Redoing is the new undoing
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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.

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. 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. 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.

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
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 techmai 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. Techmai are practiced within the shifty and unpredictable realm of nature and human affairs, hence the importance of knowing the kaimi, or right opportunity to act, also a distinguishing mark of techne.

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 craftsmanship 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. 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. 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?

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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 craftsmen 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 experiments, 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
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 artificio ... e una artifiziosa natura.” “In tal modo,” he continued, “s’ingengnano in questi tempi rassemblare una fonte, che dall’istessa natura, non a caso, ma con maestrevole arte sia fatta.”

For our discussion of risk and certainty, the technical conditions of stone fracturing raise the possibility of 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 previously associated with the dexterity of the hand is itself. One may still miss the nostalgia associated with undoing 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 façades 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 rustication and 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. 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.

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4. Plato, *Symposium*, 205b


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.


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