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Introduction: The Substance of Material

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This year's TxA Emerging Design + Technology conference, now in its second year, took an unexpected turn. Papers were less about the development of new technology and more about expanding the capabilities of current technologies, including those that are still at the forefront of the field. By delving deeper into CNC machining, 3d printing, and robotics, architects are mining current technologies for new aesthetic, formal, and performative opportunities.

Until recently, the use of these tools had been geared toward the realization of projects with a formal complexity previously inconceivable. The ability to produce many parts with each part varying from the other has allowed experimental architects to design incredibly rich and elaborate structures. These projects have pushed design aesthetics into altogether new territories. What emerged were projects that embraced complexity—projects in which the whole added up to something far greater than the parts themselves.

But what was left aside, until now, was the *what* with which we were working—the material. Material had been treated as stock, in most cases as a uniform block that could be carved and shaped to match some digitally modeled form. Material was selected for its strength and malleability in whatever combination would best realize the form. It was rare to use multiple materials in concert with each other for form making, except by assemblage and mechanical connectivity.

We are now moving into a new territory, one in which the word *material* is perhaps not best suited for the next stage of CNC technology. *Material* suggests a discrete thing, something with limited bounds, a monolith. Perhaps *substance* better describes where we are headed. Substance speaks of combination, mixture, and variable properties. *Substance* is not final; it is not discrete; it's in a constant state of change, or at least potential change.

By using CNC technologies to manipulate and give form to substance, a wide range of new combinatorial projects are being realized. We are starting to tap directly into material properties to expose a deeper knowledge of specific materials—not just, for example, that wood has grain, but precisely where the grain is and how the location of grain can be fed directly back into CNC path tooling to influence how the material is cut. As data is fed back in real time to the tool, the tool's path can be redirected to take better advantage of the exact composition of a particular stock. We are finally able to identify material differences not just between different materials, but within a piece of material itself.

In his essay "Material Evolvability and Variability," Manuel Delanda notes that Eskimos have 29 words for snow: "There are 29 different combinations of the solid and the liquid, which give very different kinds of snow. When a material is as important as snow is for Eskimos, synonyms begin to accumulate ... [and] begin taking on subtle shades of meaning marking subtle differences in their references. In other words, material variability is not dependent on or created by linguistic variability."* The potential for direct feedback between each material's highly unique and particular properties and the CNC tool being used to transform it was always there, but until recently we haven't had the capacity to directly engage it. By doing so, we are beginning to create new forms that transcend previous limits to aesthetic and formal complexity while engaging performance and function is an altogether novel way. We are starting to connect our making process to our thought process. Emerging technology is not just a means to an end, but has become a new tool for generating ideas.

* Manuel Delanda, "Material Evolvability and Variability," in *The Architecture of Variation,* ed. Lars Spuybroek (New York: Thames & Hudson, 2009), 11.