

Pimp my Box – Architecture of Transformation

Interdisciplinary Collaboration and Various Media as Design Decision and Support Tools

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Abstract: The paper describes an interdisciplinary architectural design studio setting at the graduate level, which explores the notion of “transformation” in architecture. By collaborating with a group of modern dance students, the studio approaches the creation of space from a different perspective, using dynamic movement coupled with digital tools as a space generator.

1. INTRODUCTION

“ I am my body. I am not a relation to my hand in the same utilizing attitude as I am in relation to the pen; I am my hand.” Jean-Paul Sartre

Transformation in architecture can be described and explored through dynamic and/or kinetic processes, through folding, morphing, compressing, anamorphose, caricature, algorithm, etc. The implementation of one or more of these processes can lead us to the representation of abstract formal configurations that imply the relationship of cause and effect in architecture (Terzidis 2003). Within the interdisciplinary graduate studio setting: *Pimp my Box*, which was conducted during spring term 2007, the studio participants explored possibilities to express notion of transformation in architecture [*dynamic*], considering, including, and challenging the average building that suggests stability, steadiness, mass and immobility [*static*]. Pedagogical studio objectives included a method to generate architectural

space through movement, which was based on an interdisciplinary cooperation with a group of modern dance students. The emerging conceptual approaches helped the participating students to develop meaningful architectural ideas and to generate clear spatial orderings and appropriate form responses. By means of layered physical and virtual models, the studio participants employed an array of study models and a laser cutter as a design and decision support device. The studio provided the students with tools to represent a continually expanding repertoire of three-dimensional architectural space and form.

2. STUDIO SETUP

2.1 Initial research phase

The 15-week comprehensive graduate design studio was divided into three sections. During the first section, the research phase, the students had to analyze a given urban infill site in downtown Salt Lake City, Utah; simultaneously they explored a variety of traditional, contemporary, and experimental forms and programs of theater and performance spaces as well as different exhibition layouts. Besides traditional aspects of a site analysis, such as zoning requirements, traffic, cultural functions, urban space, etc., students were asked to analyze the site also from a more general point of view, documenting, describing, and finally analyzing the narrow site and its urban surroundings through one of the following media: film, an exhibition of photographs, and a Soundscape.

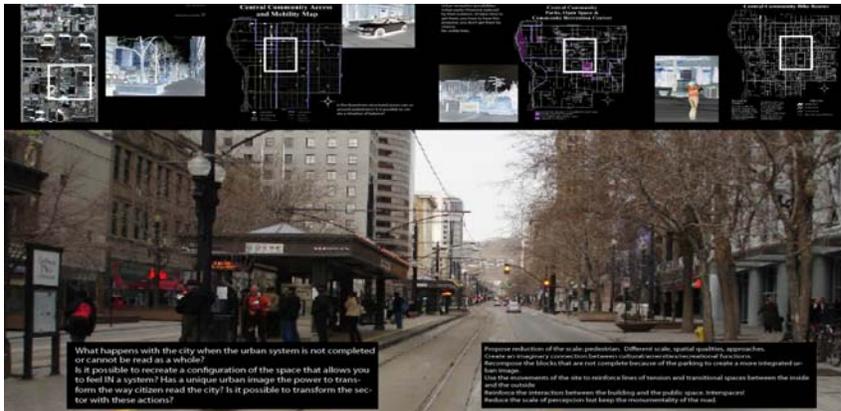


Figure 1. *Urban site analysis; student: Nicolas Longo*

2.2 The box as the architectural point of origin

Based on the initial site documentation, participants had to develop a program and diagrammatic building mass in close context to the available space on the narrow city plot, which would be based on the archetype of the box. At the same time they had to consider the rigid city grid of Salt Lake City with its urban context and the existing building code. The program, a small experimental performance space that incorporated a black box theatre, a flexible performance area, rehearsal spaces, and an exhibit and gallery space, had to be included as a schematic and functional diagram. On one hand, this first diagrammatic approach was abstract enough to leave space for later architectural implementations; on the other hand it had to be precise enough to understand the suggested spaces within the given site envelope and its larger context within the urban setting.

As a physical design tool, the studio produced a common site model of the urban infill area at a scale of 1/16"=1'-0" (metric 1:200) to work with.

The results of the research and the first proposals were summarized in an InDesign document. This electronic file was immediately accessible to all studio participants as a common work source through the studio website:

http://www.arch.utah.edu/ruegemer/classes/2007_springstudio/start.html

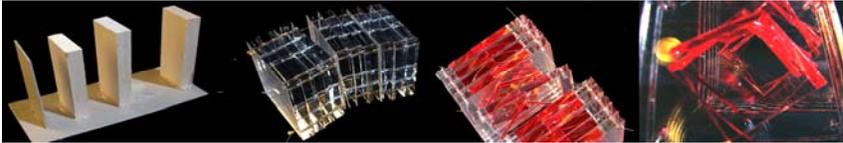


Figure 2. *Diagrammatic point of origin; student: Shelly Brady*

3. MODERN DANCE COLLABORATION

The second studio section was conducted in close cooperation with the *Department of Modern Dance* at the University of Utah, in order to overlay the so far developed [*static*] diagram with elements drawn from a [*dynamic*] experience.

The architectural students collaborated with a group of modern dance students; the number of students in both groups was equal. Throughout

several dance and performance exercises and sessions, the main focus was on the investigation of [*dynamic*] dance and body movement through space. Considering the personal experience during the dance sessions, the given goal was to analyze how the student's movements correlated to the space in which they performed, and how the space and context affected their movements, re-conceptualizing space, movement, and own perception. The work should bring to consciousness the body, space, and the act of seeing.

Based on both dancers' and architects' individual perception of space, context, and immediate environment, the mixed groups developed distinct dance performances, in which they explored the context and connection of space and body movement and its influence onto each other. The sessions provided the architectural students with new artistic body tools, enabling them to describe spatial context in time-related sequences. The given space of the architectural building was used to frame the final performances, with the task to influence the space in which the pieces were performed, and to have the performers influenced by the building.



Figure 3. Professional performance setting with architects and modern dancers

3.1 The performance as a spatial inspiration

The point of origin during the artistic performance work was the body that affects the space and in turn the space that affects the body. The perception of both the body and the space can become a means of describing and understanding those relationships. The audience's perception influences their understanding of the space and the body both as separate and integrate entities. The performer's perception of the space is vital to their process of movement as well as to their understanding of the space itself.

Exemplary for four performances that were accomplished by the students, one performance: *Body and Space* describes how the architects and dancers interpreted the given task:

The space utilized for the performance was a narrow corridor with floor-to-ceiling glazing on both sides. Some of these windows were opaque, whereas some sections of the wall were actually made of concrete. Through the large windows, the interior was visually connected to the surrounding

landscape; the solid parts of the walls represented opportunities for the performers to hide. The narrow passage suggested linear movement, without any intention of being a place of pause or destination. The audience watched the performers from the outside, being spatially disconnected but able to see the event and listen to the sounds that occurred within the performance through electronic transmittance devices.

The performers started to describe the way in which the body was intended to move through the corridor space, as they circulated in a linear manner from one end to the other, each at individual, various speeds. Becoming affected or interrupted by other performers within the narrow space, they also described movements that may be perceived by the audience to be unpredictable or uncommon in such a space. Due to surrounding landscaping and the focus onto the actual performance space, the performers initially did not perceive the presence of the audience.



Figure 4. “Body and Space” – single frames of the performance

They interacted with one another to describe the space in a multi-dimensional manner, affecting each other’s movement, speed, or direction, thus describing the space in a new way. What was once an understandable space became one in which unpredictability and chaos redefined how movement could occur within. As the performers became more aware of the space in which they moved, they suddenly noticed the presence of the audience outside, moving abruptly to the windows, freeing themselves from their narrow stage by smashing through the layer of separative glass (this last part was not intended to happen, but due to the performers excitement and dynamics, they accidentally went through the transparent threshold).

Despite being surprised by the abrupt climax, the audience instinctively applauded, understanding the finale as an intended part of the overall piece. In their later translation from dynamic performance experiences into architectural space, some of the students actually included the last sequence, opening up their buildings to the city, avoiding any closure or disconnection

of the project's spaces from the immediate urban environment within the given site.

All performances were captured by the groups with several devices, documenting movement and sound, using photos to frame specific moments in time, in order to create a movement-based inspiration as well as a source for the later creation of architectural space.



Figure 5. "The Advent" – student performance in the building's Faculty Lounge

4. SPATIAL DIAGRAMS

In the third studio section, which started in the seventh week, the above-described dynamic conceptual approaches and methods were used to develop meaningful spatial frequencies and diagrams that generated clear spatial orderings and appropriate form responses.

Similar to the method developed by French scientist and chronophotographer Étienne-Jules Marey in the 1880's, sequences of the performance pieces were analyzed in four dimensions, including the time. Students used the footage from the performances to diagram, overlay and digitally layer complex movements in single images, models, or few sequences, mostly including the fourth dimension as a time related axis that, based on the traditional x-y-z coordinate system, would spatially point to the x-direction (figure 10). In other projects the time related sequences were used as packages of spatial organized layers, in which the fourth dimension would actually point toward the z-direction, giving the diagrams a certain depth in space (figure 11).



Figure 6. Étienne-Jules Marey: Study of human movement (Source: www.expo-mary.com/)

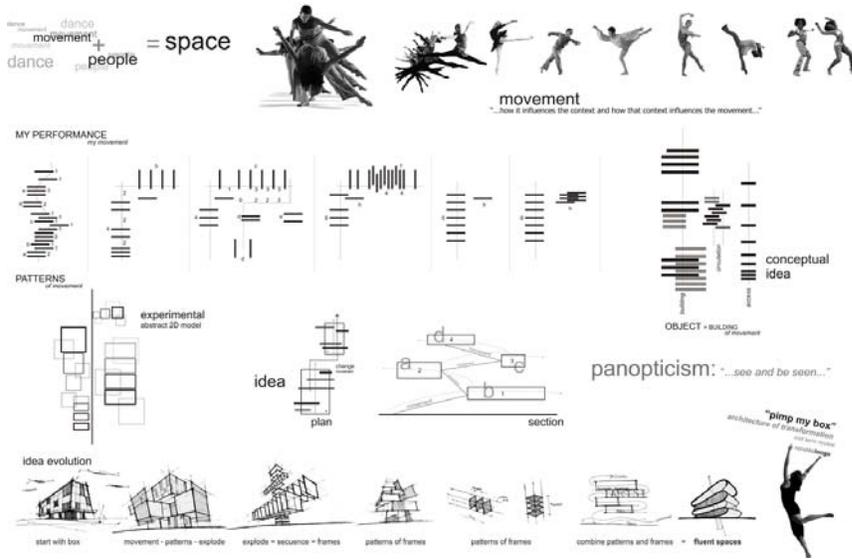


Figure 7. Graphic representation of the transformation process; student: Nicolas Longo

Other than a static body that represents a specific shape, which can be described and spatially realized more easily, students incorporated unseen effects and interactions that mostly occur in moving bodies. This could include spatial relationships with the ground, dynamic aspects such as gravity, but also emotional aspects like adrenaline, excitement, anticipation, etc. (as described in the unplanned finale of the *Body and Space* performance). Studying these aspects along with the physical movement of the body over a particular period of time, the movements often uncovered aspects that weren't anticipated in the first approach.

Figure 8 shows a static moment within a particular movement that occurs along a dramatic process of progress. In order to understand the moment captured in time, it is necessary to study and diagram the moments before and after the specific instant. Figure 9 shows a diagram that represents the movement of feet, knees, arms, and head of the person that was caught and supported (person in the center of the figure 8).



Figure 8. *Static moment within an artistic movement: “Body and Space”*



Figure 9. *Traces of movements of different body parts; student: Nicolas Brady*

The model that was produced hereafter provided a three-dimensional look at the movement's translation over time, including the body's resistance to gravity and to the specific spatial arrangement and condition. The vertical acrylic slices represent the time dimension. Since the 'time fragments' were not affixed to the model's base, they can pivot to be manipulated in relation to one another, extending the model's capabilities about another dimension. The linear tracing of the movement, which is captured in the model through little openings in the acrylic slices, can thus be altered and shifted in the model's z-direction (figure 10).



Figure 10. *Spatial diagram that captures certain traces of movements; student: Nicolas Brady*

In another project, few instances of dynamic arm and leg movement around a more or less static core (the dancer's body) were translated into two different static models: one that used a simple overlay technique where the elapsed time was represented in acrylic layers along the z-direction, therefore freezing the movement in a solid block, creating a three-dimensional object that is actually solid in the place where the dancer's body is placed. The representation of leg and arm movement shows a radius by which a three-dimensional space is defined (figure 11 left). In another model the movement was stretched along the x-direction, creating a linear element in which the movement was stored in a parallel manner, thus allowing breaking down the movement according to its speed and direction in space. Spatial implications such as movement, distance, and magnitude can be used as reference for further definition (figure 11 right).

Tools of choice for these processes were mostly digital modeling software as well as a two-dimensional laser cutter. Their influence onto the design process will be described in more detail in paragraph 6.



Figure 11. *Two different spatial models that were developed based on the same specific movement; student: David Hulsberg*

5. SPATIAL SUPERIMPOSITION ONTO THE BOX

For the five final weeks of the studio, students were asked to superimpose their emerging spatial diagrams from the previous design phase onto the urban site and the diagrammatic building program – the box. Objectives in this phase were to transform the developed archetype into a more complex structure and shape, considering architectural, formal, and functional needs of the design task, including an examination of possible structural systems, materials, and issues of sustainability and energy saving. Experiences from the previous phases like layering, rhythm, sequence, folding of space and time, morphing, hybrid, etc., were supposed to inform the process to create spatial influence onto the structure.

The two projects described in this paragraph are based on a quite literal translation of the applied method of analyzing the movements by using several layers. The first project isolated a single movement of the performance piece, capturing five single frames. By tracing the path of various points on the body, several curved lines were generated. The overlay of these captured movement fragments were then cut into acrylic, delivering the first, still abstract model of the future main space of the building.

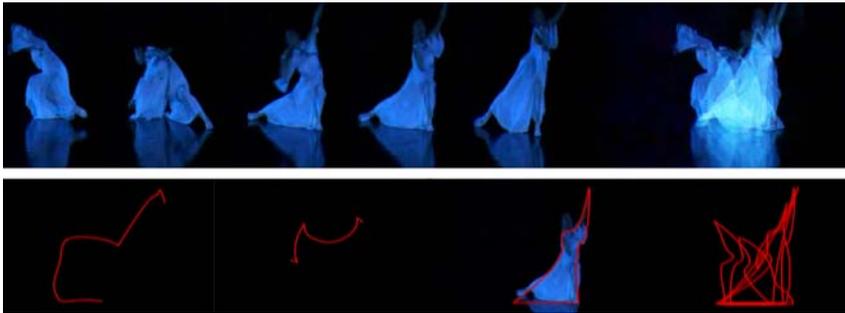


Figure 12. *Isolated movement that is layered to create spatial content; student: Matthew Hieb*

In order to represent time in space, the two-dimensional diagrams of the movements, which were flat panels, were arranged in a spatial sequence to implement time as the third dimension, thus creating a three-dimensional object. The rhythm, thickness and distance between the different layers were derived from the actual program needs of the project, incorporating more pragmatic aspects into the still abstract spatial framework (figure 13).

Finally, by extruding the movement-based shapes horizontally through the vertical fin-walls, the main space was created along the idea that the perception of that space would continually change as one moves through the volumes of the building (figure 14).



Figure 13. *Sectional rendering of a space derived from the time related layering of a two-dimensional movement analysis; student: Matthew Hieb*

The abstract image of the performer that had moved through the space-creating planes left a residue of the motion, manifested in the void of the mainspace. The intention is obviously connected to dance, where the audience is left with a memory of what was perceived in the performance.

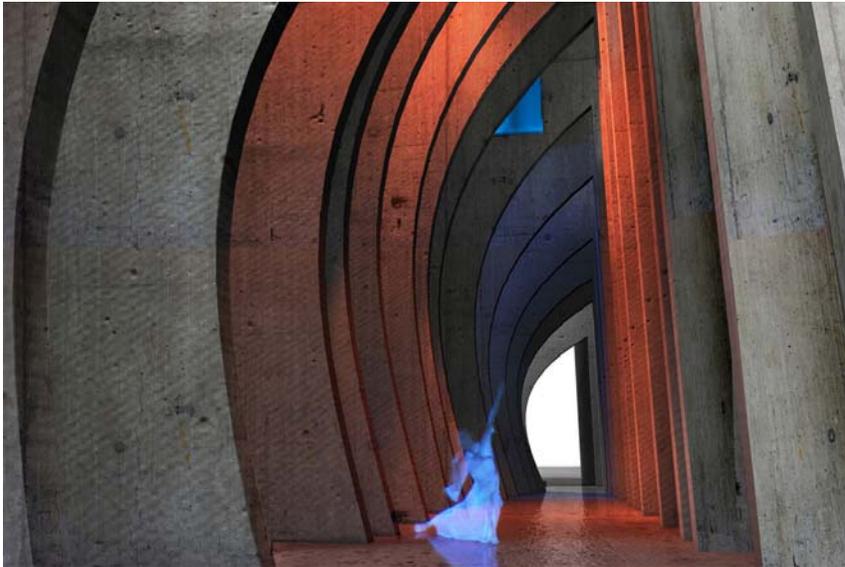


Figure 14. *Main space; student: Matthew Hieb*

The next project described below creates mystery to spark curiosity by allowing only brief glimpses of its inner organization, based on the key component of *slow expose* of the specific performance that was developed by this student's group. Within the urban setting, the project creates a juxtaposition with its environment, which is another aspect of modern dance that is often about juxtaposition of form, idea, and movement.



Figure 15. *Layered back flip*; student: *Chad Spencer*

The project was based on the corridor piece, in which the audience was exposed to the actual performance through three frames: a number of panels that were completely clear, one that was semi-opaque, and another panel that was a concrete wall. Behind the latter, spectators were left to guess what was happening, using their imagination to fill the void. This idea of controlled framed views was superimposed onto an analysis of a back flip, which then was the driving force to transform the box into a more complex building with a deeper conceptual content. The abstract sequence of the back flip was staggered vertically onto the building lot, using the single movement

frames to conceptualize the circulation spaces within the given spatial limits, purposefully extending out beyond this border in specific areas. In a subsequent step, the original property line was taken and modified according to the overlaid fragments, starting to describe a building that was finally defined through a series of different floor plans, which were based on both artistic as well as programmatic approaches. The areas of horizontal intersections between the different outlines of each story pointed back to the initial concept of framed views, in which the viewer or visitor of the building actually receives glimpses into the space, being able to see part of the activity inside, while moving around to yet another location to get another perspective from the inside (figure 15).

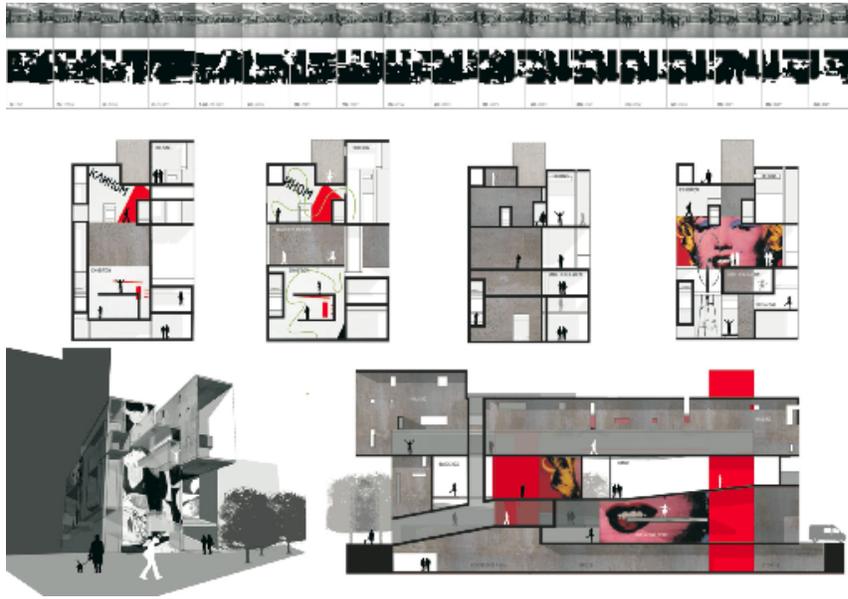


Figure 16. *Expansion of spaces; student: Maria Julia Campo*

A fundamentally different approach was pursued in other projects that built their conceptual approach upon the actual experience of the performance itself rather than the analysis of a specific movement. One was based on the described and unexpected finale in the *Body and Space* performance: by controlling perceptions from the building to the outside and vice versa, the student based her concept on extended views with a suggestion of continued space as the genesis for the forms and open spaces within the building. In other words, the project's floor slabs were extended,

expanding the occupying spaces beyond their typical boundaries. By playing with solid, translucent, and transparent materials, as well as with different methods of natural light capture within the building, using reveals, skylights, walls washed with natural light, etc., the user perceives a building with only few boundaries that ties well into the urban fabric by exposing itself into the public space.

6. THE LASER CUTTER AS A DESIGN DECISION SUPPORT DEVICE WITHIN THE PROCESS

With the intensive employment of a laser cutter through all phases of the design process, model making became a conglomerate of activities, rather than just a craft limited to the production of miniaturized copies of buildings (Kenzari 2007) and concepts. Although relatively time consuming in file preparation, the work with the laser cutter was widely incorporated into the student's work processes, especially during the conceptual phases and the production of 'layered' models. Only small amounts of parts were crafted with traditional tools and manual labour during this period. In our specific studio setting, the two-dimensional technology of the device was actually perceived as an advantage, supporting the splitting of a fluid, dynamic movement into fragments and time frames.



Figure 17. *Ready-to-be-assembled model parts from the laser cutter*

The often necessary transformation process from three-dimensional information into two-dimensional layers was not as eminent as in usual

architectural projects, where sophisticated, spatial digital models have to be transformed into a variety of two-dimensional layers in order to feed the laser cutter. This spatial translation, which forces planar thinking, comes at the price of enabling students of more organic developments and designs, permitting the creation of more accurate models in a shorter time, without relying on regular shapes and dimensions. Anyhow, the digital production process demanded a high ability of spatial understanding for the students, since the physical manifestation of the digital data could be experienced only at the end of the production and assembly process.

Traditionally, designers interact with design media by *conversation with materials of a situation* (Schon, 1983). The traditional materials include sketches on tracing paper, design drawings, physical modelling materials, and tangible models, which are used in a conversational process. Using the laser cutter involves a human-to-computer interface for the transformation process. To have a desired conversation with materials of a situation, the user is foremost involved in a process of conversation with the computer software. Anyhow, in our specific studio setting, students used the digital fabricated materials as a means of conversation. The fast, digital production process allowed them to address unique configurations of specific design problems in reoccurring cycles by reflecting upon effects of earlier moves in order to make new moves, because the laser cutter setup allowed for fast production of a high number of elements, therefore supporting the conversational process for the students. This allowed for continuous re-interpretation of statements made in the process, including unexpected results and their possible influence onto the design process.

7. CONCLUSION

Overlooking the studio development during the period of 15 weeks, as well as looking at the final studio outcome and the student projects, the employed method of introducing dynamic movement that is coupled with digital tools in order to generate architectural space, proved to be successful. The horizon of most students, which normally are used to approach their projects from a more architectural point of view, was widened by the collaborative part with the group of modern dancers, especially through the fact that they had to develop and partake in actual performances, which meant they had to explore and experience space from a very different perspective. Furthermore, the modern dancers proved to be important for the programmatic development of the projects, since they had very precise ideas of how an experimental performance space has to be organized.

Through the employment of the production line that included the laser cutter as a supportive system, the threshold between digital and physical realm was bridged better than in past projects. The required transformation of three-dimensional spatial visions and digital models into two-dimensional laser cutter information supported abstract spatial and planar thinking among participants, enabling them of more organic developments and designs and permitting the creation of very accurate models in most cases. Anyhow, manual tools and methods with physical models are hardly replaceable in the design process by a virtual approach to its full extent, but the latter was able to strengthen design methods as a supportive system and invited the students to explore new means of design work. As the studio results demonstrated, the application of hybrid design methods - non-architectural and architectural as well as digital and analogue - as design support procedures, coupled with an interdisciplinary studio approach, offered very attractive possibilities for a distinct generation of architectural space.

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