ARCHITECTURAL ABSTRACTION AND REPRESENTATION

The Embodied Familiarity of Digital Space

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Abstract. This paper argues that familiarity is the tool that enables the understanding of space abstraction and representation. Familiarity in this context is independent from embodied interaction, and is crudely based on the connection between the various similar images of space; in this particular case, virtual space. Our investigation into the nature of human interaction with space, its abstraction and its representation is based on the critical contrast between the outcomes of interaction with two virtual versions of a physical reality; the first version is a non-linear interactive graphical abstraction of the space where no assertions or indicators are given as to whether or not there is a relationship between the abstraction and its physical reality, whereas the second is a none-linear interactive 3D virtual environment clearly representing the physical space in question. The paper utilises qualitative methods of investigation in order to gain an insight into human embodied experience in space, its abstraction and representation.

1. Virtual Environments and the Image of Space

Any interactive computer 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. (Coyne, 1999: 148) 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, (Suler, 2000) 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 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. (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, which will be introduced through the concepts of *abstraction* and *representation*, in what follows

1. Familiar Space Abstraction and Representation

1.1 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. (Hamilton, 1866: 469) 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*." (1931: 76) 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", 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 of increase." (1931: 75-76) 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." (1931: 89) 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.

1.1.1 ABSTRACTION AND REPRESENTATION: THE VERBAL IMAGE OF
        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 verbal communication, the other belonging to embodied action.

    The first process translates a subject's intentionality of consciousness with a space 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.(1975) Some can only be verbal whereas others can be both verbal and physical. 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. (1954: 226) Relatedly, 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.

1.1.2 ABSTRACTION AND REPRESENTATION: FAMILIAR 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".

(2001: 126) 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.

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. 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. (1927: 267) Merleau-Ponty's *abstract* 'objective space' or 'representative space' are not based on an act of thought, rather, it is an inseparable correlative built into human bodily structure.(1945: 112-170) The processes of abstraction and representation introduce familiarity as a symptom to be noticed and studied.

2. Familiarity

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. (1980: 147-155) 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." (1987: 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. 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.

2.1 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. In order to be able to evaluate space abstraction and representation, we ought to be normative by deploying Hume's concept of normativity for its ability to tie ideas, their origin and abstraction. 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". (2009: 6) 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*.

2.2 UNINTENTIONAL SIGNIFICATION THROUGH TO INTENTIONAL IMAGINATION: METAPHOR

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. The entity of being is not Heidegger's *Dasein* anymore; it morphs into Bachelard's *des êtres entr'ouverts*. (1964: 200) 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". (1964: 7) In conjunction, abstraction of the signified conceals its structural relationship with the signifier. In the effort to associate new attributes we rely on metaphorical association, which countervail against the fact that *metaphorical systematicity* (Lakoff & Johnson, 1980) generally exacerbates perception of abstracted space, thus, admitting spatially divergent interpretations. Integration of diversities (Stanford, 1936: 101-105) 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 (Lakoff & Johnson, 1980: 9), which, in

turn, admits inappropriateness that Turbayne labels "*sort-crossing*". (1962: 11) However, Dourish argues that the referent of the metaphor may possibly possess a set of capabilities that the metaphorical object itself does not. (2001: 142-144) This can be harnessed to the fact that virtual environments allow various interactions that are, otherwise, impossible in a corresponding physical environment. Thus, as the second step in a proposed procedure for space abstraction, we suggest eliminating *metaphorical systematicity*.

2.3 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. When executing this process of isolating (disconnecting) subjective elements, we 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 familiar space as a physical environment can be correlated to the degree of elimination of Gestalt's principles of perception.

2. Abstraction and representation

2.3 VERBAL REPRESENTATION OF SPACE

The first step in verbal image abstraction is to analyse the components of the verbal image, in what can be described as *componential analysis*. A paragraph uttered by a first user of L4 (Figure 1a) is abstracted by removing all verbs, articles and propositions (Figure 1b). The next step is to apply indentation to the list in a way that reflects the spatial relations (Figure 1c). Finally, we reorganise the words spatially according to the directions given in the paragraph. The result is a cluster of apparently spatially interrelated words (Figure 1d).

a)

b)

c)

d)

Figure 1. a, b, c, and d.

2.3 VISUAL REPRESENTATION OF SPACE

The proposed steps of abstraction were applied to the plan of the space in question (Figure 2a) which is abbreviated to L4. 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 2b. 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. This resulted in Figure 2c.

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 2d. The next step is to unify all lines within the plan and give it all the same value of angles (Figure 2e).

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.
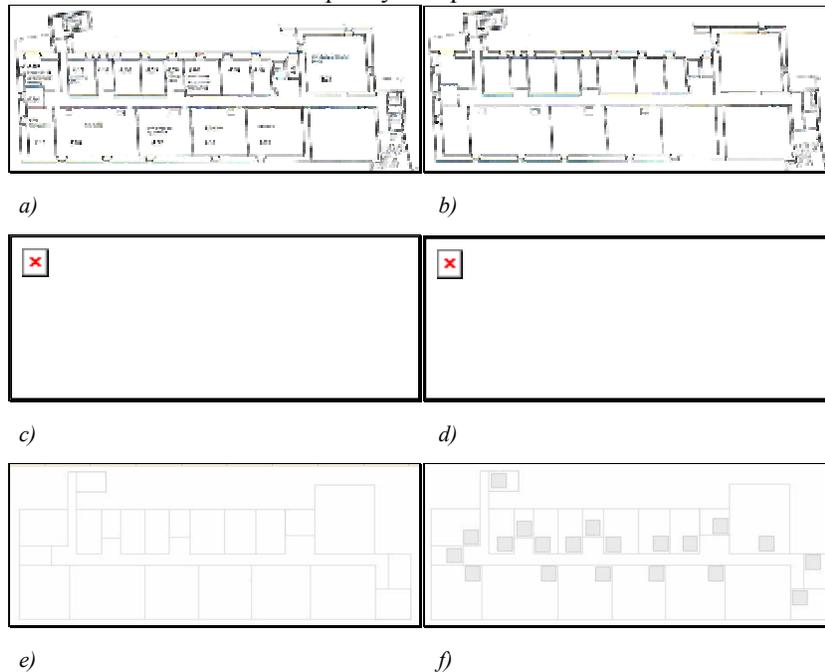

a)

b)

c)

d)

e)

f)

Figure 2. a to f.

The result of this exercise was the abstraction in Figure 2f, which removes all attributes and merits while keeping spaces from the original plan that coincide with the nouns in the paragraph describing the space. In order to examine our multilayered hypothesis, we created two corresponding interactive virtual environments.

The first 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 qualities. The abstraction holds no spatial attributes beyond its own. Thus, it does not intend to act as a reference to the abstracted space. The environment is composed of three main parts: *1- The Abstraction* (Figure 3. zone 1) *2-*

Zoom-in on the abstraction (Figure 3. zone 2) *3- Navigation section* (Figure 3. zone 3).
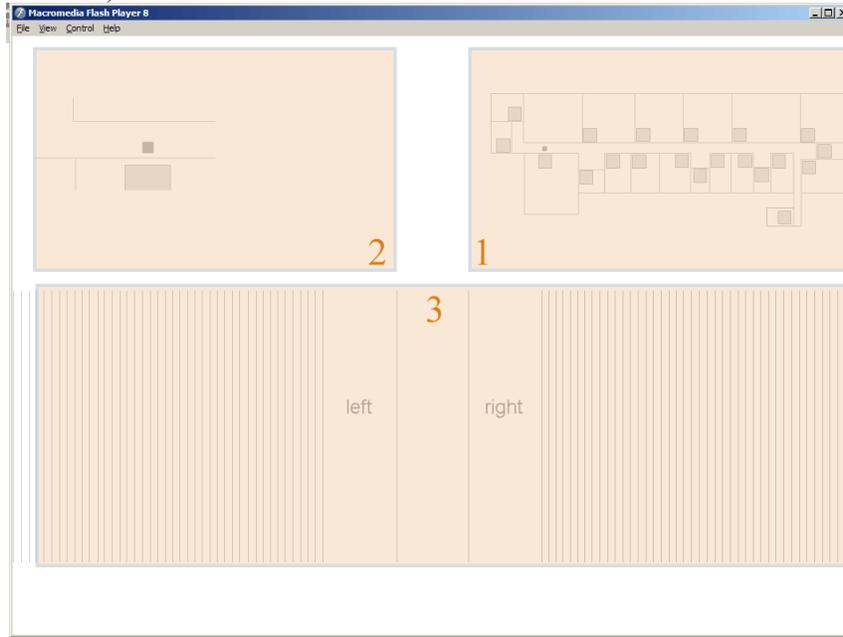

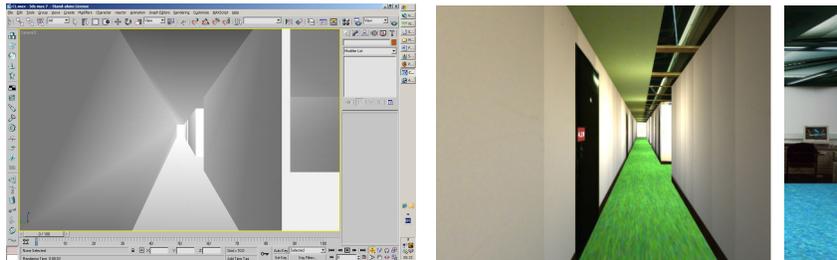*Figure 3*. Screen-shot showing 'Level 4 Abstract Environment' (L4), and highlights the three zones.

Figure 48. a) Using 3ds Max V.7. a 3D model was constructed using a series of flat screen corresponding to the Abstraction of L4. (right), and b) texture maps were applied to the 3D model to create the representation of L4. (left).

In the second environment we considered 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. (Pearson & Martinez, 1990) A

digital 3D model of L4 was created (Figure 4a) and texture maps were applied to render it as close to reality as possible (Figure 4b). The model was made available for spatial navigation and interaction using Macromedia Director. The result is a representation of L4 in the shape of a real-time interactive 3D virtual environment.

Finally, In order to examine this hypothesis, a qualitative method of research was used to probe on subjects' experience focussing on issues related to the abstraction, the representation and the familiarity of space. Subjects were asked to give a personal account of their experience which is supposed to give us an insight on how they think.

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." (Merleau-Ponty, 1945: 131)

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 experience, capable of giving a commentary and meaning to the internal impressions and the impression of possessing a body at any moment". (Merleau-Ponty, 1945: 113) 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. (1954: 114)

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 to the early arcade game of *Pacman*: "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' 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.

4. Conclusion

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

At the beginning of this paper, 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 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. 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.

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.

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PART 5

VR APPLICATION,
URBAN MODELING, AND GIS