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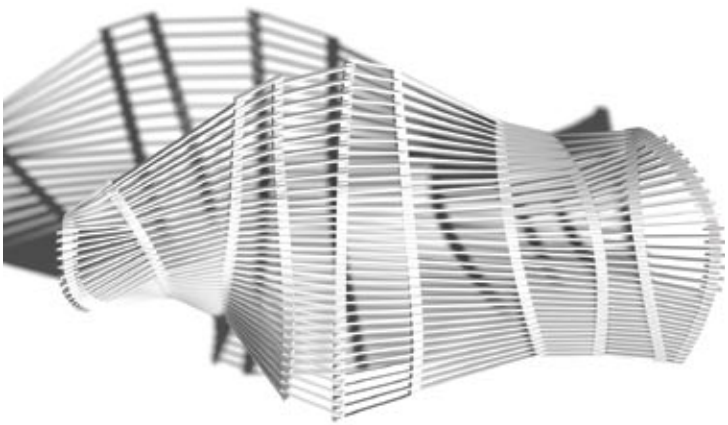
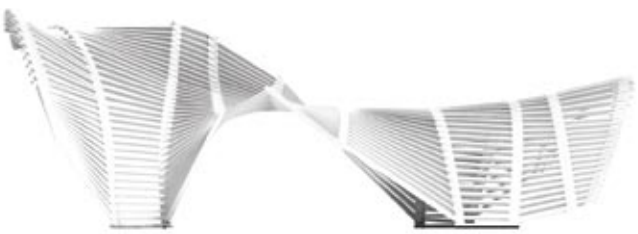
Hylomorphic Surface:
Proximate Design and Relational Modeling

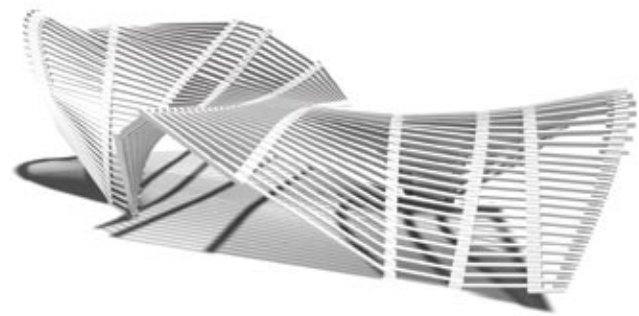
by John Cirka

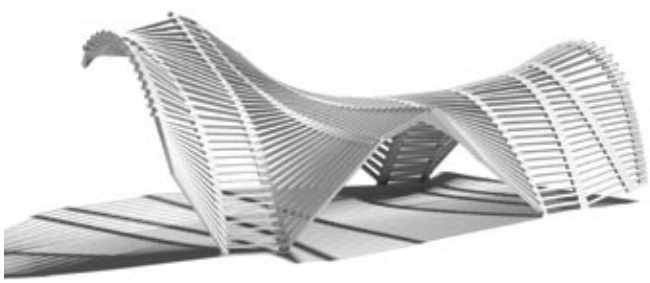
The philosophical problem of substance posed in the relation of matter and form shifts from an abstract terminology to a dynamic coupling of material and forces when considering an actual material, rather than matter in general. The detailed mapping of forces in the material world established by various branches of science has provided a clear comprehension of forces in materials. Less examined is the direct relationship between form and force, suggesting that form might be a resultant of the direct interaction of materials and forces or a configuration imposed from outside the energetic material system.

Ann Lee of the Shakers succinctly related form and force: “every force evolves a form.”[1] Deleuze expresses Nietzsche’s insight that “…the object itself is force, expression of a force. This is why there is more or less affinity between the object and the force which takes possession of it. There is no object (phenomenon) which is not already possessed since in itself it is not an appearance but the apparition of a force.”[2] In the Introduction to On Growth and Form, D’Arcy Thompson writes, “…the form of an object is a ‘diagram of forces’…” and “Morphology is not only the study of material things and of the forms of material things, but has its dynamical aspect, under which we deal with the interpretation, in terms of force, of the operations of Energy.”[3] Closer to architecture, Eduard Sekler suggests:





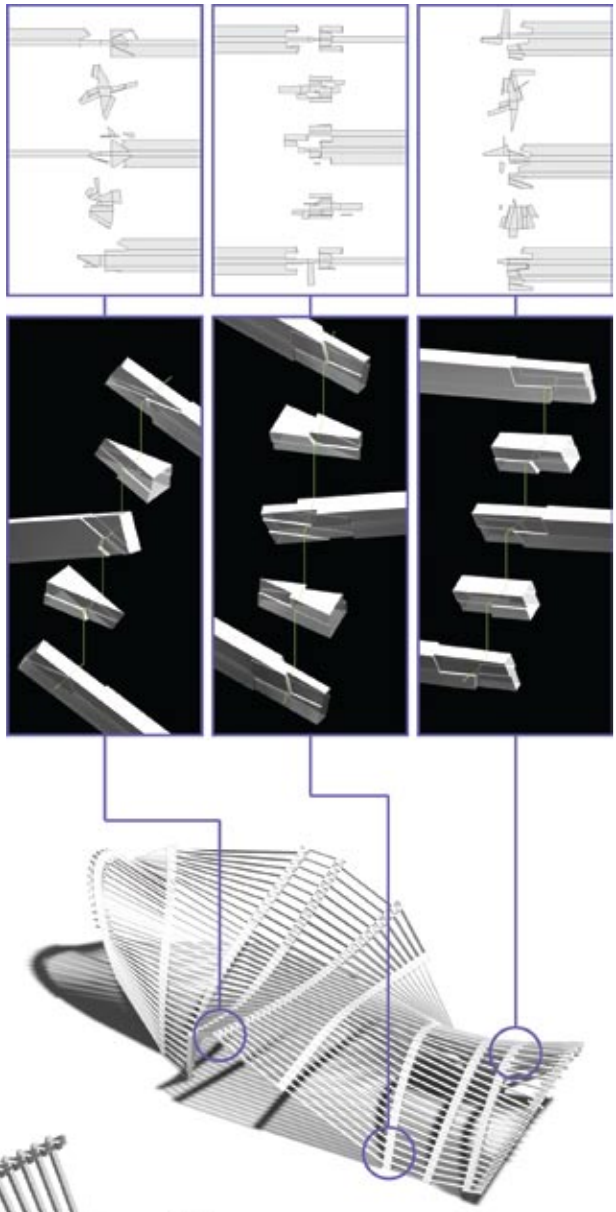


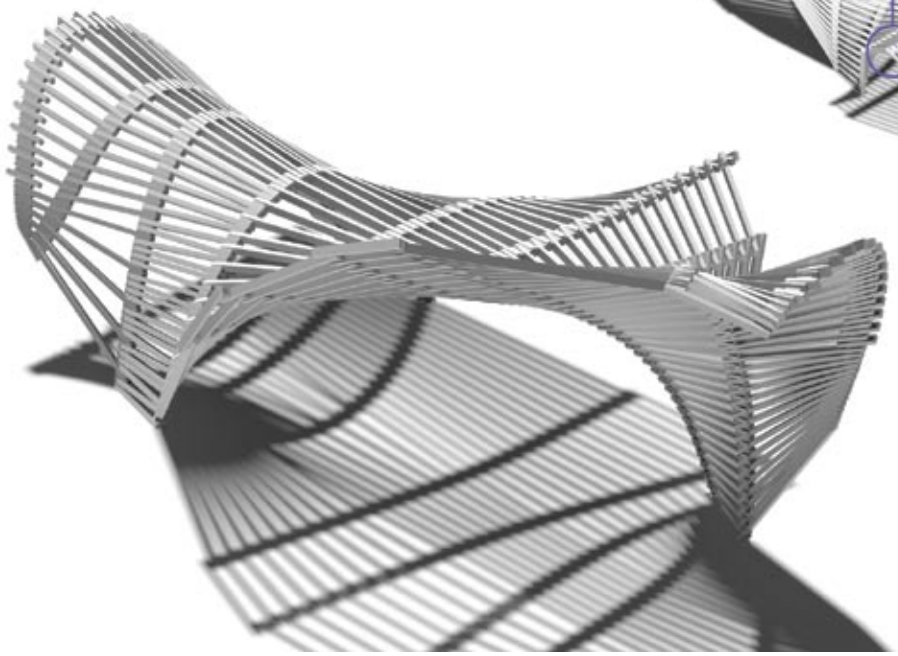


"When a structural concept has found its implementation through construction, the visual result will affect it through certain expressive qualities which clearly have something to do with the play of forces and corresponding arrangement of parts in the building yet cannot be described in terms of construction and structure alone. For these qualities which are expressive of a relation of form to force, the term tectonic should be reserved."[4]

An artisan working with a particular material is sensitive to the flow of forces at play in the material. Designers have not traditionally had the same intimate relationship with the materials which they specify and detail in the process of developing the form of their intended object. Modern techniques of production add further layers of complexity and put at a distance the link between designers, form and materials. In an attempt to overcome the gap between the design and production of built form, architects are increasingly developing closer ties with manufacturers and fabricators of building components to bring the parameters of component construction into the design process with the desire of achieving greater specificity in the definition of form with implicit consideration for forces at scales smaller than those normally falling into the range of scrutiny by structural engineers.

Designing repetitive components is a strategy for dealing with the complexities of component manufacturing and building construction. The tools of design coupled with the tools and machines used in the construction industry in the past were limited in the amount of information which could be transmitted through the design-construction system. Remarkable exceptions exist, but the bulk of

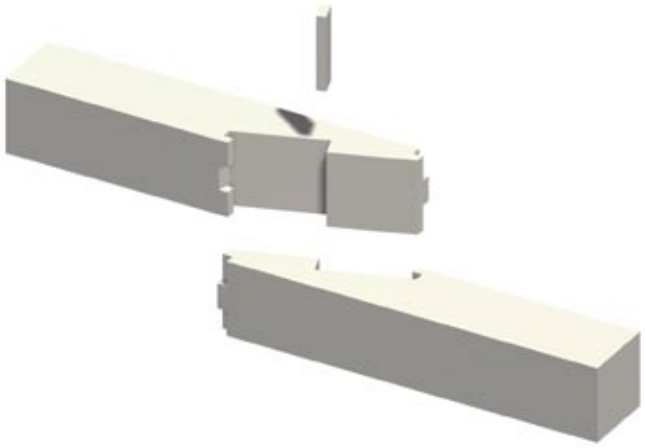




the geometries used in historical, including modern, architecture relied on simpler forms. In contrast, design tools today have the capacity to rapidly develop complex geometries and pass this dense information along for analysis or for manufacturing purposes.

In spite of the increased complexity possible in today's designed components, they do not approach the levels of complexity in the cellular matrix of organisms. Living cells display a much higher degree of flexibility in their ability to respond to varying conditions and they accomplish this feat with local interactions which accumulate and become expressions of global patterns. The network of individuals interact in a proximate space necessitated by the chemical basis of their information transfer and production.

The transfer of design information to a builder relies heavily on the accuracy of dimensioned drawings. The fluid nature of relational modeling has been slow to develop in part because of the need to stabilize design ideas into a fixed object and the computing resources required, both to operate and program. The model developed here as an exploration into relational modeling and cellular design incorporates the concept of proximate space to define the detailed form of each of its subcomponents. Each element acts as a cell, responding to its local conditions, rather than performing as a repeating modular block in a Cartesian space. The long slats stretch between geodesic lines following lines of force across the doubly curved surface, where threaded rods hold the wood members in place. Each long slat and each spacer block are oriented with their longer cross section axis aligned normal to the B-Spline surface at their centroids. The resulting normals populate a vector field across the undulating surface.



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3. D'Arcy Thompson. On Growth and Form. Cambridge: Cambridge University Press, 1961.

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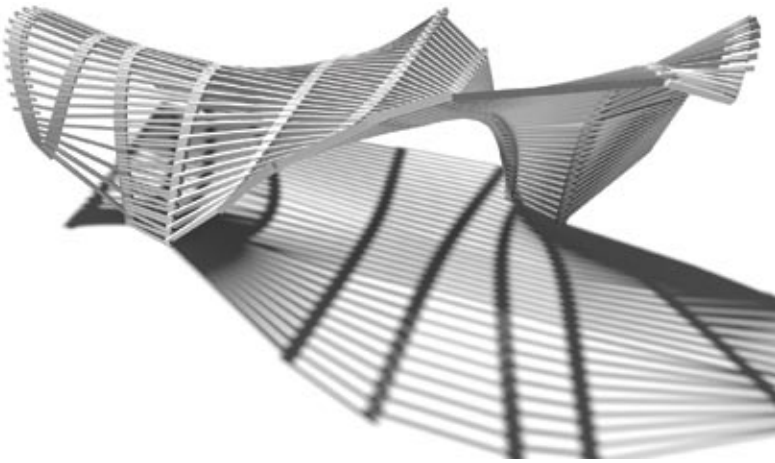

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