Introduction

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The subtle shift in architectural discourse from formal concerns focusing on the blob to production concerns centering on digital fabrication that occurred around 2000 has proved to be more profound than any one would have predicted. The emphasis on production and process over aesthetics and representation has changed the nature of our architectural horizons, both in theory and in practice. But for all of the recent publications that promote the power of digital fabrication/parametric design and describe its potential for liberating our productive (and hence formal) horizons, none examine the effect of this on how we · designers, architects, builders · conceive of our WORK. This book wants to examine not just the process of parametric design, but the labor in that process; not just the power of technology but also its effect on technologically engaged subjects.

While others · John Locke, Hannah Arendt, Ken Frampton · have made much of the distinction between "labor" and "work" · the first addressing life's biological needs, the second its rhetorical and "worldly" striving, no such distinction (for the most part) is being made in this text. We want to operate between and within the connotations of both words · the work that we all know we do when we "go to work" or "work out a problem" and also the labor of capitalism's "the system of labor" that we as makers operate in and in which we still struggle to genuinely reap the "fruits of our labor".

Here, the traditional definitions of designer, architect and builder come under attack as the relationship of each to the other shifts. "Designer" is no longer equated with "architect"; fabricators, engineers, and software programmers can lay claim to equal authorial designation. The architect has access to all the economic/organizational parameters originally known only to the builder, and hence control of the critical path is mingled with control of form. But it should be emphasized that the new modes of production do not cause this shift; they further destablize an existing dysfunctional and antagonistic relationship between all players in the client, architect, contractor trichotomy; a dysfunctionality that, being highly over·determined and (like capital itself) highly self·contradictory, demands systematic change. This is the reason that "digital" and "parametric" do not appear in the title of this work: while new technology is at the center of all the contributions here, it is understood as a catalyst only to the larger issue of how the profession and all the players in it want and need to reposition themselves for the future.

From one side, the idea for this book began as an inquiry into why, just as production and not form became the new area of architectural concern, theory seemed to go into retreat. The theoretical position of post·criticality that accompanied the emergence of parametric design quickly became, in academia, the opportunity to stop critical thoughts and just start making. Why get hung up on the issues of cooption and hegemonic culture when we can have so much fun participating in and adding to the goods? But it seems/ed in fact that theory could/should be more interesting and more important than ever: more interesting because it finally had something · production and its economic viability · other than formal navel·gazing to chew on; important because theory above all should not

back off just as labor, new technology and money enter into the picture. The intellectual inquiry moved from this observation to an examination of how architecture as a profession does indeed officially and unofficially organize its labor.

From the other side, the idea for this book began as an exasperation by those at the vanguard of the professional practice with the protocols · both contractual and self·imposed · limiting our ability to exchange information and share expertise across professional boundaries. Contracts memorializing business practices designed to limit liability, already having shown themselves simultaneously to increase antagonism and to limit social reach were now clearly proved to be impediments to disciplinary empowerment. Likewise, the traditional organization of the architectural office · linear, hierarchical and star·driven · while still intact, was and is increasingly non·sensical. What was necessary from the professional point of view was not only the revision of standard contracts but a conceptual reclassification of the players.

Thus, for the purposes of this inquiry, theory was irrelevant without practice and practice impoverished without theory.

The book is divided into two sections · "Working and Making" and "Collaboration". The first explores the relationship between the maker and the object and in this, between design (involving form, representation, and space) and craft (involving materials and tools) and between human and technological production. The second explores the relationships *between* the makers – architects, builders, subcontractors, fabricators · and in this, between intention and execution, thinking and making, opportunity and liability, innovation and responsibility. In both sections, the disruptive nature of digital technology to known patterns of behavior is keenly investigated.

In "Working and Making," these known patterns of behavior, as suggested above, are already intrinsically unstable if anxiously held onto. The instability rests on the tension inherent in architectural design between open·endedness and control, a tension that plays itself out in many and often contradictory ways: between design (exploratory) and build (practical, exacting); between design (expansive) and budget (constricting); between technique (infinitely deployable) and material (limiting parameters); between expressionism (formal rule·breaking) and precision (technical rule·appreciation); between craft (subjective variety) and design (logical premeditation); between vision (economically unconstrained) and marketability (economically constrained). Scott Marble's piece, then, opening both this section and the book, offers an excellent introduction via his evaluation of what "craft" means today, an evaluation that lays out many of the issues picked up by other authors in this section: the issue of control (or lack thereof) that arise with parametric design; the question of whether technique/tools or material should be given primacy in fabrication; and the role of the imagination in a technologically sophisticated (read: deterministic) environment. In the digital age, Marble says, craft is no longer identified merely with the hand that works physical material but with the mind that can command the operations of technology, understood as intellectual "material". He identifies the risk that is inherently involved in craft, but suggests that unlike the past, where risk lay in the transition

from designer to craftsman/builder, today it rests in the capabilities of the human imagination. Mark Goulthorpe and Jamie Carpenter offer more specific and contrasting descriptions of what they privilege as good "craft", Goulthorpe, emphasizing the value of parametric technique provided by parametric design, Carpenter emphasizing the woefully fast-disappearing concern for materiality. Goulthorpe examines the formal potential within a set of given surface-defining parameters, finding that traditional notions of space, time and movement are radically reconfigured. Carpenter insists that it is just such computer-driven formal concerns that ignore material phenomena and yields zinc as the contemporary wallpaper.

Koleravic then returns to the issue of risk, but where Marble equates parametrics (and technology in general) with control and imagination with risk, Kolarevic characterizes risk as an inherent attribute of parameterics, based as it is on relationships whose formal outcome can't be foreseen. Likewise, they have comparable but diverging views of efficiency. For Marble, efficiency is linked not to the speed of parametrics to spin out variations but with the efficiency of the human imagination; risk is linked (positively) to efficiency. For Kolarevic, the parametric iterative process is efficient in providing alternatives while inefficient in its non-linear open-endedness; risk is linked (positively) to inefficiency. The question of risk and efficiency lingers in Carpenter and Goulthorpe as well. Carpenter is clear that digital technology's ability to preview outcomes reduces costly risk in production. Goulthorpe appreciates the transparency (if not exactly the efficiency) of digital processes that makes design, in the collapse between intention and execution, proto-immediate. Kevin Rotheroe, in his essay, then attaches the issue of craft to "value". Acknowledging that "craft" – be it manual or machinic - costs money, he suggests that the proliferation of CNC precision promotes the positive reception of craft in general. In his concentration on human versus technical notions of craft, he is connected to Marble's concerns, although for Marble, the "human" rests in the imagination, not the hand.

In linking the value (both social and economic) of craft to the cost/value of labor, Rotheroe's essay connects to my piece that looks at the issue of design and craft labor through the lens of the detail. I argue that the dichotomy between "detail" and "craft" and the historical shifting of which term is privileged achieves a form of resolution in current parametric and digital-fabrication practice; at the same time, the concern for the craft laborer that obsessed 19th century architectural theorists re-emerges and provides an opportunity to more positively address the status of contemporary makers AND designers. Coren Sharples then provides a discussion of exactly what this implies for her firm, SHoP. In a description of the work done on their Houston Street Project, which follows the development of the complex brick panels on this apartment building, she describes the manner in which BIM allows the architect to function as a "leader" for the client and as a collaborator with the builder; a dispersion, in other words, of authorship. The impediment to a fully realized re-identification of the architect/author is the culture of the architectural office itself, where the inherent tension partners ("management") and staff ("workforce") needs to be actively combated the common stake in design research promoted. While craft does not come into this picture, design is redefined as organizing design and construction procurement, and its object is less the building (or, in this case, the façade) than the logic of its delivery. Finally, Kent Larson of MIT Media Lab describes a project –

House-n – that takes this notion of design to its ultimate logic. Discussing the development of "design engines" that allow a lay-person to efficiently create and buy his or her own home environment, Larson completely does away with an need for craft – the user/"designer" sources products. Even the realization that sourcing is only as good as the yet-to-be-designed universal interface leaves craft at the mercy of its traditional enemy – standardization. In all of this, Larson extends the technological imperatives of digital prototyping for factory assembly and asks if the computational solutions – not unlike the algorithmic imperatives of Goulthorpe, can act as "design configurators," rapidly displaying and (hopefully) procuring the desired consumer product.

In the second section, "Collaboration," the authors explore issues that are, again, embedded in existent architectural practice but exasperated by digital technology. These tensions have to do with the inherent ambiguity and internal contradiction of roles with regard to intention and execution: ambiguity between client (laying out intention), architect (laying out own intention or executes clients?) and builder (executing clients or architect's intention?); the ambiguity between architect (laying out intention), general contractor (reinterpreting the intention) and subcontractor (executing); the ambiguity between primary stakeholders (trying to expedite a project) and consultants (as experts, indicating that the stakeholders don't fully know how to do that); and between stakeholders (trying to execute a project) and lawyers/contracts (trying to limit liability). This section then opens with Paolo Tombesi's essay that suggests that architects are obliged – and for the most part have failed · to design a process by which their aesthetic intent can be realized. A successful process would acknowledge the non-linearity of moving from intent to execution. In the "flexible specialization" he promotes, every aspect of the design-to-build process can be considered an aspect of "design production," with designers, fabricators, builders, programmers all claiming an area of special expertise within this domain of design. Tombesi argues that as the means of modern production move from linearity to networks, so, too, does the labor of building. John Taylor explores the nature of the network itself as it struggles with innovation. Diagramming the fact that innovations practiced in one part of the network not only may not produce innovations in others but also may actually hinder its proliferation, he makes an implicit argument for the need to change the traditional "interdependencies" that organize the network. In this way, Taylor's assessment of innovation mirrors Tombesi's emphasis on the protocols of non-linear movements between design/production specialties: technology is neither the cause of nor the obstacle to a radically changed system of production; rather, labor's ability to organizes itself with flexibility and dexterity is. Attorney Howard Ashcraft, at the forefront of defining new contract models for innovative delivery models, suggests that the developments in information sharing, BIM in particular, is as much a process as it is a technology, and that as a process, it leads to collaboration. As BIM is adopted more deeply, it will increase pressure to institutionalize collaboration and move to integration. Arguing that although collaboration is traditionally not well supported by our business, new protocols remove roadblocks that have been our traditional pretext for slow adaptation. Structural engineer Rodd Merchant also argues that advanced technology – interoperability · is not the sine qua non for breaking down siloized, self-protective design to building procedures; rather, resisting existing contractual relationships binding engineers and other consultants to architects is. In the design-build model – here demonstrated with an example from a steel construction company · the engineering is a subcontract to the fabricator and coordination is internalized by the team. The centrality of contractual relationships also

guides the examination, by Attorney Chris Noble, of intellectual property standards in design. While copyrights are a minor issue now when, as he says, little is at stake, when digital information is produced that can be leveraged over the life cycle of one and many projects, "what is 'at stake' can be multiplied exponentially." In this case, contracts and licensing are more important than ever, even as the current system of contracts is virtually dysfunctional in its lack of coordination. He suggests that such coordination will be modeled on extra·net contracts such as those that govern the downloading of software and thus, control of intellectual property be determined who controls its allocation.

In Phil Bernstein's "Marketing and Positioning Design," the issue of contracts recedes, but that of authorship, implicit in the question of copyrights, arises full force. Because marketing assumes a degree of standardization – one needs to be able to fix and brand a product – the marketable architectural product tends to leave individual design identity, as Bernstein points out, behind. At the same time, positioning in the marketplace requires differentiation from ones competition, and here, perhaps not authorship, but certainly production ownership, matters greatly. Ones bank account recognizes the difference. The standardization that is at center of marketing in this case is not the normal one that threatens consumer choice, but rather, threatens architectural ego. In this, we return to the issue raised in Section One, "Working and Making": where precisely does design authorship reside with the advent of mass production, mass customization and digital fabrication, and does it depend on evidence of individual expression? It throws off, in any case, what and where we think "design" actually is in the mass·produced/customized object. In the concluding essay to both this section and the book, he speculates about whether the artificial division of "thinking and making" manifest in traditional project delivery methods will survive the redefinition of the production network, and asks whether architects in particular will see the fundamental opportunities of the new transactional models. Bernstein, like all of the authors in this book, explicitly interrogates the changing nature of design work and the architect's opportunity in it.

What is at stake in this volume is the fact that architecture is poised to either become increasingly irrelevant or grab this moment of opportunity to reinvent both its protocols and its reach. We hope it is up to the task of Building in the Future.