Building Fragile Places

Mixed Reality as an architectural platform

Brad Kligerman¹, Jamil Mehdaoui²
¹École Nationale Supérieure d’Architecture Paris-Malaquais; ¹,²Building w/immaterials, France
¹,²http://mysimulacrum.com
¹,²immaterials@gmail.com

Abstract. This paper will explore the hypothesis that Mixed Reality is a differentiated media and credible framework for the generation, fabrication and communication of projects that are explicitly engaged in design research. This will be shown through a critical presentation of three built and unbuilt projects by Building w/immaterials in the domains of architecture, installation and education. These projects will demonstrate the creative and theoretical application of Mixed Reality from within the differentiated social system of Architecture. While the majority of research into Mixed Reality seems to concern its technical aspects, we will explore its application as a creative system for project development, realization and diffusion.

Keywords. Architecture; Mixed Reality; Innovation; Virtual Worlds; Media.

INTRODUCTION

Building w/immaterials diverse projects [1] are perhaps best expressed through the binary oppositions: physical/digital, art/architecture, material/immaterial, land/scapes, nature/technology, space/image, hi-/lo-tech, representation/communication (see Glossary for binary oppositions). Of the many issues raised by the three projects analyzed in this text, the question of media is fundamental to each of them. A project’s representational media is a heuristic device capable of triggering its analytical, generational and sensational qualities. The common thread connecting the multiplicity of diverse media employed by these projects is their use of Mixed Reality as both a spatial construct and a technical framework. Mixed Reality (see Glossary) combines real and virtual environments to create singular spatial contexts where participants can interact with physical and digital information in an integrated way. The definition was further elaborated in the Metaverse Roadmap (Smart, Cascio & Paffendorf, 2007) as “the convergence of 1) virtually enhanced physical reality and 2) physically persistent virtual space. It is a fusion of both, while allowing users to experience it as either.”

We will begin by establishing some basic definitions essential to the paper’s premise. Next, we will present each project through a) a succinct project description, laying out its essential contextual, technical and operational qualities. This will be followed by an analysis of its Mixed Reality framework by b) clarifying the interactions between the project’s real and the virtual states; and c) describing its integration of these disparate states (virtual/physical,
material/immaterial). A table summarizes the qualities inherent to each project (Figure 1). In conclusion, we will show how Mixed Reality is, in fact, a particular kind of media, then reveal a latent quality inherent to all three projects: Fragility. We will analyze the emergent forms of fragility in relation to each project's context and content. Although this paper will rely on concrete projects to reveal the applied and theoretical qualities of Mixed Reality, common definitions of key concepts can be found in the Glossary, helping to avoid any unnecessary ambiguity.

**PROJECT-1: LIMINAL REALITY**

For this group exhibition (October 2008, Paris) of "artists attempting artistic production in virtual worlds" (Balzerani, 2008), Building w/immateri-als constructed an immersive installation space whose objective was to call into question the partitioning of reality into virtual versus real. By establishing real-time interactivity between actual world gallery visitors and a virtual world environment, the installation attempted to replace the binary opposition real/virtual through the resonance between space/image using a Mixed Reality environment constructed for the installation space. LIMINAL Reality [2], expresses the a) liminal space or threshold created at the intersection of these two worlds (The Reality Festival, a temporary group exhibition in Paris, France and the sustainable virtual world of SIZIGIA Island, Second Life) and b) the transitional stage in the evolution of Mixed Reality as a tangible media.

**LIMINAL Reality: Project description**

Images were projected both into a remarkable gallery space and onto a singular physical object. The object in question served as both projection screen, sculptural form. The space allotted by the curators was tangent to the gallery's entrance and central to the exhibit's organization. The large open space (10m x 10m x 5m) was framed by two perpendicular walls, the size of the projected images and built objects had to reflect both this centrality and the scale of the installations space. The corners of the vertical and horizontal surfaces of the projection space were curved, thus obfuscating the articulation between walls, ceiling and floor, and produced a smooth space. Two projectors were suspended from the ceiling, each facing one of the two walls so as to project one continuous image across the walls, ceiling and floor of the space, filling it with color, form and movement.

A second projection screen, the built object, had unabashedly ambitious (and ambiguous) formal and spatial objectives. This object was assembled from thousands of Paris metro tickets (heavy paper rectangles 66mm x 30mm) suspended from almost invisible metal rods (or piano wire) and hung from the ceiling at the installation's visual center. This object functioned on two scales: a) locally, the individual tickets acted like pixels, capturing the projected light and thus coloring and animating them, dematerializing their primary function (offering access to the urban local mass transportation infrastructure) and deconstructing the homogenous scale of the

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projected image; and, b) globally, an amorphous (though tangible) form floated in and within the projected image, animated by the dynamically changing scene. By moving through the installation, the image was subject to a kaleidoscope-like effect when seen projected against the object due to the projection striking the metro tickets/pixels oriented at different angles to the two projectors.

The image in question was captured from the virtual environment of SIZIGIA (see chapter SIZIGIA Project Description). A camera interactively flies through the SIZIGIA synthetic space, projecting it in real-time into the real world installation space. The camera’s path, velocity and orientation, can be both algorithmically predetermined and interactively modified by the installation’s visitors.

Content in this inworld environment (see Glossary, inworld) was prebuilt (by the SIZIGIA community, see chapter SIZIGIA).

**Immersion**

LIMINAL Reality opened a window between two worlds: technically between a physical world and a virtual world, and metaphorically between an art world (a specific milieu of digital art in Paris) and the artists immersive environment (on the Sizigia Island, Second Life). Its Mixed Reality infrastructure permitted the creation of multiple points of view for both simultaneous (albeit asynchronous) interaction in each world, through their representation as polyvalent, spatially compatible, creative environments. By obfuscating the distance and differences between

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*Figure 2
LIMINAL Reality Installation, images and objects*
them using this infrastructure, the project became a “a device based on a triple duality of context (real/virtual), process (immersion/emergence), manufacturing (active/passive). This autopoietic system is both a reading machine, a window, and a decoding grid, between the real and virtual worlds. Using this to reveal its unconscious, the project is also a protocol to reconstitute data, a generator of network connections and a cultural accelerator.” (Balzerani, 2008)

The installation’s tangible atmosphere was projected by the fabrication of real images from virtual worlds and, inversely, virtual images from real worlds, in order to show the multiplicity, integration and compatibility of those two worlds. It is the material aggregate for the real-time generation of heterogeneous loops of space and information from synthetic worlds. “Within a sensor/actuator connected environment, humans will be generating data in the physical world that will simultaneously interface with any one of multiple environments” (Applin and Fischer, 2011).

The installation’s ambition was not to create a totally immersive experience (like a Disney World amusement), whose goal is the suspension of disbelief until the virtual becomes real. But rather, to test the resilience of the immersive experience, not as a technical feat, but rather: immersion as a “social product… at the intersection of place and time” (Boellstorff, 2008). Our approach was to assume that everything about this installation was an absolute expression of reality, and that the conscious suspension of belief (not disbelief) was in fact, the ultimate act of resistance. Although the engagement between art world/virtual world, artist/observer, play/work seems fragile, this fragility was a deliberate component of the project’s fabrication.

PROJECT-2: SIZIGIA

The SIZIGIA project [3] began with an open competition to develop a Mixed Reality public space for the contemporary art collective Laboratorio Curatorial 060 (LC060, see Glossary): “transforming the conventionally passive role of the cultural apparatus from one that invents meaning, into an instrument capable of eliciting it through action and interaction” (Wolf, Morales & Toscano, 2008). SIZIGIA is a project whose territories and connections, artifacts and edifices, spaces and infrastructures facilitate a site-specific autonomous zone, a laboratory for “explicit socio-imaginary confluences” (Wolf, Morales & Toscano, 2008). The project’s conceptual and technical context was defined by the curators to be “situated between actual structures and virtual developments” (Wolf, Morales & Toscano, 2008). The objectives of this ongoing project are to a) elaborate the physical (architectural), inworld (virtual) and online (web site) spaces for each world; b) create an articulation (technical, international) between those worlds from within the project; and, c) develop the infrastructure for LC060’s Artists-in-Residence program.

SIZIGIA : Project description

The SIZIGIA project is perhaps best described (due to its inherent complexity and duration) by depicting each of the four worlds in which it is simultaneously present:

Frontera Coroza (Chiapas, Mexico): Work began with the physical site of SIZIGIA Island, in the Usumacinta River on the frontier between Chiapas, Mexico and Guatemala in 2007 [4]. The collective of artists and curators, LC060 commissioned twelve artists to live, fabricate and install their work in the village of Frontera Coroza. They attempted to establish a technical and cultural economy based on artistic production in an otherwise distant territory, more than 1000km from Mexico City. LC060’s long term intentions were to develop a sustainable association of artists, building the physical infrastructure necessary to house an ongoing Artists-in-Residence program. The invited artists invoked the tradition and the local population and were given an opportunity to open up a dialogue about the fragility of existence living, working literally on the border between central authority and remote independence.

Sizigia Island (Second Life): For the second stage of the project, Frontera Coroza was photographed and mapped, its geographic and visual characteristics were qualified and quantified in order to facilitate
their representation through other media. A filmmaker, a topographer and a photographer worked together closely together, trying to fix an inventory of environmental assets and cartographic views on this territory. Using this information, a digital model of its topography was built into the virtual world of Second Life (SL, see Glossary), were its development as a “site specific autonomous zone and experimental bio-engineering-through-art project” (Wolf, Morales & Toscano, 2008) was carried out. The project strove to build a creative ecosystem for artists’ to work with new media on the threshold between: real/virtual, symbolism/representation, materials/information. This necessitated the development of an adequate graphical, spatial modalities of representation in order to express the site’s physical and atmospheric characteristics. The work of the twelve artists commissioned for Frontera Coroza were now rebuilt in the new, virtual context; the art will now be experienced using an avatar’s senses of perception and sensation (Figure 3). “It is not a question of colonizing new worlds, but of developing the means to inhabit a multiplicity of territories by oscillating between them, generating a new, Mixed Reality” (Kligerman & Mehdaoui, 2008).

Frontera Augmented (Google Earth): SIZIGIA, SL is used to compensate for the economic realities that create geospatial hinterlands. Frontera, when viewed using Google Earth, not intelligible as a territorial entity. Using a Web Application (hybrid software combining data, interface or functionality from two or more sources to create new applications) of Google Earth + Sizigia Island, SL, a high resolution Mirror World (a physical environment digitally mapped in a geographically accurate way) was fabricated. A program made to act like a satellite was deployed in SL to photograph the inworld territory of SIZIGIA and import a grid of images into Google Earth to augment its visibility on the global geospatial networks. SIZIGIA becomes accessible either from the virtual world of SL or from the geospatial globe of Google Earth.

Sizigia.net: SIZIGIA becomes a laboratory for digital experimentation and representational practices, an interface, a place of reunion for inworld users, a platform for further questioning of the potential of this virtual environment. Neither isolated technologies nor homogeneous solution, but a multiplicity of spatial (building, sculpture...), artistic (image, video, sound...) and social (social networking, meeting, collaboration...) tools.

Figure 3
SIZIGIA Island, SL. Artist inworld installation showing superposition of an inworld and a real world ecosystems.
Residence
A vocabulary of scapes forms virtual territories, transformed from boundless, amorphous, and flowing, into the building blocks of contemporary imagined worlds. The spaces of SIZIGIA are dynamic and unstable, rather than static and finished; this volatility, rather than being a vulnerability, is its force, an act of resistance confronting the mercurial pressures that make up its tenuous existence perched between physical and virtual worlds. Building Identity-States and not a State identity (Kligerman & Mehdaoui, 2007) describes the simulacra necessary to prepare this complex spatial and social organization and facilitate its role as a liminal territory capable of spanning borders, connecting divergent media, ideologies, material states and distant environments.

SIZIGIA envisions its statehood spanning between “real structures and virtual developments. The virtual entity in question is the synthetic world, SL, a massively multi-player online (MMO) community: not a game, but a creative platform. Beyond simple 3-dimensional rendering with text, it is a geographically limitless and autonomous territory subject to coherent laws of physics and geometry that render a global immersive atmosphere that is its dominant quality. This global atmosphere paradoxically encourages the elaboration of local communities and adaptive ecosystems, made possible by the persistence of object and identity” (Kligerman & Mehdaoui, 2007).

PROJECT-3: REZ/FAB/REV
REZ/FAB/REV [5] is a response by Building w/immaterials to an open call for projects “which combine an installation dimension and a virtual dimension.” LABoral is an “exhibition center for art, science, technology and advanced visual industries… a venue for artistic and technological production, research investigation and training and for the dissemination of new forms of art and industrial creation.” [6] The only other indications for this call for proposals offered by LABoral were the plans and images of the gallery that will house the installation. Building w/immaterials’ objective was to invent a complex Mixed Reality machine whose hardware, software and human resources would generate both a material object and an autopoetic performance concerning that object’s fabrication.

REZ/FAB/REV: Project description
REZ: To rez, in the context of contemporary 3-D multi-user environments, is to create or to make an object appear. Rezzing an object (or prim, short for primitive object) can be done by dragging a pre-existing object from a database or creating a new object using the inworld creation tools. REZ also signifies the RESident artists of the SIZIGIA community (artists working in a media ecosystem in a 3-D virtual world, see chapter, SIZIGIA), resident artists who, through delocalized collaboration, are engaged in the creation of a synthetic sculptural form for this project, digitally generated from interactions (movement, data) captured from: the inworld space (Sizigia Island, SL) and the actual gallery space in Gijón, Spain. This data serves as parameters for the synthesis of two interlocking surfaces of increasingly complex geometric articulation that have co-evolved over time (See chapter: Synthesis).

FAB: Digital FABrication is the production of material objects from a 3-dimensional digital model. The formal properties of the model (geometric, material, spatial…) will be used to describe and fabricate the sculptural object and articulate the installation space. The installation’s sculptural component is fabricated in-situ, using the DINI d_shape 3-D layering printer (a large scale 3D printer capable of fabricating complex generative geometric form from 3D models, see Glossary). The REZ/FAB/REV installation mirrors the incremental process of the sculptural object’s fabrication (by the d_shape 3-D printer) as its formal, tectonic expression, based on the temporal framework of digital fabrication. The passage from a) the incipient inworld collaboration, b) the emergence of the digital model, c) the generation of the object’s growing geometry, to its e) layer by layer fabrication, is expressed as a material visualization of form, detail, texture and material through the fabricated object.
REV: The DINI d_shape 3-D printer is installed in gallery space. The object’s form is cast layer by successive layer from the bottom (or foundation) upwards, its complex geometry slowly REVealed over the time of the object’s fabrication (about 21 days). The Machine becomes an expressive, sym-bolic device capable of expressing its temporal framework: the transformation of form, detail, tex-ture and material as captured by the object’s grad-ual emergence (Figure 4).

Synthesis
REZ/FAB/REV is the rez-zing of a complex digital model and its fab-rication through the accumula-tion of successive material layers, a process through which its meaning can be rev-ealed. The REZ/FAB/ REV Mixed Reality infrastructure is a computational machine for the synthesis of project input data (movement, attention, interaction…) emitted from virtual worlds and social networks. This information serves to generate a 3-dimensional sculptural form whose specific material qualities (color, transparen-cy, thickness…) suggested the object’s formal quali-ties, whose geometry was transcoded according to industry specifications, interpreted as a physical ob-ject and fabricated by a digital printer according to these material properties. The idea of synthesizing 3-dimensional geometric information was adapted from the practices of sound and video synthesis, where electronic signal produce sound or image data. By integrating virtual objects into actual spac-es, writing the visual, spatial memory of the project’s creation and inventing the symbolic and material possibilities for the project’s continuity, the instal-lation becomes a Mixed Reality of heterogeneous loops of space and information.

Figure 4
REZ/FAB/REV installation fabrication process at (clock-wise from top left) 5, 10, 15 and 21 days.
**CONCLUSION**

Does Mixed Reality asserted itself as a differentiated media? By establishing the “defining medium (of architecture as) drawing”, which, in the context of contemporary architectural production, can be equated with the digital model (Schumacher, 2011), we can rephrase the question: Is Mixed Reality a process that directly leads to the creation of a digital model? If not, how can we qualify its role in the creative process?

**Framework**

Mixed reality is a framework employed to create both a project’s essential supporting structure, and a device for spatial framing. Frameworks are the technical infrastructure for the services, protocols and networks required for immersive, media-rich environments. Framing, on the other hand, attempts to describe Mixed Reality as an inherently architectural media. As borrowed from the disciplines of communication theory or sociology, framing relates to “the construction and presentation of a fact or issue framed from a particular perspective” (Goffman, 1974); or from the visual arts, where it connotes a device used to maintain or direct the focus onto the framed scene. Framing is “a system of entities, postulates and rules… that allows its user to locate, perceive, identify and label a seemingly infinite number of concrete occurrences defined in its terms” (Goffman, 1974). Mixed Reality frames and frameworks form the basis of these contemporary projects. As outlined in the manifesto, Open Source Architecture by Carlo Ratti [7], projects whose “production and critical, public, client (and) peer-related (reception) form part of the project itself, creating a feedback loop that can ground—or unmoor—a project’s intention and ultimately becomes part of it.” These projects “supersede architectures of static geometrical form with the introduction of dynamic and participatory processes, networks, and systems… distinguished by code over mass, relationships over compositions, networks over structures, adaptation over stasis.”

**Accelerator**

A program of design research is engaged by designers committing a priori a project’s development to a Mixed Reality ecosystem. Design research is a “process of innovation for the discipline of architecture” (Schumacher, 2011); design research programs are “vehicles of cumulative innovation” to assure that the “challenges posed by contemporary society are being translated into viable briefs and design tasks that can serve to upgrade architecture’s capacity to fulfill its societal function” (Schumacher, 2011). Mixed Reality is a potential and potent framework for design research, a “powerful evolutionary accelerator… pushing (architecture’s) own level of innovation” by creating “challenging media-scapes that demands techno-social intermediation across the threshold of human/technological integration.” (Schumacher, 2011)

Such projects, according to Ratti, intend to “transform architecture from a top-down immutable delivery mechanism into a transparent, inclusive and bottom-up ecological system.” [7]

**Fragility**

SIZIGIA, REALITY and REZ/FAB/REV are projects whose ambition is to position Mixed Reality ecosystems as highly accelerated cultural engines for the development of knowledge about space, time and materiality. These projects function as laboratories for digital experimentation and representational practices, favoring the colonization of sustainable-physical and immersive/virtual environments for radical experimentation. Fragility is not simply a question of what is lacking (according to the dictionary, “Easily broken, lacking substance, physical or emotional strength; delicate…”) but of capitalizing on the particular qualities inherent to fragile spaces, building a project based on those qualities. These projects motivate the exchange of identities and ideas, media and ideologies by spanning borders and traversing disparate territories, possessing multiple manifestations of Fragility.
EPILOGUE
A consensual sentiment amongst SIZIGIA’s real world/inworld residences is the desire to re-engage the project’s physical world antecedents on the banks of the Usumacinta River by following the loop back to its logical (or illogical) conclusion: the development of the real world Frontera site. Planning has begun for the actual construction of the edifices necessary to reside, produce and diffuse SIZIGIA’s work from the Mexican border. Instead of employing the traditional design process of problem/solution composing material/form, SIZIGIA’s buildings, structures and spaces will be adapted from the inworld generative process of flux/usage, time/fabrication. The soon to be constructed buildings for the SIZIGIA Artists-in-Residence complex are currently being designed; they will be both formed and informed based on the extensive inworld experience of the SIZIGIA project. Due to this surprising turn of events, where a real world building will be designed based on virtual world experience (and not the other way around), perhaps we are witnessing the reversal of the incorrigible opposition between real/virtual.

GLOSSARY
Binary oppositions is loosely related to Niklas Luhmann’s term binary codes, used to qualify all communications of society’s functionally differentiated social system (Luhmann, 1995).
Building w/immaterials is an association of architects, programmers and curators doing independent research into digital media, visual arts and built environments: spatial inquiry for the invention of new structural typologies. Architects Brad Kligerman and Jamil Mehdaoui work and teach in Paris and occupy in a plethora of digital spaces [8].
DINI d_shape is a 3D printer capable of fabricating large scale (10m x 10m) geometric forms from 3D models using a stable, ecologically balanced material composite [9].
Inworld is when a user is active in a specific virtual world.

Laboratorio Curatorial 060 (Mexico City) were awarded the Best Art Practices award for curators in 2008 for the SIZIGIA project in the category of best contemporary art projects in non-conventional spaces for their exploration of new ways of thinking about contemporary art at “the fringe of its own (im)possibilities.”

Mixed Reality is the creation of new spatial environments for human interaction with physical and digital information in a synthetic space, produced through the merging of physical and virtual environments. “While each reality is complete unto themselves, they are also enriched by their ability to mutually reflect, influence, and merge into one another” (Applin & Fischer, 2011).
Second Life (or SL) is an online virtual world where residents interact through avatars in a 3-dimensional space. The world is made from user created content (objects, buildings...), the virtual property forming the material basis of its economy. SL is considered a platform by developers for its ability to create hybrid applications (games, Augmented Reality, music and video installations...).

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