FROM VIRTUAL TO HAPTIC SPACE:
RECONSIDERING FORM AND SPACE THROUGH DIGITAL MEDIA

By

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Arts

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ABSTRACT

FROM VIRTUAL TO HAPTIC SPACE:
RECONSIDERING FORM AND SPACE THROUGH DIGITAL MEDIA

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Computer technologies provide new means for the creation of design objects and space. This thesis explores the shifting understanding in design process and the resulting environmental qualities through the integration of digital media in design and production of form and space. The focus will be on how digital media enables us to reconsider the ways that form and space are created and rethink the ways that we relate to these forms and spaces.

The changing approach in the design and manufacturing methods with the integration of digital media is evaluated by the distinction provided by Gilles Deleuze, where the concepts of 'actualization of the virtual' and the 'realization of the possible' are examined to provide the basis for evaluating the emergence of new connections. It is argued that through the use of digital media in design, a shift in the understanding of form and space emerges, which reveals alternate ways of relating to these forms and spaces through different levels of interaction. The framework for differentiating between the levels of interactivity is provided again by Deleuzian conceptual pair, 'optic' and 'haptic space'. It is argued that haptic space offers alternate ways of existing in space and questions the traditional understanding of the production of space.

Keywords: digital media, virtual-actual, interactive form-space, optic-haptic

ÖZET

SANALDAN HAPTİK MEKANA:
FORM VE MEKANIN DİJİTAL MEDYA ÜZERİNDEN YENİDEN DÜŞÜNÜLMESİ

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Bilgisayar teknolojileri, tasarım objelerinin ve mekanın yaratılmasında yeni araçlar sunmaktadır. Bu çalışma, form ve mekanın tasarım ve üretiminde digital medya kullanımının tasarıma getirdiği anlayış değişikliklerini araştırmaktadır. Çalışmanın odak noktası, dijital medyanın form ve mekan yaratma yollarını nasıl yeniden ele almamıza yardımcı olduğu, bunun yanında bu form ve mekanlar ile bağlantı kurmanın yollarını bir kez daha gözden geçirmektir.

Yeni bağlantıların ortaya çıkmasının ele alınmasına zemin hazırlayan 'sanalın gerçekleşmesi' ve 'olanaklının gerçekleştirilmesi' temalarını inceleyen Gilles Deluze tarafından bize sunulan ayrım dikkate alınarak, tasarım ve üretim metodlarınında değişen yaklaşımların dijital medya ile bütünleşmesi değerlendirilmektedir. Tasarımda kullanılan dijital medya ile birlikte, farklı etkileşim kanalları sayesinde bu form ve mekanlar ile bağlantı kurarak ortaya çıkan alternatif yolları göz önüne serecek olan form ve mekan algılanmasında bir değişiklik meydana geleceği savunulmaktatır. Etkileşim seviyelerinde görülen farklılıklar yine Deleuze'un önerdiği kuram çifti "optik" ve "haptik mekan" ile gözler önüne serilmektedir. Haptik mekannın, mekanda varolmaya alternatif yollar sunduğu savunulacak, mekanın yaratılmasındaki geleneksel anlayışlar sorgulanmaktadır.

Anahtar Kelimeler: Dijital medya, sanal-gerçek, interaktif form-mekan, optik-haptik

This thesis is dedicated to my family who offered me love and support in all my accomplishments.

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CHAPTER I

INTRODUCTION

This thesis explores the shifting understanding in design process and the resulting environmental qualities through the integration of digital media in design and architecture. The focus will be on how digital media enables us to reconsider the ways that form and space are created and rethink the ways that we relate to these forms and spaces.

First of all, the relation between technology and art will be examined based on Walter Benjamin's essay *The Work of Art in the Age of Mechanical Reproduction* (1969). The points raised by Benjamin in this essay provide grounds for the discussion of the course of art in the digital age. However, the matters of reproduction in the mechanical age do not exactly refer to the digital age since the issues of reproduction itself becomes a questionable area. The aesthetic concerns of the mechanical age are rooted in representationalist aesthetics dominated by perceptual relation with the work of art. Yet, in digital age the concerns of artwork and design product seem to be shifting from this idea.

The understanding of form and space is altered by the introduction of the digital media, therefore, the bodily relation to these forms and spaces start functioning in a different level. In order to investigate this change the differences between the traditional media and digital media are examined. Lev Manovich in his book *The Language of the New Media* (2000) clarifies the attributes that differentiate the digital from the traditional media. These can be briefly named as numerical representation, modularity, automation, variability and cultural transcoding. The fifth point, however, relates to the cultural aspects of the digitization process therefore will not be evaluated in this study.

It is also important to realize that digital media is not a new concept, what makes the digital the 'new media' is the ways that it is employed. The 'newness' of the digital media will not be argued on the basis that it provides better solutions, but instead, it offers a different design approach which initiates a diverse understanding in design by providing new connections through relating to forms and spaces on an alternate level.

The framework for displaying an argument on the 'newness' of the digital media in terms of creating form and space will be based on Gilles Deleuze's approach to 'genesis of form' who privileges the 'actualization of the virtual' over 'realization of the possible' by developing Henri Bergson's criticism on the inability of science of his time to think the new and the truly novel. Manuel de Landa explains Bergson's argument by pointing out that realization of previously determined possibilities; eternal essences referring to Plato's ideal, does not provide innovation. Therefore, Bergson privileges the actualization of the virtual

over realization of the possible, in order to offer creation through 'immanent' sources and 'emergent form'.

The actualization process refers to the transfer of the virtual qualities into tangible reality where at the same time realization of the possible requires a choice among the possibilities where other choices are neglected. However at this point it is important to note that virtual does not refer to the computer space. The 'virtual' that will be referred in this study exists in the real as explained by Deleuze:

> "The only danger in all this is that the virtual could be confused with the possible. The possible is opposed to real; the process undergone by the possible is therefore 'realization'. By contrast, the virtual is not opposed to the real; it possesses a full reality by itself. The process it undergoes is that of actualization" (1994, p.211).

The virtual-actual and real-possible couples will be explained in order to explore the design methods and production of form and space. This will be achieved by investigating the relation between the virtual realm and architectural process of generating form and space. The main argument here will be based on the distinction between the virtual-actual and real-possible couples. However, although they acquire characteristics opposing to each other, their inevitably complementary nature will be revealed through the discussion of examples from different disciplines, such as arts, architecture, product design and technology. The design methods or the design product is evaluated under the distinction of the 'virtual' and the 'possible', however in this study, the mutual coexistence of these terms emerges, since the virtual that

exists in the transitions will be captured which means that it again becomes a part of the realization of the possible.

The changes in design methodology will show that through the adaptation of algorithmic permutation and generation, form and space become continuous series of forms and most importantly formless, or, in other words, unform. The conclusion to be reached in this section is the adaptable and infinite nature of the forms and spaces created in these processes will always mean that, when they are materialized, they will again become one of the possibilities being realized while others are neglected. Therefore, the ways that these forms and spaces are constructed has to be reconsidered so their materialization does not eliminate their ability to adapt and remain in a continuously changing and interactive status.

The materialization section, therefore, tries to examine the transfer of the unform and constantly changing state into reality. The examples of new production technologies providing a shift from mass production to mass customization will be illustrated. Further examples of 'Protospace', 'muscle systems' and 'Aegis Hyposurface' supervised by Mark Goulthorpe will demonstrate the design approach to create the unform through interactive systems enabled by digital technologies.

Another design approach which will be illustrated in this chapter is morphogenesis. As explained by Michael Hensel and Achim Menges in their book *Morphoecologies* (2006), morphogenetic approach examines the

principles of generation of form in living organisms. The methods for adopting this approach are enabled by digital media where biological concepts of genetic encoding and DNA can be represented in the form of algorithmic scripts. Furthermore, gene crossover, mutation and environmental responses of an organism can be replicated in terms of permutative inputs. The significance of morphogenesis in design is related to the organic qualities of the product accomplished by this approach. The organic ability to change, adapt and respond can be integrated to design product, which again redefines the understanding of form and space.

Therefore it can be said that, the articulation of the virtual realm with the design process leads to reconceptualization of the design product since it allows the shift from the understanding of design as structurally complete, aesthetically and functionally satisfactory, finalized design objects to spaces and forms that are now able to respond to real-time interaction and therefore attain a constantly changing characteristic. In this case, production of form and space is pushed to a further stage and the meaning is produced through an embodied experience which becomes the agent that produces meaning.

This approach to design more specifically defines new ways of relating to these spaces and forms due to their interactive characteristics and their vaguely defined material thresholds which will be examined in the third chapter. The qualities and the attributes of these spaces set different standards for spatial experience. The discussion on the ways that the body exists in these spaces will be based on Deleuzian differentiation between the ‘optic’ and ‘haptic’

spaces. The interactive nature of the space means that the user plays an active part in form giving process which blurs the relationship between the object and the subject, since the subject becomes a part of the object by losing the spectator status. Therefore, once the perceptional experience is removed the body can no longer make sense of the observed object through visual experience; this is when the body occupies the haptic space instead of optic space.

The framework for discussing the changing relation between the body and space will be provided by the differentiation between 'smooth' and 'striated' spaces, where 'smooth' space is defined by 'close vision', 'haptic space' and 'abstract line'. The concepts of smooth and striated, again, are two spaces that only exist in a mixture. "Smooth space is constantly being translated, transverse into a striated space; striated space is constantly being reversed, returned to a smooth space" (Deleuze, 1987, p.474).

The bodily interactions, interactive spaces and the experience produced in-between will be demonstrated under these two concepts. Interactive production of space enables a more relative space instead of an absolute space. The differentiation between these spaces is explained by Michael Hensel and Achim Menges, where optical space can be regarded as "Newtonian conception of space as absolute, privileging material boundary threshold" (2006, p.18). They argue that the space should be based on "a relative notion of space (Leibniz and Einstein), in which space is no longer just a

given entity but instead constructed through social operations and the local experience of space-time" (2006, p.18).

The notion of relativity provides further basis of argument on the level of interactivity that creates the haptic space where the user and the built environment are no longer seen as separate beings interacting with each other, but as one system united by the exchange of information.

CHAPTER 2

INTRODUCTION TO DIGITAL MEDIA

In this chapter, digital media will be explained in two main parts. First of all, the emergence of digital media will be discussed through the concepts that were available for the age of mechanical reproduction, and the movement from mechanical age to digital age will be examined in the following section.

In the second part, attributes of digital image will be elaborated and their importance in terms of the developments and differences that they provide will be examined. Digital media offers a shift in the understanding of image if it is approached in the sense that all its potential is utilized.

Traditional understanding of image as a finished or captured representation is being replaced by a dynamic understanding of image and therefore the issues of representation require reconsideration.

2.1. Technology and Art

2.1.1. Age of Mechanical Reproduction

Art has found its way through various media of expressing itself and it was always exposed to technological developments. The first highly influential impact came with the mechanical age and, as Walter Benjamin expressed, art underwent a significant metamorphosis. Art lost its 'aura', losing its value as a unique object tied to a certain time and space in the age of technical reproducibility. On the other hand, art gained another ability, to reach to a wider audience through reproduction (Hansen, 2004, p.1).

Figure 1: Mona Lisa La Gioconda by Leonardo da Vinci, circa 1503–1507. Oil on poplar 77 × 53 cm Musée du Louvre, Paris

Figure 2: Andy Warhol, Mona Lisa: 1963 Serigraph, 44 1/8 x 29 1/8 in New York, Eleanor Ward Coll from Corbis: Leonardo Da Vinci

Mona Lisa is one of the most reproduced images, and reproductions of Mona Lisa receive their value form their original's 'cult value' (Figure 1). A critical approach to the changing status of the value due to mechanical reproduction is represented by Andy Warhol (Figure 2). Also the technology of the still and the moving camera did not only mean the reproduction of formerly existing art work but it also, as Krauss states, meant "framing pieces of the world through camera's lens" (Hansen, 2004, p.2). On the other hand, mechanical reproduction served for significant changes for the development of art. Mechanical reproduction liberated art from functioning with the intention of creating exact copies of the world and therefore, made it possible for modern art to reach to a high level of abstraction.

2.1.2. Age of Digital Reproduction

Work of Benjamin is an essential reference to provide the vocabulary for the issues of art in the age of technology; however, it cannot fully enlighten the issues of art in the digital age. As Michael Rush phrases it, "reproduction is to the digital world what the hot-air balloon was once to aviation" (1999, p.168). Digital image has mastered reproduction. It possesses all the technology required to reproduce pieces of the world.

Digital reproduction as well as the ability to create exact copies also provided the means for digitally altered images to serve for various commercial and political purposes, providing a greater alienation to the original image (Figure 3, 4).

Figure 3: Mona Lisa – Digital manipulation

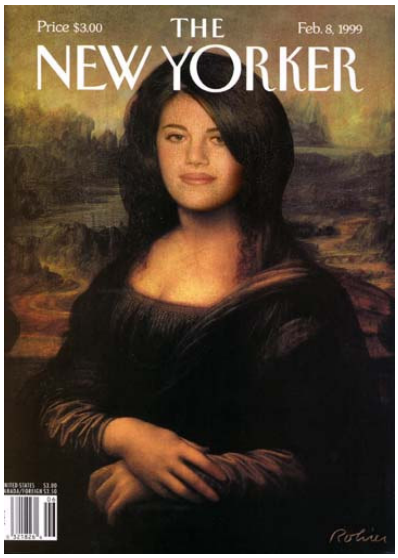

Figure 4: Mona Lisa, The New Yorker Cover

2.2. Digital Image

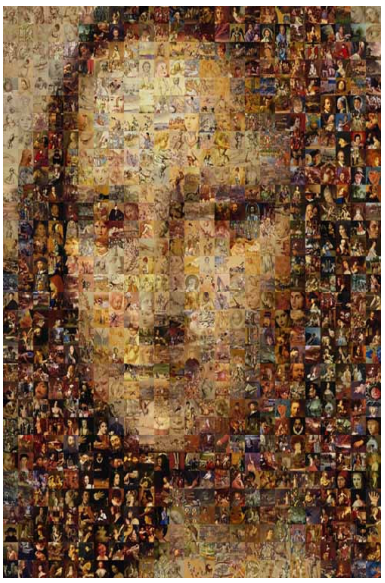

Figure 5: Photomosaic by Robert Silvers

Bergson asks: “How is it that the same images can belong at the same time to two different systems?” (Hansen, 2004, p.4) The work of Robert Silvers (Figure 5) where he uses photographs to create a Mona Lisa image can be used

to exemplify the ways that the digital image can provide means for representing information gathered from different systems to be merged together.

However, it is more important to realize the nature of the digital image that enables such manipulation. The use of digital media has altered the position of the artist or the designer as well as the spectator and the user, providing a different interaction and level of manipulation. The digital image offers a shift for art to become an active event rather than a static one. Mark Hansen states that:

> "The image can no longer be restricted to the level of surface appearance, but must be extended to encompass the entire process by which information is made perceivable through embodied experience. This is what I propose to call the digital image" (2004, p.10).

Under this definition of digital image lies the implication of a shift in the viewer's position in relation to the work of art. Also the artist's position becomes a questionable area. Benjamin's issues of authorship takes another level since in the digital age the representation shifts to manipulation. Now artists can be seen as hackers who manipulate the digital codes to form images.

In order to be able to discuss this change, the attributes of digital media that allow this transformation should be discussed. Lev Manovich (2000) proposes a guideline highlighting the four important principles of new media, which are numerical representation, modularity, automation and variability.

2.2.1. Numerical Representation

Numerical representation is achieved through digitization; conversion of analog data into digital data. Here the important point to realize is the idea of digital image which enables the new media to bring a new language and new form of representation to the arts. Numerical representation enables the separation between the image information and the physical material storing it. This nature of the image has important implications in terms of the form that they produce.

In the digital image the level of abstraction is rather different from the level of abstraction reached by modern art. For the computer the image is simply a set of numbers. This fact is also reflected to the art works by digital media artist by creating an image of Mona Lisa with a set of numbers (Figures 6, 7).

Figure 6: Andrew Patros Mona Lisa, 1965

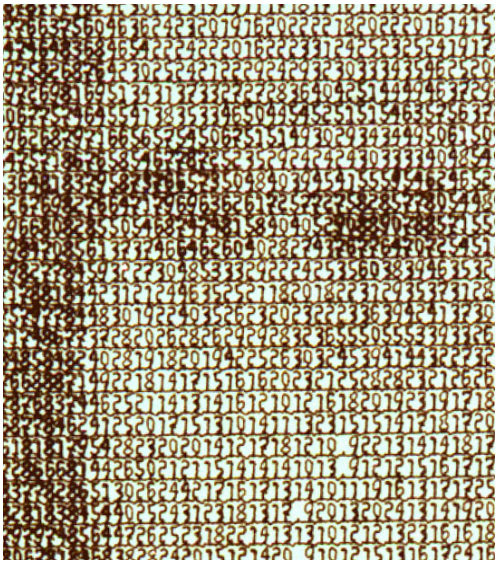

Figure 7: Close up of Andrew Patros Mona Lisa

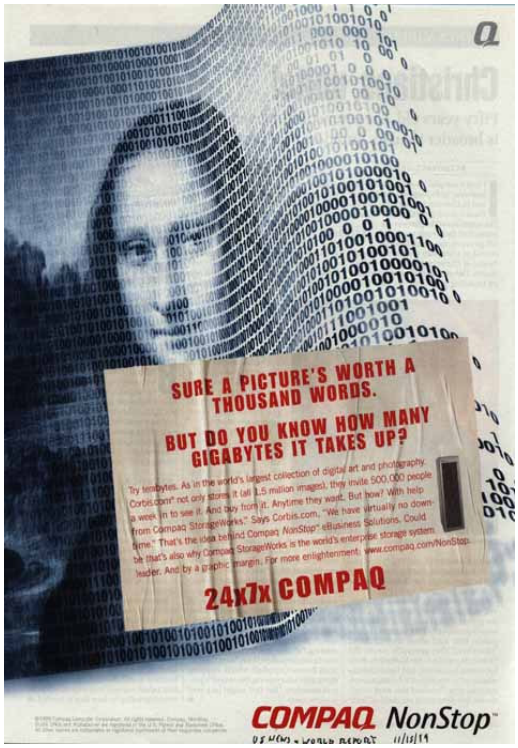

Figure 8: Compaq Advertisement

The image from Compaq commercial (Figure 8) is also useful for expressing that the computer image is a set of zeros and ones, in other words, solids and voids that make up an image.

This nature of the image has important implications in terms of the form that they produce. One cannot in fact make a picture of a number. A number is an abstraction with no physical substance that could have a physical appearance. Therefore, this could mean “liberation of figures, the emergence of figures freed from all figuration” (Deleuze, 2004, p.12). Once the image is digitized, in other words, converted into a set of numbers, it can no longer be perceived as an image. According to Bergson:

> "An image may be without being perceived – it may be present without being represented – and the distance between these two terms, presence and representation, seems just to measure the interval between the matter itself and our conscious perception of that matter" (Hansen, 2004, p.5).

Therefore the presence of the digital image is represented to allow itself to be framed by the perception of the viewer. It is possible for the digital image to exist without a form until it is converted into a format that is perceivable by the viewer.

Representation in mathematical functions might imply a way of standardization; since, for instance number **1** could stand for a certain form or color or any other attribute. This idea will then be followed by separation of parts since whenever the same attribute emerges it will be represented as **1** again. This idea resembles the principles of mechanical reproduction, however the logic behind this process is 'individual customization' rather than 'mass standardization' (Manovich, 2000). This idea will be discussed further under application of algorithmic forms.

2.2.2. Modularity

Modularity refers to the independent parts that the media object holds. Manovich refers to this principle as 'fractal structure of new media. These parts carry their identity, when combined with or subtracted from another body and they can be accessed, modified or substituted either without effecting the overall structure or in order to effect the structure. The elements of the digital media

maintain their separate identity and independence for alteration (Manovich, 2000).

Figure 9: Mona Lisa Word Document

Figure 9 is a Mona Lisa image which is converted into Microsoft Word format and it is made up of text characters and represents how simply the image can be manipulated by hitting characters of the keyboard once it is translated into a digital format. This exposure to manipulation also blurs the distinction between the artist and the viewer since both are manipulators of the image at different levels.

With media such as painting, film or video, the image information is inseparable from the physical material storing it. But the computer provides us with a phenomenon not found in other media. The information can be separable and further be manipulated. This separation is made possible by numerical

representation and the ease of manipulation is provided by the fractal characteristics of the digital media.

The digital image can be regarded as a web of information capable of producing infinite number of effects and once they are gathered in a context they form an ‘assemblage’ which could further be deconstructed and further manipulated. World Wide Web can be used to exemplify this modular structure, since it provides the space for being constantly changed, modified or substituted, and none of these actions prevent the overall structure from performing its functions.

2.2.3. Automation

Automation refers to the ability of computers to collect information from a given database in order to assert a certain formatting by using generic algorithms. This process is the feature of the computer to make artificial intelligence possible.

A digital media object is not fixed; potentially it can exist in different and infinite versions. Therefore it enables the creation of different versions instead of identical copies. Automation is the quality that enables the interaction throughout the generation process. Any external impact can be converted into an algorithmic representation to be internalized in order to manipulate the generative process at any stage.

This idea can be exemplified by the flash installation developed by San Diego Screensavers where one is able to make Mona Lisa perform certain dance moves. Below are captures from the installation:

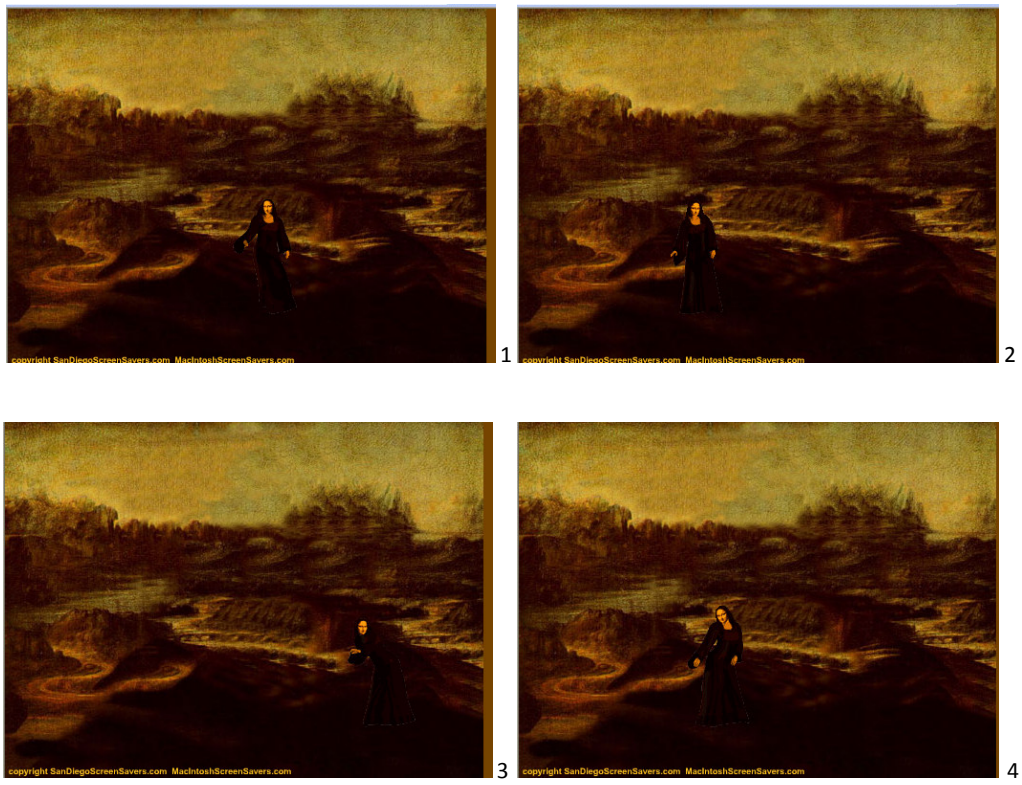

Figure 10: Mona Lisa Screensaver captures

Automation is a highly significant quality, since it also represents the real time interaction. The ability of digital image to be manipulated is enabled by numerical representation and modularity. Automation, on the other hand displays the changes that are being made. In other words, automation visualizes the real-time response given to the manipulation. Therefore it enables the integration of time, meaning that the image is no longer static but dynamic in terms of displaying movement.

2.2.4. Variability

During mechanical reproduction, creation of identical copies was made possible. On the other hand, digital reproduction gives rise to different versions. Even without any data manipulation, digital media object goes through changes due to the fact that there is a constant encoding and decoding process. For instance, a digital image can be printed out, displayed on a screen or projected on to a surface to be made apprehensible. These forms of output will show differences due to changing formatting. This idea can be taken even further, since today it is not meaningless to say that it is possible to draw music or play a drawing.

Now, it can be argued that with the level of abstraction achieved through digitization, a form can exist without being represented. Therefore, when representation is removed then it will be impossible to speak about a transcendental form in terms of a digital image until it is rendered visible through a display. This is one of the most important qualities that differentiate the traditional understanding of image from the digital image.

The below images are created with different display and 3 dimensional printing technologies showing the variability of outputs enabled by digitization of an image. Figures 11 and 12 are a chocolate and a coin with 3 dimensional printings of Mona Lisa.

Figure 11: Chocolate sculpture of Mona Lisa by Tokyo's Salon du Chocolat.

Figure 12: Mona Lisa coin by Hobo Nickel Society

CHAPTER 3

DIGITAL DESIGN PROCESS

Digital media is not a new concept in design, what makes the digital the 'new media' is the ways that it is employed. Computers have been employed as an extension of the traditional design methods. The 'newness' of the digital media emerges with the change of understanding in design methods. The argument of the following sections will not be based on that digital media provides better solutions, but instead it offers a different design approach which initiates new connections through relating to forms and spaces on an alternate level.

3.1. Genesis of Form

The framework for displaying an argument on the 'newness' of the digital media in terms of creating form and space will be based on Gilles Deleuze's approach to 'genesis of form'. Western philosophy assumes that the genesis of form is provided through eternal essences, external to the material itself where the 'idea' is prior to any form; as Manuel DeLanda suggests "spontaneous self

generation does not occur, thus always keeping some transcendental agency hidden in the background" (2005, p.1).

In order to investigate on the origins of form, Gilles Deleuze's work on Spinoza can provide a foundation where he states "that the resources involved in the genesis of form are not transcendental but immanent to matter itself" (DeLanda, 2005, p.1). An immanent resource can be found by examining endogenously generated stable states; which can be exemplified by soap bubbles. The spherical form of a soap bubble is due to the interactions among soap molecules which 'seek' the point at which surface tension is minimized. In this case, instead of an external imposition of a geometric form, a sphere, a self controlled behavior results in the emergence of a spherical shape. It is the internal information or description for the behavior of the molecules that produces the sphere. Further, "the same topological form, same minimal point, can guide the processes that generates many other geometrical forms" (DeLanda, 2005, p.1). For instance, salt crystals produce rectangular forms from the same minimal point, which in this case, becomes bonding energy instead of surface tension. These examples demonstrate an unstable level of energy which seeks the path to find the stable state which results in generating a form. "Deleuze calls this ability of topological forms to give rise to many different instantiations, a process of divergent actualization" (DeLanda, 2005, pp.1-2).

Deleuze introduces his argument on genesis of form privileging the 'actualization of the virtual' over 'realization of the possible' by developing Henri

Bergson's criticism on the inability of science of his time to think the new and the truly novel. Manuel DeLanda rephrases this argument as:

> "Clearly, if all the future is already given in the past, if the future is merely that modality of time where previously determined possibilities become realized, then true innovation is impossible. To avoid this mistake, he [Bergson] thought, we must struggle to model the future as truly open ended, and the past and the present as pregnant not only with possibilities which become real, but with virtualities which become actual" (2005, p.2).

The actualization process refers to the transfer of the virtual qualities into tangible reality, where, on the other hand realization of the possible requires a choice among the possibilities where others are neglected. As DeLanda suggests:

> "The distinction between the possible and the real, assumes a set of predefined forms (or essences) which acquire physical reality as material forms that resemble them. …realizing a possibility does not add anything to a predefined form, except reality" (2005, p.2).

However virtual and actual does not involve resemblance, since different forms (sphere-soap bubbles and cubes-salt crystals) can emerge from the same topological point; minimizing energy. According to the relationship between possible and real involves resemblance and limitation. As stated in *Difference and Repetition,* "in order to be actualized, the virtual cannot proceed by elimination or limitation, but must create its own line of actualizations in positive acts." Further the novelty of actualization of the virtual is explained as: "actualization breaks with resemblance as a process no less than it does with

identity as a principle. In this sense, actualization or differentiation is always a genuine creation" (Deleuze, 1994, p.212).

Therefore, the genesis of form could take two paths: One is making what is 'possible', 'real' through imposing a predefined form on a material. The second path is 'virtualities', the energy within the unstable state, becoming 'actual'. In this case virtual and actual do not involve resemblance since the description of a behavior is far away from representing a form unless its actualization neglects the qualities of the virtual. In other words, as John Rajchman explains, "the word virtual comes from 'virtus', meaning potential or force," and refers to the virtual as full of virtue, meaning the capacity to act. Therefore, if the actual possesses the virtue (capacity to act), resemblance cannot exist. It is also important to realize that the relation between the virtual and actual is interdependent, as Rajchman states, "[virtual] often comes coupled with the actual, meaning that through which the potential or force becomes at once visible and effective" (1997, p.115). However the visible and effective points of the actual involve a form of representation, therefore the virtual cannot be fully accomplished in the actual and they remain interdependent but separate. As Rajchman clarifies, "[actual] manifests and effectuates the virtual, but it never completely shows or actuates all that virtual implies. Something always remains" (1997, p.115).

The interdependence between the actual and the virtual also depends on this idea. The potential of the virtual is only rendered meaningful through its actualization. Elizabeth Grosz explains the nature of this interdependence as:

> "The virtual is not a pure, self-sufficient realm with its own fixed features and characteristics. Rather, it is a relative or differential concept whose status as virtual requires an actual relative to which its virtuality can be marked as such" (2001, p.76).

The introduction of the couples, 'possible-real' and 'virtual-actual', provides the basis of argument for the emergence of genuine creation. Deleuze privileges the 'virtual-actual' couple over 'possible-real' couple, stating that realization involves resemblance and limitation implying that genuine creation cannot take place. On the other hand, 'virtual-actual' couple enables the emergence of new potentials. Brian Massumi investigates the integration of virtual in architecture and states that virtual is a mode of reality where:

> "Its reality is the reality of change: the event … what is concretely given is what is – which is not what it will be when it changes. The potential of a situation exceeds its actuality. Circumstances self-abstract to the precise extent to which they evolve. This means that the virtual is not contained in any actual form assumed by things or states of things. It runs in the transitions from one form to another" (1998, p.2).

Based on Massumi's explanation, a constantly changing process can not involve resemblance since it never exists as a single form; it is always in the state of 'unform'. He argues that the challenge that the virtual poses for architectural form is it's unform nature. Architecture involves a creative and a constructive process. The integration of the virtual and architecture at the creative stage can be made possible through digital media.

The availability of automation on computer space allows a constant change to take place keeping the unform state running. However, architectural product is a still standing form requiring that the design process to be finalized in order to be constructed, and, once constructed, the product takes a final shape. Therefore, the following sections will explore how and to what extend the virtual can be integrated in the design process.

3.2. Design Methodology

The adaptation of virtual into design process is initiated at the creative stage. The contemporary design phase has already been taking place on computers, however, the newness of the digital media only emerged through the generative and parametric employment of computers. It is also important to note that the idea of virtual does not refer to computer space, although computer space can provide the grounds for integration of design and the idea of virtuality.

In order to demonstrate the integration of the virtual into design phase the two notions of the virtual has to be clarified. The common understanding of the virtual is recognized as the computer space. Greg Lynn, in his book *Animate Form* refers to this space as a 'substitute reality', meaning that the computer simulates the actual space that already exists or can exist. Grosz also points to the distinction between the two notions of virtual by stating that "the virtual spaces of computer are not the spaces of virtual, but the phantasmatic projections of real space" (2001, p. xx). Therefore, it could be said that as long as the computer simulates the real physical space the virtuality of the computer,

space remains as a ‘substitute reality’ and the digital medium remains as an extension of the traditional design methods.

The introduction of digital media in design process had a gradual impact on design methodology. First of all, once the design started taking place on the digital platform, the linearity of traditional design process cannot function, since certain elements of this process are immediately eliminated. Digital media provides a three-dimensional representational format, and once the production is possible in this format the requirement for two-dimensional plan and sectional drawings become insignificant and redundant. Architect Ulrich Königs, in his article *‘Digital Architecture’* explains this change as “the primacy of plan drawings is lost, since auxiliary constructions such as two-dimensional drawings (plans, sections, views) are no longer necessary as communicative intermediaries between the concept of three-dimensional room later constructed” (2003, p.11). The elimination of two-dimensional representation also minimizes the loss of information, since the building data does not have to be converted from three-dimensional to two-dimensional in order to be communicated, and then back again so that it can be build. Also, once the design models become the design products, two dimensional representations are no longer required.

Another shift explained by Königs is the departure from Euclidean space, “space models based on different geometry can be equivalently thought out, designed and constructed. Anexact geometry, which can no longer be described mathematically, can be constructed via parametric volume modulations with the

help of B-splines" (2003, pp.10-11). In Euclidean geometry the relationship between points that define a line or a plane remain as fixed measurements. Michael Hensel and Achim Menges in their introduction to *Morpho-ecologies* state that "Euclidean geometry operates in 'metric spaces' based on concepts such as length, area and volume. However, there exists other geometric spaces, in which distances expressed in length cannot characterize proximity as the length does not remain fixed. One example is topological space, which can be stretched or scaled without changing the characteristics of its defining points" (2006, p.39). Digital media enables the construction of anexact geometries and provides topological modification and these abilities offer new possibilities of architectonics. Topological modifications and its relation with the virtual will be further explained in this section.

Another shift in contemporary architectural design practice that is brought by an infinite procedural approach can be seen in design methodology. "Linear and centrally steered 'top down' designing becomes replaced or supplemented by parametric, procedural and relational design models" (Jaskiewicz, 2007, p.2). In order to elaborate on this idea the conventional understanding of "the abstract space of design" as an "ideal neutral space of Cartesian coordinates" (Lynn, 1999, p.18) has to be reconsidered. Traditional design process develops from lines on a two dimensional plane where digital design process develops from a point in a three dimensional space. A point is able to proceed in any direction. A form could be generated through the movement of the point in any direction and the movement can be determined through vectoral forces applied upon that

point. A point in computer space has a dynamic and interactive organization capability which provides the understanding of “abstract space of design” to become an active space. This approach introduces the concept of time in the process. Instead of designing a fixed space, an experience, behavior or a scenario is designed. In digital media this process is enabled by the use of algorithms.

The use of algorithms in architecture carries the computer aided design to a new level. Most of the prior usage was in the path of bringing possibilities into a visual reality where the reality is simply represented in a digital format. The use of algorithms proposes a path of virtualities becoming actual. This idea can be demonstrated with a brief explanation of the algorithms called L-systems.

L-systems are a mathematical formalism proposed by the biologist Aristid Lindermayer in 1968 for generation of fractals and realistic modeling of plants (Ochoa, 1995, p.2). A simple example can be provided by considering information strings built of two letters, **a** and **b**; where they could occur many times in a string. For each letter a rewriting rule is specified, such as letter **a** to be replaced by letters **a** and **b**, and letter **b** to be replaced by letter **a** whenever they occur (Ochoa, 1995, p.2). Therefore, a string initiated with b will form the below string:

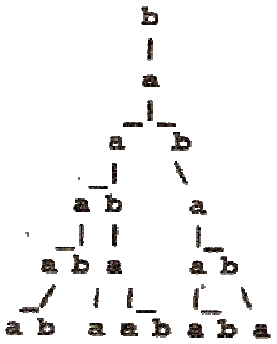

Figure 13: Algorithm strip

To adapt this string into graphic interpretation an agent called ‘turtle’ is employed and its behavior is defined by xyz co-ordinates, a path distance and angle. Simply, when the turtle sees the letter **a** on a point on the coordinate system it shifts the position from initial xyz position with a given distance and an angle to reach to a new position on the xyz system.

Figure 14: Generation of a turtle graph

More complex forms of information coding will form below results:

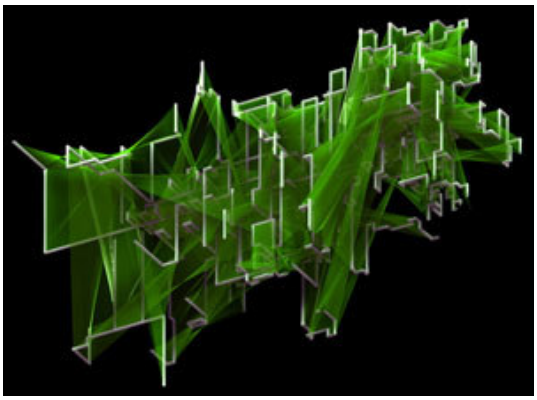

Figure 15: Visualization of turtle graph

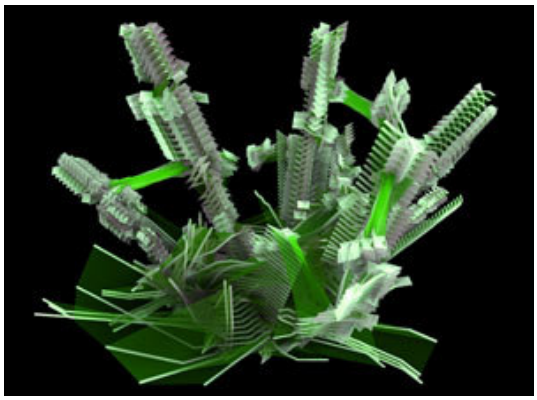

Figure 16: Visualization of turtle graph

Employment of these basic rules provide assistance to design, however it could also be argued that once the generation of the algorithm is initiated the designer is eliminated from the design process. Actually the designer in this case, instead of designing forms, designs a scenario, a sequence of events. Then the ending or the output is decided once the generation of the desired form is established. It is important to realize that if the design process shifts to the creation of an algorithmic scenario, in order to provide richness in the space that the algorithm seeks forms, certain aspects have to be provided.

Parametric design can provide certain freedom in describing algorithmic scenarios by, as Kolarevich explains, “replacing in the process stable with variable” (2003, p.17). Parametrics can also provide relational and operative dependencies as further explained by Kolarevich:

> “When those variables are assigned specific values, particular instances are created from a potentially infinite range of possibilities.
>
> In parametric design, it is the parameters of a particular design that are declared, not its shape. By assigning different values to the parameters, different objects or configurations can

> be created. Equations can be used to describe the relationships between objects, thus defining an associative geometry. … That way, interdependencies between objects can be established, and objects' behavior under transformations defined" (2003, p.17).

Generative and parametric design approach, instead of dealing with designing a fixed space, analyzes the dynamic network of behavioral relationships between spatial features and people. "The temporality of the processes is compressed towards a singular moment in time. The building is no longer a series of one design object but potentially infinite series of objects, a flow in any direction and scale" (Friedrich, n. d., p.1). Below are the snapshots of an ongoing design process. In this case "the algorithm essentially cuts a solid block into various clusters by 'shooting' rays through it. As such it has two inputs: as a fixed input a solid block that corresponds to the site's envelope, and as a variable input a set of ray attributes that determine the rays' movement. … Each iteration produces a script to construct and visualize the variant in a CAD program" (Hansmeyer, 2006, p.1).

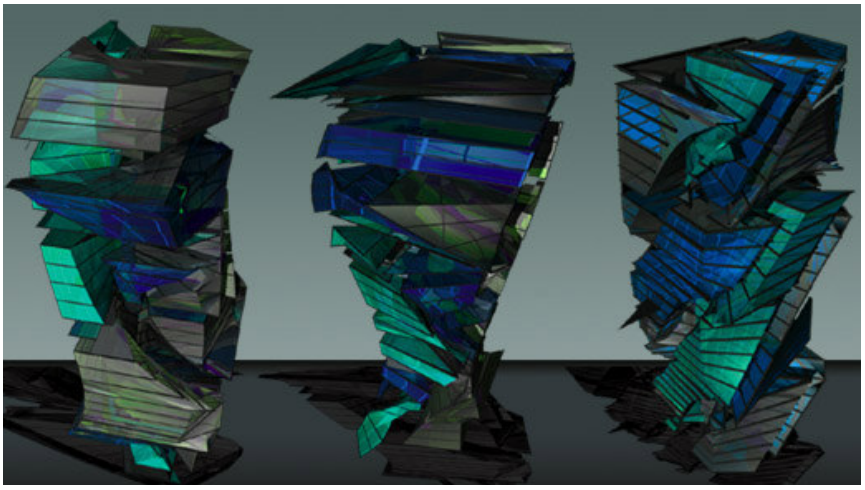

Figure 17: NGO Forum Building Design in New York

Important point to be realized here is that, parametric design enables the variety in the form seeking process since the parameters do not describe a form but describe the relation between the elements that generate the form. According to Greg Lynn, as he states in *Animate Form*, "it is important for any parameter-based design that there be both the unfolding of an internal system and the infolding of contextual information fields" (Kolarevich, 2003, p.19), meaning that the form is not only made up of parametric internal relations but also has to engage with active and variable external, environmental forces.

The genetics approach demonstrates the engagement of the parametric design and external influence. As Kolarevich explains "The 'rules' that direct the genesis of living organisms, that generate their form, are encoded in the strands of DNA. Variation within the same species is achieved through gene crossover and mutation, i.e. through the iterative exchange and change of information that governs the biological morphogenesis" (2003, p.23). Biological conception of form and its generation can be adapted to design phase by algorithmic representation and their evolution can be determined by parametric rules or external manipulations that can be imposed.

The way the algorithm gives rise to forms resembles the idea of 'divergent actualization'. Algorithmic code provides an endogenous generation and the stable state is achieved when the designer makes the decision to stop the generative process. Therefore, it could be said that the designer can breed new forms rather than specifically designing them. This idea may sound like the design process becomes routine, but this is entirely related to the richness of the

algorithm. If the designer is able to foresee the forms that will be bred, then algorithmic generation will be pointless.

A theoretical approach may be useful to construct the algorithm to provide innovative results. Manuel DeLanda emphasizes that through 'intensive' thinking this richness could be provided. Intensive thinking refers to a quality instead of a quantity. Intensities cannot be defined by magnitudes such as lengths, areas, volumes which are divisible. When a length is divided into half, half of that length can be obtained. Intensities, on the other hand, refer to quantities such as temperature, pressure or speed. When temperature magnitude is divided into half, half of that temperature cannot be obtained; in other words, it is indivisible. Intensities such as temperature represent the differences in the energy levels similar to the unstable state of the molecules that gives rise to the soap bubbles. Therefore, for instance, when the algorithm seeks solutions for architectural design, distributions of stresses in a building can represent an intensity. This will mean that the building will not lose its structural stability but the form of the structural elements will not be restricted by previously given shapes. Adaptation of this approach in design process could provide a path for virtualities to be actualized since an intensity beholds the capacity to give rise to forms but it is actually formless and therefore allows its actualizations to be in a constantly changing nature.

Another way of approaching the design process for the actualization of the virtual is topological thinking. As Brian Massumi states, "the challenge that the virtual poses for architecture lies more in it's unform nature than its

abstractness" (1998, p.2). Massumi figures that topology can provide the answer for the integration of the unform in a process that produces a still standing form.

Topology in mathematical terms is "a study of intrinsic, qualitative properties of geometric forms that are not normally affected by changes in size or shape, i.e. which remain invariant through continuous one-to-one transformations or elastic deformations, such as stretching or twisting" (Kolarevich, 2003, p.13). In order to be more exact, as Hensel and Menges explain, "… figures that are entirely distinct in Euclidean geometry such as circle, rectangle and triangle are equivalent in topology, as one can be deformed into another" (2006, p.43). The significant point to be realized is that topologies deal with internal relations between the elements that make up the form. As Kolarevich explains that the topology focuses "… on the relational structure of an object and not on its geometry – the same topological structure could be geometrically manifested in an infinite number of forms" (2003, p.13). The idea of topology dealing with relations instead of quantitative relations of the geometries also refers back to the idea of intensities and provides a path for their actualization. However, what makes topologies important in the actualization of the virtual is their ability to transform and deform. As Massumi explains "approached topologically, the architect's raw material is no longer form but deformation" (1998, p.3). This ability to deform constantly enables the change that is crucial for the existence of the virtual. Therefore, it can be stated that since topology renders form dynamic it can become a component of the actualization of the virtual. As Mark Jackson states in his article, *Diagram of the*

Fold: The Actuality of the Virtual Architecture, “topology is a response in architectural practice for negotiating how one moves from virtuality to actuality” (n. d., p.15). However, again it should be kept in mind that:

> “The computer is not used as a device to image what is to be built but is rather a tool to catalyze newness and emergence. The key notion here is force. It is not the imageability of forms of deformation that is at stake, but activating forces of deformation” (Jackson, n. d., p.15).

The forces referred here are “abstraction as an active engagement with an indeterminacy, or incalculability” (Jackson, n. d., p.15) as Massumi names as “virtual forces of deformation” (Jackson, n. d., p.15). It has to be realized that for the integration of the actualization of the virtual in design process, intensive and topological thinking can provide solutions. On a digital platform throughout the design process, it is enabled that the form has a dynamic nature exposing itself to deformation. As Massumi states:

> “The process does not of itself generate a completed form. It generates a proliferation of forms. The continuity of the deformational variation can be cut at any point, any number of times. … The outcome of any given run cannot be predicted. But a choice must be made: a set of forms must be selected to provide the foundation of the actual design” (1998, p.5).

Once the requirement for the process to be stopped arises, this means a snapshot is taken, a form is emerged. Massumi refers to it as “still-standing form appears as residue of a process of change” (1998, p.2). In order to be more exact design process can capture the virtual, since it can be run on a digital medium that enables transformation. However the production phase requires

decisions to be made which means that the vagueness in the formless state is lost, ability to transform has to stop and the active forces of the virtual attain a static nature.

The challenge that the overall design process faces in terms of actualizing the virtual emerges in the materializing process. Adaptation of the virtual as a design methodology can be achieved with the right approach in the digital media. The next section concentrates on how the virtual can be integrated in the production process.

2.3. Materializing Digital Media

The integration of design and information technology is being highly researched. Parametric and generative design methods, file to factory and computer numerically controlled (CNC) production and dynamic, interactive design performance are being practiced. These methods behold significant innovativeness, however they are employed to overcome specific problems to provide assistance for design process to run more smoothly, therefore they can only create a superficial effect in design process and outcome. In this case, information technology remains as an extension of the traditional linear design process.

Computerized design process has been seeking ways of utilizing the digital media with the actualization of the virtual approach; however the production and materialization technologies cannot afford to remain obsolete. Material and production technologies have undergone through radical changes.

This section will highlight some of these technologies and their approach to actualizing the virtual. It can be said that the virtual can integrate itself in design methodology; however, design process seeks for a final form to be produced which necessitates the elimination of the virtual. To overcome this problem, the limitation that requires the finalization of form to find its place at the end of design process should shift its location to the end of the manufacturing process. This section will concentrate on this approach which reveals itself in the production and materialization processes; leading to an interactive understanding both in design and manufacturing stages.

3.3.1. New Production Technologies

Digital means of conception and production, instead of being separate stages of a design process, have become an integrated act. This can be accomplished with 'file to factory' technologies regarded as computer numerically controlled (CNC) fabrication, and computer aided manufacturing (CAM). These technologies provided certain ease and reduction in the time consumption for most aspects of design. However, one of the most significant outcomes of these technologies is the shifting idea of optimization. For the purposes of mechanical reproduction standardization is highly important and it allows mass production to be possible. One of the most significant aspects of mass production is the ability of producing exact copies. This idea provided a possibility for everyone to obtain a copy of any mass produced object.

On the other hand, digital media offers a new possibility which again involves the aspects of mass production in terms of production in excessive quantities, but this time not the exact copies. This differentiation is provided by Lev Manovich where he refers to the logic of industrial society as ‘mass standardization’ and post-industrial society as ‘individual customization’ (2000, p.51).

Individual customization is made possible by the production of an algorithmic process at certain intervals which can be decided either by the designer or the customer. In other words, user interaction is enabled by these technologies.

Figure 18: Alessi tea pots by Greg Lynn

The tea pots in figure 18 are designed by Greg Lynn for Alessi, which are formed by the same algorithm but none of them are the same. Bernard Cache, as quoted by Kolarevich, states that “objects are no longer designed but

calculated" allowing emergence of complex forms and providing "the foundation for a non-standard mode of production" (2003, p. 53). Cache also notes that the manipulation of design parameters allows different shapes to be manufactured in the same series. The paradigm shift initiated by digital technologies is explained by Catherine Slessor, "the notion that uniqueness is now as economic and easy to achieve as repetition, challenges the simplifying assumptions of Modernism and suggests the potential of a new, post-industrial paradigm based on the enhanced, creative capabilities of electronics rather than mechanics" (Kolarevich, 2003, p.53).

The shift from Modernist understanding of mass-production to mass-customization has integrated the notion of interactivity in design. Embryological House by Greg Lynn is a mass-customizable, individually designed house.

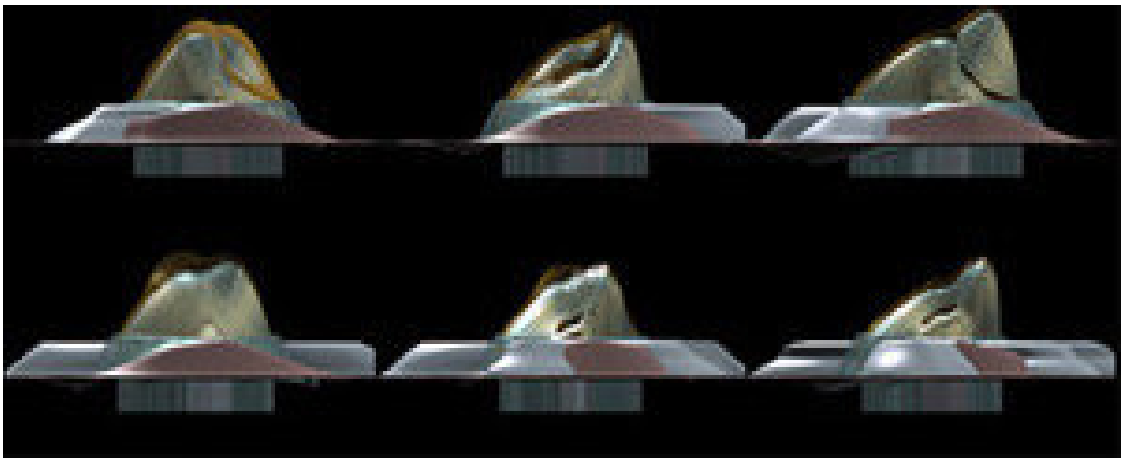

Figure 19: Embryologic House by Greg Lynn

The parameters can be modified for the individual requests. Mass-customization involves user interaction in the design stage. The involvement of interactivity enhances the integration of change which is regarded as a quality of

the virtual. However, this approach requires certain choices to be made in order to be produced, which again resemble the realization of the possible model.

3.3.2. Complex Interactive Systems

Interactive systems propose to offer real-time interactivity which aims to integrate the user in actual form giving process. Under this consideration, a research is carried out by Hyperbody Group at Delft University of Technology, led by Mark Goulthorpe as the head of the project. The examples provided in this section are developed by Hyperbody team aiming to facilitate computer technologies at a further physical and virtual stage. The first example, Protospace is designed to allow real-time connections of software applications, specialists and occupants (users).

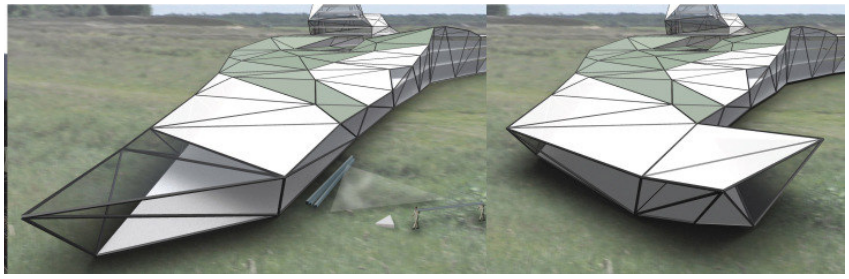

Figure 20: “file-to-factory” produced unique elements allowing instant building reconfigurations.

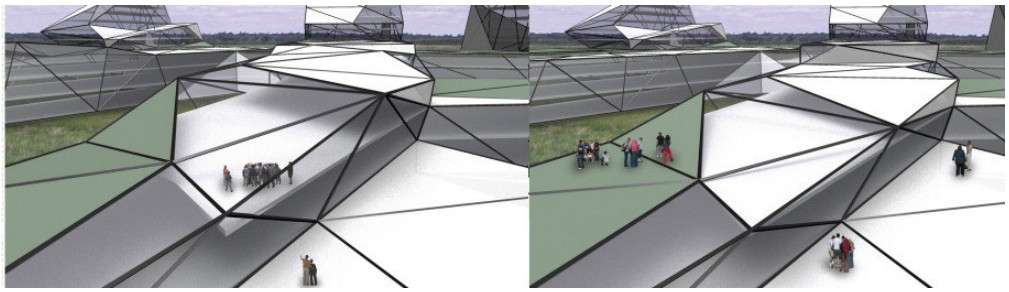

Figure 21: Dynamic building elements allowing real-time tectonic building movements.

Figure 22: Muscle prototypes by Tomasz Jaskiewicz

The system develops a bridge between different computer software and professionals from different disciplines to provide a dynamic network which allows interaction and modification at any desired stage. Protospace acts as a single platform which involves a complex system of interconnected but independent components. Each parameter change can display real time results. This is made possible by digital manufacturing technologies.

> "Virtual elements can nowadays be materialized into the built space practically instantly. Furthermore, building industry begins to more commonly adapt dynamic components actuators from other industries, allowing a high level of spatial adaptation to buildings even after their construction" (Jaskiewicz, 2007, p.2).

Thomasz Jaskiewicz suggests that architecture cannot afford to maintain predetermined purposes and functions and remain as a static construct. He argues that the pace of today's life style depends on receiving real time responses for the actions delivered. Until now architectural constructs were able

to serve as finalized design objects since the understanding of architecture was structurally complete, and aesthetically and functionally satisfactory due to prior design process and experience. This approach offered a generalizing and repetitive design approach. Now this idea is leaning towards a more suitable, individually customized and interactive approach in the design process (Jaskiewicz, 2007).

On the other hand, Jaskiewicz implies that interactivity in architecture is not a new concept, and the interaction with the built environment has always existed but not in the sense as it is comprehended today. Architecture has always responded to the environmental factors after a period of deconstruction and construction which usually meant a certain period of time to be elapsed for receiving a response. Therefore, it can be said that architecture has always been interactive, however human incentive happens much faster than architectural response which makes architectural interactivity unnoticeable. The way that architecture was approached has always leaned towards stabilizing the architectural dynamics which are already contained in it, either to make it inexistent or unnoticeable. For instance, the tectonic movements provide immediate responses to the forces that cause them and they produce subsequent movements which lead to other actions and reactions. What architecture does is to neutralize these forces, which actually never means that these forces are eliminated, but brought to a stable state which still holds a dynamic power that could react to immediate actions (Jaskiewicz, 2007).

“The developments in information technology and availability of new materials allow extending buildings with information processing, sensing and actuating properties” (Jaskiewicz, 2007, p.2). In order to accomplish such architectural objects Jaskiewicz suggests that their spatial and behavioral expression has to be designed so that it opens up the possibilities of their interaction with their environment. Furthermore, it has to be accepted that architecture cannot be seen as an act of designing finite objects. It has to be understood that architecture is a process evolving with its environment.

The adaptation of an interactive architectural concern can be demonstrated by two projects, one of which is an entry for the Zorg2007 architectural design competition for a future hospital vision. The important criterion realized in this project is that instead of dealing with designing hospital as a fixed space, it analyses the dynamic network connecting the spatial features, technologies and people.

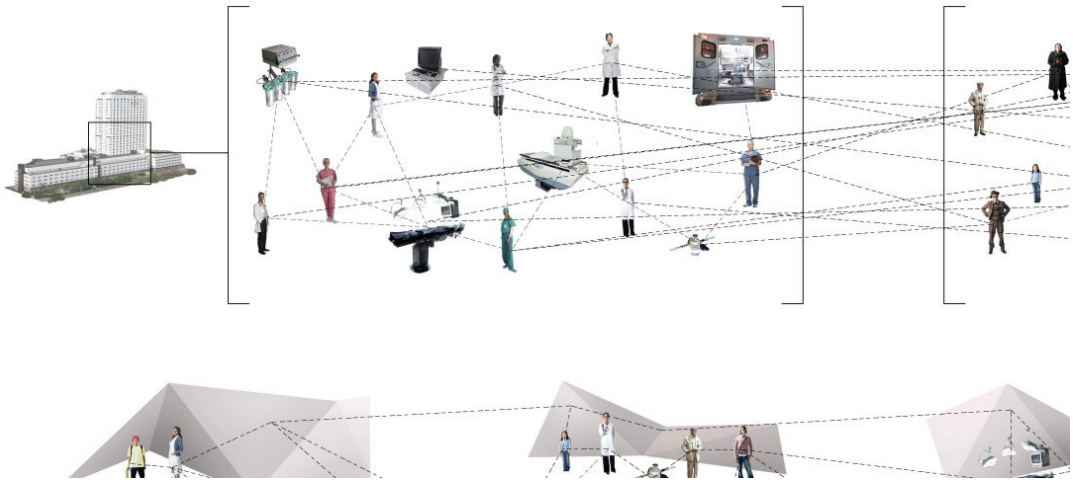

Figure 23: Hospital seen as a network of people, technology and architectural spaces.

The analysis is then translated into a network of parametric nodes which represent different components of the system. Eventually, several architectural elements can be physically built but this does not imply that the design is over. Jaskiewicz explains that the designing still takes place since:

> "Firstly, the building components stay dynamic after being erected, thus to a certain extent the building keeps "redesigning" itself. Secondly, the virtual model stays active and may result in producing numerous extensions or changes in the realized building, becoming in fact virtually embedded in the physical space, constantly feeding on the information coming from it and its environment and leading to various physical implications" (2007, p.1).

Figure 24: Dynamic, hospital-network-driven spaces.

The second example shows creation of building spaces through user interaction, transforming itself from open and public to enclosed and semi-private. The architectural intervention is quantified and translated to an arrangement of three-dimensional points in space. Under certain conditions the resolution of these points increase or decrease exerting a change in their properties and behaviors start to emerge. The validation and actualization of these behaviors are directed by algorithms and some of these autonomous scripts could be used to create an actual behavioral backbone of the building components, which allows preliminary physical assemblies to be made. The

initial physical components that receive inputs, highly from human interaction, are assembled so that they may evolve in different ways.

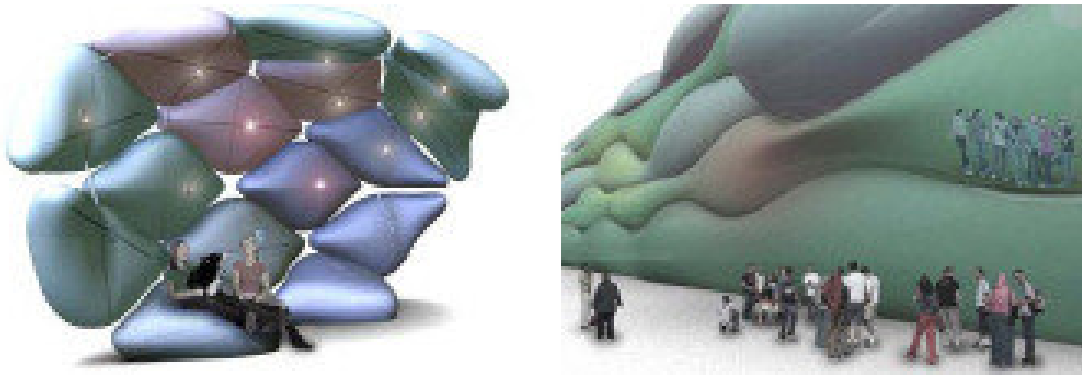

Figure 25: Cushion blocks assembly [left] as an easy material for creating participatory building spaces [right].

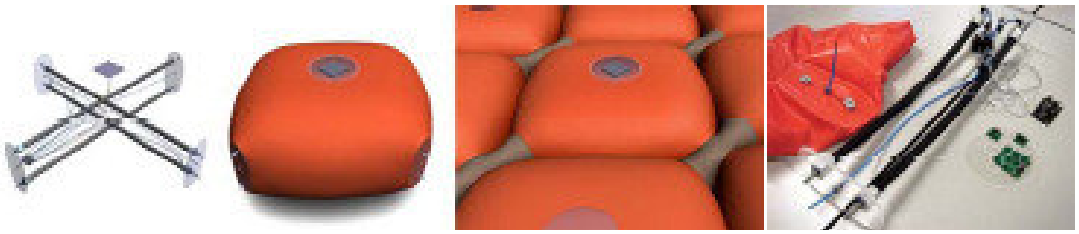

Figure 26: Cushion block component in detail.

In this example the building components are materialized in dynamic inflatable cushions. This way the entire installation gains freedom and possibility of dynamic readjustment. Furthermore, the software controlling the system is able to process behavior allowing decision making under a known condition.

Another significant project designed principally by Mark Goulthorpe and the dECOi office with a multi-disciplinary team of architects, engineers, mathematicians and computer programmers is Aegis Hyposurface. The project is designed for a competition to be exhibited on the foyer of The Birmingham Hippodrome Theatre and Goulthorpe explains:

> "Aegis was proposed as a dynamically reconfigurable surface capable of real-time responsiveness to events in the theatre, such that movement or sound can create actual deformation of the architectural surface. Effectively, Aegis is dynamically reconfigurable screen where the calculating speed of the computer is deployed to a matrix of actuators which drive a 'deep' elastic surface. The implicit suggestion is one of a physically-responsive architecture where the building develops an electronic central nervous system, the surfaces responding instinctively to any digital input (sound, movement, Internet, etc.)" (Kolarevich, 2003, p.174).

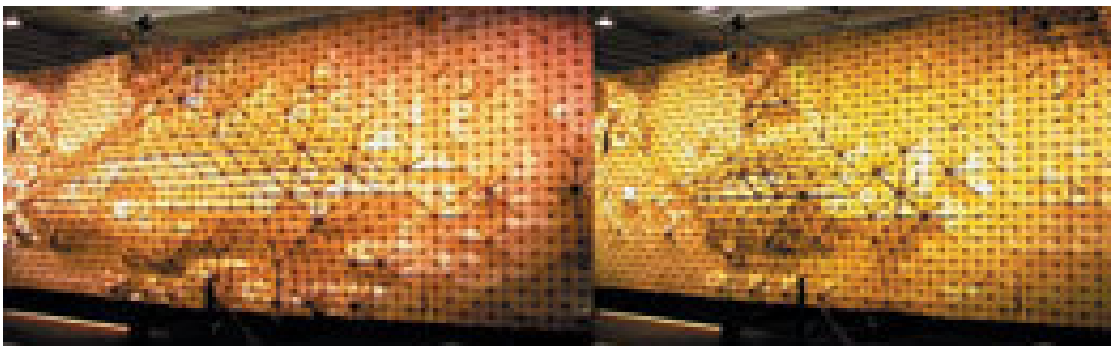

Figure 27: Aegis Hyposurface by DECOI

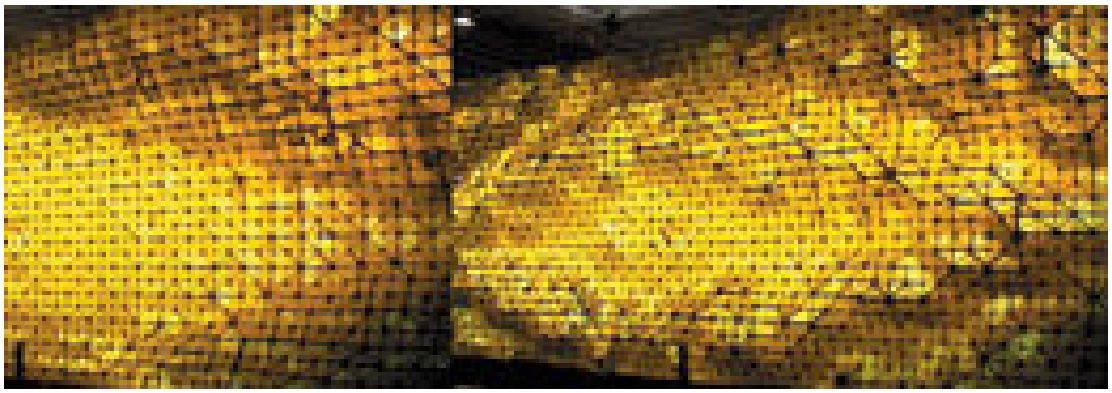

Figure 28: Aegis Hyposurface by DECOI

Aegis is a facetted metallic surface that can potentially provide physical deformation in response to electronic stimuli from the environment. The importance of this project is further explained in the design brief by Goulthorpe:

> "Our approach was not to design the form – not to define it determinately with a gestural flourish – but to set constraints by which the form could find itself. Initially we gave an imaginary force to the number of people within the theatres as a series of diffuse force fields which lifted or cushioned an elastic surface, and then we produced mathematical descriptions which gave substance to such elasticity. In effect we didn't define the form as a figure in space, but left it as a movement hanging in space – a reversal of gestural instinct: a sort of Asiatic sense. There's an elegance to this besides the flowing form, a curious new aesthetic act: not to design an object, but to devise the possibility of an object: it's not an architecture so much as the possibility of an architecture. For us it was like watching determinacy evaporate. But such model offers what we call a precise indeterminacy, which applies formally as well as processurally: there's a rigour and a relaxation - it's not an art of the accident!" (1999, p.3).

The important aspect of this project is revealed in its approach to design. As quoted above, Aegis is not designed as an object but as 'the possibility of an object' (Goulthorpe, 1999, p.3). Virtual is regarded as the state where form exists as a possibility of form and it is through actualizations that the body can comprehend the virtual state. In the case of the Aegis, the physical reality of the hyposurface can exist in a formless state filled with the possibility of form.

Another significance of Aegis in its evaluation in terms of virtual is the quality of transformation and deformation. The ability of topologies giving rise to actualizations of the virtual was through their ability to constantly deform and transform on a digitized platform. In this case, computer output was displayed on a computer screen. Aegis translates this idea into physical reality. The ability to transform and deform displays output in real time and it is continuous process. The question of Brian Massumi is very much valid "the challenge that the virtual poses for architecture lies more in its unform nature than its abstractness. How

can the run of the unform be integrated into a process whose end is still standing form?" (1998, p.2). The actual problem that the virtual beholds for architecture or any designed object is not how virtual can be integrated in a still standing form, but if the still standing form is the 'product'. To evaluate this idea Bergson's portrayal of form can be helpful:

> "There is no form, since the form is immobile and the reality is the movement. What is real is the continual change of form: form is only a snapshot view of a transition. Therefore, here, again, our perception manages to solidify into images the fluid continuity of the real" (1998, p.318-319).

Here form is not regarded as a static end product of a process but as instances of a process. As Massumi further explains:

> "The continuity of that field of variation is inseparable from the forms populating it. Yet it exceeds any one of them, running across them all. When the focus shifts to continuity of variation, still-standing form appears as residue of a process of change, from which it stands out (in its stoppage). A still-standing form is then a sign: of the passing process" (1998, p.2).

Reflection of this idea in Aegis example is that, form is not the end product of Aegis project; it is a device that generates instances of form. The reality of Aegis is the 'reality of change', referring back to Massumi where he states "virtual is the mode of reality implicated in the emergence of new potentials…. Its reality is the reality of change: the event" (1998, p.1). Therefore, it can be said that Aegis holds the qualities of the virtual which actualizes itself through interactions and real-time reactions in physical reality.

The interactive nature of Aegis displays another important shift in the understanding of generation of form. Form is not produced when the process ends and stillness does not produce form. It is the interactive action that enables the appearance of form. In other words, it is the action that triggers the instance of form.

Finally, it can be said that digital technologies provide the understanding of design product, not as a still object but as an organism that can take action and allow interaction. This idea will be further explained in the next section where the design process actually adapts the understanding of a biological organism in order to explain a new approach to design product.

3.3.2. Morphogenesis

Morphology refers to the study of forms and morphogenesis is concerned with the processes controlling the spatial distribution of the cells during the development of an organism (Hensel, Menges, 2006, pp.19- 20). Living organisms attain their form through genetic encoding, gene crossover and mutation, as Kolarevich explains:

> "The 'rules' that direct the genesis of living organisms, that generate their form, are encoded in the strands of DNA. Variation within the same species is achieved through gene crossover and mutation, i.e. through the iterative exchange and change of information that governs the biological morphogenesis" (2003, p.23).

The genesis of living organisms can be applied to algorithmic generative process. As John Frazer states in his book *Evolutionary Architecture* (1995),

architectural concepts can be expressed as digital DNA which then enable the cross-breeding and mutation, and afterwards they can be evaluated on their performance in a simulated environment. Frazer observes that emergent forms are often unexpected. This approach to algorithmic generation, through the adaptation of morphogenetic strategies, variability in the possibilities that the algorithm searches can be accomplished since nature is able to provide a great diversity among species.

Hensel and Menges examine this idea in further detail in *Morpho-Ecologies*. First of all, they define the differences between form and formation by explaining Goethe's "distinction between *Gestalt*, or structured form, which refers to that which is already formed, and the process of *Bildung*, or formation, which changes structured form in an ongoing process" (2006, p.19). They further quote Goethe "when something has acquired a form it metamorphoses immediately into a new one" (2006, p.19). This explanation of formation simulates actualization of the virtual, which seeks constant change keeping the form giving potential. Hensel and Menges are also interested in the idea of formation in terms of "how form emerges and how it continually differentiates, transforms and performs in relation to its specific environment" (2006, pp.19-20). A significant outcome that they highlight in examining the formation is that, in morphogenesis, formation and materialization are not separate processes. "In natural morphogenesis formation and materialization processes are always inseparably related. By contrast, architecture is characterized by its prioritizing of form-generation over inherent material logic" (Hensel, Menges, 2006, p.20).

Hensel and Menges, in the introduction of *Morpho-ecologies* (2006), also examine the link between architecture and ecology, starting with the explanation of ecology, which in their definition is the study of the relationship between organisms and their environment, and they argue that such a definition also suits architecture. "Architecture is to provide opportunities for habitation through specific material and energetic interventions in the physical environment" (Hensel, Menges, 2006, p.16). This correlation of ecology and architecture assumes a new framework based on biological paradigm, and, therefore is concerned with a higher level of functionality and performance capacity. This approach is called morpho-ecologies.

Hensel and Menges examine the spatial strategies and social formations developing on Robin Evans's essay on *Figures, Doors and Passages*. Evans connects social formation with spatial arrangement. He states that spatial organization can be rethought by the arrangement of material boundary thresholds as well as its possible implications for social formation.

Current spatial arrangements are derived from development of industrial standards and fabrication. Modernist discourse suggests a 'universal space' which can be accomplished by modularization and standardization of building elements where each element is required to perform at an optimum level. Optimization here refers to efficiency, meaning minimum energy and material to achieve required capacity or performance. In response to this, Hensel and Menges suggest that "an alternative understanding of optimization, efficiency and redundancy in relation to multi-performative material systems can open up a

very different take on spatial organization, environmental modulation and, ultimately, social formation" (2006, p.17).

Architecture has mostly moved away from 'universal space' and shifted towards heterogeneous space, shown by products customized to the needs of its users. Digital design offered such customization, and once production and material technologies became advanced enough, a quality that the virtual offers can be realized. However, what morpho-ecologies seek in terms of material provides a path for actualization of the virtual.

The important relationship between the virtual and morpho-ecologies approach is revealed through the comparison of material and gradient thresholds. Reyner Banham in *Architecture of the Well-tempered Environment* examines the potential of "societies who do not build substantial structures [but instead] inhabit a space whose external boundaries are vague, adjustable and rarely regular" (Hensel, Menges, 2006, p.18). Banham suggests that boundaries can be formed by a material boundary threshold which establishes tectonic divisions between inside and outside, warm and cold, private and public; where on the other hand, opportunistic use of environmental gradient thresholds differentiates dynamically, offering a gradual spectrum of environmental conditions such as a campfire.

A discussion of the boundary thresholds on the idea of actualization of the virtual will privilege the gradient thresholds since material thresholds will again require a certain form and material in order to be realized, meaning,

choice to be made among the possibilities. However Hensel and Menges state that material thresholds have fundamental importance in power operated environments since it provides environmental and social sustainability. Therefore the challenge that morpho-ecologies is trying to overcome is the synthesis of material thresholds and environmental dynamics (2006, p.18).

Also the Newtonian conception of 'space as absolute' privileging material threshold is rejected by morpho-ecologies approach. "Instead it is based on a relative notion of space" developing on theories of Liebniz and Einstein, "in which space is no longer just a given entity but instead constructed through social operations and local experience of space-time" (Hensel, Menges p.18). Hensel and Menges also state that the project being 'finished' removes the fact that performance unfolds in time, project only really begins with its inhabitation. The relative notion of space and involvement of interactivity changes the conception of the form and the body, and their relation to each other. The evaluation of form under the impact of digital technologies reveals that different relations can be formed between the form and the body. The material systems and the approaches to the understanding of form and space have forced new ways of relating to these objects and spaces.

CHAPTER 4

EXISTING IN DIGITAL SPACE

In this chapter the ways of interacting with digital or digitally enhanced product will be explored. How one relates to the digital media and exists in digital space will be examined. As Antonio Saggio explains interactivity is a key element in digital media, since it:

> "offers the possibility to arrange and organize information … that can be manipulated by a 'what if' approach. In design, interactivity opens the possibility of working on an architecture that is not only metaphorical, but is also a 'creator of metaphors,' leaving its own decodification open, free, structured or non-structured, and suggesting and offering the user a possibility of constructing his or her own 'story'" (Kolarevich, 2003, p.237).

The integration of digital media in design provides yet another understanding of design product which is no longer an object or space, but it is an experiential event that the collaborator experiments in order to produce the product. As Saggio states "there are at least three levels of interaction in architecture" (Kolarevich, 2003, p.237). One of them is the interaction enabled in the design process, as mentioned in the design methodology section. The second one is related with the forms enabling certain change in their qualities

even after they are built. The third one is, as Saggio explains, “physical interactivity being the most complex and encompassing the other two. Physical interactivity means that architecture itself changes; the building’s environment is modified according to the situation, … but also an architecture that changes according to the variations in moods and feelings of the inhabitants” (Kolarevich, 2003, p.238). These levels of interaction will be discussed in this chapter in order to demonstrate how the body performs and interacts with digital media art and installations.

In the case of interactive art, another aspect of the digital media can be brought up. The digital image literally enables the interactive relation of the viewer, again served with the ability to manipulate the image. For instance, Dream Lines site exemplifies this interaction. The visitor enters a keyword and the site finds images on the internet that relate to the entered keyword, and, by performing certain alterations on these images, it creates a flow of visual images. Below are the captures from the generated images by different keywords:

Figure 29: White roses

Figure 30: deepsea

Figure 31: ben fry

The viewer, rather than selecting preexisting images, operates by filtering information directly and, through this process, creates images. As Hansen states:

> 'The body undergoes a certain empowerment, since it deploys its own constitutive singularity not to filter a universe of pre-constituted images, but actually to enframe something (digital information) that is originally formless' (Hansen, 2004, p.11).

In a form of interactive artwork the viewer then becomes as important as the artist for the completion of the art work. With reference to Deleuze, interactivity in art and architecture can be examined under the idea of smooth and striated spaces. The way that the interactive artwork functions between smooth and striated spaces is described by close vision, haptic space and abstract line.

4.1. Differentiating between Optic and Haptic Space

In *Thousand Plateaus*, Deleuze and Guattari distinguish between the smooth and striated space yet, although these spaces are different they can only exist together.

> "…smooth space allows itself to be striated, and striated space reimparts a smooth space, with potentially very different values, scope, and signs. Perhaps we must say that all progress is made by and in striated space, but all becoming occurs in smooth space" (1987, p.486).

In terms of creation, smooth space is privileged, since smooth space is where all the becoming and creation occurs. However, it can only be captured or

comprehended by existing in striated space. In order to explain these spaces with reference to art, Deleuze and Guattari provide the distinction between optic and haptic spaces. For the purposes of this section this distinction will provide the guidelines for determining the levels of interactivity.

4.1.1. Close Vision

Deleuze explains that smooth space is the object of a close vision and the striated space relates to a more distant vision. Referring to Cezanne:

> 'Cezanne spoke of the need to no longer see the wheat field, but to be too close to it, to lose oneself without landmarks in smooth space…One never sees from a distance in a space of this kind, nor does one see it from a distance; one is never 'in front of', any more than one is 'in' (one is 'on'…)' (1987, p.493).

For close vision to take place the viewer has to become a part of the art work. As long as the viewer is able to stare at the image, the viewer possesses a distant vision. In the form of interactive art, viewers become attendants instead of spectators and once the spectator is eliminated therefore there is no longer a spectacle.

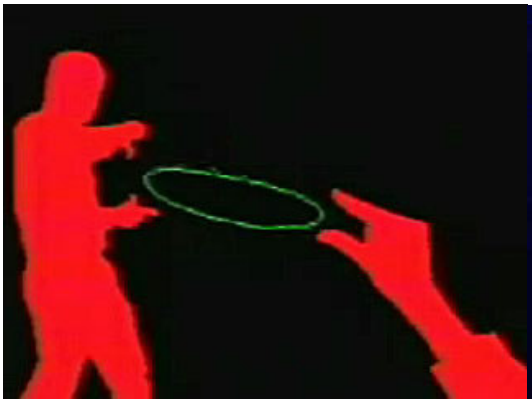

Figure 32: Videoplace Myron Krueger 1969, 1975

Figure 33: Videoplace Myron Krueger 1969, 1975

Myron Krueger believed that the entire human body is supposed to have a role in its interactions with computers. In the Videoplace installation (Figure 32, 33) a participant stands in front of a backlit wall and faces a video projection screen. The participant's silhouette is then digitized, and the posture, shape and gestural movements are analyzed. Videoplace creates graphics which climb up the participant's projected silhouette, or colored loops drawn between the participant's fingers. Krueger also allowed participants to paint lines with their fingers, and even entire shapes with their bodies.

In the case of Krueger's installation one can no longer speak of a viewer, the viewer becomes an attendant in the art work. Once such a relation is established, it is only possible to have a close vision and impossible to have a distant vision; since if the viewer does not participate, there will not be anything to be seen. In the form of interactive art, in order for the image to exist, the viewer has to become a part of the art work and therefore possess a close vision.

4.1.2 Haptic Space

Once the viewer possesses the close vision, one cannot exist in the optical space with the long distance vision. The viewer has to enter the haptic space. "Where there is close vision, space is not visual, or rather the eye itself has a haptic, non optical function" (Deleuze and Guattari, 1987, p.494).

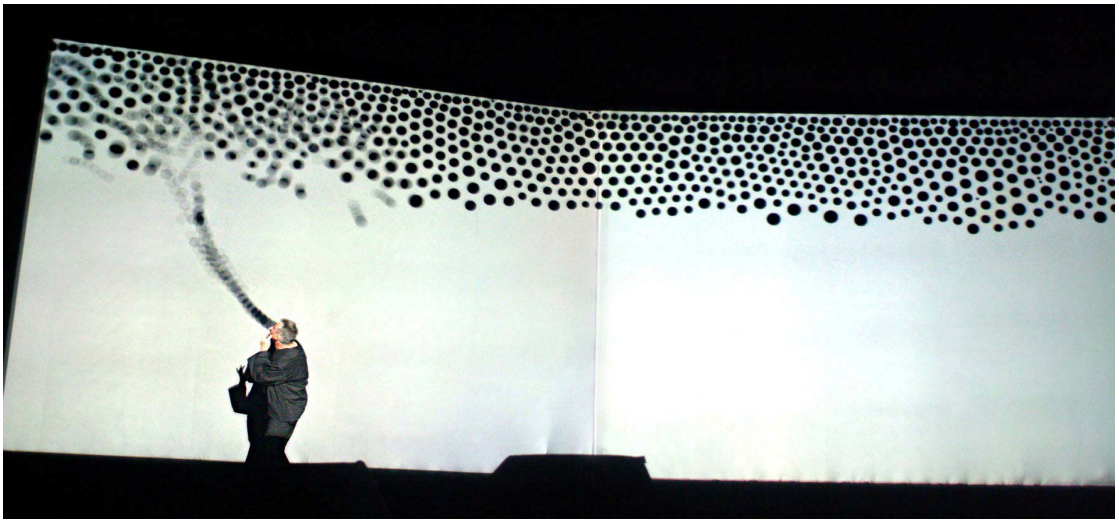

Figure 34: Messa di Voce, Golan Levin

Messa di Voce, created by Golan Levin in collaboration with Zachary Lieberman, uses whole-body vision-based interactions similar to Krueger's, but combines them with speech analysis and situates them within a kind of projection-based reality. In this audiovisual performance, the speech, shouts and songs produced by two abstract vocalists are visualized by displaying synchronized graphics. To accomplish this, a computer uses a set of vision algorithms to track the locations of the performers' heads; computer also analyzes the audio signals coming from the performers' microphones. The system displays various kinds of visualizations on a projection screen located just behind the performers. With the help of the head-tracking system, these visualizations are projected so that they appear to be emerging directly from the performers' mouths.

A similar approach is displayed in the video of the Etkivizyon (Figure 35) installation where the participant is responsible for the form that the displayed image takes by manipulating the image by his or her actions.

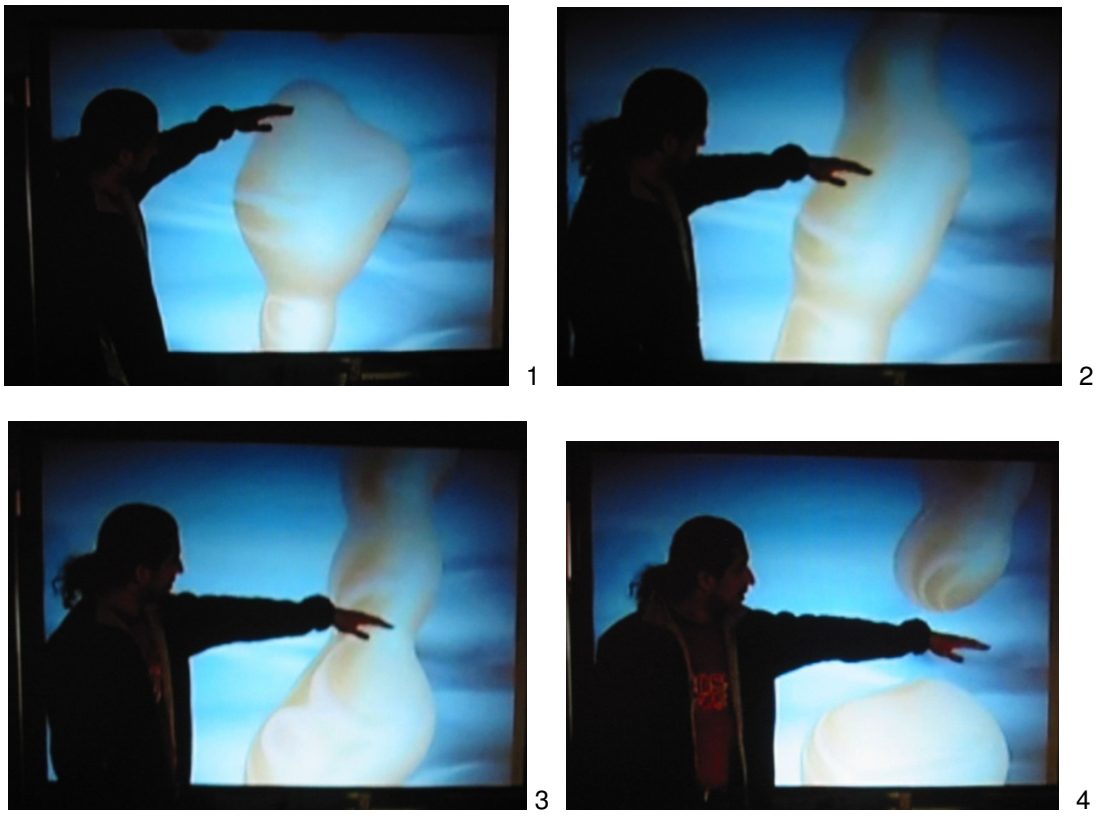

Figure 35: Captures from Etkivizyon video, Refik Toksöz

This installation is produced by a motion sensor analyzing the movements of the participant and projecting the altered image onto the desired surface. The software changes the properties of the projected image according to the stimuli sent by the motion sensors.

In the case of the above installations, it is the movements of the participant that allows forms to be generated. Therefore, the participant as well as possessing a close vision also exists in the haptic space. The production of

the form truly resembles the behavior of the tactile force acting upon a form and therefore altering its shape.

Mark Hansen explains interactivity as "by placing the embodied viewer-participant into a circuit of information, the installations and environments they create function as laboratories for the conversion of information into corporeally apprehensible images" (2004, p.11). Again it is the viewer (attendant) who striates the flowing images by providing the image to take a certain form. Hansen further states that:

> 'It is in the form of the image – the visual image above all, but also the auditory image and the tactile image – that digital information is rendered apprehensible.' Then he concludes with the digital image to propose 'a shift from a dominant ocularcentrist aesthetic to a haptic aesthetic rooted in embodied affectivity' (2004, pp.11-12).

The ability of digital image to produce a haptic interaction allows artwork to move from an optical space, which requires the distant vision of the viewer, to the haptic space. It could be argued that if haptic space is the element of a smooth space, as long as the interaction between the image and the viewer (attendant) continues to take place, smooth space will be achieved.

4.1.3. Abstract Line

Deleuze refers to the abstract line as ‘a line that delimits nothing, that describes no contour’ (1987, p.497), a line “of variable direction that …delimits no form” (1987, p. 499). Therefore, digital image provides the artist with a medium that can only draw an abstract line. As mentioned before, once an image is digitized, it is transferred into numbers which cannot draw an apprehensible image without the aid of an imaging device (screen, printer etc…)

This implies an image that cannot be represented unless it is striated and made apprehensible to the viewer. However, the way that the artist intervenes with the code of the digital image becomes important. Lev Manovich states that ‘digital media asks us to identify with somebody else’s mental structure’ (2000, p.21), but in interactive art the artist can control the image to a certain extent and cannot predict what the image will look like when the interaction is under process. When such manipulation is imposed on the code, the only thing that can be seen is what the viewer’s mind is ready to see, in other words, only a self-reflection.

It can be said that digital image exposed to interaction can describe a smooth space but it can only exist until the embodied vision of the viewer captures the image. It can be argued that it is the embodied vision that enables the striated space to emerge. Once the image is made apprehensible, again a contour is described. The next section discusses if the embodied vision describes this contour or eliminates it and highlights how the understanding of the body changes under the digital approach to space and object.

4.2. Interactive Body in Digitally Constructed Space

Mark Hansen in his book *Bodies in Code* refers to embodied space as 'wearable space' explaining that "space becomes wearable when embodied affectivity becomes the operator of spacing" (2006, p.175). Wearable space can be explained through its two crucial components, affective computing and aesthetics of eversion. Affective computing refers to the privilege of the affective basis of digital and the body interface. Aesthetics of eversion shows how space is related to the bodily senses, and also infinitely flexible and convertible through the same senses. The word "eversion" is a terminology brought by Marcos Novak meaning 'casting out of the virtual on to the actual'.

Mark Hansen states that each of these concepts foregrounds the creativity of the affective body which refers to "the role of the body as at once a source for and activator of a rich affective constitution of space" (2006, p.176). The concept of wearable space can be explained further by examining the body while 'spacing the formless', a concept proposed by Peter Eisenman. In order to argue how the body generates space, architect and philosopher Bernard Cache's definition of architecture as 'the art of the frame' provides a link to embodiment. The body becomes the agent of framing space, considering that built space involves inhabitation. Mark Hansen describes architectural framing as follows:

> "Unlike cinema and any other technical art in which framing is built into an apparatus, and unlike painting, in which the frame forms a material precondition, architectural framing occurs as a process that is contemporaneous with its reception or

> consumption. That is precisely why we can say that it is intrinsically (rather than contingently) embodied" (2006, p. 177).

Architectural framing and its relation to embodiment requires a certain clarification due to architecture's technical dimension. Buildings, even if digitally designed, face the constraints of architectural material in order to be built and require adjustment for inhabitation. Digital technologies are being demanded for overcoming these technical constraints; under this approach the space pre-given by the built form is embodied. However, digital media can provide a detachment from the pre-given constraints of architecture which offers a new importance of the body as the built form becomes a stimulus for embodied experience of inhabitation. Mark Hansen states that such correlation between space and body produces what he calls 'wearable space':

> "The more digitally deterritorialized the architectural frame, the more central the body becomes as the framer of spatial information. … Just as the body assumes a renewed importance in the aftermath of the digital explosion of the technical frame, so too does it counterbalance the digital dissolution of spatial form, offering an indirect and supplementary – but no less fundamental – means to couple deformation and inhabitation, formal play and real life. For this reason, architecture must reconceive its function for the digital age: as the art of framing par excellence, it must embrace its potential to bring space and body together in the creation of 'wearable space'" (2006, p.177)

Stephen Perella also states that the body is reconsidered in the context of digital media, defining 'hyposurface':

> "'Hyper' implies human agency reconfigured by digital culture, and 'surface' is the enfolding of substances into

> differentiated topologies. The term hyposurface is not a concept that contains meaning, but an event; one with a material dimension. We are currently at the threshold of this new configuration as a site of emergence for new intensities of culture and intersubjectivity" (1998, p.10).

Mark Jackson explains this new notion of body referring to Perella, stating that space is becoming fluid and "architecture is emerging as the construal of a new notion of body, one that imbricates and hybridizes two contemporary, dichotomous bodies" (n. d., p.5). One of the bodies being discussed is the material body as a primitive mechanism and the other is a body that consists of circulating electronic information. Architecture traditionally has dealt with 'primitive body' and now it is facing the 'third body' with the emergence of 'event architecture'. Jackson highlights Perella's idea of shifting understanding in architecture in order to explain the emergence of the 'third body'. "Hypersurfaces are a reconfiguration of both the human subject and the world of objects, a rethinking of Cartesian space and phenomenological grounds for perception" (n. d., p.6). Jackson further adds that "such architectures present an ongoing incommensurate form and image, where the surface is activated and motile and hence the perception of volume or containment is open, a 'fluxus' architecture" (n. d., p.6). Perella defines this approach to architecture as 'event architecture'. Event architecture does not seek for a subject or an object, or addresses neither a 'primitive human body' nor 'electronic informational body'. The 'third body emerges when "image / form / body become an incommensurate event" (Jackson, n. d., p.6).

In the examples of interactive installations, Videoplace by Myron Krueger and Messa di Voce by Golan Levin, the electronic circuit and the physical body remain as separate entities interacting with each other. They display the event in the form of action and reaction. In these installations once the collaborator acts the electronic circuit reacts. This is the kind of interactivity that is mostly seen in art and architectural practice. At this point another way of producing interaction can be examined. As it has been discussed earlier, the production of haptic space is highly related to the interactivity. One example that provides this interactivity and at the same time shows the collaborator the removal of the perceptional constructs is the *Skulls* installation by Robert Lazzarini, displayed at the Whitney Museum of American Art, Bitstreams Show (2000). The installation consists of a rectangular room with four sculpted skulls on each wall.

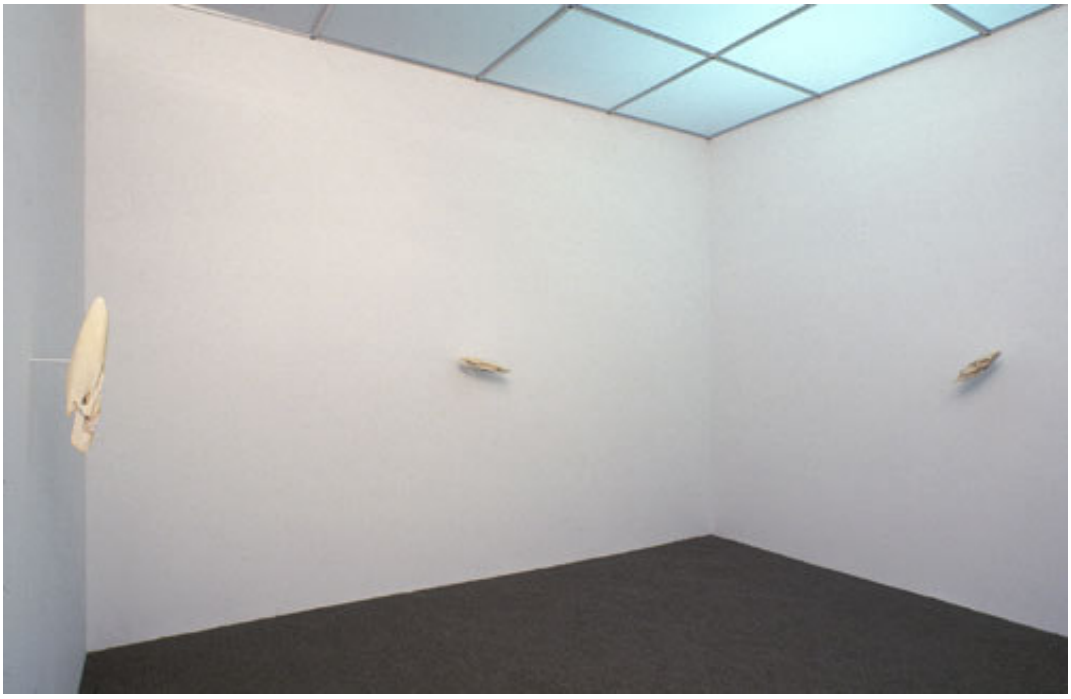

Figure 36: Robert Lazzarini, Skulls. Whitney Museum of American Art, Bitstreams Show (2000)

The displayed skulls are computer generated and captured from certain perspective angles and these captures are produced as three dimensional sculptures with prototyping technologies.

Figure 37: Detail shots of displayed skulls

The importance of the skulls installation emerges with the distorted sculptures that do not mesh with the perceptual habits. The kind of distortion that is displayed in these skulls is accomplished through digital modification. As explained by Mark Hansen, once you are in this room you try to align your point of view with the perspective of one of these objects, however they refuse to return your gaze. They appear as if they existed in a space without any connection to the space you inhabit and you become disoriented. You move and

twist your body in order to align your line of sight, or you find your body contorting itself trying to adjust to this space. As Hansen states “skulls confront us with a spatial problematic we cannot resolve” (2004, p.201), and further argues that “our visual faculties are rendered useless and we experience a shift to an alternate mode of perception in our bodily faculty of proprioception” (2004, p.202). Again, in this case, perception is removed. However the difference in skulls installation is that the collaborator is reminded that one cannot relate to this space perceptually. This installation requires again a haptic experience of the space. The skulls exist as stimuli for the experience of this installation, what Lazzarini manages in this installation is that he designs the bodily experience. It is not the skulls or the room that are being displayed in this installation, it is the experience of the collaborator that is being designed through the space and the objects.

It can be highlighted that digital media introduces a new level of relating to the objects and spaces. The most important shift that emerges with the involvement of interactivity is that, it is not only through perception that we relate to spaces and objects but it is through forming a haptic relationship. As the level of interactivity increases, in other words as it moves from simple action and reaction between two bodies to a level of interactivity where two bodies interpenetrate or merge together in order to form something else, a ‘third body’, only then the event architecture will be accomplished. Along these lines, higher levels of interactivity are linked to the relativity theory under different approaches which will be explained in the next section.

4.3. Relativity in Space

The theory of relativity has been approached in different ways in the context of changing understanding of space under the influence of digital technologies. Due to the introduction of bodily interactivity in generation of space and objects, these two notions immediately become a relative concept.

The argument of space as absolute or relative space has been an area of concern in architectural theory. Henri Lefebvre explains this separation in *the Production of Space* as "… philosophers have taken the existence of an absolute space as a given, along with whatever it might contain: figures, relations and proportions, numbers, and so on"; on the other hand, he points out Leibnizian understanding of space:

> "Leibniz maintains that space 'in itself', space as such, is neither 'nothing' nor 'something' – and even less the totality of things or the form of their sum; for Leibniz space was, indeed, the indiscernible. In order to discern 'something' therein, axes and an origin must be introduced, and a right and a left, i.e. the direction or orientation of those axes. This does not mean, however, that Leibniz espouses the 'subjectivist' thesis according to which the observer and the measure together constitute the real. To the contrary what Leibniz means to say is that it is necessary for space to be occupied" (Lefebvre, 1991, p.169).

The important point in here is regarding space as indiscernible. Considering spatial attributes as vague but not as an absolute given requires another agency in order to discern. Lefebvre asks "what, then, occupies space?" (1991, p.169-170) and continues "a body – not bodies in general, nor corporeality, but a specific body capable of indicating direction by a gesture, of

defining rotation by turning round, of demarcating and orienting space. Thus for Leibniz space is *absolutely relative*" (1991, p.170).

The second question that rises is "can the body, with its capacity for action, and its various energies, be said to create space" (Lefebvre, 1991, p.170). In the previous sections it was demonstrated that body with its capacity for action can produce form, however what is regarded as form is redefined in this process. Similar shift in the understanding of space is also required. Lefebvre agrees that the body can create space, "but not in the sense that occupation might be said to 'manufacture' spatiality; rather, there is an immediate relationship between the body and its space, between the body's deployment in space and its occupation of space" (1991, p.170).

Such an approach in creation of space should be adopted in order to enable the body create space 'with its capacity for action, and its various energies'. In the previous examples of Videoplace by Myron Krueger and Messa di Voce by Golan Levin it is demonstrated that with the removal of perception, or in other words, the optical function of the eye, the participant steps into the haptic space. Then the haptic experience is further intensified as seen in the Lazzarini's Skulls installation where removal of perception is made rather awkwardly clear to the participant. Therefore it could be argued that the vagueness, formlessness and distortion enhances haptic space trough the requirement for further bodily involvement.

In Liz Diller and Ricardo Scofidio's *Blur Building,* they examine the bodily generated space aided by digital media in an 'unform' environment. In *Blur Building,* architecture dematerializes in order to enforce the bodily generation of space, and in this process digital technologies determine the encounters between bodies that produce the experiential space or the event.

The *Blur Building* is a media pavilion developed for the Swiss Expo 2002 in Yverdon-les-Bains, Switzerland (Kiser, 2009, p.1). Blur Building is made out of fog, an artificial cloud whirling upon Lake Neuchatel created by 31.000 tiny nozzles covering a thin metal space frame. A built-in weather station controls fog output in response to shifting climatic conditions such as temperature, humidity, wind direction, and wind speed. A "liquid architecture that synchronizes its form to the environment and the human body" as explained in Thomas Markussen's interview with Brian Massumi (2005, p.1). Architects Diller and Scofidio refer to the *Blur Building* as "a dynamic form that combines natural and artificial weather forces" (Hansen, 2006, p.182) as quoted in Hansen.

Figure 38: The Blur Building by Diller + Scofido

Figure 39: The bridge to Blur Building

The *Blur* is approached via a ramped bridge. “The 400 foot long ramp deposits visitors at the center of the fog mass onto a large open-air platform where movement is unregulated. Visual and acoustical references are erased along the journey toward the fog leaving only an optical “white-out” and the “white-noise” of pulsing water nozzles” (Kiser, 2009, p.1).

Before approaching the *Blur*, each visitor is equipped with a ‘braincoat’ – a raincoat that protects the visitors from the misty environment and serves as a very tangible interface between user and building. The master computer of the *Blur* is able to track each visitor’s movements with surveillance technology and makes their ‘braincoat’ react blushing either red or green according to similarity or difference between personality profiles of people unknown to each other depending on the personal profiles that are filled out before entering (Markussen, Birch, 2005, pp.3 – 4). “As visitors pass one another, their coats will compare profiles and change color indicating the degree of attraction or repulsion, much like an involuntary blush – red for affinity, green for antipathy. The system allows interaction among 400 visitors at any time” (Kisler, 2009, p.1).

Figure 40: Braincoats - smart wear designed by Steve Rubin of EAR Studio

The design approach of *Blur Building* raises significant points. First of all, architects Diller and Scofidio refer to the project as a 'habitable medium' (Hansen, 2006, p.182). The use of fog in order to generate this medium serves for two different purposes. On one hand, it demonstrates an example for a dynamic form that can be altered without defining an exact geometry which can be traced back to the idea of 'abstract line', which defines no contour and delimits nothing. However, what is more important for this section is that the blurring of perception with fog. This second function enables the generation of bodily event through digital media. As the architects explain "architecture would dematerialize and electronic media, normally ephemeral, would become palpable in space" (Diller and Scofidio, 2002, p.44). The fog dematerializes space and puts the visitors perceptual habits on hold. "The fog mass is primarily an experience of visual interference, thus the reliance on vision competes with Blur's most notable characteristic, obscurity" (Diller and Scofidio, 2002, p.195).

Massumi in his interview with Markussen explains this process as frustration of the "usual visual expectations of architectural style by presenting, at first approach, nothing identifiable, a literal blur created by mist" (2005, p.3). Massumi continues by pointing out that "rather than addressing vision first and using vision to guide movement as is usually the case, the "Blur Building" frustrated vision in order to address movement first. The building was built to be vague, and then to become determinate through a process of cross-modal interaction that made a perceptual event of visiting it" (Markussen, Birch, 2005, p.3). Mark Hansen also explains how suspension of perception leads to the generation of space:

> "… the architects [Diller and Scofidio] structure disorientation into the Blur experience and equip the impaired, visually dependent visitor with a 'braincoat,' a raincoat with embedded technologies" (Hansen, 2006, p.182) which map the navigation of the participants. "Rather than forming a preexistent architectural ground for experience, the Blur Building can be said to result from the actual navigation of bodies inside the cloud of fog … blind bodies in a nonspace creates an architecture of nothing, an architecture that is much in the bodily experiences as it is in the acoustic and tactile mappings of space which they trace" (2006, p.182).

The significance of the *Blur Building* lies in the demonstration of the shift in architecture itself. As Brian Massumi explains, architecture instead of constructing still standing forms moves towards:

> "constructing the environment that triggers the changes that issue new forms of experience. As architects integrate new technologies more fully into their buildings, what they are really designing are possibilities of experience. They are not just building for practical function. They are becoming experience engineers" (Markussen, Birch, 2005, p.2).

Markussen in the interview with Brian Massumi notes digital architecture's strong appeal to the senses and the body in a radical way, and requests Massumi to account for the use of digital technology that effectively engages the perceptual system and body. Massumi argues that:

> "integrating digital technology into architecture multiplies the possibilities for addressing and transforming perception. The question is related to the use of computer-assisted methods in design, but is not unique to it. It is quite possible for a building designed by using cutting-edge digital techniques to end up addressing perception in entirely traditional ways"(Markussen, Birch, 2005, p.3).

As Massumi highlights, digital technologies do not always enable the radical interaction to provide the ground for event architecture. Such an approach emerges when the forming process continues through the interactive experience of the users, "by building into the architecture forces of perception that interact in ways designed to trigger experiential events" (Markussen, Birch, 2005, p.3).

The significant point to be realized here is that the integration of digital technology with architecture does not necessarily mean that a haptic interaction will be formed in order to trigger the creation of space through experiencing it. However, digital technologies can be regarded as a "very powerful tool for this, because it allows cross-connections that were never before possible. This makes it possible to transduce changes occurring on one level of experience

into events on a different level with infinitely increased flexibility, even at a distance" (Markussen, Birch, 2005, p.3).

Digital technologies, in terms of enabling these cross-connections and being able to produce immediate real time response provide architecture with a significant tool that even questions the fundamental arguments of space as a relative or absolute notion. The *Blur Building* exemplifies the relative understanding of architecture by dematerializing it in order to empower the embodied relations to generate the space.

CHAPTER 5

CONCLUSION

This study is an evaluation of the design process and the product in the scope of digital media. Digitization and the utilization of digital technologies in design brought the necessity to reconsider the design product and the process. As a consequence, the terms ‘form’ and ‘space’ have been reconceptualized, leaving their static and finished status behind in order to gain a constantly changing, experiential understanding. The reconceptualization started with the emergence of a shifting understanding of representation. Mechanical age is concerned with producing an exact ‘copy’. In the Platonic sense the creation of form is explained by the relationship between the ‘ideal’ and the ‘copy’. Based on this approach, industrial revolution accepts the production of exact copies and reproduction as the fundamental aspect of optimization. In this sense, ‘emergent’ or ‘immanent’ form can only be regarded as a failure or a bad ‘copy’. However, in the Deleuzian approach, emergent form is privileged. Deleuze argues that the production of exact copies does not involve novelty in creation, and the concepts of virtual and smooth space are used to explain this distinction. Accepting the interdependence of virtual and smooth space with their

opposite couples, possible and striated space, it should also be acknowledged that the new conceptions emerge from the transformations between these couples.

The theories of the virtual and the haptic were useful in terms of showing how new connections can be made to provide novelty and creation. Evaluation of actualization of the virtual revealed a new understanding of the genesis of form and the ways that the form is consumed, and this process has redefined the meaning of form.

On the other hand, the changing understanding of form also leads to the reconsideration of the ways that the form and space are experienced. It is argued that creation takes place in haptic space. In order to construct the haptic space, an interactive, indeterminate and experiential embodiment of space is required. The projects designed with this consideration are illustrated to reveal that the understanding of space becomes relative. The boundaries of space become vague in order to reveal a bodily production of space. This leads to redefining ‘architecture’ as an event.

The examples of real-time interaction between the body and space explain certain ways of constructing interactive dynamic spaces. However, it should be noted that the virtual and possible, optic and haptic are couples to show the distinction between the traditional and the new understanding of form and space. As long as form and space regenerate themselves, virtual forces of creation and a haptic existence in space can take place. It is important to accept

that these couples exist in a mixture. In terms of creation, the form and space can be generated with virtual forces of creation or through an haptic existence in space. However, once they are created, they again become a part of the static space that is either captured as an image or an embodied experience. Deleuze and Guattari state that “all becoming occurs in smooth space” (1987, p.486), where the perception is haptic; yet “all progress is made by and in striated space” (1987, p.486), which is defined in the optic space. In other words, in order to account for the creation that takes place in the smooth space, it has to reveal itself in the smooth space. This is the reason behind why this thesis discusses the alternate ways of creation of form and space in order to provide new connections and a new understanding of design, instead of arguing that this approach offers correct or better solutions.

The alternate understanding on form generation and interactivity also lead to further arguments in the structure of the design disciplines. Redefining the design product challenges the concerns of function and aesthetics, even their meanings. Furthermore, it re-evaluates the body that the product is intended for, which questions the deeply rooted design assumptions. The vague distinctions between the object, subject and the designer becomes the initial questionable area which then leads to the further questions in their relationships to each other. For instance, even ‘seeing’, the initial and the most established method of relating to design objects is now being challenged, forcing other methods of producing meaning.

Finally, it can be said that the changing approach in the utilization of digital media in design fields offers a different understanding of form and space in their creation, materialization and interaction. Furthermore, it locates the most established assumptions of the design fields in a questionable area. Design in the digital age can still only be defined as an unknown territory, yet to be explored by remembering that, its power of creation is its unknown nature.

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