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Redoing is the new undoing

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Published in:
Il Quaderno: The ISI Florence journal of architecture

Publication date:
2017

Document Version:
Version created as part of publication process; publisher's layout; not normally made publicly available

Document License:
Unspecified

Link to publication

ARKITEKTSKOLEN AARHUS   Designskolen Kolding   Det Kongelige Akademi

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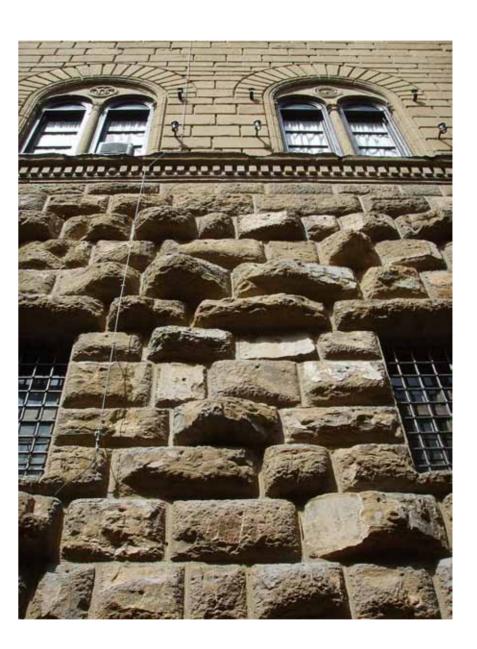# index

Redoing is the new undoing

Jonathan Foote

Workmanship of risk and workmanship of certainty
David Pye, the late 20th century English craftsman and writer, established a relationship between undoing and the aesthetic dimension of manufactured objects, a potent framework still cited by theorists in their attempt to rescue the value of craft. Pye believed that craftsmanship is a response we instinctively read into the object through the level of 'risk' associated with its making. An object produced by the *workmanship of risk*, he wrote, may be ruined or compromised at any moment through the slip of the hand or a momentary lapse in judgment; it is produced in close connection between the mind and hand. Contrasted to this, Pye outlined the *workmanship of certainty*, whereby production may be fully predicted or known beforehand, a classification by which nearly all objects of serial production are placed. In other words, with industrial manufacturing, the issue of undoing problems or errors is solved through sufficient prototyping and automation, whereas in hand production the mark of the tool on the material cannot be undone. Handwork is a risky proposition and therefore of higher aesthetic value[1].

Although published in 1968, Pye's terms have remained remarkably durable, and he continues to be referenced by theorists and re-discovered by architecture students even in the digital age. Malcom McCullough, in his seminal 1996 book, *Abstracting Craft*, bridged thirty years of technological change by elaborating upon Pye's theorisation of certainty and risk. Although penned in the era of serial industrialisation, McCullough viewed Pye's thinking as fundamental to craft perception and equally applicable to the burgeoning age of digital workmanship. In this way, craft can only be solved in the current era by breaking our stubborn and perhaps nostalgic link between craft and its association with the hands of a skilled carpenter, weaver, or stone carver. Twelve years later, McCullough's view helped set the stage for Richard Sennett's widely disseminated book, *The Craftsman*, who argued that craft, taken in its broadest sense, is not bound to handwork at all but is more broadly understood as an ethical framework for exercising skilled knowledge in any practical field[2]. Today, the term digital craft is broadly accepted as the craft of working abstractly through digital means, a skilled application of knowledge whose seamless integration with fabrication erases the old boundaries between architect and craftsman[3].

Although digital fabrication has disassociated the link between industrial production and seriality, enabling bespoke manufacturing, the nostalgia of craft persists. We still miss the 'human' element on the produced work: the inconsistencies of the hand, the

[01] Bugnato rustico, Palazzo Medici-Riccardi, Michelozzo

wobble of the chisel or the beholding of a work produced by a highly dextrous hand. Following Ruskin, we continue to idealise the life and work of the lone craftsman and community of craft-based workers. As a new generation of digital natives enter the profession, these nostalgias are re-emerging and are stronger than ever. In this way, it may be important to return to Pye and ask about craft once again. Maybe the digital craft crowd is missing a key point.

What persists for digital craft theorists, beyond Pye's specific use of the terms related to workmanship, is his bifurcation of risk and certainty. Digital craft proponents frame this as a question of digital design and fabrication workflows. On the one hand, risk signifies an approach that is non-linear and open ended, i.e., creatively risky; while on the other hand, certainty is more generally associated with the use of digital design workflows as tools for corporate or industrial production. Since there is no hand of the craftsman anymore, the risky part is assumed by the architect undertaking a design process whose certainty is unclear. And it is precisely the uncertainty of outcomes, connected with fabrication, that enable the digital craftsman to capture some of the 'risk' once associated only with handwork.

The standard translation of the Greek *techne*, in its most narrow usage, is *craft*. Cicero translated the Greek *techne* into the Latin *ars*, and it meant a general category of knowledge that could be otherwise, as opposed to unchanging knowledge, *episteme*, translated nominally into English as 'science.' In Plato's original formulation of *techne* found in the *Republic, techne* was not specifically connected to the hand at all. Rather, knowledge of *techne* belonged more generally to the realm of intelligent thought put into action, from sailors and farmers to doctors and politicians. All *technai* have an *ergon* (goal) embedded within them: the goal of medicine is health, for example. This notion of means and ends, the mode of production and the product, is at the root of the Platonic usage of *techne,* as a rational mode of knowing following the rules of practical apprenticeship[4]. *Technai* are practiced within the shifty and unpredictable realm of nature and human affairs, hence the importance of knowing the *kairos*, or right opportunity to act, also a distinguishing mark of *techne*[5].

Thus we may say that digital craft as formulated by McCullough and Sennett is generally consistent with the Platonic notion of *techne*. However, the direct association we have between craft and the handed craftsman appears to be a nineteenth century invention. Indeed, while the word *craft* may be found in English well back into the 16th century, the term *craftsmanship* does not appear in common usage until after 1850[6]. When someone complains about the 'loss of craft' in contemporary building practices, they are really talking about a decline in *workmanship* as the mark and care of the human hand. Pye was quite careful with his terms, and indeed he wrote specifically about workmanship, not craftsmanship[7]. For Pye, risk and certainty were bound inexorably to the relationship of the tool to the material. His concern was built around a notion of undoing that can only be understood through a relationship with matter, in its most narrow sense. In the digital age, where pre-programed numerically controlled machines do all the cutting, is there a way to reconnect this question of risk and matter, and to articulate a more nuanced notion of digital craft?

Redoing is the new *undoing*
Inspired by Pye, one may reintroduce uncertainty into the material processes by focusing on the precise meeting point between the tool and the material. For Pye, the workmanship of risk relies on the claim that handwork cannot be undone. A slip of the tool may spoil the entire work at any given moment, thus requiring a high level of stored-up dexterity and judgment for each movement of the tool. Of course, while digital practices are often open-ended and indeterminate, the precise action of the tool in numerically controlled processes (CNC) is, as a rule, considered a technical question of matching outcomes with simulations. Hence, CNC technicians are certainly highly skilled craftsman but have no capacity for workmanship, as Pye defines it.

To reintroduce the workmanship of risk in the digital age, however, it may help to speculate on where digital fabrication may be negated, where the machine can be tricked. As far as the CNC technician is concerned, results should meet the expectations of the simulation. One of the benchmarks of high quality tooling software, in fact, is its ability to reliably collapse the separation between virtual and actual tooling outcomes. While digital workflows are increasingly incorporating open-ended experimentation at a higher level, the actual tooling procedure, where the 'rubber hits the road,' so to speak, still fits categorically into the workmanship of certainty.

Digital fabrication workflows gain intelligence when they connect empirical data on material experimentations, environmental parameters, and formal conditions with virtual simulations. The simulations, in turn, more precisely anticipate outcomes. Unexpected results feed back into the virtual model, increasing its intelligence. However, there is still an entire universe of material behaviours that are beyond the reach of such predictive capacities.

Take stone fracturing, for example. One can create

[02] Fractured concrete, Clifford Still Museum, Allied Works

precise conditions for controlling the fracture line, but each instance of fracturing the actual surface topography is slightly varied, a result of micro resistances embedded in the heterogeneous, crystalline structures of the material itself. Repeat the exact process one hundred times, and you would have one hundred different topographic outcomes. It is impossible to redo the same fracture twice. The entire history of rustication depends precisely on this, which is why the technique was always associated with a kind of physical vitality and visible mastery of stone work. This was captured well in a 1543 description by the philologist Claudio Tolomei, who referred to the technique as "un natural artifizio … e una artifiziosa natura." "In tal modo," he continued, "s'ingengnano in questi tempi rassembrare una fonte, che dall'istessa natura, non a caso, ma con maestrevole arte sia fatta"[8].

For our discussion of risk and certainty, the technical conditions of stone fracturing raise the possibility of certain, repeatable processes leading to uncertain, non-repeatable outcomes. The notion of indeterminacy in digital processes has been widely studied, and also connected with digital craft, but it is has not been connected with workmanship[9]. In this way, the concern is whether one can repeat the exact process and receive perceptibly variant results, of highlighting material agencies. The risk at one time associated with *undoing* becomes the risk associated with *redoing* in the digital age.

When fracturing is brought into the digital age, the result can be quite remarkable. Focused on the desire to make a building "made, not manufactured," Allied Works implemented digitally customised concrete shuttering for the Clifford Still Museum in Denver, USA, completed in 2007[10]. Taking advantage of the myriad and sometimes difficult to control parameters of an in-situ concrete pour, the architects specified form boards of varying width that, when removed, induced a fractured edge at the joints. The bevel angles and board widths were carefully calculated based on empirical tests to establish the liminal bevel angle conditions for the desired effect, i.e. fractured, but not too fractured. The result is a broken, incidental, and unique facade surface that recalls in a non-arbitrary way the fractured rock of the Rocky mountains against the bright alpine sky.

Because of the level of indeterminacy, the concrete work re-introduces the workmanship of risk. The process could obviously be repeated, but no two facades would be the same. The uncertainty, or risk, previously associated with the dexterity of the hand is shifted now to the agencies embedded in the material itself. One may still miss the nostalgia associated with Ruskin and Morris' craftsman, but by negating the determinacy of the machine, at least it is no longer allowed to dominate. Perhaps this kind of 'rustica-

tion' holds some promise for a new kind of digital workmanship, reinvigorating once again David Pye's humble text.

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1_ David Pye, *The Nature and Art of Workmanship*, Cambium Press (1968), 20-23. To cite a few examples, Malcolm McCullough re-energized Pye's theories for a digital context in his seminal 1996, *Abstracting Craft: The Practiced Digital Hand*, MIT Press (1996), 21-22. More recently, McCullough's support of Pye has been reasserted by Branko Kolarevic, "Between Conception and Production," in Bernstein and Dreamer, eds., *Building (in) the Future: Recasting Labor in Architecture*, Chronicle Books (2012), 67-69.

2_ Richard Sennett, *The Craftsman*, Yale University Press (2008).

3_ See, Loh, Burry, & Wagenfeld, "Reconsidering Pye's theory of making through digital craft practice: A theoretical framework towards continuous designing," *Craft Research*, 7, vol. 2, (2016), 187-206; or Scott Marble, "Imagining Risk," in *Building (in) the Future*, 38-43.

4_ Plato, *Symposium*, 205b

5_ Plato, *Republic*, 370a.

6_ This assessment is based on an analysis of the frequency of the words appearing in books via Google's Ngram viewer.

7_ Pye defines craftsmanship as, "workmanship using any kind of technique or apparatus, in which the quality of the result is not pre-determined, but depends on the judgment, dexterity and care which the maker exercises as he works," *The Nature and Art of Workmanship*, 20.

8_ Quoted in Carlo Ginzburg, *Il filo e le tracce: vero, falso, finto*, Feltrinelli Editore (2006), 60.

9_ See, for example, Goulthorpe's notion of "precise indeterminacy," in Mark Goulthorpe, *The Possibility of (an) Architecture: Collected Essays by Mark Goulthorpe*, Routledge (2009), 123ff; or Amit Wolf, *Fabrication [to construct by assembling diverse parts] and Fabrication [an untruthful statement]*, Sci-Arc Press (2014).

10_ *Allied Works Architecture: Clifford Still Museum*, Hatje Cantz Verlag (2013), 94.

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