That matter is secondary to shape constitutes the fallacy of design after craft. By nature, and in its rite, the practice of craft is informed by matter, its method of fabrication, and by the environment.

As in Nature, when creation begins with matter, homogenous, or the generation of form, is a process engendered by the physical forces of Nature. Similarly, in the framework of this essay, Matter is not considered a subordinate attribute of form, but rather its progenitor. Such is the story of form told from the point of view of matter, and it begins, unsurprisingly, with form’s predicament.

Over the long trajectory of architectural design history, the design and production of artifacts has been characterized by a growing separation between form and matter. In contradistinction to craft in which material and form are organically interwoven into a tradition of making, modern design and production have historically evolved away from this integration, or in its absence, towards the compartmentalization of form-making as a process independent of its sources in material knowledge. At least since the Renaissance, with the emergence of architectural theories, form generation has become somewhat of a self-directed and autonomous body of knowledge. Within architecture and industrial design, the most culturally sensitive of the production design fields, form has grown in both eminence and temporal precedence in the design process to the point that the condition of form preceding materialization has become normative and virtually intuitive in contemporary design culture. With the exception of few pioneering cases in contemporary design, the secularization and debasement of the material realm has become axiomatic. Materiality has become, within the logic of the modernist tradition, an agency secondary to form.

The Industrial Revolution lay open the door to machine-based manufacturing and mass production. The creation of form was now to be conceived and created by the power of industrial automation, detached and independent of environmental forces and influences. The values promoted by ancient crafts (not unlike Nature’s way), pronounced by the integration of material substance and construction methods, once within the province of the craftsman, were abandoned while in their place emerged a design practice based on values of mass production. Fast, cheap, repetitive and modular building types and parts were synonymous with Ford’s visionary dream. Industry’s victory aside, it appeared as if design’s propinquity to ancient crafts and its design expressions as portrayed by vernacular forms of design was now doomed lost; and with it the intimate context of material technologies. Eventually, this non-material approach to the design and the automation of construction were to be reinforced under the command of computer aided design and engineering.

The Digital Revolution, which marked the shift from analog to digital technology, has transformed the designer’s drafting board into a digital canvas. Form, it seemed, was now divorced completely from the physical reality of its manifestation. This new design space afforded much liberation in formal expression, but it has also broadened the gap between form and matter, and made the hierarchical and sequential separation of modeling, analysis and fabrication processes infinitely more pronounced.

The implementation and broad absorption of enhanced computational design tools in architectural practice has, since the early nineties, reinvigorated a renaissance in the formal project in architecture: geometrically complex shapes became emblems of creativity in digital design environments and supported the design mastery of complex geometries in form-generation. This formal and geometric design orientation has also addressed “free-form” design and architecture along with their enabling technologies as part of the larger design phenomenon of “non-standard” form.

TOWARDS A MATERIAL ECOLOGY

Neri Oxman
Today, perhaps under the imperatives of growing recognition of the ecological failure of modern design, inspired by the growing presence of advanced fabrication methods, design culture is witnessing a new materiality. Within the last decade in both industrial design and architecture, a new body of knowledge is emerging within architectural praxis. Examples of the growing interest in the technological potential of innovative material usage and material innovation as a source of design generation are developments in biomaterials, mediated and responsive materials, as well as composite materials. With the growing relevance of materialization, new frontiers of material science and digital fabrication are supporting the emergence of new perspectives in architectural and industrial design. Thus the role of digital design research as the enabling environment of the transformation to a new age of material-based design in various design disciplines has become the cutting edge of computational design research. Here we are at the cusp of a new paradigm inspired by the Troika structure of craft, at the intersection of Materials Science, Digital Fabrication and the environment.

Material Ecology is an emerging field in design deeming informed relations between products, buildings, systems, and their environment (Oxman, 2010). Defined as the study and design of products and processes integrating environmentally-aware computational form-generation and digital fabrication, the field operates at the intersection of Biology, Materials Science & Engineering, and Computer Science with emphasis on environmentally-informed digital design and fabrication.

With the advent of digital fabrication techniques and technologies, digital material representations such as voxels (3-D pixels) and maxels (a portmanteau of the words “material” and “voxel”) have come to represent material ingredients, for instance in the context of additive manufacturing processes. In other words, designers are now able to compute material properties and behaviour built-in to form-generation procedures. Combined with the designer’s capacity to analyze structural and environmental forces, the enabled mediation between matter and the environment through fabrication appears to be as powerful as the ethos of craft itself.

The ability to design, analyze and fabricate using a single material unit implies unity between physical and digital matter, enabling nearly seamless mappings between environmental constraints, fabrication methods and material expression (Oxman, 2010). Such unity—like that found in natural bone, a bird’s nest, a typical African hut and a woven basket—might promote a truly ecological design paradigm, facilitating methods and material expression (Oxman, 2010). Such unity—like that found in natural bone, a bird’s nest, a typical African hut and a woven basket—might promote a truly ecological design paradigm, facilitating methods and material expression (Oxman, 2010). Such unity—like that found in natural bone, a bird’s nest, a typical African hut and a woven basket—might promote a truly ecological design paradigm, facilitating methods and material expression (Oxman, 2010). 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