., 1966. *The order of things: an archaeology of the human sciences*. London: Routledge Classics, p. 132. (Italics by author)

3- The final phase was applying to each screen the corresponding texture map produced in the photographic documentation (Figure 20).

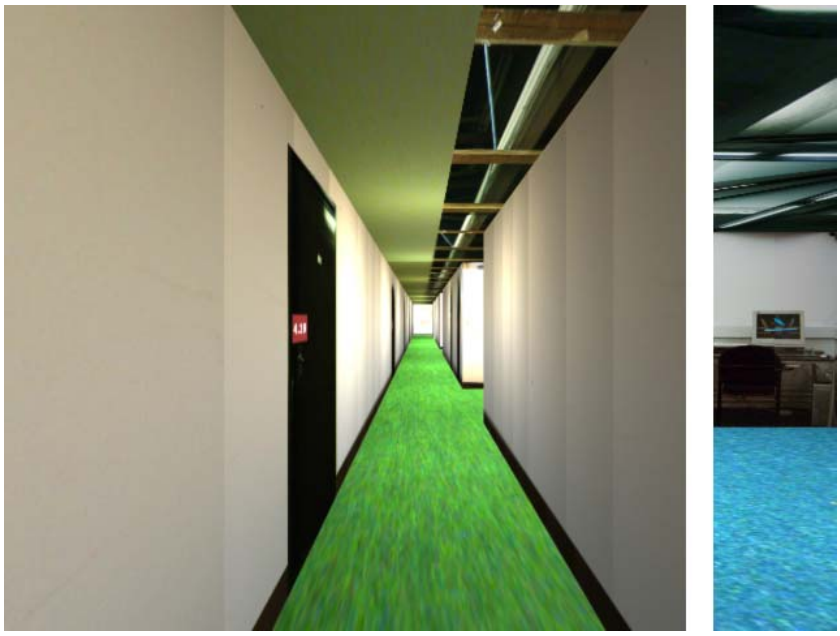

Figure 20. Texture maps were applied to the 3D model to create the representation of L4.

3.4.4.3 Interactivity

a) The system

So far, what we have is a 2D abstracted map and a 3D computer model that can be accessed and viewed on a computer screen using 3ds Max. The ultimate goal, however, is to create two environments: 2D abstract environment that permits navigation on a two dimensional level and a 3D computer model that is available for interaction, mainly by navigation. This will entail designing or adopting an interactive system, and for that we first need to review the cycle of interaction that we are going to design and implement. We utilised Norman's[241] execution-evaluation cycle which consists of seven steps:

1- establishing the goal,
2- forming the intention,
3- specifying the action sequence,
4- executing the action,
5- perceiving the system state,
6- interpreting the system state and
7- evaluating the system state respecting the goals and intentions.

241 Norman, D., 1988. *The psychology of everyday things*. New York, N.Y.: Basic Books. More can be found in Norman, D. & Draper, S., eds., 1986. *User-centered system design*. Hillsdale: LEA.

Norman's cycle emphasises the role of human more than computer in interaction. While the emphasis is soundly based on the objective of providing a better understanding of users' experience and interaction, and gaining insight into the cognitive processes involved in this interaction, our intention in this experiment is to represent, together with the previous, the nature of the environment of interaction. Hence, we expanded the focus beyond just informing human experience to include interaction environment and input-output devices.

Perhaps in this case, interactivity represents how easily visual stimuli can be changed or manipulated by the user. The diagram below is adapted from Kieras and Meyer.[242] It represents human and computer processing systems with all possible inputs and outputs.

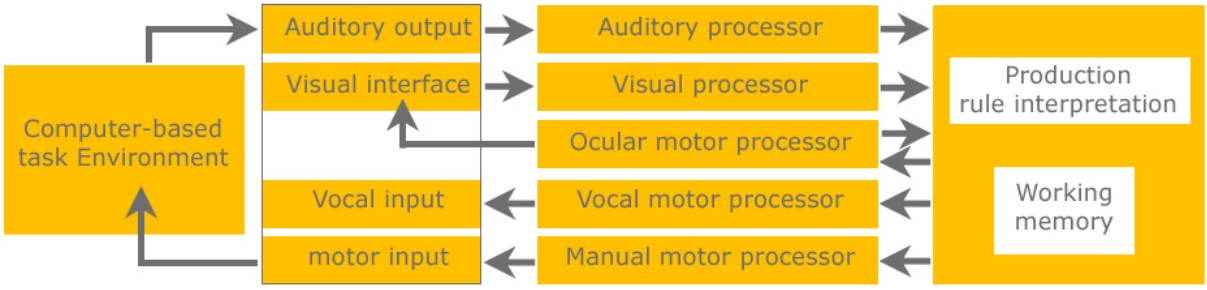

Figure 21. Human-Computer processing and interaction systems (adapted from Kieras and Meyer 1997)

We implemented the above system in two different foci or emphases for both of our environments. The first focus was to wrap user experience around the system as is the case of the abstraction of L4, while the second was to wrap the system around user experience, in the case of the representation of L4. Although in both cases, user experience was central in devising the system or environment (User-Centred Design), the abstraction of L4 intentionally did not observe several principles concerning User-Interface Design. Some of the principles are concerned with the level of intuitiveness a system is expected to have. The justification for this step is to have a system that does not assume the previous knowledge of its user. Thus, out of the following seven elements – Tolerance, Simplicity, Visibility, Affordance,

242 Kieras, D. E., and Meyer, D. E., 1997. An over view of the EPIC architecture for cognition and performance with application to human-computer interaction. *Human-Computer Interaction*, 12(4), p. 391-438.

Consistency, Structure and Feedback[243] – the abstraction of L4 aimed at creating an arbitrary system. It deployed simplicity, visibility, structure and consistency, however, tolerance, affordance, and feedback were not observed. The abstraction of L4 offers a limited set of possibilities making it intolerant. Although it constantly provides instant feedback after each action, the nature of this feedback requires it to be analysed in sets in order to make sense of it. Feedback from one action will not improve users' understanding of the abstraction, however, feedback combined from two actions will dramatically improve understanding. By contrast, the feedback from the representation of L4 was immediate and precise.

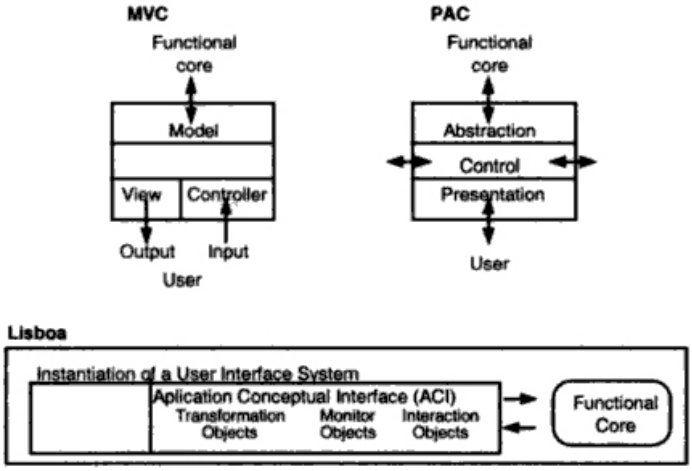

Figure 22. Conceptual architectural models of interactive systems. [244]

In order to do so, we needed to devise an interactive system based on one of the traditional models (*Figure 22*). According to the diagram, the system should have an interactive application that facilitates interaction. It should also have input and output devices.

Roger defines interactivity as "the capability of new communication systems (usually containing a computer as one component) to 'talk' to the user, almost like an individual participating in a conversation".[245] Laurel argues that an interactive system should achieve *first-personness* which is "most completely realised at the

243 Tidwell, J., 1999. *Common ground: a pattern language for human-computer interface design*. [Online] MIT Press. Available at: http://www.mit.edu/~jtidwell/common_ground.html [Accessed 10-12-2007].
244 Palanque, P. & Paternò, F., eds., 2000. *Interactive systems: Design, specification, and verification.* 7th International Workshop, DSV-IS 2000, Limerick Ireland, June 2000. Revised Papers. Lecture Notes in Computer Science Vol. 1946. Springer Verlag, p. 192.
245 Rogers, E.M., 1986. *Communication technology: new media in society*. New York, NY: Free Press, p.34.

extreme end of each of the interactive variables' continuum: Frequency is continuous; range is infinite; significance is maximal."[246] However, he highlights the fact that the design of interactive process "should limit, not what the user can do, but what the user is likely to think of doing".[247] Szuprowicz devises categories of interaction: "user-to-user", "user-to-computer" and "user-to-document", according to the type of information flows,[248] while Goertz[249] suggests four dimensions for interactivity: variability of choices available, modifiability, quantity of both of the previous dimensions and finally linearity/non-linearity of the output. Along the same line, a six-dimension model is proposed by Downes and McMillan: direction of communication, time flexibility, sense of place, level of control, responsiveness, and perceived purpose of communication.[250] The above views will be discussed in the following sections:

Rogers' scale of interactivity

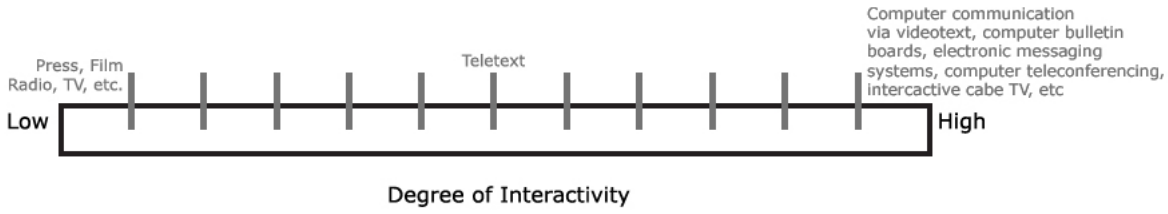

Figure 23. Modified from E. Rogers' 1 D scale for interactivity

The scale illustrated in *Figure 23* provides an indication of the degree of interactivity for each technology. One might have two takes on this scale. The first is due to the fact that it assumes a rather linear state of interaction. Degree of interaction in this scale is determined according to the definition and state of each media at one point in time. Due to the fact that the definition and state of media change constantly in a dynamic way, the scale cannot be accurate at all times, and due to the rapid development of computer technology the scale becomes more inflexible. The second

246 Laurel, B.K., 1986. Interface as mimesis. In D. A. Norman & S. W. Draper Eds., *User centered system design: new perspectives on human-computer interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc, p. 79.
247 *Ibid*., p. 81.
248 Szuprowicz, B.O., 1995. *Multimedia networking*. New York, NY: McGraw Hill.
249 Goertz, L., 1995. *Wie interaktiv sind die Medien? Auf dem Weg zu einer Definition von Interaktivität*. In: Rundfunk und Fernsehen, Jg.43, Heft 4: 477-493. In English: Goertz, L., 1995. How are interactive the media? On the way to a definition of interactivity. *Broadcast and television*, 43(4), pp. 477-493.
250 Downes, E.J. & McMillan, S.J., 2000. Defining interactivity: a qualitative identification of key dimensions. *New media and society*, 2(2), pp. 157-179.

take on this scale is the fact that the range of interactivity is limited. A new technology could have an extended level of interactivity, and thus, the border of interactivity is further pushed. Accordingly, the degree of interactivity may change relatively.

The degree of interactivity of the Abstraction and Representation of L4 is illustrated in the following *Figure 24* modified from Rogers'.

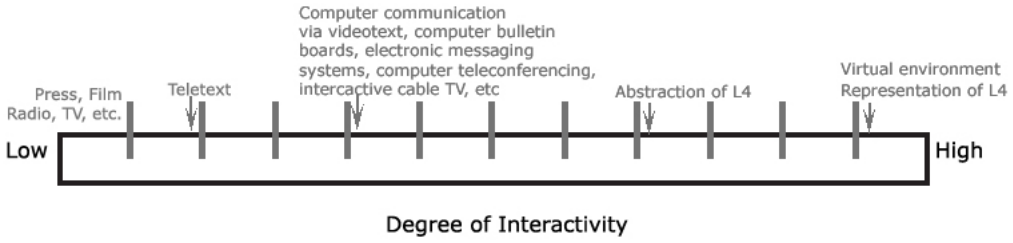

Figure 24. Modified from E. Rogers' 1 D scale for interactivity. Abstraction and representation added to the scale.

Laurel's interactivity Continuum

As opposed to Rogers' one dimensional scale of interactivity, Laurel devised a three-dimensional continuum. According to Laurel's continuum, interactivity is determined by three variables: frequency of possible actions, range of possible actions and significance change occurring due to actions.

In line with Laurel's continuum, L4 abstraction and representation had to have a range of spatial actions that would affect subjects and cause a sense of movement. The sense of movement is a perceivable cue to embodiment. The Frequency of such actions was set to occur every time an input device was used. Subject's personal synthesis and analysis of each given situation in both environments decided whether or not significance was high, and therefore, interactivity was high.

Figure 25Figure 25. The degree of interactivity of the abstraction and representation of L4 according to Laurel's 3D continuum. (Modified from B. Laurel, 1986) ,, modified from Laurel's continuum, shows the level of interactivity of the abstraction and representation of L4 environments.

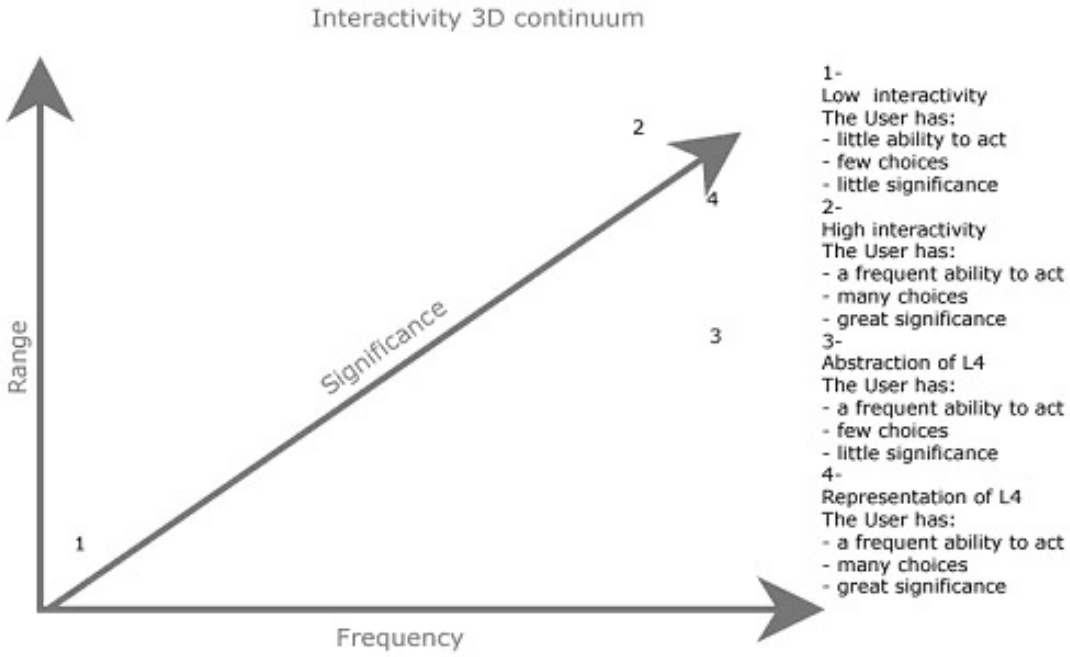

Figure 25. The degree of interactivity of the abstraction and representation of L4 according to Laurel's 3D continuum. (Modified from B. Laurel, 1986) [251,252]

Szuprowizs' matrix

Szuprowizs compares different media according to the type of media flow and mode of interaction. The modified table below shows Szuprowizs' two-dimensional matrix. L4-abstraction environment is placed within object-oriented manipulation because the subject's experience is judged by the subject's ability to critically reflect on the object manipulated, i.e. abstraction of L4, and learn the rules with which the environment operates. When the subject first hits the keys (input action), the reaction (output action) of the environment appears to be random. After several actions and reactions (interaction) a set of rules becomes more evident. The ultimate goal of this environment is achieved when the subject's action results in a screen prompting the subject to key in the name and the password. The screen (or environment) then dictates the action of the subject, therefore switching the roles between the subject and the environment. The lesson learned could be metaphorically extended to any other environment.

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251 Laurel, B., 1986a. *Toward the Design of a Computer-Based Interactive Fantasy System*. Ph.D. Dissertation, Drama department, Ohio State University.

252 Laurel, B.K., 1986b. Interface as mimesis. In D. A. Norman & S. W. Draper Eds., *User centered system design: new perspectives on human-computer interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc, pp 67 – 86.

Representation of L4 poses a slightly different question. The set of rules in this environment is already established and evident at the very start of the interaction. The subject, exposed to a rather familiar interaction, is sceptical of the rules and is ultimately looking for abnormalities and perhaps some entertainment. In the first environment, the information flow is creating a rapid process of learning and creating a new knowledge, while in the second, it is merely testing a given knowledge and looking for incongruities.

Object-oriented manipulation	Mail	Database, Abstraction of L4	Groupware
Broadcast	Newsletter	Information Kiosk	Presentation
Interactive access	Hypermedia	Graphical user interface, Representation of L4	Conferencing, training
	User-to-documents	User-to-computer	User-to-user

Figure 26. The degree of interactivity of information flows between user and abstraction of L4 and representation of L4 according to Szuprowizs' 2D matrix. (Modified from B. O. Szuprowizs, 1995) [253]

Steuer's classification

Steuer's classification of media compares different media according to the type of media flow and mode of interaction. The modified table shows that the abstraction of L4 is at the lowest point of vividness, however, it provides an absolute arbitrary form of interaction which places it at the end of the interactivity access. This was the same for the interactivity of the representation of L4; however, on the scale of vividness it ranks higher than the abstraction. The representation of L4 is nothing like a Star Trek holodeck, and so the overall axis, is near the lower rather than the higher value of it.

253 Szuprowicz, B.O., 1995. *Multimedia networking*. New York, NY: McGraw Hill, p. 15.

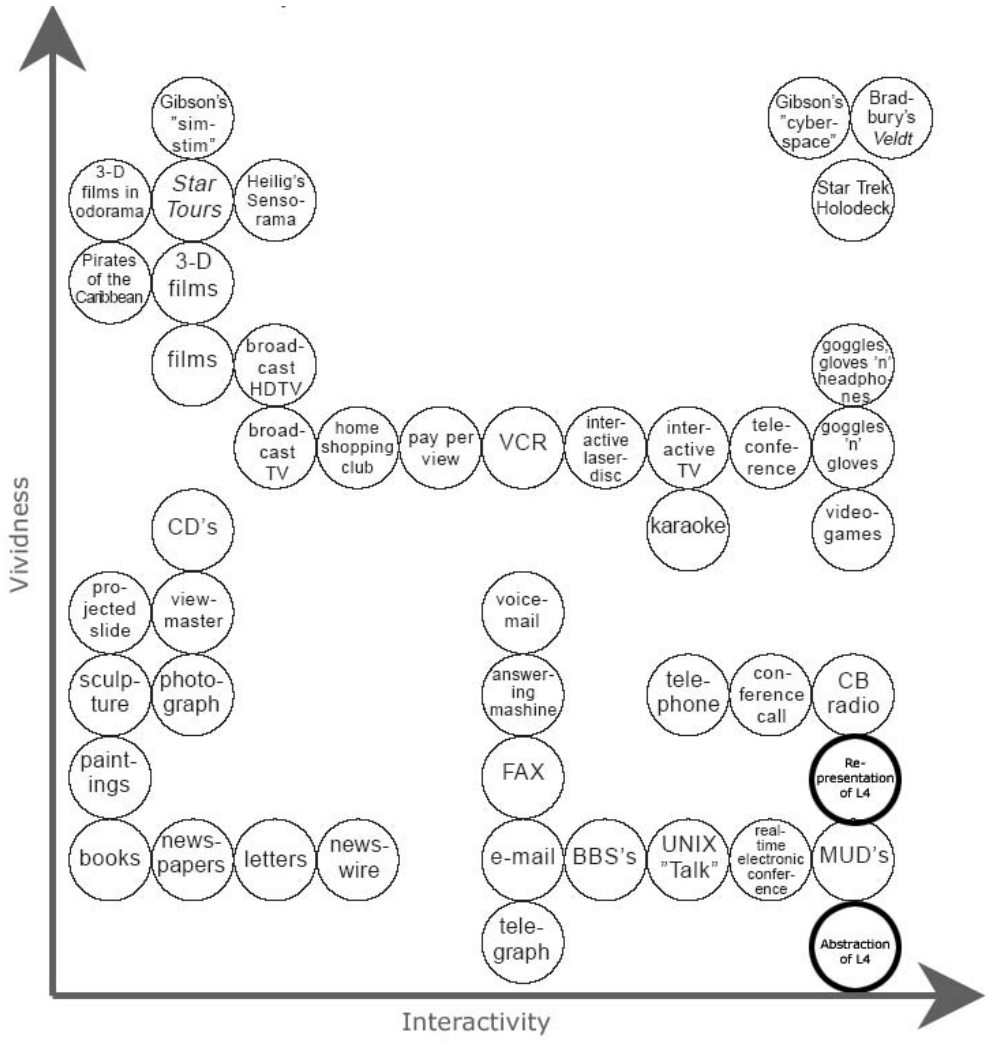

Figure 27. The degree of interactivity and vividness of the abstraction of L4 and the representation of L4 among other media technologies. (Modified from J. Steuer, 1995: 52)[254]

3.4.5 DIRECTING THE STAGE

The abstraction and representation of L4 were imported into Macromedia Director to implement the elements that would render both interactive. At the end of this process, the abstraction of L4 was a 2D visual stage with several hotspots. When the hotspots were clicked the visual element changed causing the hotspot to realign in a different way.

The 3D model representing L4 was imported into Macromedia Director and transformed into a virtual environment available for free 6 degrees of navigation.

254 Steuer, J., 1995. Defining virtual reality: Dimensions determining telepresence. In F. Biocca and M.R. Levy Eds., *Communication in the age of virtual reality*. Hilldale, N.J: Lawrence Erlbaum, pp. 33-56: p. 52.

Hotspots allow simple actions. The most important of all is the hotspot that prompts the username and password screen to popup.

Both environments were ready-at-hand for interaction. In the following section, we will review previous experiments and methodologies implemented in collecting Data.

3.5 Methodology:

The following subsection will review the methodology used in collecting data in this experiment. It will also review the experiments within the field and evaluate techniques that will be used in collecting data in our experiment.

Phenomenology is defined by Husserl as the study of objects or "whatever appears as such"[255] and is widely known as the reflective study of the essence of consciousness and the entity of being. Such a method is warranted by the distinction between reality, and appearance. A virtual environment and its corresponding physical one appear to be the same, although materially they are two different things. The success of phenomenology stems from the fact that it grants each individual a personal account of experience, and, ultimately, applies the process of phenomenological reduction to establish general facts about human experience.

Although well established beyond doubt as the study of objects and how they reveal themselves to us, a different construal of the elements implicated in this definition, may highlight phenomenology as the study of the foundation of human experience from the first person.

Phenomenology, particularly within the digital paradigm, is well informed by an extensive body of theoretical and experimental literature in the field of embodiment in relation to virtual environments. To argue for the proposed experiment, we will first present some of this experimental literature categorised by the different approaches that are to be deployed. Each approach will then be subcategorised into different techniques. We will then dispose of objections based on common assumptions relevant to these techniques.

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255 Husserl, E., 1962. *The crisis of european sciences and transcendental phenomenology: an introduction to phenomenological philosophy*. Translated from German by D. Carr. Evanston: Northwestern University Press, 1970), p. 144.

While deploying McLuhan's consideration: "media are extensions of the senses"[256], Biocca[257] argues that a developed interface of embodiment that is increasingly "natural" could result in different adaptations or changes in the user, thus highlighting the capabilities of this environment as an interactive tool of embodiment. Slater and Usoh,[258] however, emphasise the perceptual spatial character of these environments, and the role of the human body as an object within this spatial virtual environment. They also extend their argument in an attempt to explore the spatio-temporal possibilities of the duality of body-avatar. Objective physiological definitions and measurements, Sheridan argues, cannot represent the increased subjective sense of interaction and immersion or presence in virtual environments, whereas, subjective measurement techniques ought to be the central agent of human experience.[259]

The thesis that new media and virtual environments are arenas for investigation of human perception and embodiment is not new. The thesis was advocated by Lanier and Biocca[260], Heeter[261], Slater and Usoh[262], Lombard and Ditton[263], and many others.

3.5.1 SUBJECTIVE:

The main subjective measures used in collecting data in this experiment are questionnaires, and qualitative techniques. The first was in the form of a *post-test questionnaire*, while the latter consisted of two parts: *Thinking Aloud* during the actual experiment, and a *semi-structured interview*.

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256 McLuhan, M., 1966. *Understanding media*. New York: Signet.

257 Biocca, F., 1997. The cyborg's dilemma: progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication*, [Online] 3(2). Available at: http://www.ascusc.org/jcmc/vol3/issue2/biocca2.html [Accessed 18 June 2005].

258 Slater M. & Usoh M., 1994. Body centred interaction in immersive virtual environments. In *Artificial life and virtual reality*, Eds. N. Thalmann and D. Thalmann, John Wiley & Sons, England, pp. 125-147.

259 Sheridan, T.B., 1992. Musings on telepresence and virtual presence. *Presence: Teleoperators and Virtual Environments*, 1(1), pp. 120-126.

260 Lanier, J. & Biocca, F., 1992. An insider view of the future of virtual reality. *Journal of Communication*, 42(4), pp. 150-. 172. (for more information please check: Biocca, F., 1997. The cyborg's dilemma: progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication*, [Online] 3(2). Available at: http://www.ascusc.org/jcmc/vol3/issue2/biocca2.html [Accessed 18 June 2005])

261 Heeter, C., 1992. Being there: the subjective experience of presence. *Presence: Teleoperators and Virtual Environment*, 1(2), pp. 262-271.

262 Slater M. & Usoh M., 1994. Body centred interaction in immersive virtual environments. In *Artificial life and virtual reality*, Eds. N. Thalmann and D. Thalmann, John Wiley & Sons, England, pp. 125-147.

263 Lombard, M. & Ditton, T. 1997. At the heart of it all: the concept of presence. *Journal of Computer-Mediated Communication*, [Online]. 3(2). Available at: http://jcmc.indiana.edu/vol3/issue2/lombard.html [Accessed 30-03-2007].

Perhaps the first to devise subjective techniques, among other tools, to measure pilot workload[264] was America's National Aeronautics and Space Administration (NASA). Measures were developed by Dieter[265], Gartner and Murphy[266], and Sheridan and Simpson.[267] Henry Jex used simple tasks to track workload,[268] while Reid *et al*[269] developed multidimensional subjective measures of work load.

Subsequently, these techniques used in experiments targeting pilots, within NASA and the U.S. Federal Aviation Administration (FAA), were also used with the new technologically advanced Crew-Vehicle Systems Research Facility (CVSRF), or Flight Simulator. The level of realism of these systems qualified them to be some of the first Virtual reality systems. Hence, techniques developed to measure pilots' mental workload immigrated through flight simulators to the newly developed field of virtual reality.

The major contribution at that time came from Jex, who first proposed criteria for mental workload comprising measures that are:

1- Relevant

a) Direct connection with the mental workload or its components.

2- Sensitive

a) Monotonic trend with respect to mental workload

b) High test-power with respect to mental workload variable, ie high (covariance/residual) error

c) Insensitive to other variables or ambient environment

3- Concordant

a) Ubiquitous trends in target population

4- Reliable

a) Proven test-retest repeatability

b) "Differential stability" (parallel trends) among subjects with practice on task

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264 Spyker, D. A., Stuckhouse, S. P., Khlafalla, A. S., et al., 1971. *Development of Techniques for measuring Pilot Workload*, NASA CR-1888.

265 Jahns, D.W., 1972. Operator workload: what is it and how should it be measured? In K. D. Gross & J. J. McGrath, Eds., *Crew system design Conference*, Los Angeles, pp. 281–288.

266 Gartner, W.B. & Murphy, M.B., 1976. *Pilot workload and fatigue: a critical survey of concepts and assessment techniques*. NASA TN D-8365.

267 heridan, T.B. & Simpson, R.W., 1979. *Toward the definition and measurement of the mental workload of transport pilots*. Final Report, Contract DOT-0S-70055.

268 Jex, H.R., 1979. A proposed set of standardised sub-critical tasks for tracking workload calibration. In *Mental Workload: Its Theory and Measurement*, N. Moray, ed., New York, NY: Plenum Press, pp. 179-188.

269 Reid G.B., Shingledecker, C.A., Nygren, T.E., et al., 1981. Development of multidimensional subjective measures of workload. Proc. 1981 International Conference on *Cybernetics and Society*, pp. 403-406.

c) Validated means and variance statistics, with norms for norms for the target population.

5- Convenient

a) Easy to learn and administer

b) Portable, for use in field trials and evaluations

c) Low cost, for a given level of measurement reliability

Jex argued that the three dominant aspects are "Attentional Demand", "Difficulty of Control" and "Adequacy for the Task". He then compared these aspects against Sheridan's[270] dominant factors – Business, Complexity and Anxiety – and O'Donnell's "attentional demand" and "difficulty of control".

3.5.2 QUESTIONNAIRE:

1. Post-test questionnaire

Questionnaires are the most popular subjective measure of collecting data from experiments. This is due to the fact that they can reflect different aspects of human experience but maintain consistency across data from many subjects, thus allowing comparison against a specific scale.

Although Jex could be identified as the person to group the different experiments and classify them as one item, then categorising them into sub groups, Sheridan was the person with whom the techniques travelled into Virtual Environments as is the case with the whole system. There are many questionnaires in the field, most of which were developed to measure presence in virtual environments, but this section will concentrate on two main Questionnaires,

Depth of Presence in VE Questionnaire (Slater-Usoh-Steed)

Although this questionnaire was implicated in many different research projects, particularly in relation to presence, its importance stems from the fact that it started from the basic premises of *the body*. Slater *et al* assert that bodies fulfil several crucial functions. These functions are the very functions that this research is concerned with, i.e., "the physical embodiment; the medium of interaction, through the use of our bodies we interact with and are able to change the world; a medium of

270 heridan, T.B. & Simpson, R.W., 1979. *Toward the definition and measurement of the mental workload of transport pilots*. Final Report, Contract DOT-0S-70055.

communication; It is the social representation of self in several respects."[271] They depart from this proposition to construct an argument by contrasting *the body* with *virtual bodies*. This contrast results in a challenge between what they label as the everyday relationship between mind and body,[272] and what we would like to offer as the *familiar* interaction in the framework of *embodiment*.

The experiment that preceded this questionnaire attempted to offer a comprehensive measurement of presence in virtual environments by measuring: (a) The subject's sense of "being there"; (b) The extent to which, while immersed in the VE, it becomes more "real or present" than everyday reality; (c) The "locality", that is the extent to which the VE is thought of as a "place" that was visited rather than just as a set of images.[273] The experiment focus was on body and virtual body, hence, subjects were expected to assume a very high degree of identification with their virtual bodies. As, our focus is on familiar space and spatiality as an attribute of embodiment, consequently, subjects were expected to have a high degree of familiarity with the space in question.

The theme of the body in Slater *et al.*, as opposed to embodiment, highlights different aspects of human experience and perhaps the most obvious of all is the distinction between the body as an object and embodiment as a comprehensive condition or state of being. Embodiment is better suited for generalisation than the body. Consequently, body centred interaction, as Slater *et al*., suggest, involves components such as: (a) Inference about the state of the body from limited information, (b) Body centred feedback and (c) Magical and Mundane Interaction.[274] All of the above mentioned interactions, although implemented in both of our environments, have different methods of projection and feedback.

Lombard and Ditton Questionnaire

Lombard and Ditton identify six practical and theoretical concepts pertaining to virtual environments as part of new media: presence as social richness, as realism, as

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271 Slater M. & Usoh M., 1994. Body centred interaction in immersive virtual environments. In *Artificial life and virtual reality*, Eds. N. Thalmann and D. Thalmann, John Wiley & Sons, England, pp. 125-147.
272 *Ibid*.
273 *Ibid*.
274 *Ibid*.

transportation, as immersion, as social actor within medium and as medium or social actor. For the purpose of this experiment, we will concentrate on three concepts:

Social Richness

Lombard and Ditton argue that the degree to which a medium is perceived to be sociable, warm and intimate when used to interact with others is the keystone to identify a sense of presence in the media.[275] They adapt Rice's *media richness* theory[276] and cite his criteria for media variability in terms of "(a) overcoming various communication constraints …, (b) transmit the social, symbolic, and nonverbal cues of human communication; and (c) convey equivocal information"[277]

While they identify social richness as one definition of presence in relation to its social context, we would like to shift this identification in two different ways: a) by reinstating the relation between social richness and the identification of presence which, according to Lombard and Ditton, is dependent on two concepts, namely intimacy and immediacy,[278] and b) by directing both concepts towards space, instead of being interpersonal.

Realism

Lombard and Ditton bring to attention two different types of realism that are generally undifferentiated in experiments concerning virtual environments: a) social and b) perceptual. They characterise the first by how 'true to life' the events taking place in the virtual environment are. They make the distinction between the first and the second by emphasising the high level of perceptual realism that is detected in the second although it might be detached from everyday life. They present science fiction movies as an example of the second.

We emphasise both aspects in our experiment by using the abstraction of L4 to highlight the first, and the representation of L4 to highlight both. We attempt to

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275 Lombard, M. & Ditton, T. 1997. At the heart of it all: the concept of presence. *Journal of Computer-Mediated Communication*, [Online]. 3(2), Available at: http://jcmc.indiana.edu/vol3/issue2/lombard.html [Accessed 30-03-2007].
276 Rice, R.E., 1992. Task analyzability, use of new medium and effectiveness: a multi-site exploration of media richness. *Organization Science*, 3(4), pp. 475-500.
277 *Ibid.*
278 Lombard, M. & Ditton, T. 1997. At the heart of it all: the concept of presence. *Journal of Computer-Mediated Communication*, [Online]. 3(2), Available at: http://jcmc.indiana.edu/vol3/issue2/lombard.html [Accessed 30-03-2007].

understand social realism by placing it in two different, yet similar contexts. We also aim to understand perceptual realism by contrasting it with social realism. Finally we introduce familiarity as an element of both realisms.

Social Actor within a Medium

It is suggested that in a seemingly one sided interaction with no possible real-time interaction, there may exist a tendency to generate a "simulacrum of conversational give and take, [which] may be called para-social interaction"[279]

We argue that para-social interaction is a sign of familiarity that is directed towards space as a reaction to intimacy and immediacy provoked by realism.

3.5.3 QUALITATIVE :

Think aloud:

Think aloud technique is also called verbal reporting on thinking or concurrent verbalisation. The basic instruction is very simple: "Tell me what you are thinking about as you work."[280] Although well established in psychological research, perhaps the first to introduce this technique to computer science in 1972 were Allen Newell and Herbert Simon in their book: Human Problem Solving. As the title suggests, both professors of Carnegie Mellon University's School of Computer Science attempted to devise a methodology to help them model the sequence of human thoughts while solving a problem.[281] This technique was intended as part of the effort to simulate human problem solving into Artificial Intelligence.

Clayton Lewis applied this technique to optimise computer user interface as part of IBM usability tests.[282] Later on, C. Lewis and J. Rieman elaborated on this technique in their book: Task-Centered User Interface Design: A Practical Introduction. While it provides qualitative subjective data that represent the concurrent process of thinking as a reaction to stimuli, the ability of observer to

279 Horton, D. & Wohl, R.R., 1956. Mass communication and para-social interaction: observations on intimacy at a distance. *Psychiatry*, 19(3), pp. 215-229: p. 215.
280 Lewis, C. & Rieman, J., 1993. *Task-centered user interface design: a practical introduction*. Boulder, Colorado: University of Colorado. Available at: http://hcibib.org/tcuid/ [Accessed 09-10-2007].
281 Newell, A. & Herbert A.S., 1972. *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.
282 Lewis, C.H., 1982. *Using the "thinking aloud" method in cognitive interface design*. IBM Res. Rep. RC-9265. Yorktown Heights, N.Y.

decide when to intervene to prevent any misconception dictates that proper training is provided to ensure that the technique produces the data within the required scope. Since actions are uttered, subjects achieve intentionality as they are performing and describing an action, thus being aware of the action undertaken. However, this poses time limitations as the task load is increased on subjects, which might cause either drifting towards describing objects perceived instead of describing their experience or slowness in expressing the process of thinking. In the field of cyberspace in 2001, Neale et al [283] analysed the content of chat rooms and videoconferencing data to extract themes representing user opinions and behaviours. The qualitative data gathered were matched and tested against proposed hypotheses. Spagnolli et al[284] used an excerpt of text to illustrate their ideas, however, they did not clearly intend to use the technique. In Napier University, Turner P. et al. [285] and Turner S. et al.[286] deployed the technique as an essential part of their data collection strategy in their experimentation.

Now, we would like to present the questionnaire that we created deploying previous techniques, and the procedure of this experiment.

3.5.4 EXPERIMENT PROCEDURE AND QUESTIONNAIRE

The experiment was designed to take place in the same space it abstracted and represented. The experiment was divided into two sessions: one for the abstraction of L4, and the other for the representation of L4. In both sessions subjects were presented with the same instructions.

All the subjects of the experiment were regular users of the space. All subjects had a design background. Subjects were briefed about the three steps in each session of the experiment, namely, reading instructions, undergoing the experiment, and then finally answering the questionnaire.

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283 Neale, H. & Nichols, S., 2001. Theme-based content analysis: a flexible method for virtual environment evaluation. *International Journal of Human-Computer Studies*, Vol. 55 pp. 167-89.

284 Spagnolli, A., Varotto, D. & Mantovani, G., 2003. An ethnographic, action-based approach to human experience in virtual environments. *In International Journal of Human-Computer Studies*, 59 (6), pp. 797-822.

285 Turner, P., McGregor, I., Turner, S., & Carroll, F., 2003. Evaluating soundscapes as a means of creating a sense of place. In E. Brazil, & B. Shinn-Cunningham (Eds), *Proceedings of the 2003 International Conference on Auditory Display,* 148-151.

286 Turner, S., Turner, P., Caroll, F., O'Neill, S., Benyon, D., McCall, R., et al. 2003. *Re-creating the Botanics: towards a sense of place in virtual environments.* Paper presented at the 3rd *UK Environmental Psychology Conference*, Aberdeen, 23-25 June 2003.

The instructions informed the subjects that the session would be video-recorded and that no help would be provided. In the experiment, subjects were asked to achieve a simple task - to find the login interface in order to login using their username and password.

After achieving the task or deciding to stop in the first session of the experiment, subjects were presented with the questionnaire in appendix 1. The questionnaire included three sets of questions: a) preliminary questions to capture the initial reaction to the abstraction of L4 in terms of interactivity and sense of involvement, b) questions asking subjects to rate a group of social and perceptual elements, and c) a group of *yes/no* statements to rate the sense of spatiality, familiarity, interaction and embodiment.

Upon the completion of the first session questionnaire, subjects were asked to start the second session. With the exception of the environment, almost everything was similar to the first session. The environment presented in this session was the representation of L4. The questionnaire that followed the session had three parts like the first questionnaire in the first session. The questionnaire, which can be found in appendix 2, had the same questions in part b and part c, however, part a acted as a follow up on part a in the first session. Both parts formed the free magnitude estimation of interactivity and engagement.

3.6 Discussion

3.6.1 REALITY IS FAMILIARITY OF BODILY NOTIONS

"…the experience of our own body teaches us to embed space in existence." [287]

When forming the experiment, our initial assumption was that discussions with subjects would exhibit similar tendencies towards a significant difference between the abstraction and representation of L4. This position was lost in the recognition of the results of subjects following both experiments. We were left with the impression that significant similarity in the way abstraction and representation are perceived is due to what Merleau-Ponty calls 'body image', or "a compendium of our bodily

287 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, p. 131.

experience, capable of giving a commentary and meaning to the internal impressions and the impression of possessing a body at any moment".[288] Although later he attempts to show the relevance of any association established during a human experience, to total awareness of one's own postures in the inter-sensory world, Merleau-Ponty dismisses the concept of 'form' that has been billed as a central claim of Gestalt's psychology.[289]

The abstraction of L4, as stated previously, was created using a deliberation process that involved activities among which was the elimination of Gestalt's principles of perception. The underlying assumption was that by eliminating spatial cues that may identify and render a space familiar by signalling visual associations, we would be able to present an unfamiliar abstraction of a space that is familiar. We created a sign to signify an object by abstracting the object of its qualities and merits. A space's main quality is its 3 dimensionality or spatiality. Our abstraction eliminates this quality of L4, nevertheless, the abstraction has its own spatial quality as an object occupying space. We investigate the element of spatiality, then, through interviewing subjects.

We tested whether the power of metaphoric association and Gestalt's principles of perception tune people's thought analysis in a spatially congruous direction by asking subjects to determine the element of spatiality in the abstraction of L4. To this end, we presented subjects with a set of yes/no questions. Spatiality emerged as a dominant element of all subjects' experience(s) in both the abstraction and representation of L4. All subjects perceived themselves to have been present in a kind of space in both environments. Comments from subjects highlighted their spatial experience. One subject when thinking aloud said "I have to go somewhere… not inside here", later he made a comment that affirmed the fact that he had already identified the projection to be the abstraction of L4. This excitement stemmed not only from incisive identification, but from the exhilarating sense of which the subject was looking for an abstraction of his daily experience in real space: "I would like to take some coffee in the kitchen first" (the subject was pointing at the square that abstracted the kitchen. Another subject identified a different experience. He referred

288 *Ibid.*, p. 113.
289 *Ibid.*, p. 114.

to the early arcade game of *Pacman*[290]: "It looks like *pacman*". Later when auto confronted with taped video of the experiment, the subject identified two stages in the process whereby he recognised the spatiality of his experience: The first stage was classifying the object projected in front of him, "I thought *that is like a building plan*", then the second stage was matching the classified object to the appropriate tier of possible objects, "secondly when I travelled, looked around, then I figured out that is the plan (of L4)". The subject's choice of words, not as a matter of expression, reveals the spatiality of his experience. The two stages of recognising the abstraction of L4 seem to be inseparably rolled into one. One subject reports: "I pretty soon recognised the plan as being this building". The first stage of identifying the abstraction as a plan seemed to be too *rigorous*, or perhaps *unwarranted*. The similarity among subjects' choice of words reflected the similarity in their spatial experience, not merely similarity in the manner of reporting perceptions.

When asked about the reason why he referred to the abstraction of L4 as an *abstract space* the subject answered "I do not know", but subsequently attempted to use the notion of experience and tie it to space in order to give a logically satisfactory definition of *Abstract space*. He asked "you do not mean the space, you mean the experience?!" When confronted with the fact that what he was looking at was a projection on a wall, the subject nodded positively, but emphasised that "the space exists already. It is the space in my mind". When not practised, spatiality is reduced to a mental state, not a bodily attribute. It acts as a predicate and dimension to our relationship with space, which in turn is grounded in our bodily interaction. Bodily interaction is both permitted by and defines the meaning of space.

One can argue against the notion of *bodily interaction* more convincingly than for it, using the fact that the abstraction and representation of L4 are both digital interactive environments and are not real. However, if one is to interpret a thus far established spatial attribute of a human experience, one of the most important things to be developed right away is a sense of context, space in our case.

The relationship between *bodily interaction* and its context is subject to a *level-of-reality* check using context analysis. However, first we will review subjects'

290 Released in the early 1980s by *Namco*, now *Bandai-Namco* <http://www.bandainamco.co.jp/>

accounts of *reality* in relation to spatial experience, of the abstraction and representation of L4.

3.6.2 THE DIFFERENCE BETWEEN REALITY AND SPATIAL INTERACTION

When designing the experiment, we considered various interpretations that might enable us to describe L4. In one sense, we were creating two versions of one reality. One might argue we were susceptible to a duality and, possibly, introducing contradictory interpretations: abstraction (being highly subjective) vs. Representation (being highly compliant with perceptually accepted norms). We argue against that by pointing out that both interpretations find their origin in a single real object, however, the abstraction and representation of L4 are irreducible to each other.

Level-of-reality might provide an indicator as to whether or not spatiality, as an attribute of both environments, was well abstracted/represented through bodily interaction.

One Subject identified the combination of spatiality and interaction as the anchor that allows us to determine the level-of-reality of a given experience and links it with the organised spatial narrative. He justifies the spatial feeling in the representation "… because you were really inside a 3D space. You can navigate the room…", while level of reality in the abstraction of L4 was less prominent because of the relatively limited spatial cues: "I pretty soon recognised the plan as being this building, so having been here most days of the last year, it felt very familiar". The subject's sense of realness was called upon by familiarity.

Spatial cues and movement in the representation of L4, although seemingly clear and succinct, provide little insight as to how level-of-reality operates via bodily interaction to develop familiarity as a product of interaction. Lack of spatial cues in the abstraction of L4, though they might be seen as weakness, is the crucial defining factor of the nature of interaction. Hence, the distinction between level-of-reality of both the abstraction and representation of L4 can be drawn in terms of their capacity to instantiate spatial immediacy. One subject reports "in the first it was much more difficult to understand whether you were moving left or right. It was referring only to the words left or right, but you couldn't feel it … While in the second example I

would have immediately the feeling, you know, now I am turning left, right". Another subject reported the same experience with the abstraction of L4 and identified spatial immediacy as a cue that may be used to make inferences concerning understanding of space. She says "it is like seeing it from above, from a distance, not being in the space".

Spatial immediacy utilises spatial cues to familiarise sensory context. In turn, familiarity of sensory context, as an outcome of spatial interaction, translates into cumulative understanding of space and its representations, and is followed by a set of potential responses. A full understanding of space provides the basis of spatial interaction, starting with movement in real space and in turn leading to full interaction with space metaphorical representations. A subject immediately identified the abstraction of L4 "It was the *Maltings* (name of the building), immediately in a second ... I mean I just looked at the map, and I had the map already in my mind", and he justified his familiarity with the sensory context by pointing out his repetitive use of L4, thus, interpreting the abstraction of L4: "because I spent so much time there, so I said oh there is the *Maltings*. I think I even said it."

However, the failure to achieve full understanding of space may hinder one's ability interact with space representations or abstractions. Moreover, familiarity of spatial situation could affect space understanding. One subject justified her failure to attain full understanding of L4 by stating that she did not feel immersed in the space, or she felt she was above the space, in both cases space meaning that represented by the abstraction of L4. She says "But it is like seeing it from above, from a distance, not being in the space".

Subjects found movement in abstraction of L4 rather arbitrary, which, in turn, affected their understanding of spatial interaction in it. Familiarity of spatial interaction helped some subjects achieve their goal. One subject reported: "it is trial and error", but he had a presupposition which was not about space as a whole but about interaction, namely that there must be a standard, or *familiar*, way of interacting with abstraction of L4 according to the given task. He says: "I had the idea that whatever the goal was, it must be far away from the start point." Another subject had the same presupposition. He reports: "I quickly saw the bigger picture,

and realised that at the end of the corridor, and the furthest part must be the important part".

The abstraction of L4 provoked rather abstract presuppositions about spatial interaction, whereas the representation of L4, due to spatial immediacy, highlighted a different nature of spatial interaction; one that calls on the familiarity of sensory contexts. At times, the experiment can seem like a conflict between subject's own natural tendency to follow what seems to them like a logical build up of a familiar situation, and the apparently arbitrary thread of events constantly causing them to lose their grip on the familiar in favour of what seems to have nothing to do with the task in question. Familiarity's shortfall is manifested in being too narrow. Each conscious selection dictates a specific frame of understanding, and determines a form of interaction with space, thus, eliminating other options through the very selection process. Understanding space through familiarity of spatial interaction, which is hugely dependent on our embodiment, carries the danger of filtering out what could be otherwise viewed as augmentation of reality, or what Baudrillard would describe as hyper-reality. Abstraction is closer to the essence of experienced reality than representation is.

Spatial interaction and reality are interconnected with familiarity.

3.6.3 SPATIALITY, REALITY AND HOW FAMILIARITY FITS IN

When designing this experiment there were several issues to consider, but by far, the most important question in regard to the physical space of the experiment was the question of the *spatio-temporal* relationship between subjects and this space. One of the goals of the experiment was to re-instantiate this relationship on many different levels. The temporality of this relationship is explored in past, present and future analyses; past by ensuring that subjects are regular users of space on the one hand, and also, in order to assert familiarity as an axiom in this experiment, by using the very same space as the one where this experiment takes place. Consequently, when the experiments commence, a new visible layer forms a new relationship between the subject and space in present utilising the past, and thus affecting future understanding.

Familiarity, thus far, is a framework that combines human experience and space. It also extends this framework to include other objects or images of objects. By contrast, spatiality is the framework that combines human embodiment and space, where space is the plurality of associations and merit-equivalent attributes that represent our space of everyday *being-in-the-world*. Different representations represent different levels-of-reality. Accordingly, the abstraction and representation of L4 address both familiarity and spatiality through the concept of space. The framework of familiarity compensates for the loss of spatiality in the abstraction of L4. The compensation is demonstrated in many ways such as spatial expressions: "I pretty soon recognised the plan"; "it felt very familiar"; "you think of it spatially"; "I thought of it in 3D while I was with the 2D". It is also demonstrated in the act of suppressing embodiment: "… being just a little *box* navigating the corridors …"; "the *dot* that moves down"; "you wouldn't be sure if the small *dot* will turn right or left". By contrast, the familiarity is replaced by embodiment to compensate for the loss of the virtual space which is further confused by the presence of the physical space being represented in the representation of L4. This is most evident in expression of embodied interaction: "[I was] concentrating more on *walking* down the corridor"; "I think [I am] situated in the same room and even *at the corner of my eye* I can *see* the screen savers, and I am still also seeing those in the virtual environment". This is also evident in the expressions that explicitly acknowledge the role of embodiment: "I very quickly finished the experiment from my sort of *body notions*"; "I had the map already *in my mind*"; "*I* was *in* there"; "I know that *somebody* has designed it who was *human like me*".

The interplay between space and embodiment in the abstraction and representation of L4 is both dependent and affected by familiarity. Therefore we are presented with a familiar abstraction, and an embodied representation. The physical space offers the opportunity to morph both together. The next subsection introduces the attributes that were produced by subjects to describe their experience.

3.6.4 FAMILIAR SCALES OF INTERACTION

In the first part of the experiment, subjects were asked to state in one word the degree of difficulty of achieving the task. They were also asked to represent with one word

the amount of confidence they had while achieving the task. The same was repeated in the second part of the experiment. Both words describing confidence in the abstraction and representation of L4 were to serve a specific purpose by occupying the far ends of a scale where the median ground between both stools reflects the nature of experience and, perhaps, the underlying structure.

The analysis showed the abstraction and representation of L4 were linked by the virtue of being a form of representation of the actual space of L4. Thus, a description of the subject's experience would reflect the attributes of this experience but from a purely subjective point of view. Previous analysis of the nature of interaction reinstated many aspects of it, and highlighted familiarity as well as spatiality as a strong element supporting interaction. However, there was no way of determining the magnitude of this interaction except by monitoring the behaviour of subjects and their verbal comments since these were the only signs of interaction. This method borrows its premises from the well known technique in linguistics called *direct magnitude estimation (DME)*

3.6.4.1 Reattribution of Experience: Direct Magnitude Estimation (DME)

In 1953 S. Stevens attempted to build on the work of J. Merkel's *Methode der doppelten Reize*[291] and devise a method for the assessment of subjective magnitudes which he mainly used for measurements in relation to sound and light.[292] The method permits the subject or *observer* in an experiment to assign a subjective numerical value to estimate the magnitude of a given stimuli. Stevens highlighted the problem of context and how it plays a role in the estimation of a magnitude. He also reported that constraints in this method were removed in order to allow subjects to make all decisions when it comes to choices.[293] However, the Use of Numbers seemed to impose a quantitative quality that, they argue, presupposed a level of intellect required from subjects. In order to overcome this, a scale between 1 and 8, as opposed to 1 and 10, was proposed. In another experiment, he opted to pose only one limitation – that of using numbers to report magnitude estimation but without

291 Merkel, J., Die Abhängigkeit zwischen Reiz und Empfindung, *Phil. Stud.,* 4, 1888, 541-594; 5, 1889, 245-291; 5, 1889, 499-557.
292 Stevens, S. S. 1953, "On Brightness of Lights and the Loudness of Sounds," Science, 118, 576.
293 Stevens, S.S., 1956. The direct estimation of sensory magnitudes: loudness. In *The American Journal of Psychology.* 69(1), pp. 12-18.

suggesting any minimum or maximum.[294] This allowed calculating medians and effectively forming formulae that permit the prediction of different results.

3.6.4.2 Devising Attributes: Free-Modulus Magnitude Estimation (FMME)

In relation to virtual environments, the technique was first used to measure perceived presence.[295] The method enabled subjects to verbalise their intuitions without any restriction due to any preset values on a scale provided by the researcher. The subject then is presented with a different stimulus and asked to provide an estimation that is equally comparative of the stimulus in reference to the previous estimation. The power of this method lies in the fact that it imposes no criterion for estimation.

Snow and Williges used the method to estimate the level of presence in a virtual environment taking into consideration different technical variables. By contrast, our aim is to estimate the level of perceived difficulty and confidence in achieving the task in both of our environments with the intention of building up a new set of attributes according to the input.

Table 1. Free-Modulus Estimation of the level of difficulty of spatial experience.

	Level of abstract Difficulty	Level of Virtual Difficulty
1	Orange	Lime Green
2	Progressive	Smooth
3	2	1
4	Challenging	Tough
5	Average	Good
6	Black	White
7	Trapped	Open
8	Grey	Red

`Table 2. Free-Modulus Estimation of the level of embodiment confidence during the task.

	Level of abstract confidence	Level of Virtual confidence
1	sky blue	white
2	panic	fun
3	2	1
4	high	medium

294 *Ibid.*, pp. 19-22.
295 Snow, M.P. & Williges, R.C., 1998. Empirical models based on free-modulus magnitude estimation of perceived presence in virtual environments. *Human Factors*, 40(3), pp. 386-402.

5	lessening	great
6	3/5	4/5
7	uncertain	certain
8	very little	somewhat

The results reviewed above typify the contrast between the abstraction and representation of L4 and generally introduces the abstraction of L4 as a difficult task where subjects have less confidence, whereas, the representation of L4 makes their task less difficult and boosts their confidence.

Although two expressions do not explicitly form a scale, nevertheless, they contribute to the definition of the scale. There were some recurrent themes among the expressions, and these can be summarised in the following four:

Numeral

One subject estimated the level of spatial experience difficulty in the abstraction of L4 with the number 2, whereas, he gave 1 for the representation of L4. This arguably indicates the tendency of the subject to numerically evaluate or rank, rather than actually create a scale. The same subject estimated his level of embodiment confidence in the first environment at 1 and in the second environment at 2, which, again, highlights the ranking nature of his estimation, as compared to another numerical result that was given by another subject where the level of embodiment confidence was estimated as 3/5 in the first environment and 4/5 in the second environment. Though the latter subject was not given any restrictions, she chose to specify an implicit minimum and an explicit maximum of her estimation.

If we attempt to create a mathematical construction of what we have up here, then the proposition will be a fusion between two different realms; the first belongs to facts that help us make assertions (e.g. 2 has a higher value than 1 which is a true proposition of mathematics because it is "deducted from axioms by formal rules and are true in virtue of valid applications of the rules of inference and owe nothing to the world outside mathematics"[296]), while the other is a linguistic realm. We cannot generalise, but we can construct sentences that could be judged subjectively. An example of these sentences is below:

296 Goodstein, R.L., 1972. Wittgenstein's philosophy of mathematics. In *Ludwig Wittgenstein: Philosophy and Language*, Ambrose and Lazerowitz, eds., London: George Allen & Unwin Ltd., p. 282.

1 My confidence in the representation was twice as much as it was in the abstraction.

2 My confidence in the abstraction was half as much as it was in the representation.

3 I felt much more confident in the representation than I felt in the abstraction.

The numerical attributes of the intimate space represent the strong association between the virtual space and its corresponding reality more than they do for the abstract image of space. Numerical values also present conceptual assessment of our engagement with space, its abstraction and representation. The conceptual assessment could be described as being objective but from a subjective point of view.

Colours

Colours are used in two different ways; the first is to highlight dichotomies, whereas the second is arguably to represent mental states. As an example of the first, one subject who could not figure out the way to finish the first part of the experiment estimated the level of difficulty to be *black*. By contrast, she estimated the level of difficulty of the second part, which she managed to finish, to be *white*. The choice of contrasting colours could highlight the high contrast between the two levels of difficulty from her point of view; however, it could also draw attention to the familiar use of this pair of colours. Black and white, after all, form a pair that possesses a metaphorical power of association. On a lower level the use of the pair could be rooted in "*sort-crossing*".[297] Due to the lack of attributes – in this specific case, no limitations were imposed, and so no attributes were instated to reflect the level of difficulty – the subject decided to express the level of difficulty by implying a proposition in terms of another, which in turn superimposes *metaphorical systemacity*[298] which we argue is propagated by familiarity if we adopt Turbayne's view of inappropriateness or *sort-crossing*.

The second use of colours was arguably to express mental states, or emotional attributions of the environments. Pairing colours with emotional reactions to an environment, we argue, both delivers a visual expression to the researcher

297 Turbayne, C., 1962. *The myth of metaphor*. New Haven, CT: Yale University Press, p. 11.
298 Lakoff, G. & Johnson, M., 1980. *Metaphors we live by*. Chicago: University of Chicago Press, p. 9.

which might indirectly cause a similar effect on readers through their imagining the impact of the colour. The problem is that not everyone will have the same response to a colour, but we argue this makes the FMME all richer, and sharpens its subjective aspect.

Emotional states (images):

One other use that was detected in this exercise is the description of the spatial experience in terms of the emotional state. The emotions mentioned in the subjects' answers both devise and are derived from the spatial quality. They imply and characterise the possible activities in the space. They act as the target of a source implied in the space.

The emotional states devise and are derived from the space because the latter frames the human experience. As a result, a space is capable of creating an emotional state. Intimate space is characterised by such emotional state of interaction, which lends itself to other spaces rendering them emotionally familiar spaces. Accordingly, familiar space becomes the space in which a human would want to be in reaction to its experience of intimate space. It follows that space is deriving the familiarity in human spatial experience from intimacy with space. Intimate space is a space that interprets the human interaction into a condition and a quality that can be framed and delivered to others upon using the space. Human interaction in intimate space is characterised by its embodied quality. The embodied spatial quality extends to the emotional state to provide a way of relating to this state. This is evident in the contrast between subjects' emotional assertions. For example, 'certain' and 'uncertain' are what one of the subjects said to describe the level of embodied confidence in the representation and abstraction of L4 respectively. The certainty is a feeling that is induced by the spatial experience. Through the association of certainty to the representation of L4, the former feeling could become a space. This is also the case for 'panic' which implies a stronger embodied reaction. One can say that s/he panics in this space, but s/he can also say, in an abstract manner, that they do not want to go back to that place –place stands for an emotional state. Due to the embodied interaction taking place in it, space devised the feeling of panic or uncertainty, and in turn, panic or uncertainty inherited the spatial quality and became spaces. One could use the sentence "I don't want to go back to that dark place" to

express the fear of feeling negative emotions such as panic, depression, uncertainty …etc. The abstraction and representation of L4 produced emotional states reflecting the experience and forming emotional scales.

The emotional states are also associated with embodied interactions that are most evident in language. The use of the contrasting words ‘panic’ and ‘fun’ describes navigation which is a form of interaction with space. In the case of the abstraction of L4, the navigation was characterised by the emotion of panic, whereas in the representation of L4 the navigation was characterised by fun. By the virtue of its definition, panic describes the senseless but active behaviour. Panic is often used in the expression ‘panic attack’ which holds a deeper meaning. According to this association, the abstraction of L4 performed a sort of spatial attack on the subject. Space, in this case, performs an act where the subject’s embodied reaction is furnished by this emotional layer. By contrast, the emotion associated with the representation of L4, ‘fun’, describes a different type of involvement with space. Accordingly, the embodied interaction with space associated with ‘fun’ could be characterised as being intentional and active. While panic is often used in the expression ‘panic attack’, fun is used in ‘having fun’. The latter suggests that the type of involvement with space is positively active where the subject is performing the act on the space.

The emotional state forms an inherent part of the embodied interaction with space. It carries a wealth of information about this interaction and the space where it takes place.

Spatial

Perhaps the most intriguing of all of the expression were the ones that were classified as spatial. The two expressions central to this discussion are ‘open’ which was used to describe the spatial experience in the representation of L4, and ‘trapped’ which was used to describe that of the abstraction of L4.

The spatiality in the description ‘open’ refers to the space itself, whereas, ‘trapped’ describes the spatial situation of the user of the space. The openness of the space is a result of the apparent spatial quality of the representation of L4 and the feeling of being trapped is the subject’s reaction to the experience he went through in the abstraction of L4. Although the abstraction did not specifically infer a spatial

quality, it still managed to produce a spatial reaction. Physical containment schema, suggested by Johnson[299], supports certain entailments such as limited movement, fixity of spatial position or even irresponsive embodied interaction. The abstraction of L4 asserted the spatial merit that the representation of L4 did not maintain. On the contrary, the openness of the representation of L4 produced a negative effect on the physical containment schema.

The emotional state could be reflected in spatial expressions based on the embodied interaction with space.

3.7 Conclusion

Representation and abstraction of space were introduced as images of the concept and object of space.

At the beginning of this chapter familiarity was introduced as a form of unintentional anticipation of meaning formed by an unconfirmed, unclear opinion, in order to establish an understanding of the meaning and correlate it to another. The main issue in question was the lack of a clear understanding of how familiarity operates. Intimate space, its abstraction and its representation were used to test the definition of familiarity in order to produce a better understanding of intimate space and its relationship with virtual space. The interaction with the abstraction and representation of intimate space produced two types of familiarity: *emotional familiarity* and *spatial familiarity*. Both types of familiarity acted as a representation of intimacy or as a side effect to this intimacy. Familiarity came across as a reaction to intimacy produced by human embodied interaction with physical space. When physical space as a concept was amalgamated, the underpinning embodied interaction with the virtual space preserved the familiar emotion and interaction. Familiarity, in turn, produced a different understanding of virtual space. Intimacy moved from being the character of interaction with space to the condition of interaction; a condition that highlights the knowledge of one specific instance of space. Familiarity, on the other hand, appeared as a tool to produce a convincing

299 Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press, p. 21-22.

interaction between the user of intimate space and multiple instances, copies or modes of this space.

Emotional familiarity is a reaction to the embodied perception of the various modes of space. The importance of emotional familiarity stems from the fact that it forms the underpinning condition of acceptance or rejection of different modes of space –even when spatial familiarity approves the space. Emotional familiarity will be further explored in the following chapter using ethics as the focus of this familiarity. Spatial familiarity is a physical reaction to different modes of space. The characterisation of the reaction as being physical is due to the nature of human embodiment. Spatial familiarity will undergo further exploration in the fifth chapter using the focus of scale.

The interaction with intimate space implies both emotional and spatial activities. Instances of intimate space, such as the abstraction or representation of space, preserve certain attributes. The emotional attributes figured positively in instances associated with intimate space. When positivity decreased, spatial attributes occupied a bigger part of perception. In various modes of space, spatiality filled the gap created by the lack of emotional involvement with these modes. The abstraction of L4 highlighted the emotional familiarity of interaction with this mode of representation. When the abstraction was recognised as an instance of the real physical space, spatial familiarity replaced the intimacy and aided in achieving the task that included navigating the space. The representation of L4 amicably replicated the perceptual experience of the intimate space, which implied that the spatial familiarity was put forward from the beginning. The strong presence of spatial familiarity overwhelmingly eliminated emotional familiarity by dismissing it as an attribute of the original intimate space.

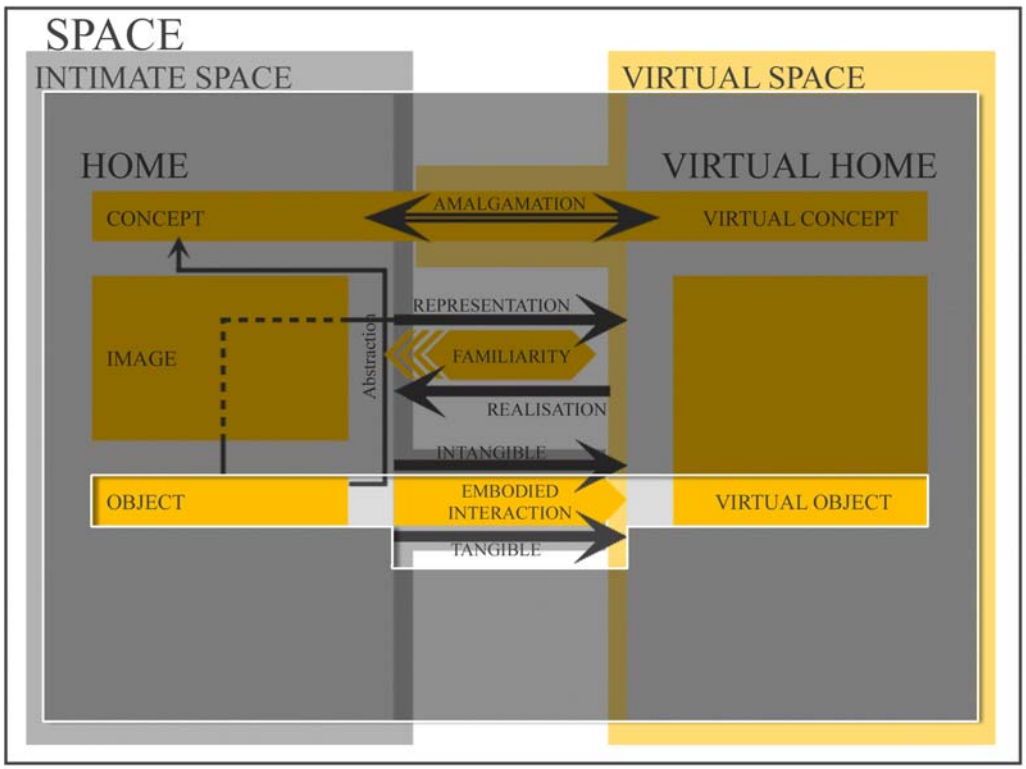
Intimate space is preserved in various modes of space through familiarity. Intimate space transforms into familiar space. Intimacy as the character of the knowledge of a space transforms into familiarity which is the character of the interaction with space. The value of familiarity is preserved through interaction; therefore, by definition interactive space is a familiar space. Familiarity is better experienced in representation, but better felt in abstractions. Successful abstraction

preserves the abstract structures of embodied interactions. Although they cannot convey space, these structures are capable of construing the emotional experience.

Familiarity is the representation of intimacy in space representations. Hence real space is intimate and virtual space is familiar.

The In-Tangible Interaction in Virtual Environments

Ethics of Virtuality



4.1 Introduction

Massively Multiplayer Online Role-Playing Games (MMORPGs) were highlighted as a powerful medium for interaction through mediating between different players. The power of virtual interaction stems from spatiality as a condition of this interaction. In the previous chapter, the process of abstraction and representation, particularly, of physical space was introduced and discussed not as the condition of virtual interaction, but as the condition of linking intimate space and virtual space, thus effectively forming the driving element in virtual interaction. However, the spatial quality of space induces real-like bodily reactions, whereas immaterial elements embedded in physical space, such as ethics, are not necessarily present or represented in the virtual counterpart. This chapter will explore the presence of intangible (virtual) elements in virtual environments.

One of the first encounters that Professor Tate[300] had in the MMORPG called Second Life, was when an avatar abused his naïve experience of this new world, cheating him by selling him an object for 300 Linden Dollars[301], when he could have simply obtained it for free. This posed two questions that James needed to address: a) is it something that he should expect, and react to, and b) should his reaction in Second Life be any different to that of the one he would usually have in real life?

In the above mentioned incident, James had to suffer the economical consequences of a metaphorical action carried out in a 3D interactive world. However, this action held a monetary value reflected in the amount of Linden Dollars he lost. In a different incident, James's avatar was pushed to water by another avatar. James expressed his surprise at this unfriendly action since his interaction with that avatar was as friendly as would be expected within the context of similar MMORPGs (excluding shooting games), and real life for that matter. However, he highlighted the fact that his reaction would have not, in any case, exceeded what was enabled by the platform creators who usually police similar

300 Director, Artificial Intelligence Applications Institute, and Professor of Knowledge-Based Systems, University of Edinburgh, (http://www.inf.ed.ac.uk/people/staff/Austin_Tate.html)
301 One US dollar is worth 300 Linden dollars, (and Needs to be updated.

actions. Available reactions included banning the aggressing avatar from accessing the 3D world for specific amount of time or permanently.

A simple comparison between both acts in both environments will highlight the different values embedded in each act within each context. Cheating to obtain real money in real life is different from cheating to obtain money in Second Life. Being physically violent in real life is different from being violent in Second life. One may suggest that the reason for cheating to obtain money in Second Life is not far removed from that in real life. One might argue that the main drive is the value attached to what the cheating avatar came to posses. However, the reason for being physically violent in real life is probably the intent to cause physical harm. This would have real repercussions on the well being of those involved. In Second Life violent actions against avatars do not bear any consequences in real physical life. When asked to compare both actions, Professor James highlighted the fact that although *he* was pushed around in Second Life, it was nothing like real life, moreover, it did not standout as an unlikely event in Second Life. Physical and perhaps emotional aggression, in cyberspace was first identified and reported in late 1998 in Dibbell's account of '*a rape in cyberspace*'. In this account he described the act of ceasing control of others' avatars in cyberspace, and applied a social meaning to it.

> "They say he raped them that night. …And though I wasn't there that night, I think I can assure you that what they say is true, because it all happened right in the living room -- right there amid the well-stocked bookcases and the sofas and the fireplace -- of a house I came later to think of as my second home." [302]

The applied social meaning is attached to social act that occurs in real physical life. The symbolic value of the act extends beyond the embodied and physical action into the virtual realms of interaction. The conceptual aggression affected those avatars, not the physical manifestation of this aggression. We argue that perceptual realism identified by Lombard and Ditton[303] induces, to a certain level, social realism. However, the element of familiarity with human embodiment, which is crudely abstracted and represented in Second Life in the form of Avatars and the

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302 Dibbell, J., 1998. A rape in cyberspace (or TINYSOCIETY, and how to hake one) in My Tiny Life, (http://www.juliandibbell.com/texts/bungle.html: June, 2006) First published in somewhat different form in The Village Voice, December 1993, Par. 1.

303 Lombard, M. & Ditton, T. 1997. At the heart of it all: the concept of presence. Journal of Computer-Mediated Communication, [Online]. 3(2), Available at: http://jcmc.indiana.edu/vol3/issue2/lombard.html [Accessed 30-03-2007].

corresponding interaction-permitting 3D virtual environment, is the main reason why avatar owners interact in Second Life in the same way they do in real life. The value and implications of their actions in Second Life do not bear physical consequences similar to those in real life. However, familiarity of the images supports the conceptual presence of these images even when they are physically non-pertinent.

The virtually violent action is highlighted as disembodied spatial action, where physical implications are eliminated and social ones are maintained. The process of eliminating some attributes takes us back to abstraction - considering an object independently of its associations, or its plurality of merit equivalent attributes. However, the very process of abstraction highlights the metaphysical nature of certain actions, although the same actions are dreaded for their physical implications.

The increased spectrum of interactions available in virtual environments produced similarly increased measures forming a new framework to govern these interactions. What is at stake here is, therefore, not attributes that get lost in translation between real life and Second Life, rather, our abandonment of embodied being and its material spatial interactions, and resolving to disembodied being and interaction.

We argue that the new framework governing these new virtual forms of interaction, which mount to forming new behaviour, borrows its premises from real life's ethics. The connection between this framework of interaction and ethics is self evident in several situations. For example, in a simple computer game, players are ready to kill their opponents relentlessly, in order to achieve their goal and get their reward, unlike most forms of competitions in reality, where players or opponents have to stay within acceptable social limits.

In reality, ethics engulfs this notion of limits or rules and furthermore engulfs the ambiguous area in-between. Ethics appears as a regulatory framework of conceptual interaction. In most cases, ethics operates when there are no rules in place, or when there are no direct material implications of the action in question. Yet ethics seem to be of less influence on interaction in MMORPGs, despite there being no elaborate rules organising relationships, and no material or physical implications.

The main factor informing the computer generated mode of interaction in this metaphorical space is spatial familiarity. As discussed in chapter two, familiarity

consists of various aspects, mostly induced by the similarity of images and symbolism which reflect on human embodied interaction. The interaction is more of a relationship in which the consciousness of the user is highly augmented in terms of sensory data perceived from objects in their environment, and from relationships between these objects.

Departing from the basic concept of familiarity of interaction with intimate space, the question this chapter will ask and discuss is: *Can the Ethics of the Real Environment be experienced in a Virtual Environment?*

Dibbell expresses the same idea in connection to the newly attained virtual embodiment.

> "It asks us to behold the new *bodies* awaiting us in virtual space undazzled by *their phantom* powers, and to get to the crucial work of sorting out the socially meaningful differences between those bodies and our physical ones. And most forthrightly it asks us to wrap our late modern ontologies, epistemologies, sexual ethics, and common sense around the curious notion of rape by voodoo doll." [304]

The transformation of the concept of intimate space into virtual space through amalgamation was represented using images of intimate space. The result was an interaction with these images in a spatially embodied manner. The resulting embodied interaction held no physical implications; nevertheless, this did not prevent the embodied interaction from taking place. The concept behind virtual space draws on the same concept of intimate space; however, the ethics governing the concepts does not govern the virtual concepts.

Answering this question requires rigorous engagement in the personal experience of the user of this virtual environment. The following section will briefly prepare for the investigation by presenting ethics.

4.2 Ethics

The Oxford English dictionary defines ethics as:

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304 Dibbell, J., 1998. A rape in cyberspace (or TINYSOCIETY, and how to hake one) in My Tiny Life, (http://www.juliandibbell.com/texts/bungle.html: June, 2006) First published in somewhat different form in The Village Voice, December 1993, Par. 1.

(after Gr. τὰ ἠθικά). The science of morals; the department of study concerned with the principles of human duty.[305]

However within the realm of this department of study, as the definition above describes it, there are many more specialised areas that cry out for consistency. The importance of ethics stems from the conflicting values and desires held by men. Bertrand Russell reports the utilitarian view of ethics as having twofold purposes: "first, to find a criterion by which to distinguish good and bad desires; second, by means of praise and blame, to promote good desires and discourage such as are bad."[306]

What is implicated in this definition or brief view is a set of complex issues that are crudely abstracted by descriptive, normative and meta ethics. To start the analysis, summaries of descriptive, normative and meta ethics are due.

Descriptive ethics is concerned with human behaviour and moral standards as perceived. In that sense, descriptive ethics shares a major characteristic with phenomenology. Both deploy a descriptive qualitative data to demonstrate the qualities of objects or entities described. Phenomenology dismisses any prejudices and presupposition while explaining human experience and common values, whereas descriptive ethics describes human behaviour while incorporating various presuppositions - be they historical, social or anthropological. Phenomenology is concerned with the entity of being, whereas ethics describes the structure of the behaviour of this entity and assigns it relative values, values that subsequently but unintentionally guide human behaviour. Thus, descriptive ethics is a body of information that describes, and therefore, constitutes the framework of human action.

As opposed to describing human behaviour as it is perceived, normative ethics prescribes human behaviour as it ought to be. It is concerned with what ought to be the norms that guide us in taking any action. Thus, normative ethics prescribes what ought to be collectively endorsed and applied values which result in acceptable and homogenous actions. However, human nature is characterised with difference, which fuels such ethical debates over what ought to be the norm. As it stands, normative ethics contradicts descriptive ethics on its position towards the apriori.

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305 Oxford English Dictionary O.E.D., (SECOND EDITION 1989). Oxford English Dictionary. [online]. http://www.oed.com/ [Accessred 9 October 2007].
306 Russell, B., 2000 History of western philosophy. 3rd ed. London: Routledge Classics, pp. 745.

The former disregards any prejudices whereas the latter deploys former knowledge as a tool of interpreting ethics.

Meta ethics is concerned with the terminology used in ethics. Its objective is to create a standard that enables communication between different divisions and subdivisions of ethics. Thus, creating a precise system of signifiers and signified, with specific values. Metaethics questions ethical statements regardless of the actions carried out, such as 'cheating is bad!', by examining the meaning of bad, and the value it holds.

4.3 Phenomenology and Ethics

Phenomenology's relationship with ethics is mainly derived from Husserl's ethics which is hugely dependent on Brentano's axiology.[307] Husserl argues ethics, just like logic, has formal and material parts, however, the formal part of logic is much more evident than its ethical counterpart as a result of its strong formal discipline, axiology and praxis. The material part of ethics is more evident and has resonance in the study of phenomenology. Nevertheless, Husserl utilises the formal part of ethics to formulate laws of transference and derivation of values.[308]

The subjectivity of phenomenology dictates that value-free objectivity should occur in or be perceived in a social context, therefore reflecting a subjective value. Objectivity as a concept and an idea is a cultural and social product of human experience, therefore, an intentional product of human consciousness. Embodiment suggests a comprehensive relationship compiling subjectivity and objectivity, however, using a systematic framework which we would like to call embodied or spatial interaction. Husserl's subjective take on human actions, together with his assertions concerning formal and material ethics, form the ground that the following phenomenologists depart from to address the issue of ethics.

Ethics, we argue, forms an inherent part of everyday space. Any space holds a meaning or significance that is communicated unintentionally by the virtue of daily

307 Melle, U., 2002. Edmund Husserl: from reason to love. In J.J. Drummond and L.E., Embree, eds. Phenomenological approaches to moral philosophy: a handbook. Dordrecht: Kluwer Academic Publishers, p. 235.

308 e.g., "If V is of a value and if it holds that if A, then V, then with regards to this relationship A equally is of value" or "If a property is valuable, then each object having this property is valuable because of it."

use; however, a place frames its attributes and merits and, more importantly, highlights communicative and non-communicative practices held by this place. The practices imply the interactive role of users which in turn spells out the necessity for ethics.

There is a formal-axiological analogue of the formal-logical laws of contradiction and of the excluded middle. In the axiological realm, however, we have a middle between positive and negative values in the form of value-neutrality, so that the formal-axiological analogues to the formal-logical laws of contradiction and of the excluded middle takes the following form: "If M is in itself of value, then it is not in itself of disvalue and it is not in itself value-neutral and vice versa according to all disjunctive combinations."[309]

In *Being and Time* Heidegger pursues the entity of being, *Dasein*. The ontological setting of *being-in-the-world* becomes a condition for this being. *Dasein's* consciousness and experience form a fit ground for assigning values and meanings. The modes of *Dasein's* engagement with the world are associated with intentionality. Heidegger acknowledges Kant's and Scheler's formal and material ethics as a form of inquiry into ethics,[310] but he makes it clear that *Dasein* is a neutral entity. This is the only communality between Heidegger and Husserl on ethics, i.e., both recognise formal and material ethics, but where Husserl applies Brentano's axiology to the values of intentional acts of consciousness, Heidegger shifts the focus from the values attached to the entity of being, to the entity itself. The underlying assumption is that *Dasein's* existence is the primary condition for the ethics *of* being, thus, the question of being must come first. This, however, does not imply a condition without values, on the contrary, Heidegger asserts "we should hold on to the rules that say how man should live in a fitting manner, however tenuously they hold human beings together."[311] (ref)

Merleau-Ponty's view on ethics is hugely based on Husserl's essences, although he shares Heidegger's shift of focus to the entity of being, and he emphasises the embodied aspects of it. Merleau-Ponty asserts that:

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309 Melle, U., 2002. Edmund Husserl: from reason to love. In J.J. Drummond and L.E., Embree, eds. Phenomenological approaches to moral philosophy: a handbook. Dordrecht: Kluwer Academic Publishers, p. 235.
310 Heidegger, M., 1927. Being and time. Translated by J. Macquarrie & E. Roinson, 1993. London: Routledge, p. 294.
311 Heidegger, M., 1998. Pathmarks. In W. McNeill ed. Cambridge: Cambridge University Press, p. 268.

> Husserl's essences are destined to bring back all the living relationships of experience ... seeking the essence of consciousness will therefore not consist in developing the *Wortbedeutung* of consciousness and escaping from existence into the universe of things said; it will consist in rediscovering my actual presence to myself, the fact of my consciousness which is in the last resort what the word and the concept of consciousness mean.[312]

He also makes a clear distinction between the human condition and its ambiguity on one hand, and the uncertainty stemming from religious morals and ethics or beliefs on the other. In particular, he highlights the tie between eternity and time by Nietzcheans, and the embodiment implied in his statement God is dead.[313]

On one level, this statement highlights the embodied perception and conception of God as the source of ethics and morals, and on another it imposes a temporal quality and dimension to its being as a result of this embodiment.

However, in a different place, Merleau-Ponty highlights tradition as the other source of ethics. Here, ethics stands as the product of the reality of what endures.

Merleau-Ponty's embodied being of the enduring reality, or tradition, inspired Paul Ricoeur's research on human capability, which, Ricoeur argues, is the cornerstone of philosophical anthropology.[314] Ethical evaluation of our actions, according to Ricoeur, is a self inflicted measure that represents our commitment to ethics because "the interpretation of ourselves [is] mediated by the ethical evaluation of our actions. Self-esteem is itself an evaluation process indirectly applied to ourselves as selves".[315] He used language: the word, the sentence and the text to articulate decision, motivation and insertion of human intention in the world. He made language the condition of the possibility of all other human capabilities. Language is the mediator of human action. Ricoeur's methodology began with Husserl's descriptive phenomenology and, due to its limits,[316] then added elements of exegesis, philology, jurisprudence and text interpretation in his effort to analyse the

312 Merleau-Ponty, M., 1945. Phenomenology of perception. Translated by C. Smith, 1962. London: Routledge, p. xvii.
313 Moran, D. & Mooney, T., 2002. Paul Ricoeur: phenomenology as interpretation. In D. Moran& T. Mooney Eds., Phenomenology reader. London: Routledge, p. 586.
314 Ricoeur P., 2002. Ethics and human capability: a reponse. In J. Wall, W. Schweiker & W.D. Hall, eds. Paul Ricoeur and contemporary moral thought. New York & London: Routledge, p. 280.
315 Ricoeur, P., 1988. Humans as the subject matter of philosophy. In T.P. Kemp & D. Rasmussen eds. The narrative path: the later works of Paul Ricoeur. Cambridge, Mass.: MIT Press, p. 99.
316 Kohak, E., 1966. Freedom and nature: the voluntary and the involuntary. Evanston, Ill.: Northwestern University Press, pp. 2-19.

symbolism of evil, myths, and fantasies.[317] The scope of his research was human action and condition. Ricoeur accepts Merleau-Ponty's assertion about the ambiguity of the human condition and argues it is due to the ambiguity of common sense, resulting from humans' various external manifestations.[318]

4.4 Ethics and the place of Architecture

> "For while the facts attached to any event born of a MUD's [Multi-User Dungeon] strange, ethereal universe may march in straight, tandem lines separated neatly into the virtual and the real, its meaning lies always in that gap."[319]

Thus far, ethics has been presented as the department of study concerned with the principles of human duty, and then further detailed into descriptive, normative and meta ethics. The relation between ethics and phenomenology was then traced in the works of Husserl, Heidegger, Merleau-Ponty and finally Ricoeur. Through the relationship between ethics and phenomenology an assertion can be made that ethics is *the interpretation and evaluation of the intentional human action by the self and by others*. This primary statement will form the basis of discussing the relationship between ethics and architecture.

Gaston Bachelard's *Poetics of Space* (1964), explores the character of built environment, the home as a cellar, a garret and a hut, as described and experienced by its user or dweller. The phenomenon of space is closely linked to intimacy and memory in Bachelard's writing. Everyday actions and capabilities within the context of a specific prototypical architectural space e.g., the *home*, is linked to human embodiment and imagination, or perception and action. Certain parts of our everyday spaces serve as "repositories" of memories. They also provide a person's protypical spatial experience, a reference point from which all other spatial experiences derive and with which they are compared. These spaces, or places, are also understood episodically, in relation to sequences of events (walking down the corridor, sitting

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317 Ricoeur P., 2002. Ethics and human capability: a reponse. In J. Wall, W. Schweiker & W.D. Hall, eds. Paul Ricoeur and contemporary moral thought. New York & London: Routledge, p. 281.

318 Kohak, E., 1966. Freedom and nature: the voluntary and the involuntary. Evanston, Ill.: Northwestern University Press, p. 355.

319 Dibbell, J., 1998. A rape in cyberspace (or TINYSOCIETY, and how to hake one) in My Tiny Life, (http://www.juliandibbell.com/texts/bungle.html: June, 2006) First published in somewhat different form in The Village Voice, December 1993, par. 15.

down for lunch, sitting down, chatting, etc). From this perspective, our *being-in-the-world* is structured narratively. The house serves as a space for Bachelard's narrative, and a house is itself a narrative space.

In the same manner language mediates human intention in the world, as argued by Ricoeur, architectural space mediates human action and becomes the condition of the possibility of human capability. Architecture, according to Maurice Lagueux, raises ethical issues because it 'produces the obligatory framework for social life'[320], allowing people to come together, or prescribing the way that they perform socially. Lagueux's assertion holds the finger prints of Ricoeur's concept, which identifies language as the condition of the possibility of human capability. In the same spirit, and departing from Lagueux's previous statement, we propose that *ethics are ubiquitous in architecture* since one can read every architectural design, built or not, from an ethical point of view, and because ethical evaluation of human action and behaviour is influenced by the architectural mediation in human action.

In this sense, ethics in the context of architecture is both the normative evaluations of design actions and design outcomes (buildings, landscapes etc) as good or bad according to an external rule or a law; and any descriptive evaluation based on the pre-accepted customs, dispositions or principles by which an architect is guided in their everyday practice.

The relation between subject and space is a problematic one. In a way we have the dilemma of having a real space that has a function and meaning and for many users it stands as a repository for memories and interactions. While the condition that enables human capabilities, i.e. language, is produced by society's evolution throughout history, the condition of the possibility of human interaction or the framework of social interaction, on the other hand, is produced by architects. Alberto Pérez-Gómez discussed the ethics and aesthetics of architecture and described its reality as *complex*. He asserts that the reality of architecture is "both shifting with history and culture and also remaining the same, analogous to the human condition that demands that we continually address the same basic questions

320 Lagueux, M., 2004. Ethics versus aesthetics in architecture. Philosophical Forum, 35(2), pp. 122.

as we seek to come to terms with mortality and the possibility of cultural transcendence: the ultimate horizon of human desire".[321]

Architecture in its totality produces the condition for the possibility of human interaction which in turn is related to the roles of ethics. Harries states:

> "I agree that architecture needs this dimension to meet what I have called its ethical function… Different buildings tasks now claim something of the dignity that once belonged only to sacred architecture, giving voice to that claim by representing the sacred architecture of the past and thus usurping its place. Such usurpation reflects the compartmentalization of our life, the splintering of the old value system, each splinter now claiming something of the dignity that once belonged to the whole."[322]

Lagueux's classification of the ethical issues pertaining to architecture is dependent on the reality of architecture as described by Pérez-Gómez. Lagueux introduces the other dimension of the relationship between architecture and ethics by making a general distinction between ethical problems that are *external* to a practice and those problems which are *internal* to it. He makes a very simple observation: If a biologist acknowledges that he is not capable of solving the ethical problems that his discovery raises, his scientific credibility would remain unaffected; he could even be awarded a Nobel prize and the problems would be discussed by bio-ethicists. On the contrary if an architect admitted his inadequacy in solving the ethical issues involved in designing a project, (e.g. a school, a hospital or a prison), his credibility would be affected dramatically; he would lose the commission and probably his licence would be withdrawn.

Through such examples, Lagueux categorises the problems that various practices face, to *internal* if they are inseparably inherent to the practice and would be expected to be solved by the practitioners; or *external* if the problems can be separated by the practice and are not expected to be solved by a practitioner, but (if they can be solved) from someone outside the specific practice.

Most of the other arts raise ethical problems internal to their practice only through *narrative* (describing human relationships or political situations). In contrast, although an abstract art, ethical problems are inherent to architecture, not because it describes or narrates them, but because *it creates ethical problems*. In other words,

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321 Pérez-Gómez, A. & Pelletier, L., 1997. Architectural representation and the perspective hinge. Cambridge Massachusetts: MIT Press, p. 204.

322 Harries, K., 1998. The ethical function of architecture. Cambridge, Mass.: The MIT Press, p. 102.

architecture *continuously* affects the life of each inhabitant or user through 'forming' the way that people come together. Architecture is the scene that facilitates, promoting or discouraging the discourse of life in terms of social interaction, thus it has Ethical implications.

> "Architects who are not concerned with the best ways to improve the lives of their building's users or inhabitants are very poor architects indeed. Architecture continuously raises ethical problems, which, however, are nothing more than normal problems that architects must solve in practicing their art. It is for this reason that these ethical problems can be called *internal* to their discipline."[323]

The real space is a space with function, memories and interactions, which define 'place'. While the virtual environment is a representation of the 'real' and a repository of meaning, it has no 'real' space. It is a place but not a space.

Although VE is understood in the same way we understand RE, it consists of a 'place' which is separate from 'space'[324].[325] 'Place' is a 'space' holding activities and cultural meanings and for this it caries ethical load.

> "Should architecture not continue to help us find our place and way in an ever more disorienting world? In this sense I shall speak of the ethical function of architecture. "Ethical" derives from "ethos". By a person's ethos we mean his or her character, nature, or disposition. Similarly we speak of a community's ethos, referring to the spirit that presides over its activities. "Ethos" here names the way human beings exist in the world: their way of dwelling. By the ethical function of architecture I mean its task to help articulate a common ethos."[326]

The ethical function of architecture that Harries envisions derives from the Heideggerian notion of *dwelling*. *Dwelling* is the primary action of being-in-the-world, be that in the Real or the Virtual Environment. In these terms every subject-being simultaneously dwells in a Real and a Virtual *place* that inherits ethics which appear both in a Real and Virtual mode. The term '*place*' is used in conjunction with the term '*virtual*' in order to emphasise the non-spatial nature of the condition of *being-in-the-virtual-world* and the spatial nature of interaction due to human embodiment.

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323 Lagueux, M., 2004. Ethics versus aesthetics in architecture. Philosophical Forum, 35(2), p. 119.
324 Malpas, J.E., 1999. Place and experience: a philosophical topography. Cambridge, Mass.: Cambridge University Press.
325 Gieryn, T.F., 2000. A space for place in sociology. Annual Review of Sociology 26, 463–496.
326 Harries, K., 1998. The ethical function of architecture. Cambridge, Mass.: The MIT Press, p. 4.

This definition of ethics includes every creation of space both as an outcome and procedure and for this it relates to both the Real and the Virtual environment. Two folds can be examined through this definition. First of all, one can see 'sins' and 'crimes' that take place in the Virtual and Real space. Dibbel's *Rape in the Cyberspace* very interestingly problematises the inclusive/exclusive character of the 'halls of LambdaMOO', the VE of a MUD community and its connection with his real life. Secondly, one can see the responsibility of the designer as an architect on the creation of the space in which people will come together. The responsibility of architects in this sense is similar to the responsibility of hackers, wizards and webmasters

4.5 Description and methodology of the experiment

> "…every set of facts in virtual reality (or VR, as the locals abbreviate it) is shadowed by a second, complicating set: the "real-life" facts." [327]

The original question proposed is '*Can the Ethics of the Real Environment be tested in a Virtual Environment?'* The virtual environment (the representation of the PhD students' offices and common room at level 4 of Minto house) developed for the experiment presented in chapter two was modified and adopted to enable certain actions. The basic premise of this experiment is that a 3D interactive virtual representation of a real environment could be utilised to examine human behaviour in both and then compare the results against each other. We will highlight a human action and discuss it and analyse it as it is carried out in both environments. We will then explore the value of this action which will consequently help us identify the presence or absence of ethics.

The components of this experiment are a place, an action and a subject. The aim of this experiment is to get a subject who is regularly involved in carrying out a type of action in a place, to carry out a different type of action that is ethically ambiguous. To achieve the goal, we need to set up the scene of the action.

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327 Dibbell, J., 1998. A rape in cyberspace (or TINYSOCIETY, and how to hake one) in My Tiny Life, (http://www.juliandibbell.com/texts/bungle.html: June, 2006) First published in somewhat different form in The Village Voice, December 1993, par. 8.

Level 4 of Minto house is one of two buildings that host the Department of Architecture at the University of Edinburgh. The level hosts, in particular, postgraduate research and master students, and also few lecturers. The level also has computer labs and lecture rooms. Postgraduate students using the floor tend to have their breaks and lunches in the common room at the end of the corridor. The common room is divided into two sections by virtue of use and function: the first is the sitting area, and the second is a small computer lab, so the room has a mixed function. Generally speaking, users of the room pop in for their lunch. In particular, one of the postgraduate students stores several personal items in a drawer in one of the desks in this room. Although the drawer is unprotected by a lock, there is a common understanding that the items stored in that drawer belong to the user. This knowledge is established due to the recurrent use of the specific user of this drawer, particularly during lunch hours when all other users are present in the room.

The salient point is the fact that the common room is a public domain which is open for users, which implies that objects within this domain also have the attribute of being public, i.e. they can be accessed by any user without any constraints. Here, we are using Husserl's formal-axiological law of the transference and derivation of values "if V is of value and if it holds that A, then V, then with regard to this relationship A equally is of value"[328], or in other words, if the common room is common then the drawer in the common room is a common drawer.

The presence of the drawer in a common area creates an ambiguous condition in that it changes the value of the drawer to a different value that is not similar to that of the common room. Our interest, however, is not in the formal-logic aspect of the value of the drawer that is inherent from the room, but in the value that is perceived by the users of the common room. To further question the value of the drawer, we placed a monetary value in the drawer that we will refer to as 'Gabriella's Barrier'. Gabriella, the user who owns the contents of the drawer, was absent at the period of carrying out the experiment. We placed the money in a pencil case that, in turn, was placed in the drawer. In order to increase the ambiguity surrounding the money, we attached a small piece of paper containing a personal note written in Gabriella's

328 Melle, U., 2002. Edmund Husserl: from reason to love. In J.J. Drummond and L.E., Embree, eds. Phenomenological approaches to moral philosophy: a handbook. Dordrecht: Kluwer Academic Publishers, p. 235.

mother tongue. On top of the contents of the drawer an A4 sheet of paper containing the following note: ‘Gabriella’s stuff, don’t even think of touching them!’ was placed. The whole setup is designed to clearly define ‘Gabriella’s Barrier’ and assign a private value to it, by making it clear that the banknotes and everything else within the drawer are the personal possessions of Gabriella.

Figure 28. A photograph of the contents of the drawer showing theA4 warning sheet and the pencil case on the lower left corner.

The second element of this experiment is the action that needs to be carried out. The action in question is the acquisition of the money placed inside the pencil case in the drawer. The physical action involved in taking the money in itself does not bear any challenge in that it is not hard to perform and the money in question is not placed in a physically inaccessible space. The challenge in carrying out the action is mainly ethical.

The third element of this experiment is the subject that will carry out the action in the place of the experiment. Subjects chosen to take part in the experiment were real life users of these offices and the common room. Subjects were of both sexes. They all share a design background, and were exposed to the first part of this experiment without the knowledge of their active participation.

4.5.1 STAGE ONE: REAL LIFE SITUATION

The experiment was carried out deploying a scenario whereby one of the researchers makes a phone call to the subject asking for the favour of getting the money from the pencil case that belongs to their absent colleague Gabriella. The subject was supposed to hand the money to the researcher downstairs outside Minto house where the researcher would be waiting. The researcher's excuse for not being able to get the money was that he could not get into Minto house because he had left the lock for his bicycle at home and he did not want to leave the bicycle unattended. The subject, who was unaware of the fact that this is an experiment, took part by receiving the phone call, making the decision of what action to take and carrying out the action of getting the money and handing it to the researcher or refusing to do so. Upon concluding the action of handing the money to the researcher or deciding not to carry out the action, the researcher informed the subject of their voluntary participation in the experiment, and asked for their consent to use the data.

The common room, where the action takes place, had a hidden video camera installed to record the action of each subject. The further challenge to ethics surrounding the problematic situation hinged on the ethically ambiguous action of taking the money from 'Gabriela's Barrier', which is placed in a public domain – the Common Room that most of the users of that level in the building use to have their lunches and tea breaks – lay in the presence of the second researcher in the Common Room, at the same time of carrying out the experiment, working on the common computers, making even more explicit the public character of the place.

4.5.2 STAGE TWO

It was mentioned previously that the three components of this experiment were the place, the action and the subject. While the subject in both stages of this experiment remained the same, the place and the action were slightly adopted to reflect a new condition. The real environment would *transform* into a 3D virtual environment, thus changing the mode of inter*action*.

The place in the second stage was a virtual environment representing the real environment of level 4 of Minto house. We would like to recall Pérez-Gómez and Pelletier's statement highlighting the competing qualities of architectural representation. They maintain that cyberspace lacks the depth that contains the

spatial and formal character. They state that "expecting architectural representation to embody a symbolic order … will seem controversial unless we revise the common assumptions about art …"[329] Elements of *Depth* locked inside a 3D world are programmatic, temporal and experiential. The last element, we argue, implicates ethics as part of the experience in a 3D world. Moreover, while we agree that cyberspace lacks the depth, we totally oppose their assumption that spatial and formal characters are contained in the element of *depth*. We argue that by adopting Merleau-Ponty's view on human embodied perception as a mediator of interaction in our everyday life, we can actually assume that embodied perception consists of several elements, the main one of which is vision. Hence, the stimuli in our 3D virtual environment will mainly be visual stimuli. Vision is used here as a language from which its products are readable to the eye of the beholder. Depth which is missing from the photographic documentation of the space due to flattened photographs is compensated for by the element of *familiarity* of the space to its users.

Figure 29 Subjects performed the task in the real physical corridor to highlight the contrast in being in a real physical space and interacting with a virtual representation of it.

The style of joining and reproducing the photos to create a whole picture primarily for the sake of documentation is nothing new. An example of documenting social contexts can be found in Robin Evan's work.[330] However, unlike architectural drawings that are produced in advance of the building they represent, the 3D virtual

329 Pérez-Gómez, A. & Pelletier, L., 1997. Architectural representation and the perspective hinge. Cambridge, Mass.: MIT Press, p. 6.

330 Evans, R., 1997. The developed surface: an enquiry into the brief life of an eighteenth-century drawing technique, in Translations from drawing to building, and other essays. Cambridge, Mass.: MIT Press, pp. 194-231.

environment produced here does not have any precedence. It is merely a realistic impression of the visual and spatial qualities of the space represented in it, which shifts it towards the side of the arts.

The RE, where the first part of the experiment took place, is in the same one that was used in the previous chapter. Instantiating Bachelard's spatial narrative as a 3D computer model available for game-like navigation and interaction, introduces some startling incongruities. As users of this new space representation, we sense a familiarity with it though we are perhaps struck by the mismatch between the medium and our bodily awareness. Our physical presence is perhaps reduced and moved into hardware and software. Our sense of recognition is suspended and spatial phenomenon reduced to concepts of digital interaction.

Throughout the experiment we established familiarity via the similarity between the real and the virtual environment, recorded the natural action of the subject in the real environment and asked the subjects to perform the same action in the virtual environment, in order to measure the virtual action to the scale of the real action.

If the goal is to understand any kind of users' responses (in this case, ethical) in the simulated space, then creating virtual interaction according to the physical one, or identifying the limitation of this system's capabilities, therefore its ability to reflect the ethics, would be of little use.

Focusing on the general common themes emerging from participants' engagement with the simulation, or the following interviews, is more useful as it is meaningful to the users of the VE.[331] Perhaps such emerging themes may form the basic foundation for ethics of virtuality, or maybe a more virtual ethics.

A qualitative method of research followed to probe their experience, focusing on issues related to ethics. Subjects were asked to give a personal account of their experience through a questionnaire and semi-structured interview which gave us an insight into how they think. For the limited space of this paper, what follows is a brief analysis of the most important outcomes of the interviews focusing on the issues of *trust*, *signification, consciousness* and *unawareness*.

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331 Spagnolli, A., Varotto, D. & Mantovani, G., 2003. An ethnographic, action-based approach to human experience in virtual environments. In International Journal of Human-Computer Studies, 59 (6), pp. 797-822.

Any space holds a meaning or significance that is communicated unintentionally by the virtue of daily use; however, a place, or a space with a meaning[332], frames attributes and merits and, more importantly, highlights communicative and non-communicative practices held by that place. Ultimately, the meaning of space is determined by those who perceive it. The value of signification lies in the fact that it highlights structural relationships between signifier and signified which shifts concentration from objects to those relationships.

More often than not, abstraction of the signified conceals its structural relationship with the signifier. It also conceals its merits and attributes. In the effort to associate new attributes we rely on metaphorical association, which countervail against the fact that *metaphorical systematicity*[333] generally exacerbates the perception of abstracted space, thus, admitting spatially divergent interpretations by virtue of the multiplicity of associations that can be observed (many examples of which were analysed in the chapter concerning cues of immersion in virtual environments). *Integration of diversities*[334] by metaphor's strict or logically necessary implication of one proposition by another, deviates abstraction, due to lack of attributes, from its space by characterising the abstraction with a *coherent system of metaphorical concepts*[335], which, in turn, admit, inappropriateness that Turbayne labels "*sort-crossing*".[336]

Spatially, within the communicative and the non-communicative domains as held by Dasein, who is both a spatial and temporal entity,[337] metaphorical systematicity is ubiquitous in design.[338] Dourish argues that the referent of the metaphor may possibly possess a set of capabilities that the metaphorical object itself does not.[339] This could be the result of the new structural relationship between the attributes of the metaphorical object and the referent of the metaphor. This could also be harnessed to the fact that virtual environments allow various interactions that are,

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332 Malpas, J.E., 1999. Place and experience: a philosophical topography. Cambridge, Mass.: Cambridge University Press.
333 Lakoff, G. & Johnson, M., 1980. Metaphors we live by. Chicago: University of Chicago Press.
334 Stanford, W.B., 1936. Greek metaphor. Oxford: Basil Blackwell, pp. 101-105.
335 Lakoff, G. & Johnson, M., 1980. Metaphors we live by. Chicago: University of Chicago Press, p. 9.
336 Turbayne, C., 1962. The myth of metaphor. New Haven, CT: Yale University Press, p. 11.
337 Heidegger, M., 1927. Being and time. Translated by J. Macquarrie & E. Roinson, 1993. London: Routledge, pp. 418.
338 Coyne, R., 1995. Desinging information technology in the postmodern age: from method to metaphor. Cambridge, Mass.: MIT Press. See also Coyne, R., Snodgrass, A.B. and Martin, D., 1994. Metaphors in the Design Studio. JAE (Journal of Architectural Education), 48(2), pp. 113-125.
339 Dourish, P., 2001. Where the action is: the foundations of embodied interaction. Cambridge, Mass.: MIT Press, pp. 142-144.

otherwise, impossible in a corresponding physical environment. Abstraction, in this context, ought not to possess any association of a metaphorical nature which might highlight one aspect and hide another. Hence, as another step in a proposed procedure for space abstraction, we suggest eliminating *Metaphor Systematicity.*

4.6 Analysis of the experiment

The complex situation created through the experiment described above, raises ethical issues because it puts the subjects into a difficult position from a moral viewpoint.

The subjects were asked to perform an action that put more than one aspect of their character into question. Their associate presented himself as being in need, telephoning, from outside the intimate space where he was 'trapped'. All of the subjects felt that they should help. None of the subjects showed any sign of reluctance or impatience throughout the duration of the experiment in the RE; they all felt that they had to accomplish a task - to help their colleague. This could also be related to the fact that during the interviews, all the subjects admitted to giving high priority to ethical issues and, in the corresponding question in the questionnaire, they all evaluated ethics as very important in their life.

4.6.1 THE TRUST "I KNOW YOU" OR "I KNOW IT"

It is very interesting that all subjects offered the fact that they found a source of trust as justification for their action. In the case of the RE situation, all subjects trusted their associate, whereas in the VE situation all subjects trusted the lightness of the virtuality of the situation, dismissing it as inconsequential or rather conceptual.

In the RE, knowing the person who was asking them to 'steal' (their term) the money quite well, seemed to have played a major role in the construction of their 'alibi', during the interviews. All the subjects in the post-rationalisation process of the RE experiment constructed a fantasy around why their associate was asking them for the money. Consequently, subjects' accounts were characterised by justification, inference and interpretation. In some cases huge and extensive presuppositions were made to pre-empt any possible negative viewing of the action they carried out. For

example, one subject thought that the money was related to 'the petty-cash of the Postgraduate Seminar Series'. The assumption presupposed a reason for the required action which effectively associated the action with a positive motive. The motive in this case was not for personal good, but rather, a public one. After all, 'the Postgraduate Seminar Series' is an activity where all postgraduates meet, and any money spent would be spent on them. Another example gives a slightly narrower presupposition to justify the action. In this case, the associate maybe needed the money because he forgot his wallet as well as his keys, but the trust element was present and the money would have been put back. In all cases, the element of trust was prevalent;

> "I wasn't really thinking… you phoned me asking for something. I know that you are a good guy and a friend, so… I think that even if I had noticed the note I would have done it anyway, because the trust I have in you and the importance I gave to what you asked me to do was more important than a note."

The accounts of subjects in the VE were different. The element of trust was strongly present, but it was acquired from a different source. Subjects did not demonstrate inference strategy, rather, simple justifications such as predominantly:

> "It is just a game-like task."

Using *just* in the previous sentence intensifies the description. The justification implies the subject's attitude towards the situation created in the VE as an inconsequential situation. The subject trusted that the value attached to his action within the VE is not equal to the manifestation of the same conceptual action in the RE. Another subject put it differently.

> "Because I did not take the VE seriously, because I thought of it as a game.

Trust has come to be of considerable importance in the study of ethics only in the last twenty years. Baier's influential article[340] revealed a large gap in the way that Moral philosophy handled the understanding of trust thus far. Following the feminist line initiated by Gilligan, Baier suggested nothing less than the re-orientation of ethics around the concept of trust in such a way that "servants, ex-slaves, and women are taken seriously as moral

340 Baier, A., 1986. Trust and antitrust. Ethics, 96(2), pp. 231-60.

subjects and agents".[341] Even more interesting for the terms of this paper is Baier's proposal for a moral test of trust. In her own words;

> "[T]rust is morally decent only if, in addition to whatever else is entrusted, knowledge of each party's reasons for confident reliance on the other to continue the relationship could in principle also be entrusted – since such mutual knowledge would be itself a good, not a threat to other goods. To the extent that mutual reliance can be accompanied by mutual knowledge of the conditions for that reliance, trust is above suspicion, and trustworthiness a nonsuspect virtue."[342]

In our experiment Baier's moral test is taken into account, since the researchers did not entrust to the subjects the knowledge of the necessary reasons for 'confident reliance'. This was done so that the subjects would be responsible themselves for creating the conditions of trust that would allow them to perform the requested action. In terms of Baier's test, all our colleagues made a decision that performed in the sphere of ethics. "A trust relationship is morally bad to the extent that either party relies on qualities in the other which would be weakened by the knowledge that the other relies on them".[343] Of course the point here is not to argue whether their action was morally good or bad. The point is to the examination of their moral attitude between the Virtual and the Real Environment.

Baier's innovative definition of trust has been a major influence in the literature of trust in Virtual Communities.[344],[345],[346]

4.6.2 THE SIGN "DO NOT EVEN THINK OF TOUCHING THEM"

A very interesting aspect of the experiment connected to the concept of trust is that during the RE phase the subjects ignored all the signs that highlighted their crossing some boundaries of privacy; the note that said 'Gabriella's stuff, don't even think of touching them!' and the sticker on the money itself saying 'Viva Brasil'.

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341 Ibid., p. 247.
342 Ibid., p. 260.
343 Ibid., p. 255-6.
344 Slater, M. & Steed, A., 2000. A virtual presence counter. Presence, Teleoperators and Virtual Environment 5 (9), pp. 413-434.
345 Chopra, K. & Wallace, W., 2003. Trust in electronic environments. In Proceedings of the 36th Hawaii International Conference on System Sciences, pp 331-340.
346 Schneider, F., ed., 1999. Trust in cyberspace. Washington DC: National Academy Press.

Figure 30. A subject reading the A4 warning sheet in the virtual drawer.

One can easily think that since the subjects had already decided to help their colleague they would not stop at such warnings. But this is an oversimplified version of making ethical decisions. On the contrary, ethical decisions are not just a matter of making an initial decision, but rather a constant interpretation of the situation.[347] In fact the signs were deliberately placed in the drawer in order to create continuous repetition of ethical boundaries that the subjects would have to cross. What was unexpected, however, was the fact that all the subjects suppressed the existence of the signs in the RE and so were surprised to see the very same notes in the VE phase.

For example, one subject reported he did not see the sign, although the sign occupied nearly 40% of the visual field of the drawer. This relatively high percentage of the drawer's visual field did not match the assigned value to the white paper. The intention of the act was to find money in a pencil case, and the paper did not match that intention. Consequently, the attention in the visual field was affixed at what would look like a pencil case, effectively excluding the act of reading a sign.

> "Now, was that sheet there when I opened the drawer? –Yeah -It must be, it must have been. It wasn't on top of things, I don't know did I just miss it or what? It was in exactly the same place as in the VE."

The subject's doubt as to whether there was note or not in the RE also highlights the level of visual engagement with the VE. The visual perception is increased in terms

347 Coyne, R. & Wiszniewski, D., 2000. "Technical deceits: critical theory, hermeneutics and the ethics of information technology." International Journal of Design Sciences and Technology. 8(1), pp. 9-18.

of perception of objects, and the intentional interaction with these objects. This is demonstrated in other accounts, of which the following is a good example.

> "I also didn't pay any attention to the note 'Don't take my stuff', cause I was on a mission to go to the coloured pencil thing and steal money. [Laughter] So I didn't read the note. I didn't even know that it was there. In fact this is the first time that I was aware that there was a note in that drawer. That's interesting."

The subject's attention was drawn to the perceived object of his intention, i.e. the money in a pencil case. Other objects were not within this intentionality, therefore, attention did not encompass them. In relation to the previous account, it is clear that the visual perception although a strong stimulus is not the decisive element in the intentional experience. In order for a visual stimuli to be interpreted, and registered, a process of intentionality first needs to apply. This explains why 40% of visual space was effectively ignored. By contrast, the VE visual field was the centre of attention, and therefore intentionality. One could argue that the reason for this attention is not the object, i.e. the money in the pencil case, rather, it is the quality of the visual field. The visual field and its context presented a new mode of interaction.

In the previous accounts, the researcher was presented with the possibility that although subjects said they did not pay attention to the sign, there was a possibility that the subject simply did not see the sign. Hence, the accounts mentioned above could be invalid, or interpreted differently. The researcher was confident that the 40% of the visual field within the limited area of the drawer will generate enough stimuli to be perceived by the subjects. However, the possibility of not seeing the sign is still a valid point.

This possibility was overruled by an interesting account that did prove that lack of attention is the reason for not registering the sign, and not a simple case of not seeing or reading the sign. Initially, according to this subject's account, he did not remember seeing the note. When referring back to the recording of the session of his experiment in the RE, it was found that he read the sign out loud while on the phone with the researcher who was guiding him. The fact that he read the sign out loud leaves no place for doubt that he actually did see the sign. However, this did not change his account of not seeing the sign. He was actually surprised; nevertheless, he found an interesting explanation.

> "That goes hand in hand with me. Because may be I did see it, but I am blocking it or something for some reason. But I do distinctly remember opening up the drawer and feeling uncomfortable whatever it was, and it had to do with sign … then I thought yeah there is something strange about this."

The interesting claim in this account is that the subject recalled feeling uncomfortable, but did not recall reading the sign that made him feel so. The emotional involvement with the experiment did seem to dissolve details and maintain general notions of discomfort. On the other hand, the perceptual stimuli did not reflect the intentionality of the experience, and the object of this intentionality. The verbalisation of perception did not help in registering the experience, rather, triggering emotions that are better remembered.

One can draw the conclusion that the trust subjects showed their associate withdrew the existence of the signs from their notice or memory. The resulting outcome of this trust of a series of boundary-crossings, concealed important facts of the RE, that during the virtual phase, were revealed and made obvious.

4.6.3 CONSCIOUSNESS: "THAT MONEY WOULD HAVE BEEN REPLACED."

The process of "changing environments" induces a momentary sense of distance from ethics. With the issue of RE and VE there is an interaction between the two conditions suggested by Heidegger, of the "ready-to-hand" and "present-at-hand" , which is also supported by the 'space' 'place' relationship. Ultimately, we maintain that the subject alternates between these two positions of interaction with RE and VE while trying to achieve the goal. Performing both tasks provides a means of abetting this process. The subject, without being aware of it, highlighted the feeling of discomfort in the first phase as he was reacting to the experiment. Ethics was the background player. In the second phase, ethics became a present-at-hand element.

The feeling of discomfort in the RE was confronted by introducing strong scenarios of the narrative in progress. Subjects tended to justify and interpret the actions they took as was demonstrated previously. In their effort to provide a convincing narrative, the subjects went to rule over any consequences that might result from their actions. For example, one subject stated that he was convinced the money would not be missed because of him.

> "I knew that it was. I mean clearly we were bumming somebody's money, obviously, but that money was to be replaced at some point. It would have been replaced. It was not stealing."

The total awareness of consequences resulted in generating this explanation. The repetition of the expressions '*be replaced*' highlights the underlying justification in this narrative. The idea that the situation would be restored to what it was before. This justification was further supported by the last statement in which the subject made the assertion that what happened '*was not stealing*'. The negation in the sentence suggests that the subject presupposed the opposite.

Generating scenarios or narratives was one conscious attempt of controlling the consequences of the action. Another interesting way to control it was by dismissing any consequences in the first place. For example:

> "I remember there was writing somewhere, I was not sure what it said, but I just thought "look … these guys have just arranged and in any case I thought it is just between you and Gabriela whatever happens". So the ethics of I was not responsible for anything."

The intentionality of the action of this subject resulted in taking a conscious decision to relegate the value of her action to a position of inconsequence.

Controlling one's own role or generating scenarios or narratives to control the consequences were some ways of addressing the consciousness of the action in the RE; however, in the VE the process of justification did not necessitate any scenarios, because the nature of the involvement was different. Subjects in the VE interacted using a rather *universal* notion of interaction with digital media, that is, there are no consequences in a computer game. This notion was evident in almost all cases. The consciousness of the action was increased dramatically in the VE. One could argue there was a level of detachment from the VE which may have resulted in a feeling of inconsequentiality; nevertheless, the nature of the spatial action stands for a different layer of engagement which is embodied.

This investigation takes us into the realms of the phenomenology of perception, spatial representation, the nature of digital media and embodiment. We illustrate our point with an example from one of the user's responses and attitudes to the issue.

> "That's it. I have gone down. I have opened the door. I opened the drawer, and I was not confronted by any dilemmas [in the VE]..… whereas before [in the RE] I was."

The subject's comparison came at the end of the VE session. His statement was voluntary and uninitiated by any questions, and was said while still navigating around in the VE. The interesting element of this account is the listing of the crucial actions in the experience of taking the money. The actions mentioned were embodied actions, not mental. The subject did not list his decisions such as '*should I take the money or not!*'; rather, he listed his actions. Those actions were spatial: '*going down the corridor*', '*opening the door*' and '*opening the drawer*' were the pinpoints, yet he did face a dilemma in the RE, but not in the VE.

4.6.4 UNAWARENESS: "SO YOU DID NOT MAKE THE CONNECTION?!"

The French philosopher Maurice Merleau-Ponty, in *Phenomenology of Perception,* first published in 1945, emphasises the role of the human body in perception. He analyses different bodily attributes to account for this role: the body as object, the experience of the body, spatiality, motility, synthesis, the sexual being, and the body as expression.

As our body constitutes a first "frontier" when encountering the world, the way we structure space draws from it. Everything about our body is not only co-ordinated, but derives a functional value that we don't have to learn but is already known to us. His investigation leads him to assert that our consciousness is *embodied* in the world.

Merleau-Ponty maintains that "the perception of space and the perception of the thing, the spatiality of the thing and its being as a thing, are not two distinct problems."[348] The subject's awareness of the surroundings and the surroundings themselves are not two different things. RE and VE are what the subject perceives them to be. Although the task was oriented towards a target, the subject missed essential information and did not build or construct the relation between both phases. Instead, the subject carried both tasks separately and successfully. The reason for this separation between both is due to the nature of the *organic habits* that form our actions. In the same way one might eat something but not remember what it was, one might do something repeatedly, but not distinguish the act. In the same spirit of the

348 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, p. 171.

statement, one subject suggested she was in the habit of doing things without paying much attention to her actions.

> "I do so many things without thinking; I put my keys in my pocket and then I don't remember where they are, or I borrowed a book from the library and then I went again asking for the same book. I don't think."

This presents an interesting mode of engagement with the surrounding environment. The basis of this mode is habitual. The habit of interacting without attention results in repetition of actions. This in turn renders familiarity an aspect of embodied actions. What is missing here is the intentionality. This subject's account illustrates the point.

> "…it was the first time I heard Gabriela had a drawer. And now when I heard it there, it reminded me of something like I have already heard Gabriela's thing somewhere, but I did not remember when or where."

The embodied habits are linked to the body in a way that excludes all other objects of experience. This subject '*did not remember when or where*' she experienced an embodied interaction although it felt familiar. The absence of the contextual elements of an experience, arguably, renders the embodied interaction instinctive; however, we argue that embodied actions characterised by unawareness form the link between instinctive actions, and intentional conscious actions.

4.7 Conclusion

Returning to the original question '*Can the Ethics of the Real Environment be tested in a Virtual Environment?*', our experiment has made a contribution towards a positive answer. The comparison of the *ethics of place* in RE and VE seems to promise a wealth of potential investigation that could follow on. Beyond the analysis of *trust*, *signification, consciousness* and *unawareness* that were tackled here, a number of other issues were raised during our experiment, but cannot be expanded upon in the limited space of this paper: the understanding of the task as a *game*, the connection of trust with the existence of an already strong community, the connection between the attention to navigation; and the lack of focus on the ethical dimension of the task and ultimately the dilemma of the virtuality

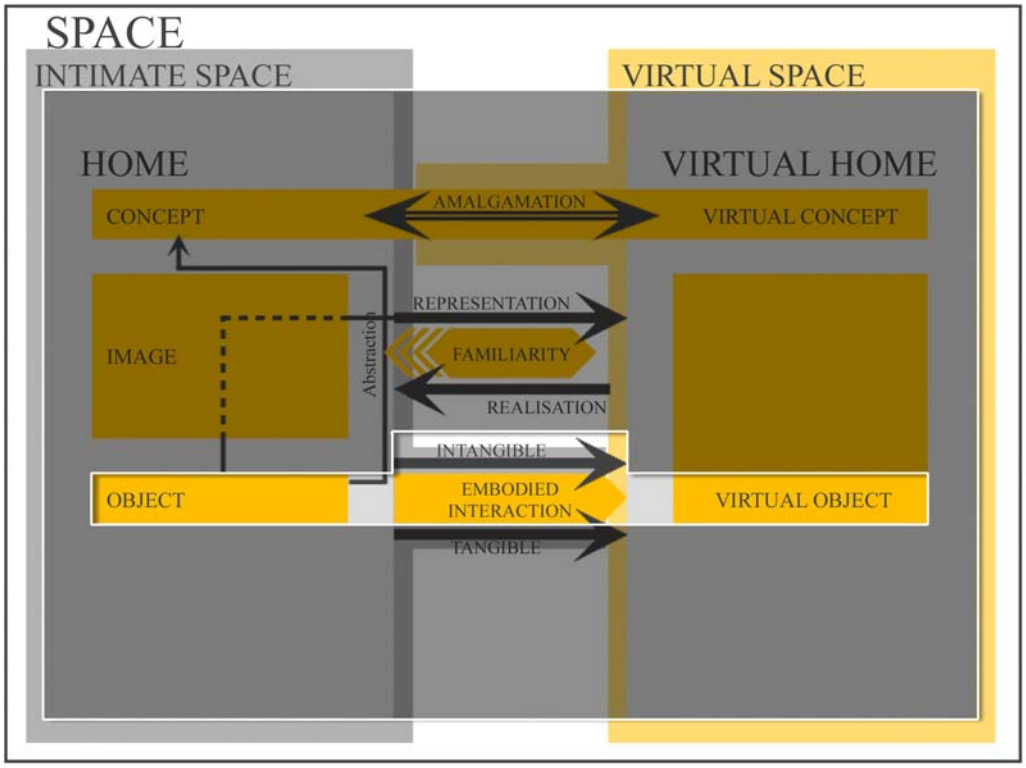
However, we realise the limitations of this experiment since it is still far from providing a formal testing procedure. For example, in its current form, the experiment fails to address issues related to the presence of the other in the VE, the creation of the emotional load in the delivery of the instructions in the VE and the awareness – though partial - of the repetition of a procedure that corresponds to the RE.

Nevertheless, the compiled list of results and their evaluation shows startling possibilities, further establishing VE as an arena for investigating issues pertaining to both architecture and ethics

Finally, it occurs – altering Diddel's words of the rape - that 'To participate, in this disembodied enactment of life's most body-centered activity is to risk the realization that when it comes to Ethics [and not only sex], perhaps the body in question is not the physical one at all, but its psychic double, the bodylike self-representation we carry around in our heads.'

Embodiment and Illusion

The Implications of Scale as a Cue for Immersion in Virtual Environments



5.1 Introduction

There are many factors that contribute to a sense of immersion in digitally mediated spaces, augmented reality, virtual environments or massively multiplayer online role-playing games (MMORPGs). We can be tricked into believing that the image or sensual stimulus before us is in fact "real," but this is only a minor motivation in artistic production, according to Bolter and Grusin: "Trompe l'oeil [optical illusion], which does completely fool the viewer for a moment, has always been an exceptional practice".[349] Photorealism is not the only determinant in the experience of immediacy, nor is it even necessary. In fact the potency of immersive environments often derives from exaggeration, selective abstraction, hyper-realism, and the play of scale. Looking beyond the visual we also see that new media present us with opportunities for haptic interaction, either imagined or actual. Furthermore, as attested by the captivating power of computer games at various levels of visual abstraction and sophistication, digital spaces are engaging, immediate, and immersive to the extent that they provide us with something worthwhile and interesting to do.

Interactive digital media provide an excellent means of testing, comparing, validating and challenging theories about perception, in our case aligning the phenomenology of Merleau-Ponty and Heidegger with contemporary researches into "embodied interaction".[350] Digital media provides an opportunity to work with scale as a variable, an idea brought to our attention in a provocative paper by Xiaolong and Furnas.[351] Dynamically changing the size of a 3D model, such as a building, or changing our own size in relationship to it, is perhaps beyond our usual experience, and so presents us a challenge to our perceptual apparatus. We are familiar with the effects of perspective as we move through a space, variable zoom lenses, digital zooming, and objects that grow and shrink before our eyes, not least in movie special effects — but what of variable scale in 3D virtual environments? Such effects

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349 Bolter, J.D. & Grusin, R.A., 1999. *Remediation: understanding new media.* Cambridge, Mass.: MIT Press, p. 31.
350 Dourish, P., 2001. *Where the action is: the foundations of embodied interaction.* Cambridge, Mass.: MIT Press.
351 Xiaolong, Z. & Furnas, G.W., 2003. In *Conference on Human Factors in Computing Systems*, CHI '03 extended abstracts on Human factors in computing systems Ft. Lauderdale, Florida, USA, pp. 790-791.

include: experiencing an urban model at human scale as a pedestrian, then changing scale to that of a giant, able to step over buildings, or hold the model in the palm of my "virtual" hand. Perhaps then we could shrink to the size of ant and explore the interstices of the city model normally invisible to human-scale investigation. What difference would such scale changes make to our interaction with the environment, and what possibilities do they provide for design?

This investigation leads us to examine the cues by which we determine our scale in relation to an object or environment. These cues include the coordinates and view angle of the viewer in relation to the scene, speed of movement, distance between eye positions (if stereoscopy is employed), aerial perspective (due to atmospheric diffusion), focal length, and depth of field. If the eye position moves then we take cues from speed, inertia and pattern of movement. If there is interaction then the distance of our reach and the mode of interaction are important. The sonic quality of environments is strongly influenced by their scale. We might expect small objects to emit higher frequency sounds than larger objects. The object in view is important. A close up, surface level perspective of a fountain pen might suggest that either I am very small or the pen is very large. The presence of grime, surface imperfections, material properties and behaviours are also determiners of scale. The effects of scale are strongly influenced by imaginative metaphorical relationship.[352] To suggest that I am an ant or a giant already colours my perception of scale. Scale perception is also mediated by the legacies of visual representation: classical and romantic painting, scale drawing, physical model making, photography, film, special effects, computer games, and digital manipulation. To change scale dynamically in relationship to our environment or image adds further complexity to the experience of scale, and is abetted by metaphors of growth, inflation, and fantasy scenarios.

How does scale and scale-change, affect our sense of engagement, immediacy and immersion in a digital environment? This chapter will explore the propositions that changing scale is a further mode of interaction that can influence immersive experience. We consider whether working in an immersive environment where there is a sense of being at different scales can be useful in accomplishing certain design

352 Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press.

tasks. More significantly we explore the proposition that the sense of scale is a strong determinant in our experience of engagement in a digital environment. The "god's-eye view" is concomitant with a sense of distance and abstraction. The eye-level view brings us into the environment. On the other hand, the slow movement of our increased size or elevation can give time to reflect and establish distance. The faster movement of the small-scale participant sometimes suggests engagement (as for the frenetic computer game player). The process of "changing scale" also induces a momentary sense of distance from the digital environment. With the issue of scale manipulation there is an interaction between the two conditions suggested by Heidegger, of the "ready-to-hand" and "present-at-hand." Ultimately, we maintain that the designer needs to be able to alternate between these two positions of immersion and distance while working on a project, and dynamic scale manipulation provides a means of abetting this process.

Our investigation takes us into the realms of the phenomenology of perception, spatial representation, the nature of digital media and embodiment. We illustrate the chapter with examples from a student design project investigating scale in virtual environments, studies of user responses and attitudes to scale issues, and research using interactive 3D environments.

5.2 Resuming Phenomenology of Perception

> "The history of architectural scale, as a subject to be explored, is almost a textbook illustration of the great difficulty of building up a cumulative understanding when, at every analysis, it is hitched to the shooting star of a living work of art."[353]

5.2.1. THE MEANING OF THE WORD SCALE

According to The Oxford English Dictionary, the word *scale* was used to denote "a drinking-bowl or cup"[354] which was recorded as early as 1205AD. According to the same reference, it was not until the year 1375 that a different meaning was recorded. The new attained meaning came as a reflection to the change in the use of the object

353 Licklider H., 1965. *Architectural scale*. London: The Architectural Press, p. 12.
354 Oxford English Dictionary O.E.D., (Draft Revision June 2007). Oxford English Dictionary. [online]. http://www.oed.com/ [Accessred 9 October 2007].

represented by the word, i.e., the bowl that is the scale. The early quotations shows the scale as an object made of metal and used to drink liquids like wine etc, whereas the new-found meaning introduced the scale as an "apparatus for weighing" or "each of the pans of a balance".[355] Its association with the balance again presented scale as an attribute of justice (1593). The definition shifted from the original object to an activity. The activity in question entailed using the balance to compare the weights of two objects against each other, but it did not necessarily assume a standardisation of the weights being used in one side of the balance. The process of weighing objects at that point is characterised of being relational i.e., having or designating a structure in a simple dimensional way.

Object (x) weighs more than object (y), or
Object (y) weighs more than object (x), or
Object (x) weighs the same as object (y).

The weight of one object is measured in terms of the weight of the other object. The use of standard weight and its subdivisions on one side of the balance or scale introduced a different dimension to the process. Beside the relational aspect of the process, a new proportional aspect was introduced. Here the object is measured against a unit of weight, as a proportion of that weight. Accordingly, scale introduces a process of correlation in terms of proportionality. The unit of weight overpowered the standard object of weight and, consequently, the notion of scale became abstract of the object, and the process of correlation and proportionality became independent of the element of weight. Scale is considered to be the attribute that designates the correlation between one object and a standard system of measurement.

5.2.2. PHENOMENOLOGY OF PERCEPTION OF SCALE

Scale as a concept transcends the objects mentioned above to denote the very process by which human perception associates certain attributes to an object using a standard method of measurement. Scale is an important element of our perception as it often contributes to the logic, or the absence of logic, of the relationship between the human body and its surroundings. The body in this case is the standard measurement

355 *Ibid.*

and, accordingly, the centre of our interaction and our mediation with the world,[356] an interaction that is characterised by its relationality, and a mediation that is characterised by its proportional intensity. The conscious experience of the human body, from the subject's point of view, is the focus of the study of phenomenology, a division of philosophy that considers both the structure of conscious experience and its intentionality. As a method of investigation, phenomenology offers a human-centred account of knowledge, based on experience. For phenomenology, experience is constituted by the interaction of our bodies with other objects, and provides the general frame for our actions.[357] The background of this frame is perception. We perceive the vast field of objects that surrounds us, being aware that, in turn, we are being perceived as objects by others; as a concept, scale is "an attempt to control a spectator's impressions of size through a system of proportions, or through directly designing for his visual experience."[358] Hence, understanding scale phenomenologically aids in understanding human embodiment and interaction with other objects, most importantly space.

What is meant by understanding scale phenomenologically is to explore the mismatch between the factual physical scale –physical scale is often interpreted as "the very direct relationship between appearance and reality"[359]– and the embodied perception of scale. The following analysis will elaborate on the topic of scale, but first the phenomenological approach to be deployed in this analysis will be presented.

In the first chapter phenomenology was introduced as a method of investigation. In that context, the focus was on the essence of objects, entities, or phenomena. The method was presented in terms of its development by Husserl, Heidegger and Merleau-Ponty. The character of human experience, namely intentionality, was coined as the centre of our interaction with phenomena. In the second chapter, various qualitative methods of phenomenological investigation were introduced to aid in the process, thus gaining insight into human experience. In this

356 Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press.
357 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, p. 235.
358 Licklider H., 1965. *Architectural scale*. London: The Architectural Press, p. 29.
359 *Ibid.*, p. 29.

chapter, and as well be illustrated in this section, the use of phenomenology will be resumed deploying Merleau-Ponty's analysis of the human perception.

The French philosopher Maurice Merleau-Ponty, in his *Phenomenology of Perception,* first published in 1945, emphasises the role of the human body in perception. He analyses different bodily attributes to account for this role: the body as object, the experience of the body, spatiality, motility, synthesis, the sexual being, and the body as expression.

As our body constitutes a first "frontier" when encountering the world, the way we structure space draw from it in many ways some of which is characterised by being relational and proportional. The built environment introduces one of the strongest examples that can be driven to illustrate the point. Designed spaces concerned with human activities are always affected by the human form before any other factor in shaping the design. This strong basic assumption of "how would an activity performed by the human body be suited in a space?" leaves other concerns such as "how would users perceive space?" in the second place.

Everything about our body is not only co-ordinated, but derives a functional value that we don't have to learn but is already known to us. Some of these values are dictated by formal forms of space that we were exposed to, which was discussed in the first chapter. Merleau-Ponty's investigation leads him to assert that our consciousness is *embodied* in the world. When it comes to this physical scale system or the relational proportional scale system, our embodied consciousness utilises them to make judgements on perception.

Merleau-Ponty argues that a perception of a relationship between:

- one object and another,
- one object and a memory of an experience whether related or unrelated to the object,
- two experiences that are related,
- two experiences that are not related,
- and two metaphors as a second level of relationship,

is neither purely sensory, nor the processing (reasoning) of facts. The decision of whether something is "real" or not is down to the perception of the relations between objects, a process of interpretation that is already embodied. When physical scale is introduced as "the very direct relationship between appearance and reality"[360], and when Merleau-Ponty maintains that "the perception of space and the perception of

360 I*bid.*, p.29.

the thing, the spatiality of the thing and its being as a thing, are not two distinct problems"[361], consequently, the determination of whether scale is a direct physical relationship or "real" on one hand, or if it is a matter of perception on the other hand is open for exploration on the basis of embodied perception and reasoning. Consciousness is a state that includes both sensing and reasoning. This state will draw on many experiences embedded in memory. For traditional empirical study (against which Merleau-Ponty positions his approach), it is only the pure sense experience that decides and gains our knowledge of every other thing in the world. For rationalism (to which he is also opposed), it is only reason that decides and gains our knowledge.[362] Phenomenology attempts a way out of this problematic.

Architecture utilises the proportional scale system in order to relate human embodiment and experience to the built environment by placing "an order of dimensions and relationships in the design which (when it is seen) may be used to control whatever the designer wishes to express in his design".

The emphasis on classifying the understanding of scale is most apparent in scale-systems' approaches to understanding design in which "they place in the mind of the designer an order of divisions and relationships which…can be a much needed stimulus to his imagination". In order to provide a designer with the background knowledge required to 'understand' design, many architectural designers attempted to create large and coherent reference systems, or design implementations in which scale is applied in a systematic manner.

The answer for some designers and architects was to produce specialised structured scale system for coping with aspects of design that requires specific type of … That is, proportional systems based on mathematical congruence are one example, and that of modular structures, is another. It then became possible to think of scale as organised into separate but interlinked sets of knowledge sub-areas which, taken together, would add up to the generalised concept that designers, in the process of design, appear to use. This is intuitively a very reasonable idea since, when we design a specific space, we presumably only use that spatially scaled down but activity-wise, highly detailed part of our skills which is required for the designing of

361 Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge, p. 171.
362 *Ibid.*, pp. 30-60.

that space. This is also self evident in the method of representation we choose for the design. In other words, when we design a space for a home, we implement the knowledge pertaining to the scale of the space of a home, and the type of activities that occur in it, but not the scale of an urban development of many houses, or the activities that occur in a stadium. Moreover, when a designer works on the design of a space, the process of representing ideas, or namely translating ideas into sketches, tends to occur in a consistent scale of representation rather than a multi-scale representation.

It quickly became apparent that fixed assumptions about scale were too rigid and inoperable upon implementation in design, and design representation. Da Vinci's Vitruvian man is one example of the rigidness that might be associated with the human body as described and presupposed by Vitruvius.

5.2.3. ANALYSING SCALE

As was demonstrated in the first chapter, the notion of intimate space cannot be independently understood without correlating it to objects such as the *home*. Counter to the common erroneous misperception, one's understanding of a concept is not independent of objects representing it. Scale is one of these concepts that are hugely intricate and constantly dynamically changing, moreover, because of its function as a medium of correlating visual elements. In the first chapter the process of amalgamation was introduced as a tool for conjoining different concepts in order to realise new innovative concepts and objects while highlighting aspects of comparison in between both. However, the comparison in the first chapter took place between the representations of objects perceived to be real. E.g., in the first illustration (*Figure 1*) the ten highest skyscrapers in the world) the comparison occurred between the graphical representations of ten different skyscrapers perceived to be real. The medium of delivery of this amalgamation eliminates any possible rejection of the content by acting as a neutral ground that conjoins the elements of amalgamation. However, contrasting the objects themselves rather than their representations necessitates that one or more of the compared objects loses its context. Context is a set of factors one of which is the scale of the object.

Thus far, scale is a concept that encompasses the direct relationship between an object and its reality; the embodied perception of an object's size through the perception of proportions. The object (*Figure 31*) is a work of art titled '*planet*' which is a sculpture of a seven-month-old baby by the artist Marc Quinn. The figure shows the sculpture displayed in a rather natural context, however, the presence of two adult people passing by, highlights the process of amalgamation that is activated by this work of art. One aspect of this amalgamation highlights the comparison between the scale of human embodiment and that represented by the sculpture. The comparison would not usually intrigue viewers, but the fact that the sculpture is a *seven-month-old giant baby* correlates it to human embodiment. In general terms, human embodiment is relative to age, i.e., in a much generalised manner, we can state that as human body ages, it increases in size as well. Thus, babies are small in size because they are small in age.

Figure 31. 'Planet', a sculpture of a seven-month-old baby by artist Marc Quinn at Chatsworth House, Derbyshire.363

5.2.3.1. Componential analysis

Analysing the components of *Figure 31* above is one way of extracting the elements that form the relations between the objects. Compositional interpretation, Gillian

363 Furlong C., 2008. Sotheby's exhibit sculptures at Chatsworth house [Photograph] Available at: http://www.gettyimages.com From home search item #82697842 [Accessed 18-10-2008].

Rose argues, is one "approach which offers a detailed vocabulary for expressing the appearance of an image".[364] It is particularly useful method because "it does offer a way of looking very carefully at the *content* and *form* of images".[365] This includes the content, colour, spatial organisation, light and expressive content. We are mostly interested in the spatial organisation and expressive content; nevertheless, we are not relegating any factors from the other three to a position of unimportance. Rose views spatial organisation as that within the image, and the viewing position inflected on the spectator. Spatial organisation within the image considers the volumes in the image and their interrelations. It also considers the qualities of the space in which the volumes exist, such as width, depth, interval and distance, whereas expressive content is 'the combined effect of subject matter and visual form'.[366] The term compositional interpretation is invented by Rose, however, when relatively viewed within the realm of vision rather than semantics, componential analysis could offer an equally valuable account of meaning, and perhaps more detailed when it comes to the components of experience, scale in this case. Componential analysis "reveals the culturally important features by which speakers of the language distinguish different words in the domain".[367] If the definition above is adapted for visual components, the result would be revealing the contextually important visual features by which perceivers distinguish different objects within domain. We will try to apply componential analysis to the photo in question.

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364 Rose, G., 2001. *Visual methodologies: an introduction to the interpretation of visual materials*. London: Sage Publications, p. 35.
365 *Ibid.*, p. 39.
366 Taylor, J.C., 1957. *Learning to look; A handbook for the visual arts*. Chicago: Chicago University Press, pp. 43-4.
367Ottenheimer, H.J., 2006. *The anthropology of language*. Belmont, CA: Thomson Wadsworth., p. 20.

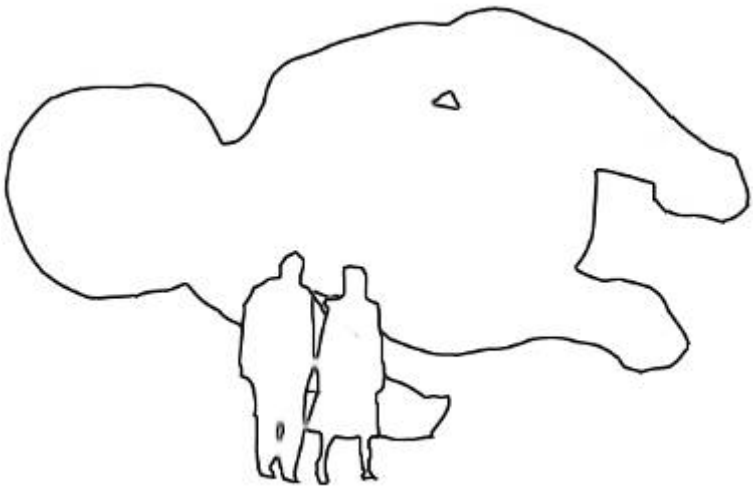


Figure 32. An outline of the human figures in the photograph in figure 31.

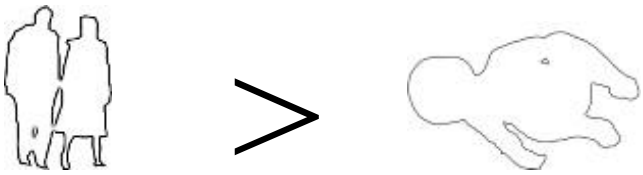
Figure 32, outlines the objects of the foreground in *Figure 31*. What we end up with is the outline of the giant-baby sculpture, and of the two people walking beside it. When both components are again separated, we end up with the outline of the sculpture of the baby, and of the two people standing beside each other. There are three components in the figure. We will avoid using words and instead list the outlines. Thus, the figure includes a and a  .

 = a HUMAN and ADULT and FEMALE or MALE

 = a sculpture of HUMAN and MALE and NON-ADULT

Generally when viewed together, it is a predisposed knowledge which is confirmed by the analysis of the general sense of the decomposed outline that the sculpture of the baby is smaller in size than the two adults.

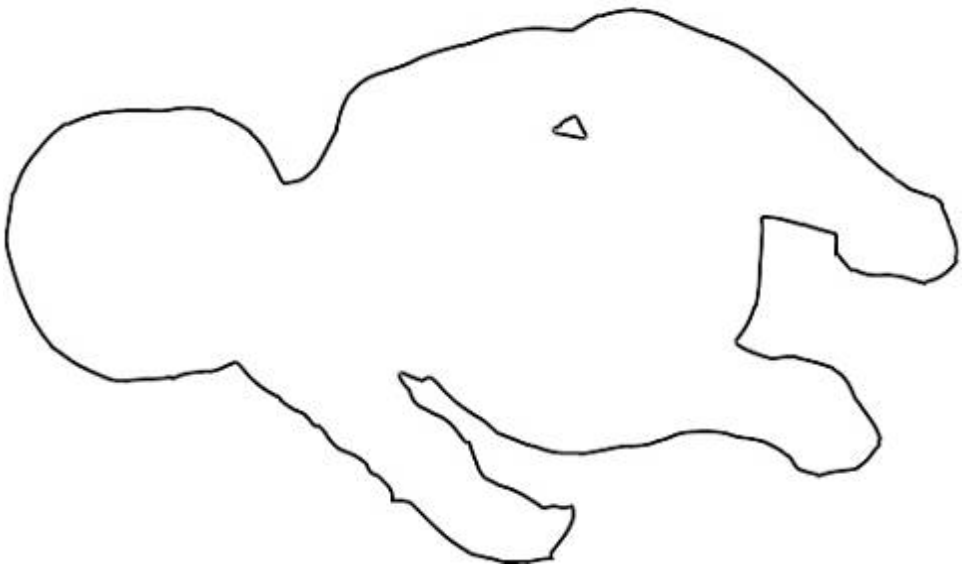
It is logical to infer that:



However, the exact outline in the figure is:

a HUMAN and ADULT and FEMALE or MALE

<



a sculpture of HUMAN and NON-ADULT and MALE

Figure 33. The exact outline of the human figures in figure 31.

However, the decomposition of the outline, as well as the original (*Figure 31*), suggests a different value of the size of  . The value (sculpture) defies the original value of the size of , and introduces, instead, a multiplying factor which omits the predisposed knowledge of the size. The value (sculpture) affects many other values, but our interest is focussed on *scale*.

Analysing the components of the image or interpreting the composition will aid in understanding the way scale operates to inform our perception of objects. While the discussed examples will be decomposed and interpreted, the scale role in the process will be discussed from different points of view: as an element within the frame of understanding, as a schema, as a scenario.

5.2.4. PERCEPTION OF SCALE AS KNOWLEDGE

The first chapter included several attempts to provide phenomenological representation of the home as the native place of *being-in-the-world* in order to form the basis of the interpretation of phenomena pertaining to virtual forms of representation. Unlike phenomenological representation, other approaches to the interpretation, such as psychoanalysis or descriptive psychology, assume to a great extent that the subject possesses the specific knowledge pertaining to a specific context or situation. While we attempted to describe the phenomenon of the home holding no presuppositions, which led us eventually to the body, descriptive psychologists would have been consumed in validating the role of home correlates in guiding or affecting subsequent life experiences. Phenomenologically, we define the home as the immediate environment beyond the screen of amalgamation, or the body, whereas, psychoanalytically, it is assumed whenever the notion of the home is mentioned, a set of predictable information are immediately made available.

Visually, given one look at *Figure 1*, the producer of the illustration did not have to inform the viewer that each building was drawn in a proportionate way with regards to the rest of the buildings, or that the scale of the building was corresponding to its real scale and the scale of the other buildings in the illustration. This type of information is always assumed to be present. The visual representation illustrated in *Figure 1*, in the first chapter, assumed the conventional aspects of an

architectural representation such as scale and proportion to be present, and was treated as basic elements. Even if not mentioned in *Figure 2*, in the first chapter, a time line that separates and chronologically classifies the different stages of evolution was assumed to be present. A good example of the ability to provide basic elements pertaining to a space was demonstrated in the previous chapter when one of the subjects reacted to the amalgamation of space through the augmented window by saying: "*Why was there no Swiss flower box of red geraniums at the window?*"

The information associated with the representation of the phenomenon at hand is present in the mind of the subject in an almost stereotypical way. Hence, the image of the window is associated with the memory of a box of red geraniums.[368] Whenever the window is mentioned, the unit that is correspondingly imagined is that of the window and the flowers as one unit, not two different units. This can be drawn back to the timeline in *Figure 2*, in the first chapter, and the scale in *Figure 31*, in the this chapter. The visual representation has characteristics that, arguably, form themes that in turn we may deduce as a result of modifying scale. The argument is that the elements that are taken for granted and sitting quiet in the background such as the geraniums beside the window, will be brought back to the foreground in the same way the absence of the geraniums was marked beside the digital window.

The proposed phenomenological intervention deals with human understanding of scale in two different ways. The first relates to embodied *schemata* of interaction and the second is *frames* or *scenarios* of perceived knowledge. Both are selected due to their influential accounts in understanding how we encounter the world, and the fact that these accounts represent a very large body of research in phenomenology.

We will also consider some related attempts in phenomenological research to provide ways of representing scale understanding as perceived and understood and how it relates to the way the world is revealed to us. The emphasis in this area is typically less cognitive or empirical or quantitative, and more concerned with how perception and consciousness are used in real time. We will analyse presented examples into their components, and discuss them in conjunction with the much

368 One might question whether or not this is a stereotypical phenomenon, but we argue that indoor plants are usually kept beside windows to expose them to sunlight and wind.

more widely used terms of schemata, frame and scenario. The idea of *prototypical event* is also discussed. Although there appear to be many different definitions employed by different investigators such as Da Vinci and Le Corbusier, there is a very large area of overlap in what these definitions are used to describe. It should be recognised that generally the deployment of different definitions and the comparison or expansion on discussion against a wider scope of research, in these various research areas do not necessarily alter or work against competing theories. The different approaches are best considered as alternative characterisations for the description of how certain factors in perception are organised from a phenomenological point of view, and also how this organisation is altered or recalled or activated in the case of understanding scale.

5.2.4.1. Scale Schema

The traditional or conventional understanding of scale as the relationship between the appearance and reality, or as an attempt to place an order of dimensions and relationships in the design as introduced by Da Vinci and Le Corbusier, was reviewed above. The general appeal was made to the existence of scale as an independent notion which was, in an instance, embodied by the modular to act as a stimulus for imagination, and much more to instantiate the process of design. The existence of repeatable spatial and temporal patterns and organisations that have a fixed ratio reflects, for the proponents of the modular, a tool of verification. However, the story might be equal but different for the proponents of embodied schemata. The repeatable spatial and temporal patterns become schematic structures that emerge from embodiment.[369] 'Physical containment' is one of the basic schematic structures. An initial account such as the one given by Paul Claudel and cited by Bachelard in his book '*The Poetics of Space*' can instantiate the physical containment in more than one way:

> "One's Paris room, inside its four walls, is a sort of geometrical site, a conventional hole, which we furnish with pictures, objects and wardrobes within a wardrobe." [370]

369 Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press, p. 21.

370 Paul Claudel, Oiseau noir dans le soleil levant, p.144, Cited in Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press. Originally published: New York, Orion Press 1964, pp. 26-27.

First, one's body is bounded in a room, which immediately draws on the common knowledge of physical containment. Second, scale is introduced in two different ways: 1) the room is a geometrical site of four walls and a room is also a hole, and 2) a room is a wardrobe and a room contains a wardrobe. While the modular is absent in the above-mentioned spatial account, the physical containment schema is instantiated and activated. The reader of this account will first recall the schema of physical containment, and then the process of activation will result in recalling the experience of the reader or the subject of a spatial experience. The account in itself does not hold the schema; it is the subject that produces the schema to comprehend the account.

Schema as an expression was originally used by Kant as 'a representative procedure of conception' or a link between embodiment and ideas. Schema is the embodiment of concepts. Kant asserts that "In truth, it is not images of objects, but schemata, which lie at the foundation of our pure sensuous conceptions."[371] However, Johnson builds on Kant's notion of schema and adds to it 'embodied patterns of meaningfully organised experience'[372] with which, the meaning emerges via schematic structures. Johnson attempts to make distinction between his use of the term and the general use within cognitive science. He considers Rumelhart's definition of schema as 'generalised knowledge about a sequence of events',[373] and labels Schank and Abelson's '*scripts*' as 'structured frameworks or schemata' which are characterised by *conceptual dependency*,[374] against which we will argue, and reintroduce and perhaps redefine or refine schemata.

Johnson's consideration of schema associates it with the cognitive science concept of a schema, yet he mixes three main independent concepts: schema, scripts, and frameworks. He then departs with the concept of embodied schema from the platform of cognitive science using Kant's wings! Anderson describes schemata as 'ideation scaffolding'[375] [376], which is interesting for two reasons: the first is the fact

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371 Kant, I., 2003. *Critique of pure reason*. Translated from French by J.M. Meiklejohn. Cambridge: Cambridge University Press, p. 102.

372 Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press, p.19.

373 Rumelhart, D., 1977. *Introduction to human information processing*. New York: John Wiley and Sons, p. 165.

374 Schank, R.C. & Abelson. R.P., 1977. *Scripts, plans, goals, and understanding: an inquiry into human knowledge structures*. Hillsdale, NJ: Lawrence Erlbaum, p. 176.

375 Anderson, R. C., 1977. The notion of schemata and the educational enterprise. In R.C., Anderson, R.J., Spiro & W.E., Monatague, eds. *Schooling and the acquisition of knowledge*. Hillsdale, N.J.: Lawrence Erlbaum, pp.415-431.

376 Anderson, R.C., Sprio, R.J. & Anderson M., 1978. Schemata as scaffolding for the representation of information in connonceted discourse. *American Educational Research Journal*, 15(3), pp. 433-440.

that on the structural side of the description, schemata appears to be a supporting structure that operates independently to maintain the structure and coherence of a given idea; the second is the consistency of this description to our investigation to the structure of space in general. The subject's experience of space is accordingly predisposed to a fixed *procedure* of interpretation.

In this light, we can think of the following illustration (*Figure 34*), as the manifestation of some fixed way of thinking about human embodiment in its perfection, and its newly encountered geometry or spatiality. This visual schema is best evaluated when compared to other different schemata, or when the schema itself is modified. The classification of this illustration as a schema is an assertion that we make within the context of the theme of this investigation, i.e., architecture. Pythagorean tradition reports that the circle represents the spiritual realm, whereas the square resembles the material existence. Human body in this schema signifies the mixed realm of human embodiment which is annotated by the Vitruvian proportions.

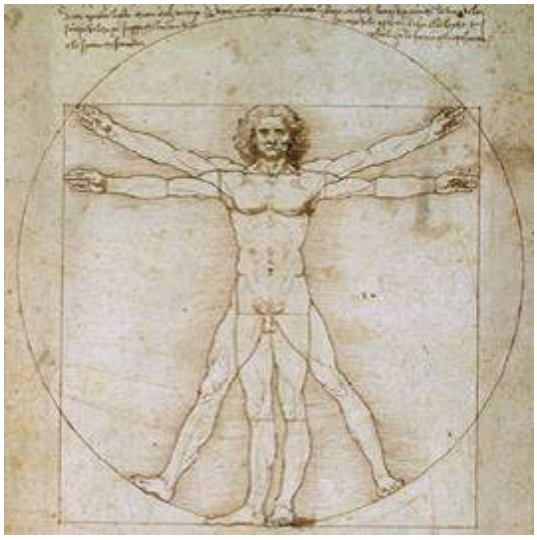

Figure 34. The Vitruvian Man by Leonardo da Vinci, c. 1487.[377]

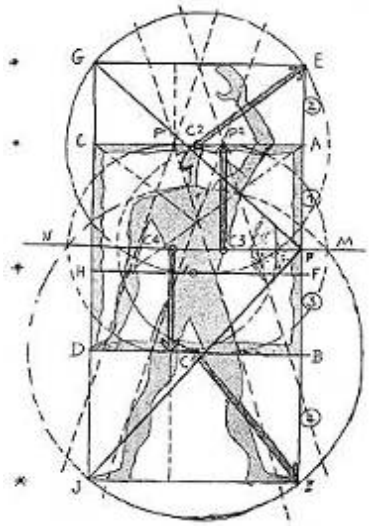

Figure 35. Le Corbusier's Modular.[378]

The structure outlined by Da Vinci's schema can be easily tied to Johnson's schemata. Predictably, the interpretation is based on human embodiment. We argue that Da Vinci's sketch illustrates a) the spatial schemata of embodied *containment, centre-periphery, cycle,* b) the balance schemata of embodied *equilibrium, point*

377 Wikipedia, the Free Encyclopaedia. 2003. *Vitruvian Man*. [Online] (Updated 10 Apr 2008) Available at: http://en.wikipedia.org/wiki/Vitruvian_Man [Accessed 12-09-2008]

378 LeCorbusier, 1955. *Modulor 2*. Translated from French by P. de Francia & A. Bostock. London: Faber.

balance, axis balance and twin-pan balance, c) embodied schemata of *surface, contact, superimposition, merging and part-whole*, d) the force schemata of embodied *enablement, removal of restraints, attraction, link and most notably, scale*.[379]

Johnson characterises *scale* schema by being fixed in directionality, having a cumulative character, having the capacity to be open-ended or closed-ended, and most importantly having a normative character.[380] The same scale normative character identified by Johnson is a type of '*stereotypical concept*' represented by schema according to Rumelhart and Ortony, and is also constantly changed and updated in what they label as a process of 'instantiation'.[381] This process of instantiation was proposed much earlier, but in a different form, by Bartlett who suggested that a schema is an 'active, developing'[382] structure of knowledge representation, which is based on 'organised mass rather than as a group of elements each of which retains its specific character'.[383] Rumelhart and Ortony's stereotypical events are akin to Bachelard's prototypical events. In this assertion, the childhood home forms the active schema of dwelling, and daily events are the prototypical events of the concept of living. This view is not far from Rosch's view, with the exception that Bachelard is addressing an embodied schema from a phenomenological point of view, while Rumelhart and Ortony are addressing a cognitive schema from a rather linguistic point of view. Rosch's view is concerned with prototypic representations of semantic categories.[384] He highlights the objects of experience rather than the events of experience. This effectively has the potential of dividing scale understanding into two categories: 1) scale schema as a prototypical concept of an object that can be instantiated or applied to other objects, and 2) scale schema as prototypical concept that can be activated in different events. This is again similar to Johnson's characterisation of scale schema – being fixed in directionality,

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379 It has to be mentioned here, that the schema of scale was presented by Johnson as basic to both the quantitative and qualitative aspects of human experience.

380 Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press, pp. 122-3.

381 Rumelhart, D. & Ortony, A., 1977. The representation of knowledge in memory. In R.C. Anderson, R.J. Spiro & W.E. Montage eds., *Schooling and the acquisition of knowledge*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc., pp.99-135.

382 Bartlett, F.C., 1932. *Remembering: a study in experimental and social psychology*. Cambridge: Cambridge University Press, p. 201.

383 *Ibid.*, p. 197.

384 Rosch E.H., 1973. On the internal structure of perceptual and semantic categories, In T.E. Moore ed. *Cognitive development and the acquisition of language*. New York: Academic Press.

having a cumulative character, having the capacity to be open-ended or closed-ended, and having a normative character. However, Rosch's prototypic representation could be extended from semantic categories into the consideration of Bachelard's scale understanding and Johnson's characterisations of scale. The prototypic representation could have the form of schema/subschema relationship which is inherent to the nature of the concept of scale. In other words, all of Johnson's and Bachelard's assertions regarding scale can be considered as subschema of the original scale schema. Other assertions could be considered minor subschema as well.

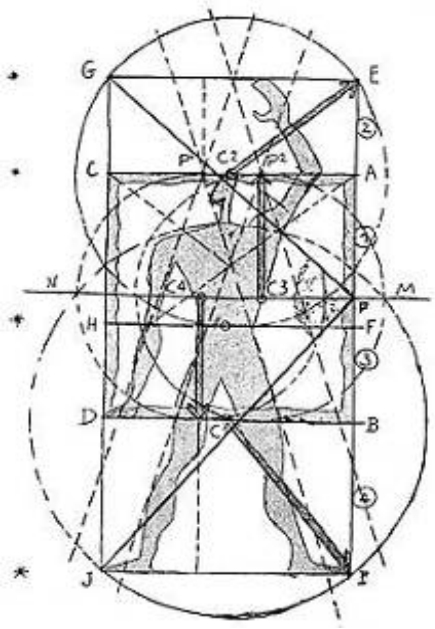

Figure 36. Le Corbusier's Modular.[385]

In that sense, Bartlett's organised mass of the group of elements that structure the active and developing knowledge[386] becomes an organised mass of a multi-scaled elements that structure the dynamic expectation of knowledge. An example of this is Le Corbusier's modular. The numerical values on which the modular, (*Figure 36*) is based could be considered the multi-scaled elements that Le Corbusier uses to structure the dynamic knowledge of design. The modular is an instantiation of this dynamic knowledge. The human body is the original instantiation of this dynamic

385 LeCorbusier, 1955. *Modulor 2*. Translated from French by P. de Francia & A. Bostock. London: Faber.
386 Bartlett, F.C., 1932. *Remembering: a study in experimental and social psychology*. Cambridge: Cambridge University Press, p. 201.

knowledge. Hence, the scale schema is inherent in design as advocated and implemented by Le Corbusier. The modular presents a pre-deterministic constraint as well, because it prevents the element that structures the dynamic knowledge from developing. Rather, it provides a 'structure of expectation'[387], that is how schemata influence our perception. This pre-deterministic constraint is mostly intentionally obvious among architects, and perhaps it can be boldly asserted that the result is manifested in the architecture of modernism.

The scale schema operates on dynamic knowledge structures within the general schema/subschema relationship as argued above. However, the introduction of unorganised mass of multi-scale dynamic structures of knowledge presents the scale schema with rather arbitrary elements. For example, *Figure 31* of the giant baby above presents an unorganised knowledge. When decomposed, the primary outlines of the elements in the figure suggested a contradiction in which the scale schema is rendered inoperable. Consequently, the stereotypic knowledge representation fails to interpret the absurd occurrence.

Figure 37. a miniature of the Eiffel Tower in focus placed on wall with the Cathedral of Notre Dame de Paris blurred in the background, and

Figure 38. a distant view of Eiffel Tower in Paris and the Cathedral of Notre Dame de Paris Blurred in the background.

(Both digital photographs are authentic and underwent no processing).

Figure 37 and *Figure 38* illustrate the same point but in a different perspective. An unorganised set of elements, in this case the Eiffel Tower and the buildings in the background, questions the understanding of the scale schema. This is most clearly evident when an outline is drawn to highlight the elements in the figure. By contrast, *Figure 38* illustrates the organised structure. It is argued that an AI system would fail

387 Tannen, D., 1979. What's in a Frame? Surface Evidence for Underlying Expectations. In R. O. Freedle, ed. *New directions in discourse processing*. Norwood, N J: Ablex, pp. 137-181.

to interpret this structure. Thus, the transformation from a stereotypic knowledge structure into a dynamic knowledge structure and the mismatch that occurs, results in a need for a new system, whereby a multi-scaled element is dynamically instantiated on the basis of the content of the frame rather than the schema of knowledge.

The structure of scale schema is composed of a set of relatively static elements that, when transformed into dynamic suffer from the changing organisation of structure. Hence, any effective schema needs to address the possibility of a dynamic transformation. Rumelhart and Ortony attempt to solve this problem but on the bases of linguistic knowledge schema. Their attempt, however, is based on a different concept borrowed from Minsky.[388] They propose that a set of elements are necessary to form a fixed structure that forms the schema. What differs in their proposal is that in order to be able to interpret the schema, we ought first to understand the frame that contains this schema instead of attempting to project the elements into a set of ready-made stereotypic structures. At this point, we need to introduce Minsky's frames of knowledge.

5.2.4.2. The Scale in a Frame of Knowledge

Minsky's *frame* theory suggests that the same different stereotyped situations have a corresponding data structure that represents them.[389] The essence of his theory is based on adapting memorised *Frames* of experience to fit reality through changing details.[390]

Minsky moves from understanding the coherence of the schematic structure into the particulars and details of this structure. A simple physical containment schema is understood as a set of coherent and dynamic relationship between two objects. This spatiotemporal relationship unfolds constantly over time. For Minsky however, the basic Heideggerian concept of Dasein or being-in-the-world is

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388 Minsky, M., 1975. A framework for representing knowledge. In P. H. Winston, ed. *The psychology of computer vision*. New York: McGraw-Hill.

389 *Ibid.*

390 In the broader sense an analogy could be made between schemata and frames on one hand, and mathematical formulae on the other. While schemata represent the general mathematical operations such as addition, subtraction, division and multiplication, a *frame* is analogous to a formula with different variables. While the formula is a relatively fixed structure, different values can be adapted to produce different results that are governed by the formula. When students sit in an exam of mathematics, for example, they often tend to retrieve different formulae and refer to similar questions to aid them in solving the mathematical problems. The very act of retrieving similar examples to aid in solving the problem is an act of retrieving a frame system. However, for Minsky, this act is applied to visual structures and in some cases linguistic ones.

transformed from a schematic structure that combines *being* and *the-world* using the physical containment schema, into an instance at a fraction of time where there exists a frame that interprets the structure of *being* and *the-world*. The frame highlights not the dynamic relationship, rather, the anticipating point of view of the *framer*. It also highlights his input into this frame. Minsky gives two examples of *being-in-the-world*. He asserts:

> "A *frame* is a data-structure for representing a stereotyped situation, like being in a certain kind of living room, or going to a child's birthday party." [391]

The first example is *being* in *a living room*. The frame captures the particularity of being (human being), in a living room (as a stereotypical instance of the world). Adapting *being-in-the-world* into *being-in-a-living-room* fits the reality of a daily experience. In the second example, Minsky adapts *being-in-the-world* into *being-in-a-birthday-party*. The frame highlights, beside space, a set of activities, and a specific atmosphere. *Being-in-the-world* is a frame with *terminals* that are already filled with 'default' assignments.[392] Although Minsky argues that "the phenomenological power of the theory hinges on the inclusion of expectations and other kinds of presumptions"[393], which inevitably forms cases for bypassing logic and making generalizations, we utilise the same expected or presumed knowledge to shed the light on objects that would not fit the reality of a situation, thus exposing logic and questioning generalisations. Minsky acknowledges that his theory generates important information when the matching process of assigning values to terminals fails, but he argues that this triggers an alternative process of finding a different frame. The connection between different frames is then based on similarity and pointers of difference. Winston proposes 'similarity networks'[394] and constructs the similarity on the basis of comparison notes or C-notes.

The connection between different frames is highlighted further and introduced by Abelson as *'scripts'* to handle 'event sequences'[395] based on Schank's

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391 Minsky, M., 1975. A framework for representing knowledge. In P. H. Winston, ed. *The psychology of computer vision*. New York: McGraw-Hill, p. 180.
392 *Ibid.*, p. 212.
393 *Ibid.*, p. 213.
394 Winston, P.H., 1970. Learning structural descriptions from examples. M.I.T. Project MAC TR-76. Available at: http://historical.ncstrl.org/tr/pdf/mitai/AITR-231.pdf [Accessed 15-05-2003].
395 Schank, R.C. & Abelson. R.P., 1977. *Scripts, plans, goals, and understanding: an inquiry into human knowledge structures*. Hillsdale, NJ: Lawrence Erlbaum.

conceptual dependency[396] which mainly addresses language understanding. In turn, Abelson addressed actions and behaviours in a frame by utilising both Minsky's and Schank's inputs. He initially identifies three modes of engagement using scripts: episodic, categorical and hypothetical.[397] Schank and Abelson recognise the active nature of scripts and argue that it embodies the changing nature of experience. It transforms by mapping an experience from one person to another in the process of understanding.[398] Schank devises the conceptual dependency network C-diagram. The difference between C-notes and C-diagrams is that the first is used to relate a frame to another using points of comparison, whereas the second is used to relate different concepts in a script using points that connect them and create sequences of actions. Although Schank's C-diagram was criticised for lacking a clear approach on how to link a diagrams to a concept,[399] or for its applicablility to a limited set of examples,[400] Schank himself states that there is a need for "additional representational mechanisms to handle the many levels at which statements can be interpreted."[401] What is apparent in C-diagrams such as *Figure 39* is that these diagrams possess a spatial value inherent in their representation. Most of the discussions around them are almost always presented in a diagrammatic method that reduces them into a formulated structure. We present Schank's example below:

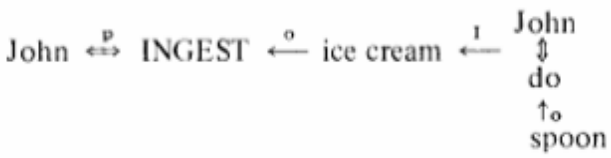

Figure 39: "John and the ice-cream" example.

The example, as proposed by Schank, illustrates a spatial value arguably inherent in its representation. The example that was used at the beginning, *Figure 31*, gives an instance of a value of a terminal that does not fit the assignment. The mismatch is a

396 Schank, R.C., 1972. Conceptual dependency: a theory of natural language understanding. *Cognitive Psychology* 3, pp. 552-631.
397 Abelson, R.P., 1976. Script processing in attitude formation and decision making. In J. S. Carroll & J. W. Payne eds., *Cognition and social behavior*. Hillsdale, N J: Lawrence Erlbaum Associates, pp. 33-45.
398 Schank, R.C. & Abelson, R.P., 1995. Knowledge and memory: the real story. In R. S. Wyer ed., *Advances in Social Cognition*, 8, Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc., pp. 1-85.
399 Dresher, B. & Hornstein, N., 1976. On some supposed contributions of artificial intelligence to the scientific study of language, in *Cognition*, 4, pp. 321-398.
400 Weizenbaum, J., 1976. *Computer power and human reasoning*. San Francisco: W.H. Freeman and Company.
401 Schank, R.C., 1978. What makes something "ad hoc". In *Proceedings of the 1978 Workshop on theoretical Issues in Natural Language Processing* (Urbana-Champaign, Illinois, July 25 - 27, 1978). Association for Computational Linguistics, Morristown, NJ, pp. 8-13.

sign of the failure of the frame to represent the knowledge. Minsky argues that in the case of such failure, a new frame is constructed, and paired with two or more different frames to suit the circumstance. The frames are, arguably, constructed from different points of view. Minsky illustrates his point using the diagram of a cube. The figure, however, highlights the point of view from which the photo was taken. Thus, the frame assumes the point of view of an average human standing in front of the objects of the photo. According to this point of view, the value of the size of the baby should not be larger than that of the two people passing by. Schank's '*conceptual cases*'[402] account for similar occurrences. He suggests questions such as:

> What caused it? (Actor)
> What was the purpose? (Intentionality)
> What are the consequences? (Efficacy)
> Who does it affect? (Object)
> How is it done? (Tool)

Our interest is mainly placed on answering the questions: Who does it affect (Object)? What are the consequences (Efficacy)?

The inconsistency between objects in the view is easily blamed on the nature of large objects to which the value of 'giant baby' is assigned. It is also possible to argue that one could use or construct a frame in which the value 'giant baby' is replaced with the value 'giant statue'. Unlike 'baby', 'statue' can possess a value of size that exceeds that of a human body or a baby.

We would like to introduce another photo of the same project '*Planet*'. In this photo, the two adults are gone. The photo highlights another frame, in which a comparison is between the 'giant baby' and the house in the background. In the photo, the giant baby appears to be bigger in size than the house. The outline of both objects will clearly show the mismatch between both. While a house should be bigger, the photo suggests the opposite. This could be explained by the distance between both. The 'giant baby' appears bigger, because it is closer to the point of view from which the photo was taken, but one could also argue that Minsky's frame with which the photo could be explained is again exposed to failure.

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402 Schank, R.C. & Colby, K., 1973. *Computer models of thought and language.* San Francisco: Freeman.

Figure 40. 'Planet', a sculpture of a seven-month-old baby by artist Marc Quinn at Chatsworth House, Derbyshire.[403]

Minsky's frame theory is dependent on mental activity. He argues that:

> "It seems to me that the ingredients of most theories both in artificial intelligence and in psychology have been on the whole too minute, local, and unconstructed to account –either practically or phenomenologically—for the effectiveness of common sense thought. The 'chunks' of reasoning, language, memory, and 'perception' ought to be larger and more structured, and their factual and procedural contents must be more intimately connected in order to explain the apparent power and speed of mental activities." [404]

However, many of the failures exemplified in this theory are accounted for by human embodiment. Any frame with inconsistency could be explained if the holder of the point of view rejects the basic assumption of being a human who posses a human body. This rejection of the basic assumption, or adaption of human embodiment to produce frames in which the basic assumptions are changed, could, we argue, provide a richer account and better understanding of human experience. Scale, both as a concept and tool, provides a value that when applied to Minsky's theory, and playing on the failures as described by Minsky, can provide the element to structure and connect the "'chunks' of reasoning, language, memory, and 'perception'".

A quick exercise, in which we will analyse according to Misnky's frame theory a piece of text we introduced in the first chapter, will highlight the role of scale as a notion in providing a richer account of meaning. The text is a conversation between my friend Danny and me:

> "I ran into my friend Danny in the street the other day. He was carrying his suitcase. He looked like he was travelling somewhere.
>
> Me: Hey Danny. How are you?

403 Furlong C., 2008. Sotheby's exhibit sculptures at Chatsworth house [Photograph] Available at: http://www.gettyimages.com From home search item #82697847 [Accessed 18-10-2008].

404 Minsky, M., 1975. A framework for representing knowledge. In P. H. Winston, ed. *The psychology of computer vision*. New York: McGraw-Hill, p. 211.

Danny: Hi… Hi

Me: Travelling somewhere?

Danny: No. I was in the airport and I have just arrived. So I am going *home*.

Me: Ah, holiday? Where were you?

Danny: Not really. I was just back *home* visiting my parents.

Me: Feeling *home*-sick? But aren't you going for a holiday this summer?

Danny: Well, I want to go and visit this country, but I have to check it on the *home*-office website to make sure it is safe to travel there, because the last time I went on a holiday I had some medical complications, and I could not wait until I got back here. The minute I got out of the airplane, I was so glad and remember shouting "Oh God… I am finally *home*."

Me: Was the medical care that bad!! You should always check the *Home*-Office website. Their *home*page has links that leads you to all sorts of information.

According to Minsky's frame theory, home is a value assigned in each different case to a different terminal. There are different frames in this text. For example, if you pass by someone you know in the street, it is anticipated that this person is going from point A to point B. It is expected in this general frame to give a value to either point. In this case point A is a terminal that was assigned the value 'airport', and point B is the other terminal and it was assigned the value 'home'. But when the frame was restated by the friend, a new value was assigned to point A, that is 'home'; thus the peculiar situation of having the same value assigned to both terminals: point A and B. The frame could potentially cause confusion, but we can draw on the power of the notion of scale to extend the concept of home. Another isolated frame can be recognised in the sentence "Oh God… I am finally *home"*. Scale as a concept can transform the knowledge into a dynamic structure allowing interpretation to take place in this text. Accordingly, point B is assigned value of home relative to the scale of the frame. If the frame is about countries, then the value of home is assigned to a country. If the frame is about physical structures, then the value of home is assigned to the house. If the frame is about social relations, then the value of home is assigned to the family. In all these frames, the value home acts as the connecting point between the different frames, which, in turn, stipulates the scale's frame.

A frame, however, has stereotypical terminals designated by objects or values, and it also has reoccurring structures of events or schemata. The combination

of structured events and knowledge highlights absurdity when it occurs, or the lack of knowledge that is expected to be present. The knowledge of one's own body is rooted in one's everyday embodied interaction. Accordingly, when absurdity is highlighted because of a mismatching combination –like in the case of the giant baby– Schank's two questions of *who does it affect* and *what are the consequences?* provide the answer of how embodiment informs the sense of scale. Accordingly, in the frame of the giant baby, there are three possibilities:

1- the distances between the two objects are misleading, or
2- the sizes of the two objects are not correct, or
3- scale of human embodiment is changed.

This image provides the perfect example of Leonardo's keen interest in proportion. In addition, this picture represents a cornerstone of Leonardo's attempts to relate man to nature. Encyclopaedia Britannica online states, "Leonardo envisaged the great picture chart of the human body he had produced through his anatomical drawings and Vitruvian Man as a *cosmografia del minor mondo* (cosmography of the microcosm). He believed the workings of the human body to be an analogy for the workings of the universe."

5.3 Digital Media

Interactive digital media enable advanced investigation on themes of embodiment and perception, providing an excellent means of testing, comparing, validating and challenging theories about perception. Computers introduce an interesting mode of interaction by deploying space as a major metaphor. The capability of creating a 3D world and filling it with artefacts from our more familiar environments is possible due to the ever increasing power of computer processing.

Our own investigation of embodiment in the world starts with a simulation of the physical world using software such as 3D Studio Max, Maya and Form Z. These programs offer capabilities that range from creating a simple shaded model to creating a full photo-realistic environment, deploying optical effects, and offering the ability to animate this world in different ways. Translating this world from physical

form to software constitutes digitisation, creating representations through various algorithmic and mechanical transformations.

There is as yet no efficient procedure for recording and simulating all plausible interactions with a digital environment. So interpretive interventions are required to orchestrate navigation, interaction and behaviours. Multimedia authoring tools such as Macromedia Director, and its ShockWave 3D functions, facilitate navigation through virtual environments, and allow a degree of user interaction, such as being able to move objects.

In a sense we are working with two metaphors. The first metaphor is about a world or an environment that resembles a physical environment (computer model as physical model, digital world as material world), and the second metaphor is of the interaction between our bodies and the world (screen cursor as hand, digital avatar as body, virtual camera as eye). Metaphors work both ways. Our study into bodily interaction with the virtual world can inform our understanding of interaction in the material world. In the manner of action research, there is the potential to uncover many outcomes. Direct outcomes include insights into the way we understand and interact with space, and the way scale affects this understanding. Indirect outcomes include determining the importance of scale as a cue for immersion in virtual environments, and developing techniques for students to examine and investigate new aspects of their designs.

Space and scale feature prominently in narratives about everyday life, modulated by the spread of digital media to create ever-expanding narratives of communication, containment, boundaries, thresholds, and transgressions.

5.4 Perceptual Study

In order to explore the concept of scale, the structures in which it manifests, and its relationship to embodiment, a perceptual study was conducted in two stages. The first focussed on a taught course for undergraduate students of architecture working for their first degree. The second stage involved research around the perceptions and observations of a small cohort of designers, using the undergraduate material as a resource.

5.4.1. STAGE 1

The first stage involved a course project on Multi-scale Virtual Environments. The course sets within the broad category of Computer Aided Architectural Design CAAD courses. The main four systems of teaching CAAD in terms of the context and content of education are classified by Achten as social, professional, educational, and innovative.[405] When our course is compared to the previous systems, the following points clearly emerge to fit our aim of the course:

1- The course assumes that students possess the previous basic knowledge of using computers, what Achten refers to as 'social system'.[406]

2- The course aims at providing students with the knowledge required in a Professional system.[407]

3- The course does not specifically require students to use "Educational" system, however, it makes all the system and its tools and equipments available for them.

4- The course both provides support to, and permits the use for Innovative systems. Although students are expected to be innovative, time limitations plus limited may affect students' ability to innovate.

Table 1 Framework of terminology for discussing software versus principles teaching in a CAAD-curriculum. [408]

	SYSTEMS			
	Social	**Professional**	**Educational**	**Innovative**
Computation	Database Structures, Computer basics, etc.	Models, software basics, data, publications, exchange formats, etc.	Programming techniques, prototyping, systems building, etc.	System design, modelling techniques, interface design, etc.
Architecture	Cost calculation, facility management, introduction new materials, etc.	Production drawings, simulation, evaluation, etc.	Design and material analysis and deconstruction (perhaps unfolding) which leads to a classification of design concepts, design strategies, building analysis, etc.	Design synthesis, form generation, and we also add concept generation, new spatial movement, etc.

5.4.1.1 The Objectives and the Processes Involved in an Innovative CAAD Course

405 Achten, H.H., 1996. Teaching advanced architectural issues through principles of CAAD. In A. Ekholm, S. Fridqvist, & J. Klercker, eds., eCAADe (The Proceedings of the 14th Education in Computer Aided Architectural Design in Europe). *Education for Practice*. Lund, Sweden, 12-14 September 1996, pp. 7-16.
406 *Ibid.*
407 *Ibid.*
408 *Ibid.*

The course encompasses two elements: the objectives and the process. All students work towards achieving a common objective using an innovative set of processes. In some cases, students work in groups to achieve the objective. However, in many other cases students work to achieve different objectives but with the same process.

When grouping the type of process with the type of objective, we get two types of interaction between students. Those two types are Collaboration and Cooperation. Cooperation is identified by Van Leeuwen[409] as the approach in which students work together to achieve shared goals. This entails learning the same processes and gaining specific skills to achieve their objectives. However, Collaboration is when students work together to achieve a common objective which entails learning different sets of skills and distributing work load to achieve the objective.

In the course students were challenged to reconstruct a 3D computer model of the streets in the city centre of Edinburgh by cooperation. Then the unfolded printout of the street model was used to construct a scaled-down physical model of the same street. Each student modelled a different street. So the models (digital and physical) could be assembled to create conceptual representations of the city.

Students were then asked to use a version of the unfolded physical models to construct a means of transportation in the virtual model, a vehicle that they could use to navigate their virtual environment. Hence, the process of creating and sharing knowledge by working together on an actual result, which is the characteristic of Collaborative approach[410], is utilised for its creative nature.

5.4.1.2 The Interplay between loosely and closely coupled systems

Karl Weick identifies two educational systems: the first is Loosely Coupled, while the other is Closely Coupled.[411] Van Leeuwen[412] elaborates on both systems by

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409 Van Leeuwen, J.P., van Gassel, F. & DEN Otter, A., 2004. Teaching collaborative design. In *Proceedings of the International Workshop on Construction Information Technology in Education*, September 7th 2004 Istanbul. Turkey, p. 1-9.

410 Sawhney, N., Wheeler, S. & Schmandt, C., 2001. Aware community portals: shared information appliances for transitional spaces. *Journal of Personal and Ubiquitous Computing*, 5, pp. 66-70.

411 Goldspink, C., 2007. Rethinking educational reform: a loosely coupled and complex systems perspective. In: *Educational Management Administration & Leadership*. British National Leadership, 35(1), pp. 27-50.

412 Van Leeuwen, J.P., van Gassel, F. & DEN Otter, A., 2004. Teaching collaborative design. In *Proceedings of the International Workshop on Construction Information Technology in Education*, September 7th 2004 Istanbul. Turkey, p. 1-9.

characterising the first as consisting of processes that requires each student to contribute from his/her particular domain of knowledge and expertise, and, at the same time, acquire a specific knowledge and domain of expertise. By contrast, the second system is characterised by working closely to realise the objective.

The obvious advantage of the first system is its ability to include students from various backgrounds and utilise the expertise to realise the objective of the course. By various backgrounds, we describe two aspects of each student: the first is students' various ways of thinking of an answer to the design question in hand; the other is students' various sets of skills that they can use in this project, and various levels of professionalism in using those sets. A Loosely Coupled system also makes a huge impact on students among themselves since every student is going through the process of learning and affecting the learning process of others. In this system the content is very diverse, and the outcome is similar to real life. The course, as it was delivered, tended to follow the first system mainly for practical and logistical reasons. While this did integrate different backgrounds of students, it also influenced, maybe negatively, the project-driven nature of the course.

However, there are disadvantages in this system. One of the main disadvantages is the fact that so many different expertises require the course team to be equally diverse, a requirement that is not always possible. Another hurdle in this system is the fact the level of interaction in the course is highly dependent on the students themselves, and on the level of diversity. As a result, a class that is not diverse could result in a course outcome that is not creative. Students' activity and engagement is also an important factor.

To implement the loosely coupled system, students were given the task of designing a vehicle which, in turn, was intended to provoke students to imagine mechanisms of transportation in a virtual environment, and the routes of travelling from one point to the other, and exploring techniques of spatial transformation: folding, bending and twisting surfaces, transforming an orthogonal street model into a folded origami vehicle.

Fusarelli argues that loose coupling permits a greater coherence in the educational system and takes into consideration, at the same time, competing

demands for limited resources.[413] Goldspink promotes a greater and multidimensional coupling that utilises both systems to create a hyper interactive model.[414] An example of this model was accomplished by encouraging students and instructors to participate jointly in the design process. Also in order to validate the process of selecting students' work for the following stage, an indirect form of assessment was implemented in the form of an auction. The digital models of the vehicles were put up for auction and shared throughout the group. This introduced a form of assessment to be devised in a peer review manner. Some vehicles were more popular than others.

The table below illustrates both systems.

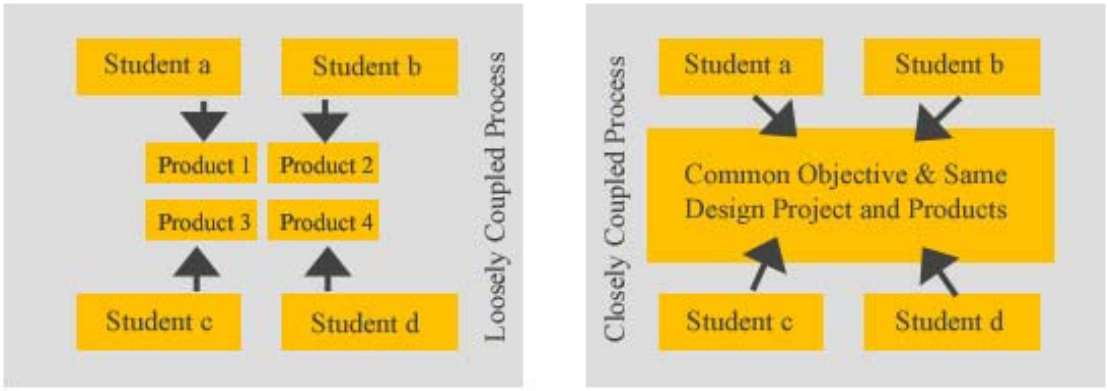

Figure 41 Loosely and closely coupled processes [415], [416]

The next step followed the loosely coupled system again. In order to enhance students' skills in using CAAD software from a pure design point of view, each student was asked to create a computer model of a multi-scale virtual environment suitable for displaying, garaging, accessing, testing and navigating the folded vehicles. Re-introducing scale was the common objective of each student and, in order to illustrate and elaborate on the investigation, each student was required to

413 Fusarelli, L.D., 2002. Tightly coupled policy in loosely coupled systems: institutional capacity and organizational change. In: MCB UP Ltd., ed. *Journal of Educational Administration*. 40, pp. 561-575.

414 Goldspink, C., 2007. Rethinking educational reform: a loosely coupled and complex systems perspective. In: *Educational Management Administration & Leadership*. British National Leadership, 35(1), pp. 27-50.

415 The diagram is based on the loosely and closely coupled system as described by: Fusarelli, L.D., 2002. Tightly coupled policy in loosely coupled systems: institutional capacity and organizational change. In: MCB UP Ltd., ed. *Journal of Educational Administration*. 40, pp. 561-575. Also,

416 Hagel, J., Durchslag, S. & Brown, J.S., 2002. *Orchestrating loosely coupled business processes: the secret to successful collaboration*. [Online]
Available at: http://www.johnhagel.com/paper_orchestratingcollaboration.pdf [Accessed 10-01-2006].

provide a simulation of movement through the multi-scale space. The aim was for the students to experiment with different ways of interacting with their models, vehicles and environments.

Ultimately, the course operates within the lines of a Closely Coupled system, but eventually finds out its way into a Loosely Coupled system. This allows it to 1) integrate students from different backgrounds and permit them to gain a uniformed set of skills and 2) operate closely with the other courses of design. It also enables the structure of investigation to be coherent as it acts as one of the stages of a Loosely Coupled process of investigation. Although it is argued that a loosely coupled system is necessary to maintain a specific level of cohesion and interaction among different courses, a specialised course might require a closely coupled system. In turn, we can argue against this by stating that the main purpose of creating the course is to create a unit that is closely coupled on its own in terms of objectives for students, but loosely coupled between each other in terms of processes.

5.4.1.3 Course Framework

The course is designed to give students an insight into the intricacies of embodiment in multiscale environment design. As a form of delivery and a way of communicating outcome, the course utilises multimedia to deliver its message. Rossignac[417] devised a framework for the process of collaboration between students while using technology. It is argued that the approach increased communication between students and staff. It also illustrated ideas better than traditional systems. Finally, it enhanced the overall level of work. The diagram below is modified from Rossignac's table and has two of the four domains of Achten[418] embedded in it. The two domains highlighted here are the *educational* and *innovative* domains as they are the ones of interest within our context and course. It is essential in this course to achieve an increased collaboration via forming work groups responsible for independent and separate elements of the work. The flow of information stands as a

417 Rossignac, J., 1999. Collaborative design and visualization. In *Proceedings of the NSF Invitational Workshop on Distributed Information, Computation, and Process Management for Scientific and Engineering Environments (DICPM)*, May 15-16, 1998, Herndon, Virginia. Cambridge, Mass.: The MIT Press, pp. 102-103. Available at: http://deslab.mit.edu/DesignLab/dicpm/position/rossignac.html [Accessed 10-01-2006].

418 Achten, H.H., 1996. Teaching advanced architectural issues through principles of CAAD. In A. Ekholm, S. Fridqvist, & J. Klercker, eds., eCAADe (The Proceedings of the 14th Education in Computer Aided Architectural Design in Europe). *Education for Practice*. Lund, Sweden, 12-14 September 1996, pp. 7-16.

core element in this framework, while management of this flow is directed by students rather than instructors. However, the role of instructors is to push students towards the innovative elements to expand their boundaries. The fact that students modelled physical streets in Edinburgh city, presented the creative element and gave them a chance to look at the city in a new light, and to create simulations and animation that question scale and bodily experience.

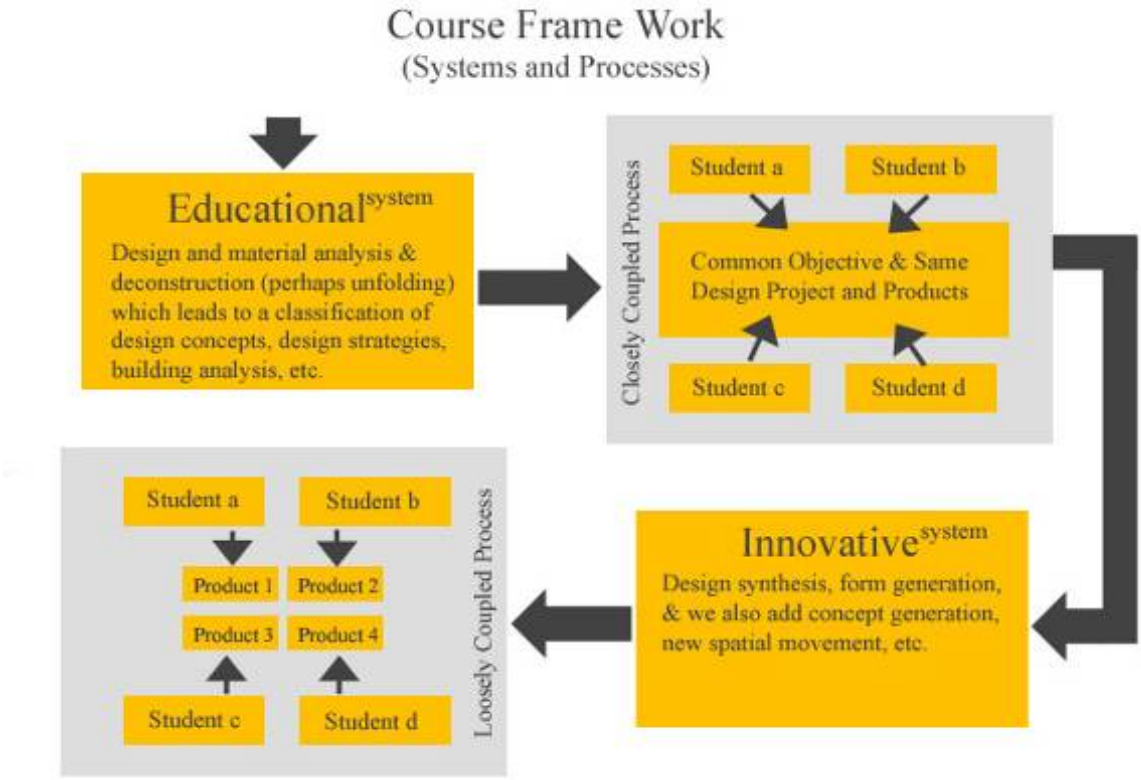

Figure 42. Definition of the framework elements (modified from Rossignac, 1999) [419]

By the end of this stage we had a model of the central area of the city of Edinburgh and a series of animations and simulations. Not only did this phase of our research provide resources for what follows, but it gave us an opportunity to develop a series of interesting scenarios about scale (a kind of design research in itself), and to

419 Rossignac, J., 1999. Collaborative design and visualization. In *Proceedings of the NSF Invitational Workshop on Distributed Information, Computation, and Process Management for Scientific and Engineering Environments (DICPM)*, May 15-16, 1998, Herndon, Virginia. Cambridge, Mass.: The MIT Press, pp. 102-103. Available at: http://deslab.mit.edu/DesignLab/dicpm/position/rossignac.html [Accessed 10-01-2006].

develop a sense of how designers think of scale, challenge it, and play with it. Our research approach fits within the framework of participatory action research.[420]

5.4.2. STAGE 2

The second stage was a pilot study using the materials created in the first stage. The materials produced by students in the first stage varied between static frames of visual material, dynamic audiovisuals describing scenarios of movement, and finally interactive 3D objects in Quick Time movies.

The materials suggested general themes of how scale is understood by designers. One might question the criteria of selection for inclusion in the presentation. The selected items for inclusion in the presentation had the common element of scenario where a shift of focus occurs. The underlying assumption is that while "one can think of knowledge of settings and situations as constituting the interpretative scenario behind a text"[421], the same is equally possible for visual materials. Frames that were set previously as "data-structures for representing a stereotyped situation"[422], become dynamic scenarios where designers manipulate the expectations of viewers in terms of scale. The selected items handle events by manipulating our stereotypic knowledge. They question the structures of schema in more than one way. Some of these manipulations are 'culturally determined'[423] – therefore, our decision to choose subjects with a design background. Tannen identified sixteen of these manipulations in language: omission, repetition, false starts, backtrack, hedges and hedge-like words or phrases, negatives, contrastive connectives, modals, inexact statements, generalisation, inferences, evaluative language, interpretation, moral judgement, incorrect statement, and addition.[424] Although the process of selection recognises the possible manipulations, it does not intend to reinstate them to subjects unless evidently present and consequently recognised by the subjects themselves. The aim is to avoid representing a well

420 Argyris, C., and Schön, D., 1989. Participatory action research and action science compared: a commentary. *American Behavioural Scientist*, (32) 5, pp. 612-623.
421 Sanford, A. & Garrod, S., 1981. *Understanding written language: exploration in comprehension beyond the sentence*. Chichester: John Wiley, pp. 110.
422 Minsky, M., 1975. A framework for representing knowledge. In P. H. Winston, ed. *The psychology of computer vision*. New York: McGraw-Hill, p. 180.
423 Tannen, D., 1993. What's in a frame? Surface evidence for underlying expectations. In D. Tannen, ed., *Framing in discourse*. New York:: Oxford University Press, pp. 14-56.
424 *Ibid.*

defined object to our memory, or what Kintsch calls the proposition based approach, and instead, to attempt to present "considerations that are powerful enough to constrain our ideas about how knowledge can or must be represented in memory".[425] While Johnson's schema theory presents the knowledge structures in a rather top-down relationship between the objects in question to the exclusion of anything else, Kintsch's Comprehension-Integration theory attempts to understand the structure of comprehension of the relationship between objects.[426]

The researcher categorised these emerging themes to form units of perceptual materials that were presented to another group of subjects with a design background, in a room set up for that purpose, and was then followed by a questionnaire and an unstructured interview.

5.4.2.1. The Presentation

The presentation classified different themes into four categories in order to avoid causing any confusion. Each of the four categories addressed one aspect or quality of our encounter with objects in the world. Recurrent themes were categorised into a) visual material, b) sonic qualities, c) details and d) interactive material.

Each category presented examples of recurrent themes in students' work. For example, the category of 'visual material' contained the following recurrent themes: *the oblique perspective, depth of view, coordinates and view angle, focal length, speed of movement*. The category of 'Sonic qualities' contained the following themes: *sound emitted by large objects, sound emitted by small objects, sounds giving hints with or against the environment*. Other categories will be reviewed in the discussion.

The recurrent themes were presented by examples of the students' work. Thematisation incorporates different examples to present various points of view, which may result in new insights. Each image, sound, animation or interactive 3D QuickTime movie presented a frame or a scenario that in turn instigated a process of perception and cognition. In the centre of this process, scale was the obvious connection between subjects and the objects in front of them. In each and every case,

425 Kintsch, W., 1974. *The representation of meaning in memory*. Hillsdale, N J: Erlbaum, P. 243.
426 Kintsch, W., 1988. The use of knowledge in discourse processing: a construction-integration model. *Psychological Review*, 95, pp. 163-182.

different frames of knowledge were activated, and different roles were taken by subjects, which in turn produced different assignments to the active frame of knowledge.

Except for the last example in the last category, all the items were designed and presented within the context of a controlled investigation using audio-visual materials. Consequently, the items in question do not necessarily serve any other purpose; nevertheless, they allow their viewers a chance to interrogate their spatial situation and the qualities of their embodiment. The frame-based or scenario-based items are characterised by 'assignments' or 'roles' that results in them being specific to a situation or a condition. The process provoked by these items, we argue, produces new schema, which are generalised forms of knowledge representations. That, in turn, results in a better understanding of our embodiment and the concept of scale. In language studies, Sanford and Garrod argue that "the success of scenario-based comprehension depends upon the writer employing suitable descriptions to elicit appropriate scenarios at the right time".[427]

The schema which the researcher hopes the subjects will produce, highlights the role of the subjects as being central to the process of interpreting items and producing various scenarios. Sanford and Garrod highlight the fact that "the interest of the reader … would be reflected in the availability of various scenarios".[428]

Figure 43. Various visual scenarios using Macromedia Director. (Photograph from the experiment session)

427 Sanford, A. & Garrod, S., 1981. *Understanding written language: exploration in comprehension beyond the sentence*. Chichester: John Wiley, p. 127.
428 *Ibid.*, p. 129.

The presentation aimed at invoking an embodied spatial experience using the scenarios, whereby the concept of scale is extended by the themes, and its reference system is expanded to a domain where scale requires interpretation. To further probe into the concept of scale the presentation was followed by a questionnaire.

5.4.2.2. The Questionnaire

The questionnaire consisted of nine questions.

1- What do you think this is an image/movie of?

2- Which of the following best describes your impression?

(1= totally disagree, 2= disagree, 3= not sure, 4=agree, 5= totally agree)

2.1-The space is large

2.2-The space is small

2.3-The scale of the space is ambiguous

2.4-I feel lost in the space

2.5-The space is confusing

2.6-The space has a clear structure

2.7-I feel small in the space

2.8-I feel large in the space

The first question probes the type of scenario of stereotyped knowledge that is activated by the subject. Upon the subject's answer another set of questions measure the subject's impressions of the 'conceptual case'[429] encountered. The result will help in further probing in the following unstructured interview.

The main issues canvassed in the questionnaire were: the scale of the body, the scale of the environment, and the scale of the body compared to the scale of the environment.

5.4.2.3. The Unstructured Interview

The unstructured interview explored the motivations behind the answers in the first part, and the way designers articulate their narratives about scale. Each category was probed by asking one or more of Schank's questions but indirectly:

What caused it? (Actor)

What was the purpose? (Intentionality)

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429 Schank, R.C. & Colby, K., 1973. *Computer models of thought and language.* San Francisco: Freeman.

What are the consequences? (Efficacy)

Who does it affect? (Object)

How is it done? (Tool)

Our interest is mainly placed on answering the questions: Who does it affect (Object)? What are the consequences (Efficacy)?

Below is an extract from one of the interviews, and the way it was analysed to extract codes.

5.4.2.4. Extract from the First Interview

1- What do you think this is an image or a movie of?	
Subject	I perceive it some how like a game environment.
2- How do you perceive the depth of field?	
Subject	I cannot understand the figures and the shapes, and all of that. I can understand that they are 3D objects. So I see the depth, but I do not recognise the space. So this is why I feel this is, more or less, a virtual space or a game Environment. I do not know something that I do not recognise. And I feel a little bet disturbed by the motion, because I cannot understand the space, and it makes me feel a little bit as though I lose my orientation maybe, and …
3- So you perceive the depth of field because of the objects basically, and because of that you feel that they are 3D, and therefore, they have to be in a 3D environment that has depth	
Subject	Yes
4- How do you perceive the scale of your body? I mean, when you go across this motion (points at the animation) for sure, you move and you feel that you have a body, I assume. Do you feel that you have a body?	
Subject	Yes. In the first part, mainly I feel that.
5- Do you feel this body is large or small?	
Subject	It is both of them but mostly small.
6- Why?	
Subject	I think because of the details of the environment. There are a lot of things.
7- How do they give you the feeling that you body scale is small?	
Subject	I could not say.
8- What makes you feel that you are small?	
Subject	(Pause). Maybe the way that the camera is moving, and the way it is left up and down, and the details of the environment. So I think that before the camera did something like that I perceive it as being my eyes. So I am down. Then and looking up.
9- So when the camera turns up you perceive yourself as looking at something that is higher than your point of view.	
Subject	My height, yes.
10- And the level of your eye view? That is why you thought you were small? But why did not you perceive the objects as being large objects rather than your body being small?	
Subject	Because I do not recognise the objects, I do not have a reference point for the objects.
11- What about the floor [texture]?	
Subject	My eyes stopped at the flooring, because I could recognise it I suppose. It was familiar.
12- Still, the floor was not enough to give you a sense of scale. So what you are saying is, generally, because you are mostly looking from your eye level, and you were looking in front of you, or up, that is what made you feel small.	
Subject	[nods agreement]

1- The frame is presented

- The computer-game scenario is activated

2- Probe for a theme

- The subject fails to find the role or assign values to the frame in front of her.
- Yet different objects signify the depth of field.
- Motion suggested by the frame is causing an emotional reaction.
- Spatial situation and movement are affection subject's judgment of scale

3- Confirming initial outcome

4- Establish the subject's body as the assignment to a terminal in this frame, or as a having a role in this spatial scenario. The body is the first object fixed in this frame. Scale is the connection to be explored.

- The subject accepts the role assigned.

5- The impact of scale on the relationship.

- Confusion or indetermination. Tends to small.

6-

- Recurrent theme #1 'details' give the feeling of being small.

7-

8-

- Subject states movement as an indicator of scale. Movement affects the interaction. She rejects the supposition that the camera is the subject's eyes.

9- Camera movement lent itself to the subject's eye movement, consequently suggesting scale.

10- Body scale is determined according the known object, then to 'reference points', then the most known object, such as the body. She knew her body. Unknown objects do not assume scale, but rather viewed

11- Inquiring about floor texture because the subject looked at it repeatedly

- Floor was not effective in deciding scale.
- The combination of the point of view and the target or view were the major element in deciding scale.

5.4.2.5. Extract from the Second Interview

1- Now you have seen this animation, do you think that the visual field is deep? Do you think it has depth?	
Subject	Yes.
2- How did you decide so?	
Subject	There are various objects in various parts in the environment.
3- And how do you perceive the scale of your body in this environment?	
Subject	I am not sure. The way I walk through it, I appear to have a normal size, because I don't feel I am very high up walking over the ground, and I do not feel so close to the ground.
4- So you decided the size of the scale of your body is normal because of your point of view…..	
Subject	Yes
5- While the depth of field did not affect your decision. What about the objects, the scale of objects in this visual field?	
Subject	They appear large.
6- And why did you decide so?	
Subject	Because when the movie enters and I go through objects, they appear to be at least twice the size of me.
7- Twice the height?	
Subject	Yes, twice my own height.
8- And that is why you perceive them as big objects and you perceive your body still to be of a normal size?	
Subject	Yes.
9- Did you try to have any frame of reference on this occasion? As though you can look at the ground and say that the texture of the ground is something I am used to and I can judge myself to be little bit smaller or a little bit larger. Or maybe it is the wall that is on one of the sides, the texture of the wall, relating to that texture.	
Subject	Oh, I get dizzy.
10- Why?	
Subject	Because it is turning too fast.
11- I see.	
Subject	Well the floor, it has a pattern. But they could be any size to me. They do not make me change my mind. And the walls do not either.

1- The frame is presented and activated

- Subject recognises the basic 3D spatial frame spatiality but no other scenarios.

2- Probe for a theme

- Objects distribution prompts spatial perception, in the form of distance between the body and different objects

3- Probing for body scale

- Subject is using terminology reflecting his engagement with the animation.
- Recurrent theme: Distance from the ground affects the sense of scale

4- Researcher attempts to connect distance with the theme of 'point of view' in order to explore the possibility of having the sense of normality due to lack of the depth of field.

5- Researcher is exploring the effect of the sizes of object on the perception of scale.

6-

- The body is used as a reference point because it is the most known object in this scenario.

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7- Possible conflict: Subject's body is of a normal scale, but subject's body is smaller than surrounding large objects

8- Possible conflict between statements. The researcher is probing to confirm and clarify.

9- Potential cause of conflict is the point of reference, in this case, the body. Researcher is trying to present different reference points in order to explore the possibilities of a understanding.

- Subject's attempt to change the point of reference caused him the sensation of dizziness. A bodily physical reaction to a virtual object.

10- Probing for the reasons

- Subject's attempt to consider a different point of reference in combination with movement depicted in the animation caused a the bodily sensation of dizziness. Although this could be a stereotypical reaction to movement, its occurrence during the attempt to consider different points of reference presents an intriguing possibility of a connection.

11-

- Floor was ineffective in deciding scale. (Recurrent)
- The absence of previous knowledge of the etails of the wall and floor caused the subject to disassociate them with the process of deciding scale.

5.5 Comparing Both Interview Fragments

Unlike many experiments that aim to detect patterns of interaction, or perception, without looking into details, this study was designed to elicit both. The study raises questions about the nature of immersion and how some people report a sense of being immersed when their scale is changed, or ambiguated, in a virtual environment. As the subject of the experiment is a user of the environment, and scale cues are changing dynamically, issues of immersion rise to the surface. How much of what we do in our being-in-the-world entails continuous attempts to fit our bodily scale into the environment, or set our own dimension against the dimensions of other objects? In fact, considering the whole project, this could be seen as a commentary on designing a functional space on the one hand, and adapting the functions of a space to our particular uses on the other. Beyond that, the study examines issues of embodiment and interaction.

In the first case we play the role of the designer, and we create environments for exaggerated and fictionalised versions of our bodies. Although this might initially sound like a simple task, it is complicated by the fact that the designer must "re-invent" herself as multiscale inhabitant of different environments. Certain consistencies in these designed environments are called for. They are found in the structures of knowledge that were introduced, namely, schemata, frames, and scenarios. Schemata were presented as the repeatable spatial and temporal patterns and structures that emerge from embodiment. Frames, on the other hand, developed to represent the coherence of the schematic structure into the particulars and details of this structure. Scenarios were constructed to incorporate different frames into one big narrative about embodiment and scale.

In the second stage, subjects were faced with surreal worlds. The usual spatial references to daily life embodiment were distorted or absent. Subjects were not specifically invited to speculate that they may be in some sort of distorted reality, but, like 'Alice in Wonderland', they try to make sense of what is in front of them. During this process, it seems that they give up their basic perception of their embodiment and, step by step, they seem to develop fixations (or obsessions) with

different kinds of embodiment. They rediscover their environment in new ways. The following will examine these hypotheses through further discussing examples, which will provide evidence for the factors that influence our sense of scale.

5.6 Elements Affecting Scale of Embodiment

The interviews corroborated the following scale cues in digital environments.

5.6.1. VISUAL ELEMENTS

The first category is *visual elements* and it is subdivided into four groups: *the oblique perspective*, *depth of view*, *coordinates and view angle*, *speed of movement* and finally *focal length*. The categories were introduced to subjects in the presentation, and attracted responses that will be discussed in the subsequent sections.

5.6.1.1. The Oblique Perspective

In this subcategory of 'visual elements', subjects were presented with two items produced by the designers in the course. Items in both cases were described by their designers as environments to host the multi-scale vehicles designed and auctioned in the previous stage. Selecting both environments came as a result of their uniqueness. Both items do not suggest any specific context. Moreover, they hold no associations with usual objects of *everyday-being-in-the-world*.

The first item is a static image showing a partial view of an environment. The environment hosts a scaled-down version of itself that may not be obvious to the casual observer. The multitude of interconnected random objects and shapes in the image, seemingly dismisses any schemata, frames, or scenarios. The only available hints in this image are the patterns of repetition of certain objects or shapes, and the proportionality of these objects, although it might not be clear due to the slightly obscure large object. Although objects are scattered in several angles, the image is arguably presented in what seems to be an oblique perspective. This is due to the platform-like object on which the scaled-down repetition rests, which suits the oblique perspective.

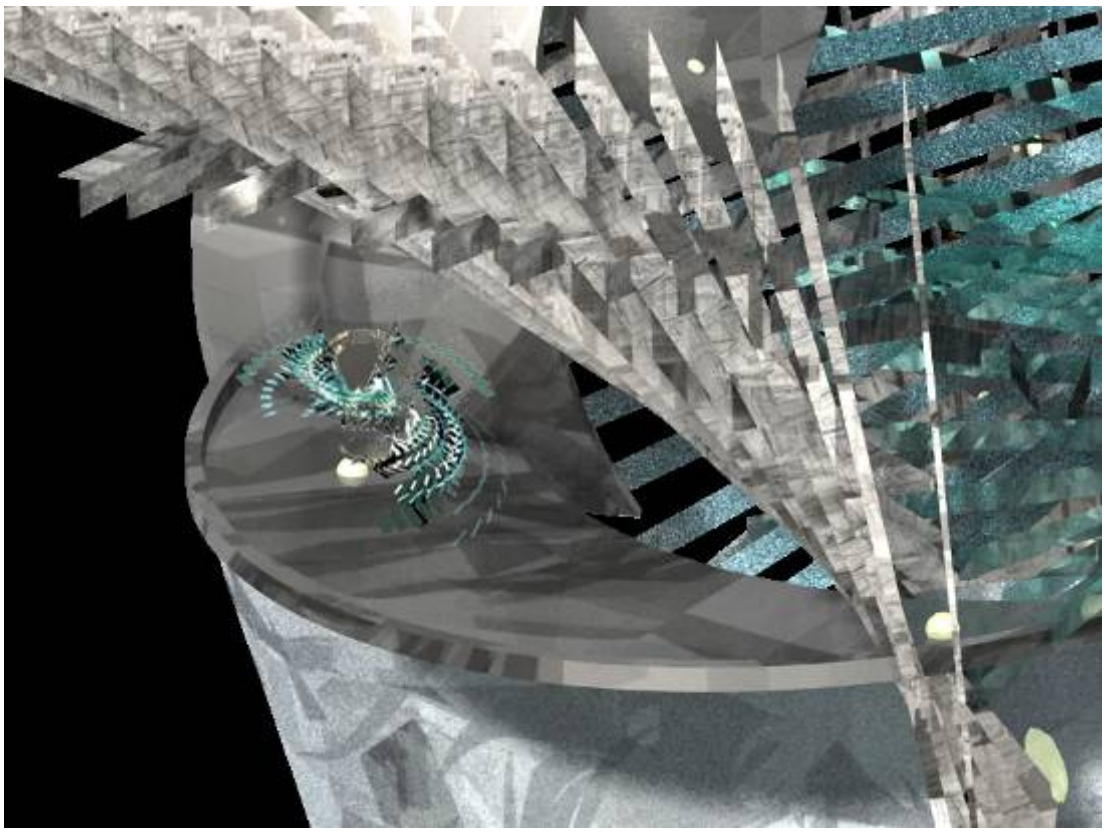


Figure 44 Screen shots of a static image showing a partial view of an environment that hosts a scaled-down version of itself.

These hints generate narratives of our embodied experiences; a special kind of stories about mini events that are emotionally induced by previous interaction with space. For example, in order to justify the sense of being small in size in relation to this image, a subject expressed how small he felt:

(1) "I just feel that I might be small in relation to this."

He then attempted to justify this feeling, by referring it to the curvy objects in the image, and linking them to an architectural referent:

(2) "Those sort of ribs they have got eh… a cathedral like quality to them … something gothic… a large structure."

By activating the scenario associated with the experience of being in a cathedral, the subject subconsciously scaled down his body to become an entity smaller than what he is looking at. The decision to make the association and, therefore, the activation of the scenario is due to the visual stimulus offered in the image.

However, the presentation of the scenario introduced an embodied experience, namely the experience of being in a large structure. This embodied experience falls within the domain of the schema of physical containment. The major element of this schema is human embodiment. The embodied experience affects the relationship between the body and its surroundings. In a large structure, we tend to feel proportionally small. But this generates the feeling of being smaller than what we are really.

The narrative of this embodied experience continues with different expressions that the subject uses to describe his feelings such as 'overbearing'.

(3) "There is something quite overbearing about the grey ribs that are coming out."

The salient point that has to be pushed against other aspects is the abstract nature of this image. This abstractness is later acknowledged by the same subject. Yet, the nature of the oblique perspective permitted different variations on the main theme of having a small body. When the subject noticed the scaled-down version of the big object was placed within it, he stated his confusion due to the lack of references to scale.

(4) "I kind of find it hard to identify any sort of scale, with that little object there."

The subject acknowledged that the metaphorical association was the major drive into believing his body was small and contained. He also blamed the confusion on the lack of references. However, the nature of the oblique perspective in this image combined with the lack of reference points and the extension of the objects in the image beyond the frame of the image itself, create a sensation of the vastness of the object being presented, although it leaves subjects confused when it comes to the scale of their own bodies. This sensation is justified by subjects in many interesting ways. For example, one subject feels that the oblique perspective induces a sensation of being small.

(5) "If you are up in the air looking down on something, you got the sense of vastness around you. And maybe that in itself does make you feel quite small in relation to what you are seeing."

Another subject also dedicated a substantial amount of attention to this aspect of the image.

(6) “I seem to be a little bird looking at something and I feel small.”

The difference here is in picking a different embodiment to justify the subject’s feeling of being small. The scenario activated here is of a small bird looking at something really big. The choice of altering embodiment into something more appropriate for the image stems on one hand, from the need to adapt to the surrounding environment, and on the other hand, from the effect of the environment on our perception of ourselves.

We can be easily affected by our surroundings and take an active approach to the adjust ourselves to fit our surroundings. This was the case as corroborated by most of the subjects. However, some subjects maintain a consistent sense of their scale and kind of embodiment in the world. For example, the subject below placed the emphasis on her embodiment, by expressing how she felt in the environment rather than how the environment felt to her.

(7) “I was really … really big and I was looking at it like in a microscope.”

The embodiment was so important to this subject that she first expressed the relationship with the environment from her embodiment’s point of view ‘I was really really big’. Nevertheless, the object in the image was also big, and perhaps bigger than her. In order to control this feeling of having a huge scale, and being in the presence of a huge object, she introduced a measure to control her visual experience. The measure was the microscope. Her body is huge, and the scale of the object in front of her is exaggerated by a tool that visually controls the scale of an object. The scenario activated in this case is a slightly more sophisticated scenario that controls the outputs of the frame to preserve the embodiment of the subject. The oblique perspective is a common element in the microscope, the birds view, and in the image we presented above. However, handling the image by subjects, mainly through interpretation, resulted in different scales and embodiments.

It might be important to try and figure out which scale takes precedence; if we first feel normal, large or small in any given environment. Certain statements uttered by subjects might present the evidence as to what takes precedence. In particular, sentences that express the opposite of what is expected. For example:

(8) “Well, seeing the whole image, that does certainly seem smaller, but in relation to that whole environment, I would feel small.”

The subject here expresses that he expects to feel something, *but* he ends up feeling the opposite. First, he feels that the image seems smaller, which consequently results in him being bigger or larger, *but* he feels small. What we establish from this is that the precedence is of being big or large.

This element of counter-expectation is also clear in other sentences. For example:

(9) “Um ... It is difficult to judge but I'd say I am small”

The subject expressed that she felt something although she felt strongly against judging. The ‘*but*’ indicated the counter of her expectation. This strength of this counter-expectation can somehow be measured by the strength of adjectives used. For example: ‘very … very big’, ‘quite small’, ‘definitely yes’.

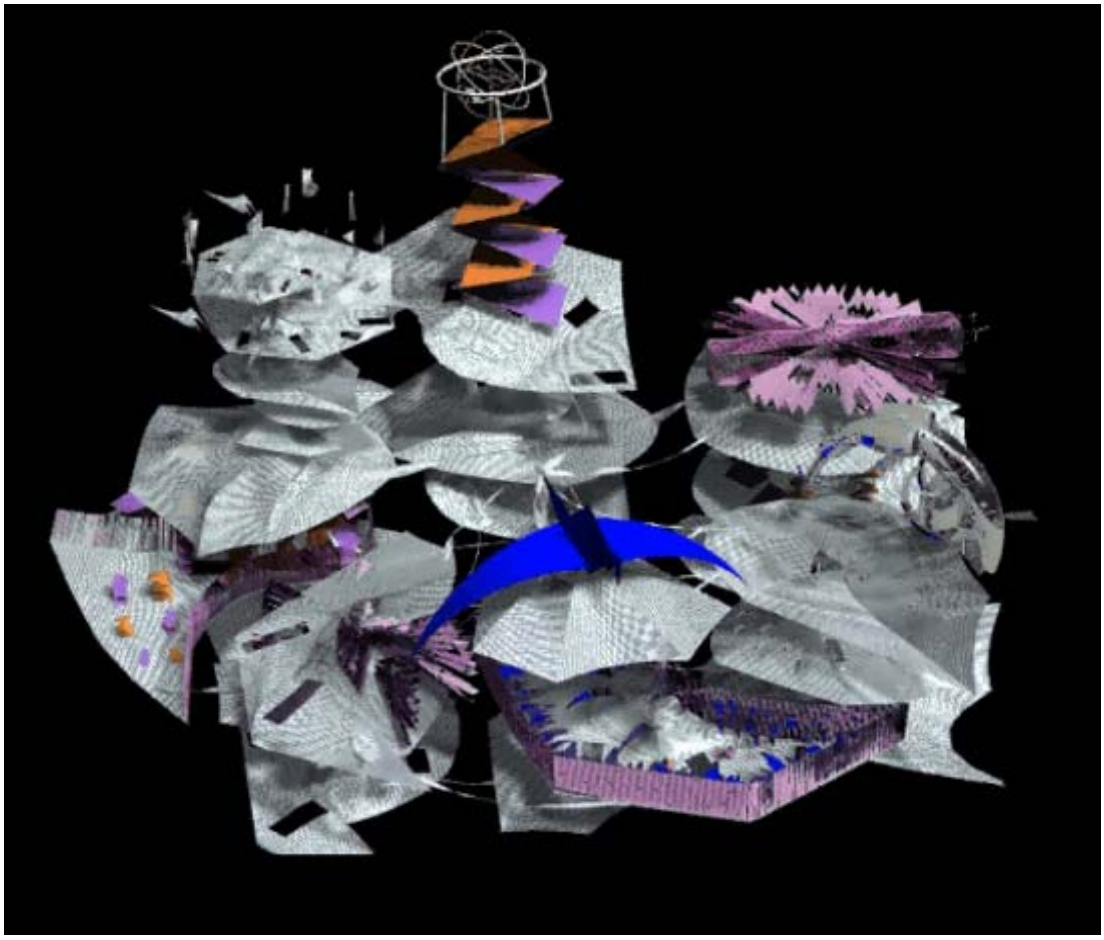


Figure 45. Screen shots of frames showing an environment changing from an oblique view (right) to an elevation view (left). (Model and animation by Masumeh Geranpayeh)

The second item is a video animation showing what appears to be a group of interconnected platforms, each of which hosts a large object (which we call vehicle), and many repeated instances of the same object at a different scale, mostly scaled down. The animation progresses from a point where the plan of the platforms is shown, into another point where an oblique view of the interconnected platforms rotating in front of the viewers and allowing them to see all different objects small and large. Finally, the oblique perspective changes back to the plan and stops there.

Although the animation dismisses any schemata, frames or scenarios, it overstates a certain aspect of scale, namely, repetition. This is done by the means of repeating different objects within the overall structure in different scales. The animation itself presents a pattern of rotation which presents the overall configuration in an oblique view for most of the period of this animation.

Subjects found the animation too abstract to be fitted into a context that can be reflected in a scenario. For example:

(10) "It is <u>also</u> a virtual environment … It could be anything."

The subject here has already established or maybe adapted a new frame to suite this relatively new situation. The frame is of an 'experiment' scenario where the subject gets presented with different 'virtual environments' in order to discuss scale. This fast adaptation of what is taking place is clear in the subject's use of the word 'also'. This, however, helped the subject in producing views that are not limited by any preconceptions. The last part of the statement 'it could be anything' shows that.

Another subject reiterated a similar view and attempted to justify this view by highlighting the lack of references.

(11) "It is kind of hard to say really, [be]cause there is <u>no</u> real reference there."

The use of the negative format 'there is <u>no</u> real reference' highlights the fact that the subject would normally expect a reference point to help him determine the nature of any given object and its scale. The oblique perspective, in this case, did not lend support in determining the object or its scale. Perhaps this was due to the abstract nature of the objects in the animation.

(12) "… this one … I did not perceive it … I did not understand it the first time I saw it … so I had to see it again."

Another subject started a process of generalisation which, in essence, is similar to statement (10) “also a virtual environment”, but includes a significant element of deduction and inference

(13) “Um ... of a weird object I would say … but not a space.

The generalisation is based on the assumption that whatever is presented to you is either a matter or a void. In this case, the animation showed an object, whereas, the previous image showed a space. Again, the negation gives a hint about the assumptions made by the subject.

The subject who adapted the scenario of the experiment in statement (10) maintained an interesting emphasis on the scale of what is in front of her, rather than the scale of her own body. She highlighted the fact that the scale of the environment felt bigger than her body because of the nature of the oblique perspective.

(14) “The space feels bigger [than me] when I see it in the three dimensional [view]”

The prominent aspect of this object-oriented process of reasoning is the element of *justification*. The subject justified her sense of how big the object is by stating the nature of the perspective. When quizzed about her size in relation to this environment, the subject stated that she felt small; however, she felt the urge to justify that again.

(15) “I feel I am small because it appears to me to be … ah … like a whole environment floating in space.”

Statement (15) suggested another aspect of this object-oriented process. The fact that the environment was floating in space corroborates a view that is mainly concerned with the environment rather than the subject herself. The subject tends to exclude herself from the environment. Upon the researcher’s attempt to shift this position in order to allow the subject to take the primacy over the environment, the subject resolved to justification.

Researcher: do you feel it is floating in front of you or do you feel you are flying around it?

(16) “No, I feel like it is rotating. Because it is probably not the path I would take.”

The intriguing aspect of the subject's justification is found in the fact that although the 'virtual environment' 'feels bigger', and 'I feel I am small', nevertheless 'I feel like it is rotating', when the logic of sizes suggests that I should be the smaller entity rotating around the object that feels bigger.

By contrast, a subject that placed the emphasis on his body and scale as opposed to the environment's size, resolved to inference in order to interpret the relationship between his body and the environment. The inference, in his case, developed from a simple feeling of being large, to a quantifiable relationship.

(17) "I would say you are relatively large in it."

The relationship between the subject and the object is established from the standpoint of the subject's embodiment. The subject asserts he feels large compared to the previous instance. He then infers the relationship with the object depending on recognising a familiar part of the object:

(18) "I wouldn't say it is in the palm of your hand, [be]cause I can see some sort of a ship there, so it must be a scale reference, something that you can walk around."

The process of inference seems to be dictating the logic behind the sense of scale of embodiment. Upon the researcher's attempt to shift this position in order to put the subject in a different perspective where the object is more centred, the subject expressed his inability to make any assertions based on inference.

(19) "There is really nothing to indicate [whether I am floating, or the environment is rotating]. It does look like … Uh … I mean you are … If I had to pick one of them, I would say that I have been flown around the model."

The subject's reluctance is evident in many ways. Firstly, the subject finds it hard to construct a sentence, and is unable to finish the sentence because he is unable to make an inference that does not begin from his own embodiment. Secondly, he resolves to pick an option, but highlights the fact that he is not comfortable with the process or the outcome of this picking. Finally, he keeps presenting actions in a subjective manner. For example, he says 'I have been flown around the model' instead of saying 'I flew around the model' or 'someone flew me around the model.'

In order to develop the relationship between the subject and the object or environment, the subject continues the process of inference. His next inference takes the form of a positive identification of an object that he can relate to.

(20) "There is that sort of ship there, which gives you some sort of reference, so it is something which you could probably walk around Um. So you would be talking about something that is maybe the sort of size of a Um… a pretty large house, something like that there … That is the sort of area that might cover"

Now, based on the previous inference in which he identified a familiar object and related himself to it, he infers a numerical value to this new proportional relationship.

(21) "I would look at that there and say … right, that is probably about 15 to 20 meters high. That sort of size that I am imagining that at.

This is not the only case. Another subject used the same process of inference, but did not recognise the small objects within the larger structure as being familiar, and consequently inferred a different scale.

(22) "So the little stuff is just little stuff in the model. It is not giving me any reference, because it is not giving me any known scale."

In the light of this inference the subject made an assertion, which mounted to the level of being a judgement.

(23) "No there is no reference in this model."

In the light of lacking the reference point that she viewed as important in order to infer the relationship, the subject activated a familiar scenario where she is an architect, and she is holding a scaled-down model.

(24) "So that is why I saw it as a scaled-down model … if you tell me this is real [then] ok … then I will tell [you] that it has around 30 to 40 centimetre diameter."

The inference that was made here utilised a familiar scenario in order to provide a reference derived from our familiar embodied experiences. This, in turn, helped relating the subject's body to the new object she encountered.

By contrasting both cases, it seems that the process of inference might be more successful in quantifying the relationship between the subject and the surroundings, whereas, the process of justification works in the opposite direction by

stating the assumption, and then working out the justification. This proves, in two different ways but for two similar results, that the oblique perspective mediates between the subject and his or her perception of scale.

Among the visual elements affecting perceptions of scale, the oblique perspective, or distant aerial view, has a strong impact. We may feel that our bodies are small and insecure, or huge and looking out over a vast landscape. Where there are familiar scale referents, the body draws on the metaphoric associations between objects and defines its scales depending on its relationship to them. In the absence of a clear frame of reference, there is a fine line between perceiving one's body as huge and overlooking a small environment under its control, and perceiving one's body as a small entity floating over a huge environment *(Figure 45 & 46)*.

Figure 46. Screen shots of frames showing an environment changing from an oblique view (right) to an elevation view (left). (Model and animation by Masumeh Geranpayeh)

5.6.1.2. Depth of View

In this subcategory of the 'visual elements', subjects were presented with three items produced by the designers in the course. It was noted previously that the oblique perspective affects our perception of scale. The process of determining scale, thus far, was based on determining scale according to a reference point that marks a known or familiar scale to us. In the absence of this reference point to scale, we tend to look for a frame of knowledge or a scenario of interaction that could act as a reference point which will help in determining the scale of environment or our bodies. As a visual element, the depth of field exhibited another quality that is much more rooted in the nature of our embodiment and perception.

Generally in photography and movie industry, the depth of field designates the distance between the nearest and farthest objects that appear in acceptably sharp focus. However, by depth of field we intend to designate the distance between the nearest and the farthest objects to the subject.

The depth of field affects our sense of scale but mainly in an interactive way. We seem to recognise this depth upon interaction with it. As this interaction develops and as we encounter the depth of field in more than one way, we produce a better understanding, and consequently our understanding of our scale changes. Hence this part will address the way we encounter the depth of field.

The items in this subcategory conveyed the depth of view in three different ways: the first was by the means of presenting an image of an abstract environment yet, with strong reference to scale. The second was by the means of presenting a QuickTime 3D movie of an environment where the depth of field was modified by producing one thin layer on which all objects were applied and which the QuickTime 3D movie reintroduced to give the illusion of the depth of field. The third was an animation of an environment that seems to convey scale in a rather normal way in terms of the depth of field.

Figure 47. The element of a stair case acts as a strong reference to the scale of human body and the environment, but when this element is repeated in various scales and in the middle of nowhere, it questions this sense of scale. (Model and rendering by Armeet Panesar).

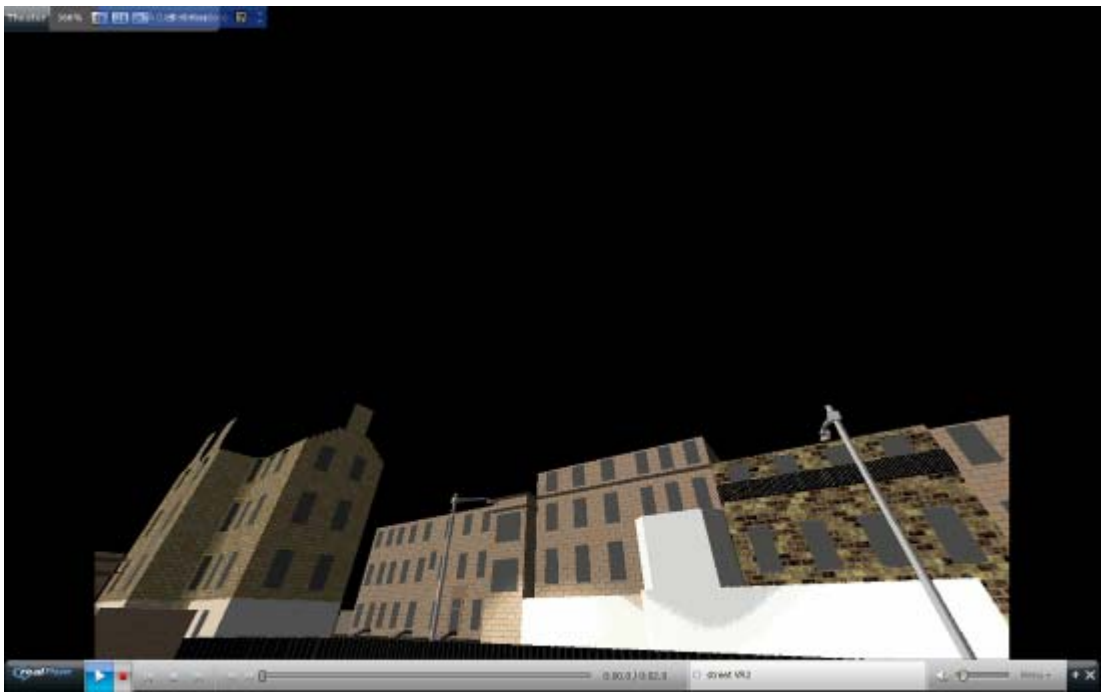


Figure 48 . Screen shot of the QuickTime 3D environment available for one point navigation. (Model and animation by Masumeh Geranpayeh)

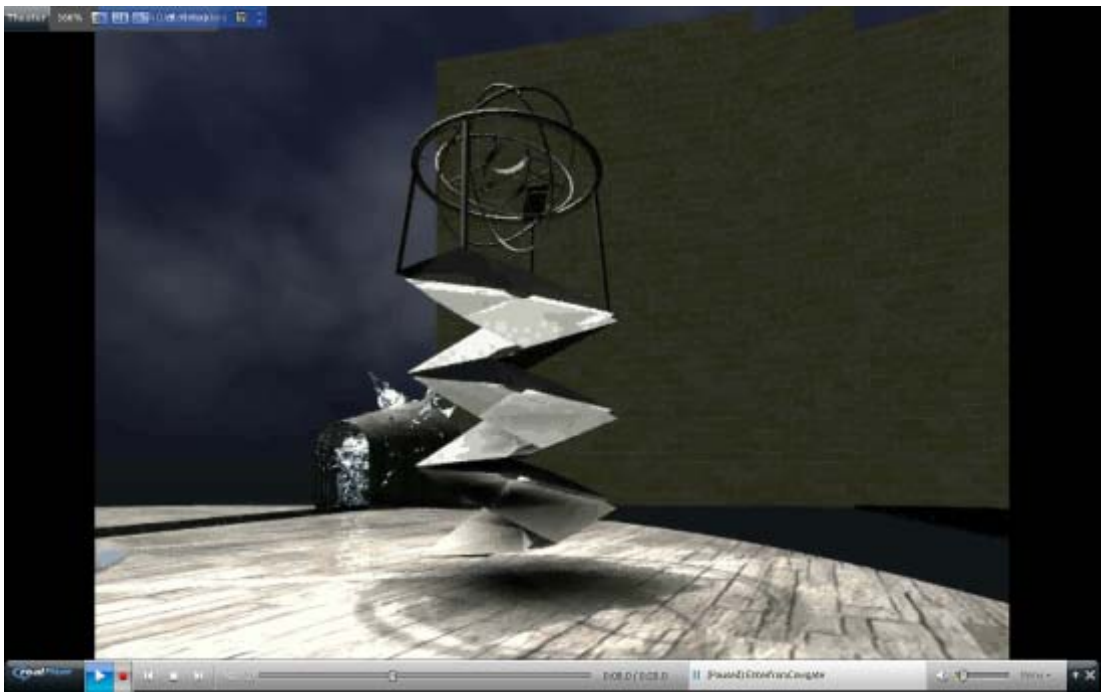


Figure 49. Screen shot of the animation (Model and rendering by P. Wang)

The first environment presented normal depth of field and several cues of different scales in the shape of many stair cases, whereas the second environment aimed at

manipulating the depth of field by reducing the actual depth to a single layer, and presenting it as a factor related to the QuickTime 3D; finally, the third presented a rather normal surroundings with slightly increased scale to give the viewer the impression that he or she are smaller than usual. While the first environment gives multiple inconsistent reference points in the shape of many sets of stair cases in different sizes, the second one suggests a relatively common reference point to its scale, and the last one clearly provides inconsistent reference points.

The first environment provides no schemata or frames of knowledge of its content or how viewers/users should expect to use it as an environment. Moreover, the first environment provides no directionality since all the sets of the stair cases were distributed randomly, whereas the second environment provides a clear directionality to the depth of field in the shape of a strong vanishing point that draws everything towards it which is one of the characters of the QuickTime 3D movies. The third environment, however, provides a clear directionality in the shape of clear up, down, right and left directions, but it does not necessarily aid in deciding the depth of field and consequently the scale of this environment and its users.

The depth of field prompted two reactions from the subjects. It was suggested earlier that the depth of field is better understood upon interaction. This view is validated by the reaction of the subjects to the three different items we presented to them.

The first item, fig(), provided no possible means of interaction since it was an image. This restriction was reflected in the way subjects perceived its depth of field. Although the image provides the reference point of the stairs, which in theory should indicate ascending and descending in different directions, however, subjects perceived it as a 2D image. For example:

> (25) D: "Whenever, I was reaching down for my cup there, I got a glimpse of it, and it <u>just seemed</u> like a pattern. It <u>really seemed</u> like a blurred pattern. So before I realised what it was … it just seemed like it was some sort of abstract noisy pattern."

There are two important points in this account. First, the action that the subject took was 'a glimpse' which was enough to see the image as an 'abstract noisy pattern'. Lack of interaction coupled with the fixed view of the environment represented in the

image prompted this characterisation which cancelled the depth of field in its totality. But the fact that the subject encountered the environment unintentionally brings about an aspect of interaction whereby objects and their depth of field, perhaps, cease to form a part of our 3D space when not consciously perceived. The subject's use of the word 'just' indicates that he was expecting more than a 'pattern'. This is reconfirmed by the repetition of his sentence and the use of the word 'really'.

The same view is corroborated by another subject.

(26) M: "It seems like a collage or something. Like a 2D image.

The difference between this view and the previous one is mainly in the choice of words, and what they mean. A 'pattern' which is a type of theme of recurring events or objects; and collage, which is a whole made from the assemblage of different forms. A pattern occurs on one layer, whereas collage permits different layers, but with minimal distances in between.

A similar view was expressed by another subject, but while previous subjects described the image using the verb 'seem', this subject described her feelings about the object.

(27) R: They are felt … whole … flat

In a way the account is self-centred because it describes the feeling inflicted on the subject by the image rather than describing the image. This could indicate the uncertainty associated with the image. In the case of this account, the description called on associations and activated no frames. The description, however, holds another aspect that might be interesting. Although the subject was presented with an image of an environment, her description came in the plural 'they felt'. This indicates that the subject perceived more than one object. This was further confirmed by the next sentence that came after a pause.

(28) R: "In one plane … all these stuff."

By definition, depth of field is the distance between two objects. The fact that she referred to the image above in plural implies the perception of more than one object. This prompted the researcher to probe for the reason behind the lack of depth. The subject, then, changed her position and highlighted the fact that the image is 3D and has depth,

(29) R: "I do not perceive a very deep field but I perceive a 3D [object]."

The depth of field as a factor affecting scale was not apparent in this item, and therefore, notably not perceived. The reason for this is reported by subjects in different ways. For example, one of the subjects commented on the colour variation as an element that helps in perceiving the presence or absence of the depth of field:

(30) M: "There is not a degradation of colours between the upper part and the more … lower part ... and I would feel that it is an attempt to represent a 3D environment but with 2D image."

The account of this subject expected a certain type of visual stimuli to reflect, and perhaps define the depth of field, therefore, scale. A frame of knowledge could be constructed based on this expectation. Strong colour degradation is one of the attributes of an environment of a large scale. The colour variation appeared in different accounts. For example, one subject pointed out the lack of colours:

(31) D: "It is stairs … thresholded[430] or something."

According to the account of this subject, *thresholding* was the cause of not perceiving the depth of field. While another subject pointed out that the changing colours of different stairs were the reason she perceived 'a little' depth of field.

(32) A: "A little, because of the different colours on the stairs, but it is difficult, if you do not have image in your head, it is difficult."

Her view is concurrent with other views that the colour variation between the object closest to the viewer, and the object farthest from her, is a strong indicator of the depth of field and therefore, scale.

All other views were also concurrent in pointing out the strength of the association between this image and another popular image of overlapping sets of stairs floating in the middle of nowhere. One of the subjects mentioned the name of the graphic artist Maurits Escher[431]:

(33) "Stairs, stair cases. It looks like Escher."

In a later stage, the researcher obtained a confirmation that the subject was referring to Escher's work titled 'Relativity'. Another subject associated the image with a scene from a film titled 'Harry Potter and the Prisoner of Azkaban'. In the scene, the

430 Thresholded from thresholding: is an image processing technique which entails a method of image segmentation. In its most basic form it creates a binary image. Other variations of the process produce images with limited or reduced colour hues.

431 More can be found about him in his official website [*http://www.mcescher.com/*]

actor attempts to ascend the staircase, but is constantly hindered from reaching his destination due to the constant movement of the staircase which results in changing the endpoints.

(34) "It is like the stuff in the Mobius Labyrinth, that there is a lot of stairs, and you can also see it in 'Harry Potter' as related to movies, as a stair playing with you and it can be both ways."

The association between this image and another image that the subject encountered previously creates an external reference point which does not necessarily determine the scale of the image at hand, but lends certain qualities such as the depth of field, which helps in understanding the image. Here, the viewer of the image, when unable to establish its qualities, calls upon a frame of knowledge of a previous experience, which is marked by its similarity. The nature of this similarity is dependent on a host of factors. Although the similarities between objects within these images form a strong factor, nevertheless, we argue that the inferred spatial experience is the essence of this similarity. A proof of this similarity is the statement (34), where the subject, initially, starts by pointing the similarity between the image and the 'Mobius Labyrinth', is conceptually similar to the image.

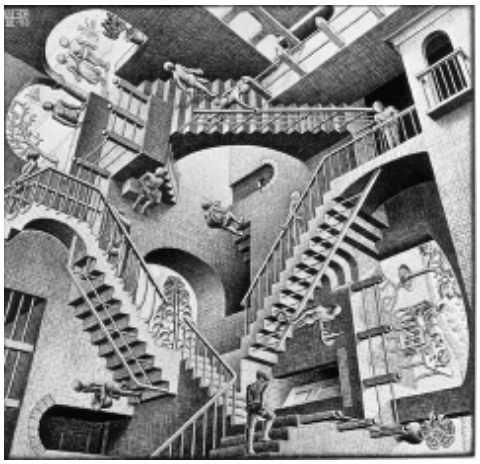


Figure 50. 'Relativity' by Graphic artist M. C. Escher Screen shot of the animation (Courtesy of http://www.mcescher.com/)

Figure 51. Image from the movie 'Harry Potter and the Prisoner of Azkaban' moving picture produced by Warner Brothers (Courtesy of http://harrypotter.warnerbros.com/)

Figure 52. Screen shot of the QuickTime 3D environment available for one point navigation. (Model and animation by Masumeh Geranpayeh)

The depth of field as a perceptual quality was put to the test in the second item. By definition, depth of field is the distance between two objects within our visual field. The QuickTime 3D environment offers interaction, which is essential in order to perceive the depth of a given field. However, the process of producing the environment consists of stitching several shots rendered from the same point of view creating a sphere of images to give the illusion of being surrounded. The ability to navigate in this environment is limited to rotation. Hence, the outcome has a perceptual depth perceived using one point of view. It does not permit changing the distance between the subject and any of the viewed objects within this field of vision.

When subjects viewed this environment several accounts were recorded. Some of the subjects expressed the sense of flatness. This came as a result of the nature of the used technique.

(35) "Yeah, I perceive it as flat scenery, four-side flat scenery … like being in a box."

This account presents, perhaps, the most accurate description of the environment. The subject described her perception of depth as unreal. The strength of the account is in the frame of knowledge drawn to illustrate it: 'like being in a box'. But, in terms of depth of field, what is it like to be in a box? In this situation, there is only one object in the view, which is the box. Hence, it is not possible to establish the quality of the depth of field by the virtue of the distance between the nearest and farthest object due to the absence of one of them, rather, the presence of only one of them. In this context, it does not really matter how big or small this box is because it will still have no depth. However, the depth of field, in this case, does not prevent the

perception of scale on the basis of the relationship between the subject's body and the bounding box. Here, the relationship is based on the physical containment schema, which transcends the frame of knowledge or the scenario of interaction. What is argued here is that the very nature of perception permits this sense of scale, not the presence of objects that are large and overbearing. Embodied schemata operate independent of details such as the depth of field. This view is validated by several accounts. For example, the subject tried to justify the reason for not perceiving the depth of field.

(36) "I don't see these buildings as having 'deepness' or having bumps on them. I just perceive as a picture."

The embodied schema is evident in this account among others, but the importance of this account is in the fact that it talks about the depth of surfaces, not objects or buildings.

(37) "Depth?! ... There is to a certain point. There are some bright surfaces … and there … some dark surfaces, gives us some sort of sense of … sort of…"

However, most of the subjects mentioned several points that aided in the perception of depth. For example, the previous subject in (37) listed the following points:

(38) "The angles of some of those surfaces, and the way that surface is moving around, the way you see the sides disappearing as you turn around."

Another subject attempted to explain why 'the buildings' were 'not just flat'. The account highlights the previous argument in two different ways: direct and indirect.

(39) "The buildings … they appear to have three dimensions, and not just flat … because the shading is darker…… on the side … I appear to have a normal perspective."

The subject's use of the 'not just flat' holds an underlying assumption that the buildings look flat. The negation came to refute the visual appearance of the flat environment. The subject, then, directly lists the points that is aiding in perceiving depth such as shading and perspective all of which will be discussed in subsequent sections. Another subject lists similar points.

(40) “It has depth, because of perspective lines, and because of shadows … lights and shadows … and because of buildings that give reference, a reference that you’re used to.”

The subject above adds to the list another point which is the familiarity with buildings which forms a reference point that helps in determining the scale. Previous experience in the form of the knowledge of objects is a good indicator of the scale of embodiment; however, another account presents us with familiarity or previous knowledge of a different nature.

(41) “I feel like I am on a soccer field”

The subject activated a scenario to help in perceiving the depth of the environment and subsequently the scale of her embodiment within that environment. The familiarity was in the spatial experience. The previous experience was of being in a ‘soccer field’ which implies specific depth of field and therefore, scale. The familiar embodied spatial experience explained the sense of scale in this environment.

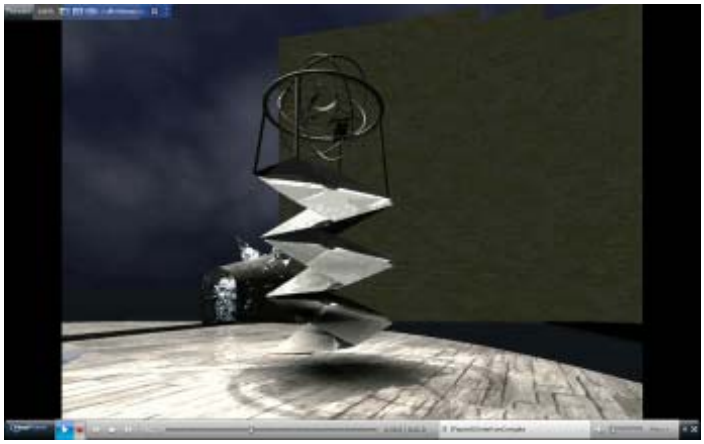


Figure 53. Screen shot of the animation (Model and rendering by P. Wang)

While in the previous two examples the depth of field was presented as a conceptual and perceptual element, this example will argue for the actual element of the depth of field. It was argued previously that the interaction with a specific environment results in a better understanding of the depth of field of that environment, and consequently, the scale of human embodiment within that environment. The previous QuickTime 3D example offered a limited form of interaction that permitted rotation. Nevertheless, the example consisted of a series of stitched images, which gave the subject a sense of flatness; that in turn affected their sense of scale, although some reported its apparent level of realism. The example used above communicates a

different experience. Although it is an animation, it presents a scenario of movement that is relatively common. It also offers several cues of scale that could be perceived differently, yet, the depth of field maintains a level of consistency with the normal scenes in our daily life. This subject justified the sense of depth as a result of being able to spatially locate objects.

(42) "The way you can sort of see things moving pass one another, which gives you a sense of where things are."

The scale of the environment in the animation was perceived as being large. One of the subjects quantified the height of the objects and the space containing them.

(43) "I will say it is a room like 30 metres by 30 metres or something … and this stuff … I will say it is like 4 metres high at least. So I perceive myself small in the room."

The account above presents a peculiar case for discussion for three reasons. The first reason is in the fact that the subject perceived the room and speculated the dimensions using the metric system of measurement. The dimensions according to her account were precise. The subject's choice of the metric system implies her urge to specify a distance characterised by preciseness. The second is that this distance formed the depth of field of the surrounding environment, which consequently helped her in determining her scale in the environment. The third is in the fact that she specified the height of the objects. According to her, the objects were 4 metres high, which is an interesting assertion. This assertion is peculiar because estimating a numerical value is one sort of establishing abstract reference point. The value itself is not the peculiar thing, rather, the nature of the value. Another subject did the same thing. She estimated the height of the objects in the environment, and said:

(44) "… they appear to be at least twice my own height."

The choice of the words is significant. The subject in (44) estimated the height of the objects by using her height, which is an attribute of her embodiment, as a reference point, whereas, the subject in (43) used an abstract unit of measurement. Accordingly, we can claim that the depth of view which appeared to be normal and which we called *actual* depth of field aided subjects in perceiving the scale of the environment and the scale of their embodiment in that environment. Generally, subjects felt either normal or small in size. We argue that their feeling of being small

is not a result of the abnormal depth of field, but due to the huge size of the environment. The two accounts above, (43) and (44), quantified the environment in terms of abstract units of measurement, and in relation to one's own embodiment. Nevertheless, there was another account that described the space in terms of the spatial experience, not the actual size.

(45) "So this will be the building of a museum … big space, and I perceive it as a big form"

The spatial experience of the environment was similar to that of space in a museum building. The scale of the environment is measured in its similarity to other spaces, not its actual abstract measurement or its relationship to my embodiment.

Subjects revealed many aspects of the relationship between the depth of field and the scale. The depth of field of a given environment could be conceptual, perceptual or actual. Conceptual depth of field is mostly dependent on the frame of knowledge or the scenario activated; it also results in alienation of human embodiment. The spatial nature of the experience is affected by the frame of knowledge or the scenario activated by the subject. Finally conceptual depth of field is applicable beyond spatial or visual experience. It acts as a connection between the notion of the depth of field as understood by us, and the human experience in general. I can use the depth of field to illustrate ideas. Perceptual depth of field is dependent on reference points. Although the perspective is extreme in most of the cases, the scale is dependent on the reference points within the environment. Actual depth of field, on the other hand, is associated with our daily life. We encounter it all the time. It presents an accurate reference to scale and spatial experience.

The depth of field and the way it affects scale is hugely dependent on the setting of display. While carrying out the experiment above, we intentionally dimmed lights in the booth where the experiment was taking place in order to reduce the potential interference between the real and the virtual environment on display. We argue that the sense of distortion in a virtual environment with a conceptual or perceptual depth of field, and therefore its scale, is greatly affected by the surrounding environment. The surrounding environment could act as a reference or comparison point for what scale should be. This is evident in the sense of seamlessness when displaying an environment with an actual depth of field.

Table x: Comparison between conceptual, perceptual and actual depth of field.

Type Attribute	Conceptual Depth of Field	Perceptual Depth of Field	Actual Depth of Field
Nature or Sense of Scale	Dependent on frames of knowledge and external references.	Enhanced by reference points or frames of knowledge	Presents accurate reference to scale
Perspective	Perspective is non existent	Perspective is distorted	Human-eye perspective
Spatial Experience	Independent of the sense of human scale	Dependent on the depth of field and the perception of environment scale	Dependent on the depth of field and the sense of human scale

According to this table, a schemata of the relationship between scale and the different types of depth of field can be devised. However, the complicated nature of the depth of field leads to devising a script using Schank and Abelson's model. Schank and Abelson's '*scripts*' are 'structured frameworks or schemata' which are characterised by *conceptual dependency*.[432] The example proposed below illustrates a spatial value arguably determined by the depth of field and, in turn, it affects scale which is embedded in the environments we encounter.

There is conceptual depth, and there is perceptual depth and there is real depth of view. Each of those depths seem to have a relationship with our environment that is critical to our perception of the scale of our environment and of our embodiment.

When the visual field is extensive, subjects tend to believe that their scale is smaller than normal, while the size of the environment is very large, but the presence of a kind of reference for a scale in the environment will always enhance this feeling. The absence of this reference on the other hand encourages the subject to think she is very large and is only observing a very small object.

5.6.1.3. Coordinates and View Angle

In this subcategory of the 'visual elements', subjects were presented with five items produced by the designers in the course. The presented items included rendered shots

432 Schank, R.C. & Abelson. R.P., 1977. *Scripts, plans, goals, and understanding: an inquiry into human knowledge structures*. Hillsdale, NJ: Lawrence Erlbaum, p. 176.

taken from different coordinates and view angles within several virtual environments. The aim was to provide shots in succession that illustrate a) coordinates starting near the ground and ending up in a position higher than standard human point of view, b) various view angles on objects that we would usually not view objects from, and c) lack of reference points to directions (up, down, left, right, front and back) such as floors or ceilings. In the examples that were presented in the previous section, the major analysis was performed using Gillian's 'compositional interpretation'[433] with emphasis placed on the form of the images, and the spatial organisation. However, in this section of the visual elements, the activation of scenarios to aid subjects in understanding the image, and help them in creating a narrative around it resulted in many contradicting views. The contradiction can be traced back to the nature of the structures of expectation associated with each frame. Thus, it was not clear whether or not the meaning behind an account could be interpreted.

In an effort to present an accurate reflection of the subjects' accounts, we decided to perform the componential analysis in order to reveal the contextually important visual features projected by the subjects. In order to clarify the point, we will contrast several accounts in two different items.

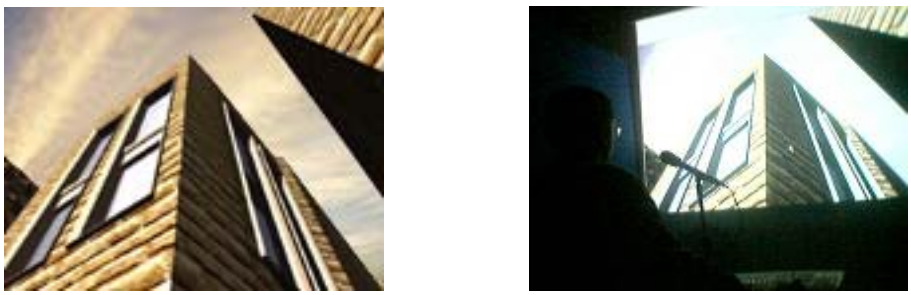


Figure 54. A building from what seems to be an ant eye perspective (left), and a subject looking at it (right). (Model and rendering by Matthew Murphy)

The first item (*Figure 54*) is a rendered shoot of a building that is well known to all the subjects.[434] The image presumably depicts what would be the view of a person looking upwards to the building in question.

433 Rose, G., 2001. *Visual methodologies: an introduction to the interpretation of visual materials*. London: Sage Publications. P. 39.

434 The building is the old part of the Scottish National Museum in Edinburgh, Scotland, UK.

One subject immediately recognised the building, and consequently felt small in relation to the environment.

(46) “I think I would be fairly small in relation to that environment.”

The reason for feeling small is induced by the view angle.

(47) “Particularly because you get this feeling that you are looking upward.”

One other subject gave a different ‘point of view’. She felt she was large in scale.

(48) “… Yeah I have a big scale.”

The reason according to her account was that the building was small.

(49) “… This is a small building.”

Another subject felt she had a normal size

(50) “No I feel normal.

The last subject in this comparison reported a different view in its totality.

(51) “It feels weird … the sky looks weird. It kind of … not fitting well together … yeah, so I cannot relate to it as something real. I feel normal I am in my normal size looking at it on the wall as an image, but nothing else.”

In order to analyse the above accounts we will first analyse the item to its components, and then analyse the image according to each subjects’ components or understanding.

Figure 55. A building from what seems to be an ant eye perspective (left), and a subject looking at it (right). (Model and rendering by Matthew Murphy)

The item is an image of a rendered shot of a building in the foreground, and the sky in the background.

$$\text{IMAGE}^{\text{point of view}} = \text{ENVIRONMENT}^{\text{quality of perspective}}$$

$$\text{IMAGE} = \text{SKY} + \text{BUILDING}$$

SO

$$\text{ENVIRONMENT}^{\text{quality of perspective}} = \text{SKY} + \text{BUILDING}$$

SKY = PINK AND BLUE BACKGROUND

SO

ENVIRONMENT = PINK AND BLUE BACKGROUND + BUILDING

AND

BUILDING = SOLID + VOID

SOLID = WALL = STONE = TEXTURE + COLOUR

VOID = WINDOWS = GLASS + FRAME

GLASS = COLOUR + TEXTURE + TRANSPARENCY

SO

$$\text{ENVIRONMENT}^{\text{quality of perspective}} = \text{PINK-BLUE BACKGROUND} + \text{STONE (COLOUR + TEXTURE)} + \text{TRANSPARENT GLASS (COLOUR + TEXTURE)}$$

Accordingly, the image above consists of background which is the sky with the blue and pink colour, and the building with the stone cladding, and the glass windows. The image of this environment has certain qualities such as the coordinates and view angle, which delivers a specific point of view that the subject will have to adapt. Different subjects perceived different components when viewing the item above. The accounts of four subjects will be reviewed below.

The first account is for a subject who perceived everything to be normal. According to her, she recognised buildings and she was looking at them while standing on a point below them.

(52) "Because I can understand those things as buildings. I am standing down and I am looking up … so I see the full height of it and I am really on the… I am really below … It is quite normal … It [point of view] is normal … I would normally feel small in space like this … I feel normal."

This sense of total acceptance of the surroundings and feeling of the normality of being within it is due to the familiarity of the view in question. The subject explains:

(53) "… Because I have seen that. I have images of those things in my mind as being in normal life."

According to her account, and although she was quizzed about the details, the subject maintained a specific description which highlighted the normality and familiarity of everything. Hence, the component analysis for her account would be:

$$\text{IMAGE}^{\text{point of view}} = \text{BUILDING}^{\text{Normal + Familiar}}$$

The scale came as a direct result of a daily experience, where it is possible for her to have the point of view of looking upward to buildings when walking beside them.

The second account is of a subject who felt he was small because he was looking upwards to the building. The subject felt that the building was normal, and that he was small in relation to it because of the sense of scale.

(54) "I would say that the building is normal. I would put it down to the sense of perspective. It feels like I am looking upward at it. So in that sense I feel small in relation to it."

Notably in this account, the subject did not state any component beyond what was present in the analysis of the components. In fact, hir account was simple.

$$\text{IMAGE}^{\text{point of view}} = \text{BUILDING}^{\text{Normal + Familiar}}$$

The image has specific coordinates and view angle, which makes the subject feel small. When the subject was quizzed about his scale and the reason to feel small, the subject reluctantly replied

(55) "my immediate thought was just that I … but again … I mean if I reflected on it a bit I would see the blocks look very big in that, so maybe, and again it is not that real, so maybe it is a toy environment and I am small … on reflection I might say that, but first impression, because I know the building then I am quite small in relation to it.

The simple previous account developed upon his 'reflection' due to the recognition of new presupposed elements. His previous understanding was based on the presupposition that the building is normally bigger than his own embodiment. Upon reflection, the presupposed size and scale was changed because the 'blocks' looked

'very big'. Accordingly, the facts entailed in the previous analysis were changed dramatically to a new set of facts whereby

$$\text{IMAGE}^{\text{point of view}} = \text{BUILDING}^{\text{Normal + Familiar}}$$

BECOME

$$\text{IMAGE}^{\text{point of view}} = \text{TOY BUILDING}$$

SO

$$\text{IMAGE}^{\text{point of view}} = (\text{SMALL} + \textit{NOT}\ \text{REAL})\ \text{BUILDING}$$

SO

$$\text{IMAGE}^{\text{point of view}} = \text{BLOCKS (COLOUR + TEXTURE)}^{\text{Small + Not Real}}$$

Accordingly, the scale of his body changed from being normal, but small in relation to the building, into small, and also small in relation to the toy building. The change in scale came as a result of the combination of the blocks' texture and the coordinates and angle of view. We can safely add to the subject's account the presupposition that he is standing while looking upwards.

The third account exhibited different components. The subject used two techniques that introduced new components to the item. The new components affected her perception of the scale of the building and of her embodiment. The components were arguably the result of the point of view in this item.

(56) "I perceive it as … I am lying on the floor taking the picture of the stairs and … yeah … I have a big scale, because that building should not be more than three meters [high] ... the bricks are telling me that."

The subject presupposed that she is lying on the floor. The presupposition is based on a scenario where she is shooting a photo of the building in front of her. In this case, the presupposition modified the type of interaction from simply looking at the building in a normal standing position, into lying down and to take a shot of the building. Accordingly, the coordinates and angle are justified in a way that preserves

her embodiment in relation to the building. She has large scale but in relation to the building. In the previous accounts, where it was not mentioned, the researcher found it safe to presuppose that the subjects are standing up. This presupposition did not survive in this account; instead, the subject introduced a different presupposition. Her presupposition, subsequently affected her perception of the scale of the building.

The second technique that the subject used is *entailment*. The subject stated she is 'taking a picture of the stairs'. In the components analysis of the item, the researcher analysed the building into solid and void because the partial view offered an external outside of the building. Hence,

BUILDING = SOLID + VOID

The subject, however, used the component of 'BUILDING' to *entail* a new subcomponent, namely 'STAIRS'. Entailing that the building is composed of elements one of which is the staircase resulted in a different reference for scale. The new reference helped the subject in inferring that the building was no more than three metres high. The entailed subcomponent justified the perception of 'bricks' as another coherent reference of scale. The outcome of this new building scale made it necessary for the subject to be well below the normal standing point if she was to see the view as it is. The convincing scenario where this view can be seen is the one where the subject is lying down on the floor. To justify this position, the subject introduced the scenario of 'taking a picture' of the building. Accordingly, the analysis of this item is dramatically changed.

BUILDING = FLOORS + STAIRS + WALLS

BUILDING = FLOORS + STAIRS + (BRICKS + TEXTURE)

Unlike the entailment of the stairs in the building, the subject cannot entail that she has a camera all the time.

The fourth and last account in this comparison sets another peculiar case. The subject in this case did not identify the item as a familiar daily seen. Instead, he identified familiar elements in the item, but maintained that they did not fit together.

(57) "It feels weird … the sky looks weird. It kind of … not fitting well together … yeah, so I cannot relate to it as something real."

The item is accordingly shifted from being a representation of an environment, into becoming work of art. The fact that the sky did not fit within the environment represented in the image caused the subject to reject the embodiment in this environment. The view reflects the fact that subjects or users of such environments look for seamlessness in representation. According to the subject the components changed from

$$\text{IMAGE} = \text{ENVIRONMENT}^{\text{quality of perspective}} = \text{SKY} + \text{BUILDING}$$

TO

$$\text{IMAGE} = \text{ENVIRONMENT}^{\text{quality of perspective}} = [\ ?\ ] + \text{BUILDING}$$

THEN

$$\text{IMAGE} = \text{BACKGROUND} + \text{FOREGROUND}$$

The significance of the account appears in two points. The first is that even if there was a positive identification of the context of interaction, the components' qualities of interaction may change significantly in a way that may result in significant change of the perception of objects or components. The other point is that the entailment of embodied interaction through the presupposition of embodied schemata or frames does not necessarily apply to the presupposed components of a human experience. Or rather, components analysis of objects on the basis of perception should not be necessarily based on the embodied immersive interaction, as one might find that we exclude ourselves in many occasions when identifying an environment due to many reasons, some of which were presented in the accounts.

The reasons for exclusion are various, and some of which will be presented in the accounts of subject who were exposed to the item below.

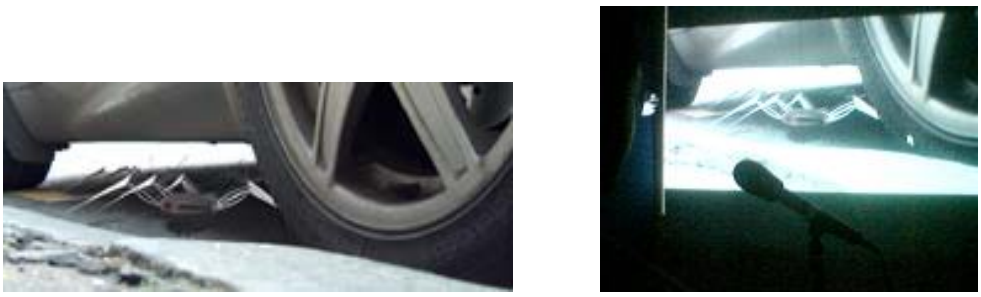


Figure 56. A normal human eye view but with proximity to ground level (left), and a subject looking at it (right). The juxtaposition creates confusion of whether the scale of the viewer is small or big. (Photograph and digital processing by James Whitaker)

The item presented above depicts a processed photograph of the lower part of the side of a car. The photograph partially shows the front wheel of the car and the right side. The photograph is processed to include a 3D rendered object which was designed to be a vehicle by the designer in the course, and it can also be described as a sort of a digital bug.

The significance of this item lies in two facts: a) it depicts coordinates of view that are not regular for the normal human embodiment, and b) it combines a real life object, and an imaginary object. Although it is argued by the designers that both objects belong to the same category, i.e., vehicles, nevertheless, there is no guarantee that the subjects will positively identify the second vehicle as intended by the designer. The strength of this account is complementary to the flow of the argument from the previous account, where the subject did not recognise the sky as a normal object. Hence, in this account we present an unidentified object and observe how subjects explore the object, and consequently construct a narrative to decide their scale.

The accounts obtained from subjects introduced several scenarios to guide the sense of scale. One subject asserted her scale was normal. She added that her embodiment is the reference of point for the environment, not the opposite. This inherently fixes her scale at her normal embodiment, and leaves the scale of the environment open for multiple variations.

(58) "I do not know … I have a feeling that … I keep comparing the space to me, not me to the space … now it is so different."

The subject's position can be described as having a tendency to hinge to reality, or stick to the knowledge obtained from previous embodied experience. In this case, the subject activated a scenario to justify what is present in front of her.

(59) "I feel like I am under a car and I see a spider."

However, a simple components analysis of her account sheds the light on a misperception. The subject identified the unknown object as a spider, which is fairly specific description. When she was asked about the nature of the view in relation to her scale, she replied positively.

(60) "Because I can identify the objects again … normal yes."

Her identification of the objects can be explained as an attempt to fit the scenario she introduced to a frame of knowledge which is based on borrowing the value of 'spider' to assign it to the terminal related to the object with eight legs. Hence, this supports the assumption that we refer to our frames of knowledge, and when we do not find the frame that is related to a situation, we tend to substitute using assignments from other frames.

The interaction implied in the response is relatively predictable.

(61) "Because I have done like that … so I am normal, but I see something that I could see in my normal life."

The overall account of the subject is interesting mainly because she discarded any abnormalities in the image, and treated it as a recurrent scenario. The abnormality was treated differently by another subject. The first thing she recognised was the digital bug. In her effort to interpret the image, she associated the bug with the fairly recent film 'Minority Report'.[435]

(62) "It looks like '*Minority Report*' I think the movie is called."

The account of this subject reintroduced the environment to fit the identification of an imaginary object. The environment now is part of a futuristic film-set. It was anticipated that activation of this scenario may lead to rather a futuristic interpretation of the item; however, the result of the account was not as anticipated.

(63) "It is an image of an underneath perspective of a car … of a tyre and little bugs … virtual bugs. But it seems like … it does not seem like a virtual environment … it seems realistic."

Although the item was identified as futuristic or as described by the subject 'virtual bug', the item on display was still considered realistic. This coincides with the previous account. Both subjects attempted to downplay the abnormality and highlight the environment as normal. When she was asked about her scale, the subject insisted she did not feel small in size.

(64) "Right, I do not feel like I am actually that small [in] size."

The use of the negation in her sentence highlights her expectation that she should feel small. The use of the term 'that small' intensifies this expectation. The subject

435 *Minority Report*. 2002. [DVD] Directed by Steven Spielberg. USA: DreamWorks. Based on the P.K. Dick book of the same name.

explained her account by assuming an activity was taking place. In this case it was lying down and looking beneath her car.

(65) "Since I know the scale of a tyre, I feel like I am lying on the ground and looking beneath the car."

The choice of activity taking place is due to its familiarity.

(66) "Because … I have looked under my car and I know the perspective."

Thus far, the accounts are similar in their structure of expectation and hence the element of scale is consistent. Yet another subject introduced a rather critical account of his experience with regards to this item. The subject established the components of his account as the car and the bug.

(67) "We are looking at a car and a bug."

But his critical account starts by predicting that his account is expected to react to the item by feeling smaller in scale, yet, he rejects this position and highlights the reason for this rejection.

(68) "You see … I am reluctant to say that I feel small because the ground is blurring as it is coming towards me. If that was somehow clearer, I would say that I am smaller. It is out of focus, and it is hard to see … It does not necessarily make me feel that I am small, it makes me feel that I am getting down and getting close to something … but my scale has not changed."

The overwhelming accounts of having a normal scale were interrupted by one that felt the opposite.

(69) "I perceive myself as small."

The account given by this subject in terms of components was similar to the previous one, but the interpretation exhibited a personal view that was opposite to previous similar components.

(70) "Because I would not be lying in the street, and there is no way that I can lean myself so low at that point of view. So I will need to be small, and be standing in front of it."

The account held by the subject exhibited that similar coordinates and view angles might result in different accounts and different scales of embodiment. The components analysis, in this case, showed a projection of subjective experience

which resulted in presuppositions related to human embodiment. In this case, the presuppositions associated with the components of this item produced an overall presupposition which employed the components to an outcome different than other outcomes of the same components.

The items that were presented in this section were consistent in that they contained components seen in daily life such as buildings, vehicles, windows streets, stairs …etc., and that these components were consistent in their perceived scale between themselves. The two sample items that were presented above covered the coordinates and view angle of the objects of daily life. However, we would like to introduce an item that presents various objects of daily life; however, it will present them in conflicting scales.

Figure 57. Familiar objects at exaggerated scale, like a cup or a beaker, give the impression that the viewer is small. (Model and rendering by Elizabeth Westmacott)

The item above is a screen shot of an animation of a 3D environment which contains objects of conflicting scales. On one hand, it presents architectural objects such as walls, building … etc., and on the other hand, it presents household objects such as bread, cheese, glass pint, cigarette… etc. Subjects gave various contradicting accounts that demonstrated the failure of the frame theory in accounting for the incoherent assignments of terminals. However, the scenario theory presented narratives to organise and interpret cognition. The components of those narratives

did not accept presuppositions or entailments. The basic presupposition that we perceive using our human bodies is challenged.

The frame theory cannot explain the huge loaf of bread that one can hide behind. It also cannot explain the giant cigarette that measures three times the average human body. The scenario on the other hand can integrate such elements into a narrative, but cannot assimilate into everyday knowledge of life.

What is being argued here is that the conflicting cues in this animation redefine our embodiment and perception, which in turn produces a new form of understanding. The understanding could be of one's own embodiment. For example, one of the subjects said:

(71) "I could be a rat in some kind of environment."

When asked about the choice of embodiment, the subject introduced interesting elements of her narrative that led to her new embodiment.

(72) "Cheese, and … the background looks like … it could be something from a laboratory [referring to the beaker]."

Another account introduced a different choice of embodiment.

(73) "… because I feel as if I am a fly or something. I fly … wonder around."

The peculiarity of the conflicting objects led one of the subjects to recall the famous storey of Alice in Wonderland.

(74) "This is like Alice in Wonderland, some stuff is huge and some stuff is normal scale so I don't have a point … well … to relate."

However, the general rule of scale perception in such case was eloquently put forward by one of the subjects

(75) "I mean that looks like a four five storey building there, over in front of us, maybe six, with a big high wall around it. You see a little bit of texture on the wall there … It is not a piece of cheese at this size, that I am very small, it is not an ordinary pint of glass. These are kinds of things that have been made large, because … I have seen a little bit of texture on the wall, which looked about you know a reasonable sort of a normal texture, you could just see about a bit at the top there on the right corner. So I would be assuming that, that is

> a five or six story façade there, with just a big high wall … and the cheese and the glass have been exaggerated in size."

What is presented in this account is the primacy of the familiar over the unfamiliar. The objects that belong to our daily lives determine the quality of our environment and inflect their qualities over our embodiment. The subject has a normal scale because he can see a wall that fits will with his familiar scale system. Any distortion is controlled and perhaps eliminated. The attempt to change one's own embodiment is one way of constructing a narrative that explains the perception.

Overall, the coordinates and angle view affect the perception of scale. The proximity to the ground level is a cue for the subject to seem smaller as proximity to the ground is generally associated with shortness of stature. It seems the reverse is not the case. Having an elevated point of view is insufficient to engender a sense of inflated scale, as elevation is mostly associated with flying, or being elevated on a plane. In most cases, it is sufficient to have a point of view close to the ground, to generate a sense of being small, but it takes more than an elevated point of view to achieve a sense of being large.

5.6.1.4. Focal Length

In this subcategory of the 'visual elements', subjects were presented with two items produced by the designers in the course. These items included rendered animations of virtual environments that had the focal length adapted to a wide angle in one environment, and a narrow angle in the other. In particular, the extreme variation in focal length provoked several reactions in relation to scale and embodiment. Predictably, the first notable variation was in the perception of the environment. Due to the effect of the wide lens, objects within the environment were visually perceived as having different shapes than what is usually perceived in the human eye's normal focal length. Accordingly, subjects were unable to recognise or characterise the objects within the environments. However, they maintained that what was in front of them is a large environment. The judgement that the environment is large is mainly due the fact that subjects are unable to see it in its totality including all the objects within the environment. This mixture of being unable to see the peripherals of the environment and all the objects within it led to the perception of a new kind of

environment. Subject described the environment in many different ways. For example, this subject assigned a general spatial value to the environment:

(76) "I feel it is an object in space. Some virtual environment I cannot define."

Another subject tried to imply the sense of vastness of the space in question:

(77) "I felt like … moving in the universe."

This subject tried to highlight the abstract and unrecognisable nature of the environment:

(78) "Ok … this is interesting. Here … it would be a dream."

While the above accounts highlighted the spatial character of the environment, other accounts addressed the relationship between the subject and the environment. This was expressed in two different ways: the first describes a mode of interaction, whereas the second describes the relationship between two objects. Embodiment was implied in both. For example:

(79) "Because I feel I am flying through."

According to (79) the action of '*flying*' is the cause of feeling that the environment is large in size. However, the direct reference to an action that is not familiar to human embodiment equally signals the unfamiliarity of the environment of interaction. (80) describes the relationship between the subject and the environment.

(80) "I felt like being in a spacecraft or something."

The account uses the basic physical containment schema of having the body inside another object. The spacecraft's function is to transport the body in vast space. Embodiment implied in the schema and choice of objects can easily lead us to infer that the subject felt small in comparison to the environment, but normal according to her daily embodiment. The account (80) was successful in finding a scenario to the fit the embodied experience, instead, (81) was unable to find the scenario and resorted to disembodiment.

(81) "I perceive my body like a spirit travelling in the space."

The abstract nature of the environment in this case resulted in an abstract existence that is not associated with embodiment. The scale in this case is also abstract since the reference to proportionality, which usually corresponds to the physical human

body, does not exist. In such case, the subject formulated the relationship in simple contrasting terms.

(82) “When you feel big, things are small, and when things are big you are small.”

Focal length affects perception of space dramatically especially at the wide angle. The accounts of subjects suggest that scale is also affected. Many rendering programs can simulate variable focal length, from wide angle to telephoto. With the absence of a referent, subjects reported confusion about scale where a wide-angled lens setting was deployed in the rendering. Yet, a wide-angle lens with high curvature is more likely to trick people into believing they are small (*Figure 58*). A narrower lens creates the feeling of being close to far objects, while objects that already have strong reference to scale appear larger than their normal size.

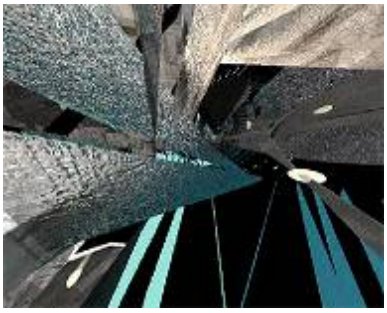


Figure 58. If the objects extend to the edge of the screen then the viewer tends to report that she is small compared to the environment. (Model and rendering by Bonnie Chu)

5.6.1.5. Speed of Movement

In the last subcategory of the ‘visual elements’, subjects were presented with three items produced by the designers in the course. The items consisted of three rendered animations of the same virtual environment starting from specific spatial coordinates and returning there at the end. The movement between the start point and end point for each animation, however, was different. Each animation depicted a style of movement which was reflected in the camera movement and the sound associated to the animation. This constructed a platform for comparison on the basis of the camera movement, and how it may affect the perception of scale.

The first item construed the same visual information but giving the impression that the movement was carried by a human being. This was evident in the

accounts of the users: all users agreed that the style of movement seemed normal. The expression of normality varied from one subject to the other. For example, one of the subjects expressed his conviction that the movement is normal.

(83) "I must be walking normally. Shouldn't I?"

The assertiveness is obvious in using '*must*', and it is also clear in the reflective negative question, which expresses the counter expectation. However, the assurance that the situation is normal is also reflected in the very basic level of using the pronoun '*I*' and the verb '*walking*'. Both of which implicate embodiment in the process of experiencing the visual stimuli.

The view in (83) is also reflected in (84); however, the latter construes a different experience.

(84) "It feels like paying a visit to the building, except that I am not entirely sure if my scale is normal or if the person is taller than me."

The experience reported in (84) is not as assertive as (83). The former held the doubt that the physical characters of the person are different in relation to that specific movement. The difference is not in the scale because the subject implicitly accepts that the scale is of a human being. The acceptance is demonstrated in the comparison between the movement in the animation and the daily action of visiting a building. However, the comparison is based on the emotional reaction to both cases, hence, the use of the verb '*feels*'. The emotional comparison between the movement in the animation and the normal act of visiting a building is slightly affected by the change of vertical point of view in the animation. This is the reason behind the doubt which is manifested in the subject's attempt to produce a separate entity of the same scale but with slightly taller stature to fit the view. Nevertheless, the subject is convinced the movement is that of a human being.

The twist in the subjects' accounts came from one subject who viewed things differently. According to him, the normality of the animation provoked a critical review of it. The review questioned the aspects that seemed important to the subject in judging the scale according to the movement.

(85) "After all these scenarios and environments, this one does not look normal anymore. Um … I am not sure why. Maybe now I am more critical of anything I see. Perhaps the animation went too fast for a

normal person? … Like it should be slower and more synchronised with the sound? I am not sure. Maybe it's just normal."

According to the subject, the aspects of the movement that helps in perceiving the normality of the animation, therefore scale, are the speed of perspective change and how it is synchronised with the sound.

The second item presented what could be described as the gliding of a bird flying and landing within the building. The animation was supported with a suitable sound effect. Subjects in general expressed similar views that recognised the implications of the movement in conjunction with the sound. However, the recognition came in different ways. For example,

(86) "So … that's what it is like to be a pigeon. Mind you, this could be a fairly big pigeon … no?"

The subject stated the expectation that the animation is supposed to make him feel like a pigeon flying to the building. However, he adapted his narrative by changing the scale of the pigeon to become similar to human scale. He did not change his scale to the pigeon's own scale and embodiment. This view is similar to another one that is more vocal in stating the fact.

(87) "My scale is normal, because everything looks the same … but I feel like I am flying."

In this account, the scale is reinstated as normal; the bodily implications of this instatement are manifested in the form of an adapted type of interaction '*flying*'. We are unable to fly, but it is easier to imagine a human flying, than it is to imagine us as pigeons. In other words, being human with un-human actions is an easy form of amalgamation, whereas, possessing a different embodiment and, consequently, the actions entailed in this embodiment is harder to grasp and accept. In this case, the presence of the amalgamation enabled the easy grasp of the idea of a flying human.

If the amalgamation does not exist, the subsequent process of changing embodiment forms the only possible prospect of grasping the action. This subject presents an account that illustrates the point.

(88) "I am not sure if I can interpret this in the right way, but generally, I am in a normal scale, but my movement is strange. I mean I can't fly. But in there … I am flying. That is weird."

The amalgamation is not present in this account; therefore, the movement is rendered strange. The sonic quality is disregarded and the human embodiment is considered to be a fixed factor in the process of perception.

The account (88) presents a middle ground to connect the process of amalgamation with the movement and how it affects the embodiment and therefore, scale. This is also evident in the subjects' account in the third item. In this item, the animation depicted the movement of a small entity with multiple legs. The scuttle associated with the animation gave a strong hint to the type of entity in the animation. The proximity of the vertical view to the ground also gave a hint to the height of the entity. The very short entity with many logs that scuttle near the ground was described by many subjects as a metallic spider. This did not affect their perception of the scale or their embodiment; on the contrary, it caused subjects to reject the proposition that the camera translating the animation as the eyes of the metallic spider were their eyes as well. Their embodiment was intact because the movement and surroundings were unfamiliar.

The third item depicted a movement that is yet new and different. The metallic spider (we call it metallic because of the scuttle noise associated with the animation; spider because the frequency of noise suggests the presence of more than four legs) had a point of view close to the ground and a slower speed than in the previous two animations in this subcategory. Subjects expressed their conviction that the movement is not embodied; however, they accepted that the insight from such movement exceeds what they would get from their daily experience. They also maintained that the speed of movement did not act as a major cue to scale, rather, the point of view, the perspective and the sonic quality of the environment.

Speed of movement of the camera is stronger than many other elements in dictating the size of the subject. Fast speed seems to suggest that the subject is large, but in the absence of other scale referents, fast movement can suggest that the objects encountered are large. Slower speed is generally associated with being small. The familiar movement of the camera is much stronger in accentuating the mode of embodiment; however, unfamiliar movement diminishes as a cue in the presence of other cues of immersion.

5.6.2. SONIC QUALITIES

In this category subjects were presented with three subcategories and items that were produced by the designers in the course. The presented sonic items were accompanied by an animation of what the designers described as environments to host the multi-scale vehicles designed and auctioned in the previous stage. Selecting the three sonically modified animations of these environments came as a result of their uniqueness. The camera in each animation presented the point of view of the subject in what seemed to be a movement carried out by the subject or the vehicle that the subject is driving. The objective of these items was to enhance the animation with a sonic quality that conveys a certain level of immediacy between the subject, and the environment represented in the animation. The immediacy is achieved through convincing the subject of his/her engagement by suggesting that the camera in the animation is actually his eyes, and that the movement of the camera is affected by the movement of his body, or virtual body. The result was three animations that suggested either that the source of the emitting object is large in scale, or that it was small in scale in the first and second items. However, the third item presented sonic quality that did not coincide with the visual data obtained from the animation, which opened the door for any interpretation by subjects. The strength of these animations also lies in the fact that they have a suggestive power to alter embodiment of the viewers. With the sonic quality not only you would imagine the point of view of a bird, but if you hear the wings flapping then you will also imagine yourself a bird in the sky. All animations started from an independent point in the air with a simulation of a free-falling movement which then developed into the animation and sound at the same time. This was done mainly to avoid overpowering the coordinates and view angle in deciding the scale of embodiment, and to make sure that the sonic quality is perceived in time that will permit sonic adjustment using the visual activity delay time. The subjects' accounts corroborated the following.

5.6.2.1. Sound Emitted By Large Objects

The first item presented an animation depicting walking movement. The camera in the animation had a relatively more than average height of human embodiment. The

slight increase in height enabled the subjects to lose any presuppositions of normality of stature. The sound accompanying the animation depicted the sound of footsteps of what would normally be perceived as a human being. The combination of the perceived sonic quality with the point of view of the movement may result in various accounts concerning scale.

Subjects reported mixed views and perceptions of this item. For example, one of the subjects described that she felt large in that space compared to what she would feel normally. She also felt the space was small. The reason she reported was that although the steps sounded normal to her, the frequency of these steps, or the number of steps per a given unit of time, did not match what she would normally expect it to be in order to enable her to walk the same distance covered in that animation. This aided her in inferring that she was larger than her normal scale, or that the environment was small. She stated that should there have been no sound with this animation, she would have had felt normal judging by the point of view and angle.

> (89) "I feel that I am larger by hearing the foot steps than I would normally perceive the space … say … meaning that … if I were to perceive the way the movie takes me through, my foot steps have to be smaller." because the sound was really steep and loud, more than normal, so I suppose if I were really small and I had, I will concentrate really more one sound than the others."

Hence, the sonic quality disturbed two scale systems which caused a totally different perception. What has to be kept in mind in this case is that the sound and movement associated with it were cognitively comprehensible. What is meant here is that the subject did hear the sound and then identified that it was a sound of a human steps. Had the subject not recognised the sound, the outcome would have been different. This aspect will be discussed later in the third subcategory of the sonic qualities.

Several subjects expressed similar tendency to consider their scale larger than normal due to the sonic quality, however, two accounts expressed different views. The first was of a subject who perceived her scale to be smaller than usual. The reason for this, as explained by her, was due to the volume of the sound. The judgement she took was based on the fact that the sound of the steps was the most prominent sound in the animation. This, in turn, caused her to believe that her scale

was small since the sound affected her that much, while should her scale have been large or normal, she would have had heard other sounds as well. This account is interesting because it transcends the direct interpretation into deploying the scale as a relationship between objects. Proportionality is so strong in this account.

(90) " … because the sound was really steep and loud, more than normal, so I suppose if I were really small and I had … I will concentrate really more on one sound than the others."

The other different and interesting account came from a subject who felt his scale was ambiguous. On the contrary from the previous subject, this one did not make a judgement as to his scale due to an inference. Rather, he decided the environment was magnified.

(91) "… I feel the views are magnified at some stages, and at others not. I think the magnification leads me to a distorted understanding of the scale. Ambiguous, I cannot be sure."

The distorted understanding of scale is not necessarily due to the perceived distorted scale. On the contrary, the scale of the environment is normal, but the sonic quality suggests that the subject is large in scale. This should lead the subject to perceive the environment to be smaller than usual; however, the fact that he still perceives it as normal instead of small, leads him to the feeling that the environment is magnified. The account illustrates how the sonic quality of the environment affected the perception of the environment. The ambiguous feeling suggests that the reaction to the animation was unconscious. Hence, the process of inference did not take place consciously, and therefore, embodiment suffered the illusion of not being normal. When the sound within the environment was brought to the attention, or rather the intention, of the subject, he immediately made the connection and said.

(92) "The sound leads me to believe that I am maybe a giant walking through the space, ah … then … and the speed of the movie as well … along with the sound makes me feel like a giant."

The overall insight gained from the accounts of subjects highlights the suggestive power of low-pitched sounds. This power tempers with the typical balance of scale and proportionality by distorting the fixed-ratio relationship between a human body,

and its surrounding environment. Low-pitched sounds suggest that objects are large, but it still means that the subject might be small.

5.6.2.2. Sound Emitted By Small Objects

The second item presented an animation depicting a movement using a camera that had perceivably a close-to-ground point of view. The perceived low point of view combined with the sound suggested the subject was not of a normal stature. The sound accompanying the animation depicted what can be safely described as repetitive tabs of more than two-foot body (crab, lobster, spider …etc). The combination of the perceived sonic quality with the point of view of the movement came back with relatively anticipated answers. For example, one subject immediately expressed her feeling that her embodiment is not of a human being, rather, an ant or spider. She blamed it on the view and the sound.

(93) "The sound and the perspective make me feel small. [I] sound like an ant or may be spider walk through the building, along the building."

Another subject gave more details of the reason why she felt like an ant. Her explanation concentrated on the sonic quality of the animation, but not the animation itself.

(94) "… because there were small steps and tiny clicks … click … click … click. Actually it was like being an ant; it was too frequent like many legs."

The scale of the environment was perceived to be normal, whereas the subjects scale was reduced. The high-pitched sound emitted by small objects is not the main factor in deciding the scale in the environment; however, it is a strong cue in making this decision. One of the subjects highlights this fact in his own words.

(95) "I think it enhances the effect rather. The short intervals between the steps contribute to a feeling of being small, and it imitates the sounds of crawling insects as well."

High-pitched sound in this case appears to be the most consistent and the best enhancement sonic cue for scale. Other low-pitched sounds perceived by the body from the surrounding environment suggest a small scale.

5.6.2.3. Sounds Giving Hints With or Against the Environment

This subcategory presented an animation that contained various objects of conflicting scales. The sound accompanying the animation starts with an airplane engine but develops into the sound of a bird's flapping wings. The mixture of sounds and objects resulted in various accounts of conflicting perceptions. This section will present some of the accounts and the reasons held.

One of the subjects chose to describe her body as that of a bird.

(96) "I feel first like a bird then like a mosquito."

Another subject contrasted that by stating first that she did not feel like a bird.

(97) "… No not like a bird … but like you are flying but in an object because the sound did not suggest a bird. It suggests like an artificial object."

A third subject reported it was difficult for him to judge, and eventually he decided that his embodiment was that of a mouse.

(98) "Very difficult to judge because I cannot make out what many of the features are. I can be a mouse moving around in a maze."

The first subject's feeling of being a bird is due to the sonic cue. The sound of flapping wings suggested she was a bird. When she was quizzed about the conflicting scales of objects in the environments, she stated that the sounds were stronger than the other objects in the environment.

(99) "they did not interfere to much …no. I did not concentrate much on them. I don't perceive as being that small. It is like a larger scale of myself."

The second subject, however, gave a different justification. Her feeling she was not a bird, but a pilot of an artificial object or vehicle was due to the way she was moving around the environment. This eventually led her to perceive her scale to be larger than normal.

(100) "I don't perceive [myself] as being that small … It is like a larger [version] of myself."

Finally, the third differing view justified his sense of feeling like a mouse due to the conflicting objects.

(101) "It is really hard …very difficult to judge because I cannot make out what many of the features are."

However, the presence of a strong reference in the shape of a big piece of cheese resulted in him deciding he was a mouse in a puzzle. This account highlights the strength of the visual cue in comparison with the sonic one. It also demonstrates the frame theory, whereby, when objects of conflicting scales were presented and the cheese and the beaker were obvious, the laboratory mouse frame was activated. When the subject was quizzed about his feeling of scale, and although the clip was playing over and over, he suggested that the stairs in part of the animation does not look fit for a mouse use, which may confuse him, but he does feel like a mouse.

(102) "The staircase seems to be suitable for a human scale … for humans … so that contradicts the feeling of the space being fit for a mouse."

The sound did not play a crucial role. When the frame was activated, many other cues of immersion were ignored, such as the sound of wings and the stairs.

The various accounts presented in this subcategory suggest that the sonic quality of an environment suggests a scale of embodiment and sometimes a different embodiment. However, the activation of a frame of knowledge or a scenario of interaction could easily result in subjects suppressing the sonic cue in favour of the visual cue in the activated frame. All sounds that give hints by being associated in real life with large or small objects lead the subject to adapt his scale to suit the size of the object of the sound. For example, associating movement with the sound of scuttling encourages subjects to think that they are small.

5.6.3. DETAILS

The third category is *details* and it is subdivided into four groups: *details of grime, rust and dirt*, *details of material properties and behaviour, details of surface imperfection* and *details of surface level Perspective*. This category, unlike the previous one, introduced a fascinating narrative that joined together perception, cognition and embodiment.

5.6.3.1. Details of Grime, Rust and Dirt

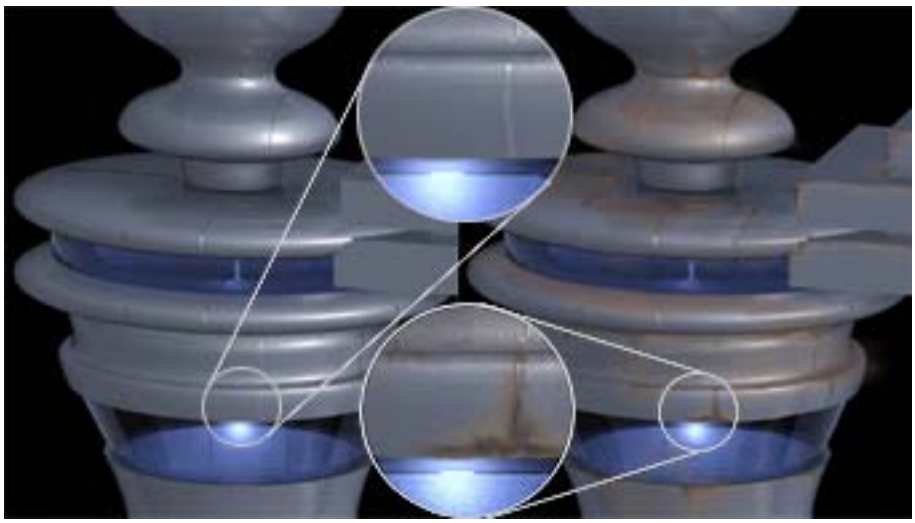


Figure 59. Grime, rust and dirt are not necessarily elements confusing to perception of scale. (Model and rendering by K. Tong)

The first episode of this narrative starts with the perception of scale as a factor associated with details of grime, rust and dirt. Subjects exhibited a certain tendency to report these details of an object upon their perception from their own point of view and embodiment, therefore, almost always characterising themselves as having a human embodiment. They, however, revealed their scale by expressing their expectation of how they might be interacting with objects in their view. The above example gave an extensive account of this tendency. For example, one of the subjects felt the object on the left hand side was of obscure scale. Her justification was due to the act she was performing on this object. The act itself suggested the scale of the object.

(103) A: "… because … I do not know … [it] is as if I am examining this object."

The act of examining the object needs to be carried out from a close distance, and has to be done to an object that is presumably not huge in size.

Another subject, raised her uncertainty, yet, her explanation indirectly highlighted her perception of the object's scale.

(104) M: "… because I am too close to the object than I would normally get."

This justification, again, indirectly expressed that the object's scale was larger than how it is usually encountered. This interchanging relationship between the object's scale and subject's expectation is part of the general narrative of details. The scale is

part of a daily experience that forms this narrative, which consequently develops into a narrative about how we encounter objects. Objects encountered in a specific way become different to us when we encounter them in a new way. This is clear in the next subject's account. The account describes the object, while the narrative describes the way the subject encounters the object.

(105) "… because I see so much of it."

Later, all subjects express that their narrative about the object entails time as well as size.

(106) "… because of the details that we had in the previous image and we do not have here."

The details made it clear that they, as subjects, could see more than they can do normally. They can see a big object, and they can perceive time in a better way. But the narrative discounts any change to the subjects' scale. An example would be.

(107) "I see it as being larger, I do not know, I cannot think of myself as being smaller comparing to that."

The priority is for subjects' embodiment to be normal. The same view mentioned in (107) is mentioned in a different way by another subject in (108).

(108) "I do not think it makes it feel any bigger."

Here, the subject doubts the presence of a change in perception. However, the details of grime, rust and dirt suggest equally being close to an object and being large in size. The subject decides his scale depending on the perspective, but does not suggest a change in the nature of the human embodiment.

5.6.3.2. Material Properties and Behaviour

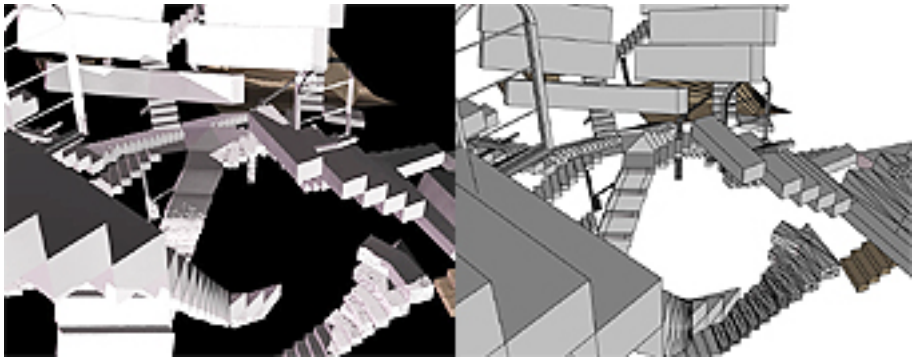


Figure 60. Material properties give the illusion of involvement in space and increases the sense of change to scale. (Model and rendering by Armeet Panesar)

The narrative continues in this subcategory. The details here are concerned with material properties. Subjects' use of interpretation within this subcategory introduced a new account of encountering details. This was partially encouraged by the contrast that is created between the two items, or perhaps the two views rendered in two different ways. The narrative at the first subcategory saw the subjects affixing their scale and concentrating on the subject within their view. While the details of grime and rust offered an extended sense of time and object's scale, the material properties yielded subjects' account of expectations about the environment in general, and the object in particular. In the previous subcategory, the perception of details was the main drive behind the inference of scale, whereas in this subcategory, the interpretation of details expresses a mode of interaction with the environment's material quality. Interpretation of materials properties, or the lack of these properties, highlights the cognitive process and, at the same time, relates to what was highlighted in the second chapter within the section discussing abstraction. The processes of cognition are the main drive behind deducing scale, but the nature of engagement with the environment is dependent on the material properties, which in turn affects embodiment. A user encountering an environment with high level of material properties is more likely to engage with this environment; in turn, there is a higher possibility of inflecting a sense that might cause a perceptual change in embodiment. However, in an environment with a lower level of material properties, the engagement with the environment is not embodied, and therefore, the scale is preserved. The material properties being questioned in this subcategory are independent of the objects that possess them. Therefore, when a subject encounters an unfamiliar environment, i.e., that has no recognisable or known objects, higher level of material properties may cause the subject to readapt his scale to suit his perception. By contrast, the role of these material properties is reduced or perhaps diminished when recognising an object of a known scale such as a staircase, or a door.

The material properties may not feature prominently in the process of cognition, but their effect can be easily traced and isolated. For example, one of the subjects commented on the fact that the presence of a strong reference to scale (the staircase) gave her the feeling that her scale is normal.

(109) “I feel normal … because I can see myself wonder around there”

When asked about the effect of the material properties on her perception and engagement, she said:

(110) “They do not distract me.”

The strong reference eliminated the role of the material properties. But when we have another look at it, we find that the role of the material properties is not as important as the role of the known reference. It also follows that the process of interpretation for any spatial experience is dependent on the knowledge held by the subject, and to the exclusion of any new details.

The lack of material properties permits a certain level of interpretation, which helps in constructing narratives about embodiment that does not include scale. The sense of being engaged with the environment is replaced to a reaction against the environment. For example, this subject isolated herself from the environment.

(111) “No … I do not see myself so much in that.”

Nevertheless, when she was asked about the reason, she stated that material properties that were missing prevented her from relating to the new version of the same environment.

(111) “… because of the details that we had in the previous image and we do not have here.”

Accordingly, the same environment was engaging when it revealed more material properties. It is also notable that the subject reacted to the loss of material properties by expressing her sense of ‘*disorientation*’.

With the presence of photorealistic materials, the subject seems to perceive the details and properties of these materials. But with the absence of these material properties, the subject perceives the environment as a 2D flat image or a series of flat frames.

5.6.3.3 Details of Surface Level Perspective

The narrative regarding the details continues here as well. The prominent element that adds to this narrative is embodiment. The details of surface level perspective add to the perception and cognition an extra layer that reinforces embodiment. While the first subcategory had the human embodiment fixed on the scale of a normal human,

the details of grime and rust implied the role of certain factors such as time and object's scale beside the way in which the object is encountered by us. Introducing material properties or abstracting them, ignites the process of interpretation which is part of the cognitive process of how we perceive scale. At this point when the details of surface level perspective are introduced, the perception of objects and the material properties of these objects are both combined with the way we encounter these details within a perspective. The result is a perception that leads to a cognition which highlights embodiment. Here, the narrative about details is completed. It concludes the various aspects of the relationship between our embodiment and the details of the objects we encounter.

Subjects' accounts illustrated this narrative in various ways that were highlighted by the nature of embodied interpretation. The interpretation came as a result of cognition, and delivered a host of views regarding the object, the environment and the scale. If a subject states that the perspective is 90 degrees inclined, then this is a statement. When the subject expresses that the inclined view is a view of small object, then s/he is deducing a visual experience. When the subject states that his body is small, then this is a personal statement regarding embodiment. This personal interpretation connects the subject and the environment. It also develops a narrative that interplays perception environment and embodiment. Surface level perspective is again a strong cue if the surface is the ground, but if the surface is a wall, and unless coordinates of view take the wall surface as the lower part of the screen, it will not affect the scale of the subject (*Figures 61 and 62*).

Figure 61. Surface level perspective of a wall. Yet the angle of view suggests movement perpendicular to the wall. This suggests a change in scale. (Model and rendering by Matthew Murphy)

The items we chose for this subcategory presented two different perspectives that reflect two different degrees. The first perspective is a frame taken out of an

animation. The frame presents an inclined surface level perspective (*Figure 61*). The 30 degree inclination presents a unique situation since it places the observer in a position of uncertainty. It is not clear from the figure if the subject is tilting his head, if the environment is inclined or if the subject's orientation is totally different. The normal horizontal nature of our perspective is questioned by the inclination in the surfaces in the item. As a result, the subject may need to interpret his spatial location. Shadows cast in the perspective gave a neutral effect since it did not form any specific angle which added to the indeterminacy of the inclination.

By contrast, the second item (*Figure 62*) displayed a vertical plane with a clear texture, but with a confusing depth of field. The result questioned subjects' perception of the details of the surface level perspective, but did not question their embodiment or scale. In both items, the surface level perspective did not introduce a challenge to embodiment. Most of the subjects related this to the fact that the shots were familiar in both cases, and that they were not presented with something new. They also noted that both items did not challenge their perception, or did not present a new challenge. The material properties in both cases compensated for the strange perspective, and rendered the scene normal.

Figure 62. Surface level perspective of a wall but with no change to the angle or scale. (Model and rendering by Naomi Harris)

5.6.4. INTERACTION

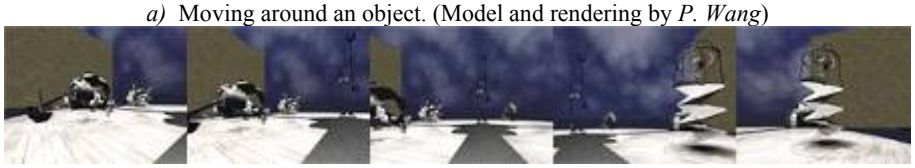
In all previous examples, the introduced items depicted rendered shots of 3D environments, animations of scenarios within 3D virtual environments or, in some cases, QuickTime 3D movies. All of the above items permitted limited or no interaction. Subjects' actions did not trigger reactions from the items. On the contrary, this section presents items that provide this capability at different levels of

interaction. The interaction offered was mostly spatial interaction in the form of navigation. However, the objects' scale did vary according to the environment; consequently, their proximity to objects varied. The objective of this category is to explore the effect of interaction on the perception of scale. We divided the interaction according to the scale of human embodiment on the basis of *'proximity and action'* and *'partitioning'*. Both are features of space as devised by Harrison and Dourish.[436] This produced two subcategories: interaction with objects within arm's reach and interaction with distant objects in space.

5.6.4.1. Interaction with Objects within Arm's Reach

The subcategory presented three ways of interaction with objects within arm's reach: a) to move around an object, b) to look around space from one point and c) to have an object rotate in front of you. The three choices above were the most common among the designers in the course. Designers had the tendency to display space and objects in their animations, using one of the three spatial manoeuvres. It is also worth mentioning that most of the 3D Software used in producing these animations provides capabilities that enable designers to view the objects in of design in the three ways mentioned above. This is not to say that the software interface design influenced designers' choice of animation movement, nevertheless, it is a factor that is worth mentioning. Subjects' proximity to objects changed according to their interaction, or according to the animation displayed. Some animations gave subjects the illusion that they were going through objects and their materials.

a) Moving around an object. (Model and rendering by *P. Wang*)



b) Looking around the space from one point (Model and rendering by *P. Wang*)

436 Harrison, S. & Dourish, P., 1996. Re-place-ing space: the roles of space and place in collaborative systems. In *Proceedings of ACM Conference on Computer-Supported Cooperative Work CSCW'96* (Boston, MA). New York: ACM, pp. 67-76.

c) Having the object rotate in front of the viewer. (Model and rendering by *K. Tong*)

Figure 63 (a,b,c) . Screen shots of frames showing the nature of movement

The first item (*Figure 63*) in this subcategory is an animation that depicts normal surroundings with slightly increased scale to give the viewer the impression that he or she are smaller than usual. Nevertheless, the combination of details of textures and material provides inconsistent reference points to scale. The animation adopts a spatial manoeuvre that gives the illusion of moving around the object in the animation. It also gives the illusion of moving through the object. The closeness to the object in display is reflected in the size of the object within the projection. When subjects stand close to it, the display exceeds the edges of subjects' visual field giving the illusion of immersion. This feeling is further exploited by the process of interaction. One of the subjects highlighted the process of recognition and realisation of the objects within the animation. She reported:

(112) "… for this one I felt it because I realise there are 3D objects … I was not disorientated in this movie, I did know how to touch those objects, where to touch them."

This sense of certainty is partially due to the state of awareness which the subject was in. She reported she was in total awareness of all the surroundings. The other reason for this certainty is the familiar point of view. The subject reported she did not feel disoriented in that animation, and in comparison to other animations, this one had a relatively normal point of view. When asked about her scale, the subject felt smaller than usual. Her feeling was induced by the angle of the camera in the film. It gave her the feeling she was looking up to something.

(113) "A little bit small … because of the way that I see."

Although this view was common, i.e. considering the camera to be our eyes in the virtual world, there were other views that counteracted this basic assumption by a process of isolation. This view had a dual aspect whereby the camera is the subject's eye in the virtual world, but it is only the eye that exists in this world. The body is

not there in its totality. This, however, is expressed in a reversed way. The following example illustrates how this duality operates.

(114) "Because of the sort of the way you are moving in and looking up. It feels like sort of a journey in … and it feels like you are sort of looking up towards something, so, the way the camera is moving gives the impression that it is just a person walking and looking up around …"

The subjects first used '*you*' but with the intention of referring to '*I*' to refer to the action depicted in the animation. To him, he was moving and looking up. This however, changed when the camera was brought into the conversation. When the camera was mentioned, the '*I*' changed into a '*person*'. With the eye, the action was embodied, whereas, with the camera, the immersion was disembodied. However, the embodiment was retrieved once again when subject use the verb to see.

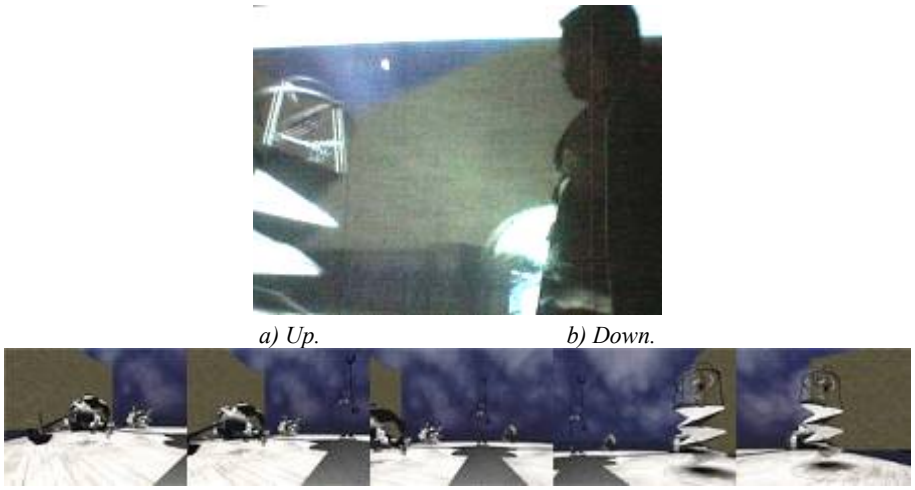
(115) "… and you can see just a little bit of texture on the ground there as well, which kinds of helps a little bit to add some sense of scale."

The proximity induced a stronger sense of interaction. Embodiment was implicated through the act of grasping by the hand. The sense of distance became more prominent as well, due to the process of comparison with the sense of closeness of objects.

(116) "Well, those are coming quite close past you so you do feel that you are passing through those and that they are touching you and stuff. But once you are through that there, nothing here feels close enough to touch. I mean yeah, you can sort of grab that, but the rest of it, it feels like they are on display, and it does not seem to get close enough to you that you could actually touch it."

The first item (*Figure 63a*) established that looking around an object is a strong cue of immersion when coupled with the embodied sense of closeness which is manifested in the ability to perform the bodily act of grasping with the hand. The bodily action is attributed to the *other* in the environment, while the viewing of the environment is attributed to the *self*. The embodiment is viewed in the *ready-to-hand* mode when interaction is visual, while when interaction in virtual environments exceeds the visual barrier and slides into the bodily interactive mode, the

embodiment's acceptance of surrounding virtual environment drops and results in the *present-at-hand* mode of interaction.



a) Up. *b) Down.*

Figure 64. A subject (a), looking at the motion described in the series of frames (b). (Model and rendering by P. Wang)

The second item (*Figure 63b*) in this subcategory pointed out a different aspect to the duality that came into light in the previous subcategory. Initially, the purpose was to rotate the subject's view around an axis radiating from a fixed point on the ground. The subject would rotate to view different objects that would progressively get closer to the subject. The expectation was to achieve a feeling of being smaller when the objects in the environment get within hand reach of the subject; however, we were faced by a different aspect of embodiment. The first item suggested that subjects lose their sense of embodiment when interaction exceeds the visual barrier, whereas, this item suggests that this sense of embodiment is somehow restored when objects within a virtual environment get visually closer to the subject. For example,

(117) "… there is something else that becomes too close … that <u>becomes actually invasive</u>. It invades our space and it becomes very close, and some of that there, I would say as far as interacting goes … ok… I know it <u>is an image</u> I am looking at, but … as far as their closeness to me … if in real life something was that close at that sort of speed, I think I would find it almost … yeah that <u>it is invading my personal space</u>, and I would <u>want a little bit distance from it</u>."

The act of invasiveness is performed by the object against the body of the subject. The subject's awareness of his personal space was simultaneous with his perception of the *image* of the environment, and it was actually raised by the interaction with what he called *image*. The change of the display caused the interaction due to the nature of our embodiment, and the normal reaction would have been to distance ourselves from such invader of personal space. However, the environment's *ready*ness-*to-hand* is promoted by the closeness and sense of being within hand's reach. In a literal manner, being within one's hand reach makes an object *ready-to-hand*.

The invasiveness is induced by closeness to one's reclaimed embodied experience. The same experience is subjected to another condition whereby it is lost again. When an object within a virtual environment is displayed in a manner that depicts it going through your virtual body (by going through the camera that is rendering the scene), subject's embodiment is suspended. Hence, interaction with distant objects is mainly visual, but develops into an embodied interaction when objects get closer. When objects exceed the perceptual body barrier the embodiment is lost again. This is explained by some of the subjects.

(118) "… there is no material, it is quit flat, you are sort of pushing through it, which of course is not a real sensation. It is almost as if you are just passing through the material, which also causes you to suspend belief because you are just passing straight through it."

This view is mirrored by different subjects. For example:

(119) "I am not passing through gaps; I am actually just passing through it … and it happens with so much frequency that you can't place yourself there. You cannot sort of immerse in that because these things, it is not as if they are going past you and you are taking a sort of route through them.

The subject justification is that such action would not take place in the real world. Therefore, such action is hard to relate to and engage in an interaction with it. Another subject suggested alternatives to engage such closeness.

(120) "Like some of the other ones where there was some nice set paths, you know, you can kind of suspend belief, and you can engage with

them. But whenever you are just blatantly passing through them, you know material after material; it becomes harder to engage really with the environment."

The general character of the views above is that subjects were encountering a virtual environment where they felt the necessity to engage with the environment in its totality. However, one subject turned things around and, instead of addressing the totality of the environment, he looked at different objects as being independent. Consequently, his account addressed various aspects within the environment. First, he acknowledged his embodiment in the environment, but dismissed the object as being unreal because he could not identify it.

(121) "There is nothing realistic for me to touch, it is abstract. It did not feel like something I can touch because I can go through it."

When he was quizzed about what he meant by *abstract*, he said:

(122) "Well, there is no materiality. I mean what kind of material is this? For a start… and the shapes, they are not associated with anything. The only thing could be glass, or some sort of crystallised thing, but then I was moving through it."

The subject asserted his embodiment, and dismissed the object in the environment for having no materiality because he "was moving through it". This account demonstrates the subject's ability to interact with the environment in the *present-at-hand* mode. It also demonstrates that engaging in a virtual environment and accordingly adjusting one's scale could be a decision made for a host of reasons.

The third item (*Figure 63c*) is the 3D QuickTime movie depicting one of the vehicles proposed by designers in the course. Like all other items, the nature and function of the object is unknown to the subjects. The item permitted a limited level of interaction in the form of the ability to control the view by rotating the vehicle. This exceeded previous items since they did not permit similar control. When subjects were quizzed about the scale of the object in conjunction with the interaction, we gained some interesting insights on how they *interact* together.

The first prominent topic was the sense of control which came as a result to subjects' ability to manipulate the display. This ability to control resulted in the sense that the object being controlled is small in scale. For example:

(123) “The size of the object was … actually I do not know about the size of the object ... I am not sure. Maybe I perceive it as being, as if it was small.”

The subject voices her reluctance to decide the scale of the object for three times before she makes the decision that it is small. We suggest that the reluctance is the result of the contrast between the fact that the object is a vehicle and the interaction whereby this vehicle is manipulated. This view was corroborated by other subjects in different ways. For example this subject expressed the ability to control the object by moving it, however, the movement implied is the direct result of what is enabled by the QuickTime 3D movie:

(124) “… maybe the movement has to do with it ... the way you can move it around [an axis].”

By contrast, the following subject expressed the ability to control the object by an expressively embodied interaction:

(125) “… the shape and form of it, and the way I am looking at it ... the way it is moving around suggests it is a small object that I can pick up.”

The type of action suggested by the subject exceeded what is permitted by the QuickTime 3D movie either interactively (in the form of rotating the object around) or passively (in the form of viewing the environment as a visual stimuli). The object scale was deemed by subjects as small in scale, and the subject’s embodiment had a normal scale.

(126) “I was feeling normal [in terms of scale].”

However, one subject reported a different view upon recognising the fact that the object looked like a vehicle and, consequently, he made a reference to embodied interaction.

(127) “I suppose you can see yourself sitting in that so there is something quite real about it, so I would see myself just at a normal size and I would see that as something upper in the size like a fighter plane or something like that.”

He also recognised that his sense of control might be the reason for his feeling of engagement.

(128) “I mean you are engaged more with that because you have some sense of control. You are engaged slightly more with that, than you were engaged with the previous animations [because] you feel there is some source of response there.”

Nevertheless, the subject rejected the notion that this engagement could lead him to feel that he can touch the object:

(129) “… no, it is just a 2D image ... you would really have to get into projecting a dual image and the glasses thing to give somebody the sense that they can actually reach it and touch it.”

This view gave the primacy to vision over interaction. To achieve a sense of engagement, the subject needed to feel visually involved. This, according to the subject, would be achieved by perceiving depth. Without this sense of depth, the display is just a 2D image.

This account is interesting, but it contradicts another account that viewed things differently. To this subject, embodiment is a strong component of the daily experience. Consequently, any association between the body and other visual displays constitutes an embodied experience. In other words, the amalgamation of the body with any form of display renders the display embodied. This takes us back to the amalgamation of concepts and the resulting forms of interaction between real objects (the human body) and virtual objects (3D display of the vehicle).

(130) “I think what has happened, when I went close to the screen. I could see my hand on the screen, and that corrected my scale. Cause initially I thought everything was bigger than me. But when I went close and when I stood up on the ground, when I felt the ground, and when I stood next to the screen, I had information telling me about my own scale, and I had information telling me about the borders of the image … so therefore, everything else became smaller and I felt as if I could touch it.

The account above clearly states actions induced by the conceptual amalgamation. The opposite standpoint views the displays as 2D images with no depth and a limited ability to control. However, having objects within arm’s reach is a major contributor to immersion. Once an object is felt to be touchable, it can affect the determination of

the subject's scale due to the implied embodiment. The fact that the object is within arm's reach, helps the subject judge the scale of the object accurately. This seems to reflect on the sense of scale of the object *(Figure 63*).

5.6.4.1. Mode of Interaction with Objects within Spaces

In this section, subjects had the chance to interact with objects in a 3D virtual environment and had the chance to get close to objects, far from them, look at them from different points of view, move in different speeds, and had different versions of the environment with different focal lengths (*Figure 65*). This showed how the combination of all these elements could affect the perception of scale in virtual environments. The crucial element in this subcategory is the presentation of the same element, which is an interactive 3D virtual environment that is available for navigation, but in two different scales. The first version depicted the scale of a normal human being. The depiction is enforced by implementing most of the previous categories and subcategories to the desired effect. For example, the starting point in first version is 180cm over the floor level; the width of the lens used is a normal 50; the permitted speed of movement is the average for a human walk; the mode of level of the view is always perpendicular to the ground level; the sonic quality reflected a normal level decaying per distance; level of details were average. By contrast, the other version had the opposite extremes in order to depict an environment that could be fit for an insect crawling on the floor. This was reflected in the point of view; the perspective; speed of movement; lens size; sonic quality …etc.

Figure 65. A Shockwave 3D interactive virtual environment of a physical space within the University: the Playfair Library, with small scale (right), and normal scale (left). (Model, rendering and programming by Aghlab Al-Attili)

All subjects perceived the first version as a normal environment. All of them felt normal in terms of scale. They identified the space as a large hall and some of them recognised the hall as a hall that they visited before. All subjects found it easy and rather intuitive, and somehow fulfilling to move around and explore the space. In particular, subjects that did visit the real space found that the virtual space introduced lots of other elements that they did not register when visiting the real space. In a way, it seems that the level of engagement in the virtual environment stimulated the perception of details. Another element that was prominent in the virtual environment was the movement. The freedom of movement permitted by the virtual environment encouraged the subjects to explore various parts of the space. In particular, they flew up to the ceiling to check the details, and looked on the sides to better examine the architraves. They also went down near the floor to check the new perspective, and made various remarks about feeling like a 'mouse' or a 'cat' … etc. It was also quite notable that looked closely on the statues that were distributed in the hall, and some of them took the point of view of the statue. The overall sense of familiarity in the space overcame other senses, and produced a rather smooth interaction. Subjects felt as if they took part in the existence taking place in the environment.

By contrast, the second version, which was presented after the first one, introduced rather unpredicted attitudes and results. All the subjects failed to recognise the relationship between the first and the second versions. Some recognised the environment as a different hall than the first one, and suggested it was much bigger, whereas some thought the planes of the hall were not rectilinear. One of the subjects went far and perceived the environment to be a train station. When asked about the reason, he blamed it on the nature of the sonic quality and the perspective. While some of the subjects felt the movement was really slow, others did not realise that there was movement at all. By contrast, all the subjects expressed their surprise of the speed of rotation. They felt that the change in perspective amplified the effect of rotation, whereas, and the lack of change of perspective in the case of the forward movement, did affect their perception. Most of the subjects

navigated in the environment to reach a point of view that might deliver a relatively close-to-normal perspective. This was done by changing the height of the point of view, and by getting closer to objects in order to remove the effect of the strong vanishing point. They also tried to move in a calculated speed in order to maintain a relatively stable change of perspective. Most of the subjects attempted to reach the familiar level of interaction that they are used to.

The overall accounts of subjects in the second version expressed the sense of being startled. The encounter with the environment revealed a new perspective and offered an interaction that was not familiar before. The novelty of these elements of immersion in virtual environments could play a vital role in giving subjects a different perspective to various different spatial experiences. Most importantly, it could give subjects the chance to experience difficult spatial scenarios.

5.7 Conclusion

This preliminary study indicates that perceptions of scale vary according to a range of factors, and these are interrelated. Presumably concepts of scale already have fairly sophisticated expressions in the practices of architectural designers, draftspersons, geographers, and cartographers. Technically, scale is a fixed ratio between the dimensions of the representation and the object being represented: 1:1, 1:50, 1:100, 1:10,000, etc. It is most comfortably discussed in the context of orthographic projection (plans, elevations). In the case of perspective projection, however, scale refers more to the size relationship between the viewer and the viewed object. None of the subjects interviewed had difficulty discussing scale, and change of scale, in this context.

Scale was discussed in a different context in relation to the previous chapter. Accordingly, scale was treated as an attribute of visual stimuli whereby if it was to be eliminated by the process of abstraction of a space, the viewer would have a different experience. The experiment contained still images and animated scenarios of various objects; and focused on the subjects' accounts of what it feels like to be engaged in a virtual space in terms of its implications on embodiment, and to use scale to create what we may describe as various embodied expressions of that

engagement. From the outset, accounts of componential analysis and compositional interpretation were offered to aid in analysing the visual factors as well as the objects' qualities within any given image or animation. This resulted in producing images and animations that could be conventionally associated with the conceptual development of scale.

Scale has been referred to in the past as "an attempt to control a spectator's impressions of size through a system of proportions, or through directly designing for his visual experience".[437] Le Corbusier's modular was an attempt to embody this impression with a system of numerical values, but in this chapter the results argue for a slightly broader account which identifies scale as *a quality of human embodied engagement with intimate space*.

An instance of scale marked down on an architectural drawing is an indicator of a quality of human embodied engagement with the space which is represented in that drawing. The chapter in which abstraction and representation of space were discussed provided a conceptual or diagrammatic structure that can be recalled to introduce scale as a concept-image duality. When reflecting on the abstraction of scale, we find a concept that relates Dasein's perceptual experience of embodiment to other objects in space. The concept extends beyond objects of perception to objects of cognition in an interchangeable process of interaction.

When reflecting on the representation of scale, we, rather than controlling impressions of size or systems of numerical values, find a developmental tool deploying the concept of scale to support a constant and huge process of reasoning through perception. The power of scale stems from its ability to connect objects to our embodiment through reasoning of the relationship with these objects.

In the previous chapter the notion of embodied behaviour that aided subjects in navigating an abstraction of a daily used space through the mere power of embodied habits, was used to introduce a mental operation that supported the process of embodied interaction. The comparison between subjects' accounts on still images and animations gave phenomenological evidence to support the notion that scale can be extended to a broader account. According to this account, the change of an object's perceived size as a result of animation in which the object appears to be

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437 Licklider H., 1965. *Architectural scale*. London: The Architectural Press, p. 29.

moving is treated as a rate. This rate is the product of the change of the visual stimuli in relation to the human embodiment. The change in the size of the visual stimuli is accompanied by various changes in other perceptual stimuli should the subject encounter the real physical object. The changes that accompany visual stimuli in the form of scale manipulation are manifested in two different ways according to the nature of change and if it is positive or negative in value. The significant aspect of the phenomenological reports is that they gave the working details of the deployment of the concept of scale. The embodied aspects of these accounts highlighted the importance of the role of image in portraying the attributes of objects of the deployment. It is through the image manipulation to alter scale, and the components represented in images that the subject activates scenarios of embodied interaction or otherwise.

Generally, the accounts introduced subjects' description of scale as embodied notion. The subjects' perception of scale was initially an attempt to interpret the frame taken out of a scenario where objects exist in an environment. When a frame introduced an animation, a process of interpretation was deployed whereby scale was abstracted from the relationship between object's disposition and subject awareness of its displacement. This was further elaborated by the object's movement and how it figures within the general context of environment. The subject's ability to infer scale is uncoordinated, rather, affected by reference points that when absent, it results in their inability to decide scale in relation to their embodiment or in relation to the object of perception. When a frame introduced a still image, scale emerged as fixed image of a dynamic concept related to human embodiment. This fixed image or instance of scale was quantifiable, although the lack of interaction with it may have suggested the opposite. Still images offered still instances of scale which in turn allowed a incremental understanding the concept of scale concept in a process that can be analogical to interpolation of human embodiment.

The visual stimuli offered a better chance to understand the visual and interactive aspects of scale. Scenarios in animations and still images permitted the process of interpolation due to the nature of the part/whole relationship between them. However, various other perceptual stimuli could not offer the same potential of incremental understanding. In the section discussing the sonic qualities, we made the

case that the kind of sonic stimuli perceived in an environment are foundational for grasping the scale of engagement in that environment. The sonic qualities permitted a better understanding of scale of perceived objects and subjects' own embodiment.

In the section discussing the effect of embodied interaction on the perception of scale, it was demonstrated how subjects with design background improvised steps of interaction that achieved two contrasting results. The first was in allowing them to better understand a known space and explore it in various ways otherwise not available in their normal embodiment. The second was in obstructing the process of understanding objects' relationship to their bodies and to the surrounding space.

The major factor in validating this procedure of phenomenological experimentation, arguably, is in the actual process of developing instances of human experience by designers; instances that reproduce both conceptual and imaginative alongside daily experiences which in turn reflect a process of thinking. Without these instances, subjects, who were designers as well, could have not composed an account of the situation that their fellow designers successfully framed, thus moving it from the domain of the *ready-to-hand* to the *present-at-hand*. Subjects could have not perceived the dynamics of scale without the richness of the accounts of the instances of scale involved.

The presence of various phenomena pertaining to scale aided in perceiving and perhaps forming new associations and attributes of the nature of engagement with space in terms of scale. The engagement is pertaining to the relationship between the human body and objects in space. Should this have not been the case, the alternative would have been the simple understanding of scale as mark drawn on an architectural drawing to imply the proportional relationship between the drawing the real object.

The argument in this chapter discussed scale as a cue of immersion in virtual environments. The chapter touched on the role of scale in enhancing the understanding of design for students of architecture. Scale's mediation between perceptual stimuli and embodiment proved to be in the essence of human experience of the environment. Accordingly:

1- Virtual environments consisting of coordinated cues of immersion can consolidate concepts resulting in illusions over constituted embodiment.

2- Users deployment of constituted modes of embodiment permits a richer account of engagement and interaction with space as the conceptual framework of *being-in-the-world*.

3- Images forming instances of *being-in-the-world* may result in various activities and their products that exist only in the virtual environment.

The background experience and training of the subject plays a major role in perceptions of scale. Expectation is a significant theme of perceptual studies in phenomenology. If an object that has the shape and texture of a beer glass or a slice of cheese enters the perceptual field then that triggers expectations about the size of the viewer in relation to the environment. But as attested by fantastical painting, from Hieronymus Bosch to the Surrealists, familiar objects in unfamiliar contexts create ambiguities that excite the senses in new ways. Most of the imagery presented to the subjects exaggerated the issue of scale in some way, provoked interest, and evoked interesting responses. Designers at least seem to enjoy, and are engaged by, visual imagery that presents ambiguities of scale.

Much of this engagement by the subjects had the character of play. Subjects enter into the "experimental" situation as if participating in a game. They played along with the theme of the study. According to one participant: "I feel like I could crawl into that piece of cheese." We assume that such assertions, and the expressions of feelings of vertigo or dizziness in some cases, were analogous to the putative emotions recounted in the case of watching an engaging film. We are not easily fooled into believing that the images before us are real, but we enter into the experience as in play. The play element was also evident as we observed how respondents would adapt their expectations according to what had already transpired. Each situation in the study further consolidated the rules of play for the next stage. The subjects spontaneously discussed issues, problems, misgivings, and confusions about the images being presented in terms of the theme of the study: scale. To a subject whose experience is being framed in terms of scale, everything becomes an issue of scale. On the one hand this vindicates the issue of scale as a major

determinant of our immersion and engagement in digital environments. It is also testimony to the importance granted within phenomenological study to the roles of projection, metaphor, and imagination in perception.

This chapter tackled the perceptual and physical elements of human experience such as objects existing in space that can be described as physical phenomena, but did not discuss mental phenomena such as behavioural codes of interaction. The next chapter will present an attempt to discuss virtual elements of human experience. The example to be presented will be ethics.

Conclusion

6.1 Summary of research

The aim of the thesis was to answer the following questions:

1- How can human embodiment be informed by intimate space, and in what way does the latter affects the former?

The analysis demonstrated various aspects of the relationship between the intimate space and its users' embodiment. The complexity of the concept was demonstrated in the responses from subjects and the scope of topics that were included. Accordingly, intimate space and virtual space were deemed as characterisations of space on the basis of embodied perception and interaction; and hence formed the basis of the extended exploration and research that was carried out subsequently. This thesis has concluded that the perception of intimacy seemed to be a reflexive process in which human embodiment is shaped by the first intimate space, and in turn affects subsequent spaces of being. The thesis has also concluded that the perception of abstraction and representation of intimate space demonstrated the presence of tangible and intangible aspects of interaction.

2- How does embodied interaction with/in virtual space utilise familiarity as a link between intimate physical space and virtual space, and is there a thorough understanding of the definition and role of familiarity in the literature on embodied interaction?

The main issue in question was the lack of a clear understanding of how familiarity operates. Intimate space, its abstraction and its representation were used to test the definition of familiarity in order to produce a better understanding of intimate space and its relationship with virtual space. The interaction with the abstraction and representation of intimate space produced two types of familiarity: *emotional familiarity* and *spatial familiarity*. Both types of familiarity acted as a representation of intimacy or as a side effect to this intimacy. Familiarity came across as a reaction to intimacy produced by human embodied interaction with physical space. When physical space as a concept was amalgamated, the underpinning embodied interaction with the virtual space preserved the familiar emotion and interaction.

Familiarity, in turn, produced a different understanding of virtual space. Intimacy moved from being the character of interaction with space to the condition of interaction; a condition that highlights the knowledge of one specific instance of space. Familiarity, on the other hand, appeared as a tool to produce a convincing interaction between the user of intimate space and multiple instances, copies or modes of this space.

Familiarity is the representation of intimacy in space representations. Hence real space is intimate and virtual space is familiar.

3- Is it possible to understand embodiment and embodied interaction using various foci such as *ethics* or *scale*?

The experiments and the following discussions of intimate space revealed various aspects that contribute toward a better understanding. The compiled list of results and their evaluation shows startling possibilities, further establishing VE as an arena for investigating issues pertaining to both architecture and ethics. It reinterprets Dibbel's words - that 'To participate, in this disembodied enactment of life's most body-centered activity [sexuality] is to risk the realization that when it comes to Ethics [and not only sex], perhaps the body in question is not the physical one at all, but its psychic double, the body-like self-representation we carry around in our heads.'[438]

The question of deploying various foci to understand embodied interaction developed several promising themes. The comparison of the *ethics of place* in RE and VE seems to promise a wealth of potential investigation that could follow on. Beyond the analysis of *trust*, *signification, consciousness* and *unawareness* that were tackled here, a number of other issues were raised during our experiment, but cannot be expanded upon in the limited space of this research: the understanding of the task as a *game*, the connection of trust with the existence of an already strong community, the connection between the attention to navigation; and the lack of focus on the ethical dimension of the task and ultimately the dilemma of the virtuality. The disembodied nature of the virtual medium leads to a different discussion that highlights issues pertaining to privacy in cyber space as an element that is most

438 Dibbell, J., 1998. A rape in cyberspace (or TINYSOCIETY, and how to hake one) in My Tiny Life, (http://www.juliandibbell.com/texts/bungle.html: June, 2006) First published in somewhat different form in The Village Voice, December 1993, Par. 16.

evident in daily practices in computing. It also frames the dilemma of repetition between VE and RE.

The tangible element of scale was discussed in a different context. Accordingly, scale was treated as an attribute of visual stimuli whereby if it was to be eliminated by the process of abstraction of a space, the viewer would have a different experience. When reflecting on the representation of scale, we, rather than controlling impressions of size or systems of numerical values, find a developmental tool deploying the concept of scale to support a constant and huge process of reasoning through perception. The power of scale stems from its ability to connect objects to our embodiment through reasoning of the relationship with these objects.

The comparison between subjects' accounts on still images and animations gave phenomenological evidence to support the notion that scale can be extended to a broader account. According to this account, the change of an object's perceived size as a result of animation in which the object appears to be moving is treated as a rate. This rate is the product of the change of the visual stimuli in relation to the human embodiment. The change in the size of the visual stimuli is accompanied by various changes in other perceptual stimuli should the subject encounter the real physical object. The changes that accompany visual stimuli in the form of scale manipulation are manifested in two different ways according to the nature of change and if it is positive or negative in value. The significant aspect of the phenomenological reports is that they gave the working details of the deployment of the concept of scale. The embodied aspects of these accounts highlighted the importance of the role of image in portraying the attributes of objects of the deployment. It is through the image manipulation to alter scale, and the components represented in images that the subject activates scenarios of embodied interaction or otherwise. Scale's mediation between perceptual stimuli and embodiment proved to be in the essence of human experience of the environment. Accordingly:

a- Virtual environments consisting of coordinated cues of immersion can consolidate concepts resulting in illusions over constituted embodiment.

b- Users' deployment of constituted modes of embodiment permits a richer account of engagement and interaction with space as the conceptual framework of *being-in-the-world*.

c- Images forming instances of *being-in-the-world* may result in various activities and their products that exist only in the virtual environment.

4- How can this understanding aid designers in the process and method of design for interaction in virtual environments?

The major factor in validating this procedure of phenomenological experimentation, arguably, is in the actual process of developing instances of human experience by designers; instances that reproduce both the conceptual and imaginative alongside daily experiences which in turn reflect a process of thinking. Without these instances, subjects, who were designers as well, could have not composed an account of the situation that their fellow designers successfully framed, thus moving it from the domain of the *ready-to-hand* to the *present-at-hand*. Subjects could not have perceived the dynamics of embodiment without the richness of the accounts of the instances of embodied interaction involved. The experiments and the following discussions of intimate space revealed various aspects that contribute toward a better understanding.

The concept of intimate space is largely based on human interaction, engagement and emotional involvement with space. The example given by Bachelard, aided in phenomenologically analysing the role of intimate space in forming and shaping embodied habits. The emotional involvement with intimate space characterised the space with what can be described as protection quality. One of the most important aspects of a shelter is the sense of protection, which might contribute toward a sense of trust between the user and the space itself. As one type of space, intimate space relates to other types through various connections: we identified the original/copy connection. According to this connection, users of any space have the tendency to treat that space as a copy of their intimate space. Although spaces are not similar, users' attitudes toward them are based on the original attitude toward intimate space. We also identified the emotional connection between users and their intimate space. The connection was brought into light due to our subjects' awareness of its absence when interacting with the virtual environment. The functionality of intimate space is not inherently essential in supporting the importance of this space. Any intimate space can be intimate without having to be functional. The main element is the ability to provide shelter to its users. However,

any functionality provided by an intimate space can provoke the nostalgia for a similar functionality in any other space.

The connection between intimate space and familiar space was explored in the second chapter by analysing the perceptual elements of intimate space and then putting them into a test based on interaction. We found that the abstraction and representation of intimate space produced emotional and spatial familiarity. The introduction of interactive virtual environments corresponding to physical environments contributed toward problematising the concept and image of intimate space. Subjects' accounts of their experiences revealed an aspect of the relationship between intimate and virtual space. The revelation suggested that virtual space is the 'familiar stranger'[439] that subjects recognise, but with whom interaction is not equally possible in the same magnitude as in intimate space. Familiarity describes the mode of embodied perception and interaction with virtual space, not the space itself.

The relationship between subjects and their intimate space is based on the sense of protection and security. Such sense forms the ground of repetitive or habitual emotional involvement with space. There are many intangible elements that can be introduced, but we chose ethics. Our choice elicited the nature of our ethics and how they were modified to better suit our new mode of space. Trust in intimate space transformed into trust of the medium of virtual space. The notion is far from comprehensive, but possesses startling possibilities.

On the other hand, tangible elements appeared to be the trigger of interaction with intimate space and equally virtual space. The direct interaction with virtual space produced embodied attitudes towards it. Scale, as a tangible element, provided a unique opportunity to explore human embodiment from two different points of view. The first is the ability to explore it from the subjects' point of view while the environment is modified. The second is the ability to explore embodiment as a dynamic element that can be changed. The outcome came in the shape of extended subjects' accounts that can be used as a template for various reasons.

439 Milgram, S., 1977. The familiar stranger: an aspect of urban anonymity. In S. Milgram, ed., *The individual in a social world*. Reading, Mass.: Addison-Wesley, pp. 51-53.

The contribution of this thesis was presented at the end of each chapter, but due to the nature of experimentation, which was similar for all the experiments, the difficulties and limitations were common.

6.2 The Limitations of this study

6.2.1 CRITERIA OF SUBJECT SELECTION

Due to the topics of investigation and the nature of this study, the emphasis was placed on gaining insights from human experience. Phenomenology was embraced as the method to achieve this target. However, the subjective nature of human experience presents us with inconsistencies that are not only present between the views of different subjects, but also can be identified in the views of the same subject when interviewed more than once but with a space of time in between. This might be due to the change in views that could be the result of changing technology or a changing mode of engagement with technology or space. This observation came as a result of the choice of space to explore in conjunction with the subjects' selection criteria. From the outset a decision was taken to select subjects with design backgrounds who are the daily users of the space in question. As a result of the first decision, the criteria for selecting the space to be modelled had to take into consideration that the user group fit the selection criteria. Subjects, although they gave rich insights into the topic of each experiment, seemed to express their spatial experience differently from one experiment to the other. This could have been avoided by permitting a wider selection of subjects with design backgrounds to participate in the experiments, but this would have probably compromised the notion of intimacy and familiarity with the space. It was also possible to select subjects without a background in design from the daily users of the space, but this in turn would have most likely affected the choice of design terminology used in the experiment and results. The uniqueness of this study is evident in its choice of a physical space and a corresponding virtual space.

6.2.2 EMPIRICAL VALIDATION OF SUBJECTIVE EXPERIENCE

The subjective nature of human experience is one of the most difficult to capture in the process of experimenting. As a result, different techniques were used in gathering data. The questionnaires, although they were kept simple, had proven to be an efficient method of gaining insights into the main topics of interest within a group of subjects. The collective insights of all subjects formed a pool of topics for the unstructured interviews. However, the nature of embodied interaction may suggest an element of empiricism in the process of investigation. Many experiments were carried out with the intention of gathering both qualitative and objective data using empirical methods. It was the intention of this research project to include an empirical aspect of experimentation. Therefore, an eye-tracking method was used to track the movement of the subject's eyes when carrying out the task in the experiment. The eye-tracking was introduced into the experiment concerning abstraction and representation. The nature of the data gathered and the amount of analysis required has proven to be infeasible. This is mainly due to two reasons:

a) The data gathered from eye-tracking the subjects in the abstract virtual environment introduced a rather two dimensional set of movements that can be analysed in conjunction with the elements on the screen. By contrast, the eye-tracking of subjects in the representation of the virtual environment introduced a set of two dimensional movements but corresponding to a three dimensional space. The analysis of the latter introduced uncertainties due to the impossibility of producing an accurate interpretation of the data. In particular this was the case when analysing elements pertaining to the depth of field. The comparison between both movements would have not been categorically consistent due to the nature of the medium. Eye fixation time for each independent area or hot zone has proven to be dramatically different for each subject. A correlation can be detected between the subject's reported nature of the experience and the subject's performance of the task. The size of our sample, however, did not provide the statistical power that may be required to make assertions or claims. Without such power, claims cannot be made or verified, and instead, we may fall into generalisations. Although supportive to our overall subjective approach toward human experience, generalisations are counter-productive to the empirical nature of the method of investigation.

b) The amount of research and number of publications on the methods and techniques for eye-tracking are limited in size and specialisation. They are mainly concerned with tracking the eye movement when reading text, and in some cases with tracking shapes and figures. The latter was relevant when experimenting with the abstract environment, but for the purpose of the other environment, there was no reference.

As a result, the decision was taken to leave out this part of the experiment, and perhaps stage it as a future development and further investigation. The field is promising, and when interaction is enabled, a subject could navigate space using their eye movement, which is arguably the next step in the progression of embodied interaction.

6.2.3 THE TASK AND THE MEDIUM

Although questionnaires were worded carefully to investigate specific issues and generate precise topics, the following issues were somewhat notable among some subjects in some of the experiments. Some subjects focused on the computerised aspect of interaction with the virtual environment, which caused confusion. Accordingly, few subjects felt they were confident in using the interactive system, as opposed to exploring the environment.

Finally, future experimentation to further develop the concept should include the empirical aspects of research, mainly by utilising and building on the eye-tracking technique that was previously explored.

Bibliography

- A -

Abelson, R.P., 1976. Script processing in attitude formation and decision making. In J. S. Carroll & J. W. Payne eds., *Cognition and social behavior*. Hillsdale, N J: Lawrence Erlbaum Associates, pp. 33-45.

Achten, H.H. and VAN Leeuwen, J.P., 1999. Feature-based high level design tools: a classification. In Augenbroe, G. and Eastman, C., eds. CAAD-Futures (The Proceedings of the 8th International Conference on Computer Aided Architectural Design Futures). *Computers in Building*. Atlanta, USA 7-8 June 1999, pp. 2-9.

Achten, H.H., 1996. Teaching advanced architectural issues through principles of CAAD. In A. Ekholm, S. Fridqvist, & J. Klercker, eds., eCAADe (The Proceedings of the 14th Education in Computer Aided Architectural Design in Europe). *Education for Practice*. Lund, Sweden, 12-14 September 1996, pp. 7-16.

Active Worlds. 2003. *Home of the 3D chat, virtual worlds building platform*. [Online] Available at: http://www.activeworlds.com/ [Accessed 01-10-2007].

Active Worlds. 2003. *AlphaWorld*. [Online] Available at: http://www.activeworlds.com/worlds/alphaworld/ [Accessed 10-07-2003].

Agre, P.E., 1997. *Computation and Human Experience.* Cambridge: Cambridge University Press.

Al-Fairouzabadi, Majdud-Dein, 1986. *Alqamous ul-Moheit*. Ed. Yousif Al-Biqa'ei, Beirut: Al-Fikr. [Originally Published in 1383]. In Arabic:

- القاموس المحيط ، مجد الدين الفيروزآبادي (785هـ الموافق 1383م : 1986م) ، ضبط وتوثيق : يوسف الشيخ البقاعي ، بيروت : دار الفكر .

Al-Jawhary, Ismael, 1999. *As-Sahhahu fel-Lugha*. Eds. Emile Yaqoub and Muhammad Tarifi, Beirut: Dar Al-Kotob Al-Ilmiyah. [Originally Published in 1240]. In Arabic:

- الصّحّاح في اللغة ، إسماعيل بن حماد الجوهري (638هـ الموافق 1240م : 1999م) ، تحقيق: إميل بديع يعقوب ، محمد نبيل طريفي ، بيروت : دار الكتب العلمية.

Al-Masri, Ibn-Manthour, 1998. *Lessanul-Arab*. Ed., Yousif Al-Khayyat and Nadim Marashly, Beirut: Al-Ma'arif. [Originally Published in 1311]. In Arabic:

- لسان العرب ، ابن منظور المصري (711هـ الموافق 1311م : 1998م) ، إعداد وتصنيف : يوسف خياط ، نديم مرعشلي ، بيروت : دار المعارف.

Anders, P., 1999. Envisioning cyberspace: the design of on-line communities. In J. Beckmann, Ed. *The Virtual Dimension: architecture, representation and crash culture*. New York : Princeton Architecural Press, pp. 218-233.

Anderson, R.C., 1977. The notion of schemata and the educational enterprise. In R.C., Anderson, R.J., Spiro & W.E., Monatague, eds. *Schooling and the acquisition of knowledge*. Hillsdale, N.J.: Lawrence Erlbaum, pp.415-431.

Anderson, R.C., Sprio, R.J. & Anderson M., 1978. Schemata as scaffolding for the representation of information in connonceted discourse. *American Educational Research Journal*, 15(3), pp. 433-440.

Argyris, C., and Schön, D., 1989. Participatory action research and action science compared: a commentary. *American Behavioural Scientist*, (32) 5, pp. 612-623.

Austin, J.L., 1975. *How to do things with words*. 2nd ed. J.O. Urmson & M. Sbisà. Cambridge, Mass.: Harvard University Press.

- B -

Bachelard, G., 1958. *La poetique de l'espace*. Paris: Presses Universitaires de France.

Bachelard, G., 1994. *The Poetics of space*. Translated by M. Jolas. Boston: Beacon Press. Originally published: New York, Orion Press 1964, [French Version originally 1958].

Baier, A., 1986. Trust and antitrust. *Ethics*, 96(2), pp. 231-60.

Bain, A., 1868. *The senses and the intellect.* 4th ed. London: Longmans, Green, and Co.

Bal, M. & Bryson, N., 1991. Views and Overviews: Semiotics and Art History. *Art Bulletin* 73, pp. 174-208.

Barfield, W. & Hendrix, C., 1995. Factors affecting presence and performance in virtual environments. In *Proceedings of the Interactive Technology and the New Paradigm for Healthcare.* Washington, DC: IOS Press, pp. 21-28.

Barlow, J.P., 1996. A declaration of the independence of cyberspace. In J. Casimir ed., *Postcards from the net: an intrepid guide to the wired world.* Sydney: Allen & Unwin, pp. 365-367.
Available at: http://homes.eff.org/~barlow/Declaration-Final.html [Accessed 30-10-2004]

Barthes, R., 1977. *Image-music-text*. Translated from French by Stephen Heath. New York: Hill.

Bartlett, F.C., 1932. *Remembering: a study in experimental and social psychology*. Cambridge: Cambridge University Press.

Baudrillard, J., 1996. *The system of objects*. Translated by J. Benedict of *Le Système des objets* 1968. London:Verso.

Bazin, André, 1967. The Ontology of the Photographic Image. In H. Gray, ed. *What is Cinema?* Berkeley, CA: UC Press.

Benyon, D., Turner, P. & Turner S., 2005. *Designing Interactive systems*. Edinburgh: Pearson Education Limited.

Biocca, F., 1997. The cyborg's dilemma: progressive embodiment in virtual environments. *Journal of Computer-Mediated Communication*, [Online] 3(2).
Available at: http://www.ascusc.org/jcmc/vol3/issue2/biocca2.html
[Accessed 18 June 2005].

Bolter, J.D. & Grusin, R.A., 1999. *Remediation: understanding new media.* Cambridge, Mass: MIT Press.

Brentano F., 1973. *Psychology from an empirical standpoint*. Translated From German by A. Rancurello, D. Terrel and L. McAlister, 1924. London : Routledge and Kegan Paul. [originally published in 1874].

Brentano F., 1981. *Sensory and noetic consciousness: psychology from an empirical standpoint III.* L. McAlister, ed. Translated from German by M. Schättle & L. McAlister. London : Routledge & Kegan Paul.

Brentano F., 1995. *Descriptive psychology.* Translated & Edited by B. Mu□ller. London: Routledge.

Brey, P., 1999. The ethics of representation and action in virtual reality. *Ethics and Information Technology*, 1(1), p. 5-14.

Burdea, G. & Coiffet, P., 2003. *Virtual reality technology*. New York: Wiley-Interscience.

- C -

Chen, C., 1999. *Information visualisation and virtual environments*. Singapore: Springer-Verlag London Limited.

Chopra, K. & Wallace, W., 2003. Trust in electronic environments. In *Proceedings of the 36th Hawaii International Conference on System Sciences*, pp 331-340.

Clancey, W.J., 1997. *Situated cognition: on human knowledge and computer representations.* Cambridge: Cambridge University Press.

Council on Tall Buildings and Urban Habitat. 2006. *List of the World's Ten Tallest Buildings*. [Online] (Updated January 2006)
Available at: http://www.ctbuh.org/ [Accessed 01 February 2006].

Coyne, R., Snodgrass, A.B. and Martin, D., 1994. Metaphors in the Design Studio. *JAE (Journal of Architectural Education),* 48(2), pp. 113-125.

Coyne, R., 1995. *Desinging information technology in the postmodern age: from method to metaphor*. Cambridge, Mass.: MIT Press.

Coyne, R., 1999. *Technoromanticism: digital narrative, holism and the romance of the real*. Cambridge, Mass.: MIT Press.

Coyne, R. & Wiszniewski, D., 2000. "Technical deceits: critical theory, hermeneutics and the ethics of information technology." *International Journal of Design Sciences and Technology* 8(1), pp. 9-18.

- D -

De Vries, B. & Harink, J., 2007. Generation of a construction planning from a 3D-CAD model. In: Elsevier Science B.V. GB: *Automation in Construction* (16), pp. 13-18.

Dibbell, J., 1998. A rape in cyberspace (or TINYSOCIETY, and how to hake one) in My Tiny Life, (http://www.juliandibbell.com/texts/bungle.html: June, 2006) First published in somewhat different form in *The Village Voice*, December 1993.

Dourish, P. & Button, G., 1998. *On "technomethodology": foundational relationships between ethnomethodology and system design*. Human-Computer Interaction, 13 (4), pp. 395-432.

Dourish, P., 2001. *Where the action is: the foundations of embodied interaction.* Cambridge, Mass.: MIT Press.

Downes, E.J. & McMillan, S.J., 2000. Defining interactivity: a qualitative identification of key dimensions. *New media and society*, 2(2), pp. 157-179.

Doyle, W.K., 1995. Low end augmented reality in neurosurgery: an interactive image-directed system used in epilepsy surgery. In *Proceedings of Virtual Reality in Medicine and Developers' Expo*. Cambridge, Mass., 1-4 June 1995.

Dresher, B. & Hornstein, N., 1976. On some supposed contributions of artificial intelligence to the scientific study of language, in *Cognition*, 4, pp. 321-398.

- E -

Ellis, S.R., 1994. What are virtual environments? *IEEE Computer Graphics and Applications*, 14(1), pp. 17-22.

Evans, R., 1997. The developed surface: an enquiry into the brief life of an eighteenth-century drawing technique, in *Translations from drawing to building, and other essays*. Cambridge, Mass.: MIT Press, pp. 194-231.

- F -

Fors, A.C. & Jakobsson, M., 2000. Beyond use and design: the dialectics of being in virtual worlds. *Internet Research 1.0: the state of the interdiscipline*. Lawrence, KS, USA.

Foucault, M., 1966. *The order of things: an archaeology of the human sciences*. London: Routledge Classics.

Furlong C., 2008. Sotheby's exhibit sculptures at Chatsworth house [Photograph] Available at: http://www.gettyimages.com from home search item #82697842 [Accessed 18-10-2008].

Fusarelli, L.D., 2002. Tightly coupled policy in loosely coupled systems: institutional capacity and organizational change. In: MCB UP Ltd., ed. *Journal of Educational Administration*. 40, pp. 561-575.

- G -

Gartner, W.B. & Murphy, M.B., 1976. *Pilot workload and fatigue: a critical survey of concepts and assessment techniques*. NASA TN D-8365.

Giannakopoulos, P.E., 1994. *Lexiko tis Arhaias Ellinikis Glossas*. Athena: Pelekanos. In Greek: Γιαννακόπουλος, Π. Ε. 1994. *Λεξικό της Αρχαίας Ελληνικής Γλώσσας*. Αθήνα: Πελεκάνος.

Giddens, A., 1991. *Modernity and self-identity: self and society in the late modern age*. Cambridge: Polity Press.

Giddens, A., 1994. *The transformation of intimacy: sexuality, love and eroticism in modern societies*. Cambridge: Polity Press.

Gieryn, T.F., 2000. A space for place in sociology. *Annual Review of Sociology* 26, pp. 463–496.
Goertz, L., 1995. Wie interaktiv sind die Medien? Auf dem Weg zu einer Definition von Interaktivität. In: *Rundfunk und Fernsehen*, Jg.43, Heft 4: 477-493. In English:
Goertz, L., 1995. How are interactive the media? On the way to a definition of interactivity. *Broadcast and television*, 43(4), pp. 477-493.
Goldspink, C., 2007. Rethinking educational reform: a loosely coupled and complex systems perspective. In: *Educational Management Administration & Leadership*. British National Leadership, 35(1), pp. 27-50.
Goodman, N., 1968. *Languages of art: an approach to a theory of symbols*. New York: Bobbs-Merrill.
Goodstein, R.L., 1972. Wittgenstein's philosophy of mathematics. In *Ludwig Wittgenstein: Philosophy and Language*, Ambrose and Lazerowitz, eds., London: George Allen & Unwin Ltd., pp. 271-286.

- H -

Hagel, J., Durchslag, S. & Brown, J.S., 2002. *Orchestrating loosely coupled business processes: the secret to successful collaboration*. [Online]
Available at: http://www.johnhagel.com/paper_orchestratingcollaboration.pdf [Accessed 10-01-2006].
Hamilton, Sir William. 1866. *Lectures on metaphysics and logic*. Boston: Gould and Lincoln.
Harper, D., 2001, *Online Etymology Dictionary*. [Online] (Updated 28 Feb 2007)
Available at: http://www.etymonline.com/ [Accessed 10-04-2008].
Harries, K., 1998. *The ethical function of architecture*. Cambridge, Mass.: The MIT Press.
Harrison, S. & Dourish, P., 1996. Re-place-ing space: the roles of space and place in collaborative systems. In *Proceedings of ACM Conference on Computer-Supported Cooperative Work CSCW'96* (Boston, MA). New York: ACM, pp. 67-76.
Heeter, C., 1992. Being there: the subjective experience of presence. *Presence: Teleoperators and Virtual Environment*, 1(2), pp. 262-271.
Heidegger, M., 1927. *Being and time*. Translated by J. Macquarrie & E. Roinson, 1993. London: Routledge.
Heidegger, M., 1936-53. Gesamtausgabe. [Online] (Updated 10-11-2005)
Available at: http://www.freewebs.com/m3smg2/HeideggerGesamtausgabe.html [Accessed 10-5-2007].
Heidegger, M., 1999. *Ontology: the hermeneutics of facticity*. Translated by J. van Buren. Bloomington, Indiana: Indiana University Press. (first published in 1923)
Heidegger, M., 1971. Building dwelling thinking, in *Poetry, Language, Thought*. Translated from German by A. Hofstadter. New York, NY: Harper Colophon, pp. 145–161.
Heidegger, M., 1985. *History of the concept of time: prolegomena*. Translated by T. Kisiel. Bloomington : Indiana University Press.
Heim, M., 1998. *Virtual realism*. New York: Oxford University Press.
Hodges, L.F., Rob K., Thomas C.M., Barba.ra O.R., Dan O., Johannes J.G., James S.W. & Max M.N.,1995. Virtual environments for treating the fear of heights. *IEEE Computer Graphics and Applications*, 28(7), pp. 27-34.
Hof, R., 2006. SecondLife's First Millionaire. *BusinessWeek*, [internet] 26 November.
Available at:
http://www.businessweek.com/the_thread/techbeat/archives/2006/11/second_lifes_fi.html
[Accessed 20-03-2008].
Horner, D.S., 2001. Cyborgs and cyberspace: personal identity and moral agency. In S. R. Munt, ed., *Technospaces: inside the new media.* London: Continuum, p. 71-84.

Horton, D. & Wohl, R.R., 1956. Mass communication and para-social interaction: observations on intimacy at a distance. *Psychiatry*, 19(3), pp. 215-229.
Howell, F.C., 1980. *Early Man*. Virginia: Time-Life Books.
Hume, D., 2009. *A treatise of human nature*. [e-book] Scribd.com. Available at: http://www.scribd.com/doc/52892/A-Treatise-on-Humane-Nature

[Accessed 24-04-2008].
Husserl, E., 1931. *Ideas: general introduction to pure phenomenology*. Translated by W.R. Boyce Gibson, 1931. London : Allen & Unwin New York : Humanities Press.
Husserl, E., 1970. *Logical investigations (Logische Untersuchunget) Vol. I*. Translated from the 2nd German edition by J.N. Findlay. London : Routledge and K. Paul ; New York : Humanities Press.
Husserl, E., 1970. *Logical investigations (Logische Untersuchunget) Vol. II*. Translated from the 2nd German edition by J.N. Findlay. London : Routledge and K. Paul ; New York : Humanities Press.
Husserl, E., 1962. *The crisis of european sciences and transcendental phenomenology: an introduction to phenomenological philosophy*. Translated from German by D. Carr. Evanston: Northwestern University Press, 1970).
Husserl, E., 1929. *Formal and Transcendental Logic*. Translated by D. Cairns, 1969. The Hague: M. Nijhoff.
Hutchins, E., 1995. *Cognition in the wild*. Cambridge, MA: MIT Press.

- J -

Jay, M., 1994. *Downcast eyes: the denigration of vision in twentieth-century French thought*. Berkeley and Los Angeles: University of California Press.
Jahns, D.W., 1972. Operator workload: what is it and how should it be measured? In K. D. Gross & J. J. McGrath, Eds., *Crew system design Conference*, Los Angeles, pp. 281–288.
Jex, H.R., 1979. A proposed set of standardised sub-critical tasks for tracking workload calibration. In *Mental Workload: Its Theory and Measurement*, N. Moray, ed., New York, NY: Plenum Press, pp. 179-188.
Johnson, M., 1987. *The body in the mind: the bodily basis of meaning, imagination, and reason*. Chicago, Illinois: the University of Chicago Press.

- K -

Kant, I., 2003. *Critique of pure reason*. Translated from French by J.M. Meiklejohn. Cambridge: Cambridge University Press.
Kieras, D.E. & Meyer, D.E., 1997. An over view of the EPIC architecture for cognition and performance with application to human-computer interaction. *Human-Computer Interaction*, 12(4), p. 391-438.
Kintsch, W., 1974. *The representation of meaning in memory*. Hillsdale, N J: Erlbaum.
Kintsch, W., 1988. The use of knowledge in discourse processing: a construction-integration model. *Psychological Review*, 95, pp. 163-182.
Kohak, E., 1966. *Freedom and nature: the voluntary and the involuntary*. Evanston, Ill.: Northwestern University Press.

- L -

Lagueux, M., 2004. Ethics versus aesthetics in architecture. *Philosophical Forum,* 35(2), pp. 117-133.
Lakoff, G. & Johnson, M., 1980. *Metaphors we live by*. Chicago: University of Chicago Press.
Lanier, J. & Biocca, F., 1992. An insider view of the future of virtual reality. *Journal of Communication*, 42(4), pp. 150-. 172.
Laurel, B., 1986a. *Toward the Design of a Computer-Based Interactive Fantasy System*. Ph.D. Dissertation, Drama department, Ohio State University.

Laurel, B.K., 1986b. Interface as mimesis. In D. A. Norman & S. W. Draper Eds., *User centered system design: new perspectives on human-computer interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc, pp 67 – 86.
LeCorbusier, 1955. *Modulor 2*. Translated from French by P. de Francia & A. Bostock. London: Faber.
Lewis, C.H., 1982. *Using the "thinking aloud" method in cognitive interface design*. IBM Res. Rep. RC-9265. Yorktown Heights, N.Y.
Lewis, C. & Rieman, J., 1993. *Task-centered user interface design: a practical introduction*. Boulder, Colorado: University of Colorado.
Available at: http://hcibib.org/tcuid/ [Accessed 09-10-2007].
Licklider H., 1965. *Architectural scale*. London: The Architectural Press.
Lombard, M. & Ditton, T. 1997. At the heart of it all: the concept of presence. *Journal of Computer-Mediated Communication*, [Online]. 3(2),
Available at: http://jcmc.indiana.edu/vol3/issue2/lombard.html
[Accessed 30-03-2007].

- M -

Macromedia Director MX, Macromdia,Inc. 1984-2002. http://www.macromedia.com/
Malpas, J.E., 1999. *Place and experience: a philosophical topography*. Cambridge, Mass.: Cambridge University Press.
McLuhan, M., 1966. *Understanding media*. New York: Signet.
Melle, U., 2002. Edmund Husserl: from reason to love. In J.J. Drummond and L.E., Embree, eds. *Phenomenological approaches to moral philosophy: a handbook*. Dordrecht: Kluwer Academic Publishers, pp. 229-248.
Merkel, J., Die Abhängigkeit zwischen Reiz und Empfindung, *Phil. Stud*., 4, 1888, 541-594; 5, 1889, 245-291; 5, 1889, pp. 499-557.
Merleau-Ponty, M., 1945. *Phenomenology of perception*. Translated by C. Smith, 1962. London: Routledge. [reprint 2003].
Milgram, S., 1977. The familiar stranger: *an aspect of urban anonymity*. In S. Milgram, ed., *The individual in a social world*. Reading, Mass.: Addison-Wesley, pp. 51-53.
Minsky, M., 1975. A framework for representing knowledge. In P. H. Winston, ed. *The psychology of computer vision*. New York: McGraw-Hill.
Mitchell, W.J., 1986. *Iconology: image, text, ideology*. Chicago and London: The University of Chicago Press.
Moran, D. & Mooney, T., 2002. Paul Ricoeur: phenomenology as interpretation. In D. Moran& T. Mooney Eds., *Phenomenology reader*. London: Routledge, pp. 573-600.
Mulhall, S., 1990. *On Being in the World. Wittgenstein and Heidegger on Seeing Aspects*. London: Routledge.

- N -

Nardi, B.A., ed., 1996. *Context and consciousness: activity theory and human-computer interaction.* Cambridge, Mass.: The MIT Press.
Neale, H. & Nichols, S., 2001. Theme-based content analysis: a flexible method for virtual environment evaluation. *International Journal of Human-Computer Studies*, Vol. 55 pp. 167-89.
Newell, A. & Herbert A.S., 1972. *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.
Newman, W. & Lamming, M., 1995. *Interactive system design*. Cambridge: Addison-Wesley Publishers Ltd.
Ning, G., & Maher M., 2005. Dynamic designs of 3D virtual worlds using generative design agents. In *Proceedings of the 11th International Conference on Computer Aided Architectural Design Futures.* Vienna (Austria) 20–22 June 2005, pp. 239-248.
Norman, D. & Draper, S., eds., 1986. *User-centered system design*. Hillsdale: LEA.

Norman, D., 1988. *The psychology of everyday things*. New York, N.Y.: Basic Books.

- O -

Ottenheimer, H.J., 2006. *The anthropology of language*. Belmont, CA: Thomson Wadsworth.
Oxford English Dictionary O.E.D., (Draft Revision June 2007). Oxford English Dictionary. [online]. http://www.oed.com/ [Accessred 9 October 2007]
O'Regan, J.K. & Noë, A., 2001. A sensorimotor approach to vision and visual consciousness. *Behavioral and Brain Sciences,* 24 (5) 939-973.

- P -

Palanque, P. & Paternò, F., eds., 2000. *Interactive systems: Design, specification, and verification*. 7th International Workshop, DSV-IS 2000, Limerick Ireland, June 2000. Revised Papers. Lecture Notes in Computer Science Vol. 1946. Springer Verlag.
Pearson, D., Hanna, E., & Martinez, K., 1990. Computer generated cartoons. In H. Barlow, C. Blakemore, and M. Weston-Smith, eds. *Images and understanding*. Cambridge: Cambridge University Press, pp. 46-60.
Pérez-Gómez, A. & Pelletier, L., 1997. *Architectural representation and the perspective hinge*. Cambridge, Mass.: MIT Press.
Pratt, D.R., Zyda, M. & Kelleher, K., 1995. Virtual reality: in the mind of the beholder. *IEEE Computer*, 28(7), pp. 17-19.

- R -

Reid G.B., Shingledecker, C.A., Nygren, T.E., et al., 1981. Development of multidimensional subjective measures of workload. Proc. 1981 International Conference on *Cybernetics and Society*, pp. 403-406.
Rheingold, H., 2000. *The virtual community: homesteading on the electronic frontier*. London: MIT press. 2000. Originally published in 1993 by Adison Wesely.
Rice, R.E., 1992. Task analyzability, use of new medium and effectiveness: a multi-site exploration of media richness. *Organization Science*, 3(4), pp. 475-500.
Ricoeur, P., 1988. Humans as the subject matter of philosophy. In T.P. Kemp & D. Rasmussen eds. *The narrative path: the later works of Paul Ricoeur*. Cambridge, Mass.: MIT Press.
Ricoeur P., 2002. Ethics and human capability: a reponse. In J. Wall, W. Schweiker & W.D. Hall, eds. *Paul Ricoeur and contemporary moral thought*. New York & London: Routledge.
Rivlin, R. & Gravelle, K., 1984. *Deciphering the senses: the expanding world of human perception*. New York: Simon and Schuster.
Rogers, E.M., 1986. *Communication technology: new media in society*. New York: Free Press.
Rosch E.H., 1973. On the internal structure of perceptual and semantic categories, In T E Moore ed. *Cognitive development and the acquisition of language*. New York: Academic Press.
Rose, G., 2001. *Visual methodologies: an introduction to the interpretation of visual materials*. London: Sage Publications.
Rossignac, J., 1999. Collaborative design and visualization. In *Proceedings of the NSF Invitational Workshop on Distributed Information, Computation, and Process Management for Scientific and Engineering Environments (DICPM)*, May 15-16, 1998, Herndon, Virginia. Cambridge, Mass.: The MIT Press, pp. 102-103.

Available at: http://deslab.mit.edu/DesignLab/dicpm/position/rossignac.html [Accessed 10-01-2006].
Rumelhart, D., 1977. *Introduction to human information processing*. New York: John Wiley and Sons.
Rumelhart, D. & Ortony, A., 1977. The representation of knowledge in memory. In R.C. Anderson, R.J. Spiro & W.E. Montage (Eds.), *Schooling and the acquisition of knowledge*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc., pp.99-135.
Russell, B., 2000 *History of western philosophy.* 3rd ed. London: Routledge Classics. (First published in 1946).

- S -

Sanford, A. & Garrod, S., 1981. *Understanding written language: exploration in comprehension beyond the sentence*. Chichester: John Wiley.
Sartre, J.-P., 1972. *The psychology of imagination.* London: Methuen.
Sawhney, N., Wheeler, S. & Schmandt, C., 2001. Aware community portals: shared information appliances for transitional spaces. *Journal of Personal and Ubiquitous Computing*, 5, pp. 66-70.
Schank, R.C., 1972. Conceptual dependency: a theory of natural language understanding. *Cognitive Psychology* 3, pp. 552–631.
Schank, R.C., 1978. What makes something "ad hoc". In *Proceedings of the 1978 Workshop on theoretical Issues in Natural Language Processing* (Urbana-Champaign, Illinois, July 25 - 27, 1978). Association for Computational Linguistics, Morristown, NJ, pp. 8-13.
Schank, R.C. & Abelson. R.P., 1977. *Scripts, plans, goals, and understanding: an inquiry into human knowledge structures*. Hillsdale, NJ: Lawrence Erlbaum.
Schank, R.C. & Abelson, R.P., 1995. Knowledge and memory: the real story. In R. S. Wyer ed., *Advances in Social Cognition*, 8, Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc., pp. 1-85.
Schank, R.C. & Colby, K., 1973. *Computer models of thought and language.* San Francisco: Freeman.
Schneider, F., ed., 1999. *Trust in cyberspace*. Washington DC: National Academy Press.
Second Life. 2008. *What is Second Life.* [Online] (Updated 16-01-2008) Available at: http://secondlife.com/whatis/ [Accessed 16-01-2008].
Second Life. 2008. *The marketplace.* [Online] (Updated 16-01-2008) Available at: http://secondlife.com/whatis/marketplace.php [Accessed 16-01-2008].
Second Life. 2008. *The creations.* [Online] (Updated 16-01-2008) Available at: http://secondlife.com/whatis/creations.php [Accessed 16-01-2008].
Sheridan, T.B. & Simpson, R.W., 1979. *Toward the definition and measurement of the mental workload of transport pilots*. Final Report, Contract DOT-0S-70055.
Sheridan, T.B., 1992. Musings on telepresence and virtual presence. *Presence: Teleoperators and Virtual Environments*, 1(1), pp. 120-126.
Slater M. & Usoh M., 1994. Body centred interaction in immersive virtual environments. In *Artificial life and virtual reality*, Eds. N. Thalmann and D. Thalmann, John Wiley & Sons, England, pp. 125-147.
Slater, M., Usoh, M. & Steed, A., 1994. Depth of presence in virtual environments. *Presence: Teleoperators and Virtual Environments*, 3(2), pp. 130-144.
Slater, M. & Steed, A., 2000. A virtual presence counter. *Presence, Teleoperators and Virtual Environment* 5 (9), pp. 413–434.
Snow, M.P. & Williges, R.C., 1998. Empirical models based on free-modulus magnitude estimation of perceived presence in virtual environments. *Human Factors*, 40(3), pp. 386-402.
Spagnolli, A., Varotto, D. & Mantovani, G., 2003. An ethnographic, action-based approach to human experience in virtual environments. *In International Journal of Human-Computer Studies*, 59 (6), pp. 797-822.
Spyker, D. A., Stuckhouse, S. P., Khlafalla, A. S., et al., 1971. *Development of techniques for measuring pilot workload*, NASA CR-1888.
Stanford, W.B., 1936. *Greek metaphor*. Oxford: Basil Blackwell, pp. 101-105.
Sternberg, R., 2003. *Cognitive Psychology* 5th ed. Hove, East Sussex: Psychology Press.

Steuer, J., 1995. Defining virtual reality: Dimensions determining telepresence. In F. Biocca and M.R. Levy Eds., *Communication in the age of virtual reality*. Hilldale, N.J: Lawrence Erlbaum, pp. 33-56.
Stevens, S.S., 1953. On brightness of lights and the loudness of sounds. *Science*, pp. 118, 576.
Stevens, S.S., 1956. The direct estimation of sensory magnitudes: loudness. In *The American Journal of Psychology*. 69(1), pp. 1-25.
Silvano, L., ed., 1997. *Surrealism: Surrealist Visuality*. Edinburgh: Keele University Press.
Suchman L., 1987. *Plans and situated action*. Cambridge: Cambridge University Press.
Suler, J., 2000. Bringing online and offline living together: the integration principle. *eNotAlone*, [Online]. Available at: http://www.enotalone.com/article/3208.html [Accessed: 25-6-2007].
Szuprowicz, B.O., 1995. *Multimedia networking*. New York, NY: McGraw Hill.

- T -

Tannen, D., 1979. What's in a Frame? Surface Evidence for Underlying Expectations. In R. O. Freedle, ed. *New directions in discourse processing*. Norwood, N J: Ablex, pp. 137-181.
Tannen, D., 1993. What's in a frame? Surface evidence for underlying expectations. In D. Tannen, ed., *Framing in discourse*. New York:: Oxford University Press, pp. 14-56.
Tannen, D. ed., 1993. *Framing in discourse*. New York: Oxford University Press.
Tannen, D. & Wallat. C., 1993. Interactive frames and knowledge schemas in interaction: examples from a medical examination/interview. In D. Tannen, ed. *Framing in discourse*. New York: Oxford University Press, pp. 57-76.
Taylor, J.C., 1957. *Learning to look; A handbook for the visual arts*. Chicago: Chicago University Press.
Tidwell, J., 1999. *Common ground: a pattern language for human-computer interface design*. [Online] MIT Press.
Available at: http://www.mit.edu/~jtidwell/common_ground.html
[Accessed 10-12-2007].
Turban, E., & Aronson, J., 2001. *Decision support systems and intelligence systems*, 6th ed. Upper Saddle River, New Jersey: Prentice Hall.
Turbayne, C., 1962. *The myth of metaphor*. New Haven, CT: Yale University Press.
Turner, P., McGregor, I., Turner, S. & Carroll, F.,2003. Evaluating soundscapes as a means of creating a sense of place. In E. Brazil, & B. Shinn-Cunningham (Eds), Proceedings of the 2003 *International Conference on Auditory Display*, pp. 148-151.
Turner, S., Turner, P., Caroll, F., O'Neill, S., et al. 2003. Re-creating the botanics: towards a sense of place in virtual environments. Paper presented at the 3rd *UK Environmental Psychology Conference*, Aberdeen, 23-25 June 2003.

- V -

Van Dijk, T.A., 1981. Review of RO Freedle ed., 1979. *Journal of Linguistics*, 17, pp. 140-148.
Van Leeuwen, J.P., van Gassel, F. & DEN Otter, A., 2004. Teaching collaborative design. In *Proceedings of the International Workshop on Construction Information Technology in Education*, September 7th 2004 Istanbul. Turkey, p. 1-9.
Vlahou, V.P., 1996. *Ta Rimata Omala kai Anomala tis Arhaias Ellinikis*. Athena: Gutenberg. In Greek: Βλάχου, Β. Π. 1996. *Τα Ρήματα Ομαλά και Ανώμαλα της Αρχαίας Ελληνικής*. Αθήνα: Gutenberg.

- W -

Weizenbaum, J., 1976. *Computer power and human reasoning*. San Francisco: W.H. Freeman & Company.
Wikipedia, the Free Encyclopaedia. 2003. *Richard Garriott*. [Online] (Updated 21 Mar 2009) Available at: http://en.wikipedia.org/wiki/Richard_Garriott [Accessed 10-04-2008]
Wikipedia, the Free Encyclopaedia. 2003. *Vitruvian Man*. [Online] (Updated 10 Apr 2008) Available at: http://en.wikipedia.org/wiki/Vitruvian_Man [Accessed 12-09-2008]
Wilson, M.D., ed., 1969. *The essential of Descartes*. Mentor Bk: New American Library.
Winston, P.H., 1970. Learning structural descriptions from examples. M.I.T. Project MAC TR-76. Available at: http://historical.ncstrl.org/tr/pdf/mitai/AITR-231.pdf [Accessed 15-05-2003].
Wittgenstein, L., 1968. *Philosophical investigations*. Translated by G.E.M. Anscombe; 3rd ed. Oxford: Blackwell.
Wittgenstein, L., 1968. *Tractatus Logico-Philosophicus*. Translated from German by D. Pears & B. McGuinnes 1961. London: Routledge.

- X -

Xiaolong, Z. & Furnas, G.W., 2003. In Conference on Human Factors in Computing Systems, CHI '03 extended abstracts on Human factors in computing systems Ft. Lauderdale, Florida, USA, pp. 790-791.
Xiaolong, Z., 2008. A multiscale progressive model on virtual navigation. *International Journal of Human Computer Studies*, 66(4), p. 243-256.

List of Appendices

Appendix 1: The Abstraction of L4 Questionnaire

Part 1:

Please read the following instructions carefully:

This session will be video recorded.

There will be a timer, and the time required to finish the task will be marked.

In this task you are required to login using your username, and password.

To do so in the first experiment, you need to:

In order to 'login', you need to write down your username and password. In order to do so, you need to find the 'login' interface. You can use the mouse to move the cursor in front of you. You can click any available link using the left button of the mouse.

PLEASE VERBALISE YOUR THOUGHTS (THINK ALOUD).

NO HELP WILL BE PROVIDED.

Inform the researcher when you are ready to start the session.

Part 2:

Please answer the following three groups of questions: (Feel free to ask the researcher for any help you may require).

A) Preliminary questions to capture the initial reaction:

1- Do you think you had a lot of options/possibilities to achieve the task? Y/N

2- Do you think you were given enough amount of information to achieve the task? Y/N

3- Estimate the level of difficulty of finishing the task. Use any number (1, 2, 3;... etc.), color (red, white black purple;...etc.), expression (good, bad, so so, satisfying,...;etc.), object (bird, pc,...; etc.), or any other word that crosses your mind.

4- Estimate the level of your confidence during the task. Use any number (1, 2, 3;... etc.), color (red, white black purple;...etc.), expression (good, bad, so so, satisfying,...;etc.), object (bird, pc,...; etc.), or any other word that crosses your mind.

B) Please rate each question on a 1-5scale where 1=poor, 2=fair, 3=good, 4=very good, and 5=excellent.

1. How strong was your sense of success in achieving your task in the virtual environment (projection) in front of you?
2. How strong was your grasp of space in the virtual environment (projection) in front of you?
3. How strong was your feeling of surroundings in the virtual environment (projection) in front of you?
4. How strong was your sense of orientation in the virtual environment (projection) in front of you?
5. How strong was your sense of being inside in the virtual environment?
6. What was your overall comfort level in the virtual environment (projection) in front of you?
7. What was your overall enjoyment level in the virtual environment (projection) in front of you?

C) Please answer the following questions with either Yes or No

1. I perceive that I am present in a kind of space
2. My feeling is that this is real.
3. The thought that this is familiar, crosses my mind often.
4. I achieve my task using notions derived from my body often.
5. I perceive the space as being only a projection on a screen, but not real.

Appendix 2: The Representation of L4 Questionnaire

Part 1:

Please read the following instructions carefully:

This session will be video recorded.

There will be a timer, and the time required to finish the task will be marked.

In this task you are required to login using your username, and password.

To do so in the second experiment, you need to:

In order to 'login', you need to write down your username and password. In order to do so, you need to find the 'login' interface. You can use the mouse to orient you view on the screen. The four arrows can be used as well. You can click any available link using the left button of the mouse.

PLEASE VERBALISE YOUR THOUGHTS (THINK ALOUD).

NO HELP WILL BE PROVIDED.

Inform the researcher when you are ready to start the session.

Part 2:

Please answer the following three groups of questions: (Feel free to ask the researcher for any help you may require).

A) Preliminary questions to capture the initial reaction:

1- Do you think you had a lot of options/possibilities to achieve the task? Y/N

2- Do you think you were given enough amount of information to achieve the task? Y/N

3- Depending on the chosen word to estimate the difficulty of the previous Ex, estimate the level of difficulty of finishing this task. If you used a number, then use another number. If you used a color, use another color ...etc

4- Depending on the chosen word to estimate your confidence during the previous task estimate your confidence during this task. If you used a number, then use another number. If you used a color, use another color ...etc

5- Do you think the experience of the previous tasks helped you confronting the experience of this task? Justify your answer.

B)

Please rate each question on a 1-5scale where 1=poor, 2=fair, 3=good, 4=very good, and 5=excellent.

1. How strong was your sense of success in achieving your task in the virtual environment (projection) in front of you?
2. How strong was your grasp of space in the virtual environment (projection) in front of you?
3. How strong was your feeling of surroundings in the virtual environment (projection) in front of you?
4. How strong was your sense of orientation in the virtual environment (projection) in front of you?
5. How strong was your sense of being inside in the virtual environment?
6. What was your overall comfort level in the virtual environment (projection) in front of you?
7. What was your overall enjoyment level in the virtual environment (projection) in front of you?

C) Please answer the following questions with either Yes or No

1. I perceive that I am present in a kind of space
2. My feeling is that this is real.
3. The thought that this is familiar, crosses my mind often.
4. I achieve my task using notions derived from my body often.
5. I perceive the space as being only a projection on a screen, but not real.

Appendix 3: Ethics of Virtuality Questionnaire

- How important do you find Ethics in your life?
- Did you hesitate to take the money more in the case of the physical space or in the virtual environment?
- Did the fact that you had more time to walk around in the VE give you more time to think about the Ethical problem that you had to deal?
- Did the way of moving into the space distract you from the goal to take the money?
- If ethics is ubiquitous in architecture because it constructs the real boundaries in
- When was the most critical moment from an Ethical point of view:
    - The moment that you started to go for the money from the place that you were before?
    - The moment that you stood in front of the drawer?
    - The moment that you open the drawer?
    - The moment that you took the pencil case from the drawer?
    - The time when you took the money out?
    - The time that you were giving me the money?

- VE is a representation of RE. Do you think that Ethics in VE represent Ethics in RE?
- The common room in the VE had different furniture arrangement compared to the RE. Were you surprised when you entered the common room?
- Do you relate your familiarity with the space with the Ethics of the action taking place in it?

Appendix 4: Depth of Presence in VE Questionnaire [440]

1. Please rate your sense of being in the virtual environment, on a scale of 1 to 7, where 7 represents your normal experience of being in a place.

2. To what extent were there times during the experience when the virtual environment was the reality for you?

3. When you think back to the experience, do you think of the virtual environment more as images that you saw or more as somewhere that you visited?

4. During the time of the experience, which was the strongest on the whole, your sense of being in the virtual environment or of being elsewhere?

5. Consider your memory of being in the virtual environment. How similar in terms of the structure of the memory is this to the structure of the memory of other places you have been today? By 'structure of the memory' consider things like the extent to which you have a visual memory of the virtual environment, whether that memory is in colour, the extent to which the memory seems vivid or realistic, its size, location in your imagination, the extent to which it is panoramic in your imagination, and other such structural elements.

6. During the time of your experience, did you often think to yourself that you were actually in the virtual environment?

440 Slater, M., Usoh, M. & Steed, A., 1994. Depth of presence in virtual environments. *Presence: Teleoperators and Virtual Environments*, 3(2), pp. 130-144.

List of Publications

Books

Okeil, A., Al-Attili, A. & Mallasi, Z. eds., 2007. *Em'body'ing Virtual Architecture*. The Proceedings of the 3rd ASCAAD International Conference, Alexandria: Bibliotheca Alexandrina Press.

Published peer-reviewed conference papers

Attili, A. & Androulaki, M., 2009. Architectural Abstraction and Representation: The Embodied Familiarity of Space Representation. In *Digitizing Architecture: Formalization & Content*, the Proceedings of the 4th ASCAAD International Conference, University of Bahrain, Manama (Bahrain) 11-12 May 2009, pp. 273-293.

Attili, A. & Androulaki, M., 2009. The Familiarity of Being Digital: Digital Abstraction and Representation of Embodied Interaction, In the proceedings of the Second International Critical Digital Conference: *Who Cares(?)*, Harvard University, Graduate School of Design, Cambridge, Massachusetts, (USA) 17-19 April 2009, pp. 153-157.

Al-Attili, A. & Mendoza-Robles, R., 2007. *Digitising Heritage or Reconstructing Imagination*, in Communication in the Virtual Society, 11th SIGraDi International Conference, La Salle University, Mexico City (Mexico) 23-25 October 2007, pp. 48-53.

Karandinou, A. & Al-Attili, A., 2007. *Conscious Interaction with Immaterial Space: Augmented Reality of everyday life*, Embodying Virtual Architecture, 3rd ASCAAD International Conference, Bibliotheca Alexandrina, Alexandria (Egypt) 26-28 November 2007, pp. 243-252.

Othman, A., & Al-Attili, A., 2007. *re-Placing Embodied Interaction: Palestinian Architects Virtual Community*, Embodying Virtual Architecture, 3rd ASCAAD International Conference, Bibliotheca Alexandrina, Alexandria (Egypt) 26-28 November 2007, pp. 381-298.

Al-Attili, A. & Koutsoumpos, L., 2006. *Ethics of Virtuality… Virtuality of Ethics*, Communicating Space(s) 24th eCAADe Conference Proceedings, Volos (Greece) 6-9 September 2006, pp. 32-39

Al-Attili, A. & Coyne, R., 2004. *Embodiment and Illusion: The Implications of Scale as a Cue for Immersion in Virtual Environments,* e-Design in Architecture, 1st ASCAAD International Conference Proceedings, King Fahd University for Petroleum and Minerals, Dhahran (Saudi Arabia) 22-24 February 2005, pp. 273-293.

Al-Attili, A. Young, H.J., Rebelo, P. & Coyne, R., 2003. *The design implications of time-based interactive media.* Generative Art 2003: 6th International Conference Proceedings, Milan Polytechnic University, Milan (Italy) 10-13 December 2003. AleaDesign. II-78 to II-85.

Published peer-reviewed journal articles

Al-Attili, A. & Kadoi, Y., 2006. Embodied Interaction with Digitised Heritage: The Case of Qusayyer Amra. *Edinburgh Architecture Research* Vol. 31, 2006, pp. 92-98.

Al-Attili, A., 2004. A phenomenological study into perception of "the real" and "the virtual" in computer-mediated interactive environments. *Edinburgh Architecture Research* Vol. 29, 2004, pp. 111-117.

……. Submitted Articles awaiting publication

Al-Attili, A. & Kadoi Y., (2009), A Study into the Conservation of the Memory of Place via Embodied Interaction Using Immersive Virtual Environments, in *Dirasat: Engineering Sciences*, Volume 38, Issue 3. Amman: Deanship of Academic Research, the University of Jordan's Press.

Unpublished peer-reviewed conference papers

Al-Attili, A. & Liangxiu H., 2008. A Phenomenological Review of the role of the Course Organiser , In *Perspectives from within and beyond Edinburgh*, the 13th Annual Forum for Course Organisers, Moray House School of Education, The University of Edinburgh, (UK) 15 May 2008.

Al-Attili, A., 2006. Design Elements of Immersion, the 4th College of Arts & Social Sciences Postgraduate Conference, University of Aberdeen, Aberdeen (UK) 28-29 June 2006.

Al-Attili, A. & Kadoi, Y., 2006. *Digitizing Heritage: The Case of Qusayyer Amra,* WOCMES-2 The Second World Congress for Middle Eastern Studies, Culture Palace, Amman (Jordan) 11-16 June 2006.

Al-Attili, A., 2006. *Scale Up and Scale Down: VR in Design Studio,* Architectural Humanities Research Association (AHRA) Annual Research Student Symposium, at Architecture, School of Arts, Culture and Environment, the University of Edinburgh. 6-7 April 2006