Material Inquiries, Immaterial Affinities

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INTRODUCTION

The challenge and opportunity of the second-year, graduate-level studio at the University of Pennsylvania is that the practice and the question of the digital is introduced at the same moment as are investigations into the tectonic and topographical reality of buildings. As Michel Foucault elaborates in *Representation and Resemblance*, what is real is precisely what escapes representation; what is real is what the representation lacks. The studio posits that one of these things is material, the other is scale. The studio uses translations from digital representations to physical models to help students to make a transformational leap from the virtuality of the digital diagrams to tectonics. Rather than being nostalgically material or virtually enthralled, the pedagogical strategy alternates between the digital and the material. Through experiments with real building materials and the techniques with which they are worked, students discovered phenomenally and structurally based material criteria. These *translations from drawing to building* elucidated the architectural projects and in some instances also determined the generative strategy. The goal is to understand the conceptual and literal role of materiality in architecture. Material inquiries include: Q. What are the relationships between the design of a wall in a specific material and the perceptual effects that it perpetuates? Q. How can materials design systems?

This crossing of the immaterial and the material, the abstract and the tangible, finds locus in the term, *chora*. In his "The Space of Architecture: Meaning as Presence and Representation," Alberto Perez-Gomez makes the contention, "'*chora* … is the meaning of architecture".[5] *Chora* is a third term along with *being* and *becoming*, in Plato's articulation of reality, the *place* into which the universe is created.[6] In its transitory status, chora shares the properties of both the ideal forms and the material reality while simultaneously remaining a neutral receptacle, having no specific properties or qualities. In the binary oppositions which are set up by the text, *chora* exists between being and becoming, the intelligible and the sensible, the ideal and the material. It separates the two, enabling their simultaneous co-existence and interchange. Unlike *topos*, which invokes a particular place or location, *chora* has no specificity, it is "'…the screen onto which is projected the image of the changeless Forms."[7] The virtual space of the screen, the *place* which is delineated in so much software by the Cartesian space of the 3D grid, is quite similar. It is the place where the architectural form comes into being, the bridge between the digital representations and the material model. In fact, it is hard not to read this particular attempt of Plato to describe chora without thinking about this virtual space:

> It can always be called the same because it never alters its characteristics. For it continues to receive all things, and never itself takes a permanent impress from any of the things that enter it, making it appear different at different times. And the things which pass in and out of it are copies of the eternal realities, whose form they take in a wonderful way that its hard to describe.

THE QUESTION OF THE IMAGE AND ITS RELATIONSHIP TO MATERIAL

The design studio, *Material Inquiries, Immaterial Affinities* begins with the proposition that the architectural project exists in a state of becoming: between the imagined building and the constructed one, between generative strategies and their representations, and between digital representations and material ones. The creative process is informed and abetted by a series of such translations and iterative drawing operations.

Robin Evans' formidable work on the relationship between drawings and buildings testifies to their "enormously generative"[8] role in design. Drawing is always a creative act, and the "digital drawing," understood as a space of thinking and creation as Evans describes, and "not so much a work of art or a truck for pushing ideas from place to place,"[9] necessarily enlarges the category of what we call drawing. Moholy-Nagy encouraged his students similarly, about the potential of the new photographic apparatus: "Whoever is capable of abstracting the surface projection of a 'holyhand' and a 'souless' apparatus and is able to discern the creative powers of the artists which went into this effort finds it impossible to be for the brush and against the device."[10]

While not absent in drawings made by hand, what is strikingly characteristic of the digital interface is the ability to easily synthesize the rational and intuitive forces at work in the creative process. A digital drawing achieves exactitude and geometrical fidelity through rational means but these means are transparent to the user and do not present a hindrance in terms of speed or ease of expression. The drawings are simultaneously measurable and abstract. The process is interactive; dynamic feedback is provided through the image on the screen, the image is judged and the drawing is acted upon. The question of the drawing, even when the definition is stretched to include drawings made with digital means, is distinct from the question of the image. Their relationship may be thought of in terms not unlike the "complementarity and competition"[11] between assiduous copies of drawings made by hand and those that guaranteed fidelity of the original through printing in the 16th century.

The digital image, however, is no stable likeness, resemblance or similitude.[12] Like transparent layers of superimposed video[13], the images that constitute the project accumulate in the imagination, slowly focusing the mental image of the work. The proliferation of the image and of simulation over representation is presaged by Jean Baudrillard in "The Precession of Simulacra': The image moves through successive phases, understood through representation as a basic reflection of reality, it becomes the very thing that masks reality, and then, the absence of reality. Finally, it escapes from the order of appearance altogether and becomes its own pure simulacrum, completely unrelated to reality. It is at this moment when the figurative is resurrected and nostalgia drives a "panic of material production."[14]

The emphasis on material intends the double entendre of the word itself: *relating to matter rather than form* and *having real importance or great consequence,*

relevant. As Nina Hofer has written, "Engagement with matter can be a primary consideration and generator … it is inherently both spatially and metaphysically generative: the potential for meaning is latent within the characteristics of any material and the ways in which that material is worked…Through a careful interplay of reason and imagination material premises can accumulate layers of analogous association and invent rather than accommodate tectonics".[15] It is the working of the material by hand and the construction of material models made by hand from interpretive translations of the digital drawings and experiments with the material itself which are productive and valuable to the design process. The digital manufacturing of 3d models from homogeneous materials using immaterial processes like 3d-printing and CAD/CAM requires neither inquiries into material nor logics of construction and assembly which are critical for the introduction of tectonic reality in the design studio. These are classed as "reproductions" rather than translations of their generative digital images and seen as equivalent to them.

Drawing is the discipline that connects sight and knowledge — Rafael Moneo

Exercise One: Strategies of Observation and Description

The students are asked to visit the PSFS Building and concentrate on the sensory aspect of things: the passage of time, qualities of color, material, measures of darkness and lightness, transparency, reflection and luster. They are asked to complete three drawings of the building at three different scales of perception. The drawings are acknowledged to be necessarily fragments. No single image will capture the building "as it really is" but the set of three has the potential to reveal the interplay between the experiential phenomena produced by the building and the building's material reality. In "What Goes Unnoticed: On the Canonical Quality of the PSFS Building," David Leatherbarrow alludes to some of the reasons this building is especially suited to an exercise in the observation and description, particularly one with an implicit agenda to link immaterial visual effects (perceptible through the image) and material constructs:

> The treatment of the building's surfaces, inside and out, works toward the same goal of laconic precision, or a kind of muted splendor. Little or nothing is applied to the building's materials-neither paper nor paint. Instead each piece of steel or stone is polished to a specified degree…representation is thus avoided and the things themselves are exposed.[16]

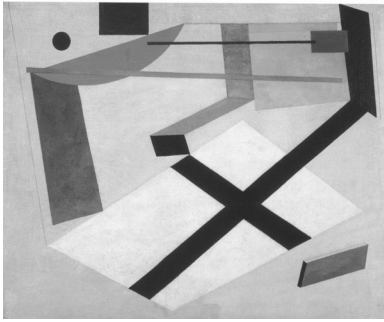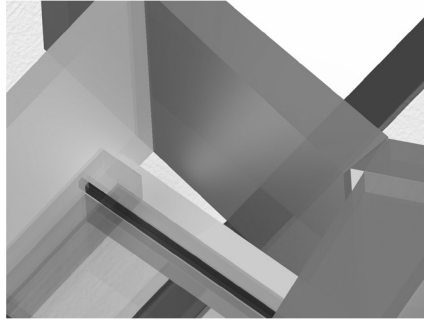Fig. 1. Proun 30T El Lissitsky (1920). Jones.

Fig. 2. Rendered Digital Model, M. Jones.

Fig. 3. Rendered Digital Model, M.

To help grasp the extent and implications of the exercise, students began by doing an analysis in visual studies of the work, Proun 30T, by El Lissitsky (1920). (Fig. 1.) They were asked to construct a 3-d model from their reading of the perceptual effects of color, including apparent transparencies, reflections and textures. They also referred to El Lissitzky's writings on the *Prouns*, in particular, which describe the strong association of colors with specific materials. The spatial translations from two-dimensional painting to three-dimensional digital models were constructed with rigorous attention to the intuitive and formal properties of color as spatially constitutive. Multiple rendered images they constructed revealed that the same model and colors could be made to look very different depending on point of view, material reflectivity or transparency and texture.

From the student analysis:

''The Proun is a three-dimensional thing that has been captured by two-dimensional images. Proun was Lissitsky's approach to the idea of rotation in space. Simple geometric forms (squares, triangles, circles and intersecting lines) create a dynamic image that expresses different speeds and rhythms. This and the color suggests particular qualities of weight and therefore material. This was the way I approached the space at the PSFS which drove me to understand it better. Planes and walls that border each other are totally opposite: like black and white or glossy and opaque. Sometimes the same material looks like a completely different color or something opaque seems to be completely transparent. Images of the same thing change depending on where you stand and where the light is.''

Strategies of Observation and Description resulted in drawings of the PSFS that were hybrids of photographs, digital drawings and hand drawings. In some case, digital models were made to simulate the effects of light and transparencies in excess of what was able to be captured photographically or through drawing. This

hybridization of media emphasized the salient qualities of each representational media, and their often over-determinant characteristics. The most successful drawings were able to allude to the perceptual inconstancy of the materials using an ambiguity that was registered analogously across the drawing's several media. In other words, when the photograph established the measure or materiality and the digital model simulated a perceptual effect.

… material in the broadest sense of the word, as comprising the concrete stuff from which a work of art is made, the techniques available, the arsenal of images and memories deployed by the artist and the world's various contexts—Theodor Adorno

EXERCISE TWO : MATERIAL INVENTORY, CATALOG, ENCYCLOPEDIA (ASPIRATIONS TOWARDS COMPLETENESS)

Students were asked to examine the material of their choice and categorize and employ several techniques of its fabrication. For example, for wood, students experimented with steam-bending or lamination; for metals, with perforation, folding and weaving; for cast materials like concrete and glass, with casting, molding). Through direct experimentation with the material processes the students constructed composite material studies. These material constructions were tested against digital simulations for their prolonged phenomenal effects, for instance, accumulating daylight studies over a year. The simulations, in turn, were tested against the material constructs for their tectonic qualities and structural viability.

From student 's material study:

''I was looking for opposite materials, and the idea of one material acquiring a perceptual quality from the other. The plaster is a material that has weight, and can be colored. It is warm and opaque, whereas stainless
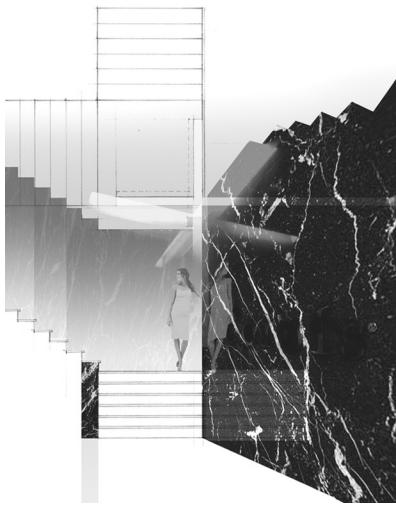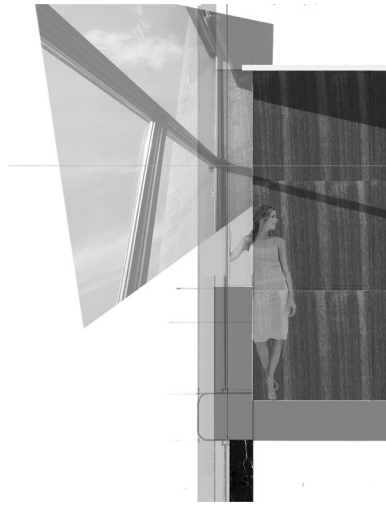
Fig. 4. Foreground, Heewon Park.

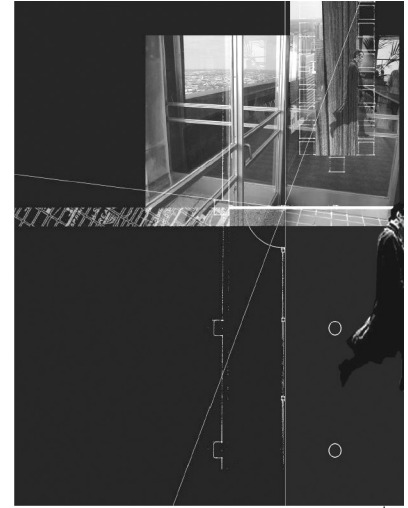*Fig. 5. Middleground,* Heewon Park.

Fig. 6. Background, Heewon Park.

steel is light, cold and reflective. The stainless steel can obtain color from its environment. The stainless steel gets its form from the application of force, the plaster from another figure, a mold that gives it shape. My model tries to capture something I saw at the PSFS, the interaction of light and color between two materials and the recollection of light in the edge of two contracting materials. The sense of rotation in space is made possible because of the contrast of perceptual effects in the materials. Color is projected onto surfaces through reflection and changes with the changing light. Glass looks like stone, stone looks transparent. This is the same technique that Lissitsky used in his painting. The sense of movement and rotation is created by the materials, not by the shape of the space in which they exist.''

The Program, a Holistic Research Center & Spa, introduced as '' ' a mythological bridge between the intelligible and the sensible, the mind and the body…'' [17] has

facilities for the 21st c. highly-stressed urban nomad. The 22,000 sf program includes an aqua center with sauna & steam bath, sunbeds for outdoor sunbathing and massage, meditation rooms, small auditorium for musical performances, a banquet room for symposia, a Café, and a research facility for aromatherapy that includes an herbal greenhouse. As with the observation and description studies, the project drawings were a locus for both static abstract measurements and dynamic perceptual effects. The daylight studies and rendered sections allowed for the description of intended light and color environments. This was seen as critical to the design of the Holistic Spa, which offered an array of sensory environments which included still and moving water, aromatic plant life, humidity and dry sauna, interior and exterior spaces, solitude and conviviality. Certain rooms were choreographed to spatially coincide with light penetration or qualities of lightness, darkness and reflectivity at certain times of day. Sequences of

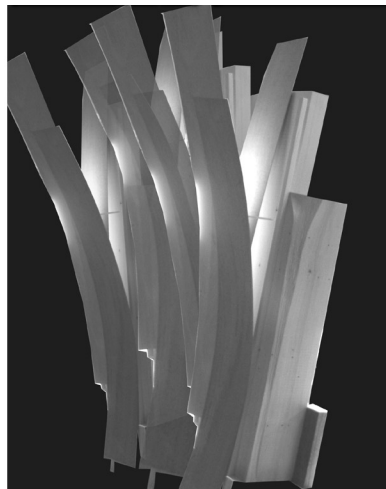*Fig. 7. Mat. Study* A. Hernandez.
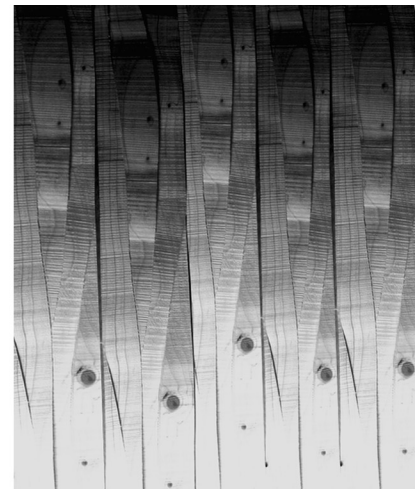

Fig. 8. Material Study, Pei ling Ko.

Fig. 9. Material Study, Pei ling Ko.

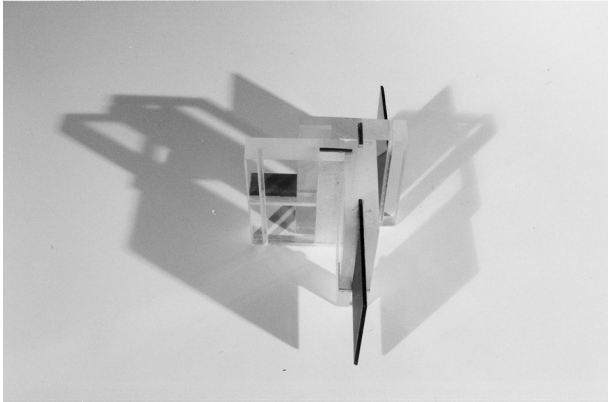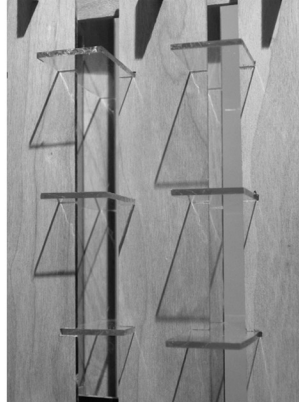Fig. 10. Material Study, Ozgu Saracoglu.

Fig. 11. Material Study, Heewon Park.
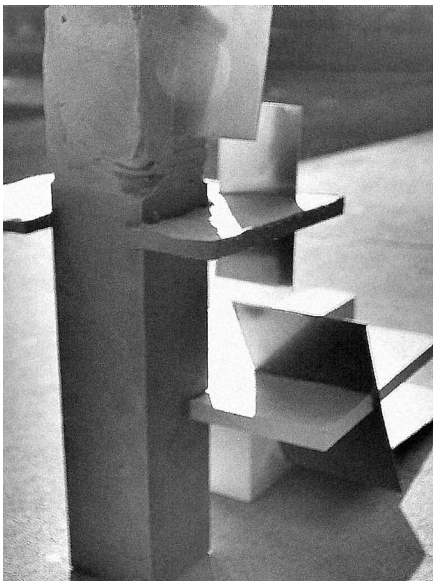

Fig. 12. Material Study, A. Hernandez.

Fig. 13. Digital Study, A. Hernandez.

engagement with the building and the activities accommodated were further described through animations.

Topographical issues, particularly location on the site relative to existing buildings was studied using a shared site model. Massing studies involved both this physical model and a digital model of the site which provided valuable information about shadow casts from adjacent buildings. It was also possible through the use of the digital studies to determine which fragments of the building would have light all day, and for how many days a year.

The studio aimed to strengthen and achieve "a synthesis of the spatial and material imagination"[18] through experiments with real building materials reason and the techniques with which they are worked, and which give each its salient characteristics. Moving between digital and physical models, phenomenally and structurally based material issues and criteria are revealed and

explored. These abstract criteria fed into an ecological & technological study of an exterior wall of the project as the active link or exchange between architecture and the environment.

CONCLUSION

Edward Sekler coined the term *atectonic* when he spoke about the way Josef Hoffman used the cable moldings at Palais Stoclet: "at the corners where these parallel moldings come together, the effect tends towards a negation of the solidity of the built volumes. A feeling persists as if the walls had not been built up in a heavy construction but consisted of very thin sheets of material joined at the corners with metal bands to protect the edges."[19] Bill Mitchell posits the term "anti-tectonic" to describe an avant-garde architectural domain where spatial experiences are totally separated from physical constructions, mass and tactility; there is no material to
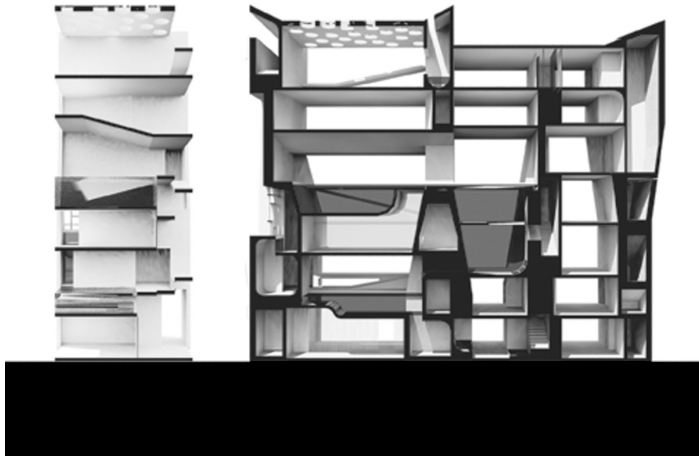
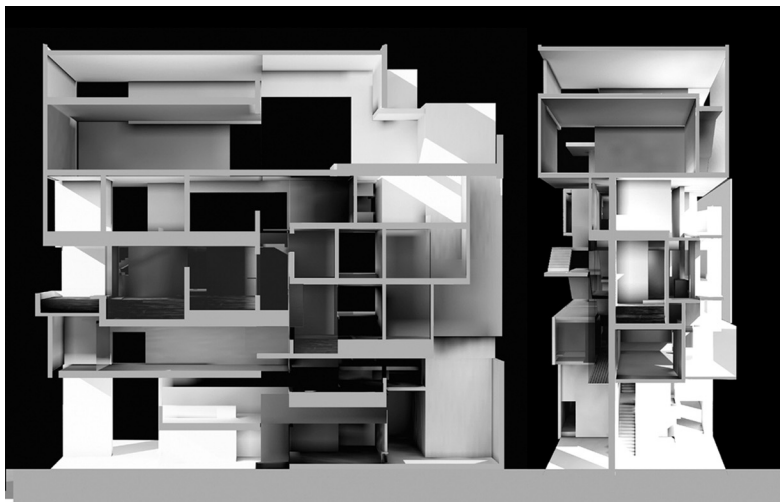*Fig. 14. Sections, Holistic Health Spa, rendered digital model,* Wiebke Lemme.

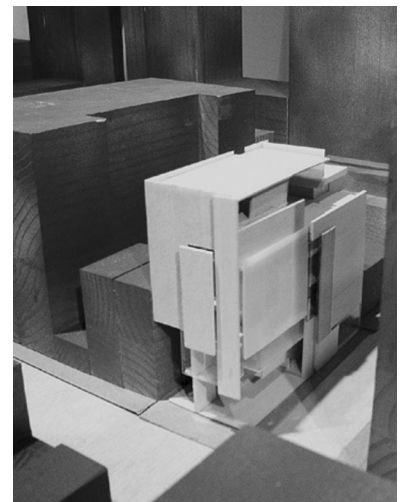*Fig. 15. Sections, Holistic Health Spa, rendered digital model,* Heewon Park.

Fig. 16. Model, Heewon Park.

transform, no weathering of surfaces over time. ''In the search for a 'poetics of virtuality' the capabilities of the craftsman no longer limit the domain of design possibilities (and no longer guide it, either). Joints just don't matter, surfaces have no thickness, there is no up, no down, no body and nobody — civic subjectivity, no ground, no underpinnings, no framework''.[20] Virtual realities which are never meant to be manifest physically reduce architecture to its visually perceptible components, producing an individualistic ''spatial experience'' which is just perfect for a video game. It leaves out what this studio set forth as the ground of architectural design, the tectonic and topographical reality of buildings. Mitchell offers one answer: The virtual appropriates from the material and the material from the visual. In its pedagogical approach and working method, *Material Inquiries, Immaterial Affinities* exercises this encouraging resolution.

NOTES

[1] Selected meanings from Webster's New Collegiate Dictionary. (Springfield, MA.: G & C. Merriam Co., 1977). 1. Material: relating to matter rather than form 2. having real importance or great consequence, relevant.

[2] ... Affinity: Bordering on, related by marriage, kinship, attraction, esp. an attractive force between substances that causes them to enter into and remain in chemical combination.

[3] Selected meanings from Webster's New Collegiate Dictionary. (Springfield, MA.: G & C. Merriam Co., 1977). 1. Material: relating to matter rather than form 2. having real importance or great consequence, relevant.

[4] ... Affinity: Bordering on, related by marriage, kinship, attraction, esp. an attractive force between substances that causes them to enter into and remain in chemical combination.

[5] Alberto Perez-Gomez, ''The Space of Architecture: Meaning as Presence and Representation'', *Questions of Perception: Phenomenology of Architecture*, ed. Steven Holl, Juhani Pallasmaa, Alberto Perez-Gomez, (A+U Special Issue 1994) p. 8-25.

[6] Plato, Timaeus and Critias , trans. D. Lee. Harmondsworth: Penguin, 1977. (48e-53a).

[7] Elizabeth Grosz. '' ' Woman, *Chora*, Dwelling.'' *Gender Space Architecture.* ed. Jane Rendell, Barbara Penner and Iain Borden. (London and New York: Routledge, 2000). p. 213.

[8] Robin Evans, *Translations from Drawing to Building and Other Essays*, Architectural Association Publications (London and Janet Evans, 1997). p.156.

[9] …ibid, p.186.

[10] Laszlo Moholy-Nagy, '' 'Isms' or Art?'' *Vivos voco* (Leipzig), Vol. V, No.8/9, August-September 1926., quoted in *Bauhaus,* trans. Wolgang Jabs and Basil Gilbert, ed. Joseph Stein Cambridge, MA: MIT Press 1969. p. 115.

[11] A study suggested in Mario Carpo, *Architecture in the Age of Printing,* trans. Sarah Benson, Cambridge, MA: MIT Press 2001. p. 11.

[12] Mitchell, W.J.T. *The Language of Images* Chicago: University of Chicago Press, 1974.

[13] Like a *Salient Still* — an image that translates time into space, created in a recent (1994) project at the Media Lab the process takes several seconds of video and prints them as a still in such a way that the still has a higher resolution than any single frame of the video. It is an image that never existed; it represents a still frame of many seconds, where the elements that do not move are registered in the image and the those that do move, drop out.

[14] Baudrillard, Jean, ''The Precession of Simulacra'' *Simulations*, New York: Semiotext(e), 1983. p. 257.

[15] Nina Hofer, ''Troping Matter: Death Masks and Life Casts,'' 85th Annual Meeting & Technology Conference, (ACSA Press : 1997). p. 639.

[16] David Leatherbarrow, ''What Goes Unnoticed: On the Canonical Quality of the PSFS Building'', Harvard Design Magazine (Summer 2001: Number 14).

[17] Grosz, p. 210.

[18] Gaston Bachelard, quoted in Perez-Gomez, p. 23.

[19] Edward F. Sekler, ''The Stoclet House by Josef Hoffman,'' in *Essays in the History of Architecture Presented to Rudolf Wittkower* (London: Phaidon Press, 1967), p.230-231 quoted in Frampton, Kenneth, *Studies in Tectonic Culture: The Poetics of Construction in Nineteenth and Twentieth Century Architecture*. Graham Foundation for Advanced Studies in the Fine Arts, Chicago IL and the MIT Press, Cambridge, MA. 1995.

[20] William Mitchell, ''Antitectonics: The Poetics of Virtuality'' *The Virtual Dimension: Architecture, Representation and Crash Culture*, ed. John Beckman. New York: Princeton Architectural Press, 1998. p.204.