BODYCAD: CREATIVE ARCHITECTURAL DESIGN THROUGH DIGITAL RE-EMBODIMENT

BANU PEKOL

Combining architectural theories with insight from courses/workshops taught to architects on embodied design, this paper deals with the question of how the use of digital media in architectural design can propose creative conditions for movement and how movement creates similar openings for architecture. It demonstrates the need for the creation of an informed architecture inviting movement through relational architectural interventions.

Architecture incorporates the possibility of action, which is naturally tied to a bodily reaction. Any structure that aims to be evocative should go beyond the merely visual. Unsurprisingly, the same can be said about choreography. This paper aims to demonstrate how architectural education can be enriched through digital spatial analysis tools which stem from the need for an enhanced bodily awareness for architects. The projects which this paper refers to are all concerned with deconstructing space such that it is experienced differently: through the use of the graphic programming environment Isadora, the structure provides a reassessment of itself. Methodologies for assessing the impact of movement on the perception and cognition of architecture have yet to be developed fully. The experience of space is closely tied to what it means to be a subject and with the constructions of subjectivity. This paper argues that both architecture and dance are about experiencing and visualizing space, which furthermore shapes the creativity as well of subjectivity of architects (or even, dancers).

Architecture is a dependent discipline. Yet also, architecture, as a profession and practice, does everything to resist that very dependency. This means that architecture is influenced by external forces from the design stage to the construction and even occupation stage. Thus, even if the architect has internal processes of her own, it is the external forces that shape the architecture itself. From this dichotomy arises a gap, which this paper engages with by incorporating the body and movement into architectural creation. Beginning as a consequence of the Beaux–Arts system, architecture has retreated into an exclusive and self–referential world. Today, even if the architectural outcomes in schools look radically different, the processes and methods used to achieve these outcomes are analogous. In some schools, conventional software is put aside for new algorithms generated by the students, which actually all follow a similar value system. [1] Progress seems to be represented by technology combined with aesthetics, using the newest technologies, forms and surfaces available. This is mainly due to scrupulous attention being paid to winning the client or audience, using various visual ploys and tactics. Also, the inevitable use of photographs in publications shifts our attention from architecture as a spatial whole, to the representation of it. Further, as curriculum requirements become standardized, more technical and even administrative skills being expected from an architecture graduate.

Architectural Theory and Embodiment

Kant defines space as an “a priori representation which underlies all our outer intuitions.” [2] The space he explains is mostly derived from inside the subject, rather than external factors. This is a notion which implies that space is created from within the individual, a theory has been proven scientifically through

evidence that a certain area within the human parahippocampal cortex is more active in response to lay-out of space, as compared to using only objects as a reference point. [3]

As the German philosopher Johannes Volkelt argued in the late 1870's, the composition of a particular space can only be explained through movement and we must participate in this *emotion of movement* in order to understand it aesthetically. Such participation will provide the viewer with a more holistic experience of the building. Even though the importance of space is acknowledged in architectural historical literature (always within the limits of a privileged historiography), this is not extended to movement through space, and how the body responds to space.

In the second half of the 20th century, J. J. Gibson challenged the concept of visual perception and demonstrated that it is part of a perceptual system which actively involves locomotor movement. J.J. Gibson's reversal of sensory apparatus with types of environmental information the body deals with can similarly be adapted to this case. The function of architecture as stable and inert, and the body as a walking organism can be applied in such a way that architecture is regarded as the information that one can interact with, and accordingly the body will be forced to acknowledge the space created by the architecture: a new language, or inventory for movement will be created.

Heidegger's concept of *ent–fernung* –where one distances herself not according to physical distances but to what is important to her– is also useful to elaborate what is aimed at in this project. [4] In this way, physical priorities are played down and factors such as the perceptual and social can be engaged with much more efficiently. Space becomes a vessel for possibilities (social, cultural, perceptual), merging the body phenomenal and body politic.

Lefebvre, in *The Production of Space*, argues that space is produced by multiple social forces which he categorizes into the perceived, conceived and lived. This argument is useful to show that architectural design is one aspect of spatial production, and that the other agencies are as valid, if not more, than architecture. [5]

A work of architecture, even if its outer walls remain put, has within it spaces that can change or move. The "mobility of building and within building is one possible idea of Deleuzian thought that might be of tremendous value in architecture." [6] Building is generally understood as the movement of materials for the final stabilization of a structure. Yet the activity of building should also be seen as a method of creating, opening and unfolding spaces. This means that a building can allow new methods of mobility, movement and change.

Why should a building built by humans who inhabit their physical bodies not be influenced in a more informed way by these bodies? The corporeal presence of a building is thus both an apodictic part of design, and also an element of architecture that is not as removed from the architect as, for example, the infrastructure. Architects should feel free to seek ideological inspiration beyond their field of discourse. Such inspiration and expressive potential can then be used not only for conceptual propositions, but also physical applications. In turn, this will bring closer the architect and architecture, the designer and the design.

Movement and Architecture

Defining architecture through a field not normally and necessarily perceived to be related to it allows us to engage in a dialogue with architecture which would otherwise have not been possible. Architecture and movement can be studied together, but for what use? The means of architecture are basically set forth by our capabilities to make and sense physical distinctions in space. Movement/dance is not a part of architectural education, or vice versa. Yet both disciplines can borrow from each other in their process of creation. For example, both dance and architecture organize space. However, therein lies a nuance: dance de–stabilizes the space for the in stasis spectator, while architecture reinforces the space with factors such as gravity and functional necessities. Architecture can be considered as the main, dominant discourse for structuring space, and dance can be considered the main discourse for 'feeling around' space. A dancer can articulate space in a way much different than an architect. If architecture is a "set of practices, techniques and skills" then dance can provide a further set of skills or techniques to it.

Our bodies as psycho–sensorial systems are capable of picking up and sending haptic signals and responses. Architecture is capable of creating a bodily response and participation; however few buildings succeed in doing so. Since all buildings are created with the human mind, it is first and foremost the mind that should work with the body to become aware that architecture –which embodies the possibility bodily interaction–, will enrich the human experience. The interaction may not be tactile; it can be imagined as well, by envisioning flying over and under buttresses, gliding along curved walls or soaring upward through stairwells. An initial disorientation is necessary to then become aware of the spatial relationship of our potential movements with the architecture itself.

As Le Corbusier says, architects live in the extraordinary world of the acrobat. [7] Dance and architecture both frame, articulate, structure, give significance, relate, separate and unify, facilitate and prohibit. Mostly, they do this through logic of visualization stemming from notions of perspective, and thus viewing the world in a Cartesian way. If we consider the logic of visualization, we understand that seeing things from such a particular perspective or viewpoint locates the viewer and affects their sense of subjectivity. But dance and architecture also can disrupt this logic by lessening the distinction between buildings and space, inside and outside. Distinctions between warm and cold, still or windy air, scents and sounds, the feel of various surfaces are all components of architectural experience that can only be enhanced through being exposed to and creating such sensational experiments.

The Graham technique in modern dance uses exercises based on the haptic experience of space. The expression of 'feeling the space' is almost literal, as dancers who practice this technique pull and push the space around them to give meaning to their movements. Rudolf Laban's dance notation is another attempt to define space through the movements of the body using geometric planes.

Digital Tools and Architectural Embodiment

Choreographers have been working with digital platforms since the 1990's in order to pass on their choreographic theories and practices to their future company members, or interested dance–enthusiasts. The most well known is William Forsythe, who has worked with researchers and artists from varied fields for his award–winning online dance notation 'Synchronous Objects, for One Flat Thing Reproduced'. His works are interesting because they are able to convey his choreographic logic not only to dancers, but also non–arts specialists such as cognitive scientists.

Such open–ended digital educational tools are becoming ever more popular. Architectural education has been using digital platforms mainly for translating the sketched image into perfectly calibrated drawings, and easily manipulating it once on screen. Even with 3D renders of architecture, the fact that the viewer's body is motionless while looking at a flat screen remains unchanged.

The gap between the internal processes of the architect and the external forces that shape the architecture can be studied through digital technologies. Architecture is taken here in the context not only of the built environment but in the multiple groundings and environments for movement. Architecture does not necessarily mean the practice of building; the intelligence from architectural education can be applied in various ways. This conclusion that models used in design science are metaphors which convey their meaning by way of a hermeneutical understanding has been exemplified in multiple studies. [8]

"Aesthetic and cultural practices are peculiarly susceptible to the changing experience of space and time precisely because they entail the construction of spatial representations and artefacts out of the flow of human experience." [9] The outcomes of working with architecture and dance not only benefit the digital representation of space and architecture; they redefine a movement vocabulary. When walking on the ground, one notices a small inclination, or any irregularity. The muscles and balance, adapting to the surface, automatically compensate this. When using a virtual model, such automatic reflexes do not exist at first; they must all be learned and experimented with, to find the ideal response. The walls, although virtual, represent obstacles, and since the voyage is undertaken not just by walking on the floor, the ceiling, walls, windows, doors and columns all have as much importance as the floor. Architectural elements gain a new meaning, and features such as arches which used to be structural and decorative, now interact with the inhabitant.

The idea that aesthetic perception of architecture should be enriched with the inclusion and application of full spatial comprehension forms the basis of this paper. Since Kurt Gödel, it has been confirmed that no system of logic can contain its own explanations: a given system is always built upon axioms which are subject to further analysis. The form of one system becomes the content of the next higher system, and so on. So, the form of the building is the content of our interaction with it. You cannot interact with a façade. The project similarly is a work on oneself, on one's own interpretation on how one sees things etc.

The following examples aim to illustrate how such participation can be developed, and how the body can be used interactively with the space/architecture around the architect in training so that architecture becomes an expression of life, rather than an evasion of it.

ARCHITECTURAL BODIES

In the workshop titled *Architectural Bodies: Experiments on Gestures*, conducted by the author in Summer 2011, participants were led through a series of intellectual, cognitive, and physical exercises that seek to question the relationship between gestures and architectural spaces. Both the technical as well as the creative processes underlying this workshop allowed the participants to experiment with their own perception of 'natural gestures' as well as creation of 'spatial gestures'. For the workshop, using the graphic programming environment Isadora, a computer programme that analyzes real–time gestures and their interaction with various architectural settings was prepared. Each participant formed her own "spatial gesture" by choosing a particular pre–recorded space and through the computer program output constructed a physical response to the space with her own body.

This workshop aimed to demonstrate how spaces condition particular gestures, and how gestures are inherent even in activities where only one person is involved. The translation of gestures into architectural images provide an exciting yet challenging insight into how dominant jests can be re–evaluated within the context of space–creation. Architecture students, who are used to working with AutoCAD, Rhino and other computerized architectural programs, when faced with their body in space, acknowledged that their bodies in space have no relation to the straight lines or geometric shapes which they are accustomed to working with. In the workshop, the real and the virtual imply each other continuously. Through the experiences gained from virtual interactivity, the sequence in which the content is structured will not –as is customary– stay linearly organized, accessed and unchanged.

The workshop allowed the participants to acknowledge that gestures can not only be understood as re–presenting body–images, as the movements of the participants were driven by proprioception rather than architectural design principles taught in their classes. This fact is reminiscent of Agamben's argument that "If dance is a gesture, it is so, rather, because it is nothing more than the endurance and the exhibition of the media character of corporal movements. The gesture is the exhibition of mediality: it is the process of making a means visible as such". [10]

One other program prepared for the workshop connects the limbs of the participant to a 3D CAD mode, using sensors. The spatial limits of the building make the voyager move in a certain way, completing the interactive cycle. The space suggests a particular way of movement to the voyager and with this suggestion it will reveal that which it is harmonious with, and anything that prevents it will seem out of place. This can then be linked to the design problematics in architecture, pre–construction analysis, or to different analyses of theories of architectural analysis. The user of the program must always try to think of and use 'form' in its full spatial completeness. In order to do this, she stops prioritizing the façade. This is akin to when in dance, the dancers are constantly reminded to feel their centre and move through the manipulation of the centre. Such a centre of intention can be formed in architectural movement research. Thus, through our interaction with the work and our decisions to move in a particular way throughout this interaction, we meet ourselves in the work.

The workshop also draws from Paul Schilder's concept of "body image/body phantom" which is a neuropsychological mapping of the body which refers to the inner image of one's outer, physical appearance. The graphics, formed by the workshop participant's bodies on the architectural videos provided an alternative body image. By internalizing the external to the body (the architecture, in this case) into her corporeal activities, the participant began to adapt her body to the context.

BODY AND SPACE IN ARCHITECTURE

An undergraduate course titled *Body and Space in Architecture* created and taught at the Mimar Sinan Fine Arts University's Faculty of Architecture by the author, focused architecture undergraduate students on architecture and embodied design. The majority of students had difficulty tearing themselves away from the obsession with producing visually impressive work. Once they got the hang of the subject, they began seeing the body in every aspect of architecture. After completing their end–of–year project, the students came back with results that they confessed they had not expected, with comments such as realising that functions were not the same as desires in architecture. This implies that their education which included courses on ergonomics was in need of a supplementary module which demonstrated the versatility of the body in architecture.

Conclusion

The theoretical background along with the examples from educational practice complete circle back to William Forsythe, whose understanding of space is "an inclusive concept that even integrates the interior of the bodies, breath, and most essentially proprioception; all of these factors become interfaces for artistic response and creation." [11] Forsythe's CD–Rom 'Improvisation Technologies' applied geometries of objects in the space around the dancer onto the dancer's body. The digital practices where body becomes space itself can be applied to architecture students who will then stop relying on their auto–pilot (or rather, auto–architect), and engage in a more intimate and visceral manner with their design concepts. Heidegger's suggestion that we live in the space opened up and revealed by technology rings true once more, in this context. [12]

Architecture is generally experienced by dwelling in it. August Schmarsow 's term *Raumgefühl* (sense of space), rather than *Formgefühl* (loosely translated as sense of form) is what should guide the design approach. The architectural experience of a space should be extended from only accepting it as a dwelling to a more aggressive, seeking approach to architectural forms with the use of new psychophysical coordinates. Architectural design can become a process of interpretation, rather than focusing on presentation and representation. This re–shaping of space–creation through digital tools should be presented as an educational model based on the creation of an informed architecture that invites ways of moving through not just bodily gestures of the humans themselves but relational architectural interventions.

References and Notes:

1. *Jeremy Till, Architecture Depends (Cambridge, MA: The MIT Press, 2009), 14-15.*
2. *Immanuel Kant, Critique of Pure Reason, trans. Norman K. Smith (London: Macmillan, 1929), 71.*
3. *Russel Epstein and Nancy Kanwisher, "A Cortical Representation Of The Local Visual Environment," in Nature 392, no. 6676 (1998): 598-601.*
4. *Martin Heidegger, Being and Time, trans. John Macquarrie and Edward Robinson (Oxford: Blackwell, 2005), 140.*
5. *Henri Lefebvre, The Production of Space (Oxford: Wiley–Blackwell, 1991).*
6. *Elizabeth Grosz, Architecture from the Outside (Cambridge, MA: MIT Press, 2001), 7.*
7. *Le Corbusier, My Work, trans. James Palmer (London: Architectural Press, 1960), 197.*
8. *Adrian Snodgrass and Richard Coyne, "Models, Metaphors and the Hermeneutics of Designing," in Design Issues 9, no. 1 (1992): 56-74.*
9. *David Harvey, The Condition of Postmodernity (Cambridge: Blackwell, 1992), 327.*
10. *Giorgio Agamben, Means Without End: Notes on Politics, trans. Vincenzo Binetti and Cesare Casarino (Minneapolis, MN: University of Minnesota Press, 2000), 58.*
11. *Peter M. Boenisch, "Decreation Inc.: William Forsythe's Equations of 'Bodies Before the Name," in Contemporary Theatre Review 17, no. 1 (2007): 15-27.*
12. *Martin Heidegger, "The Question Concerning Technology," in The Question Concerning Technology and Other Essays. trans. William Lovitt (New York: Harper and Row, 1977), 12-14.*