PANOHAPTIC INTERFACE FOR ARCHITECTURAL FILMIC IMPROVISATION

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Abstract – This project attempts to redefine an augmented reality (AR) architectural concept of traversing the filmic space as a method in a new remote navigational interfacing. Through *Panohaptic* visualization one is invited to experience a soft architectural space in an improvisational manner, connecting the physical optic world to the haptic through AR and digital filmic media. The main goal is to be able to use this interface in a real-time environment controlling film's time and space in order to manifest a new imaginative architectural situation. Remote physical interaction is achieved using optical tracking and multi-touch control through LED gloves, i.e. visual arts and performance events. This interface is creating a new topology that exists in the cinematic architecture realm attempting to bridge haptic and optic vision.

INTRODUCTION

This project uses combination of augmented reality which is a subset of mixed reality digital media applications typically using webcam video, and the concept of tangibility. AR projects a computer-generated 3D image on an audience's view of the physical environment. Artists as well as scientists are experimenting with AR based data visualizations and layered video-based information. This is achieved through post capture software processing such as *ARToolkit*² which is a software library for building AR applications of overlaying virtual data on real world filmic media.

In this research moving images or film conveniently gives us a dynamic form to unwrap the space of architecture, and augmented multi-sensory dimensions. The essence of sensory appears in montage because when emotion triggers a synthetic essence of film, the same as hapticity and motion creating kinaesthetic in the space of architecture. These spatial and temporal dimensions include montage and juxtaposition, duration, scale and contrast, light and shadows, sound and image. Spatial montage could take advantage of the synesthetic dimensions and use the continuous dynamic of filmic space in storyboarding a methodology for architectural design process. In film space architecture is a spatial montage in different layers of time as Eisenstein refers to this in his writing *Architecture and Montage* (1938). At the same time Pallasmaa emphasises every touch, emotional experience as multi sensory dealing with scale, matter, space with qualities that we measure by our eye, nose, ears, skin, the way our body moves through space between a kinaesthetic experience and other sensory modalities that

² <http://www.hitl.washington.edu/artoolkit/>

altogether create a montage of our sensory affects, and our touching experience with architecture [12]. Panohaptic interface for visualizing architectural improvisation uses filmic montage theories and kinaesthetic haptic modalities to translate motion of body through augmented spatial database, creating a soft architecture, and a 'soft cinema' semi-immersive interface [7].

Changing the state of a computable system almost exclusively involves using an interactive system. Communication plays a central role, and interactive software interfaces are designed with the goal of successful communication. These interfaces must therefore be functionally effective and aesthetically attractive³

CINEMAGIC AND TANGIBILITY IN FILM : CAMERA AS SENSOR

Vertov's *Man with the Movie Camera* (1929) points to the active camera as what he sees (records) sequentiality of a city is a hidden glimpse that could only be seen through his expanded kind of editing filmic database in a flexible montage time-space. The camera's active role in creating an augmented reality is like breaking it down and putting it together in Vertov's montage. The hidden images of a city reveal itself when he puts montage of different spaces into motion, time, different speeds and durations using the camera as active technology. Scientific traits in AR creation means like Vertov one has to spend time editing, testing, and experimenting in a lab like environment, with other instrumental objects present such as several fiducial markers. Vertov montage methods were early attempts at augmented reality cinema. Although one of the first to achieve this was the early French filmmaker Georges Méliès in *The Hilarious Posters* (1907) where a large scale city poster comes to life and personalities interact with each other and the reality. Méliès is known as the 'cinemagician' or the father of special effects in film. Today anybody experimenting with augmented reality may encounter a similar cinemagic experience. The effect is in reality a time-space layered as spatial narrative of hidden information, databases, and on demand media. AR similar to Vertov and Méliès

Figure 1. *The Man with the Movie Camera* (1929) by Dziga Vertov, and *The Hilarious Poster* (1907) by Georges Méliès, one of the earliest augmented reality films.

³ Mullet and Sano 1995, from Fishwick 2006:53

filmic experiments extends the right to objectify our spaces through digital media and simple technologies such as webcams that are now becoming ubiquitous.

In 2002 Stewart Morgan, a digital media designer, made a concept film called *Architecture of Information* which in it he explains the coming of a multi-sensory based global vision of AR as visualization that map digital information on a physical world and change our perceptions of the environment. This information will be screened or embedded into perhaps head mounted gears and gradually eye glasses, contact lenses, car windscreens, blending our views of the world with digital information. The recent innovations in *Augmented Reality Tangible User Interface (AR TUI)* via head mounted camera glasses will possibly cause the headgear's popularity to return especially in the video gaming industry integration with AR as in French student Frantz Lasorne's thesis project *Augmented Reality Toys*.⁴ This is an early example of AR video game experimenting which uses a camera as 'active' source of making a video gaming space. AR moving image is a cross-synthesis of virtual data algorithms and our (visual) reality, which transforms (montages) the 2D space of video, and 3D space of VR with augmented data; it becomes making an "*anthropomorphic stimulation of human vision*" [6] where real video is understood as a more cohesive, experiential, and performative 3D world with database information objects becoming more tangible. In AR the presence of body and sensory interaction are encouraging and adds the missing human interaction to its expressive digital form. There is a sense of shared body experience in AR video; almost everyone can read the meaning of an AR video magic and it makes this digital technology more tangible, not just to the laboratory user, rather the casual users alike.

AR is using digital type cameras as primary instruments of video tracking of body gestures which invite the audience to experience it on their own using Open Source AR technologies. During TechFest 2009, Microsoft presented gesture-based video interface concepts using augmented reality among them *Photosynth for Video* and *Video Collage*. Microsoft researchers developed a technology for seamlessly stitching together video clips; so that several people, at an event for example, record their videos stream on their cell phones to a database server, then the software montages together the video streams into a larger scene. The French research and consulting company Total Immersion is developing and passing AR technology on client-need bases; their video-in-video experimental clips on Youtube using AR shows the extended use of video, blurring the digital moving image montage boundaries and recreating the cinemagic illusions. This research project emphasising augmented reality use of two video devices copied and pasted on to each other's content in real-time.⁵ The challenge of AR is tracking the user's viewpoint, and calculating the real camera position and orientation relative to the physical markers in real-time.⁶

⁴ <http://turing.lecolededesign.com/flasorne/portfolio/index.php?2009/01/25/30-real-virtual-playground>

⁵ <http://www.youtube.com/watch?v=kd0rCu3teb8>

⁶ Ibid.

ARCHITECTURE OF TRANSITION : IMPROVISING FILMIC SPACE AND TIME

Architecture starts as an idea in mind with plastic form, but when put on paper or computer it loses its plasticity and becomes bound to CAD's two and three dimensionality. What qualities does the perception of the gap have between the transition of 2D and 3D? This refined space in perception of architecture is commonly underrated in favour of the CAD's automated commands. The temporal and sensory expression of architectural environment has been largely unexplored until recently where we are starting look for the signs of these effects and expressions in other art forms such as film. This research is by modelling of multi-sensory as n-dimensionality using film and the time-space of moving image, sound, in a spatial montage evoked by Eisenstein's writings, including *The Filmic Forth Dimension* (1929). Then the "internal multidimensional behaviour" [5] becomes questioned and approached as a multidimensional thinking that looks beyond the 2D and 3D. Can sensory affects on the built environment be studied in a spatial multidimensional methodology so that we can systematically use the result in our design? Through a theoretical approach sensory effects can be explored where other dimensions such as psychological effects of the space can be objectified and through a compatible medium such as film be translated into architecturally coded data.

The Manhattan Transcripts is a model that similar to my research is using various disjunct media between real and fiction to develop a program as 'scripts' as Bernard Tschumi points out become self-contained set of notations, or drawings; this is a sort of architectural device and possibly a plan for interfacing space and its usage. Tschumi suggests scripts with striking resemblance to Eisenstein's montage; he based his transcripts on a series of episodic events that deal with as he puts it "tripartite mode of notation" [14] which includes event, movement and space. This is similar to Eisenstein's structurally model of multimedia as a diagrammatic score of (1938) film *Alexander Nevsky*, where different elements of the film such as music, duration, and pictorial composition have been visually mapped in relation to each other and in a spatial and temporal flow.

Tschumi is using the vertical montage method of Eisenstein visual score to organise experience, action, and the order of time; he also questions the different modes of architectural representation in an attempt to go beyond the limits of architectural language. In the same way the Eisenstein attempted to manipulate different parts of the film as its own dimension, based on a continuous narrative. Tschumi also does this by using photography as data to extend the 3D representation of architecture. It is similar to new dimensions as notations to extend the action affects in space such as dancer body movement 'carving the space,' her movement producing a form of 'frozen' (4D) space permanent in time.

Figure 2. Eisenstein: *Alexander Nevsky* (1938) vertical montage as a multidimensional map of action.

Figure 3. Tschumi : *The Manhattan Transcripts* (1981) montage as order of the experience and action.

For Eisenstein the idea of musical overtones was similar to filmic overtones created from dialectical montage; in these overtones the conflicts of shots and visuals created the complexity of shots and a psychological quality that is a “*whole complex of secondary stimuli*” [1] as other dimensions of film beside the dominate ones. This is what he called the ‘metrics’ or the ‘dimensions’ of film and is only evident in its dynamic state not static; in other words, when the film is being played or as in music is playing is when we notice these overtones, not when they are static. He thought of these overtones as actual entities, a fourth dimension that needs to be explored in design. Here as a cinematic fourth dimension, space time is compared to an overtone montage sensation as measured substance that can be tangibly used in a methodology. By looking into the transitional spaces between 3D modelling and 4D animation we will propose a new geometric translation of filmic space. Similar to Robin Evans theory of “*third geometry of architecture*” [2] which could be parallel to Roland Barthes third meaning, signifying a n-dimensional new geometry incorporating scientific, sensory, psychological, and other dimensionalities that are non-visible but can be examined in relation to architecture [5]. For instance, to access the time parameter in design one must animate a model and it is only available in a time line. However, time can be

accessed as a geometric fourth dimension to contain more than just motion as animation. In a cinematic architecture exploration time will become geometric slices of topologies. So we can visualize sense of time in the process of design and modelling.

PANOHAPTIC INTERFACE

*When designers set out to define an interface for an application.... The interface should serve as a transparent window, presenting the user with an information workspace without interference or distortion*⁷

Tschumi's early project is a good model for a 'new media architectural visualization' and improvisation methodology that utilises filmic modelling and multidimensional, multi sensory interfacing with architectural design. Using the techniques of horizontal and vertical montage strategies, the temporal arrangements of different sensory data can be joined and related. This type of dynamic architecture is a way of augmenting the transitional space as a spatialisation of consciousness through sequencing, exposing the meaningful images as juxtapositions, spatialising montage and the meaning of space through film. Schoning describes cinematic architecture as tangible reality [13]. If through cinematic architecture we can reflect our mental, sensory dimensions as physical ones we are capable of creating a new dynamic building design and experience a new generative more imaginative architectonics dimension. A generative architecture of imaginary dimensions exists as we experience them in a 'pano-cinematic' architecture.

Panohaptic is inspired by panorama and the concept of *panoptic* as including everything visible in one view, and *panhaptic* defining a touch-sensing modality to render tactile sense to optic at all times as "*a tactile, digital interplay between the senses, a haptic-made-optic.*"⁸ In a trajectory between optic and haptic Brian Massumi suggest considering architecture topologically thinking of space as slice in time. "*The distinction that is most relevant here is between topological transformation and static geometric figure: between the process of arriving at a form through continuous deformation and the determinate form arrived at when the process stops. An infinite number of static figures may be extracted from a single topological transformation.*" [8]. Panohaptic system uses haptic topology and transforming the optic Euclidian space into a plastic experiential 'hyperspace' effect. The spatial illusion in a panorama representation is an immersive visual experience by giving a viewer a 360° field of view; normally human vision can extend a field of view of 200°; thus, a realistic perspective of a landscape is perceived by 160°-200° field of view. If we also consider binocular vision for making detailed observations of a landscape an enhanced vision offers an expanded cinematic field of visual as well as kinesthetic (haptic) sensitivity in a semi-immersive (curve walled) projection. Some of the aesthetic computational aims of panohaptic interface are:

- Cinematic (sequential) and panoramic architectural walk through
- Animating time and space (4D) as 3D forms on a cinematic 2D surface/skin

⁷ Bolter and Gromala, from Fishwick 2006:375

⁸ <http://www.sportswebconsulting.ca/sportsbabel/tags/panhapticism/>

- Natural user interface for filmic architectural improvisation
- Simultaneous architectural visualization in 3D and 4D
- Distance approximation, remote sensing and interaction
- Track meaningful gestures, tangibility and haptic interfacing
- Panoramic explorations of optic architecture as haptic material (Panohaptic).

Figure 4. Panohaptic system prototype

Through Panohaptic visualization we can investigate a generative aesthetic computing methodology for architectural exploration as well as gestural media control possibilities in an AR integrated environment through physical body interaction with 2D and 3D moving images. The panoramic perspectival illusion is our body's experience of space and of our senses making it a rational experience. In Merleau-Ponty's writings the visible and invisible are compared and "*the visible is pregnant with the invisible, that to comprehend fully the visible relations (house) one must go unto the relation of the visible with the invisible.*" [10]. He explains that "*the unity of the object*" cannot be grasped "*without the mediation of bodily experience.*" [9]. In another words, body (sensory) and perception cannot be separated.

Figure 5. A 'soft cinematic' framework using montage theories

AR AS EXPRESSIVE SPATIAL MONTAGE

Moving image is *"no longer just a subset of audio-visual culture, the digital moving image becomes a part of audio-visual-spatial culture"* [6]. This means that digital moving image is part of a spatialised practice. When does an AR visualization or experience become meaningful to the mass audience? Is it the same thing as saying when an architectural plan does becomes understandable to the general public? What type of AR video is right for the general public as visualization and not exclusive in its translation? One answer according to research done by François Penz of Cambridge University is to have expressive narrative space in films, having this quality will engage the audience emotionally as well as rhythmically and so not to rely on temporality. This can add expressive space to the film to depict space of architecture. A narrative of an AR space will transform places into spaces of mixed meanings and algorithmic frames. This type of data is not normally addressed in today's mainstream architectural visualizations, which are less expressive.

We experience architecture through our body and mind in a series of individual visual images to understand separate topographical layers that link together to get a complete understanding of a place. AR video reflects two distinct spatial layers, a virtual and a reality stacked in a suspended time-space of the present. As a spatial montage it's embedded with information from two visual realms, coded and a non-coded. In a situation when we enter a place for the first time, and receive the first bit of its information, we go with that until we get the next bit of information as we are building a spatial mental map and fluidly put them together to create a complete picture.

Similarly with augmented reality video data is not static but in movement with people. The movement is very important in organising the architectural sense of space. The architect Bernard Tschumi's work *Parc dela Villette* in Paris is a playful geometric system of paths and lines that creates a sense of eventfulness for the body that constantly engages with the invisible space of mind and physical events. Tschumi creates unfolding planned arbitrary games whilst creating a strong sense of place, through augmentation of architectural actions that creates his unique 'place making' methods and design process. A focus is on tangibility to translate the framing of film and digital media into its plastic mental experience, 'body site' as a video-tectonics of database rather than sight of our body in architecture. The body sites are everyday experiences with shapes of space and place. Camera's framing of user's body in their visible space as well as an invisible stage; outside of the visible frame and considering distinctions that Maurice Merleau-Ponty makes between geometric space and anthropological or existential space, AR is situated in-between the actual experience of the real world transforming, animating, and influencing its existence.

CONCLUSIONS : PANOHAPTIC VISUALIZATION AS PLASTIC SCIENCE

In computational data visualization architectural design can use AR to blend 3D space and objects interactively and flexibly with the physical sense of reality, creating a tangible portal to the virtual and invisible video data. Similar to the mental image of architecture as a plastic phenomenon concept⁹ [4] augmented reality can form the same way as plastic objects, relating to its qualities that are inherent to modelling. Plastic architecture is what Le Corbusier refers to "a pure creation of the mind"¹⁰ as a state that architecture exists when there is a "poetic emotion" he says "*architecture is a plastic thing. I mean by 'plastic' what is seen and measured by the eyes.*" In his definition construction is not architecture because it doesn't happen in the mind and "plastic creation."¹¹ Architecture is modelled, extruded and shaped as a plastic matter; an architectural representation is closer to its plastic modality and is opposite of static existence. Hence, in reality the plastic qualities of architecture are more retained in the mind as an effect of the architecture and are enhanced as we traverse through it. Panohaptic is a framework for a soft visualization of non permanent architecture. It redefines action of architecture as a plastic experience both visually and contextually; it's analogous to Manovich's video database navigation and its accessibility as '*soft cinematic*' [7] forms. To create an experience of traversing through a real architectural space as a temporal plastic space the challenges are in the lack of haptic modalities in visualization today. Augmented reality materialises the mental perception of this simulated plasticity juxtaposed and overlaid in a real representation of space. Panohaptic interface aids in tangibility and haptic links to this visualization process; therefore, panohaptic interface is a soft spatial montage in real-time using filmic clip database. Connecting this plasticity to hapticity through the complex world of digital

⁹ Le Corbusier 1986: 212.

¹⁰ Ibid: 240

¹¹ Ibid: 215

moving image, panohaptic is adopting montage as “*dramatic analysis of action*” [15]. Its aim is visualizing through tactile eyes, which is achieved through optics of AR camera sensing for spatialising a new tangible architectural vision.

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