Nader Tehrani :author

Head of the Department of Architecture , Massachusetts Institute of Technology, Office dA :organization

United States :country

On the Abstraction of Information and the Physical Tectonics of Materials

Interview to Nader Tehrani, Principal of Office dA developed on Tuesday June 15th of 2010 by Pablo Lorenzo-Eiroa, Aaron Sprecher and Shai Yeshayahu, ACADIA 2010 Co-Conference Chairs.

ACADIA 2010 Conference Chairs: *Your work has developed interesting cross relationships between information, and the behavior of materials, mostly in the experimental architecture of your installations. For instance, one of your first explorations formed a relevant part of the exhibition and publication* ***Immaterial/Ultramaterial*** *edited by Toshiko Mori at Harvard.*

It would be interesting if you could begin by defining the relationship between geometry, form, and the organization of the project relative to materialization. First, from its initial digital representational conception and then the difference that is forced by the actualization of materials. It seems that particularly in your work starting at the Harvard GSD installation and within the process of transferring of information, there are certain digital systematic innovations that inform the relationship between the organization of the project and the performance of the material.

Could you elaborate on this problem?

Nader Tehrani: By way of introduction, I should say that most projects that we do, we work from bottom-up and top-down simultaneously. By bottom-up, I mean that we either work with a unit, a material, or a method of aggregation without really knowing what the complete form is going to be. But at the same time, we may work top-down: an urban strategy, a formal analysis that defines the attributes of a larger design figure. And these two approaches, hopefully, come into a kind of a productive tension; but such was the case in the Immaterial project (Figure A), where the various forces played themselves out on the installation.

From the perspective of the geometry of the overall form, we had several clues. The first was what the lower elevation of the donut—the information booth where the attendant is sitting. If you like, let's call that one parameter. Secondly, there are two strong public features that motivate the flow of circulation in the lobby: the Library on one side and Gund Hall on the other; this public axis required a threshold of sorts, framing the passage through. And finally, the column, which anchors the installation. Those are the three basic formal parameters that define the figure of the installation.

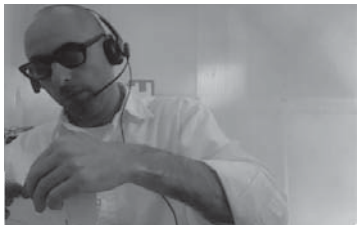

Figure 1. Nader Explaining a Dart

Figure 2. Nader draws ruled surface

Figure 3. Nader showing a Dart

Figure 4. Nader bending the sheet as described. Sheet shows graining of wood on surface

The second point has to do with the nature of the units. The first experiment we did was to try to figure out how to make a compound curve...but sheet materials can't bend in two directions at the same time, outside of a strategy that hammers or molds that surface into a different form. But we wanted to work with the rigors of geometry to deal with sheet material and therefore we had to deploy a developable or ruled surface. And one strategy to achieve that is work with darts. A dart is... (Figure 1.)

If we draw a line in a sheet of paper...and then if I cut this sheet converging into a point with a triangle and bring these pieces back together, I have curvature. This is how bras were made in the pre-spandex era, a very common technique in tailoring. It produces the geometric description of a cone, essentially a ruled surface. (Figure2, 3)

From any point, to any other point, you get a straight line. Thus, it's not a compound curve, but it helped break down the geometry in ways that approximated the larger figure we wanted to achieve.

Experiment number two dealt with how materiality engaged the geometric operations we were undertaking, something that cannot be drawn, but that requires material testing and mock-ups.

Working with wood, we came to understanding that the grain helped define different limits of pliability depending on which axis we bent the wood on; the yield points vary depending on whether one bends with or against the grain. The material behavior helped define another set of parameters for us; even if we were less able to document it in metric terms; we thus developed a series of limits so that we never breached certain geometries and extreme bends. (Figure 4)

We worked with thin-ply, which is a double layer of wood, not thick like conventional plywood. It's about 1/16" thick, and while it's malleable, it is also relatively delicate.

CC: *Not only you developed a certain study of the material but you overlaid a behavior that is not proper of the wood, is that right?*

NT: That's right.

CC: *For instance, you worked with the behavior of fabric applied to wood. In a way, this references to the idea that a novelty may come out of a crossing of information, in reference to Gregory Bateson. You did not rely only on the experimentation of a material, but there was something extra brought from the outside that was crossed with the capacity of the material.*

NT: The darting, the wood grain, and the geometric definition had little to do with each other, so in a sense they were not integrated elements to begin with; they were forced to engage each other, with the hopes of creating

telling scenarios. The darting not only helped resolve geometries, but it produced ruptures within the wood depending on how it crossed the wood grain, in some instances making us study the graining as a larger global problem on the installation.

We were also looking at effects and strategies of performance that had nothing to do with the geometric layout-- for instance, its structural potential. It has to do with a larger idea of yield, about how one makes an architectural element self-sustaining.

On another level, once we had decided on wood, we looked at its qualities —to acknowledge them and to come to terms with the fact that beyond our intentions, the piece will have a range of interpretations that gain a wider semantic reach. The connection between the thin-ply and bark was irrepressible, and thus somewhere in there, signification, performance and rhetoric, essentially, are infused into the process of thinking.

So when you pose the question about fabric, I think of the multivalent ways in which fabric may be invoked…not so much through metaphor, but through technique, signification, performance, and beyond—but somehow they are all latent.

CC: *Latent is a word that I think is very important, latencies that are brought up. Concerning what we are discussing, there are seems to be three phases in this process: the subject of information that generates a project (i.e. concepts, ideas, form), the interfaces involved transferring that information (i.e. mediums of representation) and there is at the end, the physical actualization of this information in a built form.*

Do you consider that there is a distance between the abstraction of information and how it informs and tensions a material? Or, do you understand this process of crossing of information, ideas, geometry, form, and materials as a hybrid organic process without hierarchy?

NT: Procedurally, it is important to recognize that there is no linearity in the design process. You are bringing to the table a range of information, operations, even intuitions that are at best on a collision course together. And you don't know which one is going to win. I think that explains it as a process. So obviously there are motivations and decisions that have to do with an architecture that is trying to aggressively establish a relationship between figuration on the one hand, and configurative processes on the other.

To some extent, I am trying to take design cultures that often refute each other and make them confront each other—and that's consistent from project to project also.

CC: *To what extent is this informational logic manifested through the various stages of the design? Is there a certain logical structure, something that prevails?. One would argue that even though you look for latency in the radical way that consider materials, that there is something that is autonomous to that moment, even if that moment is taken very critically and re-informs the project.*

NT: We are trying to discover the extremities and radical possibilities of how bricks stack, or how sheets of wood interlock, or how metal panels shingle—this, as a way of advancing knowledge about the discipline through construction. As the saying goes, we are not "asking the brick what it wants to do," but forcing the brick to do what it doesn't want to do. We're taking the parameters as far to their extreme as we can before there's a yield.

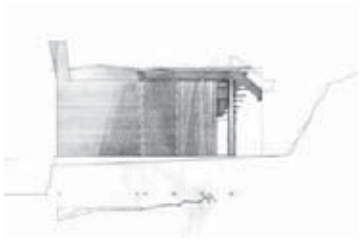

Figure D. Casa La Roca

Figure 5.

Figure6

Figure: A: Immaterial isntallation

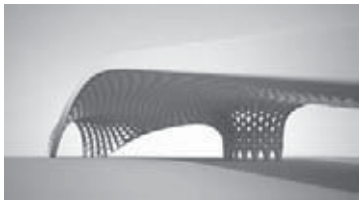

Figure F: Villa Moda

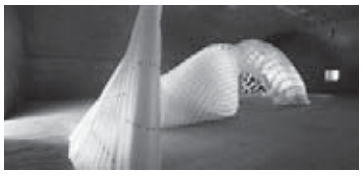

Figure E: Voromuro

Within this context, we took two different experiments, among others. In the Immaterial project, we were bringing discipline to mass-customized units, but in the Casa La Roca (Figure D), we were dealing with mass-produced units to take on variable forms. They acquire their variability through the introduction of expanded and contracted dimensions which would normatively be held within the bonding dimensions of three-eight's of an inch. But knowing that bricks can stack anywhere from a running bond to a Flemish bond, affords you the possibility not only of expanding them this way or contracting them that way but also bending them this way (Figure 5) and bending them that way (Figure 6).

CC: *In regards to how contemporary architecture deals with digital fabrication, the reasoning behind these assumptions is that your work proposes a hierarchy of thought over a material logic. It seems unavoidable that the work finds its organization in tension with the physical forces encountered in the materials—therefore opening up an alternative to the linear translation of information that has been dominating in digital fabrication.*

NT: As you know, my encounter with the computer actually came as a result of your generation, so we are constantly struggling to make sense of computation, taking advantage of it, while we're also trying to engage in problems in the building industry, of the means and methods of production, and the processes of aggregation all at the same time.

Going back to Casa La Roca (Figure D), we conceived it as a parametric project drawn and drafted by hand. When we did Immaterial (Figure A), it was designed and conceived through Rhino but actually formed manually. Villa Moda (Figure F), was also done on Rhino but because we tried to establish reciprocities between typologies of space on the one hand, and the breakdown and geometries of coffering units on the other it was not something that could easily be scripted, and was thus done manually. It was only after that, when we did Vorumuro (Figure E), when we corrected that process by scripting geometries, in this case based on the Voronoi pattern that could automate the relationship between the part and the whole. Some of the automation became critical to our way of thinking. As a result, the way that we built Voromuro (Figure E) is different than Villa Moda (Figure F) project as it establishes strict parameters based on the extrusion of walls whereas in Voromuro (Figure E) has a much more malleable geometric layout, based on sheet material, and the way that they conform to straight edges, arched edges and compound or vaulted surfaces. The parametric, thus, has been in the works for some time, but the transition from manual to digital platforms has been constantly evolving.

CC: *Maybe it's my way of looking at or understanding your work, relative to my work, that's why maybe the ambition of the question is to force a direction in terms of material logics. I think one of the problems I see in my generation in terms of fabrication is the non-conceptualization of the moment in which information is taken out from the computer.*

NT: That was one of the reasons I take you to the Villa Moda (Figure F) project. One needs to understand the cultural, spatial and performative differences between a cinema, a marketplace, an arena, and housing, in order to engage in questions of conventionality, on the one hand, and peculiarities of metric differences. It is only then that one can imagine how to motivate some of the broader computational possibilities that geometries can have. It's not actually a free for all. What's today more commonly held as geometric parameters is rarely looked at in terms of cultural typological or functional terms, the sum of which defines the complexity one can bring to the discipline. There's often two things that are happening at the same time—the abstract processes that a geometry undertakes, but also there's the architectural baggage that comes with it...building typology, it's material technologies, its circulatory requirements, structural principles, its environmental engineering, its all of those things that begin to cultivate a more dissonant relationship with abstract properties. We're interested in that friction. If you don't bring that layering into our work, then the patterns and geometries are graphic at best. We are trying to establish smart ways of having scripts engage with the contingencies that frame architectural problems. This is where questions of medium are important.

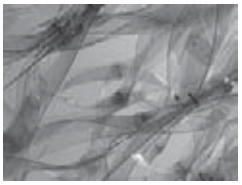

Figure C: Ventulett

Figure G: Voroduro

CC: *I think that by recognizing the interface through which one constitutes form, in your case you call that the medium, is when representation becomes active within the work and therefore performs at an architecture level.*

NT: The underlying imperative of architecture as an integrative act, as a medium that is constantly reconciling multiple agencies and conflicting mandates is central to its spectacular mission.

CC: *Let me change the attention of the interview into questions that are raised in other projects. How would you define the notion of pattern relative to structure, particularly in your last installations Ventulett 2006 (Figure C), Voromuro (Figure E), and Voroduo (Figure G)?*

NT: Voromuro (Figure E) and Voroduo (Figure G) are really the same installation. Voromuro (Figure E) was the first one, and it actually failed. It was a structural system that collapsed. What you don't see in the photographs are tensile cables that hold it up. When we did Voroduo [Figure G], we redesigned the system to make it structurally intelligent. But basically, it is a two-way slab, a coffering with varied depths that responds to the various requirements and structural forces of its context. For Voroduo [Figure G], we created a figure-eight, one half of it which is in compression, and the other half of which is in tension. But it's very simple; the pattern of a coffer is really an extrusion and so it's not really a three-dimensional system, it's a two-and-a-half dimensional system.

The Ventulett (Figure C) project, in my mind, is altogether, much more sophisticated. First, it develops a parametric unit that is able to engage multiple morphologies (unlike a brick, or slat of wood, or a shingle), and secondly, the installation proposes a topological strategy to bring together varied structural typologies; the form active, the surface active, and the vector active are all reconciled by a singular system of aggregation that both formally and structurally engages the different moments of the installation.

This project goes from a stacked masonry system to a surface active wall, to a truss, and then to a shell that cantilevers eight feet. That, to me is one of the most exciting ideas. The other thing I really like about Ventulett (Figure C) is that when we finally took the formwork out from under it in the construction process, it slumped less than two inches...so the structural intuition was not too far off.

CC: *It's interesting that to me there is a certain expansion on the notion of pattern; when you say that the project starts being performative and cohesive. When the pattern builds up a connection between a repetitive unit and how that repetitive unit enters in a solidarity, it builds up an organic structure. It seems that what these problems inquiry are a deeper understanding of the physical world not in terms of materials any longer, but rather as a system of forces of information with a physical dimension. This physical understanding places your projects in a parallel dimension to a digital work that questions these logics by structuring and inducing relationships.*

NT: Buildings are complex animals. Do we not gauge the laminations of a wall through how much insulation we need? Do we not dress the building through waterproofing membranes? Do the interiors not have different claddings that deal with the character of the interior?

All of this is to suggest that architecture is, more often than not, the result of composite thinking, not singular operations. Your questions and comments about materiality bring up the ambiguities and complexities that are so common in architecture, the negotiations between fact and fiction, and the necessity of juggling matter with rhetoric. There's no escape from that, it seems. And this is something many haven't really attended to because it's not part of the theme of computation, of patterning, of material processes, because the moment you get into composites, you get into a much more murky area, where the different ways in which construction build-ups have multiple motivations, sandwiched into a kind of system.

CC: *For instance, that is what I think it is interesting about the installations, particularly the last one. You understand the kind of forces that are acting in those materials...it's no longer about the material; it's more about the understanding of the inner forces that are acting within those materials. Moreover, in relation to the structural capacity that you were mentioning, in which the accumulation of the pattern produces different types of structures along the relationships that they establish. There is a certain moment in which a material is working one way, but then that same material is working in a completely different way along the same project. Therefore, what's important is not any longer the material itself, but what's going on with that material. That's what I think acquires a certain autonomy from a material logic.*

NT: Absolutely, agreed. I do think that there are obvious freedoms and ambitions that the installations have, that conventional building processes cannot afford. But they are also central to the possibility of taking them on a test drive so that you can imagine them for a kind of broader adaptation once you enter into more complex situations