Notes on Craft and Interaction Design
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My first degree was in computer engineering. I was never a spectacular programmer, even though I did get to the point where I could see beyond the syntactic details of specific languages to think in terms of data structures and control flows, then implement them relatively effortlessly in whatever programming environment was at hand. As I drifted into human-computer interaction and interaction design in the 1990s, the ability to experiment with interactive form and behavior turned out to be quite useful when exploring non-standard design ideas. Some old examples that still make me somewhat proud are Sens-A-Patch for browsing (moderately) large amounts of information on a small surface, the Pinpoint concept to support networking and communication in large complex organizations, and Capable Books where I connected to my own traditional craft skills in bookbinding to create physical books that could sense electromechanically which spread they were opened to.

What these examples have in common is that the creative process of discovering and assessing interactive forms and behaviors literally happened through making many quick, partial implementations. I would play around with a current version or ask someone to play around with it, some aspect of the interaction would stand out as particularly engaging or interesting, other
aspects would be awkward and contrived, and a decision would form to take the next version in some directions but not others. Some detailed design decisions were taken by repeated tweaks of a particular piece of code until the resulting interaction looked and felt just right. The Capable Books project in particular progressed through a series of prototypes where some honest attempts to realize the original idea ended up suggesting completely new functionality (such as a pressure-sensitive book).

This kind of back-and-forth can be described as exploring a space of possibilities. It feels somewhat similar to sketching, which is commonly characterized as thinking by drawing or being in a conversation with the sketchpad. However, sketching usually relies on a visual shorthand where a few quick pencil strokes represent potentially complex forms that are ultimately suitable for construction in the intended delivery material. A designer engaged in sketching needs to know the properties of the intended material – what can be done easily and elegantly, what can be done with extra effort and expenditure, what goes against the grain of the material or is even impossible to accomplish? The typical example in interaction design might be where UX architects sketch alternative designs for a mobile app using thumbnails and wireframes, laying out the information structure and interaction sequences using quick pencil strokes representing conventional user interface components and their temporal ordering. But for me, the situation was rather that I wanted to go beyond conventional user interface components, to identify new interactive forms and behaviors and to predict their experiential qualities in use. In a sense, I guess my aim was to learn about the possibilities of the digital material of interaction design, to find out what could be done and what would be worth doing. And
the way I had to go about doing that was to experiment directly in
the intended delivery material.

A craft is any process that attempts to create a functional artifact
without separating design from manufacture.
[ ... ]
Creating a human-computer interface is usually, and perhaps
always, a craft, because of the investigative nature of each
designing.
[ ... ]
Fundamentally, the materials shape the craft. Computer
programs are unlike any other material, and the form of
craftsmanship in software will surely be unique.

These lines are taken from a book chapter by David Wroblewski,
published already in 1991 and largely overlooked since then in
terms of citations and impact. I was lucky enough to stumble over
it sometime in the mid-1990s, and ever since then I have carried
the notion that a craft perspective on interaction design could be
fruitful, for practice as well as teaching and research. Wroblewski
wrote his prescient piece at a time when the material of interaction
design largely consisted of software running on computers with
screens, keyboards and pointing devices. In more recent years,
the digital material has become increasingly physical and spatial,
extending into handheld and worn interactive devices, interactive
spaces and tangible interaction. This development towards a more
physical digital material largely coincided with the academic HCI
community starting to consider notions of design materials and
explorative making in what has been called “the material turn of
HCI.” In principle, I find this to be a promising and productive
step towards bringing HCI closer to other design fields addressing sociospatial issues and the built environment. It should also mean that this might be a good time to start exploring what interaction design can learn from looking at craft a little more deeply.

The idea of a book called “The Craft of Interaction Design” has been with me for the last few years, and I have even tried telling people about my plans in an attempt to motivate myself to actually write the book. It hasn’t worked so far. What I have done merely amounts to collecting material, thinking about it and poking around with it. In December 2019, my friend Erik Stolterman happened to see a pinboard version of the material, listened to my complaints about not being able to pull myself together, then said calmly that the collection already represented something potentially useful. I was very grateful and immediately jumped on the idea.

And here we are. This document is built around a collection of sources that I have personally found relevant for thinking about interaction design through a craft lens. Most of the sources consist of excerpts from published works. I have sorted them roughly according to topics, and written my own reflections on some of them. Not much in terms of added value, no overall narrative or coherent argument, but still I hope Erik is right. If you can find anything here that can inspire you in practicing interaction design, thinking about interaction design or teaching interaction design, then it might have been worthwhile after all.
The diagram on the next spread is a visual table of contents (of sorts). It summarizes all the sources collected on the following pages, sorted into seven topical areas as follows.

*What is craft?* Attempts from various disciplines, mostly craft research and art history, to define and characterize the concept of craft.

*Craft ethics.* The values and driving forces underpinning craft and craft practice.

*Craft aesthetics.* Beauty and other aesthetic qualities in craft.

*Practical knowing.* The nature of knowledge in practice is an important part of understanding craft.

*Design, innovation.* How craft relates to the design disciplines and to more contemporary notions of innovation.

*Digital craft.* The effects of digitalization on traditional craft.

*Interaction design and craft.* Other examples of interaction design scholars and practitioners making connections to craft.

The placement of the labels in the diagram is intended to suggest relations between different sources, as far as a two-dimensional surface is able to render the complexities of a network of concepts and ideas. If your eye catches a label that seems interesting, the page number indicated in the label takes you to the full excerpt from the original source. If the page number is set in bold face in the label, then you will also find my reflections on the excerpt.

The final part of this document is a bibliography, containing two parts. One is a list of references for all the works I have excerpted, and the other is a list of other sources that may also be of interest for thinking about craft and interaction design.
Why do you make things?

Craft simply is being checked

The satisfaction of making things

Some people make things to be checked. They like it when others tell them what they've done is good. For some people, it feels like being checked. For others, making things is more important than being checked. For some people, making things is a way of life. For others, it's just a hobby. For some people, making things is a way to express themselves. For others, it's a way to make money. For some people, making things is a way to learn. For others, it's a way to explore. For some people, making things is a way to escape. For others, it's a way to socialize. Whether you're checking or being checked, making things is a way to connect with others. Whether you're checking or being checked, making things is a way to express yourself. Whether you're checking or being checked, making things is a way to learn. Whether you're checking or being checked, making things is a way to escape. Whether you're checking or being checked, making things is a way to socialize. Whether you're checking or being checked, making things is a way to connect with others.
I couldn’t say what would be the “best” way, or even the intended way, of using this collection in its present form. More than anything else, I suppose it reflects my own fascination with the infinite treasures of articulation and insights that the academic literatures offer, even on a non-academic topic such as craft.

Having said that, there are some thoughts behind the decision to make the material available instead of merely keeping it on my own pinboard. The first is obviously to provide some wayfinding to other interaction design scholars interested in craft, in terms of curating and (in some places) commenting works I have found to be of value. I have tried to cast a rather wide net, and perhaps some of the sources included here can inspire further thoughts in unanticipated directions. For such use, I suppose that the bibliography at the end would be the main reference.

Another idea concerns academic teaching. I have tried on occasion to revitalize the stale and frustrating format known as the lecture by introducing some unpredictability, sometimes by selecting a concept or a section randomly from the course literature and then providing improvised commentary from the lectern. A more engaging and possibly more meaningful variation is to ask the students to read or study something, then list in class the concepts or perspectives they want to discuss. The piecewise structure of this collection might be suitable for such teaching uses.
What is craft?
the word “craft” is associated with “skilled manual labour” or “the aristocracy of labour.” To an economist, with a stage in economical development preceding capitalism (there are c anthropologists with traditional rural pursuits. To a countryman, with traditional rural pursuits. To a literary historian, with the anti-establishment stance of the Romantics. To a trade unionist, with a community of skilled people defending the way they perform their occupations. To a laboratory scientist, with the use of equipment to do science – a contemporary version of Galileo’s dialogue between Galileo, the astronomer and Galileo the builder of the telescope, the “starry messenger.” In Germany during the 1920s–1930s, the culture of “craft” – and of antimodernism – was strongly associated with the political Right; in Britain during the 1880s–1890s – through the writings of William Morris, Walter Crane and disciples – with the political Left: similar repertoire of arguments, radically opposed conclusions. In Germany, this became a popular movement, centred on disaffected artisanal businesses; in Britain, it was mainly confined to the artistic realm and was much better tempered. All in the name of craft. Policy-makers today prefer to see “craft” as a stimulus to local and regional economies, skills and materials, sometimes in relation to wider networks. To an art critic, the word “craft” is about the distinction between an “art” – as in intellectual/conceptual – and a “mere craft” – as in manual – a debased version of age-old debates about the social recognition of the artist which go back to the Italian Renaissance, sharpened in England by Royal patronage of “fine artists.” […] To a designer, “craft” is about the workmanship of risk and – most recently – the slow design movement. Many perspectives on craft. Frayling, 2011, pp. 9–12.
Craft is old. The story usually starts with the concept of Homo Faber, “man the maker”, characterizing humans as the race that uses tools and crafts artifacts as needed, thus being able to control their environment and their fate. It might be noted in passing that the separation of design and craft, the specification of an artifact as distinct from its making, is a relatively recent notion in this context.

With this long history in mind, it is not surprising that craft pervades many different directions on human development and appears in many historical as well as contemporary discourses.
At any rate, craft-as-a-class-of-object is further identified by a menu of characteristics, as I mentioned above. I would submit, for instance, that a craft object must be made substantially by hand, utilising the hand itself, handtools, and to some degree, power tools. Objects made on an industrial assembly-line, partially or entirely with automated machinery, are not usually regarded as craft. Coca-Cola cans and most motor cars are not crafted: they are not fabricated with a significant amount of handwork. While a certain amount of machine work is now accepted—most woodworkers have long consented to the use of stationary and portable power tools in the fabrication of “handmade” furniture—the involvement of handwork remains both a definition and a limitation of craft. Furthermore, to some degree craft can be identified by the use of traditional craft materials, use of traditional craft techniques, and addressing a traditional craft context. By “traditional”, I mean the materials, techniques and formats that survive from pre-industrial production. For instance: clay as material, throwing on the potter’s wheel, and vessels constitute a traditional locus of the craft of ceramics—because this triad has been employed by many of the ceramic-using cultures worldwide, long before the Industrial Revolution. Other traditions operate in the craft of ceramics as well: hand-building, pit-firing, glaze decoration and figurative sculpture, to name a few. But the triad of traditional material, technique and context continues to provide a centre and reference for contemporary ceramics-as-craft. In contrast, research into machinable ceramics for automotive engines does not. These three identifying criteria are quite elastic: a craft object can retain only one out of three of these characteristics and still be recognised as craft. A woven nylon hanging, in which a non-traditional material is manipulated with a conventional...
Metcalf talks about ceramics in this particular passage, but I would argue that his definition of craft is one that resonates with common-sense notions also in other fields of practice and in general parlance. Using materials and techniques from pre-industrial production, and framing the work with reference to pre-industrial contexts, would certainly qualify as craft in most situations.
Adamson’s craft characteristics

Adamson, 2007, p. 4.

First, while modern artwork has usually been held to be autonomous, the work of craft is supplemental. Second, where artistic practice has normally been oriented to optical effects, craft is organized around material experience. A third chapter, less dialectical in its arguments, presents the case of skill. This is the lynchpin of the book, in that skill is the most complete embodiment of craft as an active, relational concept rather than a fixed category. The final two chapters turn to craft’s situation in the modern social fabric: the pastoral and the amateur, two ideological frameworks within which craft is structured. The first of these terms normally has positive overtones, and the second a pejorative quality. Yet I hope to show that both the pastoral and the amateur are conceptual structures in which craft’s marginalization has been consciously put to use.
This, on the other hand, is an art historian’s take on craft. The discussion here is focused on craft in the context of art and artwork.
Craft’s position within the arts is a complicated affair. In some ways, it is analogous to the term “color.” Just as every object must be made in some way and hence could be considered in some sense to be crafted, every object has color. When one says that an object is colorful, this is not taken to mean that other objects lack color entirely; similarly, when we say that something is highly crafted, we are distinguishing it only in degree, and not in kind, from other things that have been made. There are artworks that are not only colorful, but are in some sense about color – by artists as diverse as Titian, Rubens, Monet, Kandinsky, and Richter. Equally, artworks may not only be well made, but may address the conditions of their own manufacture. And there are other parallels. Like art that seems to be about its own craftsmanship, art about color was at some points in history thought to be inferior. Finally, like color, craft is a word that most people think they understand – a commonsense term. Yet both have been subject to considerable speculation.
The analogy between craft and color has some intuitive appeal: “Just as every object must be made in some way and hence could be considered in some sense to be crafted, every object has color.”

Still it makes me a little uneasy when thinking about it. I cannot quite put my finger on what the problem is, but it might have to do with the fact that color is (also) an objective property that every object has. Craft, to me, is not an objective property of every object. First, there is clearly the large class of objects made by machines in industrial production. But even if we limit ourselves to hand-made objects, I am still not comfortable with assigning them all various degrees of craftedness. For me, craft has a lot to do with skill and I would find it awkward to talk about the class of objects that were made in unskilled ways or more or less unintentionally as “crafted, but not highly crafted.”
Before the redefinition of the 1970s, the popular traditional view of the crafts would have gone something like this:

- Crafts must be made of natural materials, preferably in beige;
- Crafts must be functional;
- Crafts must be the work of one person, perhaps featuring visible thumbprints or surface imperfections to prove it;
- Crafts must be the embodiment of a traditional design (unless of a musical instrument);
- Crafts must be in the ‘artisan’ rather than the ‘fine art’ tradition;
- Crafts must be rural products;
- Crafts must be untouched by fashion (which, it went without saying, meant “badly made fashion”);
- Crafts must be easily understood;
- Crafts must last, like a brogue shoe or a fine tweed;
- Crafts must be affordable (even if, like William Morris’s work, affordable mainly by Oxbridge colleges, Anglican churches and collectors);
- Above all, crafts must provide a solace, in a rapidly changing world.

After the redefinition, a fashionable, less traditional view of the crafts would go something like this:

- Crafts can be made with machines and even by them, if numerically-controlled technology goes on improving;
- Crafts can be made with synthetic materials, in all colours of the rainbow;
- Crafts can be non-functional, and may even conform to the American Customs definition of “art” – that it must be totally useless;
- Crafts can be made in limited production;
- Crafts can be designed by one person and made by another (as they often were, in fact, in the original Arts and Crafts period);
- Crafts can provide designed prototypes for industry;

Old and new definitions of craft

Craft has never been simply functional, even at its most traditional, nor will it ever be entirely autonomous, even at its most modern. While it is an object-focused discipline, the craft object is never an end in itself – craft objects are also means to ends. And even at their most rarefied, they retain vestiges of functionality, domesticity, and flow. They remain craft as long as there is that embodiment of humanity resulting from process, or evident in references to potential or historical functionality. Similarly, the functional craft object is never entirely transparent, nor does it intend to be. It is always available for contemplation. The crafted bowl is as available to the mantelpiece as to the kitchen cupboard, as appropriate in the gallery as in the ethnographic museum. In use it passes through moments of presence and disappearance, and also, importantly, has the ability to create an experiential space that blends these in a special kind of awareness. To take an example, Chris Knight’s silver shot glasses fulfill the functional requirements for drinking tequila – their scale and form is right according to our experience – but the act of holding these spiky tumblers draws immediate attention to the danger inherent in the activity for which they are designed. Craft objects have always had the capacity to segue between transparency and reflection, that most pressing issue for tangible interaction design. They have always occupied, even constituted, a unique place between art and life, available for the aesthetic
Kettley outlines an old view of craft from the Arts and Crafts tradition, and a new one where craft is more or less art. She argues for seeking a synthesis where craft is both functional and conceptual, where craft objects are both transparent and at the same time conducive of reflection.
Craft is intimate


This process, which centres on the relationship between the creator and the handmade object, highlights why craft objects possess qualities of intimacy, beauty and sensitivity, while designed objects do not. The designer is necessarily distanced from the object by engineering, marketing, and all the other specialisms involved in bringing that object into being. But the craft maker is the only person who creates their object. This object arises from an intimate relationship between the maker and their material and, indeed, an attachment with it. So the maker feels attached to the object, knows that they and only they could create it, and thus “loves” the object of their labours. It is this love of labour, process, material and object that is distinctive and it is this which discovers the qualities of beauty in the object.

We propose that there are three central characteristics of craft that enable it to find beauty: (i) enchantment, (ii) empathy, and (iii) intuition. Enchantment is an outcome and part of the interpretative frame of craft practice, the facilitators of which include empathy as a fundamental aspect of the craft process, unifying maker, material and user. Intuition is linked to a sense of “knowingness”, placing craft beyond reducible definitions. We will now consider each of these themes in turn.
A craftperson’s relation to the object crafted is much more intimate than that of a designer’s relation to the object designed. We will encounter this observation or claim in several places in this collection; here, it is used to argue that the craftperson “loves” the object of their labors and that this love is the reason why craft can find qualities of beauty.
One strand is particularly worth picking out: the binary opposition between the material and the optical. This line of thought closely parallels that considered in the previous chapter. Just as craft’s supplementarity makes it antithetical to modern art’s autonomy, its grounding in material specificity is oppositional to the ambition of modern art to achieve a purely visual effect. This is not to say that craft is somehow equivalent to materiality in itself (that is, the extension of matter in space). It would be better to say that craft always entails an encounter with the properties of a specific material. This could be wood, glass, metal, clay, paper, plastic, paint, stone – anything – or more than one material in combination. In any case, though, craft involves direct engagement with specific material properties. The normative idea of modern art, by contrast, involves the transcendence (which, as in the case of autonomy, is also a repression) of just this encounter.
Another recurrent observation is that craft is constituted by its material. In the context of art history, Adamson uses this observation to distinguish craft from modern art.
Over the years, we have tried to capture the particular flavour of each issue through the titles of our editorials, and highlighted by the cover images. The topics of the titles can loosely be grouped into three categories: the (changing) nature of craft, meaning making through craft and the social and cultural impact of craft.
Craft-based approaches are increasingly gathering attention in the field of HCI and design research e.g. (Benford, 2015, Buechley and Perner-Wilson, 2012, Nimkulrat, 2012, Nitsche et al., 2014, Zoran, 2016). These approaches require time-consuming constructive skill development as well as an acute sensitivity towards both physical and digital materials and their composite qualities, skills which constitute valuable tools of inquiry in areas of digital–material research (Wiberg, 2018).

Sympoietic processes, are nonlinear approaches to collaborative making and thinking, inclusive of a wide array of co-creating partners: human and nonhuman, organic as well as inorganic, physical, virtual and conceptual. Sympoietic (from ancient Greek: sym = together; poeisis = creation) thinking and making is intrinsically embedded within craft practice, which may explain – at least in part – why analog crafts has gained so much traction within HCI and interaction design research, even though they at first glance seem quite incompatible.

Craft-based, sympoietic research processes are slow and sometimes unfold over years before coming to conclusion, due to a) basic skill acquisition is slow and laborious and requires dedication and at times tenacity to master. Although in essence often comprised of rather simple hand-skills, they require the development of an acute sensitivity to the materials at hand, e.g. exactly how much tension to apply, how much pressure is needed or just how deeply to cut; b) the projects themselves take considerable time to construct; and c) sympoietic processes are unpredictable as they find their form in response to encounters with the various elements in a given environment, i.e. they may meander and move in unanticipated directions.

Craft is sympoietic.
The notion of sympoiesis refers to how creation happens in collaboration between human and nonhuman partners. Frankjaer uses the concept to characterize craft as a process of discovery where the craftsperson and her materials play the leading roles in the co-creation. The idea is closely related to Donald Schön’s famous notion of sketching as a conversation, and Frankjaer develops it in a very appealing direction in her work as well as her writing.

The slow and inquisitive nature of the sympoietic craft process, the sensitivity and attention to the qualities of the provisional outcomes, the willingness to learn from the materials… these are all strong reasons for why I think interaction design has a great deal to learn from craft.

**Sources used in excerpt**


Workmanship of the better sort is called, in an honorific way, craftsmanship. Nobody, however, is prepared to say where craftsmanship ends and ordinary manufacture begins. It is impossible to find a generally satisfactory definition for it in face of all the strange shibboleths and prejudices about it which are acrimoniously maintained. It is a word to start an argument with.

There are people who say they would like to see the last of craftsmanship because, as they conceive of it, it is essentially backward-looking and opposed to the new technology which the world must now depend on. For these people craftsmanship is at best an affair of hobbies in garden sheds; just as art is an affair of things in galleries. There are many people who see craftsmanship as the source of a valuable ingredient of civilization. There are also people who tend to believe that craftsmanship has a deep spiritual value of a somewhat mystical kind.

If I must ascribe a meaning to the word craftsmanship, I shall say as a first approximation that it means simply workmanship using any kind of technique or apparatus, in which the quality of the result is not predetermined, but depends on the judgment, dexterity and care which the maker exercises as he works. The essential idea is that the quality of the result is continually at risk during the process of making; and so I shall call this kind of workmanship “The workmanship of risk”: an uncouth phrase, but at least descriptive.

It may be mentioned in passing that in workmanship the care counts for more than the judgment and dexterity; though care may well become habitual and unconscious.

With the workmanship of risk we may contrast the workmanship of certainty, always to be found in quantity production, and found in its pure state in full automation. In workmanship of this sort the quality of the result is exactly predetermined before a single salable thing is made. In less developed forms of it the result of each operation done during production is predetermined.
David Pye, who trained as an architect and taught furniture design at the Royal College of Arts, was very skilled in wood craft. Maybe that is an important reason why his attempt to define craftsmanship has been, and continues to be, highly influential.

Pye places craft in opposition to industrial production, emphasizing that as the craftsperson is shaping the material there is always a risk of ruining the job. Whether this is due to inattention, inexperience or lack of attention, if the next cut is too deep then there is no way back, no way to redeem the crafted piece. Hence he defines craft as the “workmanship of risk.”

Industrial production, on the other hand, is a “workmanship of certainty” where a large quantity of pieces can be produced and we can be certain that each of the pieces comply with designs and specifications drawn up prior to production.

It is clear to me that these concepts capture a very powerful distinction between craft and industrial production when it comes to physical materials. However, what can we possibly learn from this when it comes to interaction design? After all, one thing that sets the digital materials apart from the physical ones is the ability to undo more or less any shaping operation. Is it even relevant for us to talk about a workmanship of risk? (These questions are addressed by other thinkers in this collection – see, for example pages 266 and 318.)
Craft ethics
So strong is the urge to make things in the fashion that Mick Casson has described that it seems likely that making will endure in the teeth of its apparent cultural or technological irrelevance. For some people the method of exploring ideas through making is the best route to understanding those ideas or responding to a class of objects that already exist. For others there is the control provided by directing their life through their work and making a living from it. These two reasons often overlap. Regardless of the status of craft or “the crafts” and regardless also of the apparent irrelevance of some crafts to mainstream culture, craft making is unlikely to disappear. It gives some individuals so much intellectual, imaginative and sensory pleasure to make things and acquire the complexities of know-how for themselves that craft making will continue, even when the Turing Test for practical thinking has been satisfied in every conceivable craft discipline.

Why do you make things?

The test that Alan Turing originally proposed in 1950 concerned the ability to tell the difference between a human and an artificial intelligence in a conversational setting. The “Turing Test for practical thinking” that Dormer talks about deals with handmade versus machine-made objects. The argument is that if it is impossible to tell among a group of objects which ones were made by hand and which by machine, then one of the foundations for the status of craft would be called into question.

However, Dormer points out that there are other reasons to make things and engage in craft practice than its status (and the commercial value of the resulting objects?). For me personally, craft is primarily a way of learning things that I cannot learn in other ways such as reading, talking or watching. This seems to hold for traditional crafting (bookbinding, in my case) as well as for tinkering in the delivery materials of interaction design.
I started working as an electrician's helper shortly before I turned fourteen. I wasn't attending school at the time and worked full-time until I was fifteen, then kept the trade up during the summers while in high school and college, with steadily increasing responsibility. When I couldn't get a job with my college degree in physics, I was glad to have something to fall back on, and went into business for myself, in Santa Barbara.

I never ceased to take pleasure in the moment, at the end of a job, when I would flip the switch. 'And there was light.' It was an experience of agency and competence. The effects of my work were visible for all to see, so my competence was real for others as well; it had a social currency. I was sometimes quieted at the sight of a gang of conduit entering a large panel in an industrial setting, bent into nestled, flowing curves, with varying offsets, that somehow all terminated in the same plane. This was a skill so far beyond my abilities that I felt I was in the presence of some genius, and the man who bent that conduit surely imagined this moment of recognition as he worked.

As a residential and light-commercial electrician, most of my work got covered up inside walls. Still, I felt pride in meeting the aesthetic demands of a workmanlike installation. Maybe another electrician would see it someday. Even if not, I felt responsible to my better self. Or rather, to the thing itself—craftsmanship has been said to consist simply in the desire to do something well, for its own sake. If the primary satisfaction is intrinsic and private in this way, there is nonetheless a sort of self-disclosing that takes place. As the philosopher Alexandre Kojève writes,

The man who works recognizes his own product in the World that has actually been transformed by his work; he recognizes himself in it, he sees in it his own human reality, in it he discovers and reveals to others the objective reality of his humanity, of the originally abstract and purely subjective idea he has of himself.

The satisfactions of manifesting oneself concretely in the world through manual competence have been known to make a man quiet and easy. They seem to relieve him of the felt need to offer chattering interpretations of himself to vindicate his worth. He can simply point: the building stands, the car now runs, the lights are on. Boasting is what a boy does, because he has no real effect in the world. But the tradesman must reckon with the infallible judgment of reality, where one's failures or shortcomings cannot be interpreted away. His well-founded self-disclosing is the fruit of a direct contact with the thing in itself.
Even though the tone can be somewhat romanticizing at times, there is clearly appeal in the idea that making things – “manifesting oneself concretely in the world” – has intrinsic value for the maker. Crawford further points to the humbling qualities of made things in that their shortcomings are also concretely manifested and cannot be explained away or disregarded.

These kinds of arguments all seem to rely on the presence of the made thing. You could argue that a bridge or a house are very present, very concretely manifested in the world, always there for all to see and use for many years to come. Interaction design, on the other hand, would seem quite ephemeral in comparison. The things we make are only present under specific circumstances, such as the device being powered up and connected correctly, or the app running on a specific software infrastructure.

Yet this is perhaps more of a difference of degree. In a specific situation of using an interaction design product, it might actually be that your world at that moment consists more of the interactive experience and less of the house you are in or the bridge outside the window. I find it quite possible to think of interaction design as manifesting concretely in the world through manual competence, and to imagine that interaction designers can draw intrinsic satisfaction from their work.

**Source used in excerpt**

It might also be said that one never sees a classic MacKenzie pot, not only because he has avoided settling into a repetitive style, but also because the ongoing experience of making is for him the real interest of craft. As he has written, “the potter does not preplan a major piece ... each work is approached as a continuum of ideas and concerns that make up the potter’s life.” MacKenzie even seems quite unconcerned about his results at times, and tells his sympathetic audience that his pots are “extraordinary objects only and precisely because they are ordinary objects.” As a demonstration of his ethos, he had a show in 1976 at the Rochester Art Center in which every ceramic object from a single kiln firing was exhibited in one group, implying that the notion of relative quality was a distraction from the unity of the process. In the catalogue, MacKenzie stated, “I don’t believe in striving to make every pot a super pot. First of all, because I don’t know what that is, and secondly because I think the best pots come almost without you expecting them.”
The example presented here seems more like an artist than a craftsmen in the traditional sense, perhaps, but it still conveys a strong sense of the intrinsic and holistic value of making things.
This stretch-out occurred in two phases. First, she lost awareness of her body making contact with the hot glass and became all-absorbed in the physical material as the end in itself: “My awareness of the blowpipe’s weight in my palm receded and in its stead advanced the sensation of the ledge’s edge at the blowpipe’s midpoint followed by the weight of the gathering glass on the blowpipe’s tip, and finally the gather towards a goblet.” (O’Connor, 2005) The philosopher Maurice Merleau-Ponty (1945/1962) describes what she experienced as “being as a thing.” The philosopher Michael Polanyi (1962) calls it “focal awareness” and recurs to the act of hammering a nail: “When we bring down the hammer we do not feel that its handle has struck our palm but that its head has struck the nail. ... I have a subsidiary awareness of the feeling in the palm of my hand which is merged into my focal awareness of driving the nail.” If I may put this yet another way, we are now absorbed in something, no longer self-aware, even of our bodily self. We have become the thing on which we are working.
The experience of losing track of time and place while engaging deeply in an activity is familiar to many of us, and I think quite generally perceived as a pleasant one. Common points of reference in the interaction design community would be Csikszentmihalyi’s concept of flow, or perhaps mindfulness or somaesthetics.

The value of being absorbed is by no means limited to physical-material hand work such as glassblowing and other traditional crafts. Again, it would seem that the difference between physical and digital materials can be one of degree rather than one of kind.

**Sources used in excerpt**


“Craftsmanship” may suggest a way of life that waned with the advent of industrial society – but this is misleading. Craftsmanship names an enduring, basic human impulse, the desire to do a job well for its own sake. Craftsmanship cuts a far wider swath than skilled manual labor; it serves the computer programmer, the doctor, and the artist; parenting improves when it is practiced as a skilled craft, as does citizenship. In all these domains, craftsmanship focuses on objective standards, on the thing in itself. Social and economic conditions, however, often stand in the way of the craftsman’s discipline and commitment: schools may fail to provide the tools to do good work, and workplaces may not truly value the aspiration for quality. And though craftsmanship can reward an individual with a sense of pride in work, this reward is not simple. The craftsman often faces conflicting objective standards of excellence; the desire to do something well for its own sake can be impaired by competitive pressure, by frustration, or by obsession.
Is it the case that Sennett is focusing on one specific value or driving force of craft and craftsmanship here, and uses it to define the whole concept unusually broadly? I think he might be.
What do we mean by good-quality work? One answer is how something should be done, the other is getting it to work. This is a difference between correctness and functionality. Ideally, there should be no conflict; in the real world, there is. Often we subscribe to a standard of correctness that is rarely if ever reached. We might alternatively work according to a standard of what is possible, just good enough – but this can also be a recipe for frustration. The desire to do good work is seldom satisfied by just getting by.
My synthesizer had forty-five knobs and a joystick. Rather than matrix pins it used wires and plugs to set up sounds in a poor man's version of the Moog patching system. It even had a rudimentary sequencer that allowed me to program six different sounds in succession which would repeat endlessly. The transistors were always burning out – but repairing it was almost as much fun as playing it. I soon recognized the smell of different burning transistors and could almost feel which component was on its way out. I used an old organ keyboard that I had wired up with resistors to control the sound. The organ keyboard was impossible to tune so I abandoned tuning altogether and found that it was more interesting playing in my own invented scales or nonscales. I had a two-track tape recorder – the plan was to make my own electronic music by laboriously recording one sound at a time.

As time passed our communal living dissolved. The synthesizer moved with me to my garret apartment. Some nights I couldn’t get anything interesting out of the synthesizer and then there were those magical nights when it seemed every new sound was a source of inspiration. I pictured the sounds coming out of the ether, like the radio stations I had listened to. A tiny movement of a wire or knob could make a huge difference. Filters were imperfect and the stray capacitance from my hand changed things. The reverb unit – built around a real spring – made interesting sounds if I shook its case. Broken modules were sometimes sources of frustration, but with experimentation I found they could produce even more interesting sounds. Wires straddled my synthesizer as each new botch and fix started to take on a life of its own. Closer and closer I got to the essence of electronic sound – no longer interested in making tapes, I just wanted to experience new sounds, to find the elusive combination of timbres that would enable transcendence. I escaped into my own world of sound. Was it music? I no longer cared. At last I started to experience what Lindsay must have felt – I was living with a machine and it was becoming part of me.
Pinch tells the story of how he went from trying to create and record music on an old analog synthesizer, to engaging more and more deeply with the components of the synthesizer and their fundamental sound-generating properties. I read it as an illustration of going from the external motivations of design – making something for someone – to the intrinsic motivations of craft – exploring the material to find out what it can do. The quote “Was it music? I no longer cared” sums up this transition rather beautifully.
In similar fashion Tempte describes his reconstruction of Tut’s chair, where he talks of a huge “emotional drain.” “Tut’s chair” was fashioned by an Egyptian carpenter for the Pharaoh Tutankhamen more than 3,000 years ago. This was the chair Thomas Tempte reconstructed. He worked to a great extent with reproductions, mainly of tools. This is the context in which he says: “Tools which work well and effectively generate a sense of fulfilment and pleasure in the work and promote the desire to do the job. But they also bear witness to the wisdom and i
Tut’s
Egyptian

temple
enlightenment

Tempte on the ethics of craft

“pure”

Tempte contrasts the intellectuality of practical work with “pure” intellectualism which he repudiates but says little about. He does, however, mention that the (then) new Swedish secondary school curriculum, for example, results in “trainees whose skills are acquired at the schooldesk rather than the workbench.” This could perhaps be described as an intellectuality characterised by a firm belief in the power of the word.

Tempte refers not only to the intellectuality of practical work, but also to “the practical intellect,” which is a creative and imaginative intellect – at work creatively and imaginatively throughout the whole process from an (internal) image of the desired result, through production right up until the finished product.

Tempte says that theoretical knowledge is always changeable and uncertain. Practical knowledge is said, on the other hand, to be definitive and tangible. Here we find a key area of tension and one which is difficult to gain access to. If we can get a grasp of this tension, or polarity, we will have made considerable progress along the road to a theory of practical knowledge.

What is “definitive,” final in action, has to be compatible with a fallibilistic position, i.e. the point of view that in every case we may always be mistaken in believing that we possess knowledge. We can be mistaken, or make a mistake, even when
Thomas Tempte is a cabinet maker who has written about craft and its practical knowing. The point he makes here relates closely to how Crawford talks about the definitive and irrevocable nature of making things (see p. 46).

**Sources used in excerpt**


Despite its diminutive size, it is a particularly pleasant room. There are few jobs in which years’ worth of labour can be viewed in a quick scan of four walls and even fewer opportunities granted to gather all our intelligence and sensitivity in a single place. Our exertions generally find no enduring physical correlatives. We are diluted in gigantic intangible collective projects, which leave us wondering what we did last year and, more profoundly, where we have gone and quite what we have amounted to. We confront our lost energies in the pathos of the retirement party.

How different everything is for the craftsman who transforms a part of the world with his own hands, who can see his work as emanating from his being and can step back at the end of a day and point to an object – whether a square of canvas, a chair or a clay jug – and see it as a stable repository of his skills and an accurate record of his years, and hence feel collected together in one place, rather than strung out across projects which long ago evaporated into nothing one could hold or see.
My argument in this chapter has been that in the same way, too, the potter’s feeling flows in and out in a correspondence with the clay, the herdsman’s in correspondence with the airborne rope, the flyer’s running with the wind, and the cellist’s bowing with musical sound. Even the Musselled Moore develops a feeling for the waters of Lake Ontario. To correspond with the world, in short, is not to describe it, or to represent it, but to answer to it. Thanks to the mediating work of transduction, it is to mix the movements of one’s own sentient awareness with the flows and currents of animate life. Such mixture, where sentience and materials twine around one another on their double thread until – like lovers’ eye-beams – they become indistinguishable, is of the essence of making.

*Ingold, 2013, p. 108.*
The topic of repair intersects prevailing HCI agendas on tools and system development on the one hand and the reflexive turn to traditional craft on the other. HCI/STS scholar Jackson and his colleagues sees repair as “acts of care” where in sociotechnical systems are maintained and transformed, human values undergo changes, and a complex combination of “organizations, systems and lives” emerges (Jackson, 2014, p. 231). According to Jackson, the ethos of care undergirding repair is embroiled in the consistent work of sustaining media objects, systems and technologies. Care exists as a way to alter, appropriate, and subvert. Moreover, it reveals the more-than-instrumental relationships between human and non-humans and makes important the maintenance of such attachments. In other words, maintenance work not only revolves in the realm of repairing material goods and infrastructures, but also the social world we live in (p. 222-23).
In my experience, the ethos of care is relevant not only to repair, which seems rather obvious, but also to use and daily upkeep. There seem to be some people who use interactive digital things more carefully than others. Allowing the operating system to complete its starting procedures before starting to push buttons and launch apps, cleaning out and purging trash, uninstalling unnecessary components to help performance, doing updates when the system asks for them, ... all of this suggests a level of “respect” for the thing and its complexity that I somehow connect with a craft mentality.

**Source used in excerpt**

Most importantly for my purposes, Frampton shows how profitable it can be to think about craft skill in the most general of terms, as Dewey and Albers conceived it: not as a discrete set of techniques, but as a way of being within society. His mobilization of materialist analysis in the service of cultural critique is strongly reminiscent of the perceptions that Michael Baxandall found in the lineaments of limewood. Frampton reminds us that through the mechanism of skill, the builder (like the carver) engages with the internal forces of material; these, in turn, provide a set of constraints that test and shape the building. In the process, the material becomes the cultural. He also encourages us to think about craft broadly, in a way that both respects the qualities of particular disciplines (like architecture) and transcends their self-assigned limits. It is a set of ideas that seem overdue. What Baxandall was able to do for sixteenth-century woodcarvers, after all, we ought to be able to do for ourselves.
SOURCE USED IN THE EXCERPT

Loos vs Wittgenstein as architects

Sennett, 2009, p. 262.

The good craftsman understands the importance of the sketch – that is, not knowing quite what you are about when you begin…

The good craftsman places positive value on contingency and constraint…

The good craftsman needs to avoid pursuing a problem relentlessly to the point that it becomes perfectly self-contained; …

The good craftsman avoids perfectionism that can degrade into a self-conscious demonstration – at this point the maker is bent on showing more what he or she can do than what the object does…

The good craftsman learns when it is time to stop.
Sennett tells the story of two houses being designed and built in Vienna in the 1920s, one by the philosopher Ludvig Wittgenstein for his sister and one by the professional architect Adolf Loos (of *Ornament and Crime* fame).

Wittgenstein's house design was strongly inspired by the work of Loos and the concept of Neue Sachlichkeit, a “new objectivity”, but according to Sennett he was very unhappy with the results in spite of spending enormous amounts of money and effort on it. Sennett describes it as a case of cramped obsession, with every part painstakingly detailed and proportioned but the overall result lacking a sense of wholeness. The house by Loos, on the other hand, is playful and inviting in terms of its exterior as well as its internal dynamic space.

Loos, the experienced professional, worked in a continuous and explorative conversation with form, material and the site. Wittgenstein, on the other hand, tried to anticipate the house in detailed blueprints implementing formal design rules.
Notes on play in craftsmanship


On play: pp. 270–271 lay out the history from Huizinga (“when utility rules, adults lose something essential in the capacity to think; they lose the free curiosity that occurs in the open, felt-fingering space of play”) to Geertz (“deep play” and formal gravity in ceremonies, “making up and acting out rules endures throughout the human life cycle”) to Erik Erikson (“Play may be a field of infantile sexuality, but … Erikson asserted that it is also technical work on material objects.”)
SOURCES USED IN EXCERPT


Many of craftsmanship’s themes appear in Dewey’s writings in a more abstract form: the intimate relations between problem solving and problem finding, technique and expression, play and work. Dewey the socialist best assembled these connections in the book *Democracy and Education*: “Both work and play are equally free and intrinsically motivated, apart from false economic conditions which tend to make play into idle excitement for the well to do, and work into uncongenial labor for the poor. Work is psychologically simply an activity which consciously includes regard for the consequences as part of itself; it becomes constrained labor when the consequences are outside of the activity, as an end to which the activity is merely a means. Work which remains permeated with the play attitude is art.”
SOURCE USED IN EXCERPT

Knowledge in action can be improved in many different ways in terms both of orientation and control, separately and in concert. Through training and experimentation, one can learn to improve one’s mastery of various aspects of reality. In many contexts, an advanced theoretical form of instrumental knowledge is required. Skilful action requires an overview and the ability to see beneath the surface. One needs to be able to weigh and evaluate various possible strategies and goals. And so on. And so on. No type of knowledge is excluded. However, these forms of knowledge only take on significance for action – and, hence, become candidates for knowledge in action – to the extent that they orient action, become action-orienting; which may also be expressed in the following way: only to the extent they can coalesce with reasons for action, can they be moulded and become reasons in action. “Purely theoretical knowledge” has no relevance in this context, since the “element of application” is missing which can turn something into a reason in action. Knowledge in action cannot be separated from the acting subject.
I have referred in this book to “tacit knowledge” and made use of compound terms such as propositional knowledge and knowledge of familiarity. I have used the word “knowledge” on many occasions, but only rarely referred to ignorance and lack of knowledge. The terms “tacit knowledge,” “professional knowledge” and “knowledge in action” are not, however, solely to do with knowledge itself, and it is this which forms the theme of this section.

We could just as well, or perhaps even better, refer to “tacit knowledge” by other terms such as: understanding, skill, assurance, mastery (of an art), judgment, talent, attentiveness, familiarity, experience, personal commitment…

Understanding (mastery, judgments) covers both a “body of knowledge,” which may well be scientific, and an understanding of the point or ethos of an activity or occupation. However, what is at stake is this understanding in use, not a particular articulation or description of it. We focus therefore on the action-oriented aspects:

Within an occupation or profession it is essential that the right thing is done at the right time, which amounts to rather more than possessing a number of special skills. It is important to know (understand, realise, be sure of…) which tasks one is competent to perform and which one is not. One has to be able to rely on one’s knowledge and one’s experience but at the same time to “know” their limits; one has to be able to shift perspective – this is a matter of insight, attentiveness and, above all, ethics.

A lack of self-confidence forms a barrier to acquiring knowledge and an obstacle to allowing the knowledge one has to be put to use, “you can do more than you know.” In order to carry out a task in the best way, a level of personal commitment is required – which may, of course, be different for different activities – this is a question of disposition (attitude, inclination, etc.), which is clearly not knowledge but is necessary to make – and keep – knowledge alive when dealing with reality.

On the other hand: too much self-confidence can stop...
An important driving force of craft is the exploration of possibilities by tinkering with materials and forms, and paying attention to the insights that present themselves. Molander’s analysis is focusing on what is required for such exploration: to know what you are capable of doing, and to have the confidence to go beyond what you are currently capable of.
“True creative work,” Gropius wrote, “can be done only by the man whose knowledge and mastery of the physical laws of statics, dynamics, optics, acoustics equip him to give life and shape to his inner vision. In a work of art the laws of the physical world, the intellectual world and the world of spirit function and are expressed simultaneously.” The physical qualities of material and the constraints of use, both held to be objectively verifiable, were used as parameters (or in Gropius’s words, “pre-ordained limits”) within which artistic practice could flourish. The workshop was a “laboratory” for the creation of “type-forms” according the “theoretical and formal laws.”

Gropius’s ideas about craft skill had much in common with Dewey’s. Both resisted the hierarchical division of fine and useful arts, and saw artistic potential in all modes of technological production. Like Gropius, Dewey had specifically attacked the artist who “attempts to engage in self-expression that is isolated and without reference to the context out of which inquiry into materials arises.” He argued that technique applied through materials gives access to a universal whole. However, there were important differences as well. Though both men were politically to the left, Dewey gradually came to side with those who hoped to erect a barrier between vocational education and industrial training, out of a fear that children would be taught craft skills only to serve more effectively as factory workers. Gropius’s objectives were no less politically motivated – he hoped that craft would serve as the basis for a democratic, mass-produced modernism – but he remained steadfastly instrumentalist.
Sources used in excerpt


For even if workmanship is really nothing more than an actualization of a pre-existing idea, it is still an investment. This is obviously true in the sense that craft costs money, and so wherever it manifests itself, a cultural observer should be ready to look for the interests involved. (In this sense, skill might be seen as a form of rhetoric.) Less obviously, it should be pointed out that craft skill never comes for free; it must be learned. Indeed, in a sense, skill is something that seems noteworthy only from the position of the unskilled. The skilled practitioner takes skill for granted. It is only during the difficult process of acquiring a particular skill that skill as such emerges.

As Peter Dormer put it in his own book-length study on the subject of craft knowledge, “The constitutive rules of a craft are only learned by actually doing the activity. Indeed, they are the activity.” If the conscious experience of skill is intrinsically transitional, however—a matter of coming to grips with technique, rather than applying a technique that has already been mastered—then Pye’s view of skill as a form of constraint must be modified. This is not to invalidate his point about the fundamentally restrictive quality of skill, but rather to insist on the incompleteness of that account. The experience of craft, precisely because it is hard won, is always a revelation. Moreover, this experience always takes place within a specific cultural context. Hitting a nail with a hammer may be an identical action no matter when and where it occurs, but both the experience and the motivations involved in the hammering are always historically contingent.
Sources used in excerpt


Craftsmen take pride most in skills that mature. This is why simple imitation is not a sustaining satisfaction; the skill has to evolve. The slowness of craft time serves as a source of satisfaction; practice beds in, making the skill one’s own. Slow craft time also enables the work of reflection and imagination – which the push for quick results cannot. Mature means long; one takes lasting ownership of the skill.

... [taking pride in making the atom bomb] ...

Pragmatism has no great solution to the ethical problem posed by pride in one’s work, but it does have a partial corrective. This is to emphasize the connection between means and ends.

... Pragmatism wants to emphasize the value of asking ethical questions during the work process; it contests after-the-fact ethics, ethical enquiry beginning only after the facts on the ground are fixed.

It is for this reason that I have emphasized, throughout this book, stages and sequences of the work process, indicating when the craftsman can pause in the work and reflect on what he or she is doing. These pauses need not diminish pride in the work; instead, because the person is judging while doing, the result can be more ethically satisfying. ... [T]his effort to look forward is the ethical way to take pride in one’s work.

So there is an aspect of inquiry that hovers about our practical activities, which may or may not be brought to full awareness and issue in careful reflection. Following Aristotle, Brewer connects this aspect of inquiry to our experience of pleasure, the kind we get when we become absorbed in what we are doing (like Comaneci on the balance beam). He writes that there is an “appreciative discernment of value that accompanies and carries forward intrinsically valuable activity.”


There is a classic psychology experiment that seems to confirm Brewer’s point. Children who enjoy drawing were given marker pens and allowed to go at it. Some were rewarded for drawing (they were given a certificate with a gold seal and a ribbon, and told ahead of time about this arrangement), whereas for others the issue of rewards was never raised. Weeks later, those who had been rewarded took less interest in drawing, and their drawings were judged to be lower in quality, whereas those who had not been rewarded continued to enjoy the activity and produced higher-quality drawings. The hypothesis is that the child begins to attribute his interest, which previously needed no justification, to the external reward, and this has the effect of reducing his intrinsic interest in it. That is, an external reward can affect one’s interpretation of one’s own motivation, an interpretation that comes to be self-fulfilling. A similar effect may account for the familiar fact that when someone turns his hobby into a business, he often loses pleasure in it. Likewise, the intellectual who pursues an academic career gets professionalized, and this may lead him to stop thinking.
When does a job feel meaningful? Whenever it allows us to generate delight or reduce suffering in others. Though we are often taught to think of ourselves as inherently selfish, the longing to act meaningfully in our work seems just as stubborn a part of our make-up as our appetite for status or money. It is because we are meaning-focused animals rather than simply materialistic ones that we can reasonably contemplate surrendering security for a career helping to bring drinking water to rural Malawi or might quit a job in consumer goods for one in cardiac nursing, aware that when it comes to improving the human condition a well-controlled defibrillator has the edge over even the finest biscuit.

But we should be wary of restricting the idea of meaningful work too tightly, of focusing only on the doctors, the nuns of Kolkata or the Old Masters. There can be less exalted ways to contribute to the furtherance of the collective good and it seems that making a perfectly formed stripey chocolate circle which helps to fill an impatient stomach in the long morning hours between nine o’clock and noon may deserve its own secure, if microscopic, place in the pantheon of innovations designed to alleviate the burdens of existence.

The real issue is not whether baking biscuits is meaningful, but the extent to which the activity can seem to be so after it has been continuously stretched and subdivided across five thousand lives and half a dozen different manufacturing sites. An endeavour endowed with meaning may appear meaningful only when it proceeds briskly in the hands of a restricted number of actors and therefore where particular workers can make an imaginative connection between what they have done with their working days and their impact upon others. It is surely significant that the adults who feature in children’s books are rarely, if ever, Regional Sales Managers or Building...
It is often said that the defining characteristic of design is that of being in service. (See, for example, *The design way: Intentional change in an unpredictable world* by Nelson and Stolterman, 2012.) This is a kind of external motivation that feels intuitively appealing; it is easy to see how a task feels meaningful if it does good for others. Craft and design are probably not much different in that regard.
But all this is perhaps too categorical. For in fact, there are people who enjoy their work. You can earn money at something without the money, or what it buys, being the focus of your day. a job has to have room for progress in excellence. In the best cases, I believe the room means that it points to, or serves, some more comprehensive understanding of the good life.

I like to fix motorcycles more than I like to wire houses (even though I could make about twice as much money wiring houses). Both practices have internal goods that engage my attention, but fixing bikes is more meaningful because not only the fixing but also the riding of motorcycles answers to certain intuitions I have about human excellence...

I try to be a good motorcycle mechanic. This effort connects me to others, in particular to those who exemplify good motorcycling, because it is they who can best judge how well I have realized the functional goods I am aiming at. I wouldn’t even know what those goods are if I didn’t spend time with people who ride at a much higher level than I, and are therefore more discerning of what is good in a motorcycle. So my work situates me in a particular community.

My point, finally, isn’t to recommend motorcycling in particular, nor to idealize the life of a mechanic. It is rather to suggest that if we follow the traces of our own actions to their source, they intimate some understanding of the good life. This understanding may be hard to articulate; bringing it more fully into view is the task of moral inquiry. Such inquiry may be helped along by practical activities in company with others, a sort of conversation in deed. In this conversation lies the potential of work to bring some measure of coherence to our lives.
When we talk about external motivations of the being-in-service kind, craft is situated in communities of making and use. An interesting feature of those communities is that conversation happens in deed more than in words. In Crawford’s example, the backbone of the conversation consists of making changes and adjustments to a motorcycle, and then riding that motorcycle in advanced and demanding ways.
This social aspect is also beautifully expressed by Betsy Greer, who writes in her book Knitting for Good: “I began to understand that there are benefits to knitting with others beyond just teaching them something new and then setting them free. We can have conversations that unfold just like the knitting itself. Instead of only speaking for a minute in passing, when you are knitting with someone else, you have a chance to see where a conversation takes you without having to rush. Just as your knitting has a rhythm, so do the conversations you engage in while you work. The ease of conversation prompted by craft helps us connect with others beyond our own racial, economic, or social backgrounds, allowing everyone involved to learn about someone new and foster a sense of belonging.” (Greer 2008, p. 54-55).

So the rhythm of repetitions in practicing a craft serves to develop material consciousness and tacit knowledge, but also as a tool for conversation and reflection which can only occur in a social context. An important place to practice and proliferate crafts has always been the workshop. Throughout history master craftsmen have shared secrets of the trade with their apprentices in the workshop (Sennett 2008, p.64-65, 73-75). The relation between a master and his or her apprentices is important, but the service of proliferating craftsmanship is not only delivered from master to apprentice. The interactions between apprentices are also a key part, as they help and challenge each other and may compete or share in order to advance. Everyone in the workshop plays a role in the transferal of knowledge and for this being both receptive and willing to share is necessary. Keeping things to yourself is counterproductive. By sharing expertise, the body of knowledge remains in motion, helping both the craft and the people practicing it develop. We call this social construction of craftsmanship a “social fabric.”
Baggerman et al. identify the social context of craft as the workshop, and elaborate on the communication, learning and sociality that happens there. The arguments are very familiar to anyone with experience of a design studio, in professional practice as well as in educational settings.

However, there is one aspect that needs to be considered specifically in the context of interaction design. The traditional craft workshop, as well as the traditional design studio, are characterized by material practices. When a thing is made in a workshop or studio, the making as well as the outcome are fully observable and in a sense contribute to an ongoing, nonverbal conversation among the colleagues sharing the space. Much of the making involved in interaction design lacks this observability – colleagues sitting in front of their computers look, sound and move pretty much the same way whatever they may be working on. One tentative conclusion might be that interaction designers need to make specific efforts to sustain the nonverbal conversation that happens for free in traditional, co-located material making practices.

**Sources used in excerpt**


I believe the question of whether work is 'alienated' or not may be understood in terms of the kind of perception it affords. Marx held that it is through work that we realize our 'species character,' and this consists in our being both rational and social beings. For him it follows that we get alienated from ourselves when the product of our work is appropriated, since that product is a concrete manifestation of one's own most human possibilities. The workers product is 'torn away' from him, and Marx suggests that it becomes an alien thing, hateful to him, because it is used by another. But why should this be? I find Marx unconvincing on this point. If I am a furniture builder, for example, what am I going to do with a hundred chairs? After all, I want to see them in use; this completes my activity of making them, and gives it social reality. It makes me feel I have something real and valuable to contribute to my community. Talbot Brewer, the philosopher, has pointed out how direct perception of use is necessary for consciousness of the product as cultural.

It is clear that some of the world's most beautiful and functional objects are so foreign to us that we can barely comprehend them. Take, for example, that quilt from China which is being used in the U.S. It is one thing for the Chinese factory worker to know that somewhere in the U.S. hinterlands, the vernacular rural American quilt that she has stitched together is being used, and that it has some culturally specific significance to the person using it, which she can barely comprehend. It is another thing for a carpenter to walk around a town and see the new entryway he designed and built for that store, to learn from a direct experience and from chatting with others of its functional and aesthetic achievements and shortcomings, and to modify future work in accordance with this running feedback that is picked up in the course of daily activities. There are, of course, a world of possibilities between these two extremes. One might read Marx as having gestured, at least, towards the plausible thought that the nearer one is to the carpenter's end of the continuum, the less alienated one is from one's own work. When the maker's (or fixers) activity is immediately situated within a community of use, it can be enlivened by this kind of direct perception. Then the social character of his work is separate from its internal or "engineering" standards; the work is improved through relationships with others. It may even be the case that what those standards are, what perfection consists of, is something that comes to light only through these iterated exchanges with others who use the product, as well as other craftsmen in the same trade. Through work that has this social character, some shared conception of the good is lit up, and becomes concrete.
Another elaboration of the community of makers, made things, and people engaging with the things that constitutes craft. The argument of a community of use is similar to de Botton’s biscuits (p. 86).
Before we analyze our five themes, we will discuss a fundamental commonality: people working in all of the areas we surveyed shared an enjoyment of the process of making and an affection for the outcome of their labor. “I love sewing. It’s a creative and inspiring experience because you can take a simple piece of cloth and turn it into something extraordinary” [S6 (sewer #6)]. “A feeling of contentment comes when I complete a carving” [C3 (carver #3)]. “I enjoy the satisfaction of creating something and the process of putting things together” [E9 (electronics maker #9)]. “I love the feeling when I’m drawing” [P10 (painter #10)].

Yet the experience of building was not uniformly positive. People across domains also wrote about negative aspects of their practices. The most common comments involved the amount of time required to do things and a feeling of frustration or stress. “(Painting) is a very drawn-out process that can be frustrating” [P2]. “For me, the experience of sewing is a frustrating one. It takes a long time and a lot of practice” [S3]. These comments align well with research on the nature of creative experiences – both its joys and challenges. It is widely known that productive work can provide people with pleasure and fulfillment [Ross et al. 2010; Papert 1980]. Yet the pleasure derived from a constructive activity relates to a matching of the activity’s challenge and its reward [Csikszentmihalyi 2008].
Unsurprisingly, it seems that the craftspeople interviewed by Buechley and Perner-Wilson find pleasure in craft practices and that part of the attraction lies in the inherent difficulties. It can be powerful motivation to face the challenges to the hand and the mind that craft materials and techniques sometimes pose, devote the time and effort required, and finally succeed.

**Sources used in excerpt**


In craft, a powerful motivation is essential. To gain control over a chosen medium, a student must persist in the face of many doubts and failures. A potter must become proficient in throwing and handbuilding, as well as learn about different clay bodies, glazes, firing practices and kilnbuilding. Much of this learning comes with frequent frustrations – every potter has stories of kiln-loads lost and glazes gone bad. And so it is with jewellery-making, weaving, glassblowing, and all the rest of the craft disciplines: one must serve a long apprenticeship to the material and its processes. It takes four to six years before a craft practitioner has enough experience to function as a professional or a teacher, and even then the learning never stops. The first intuitive glimmer of recognition matures into an investment in one’s own life, but gaining this maturity demands an unwavering motivation. It should come as no surprise, then, that many craftsmen develop an unshakeable loyalty to their medium.

Most Western crafts practitioners follow the same trajectory. They first felt their bodily intelligence awaken upon contact with the clay, wood, fabric, glass or metal; they were moved to endure the long training; they developed an abiding love for their work. Such shared experiences lead directly to a shared value-system in which handwork, technical mastery, and passion in one’s labour are all unstated but deeply meaningful. These three values have helped shape a new culture of craft.
Are there then skills that allow people to dwell, and productively dwell, in frustration? Three skills stand out. The first draws on the reformatting that can inaugurate a leap of imagination. [...] The second response to resistance concerns patience. [...] From which follows a third skill in working with resistance that I am somewhat embarrassed to state baldly: identify with the resistance... The identification a good craftsman practices is selective, that of finding the most forgiving element in a difficult situation.
Craft aesthetics
Beauty, in our view, is not found by design, rather it is discovered through craft in the fullest sense of the term. Beauty is in the making of it, through engagement with material and process and through craft's sensibility and sensitivities. Craft finds beauty and design puts that beauty to work.
Even though the phrase (“craft finds beauty and design puts that beauty to work”) might be a touch too cute, I still think it carries an important reminder. Crafting, as in explorative making in attentive dialogue with the material, provides opportunities to discover aesthetic possibilities of form and function that may later prove useful and effective in a design situation. In other words, designers might benefit from practicing and studying craft in the materials pertinent to their design fields.
The pastoral framing of craft

Despite Emerson’s attempts to rehabilitate it, however, pastoral has always occupied the lowest rung on the ladder of literary modes. It has often been said that the pastoral mode wins its reflective qualities only at the price of an inability to deal concretely with cultural reality, as the authors take refuge from complex cultural problems in evocations of an imagined, simpler realm. And it is striking how completely craft exemplifies both the positive and negative aspects of pastoral: its double structure—in which making a chair or pot is valued not only in itself but also as a symbolic gesture about the value of lifestyle, integrity and so forth—but also its tendency towards sentimental escapism. Both aspects of the pastoral lie at the heart of the history and the mythology of the craft movement.

The summer schools just mentioned, places like Haystack in Maine or West Dean in Sussex, are obvious examples. Sited at a conspicuous remove from cities, they are places where one encounters vernacular architecture, natural food, and fund-raising events that recall a livestock auction at a country fair. Yet despite their seeming purity and innocence, summer crafts schools are highly self-conscious and purposefully constructed places. They are the direct descendants of such reformist enterprises as the Byrdcliffe colony in Woodstock and Dartington Hall in Devon, sites that were organized by wealthy benefactors for the purpose of idealistic social experimentation. From William Morris’s rural retreat Kelmscott Manor to Sam Maloof’s woodworking studio in an Alta Loma lemon grove, the pastoral stance has animated many of the sacred sites of the craft movement. It would not be too much to say that the ambitions and limitations of craft as a cultural force cannot be sufficiently described without using the self-reflective language of an imaginary future.
Adamson considers the pastoral narrative to be one of the defining characteristics of (traditional) craft. One could ask whether fab labs and maker movements represent the contemporary pastoral narrative of interaction design. Some of the notes in the later parts of this compilation might give that impression, at least.
After establishing his pastoral credentials, Carpenter launches immediately into a withering dismissal of “artiture,” an apparent contraction of “art furniture,” or perhaps “arty furniture,” and everything it stands for. “Some woodworkers seem to be going ... toward fame by investigating material and form to the exclusion of function,” he writes. “My daughter Victoria calls this work ‘artiture,’ artifacts that have the traditional form of furniture, but are not of any practical use.” It is worth noting that Carpenter attributes the neologism to his daughter, dodging authorship of the most contentious, critical, and thus altogether un-pastoral term in the essay. Otherwise, his opinion of artiture seems identical with the conservative stance that we have already encountered in the figure of Richard LaTrobe-Bateman. “I am not sure what the impulse is for making much of the artiture I saw, whether it is for play, pun, farce, or a quick ego fix,” Carpenter writes. “But to cut a chair in half, paint it striped, and hang it on a wall draws much more attention, brings ten times the money, and is much easier than making a chair that works, and that sings with the care of its maker.” So much for artiture, the reader thinks. Reading on, however, one becomes increasingly aware that it’s not as cut-and-dried as Carpenter has indicated it might be. Similarly, when Carpenter encounters Wendy Maruyama’s tall-backed chair Mickey Mackintosh, he at first professes disappointment in its obvious suggestion of Mickey Mouse’s ears. But when Carpenter later discovers that the chair was intended by the artist as a perverse combination of Walt Disney and Charles Rennie Mackintosh, he finds himself delighted: “I don’t know whether Maruyama sees it this way, but artiture when it teases the seriousness of furniture, even gratuitously, does service.” In saying so, even in his self-consciously abashed way (of course, Remme Mackintosh, the reader thinks) Carpenter was among the earliest writers looking at studio craft to pick up on this cleansing effect of the satirical aspects of postmodernism. Carpenter’s essay today seems somewhat behind the times—particularly in its narrow focus on questions of functionality—and its context in a how-to woodworking magazine is humble indeed. Yet it is nonetheless a model of the productive ambiguity of craft as pastoral. Just as Leider is ultimately left in agonized conflict by his attraction to Canyon, Carpenter leaves the reader without a clear sense of his opinion of artiture—except that perhaps he himself is unsure of its relevance.
Carpenter is a furniture maker whose work combining formal sophistication with a rustic, honest lack of pretense inspired many neo-pastoral craftspeople and designers from the late 1960s and onwards. He coined the term “artiture” (for “art furniture”, or perhaps “arty furniture”) to refer to gallery-centered work lacking practical use and function. As Adamson points out, the main takeaway of Carpenter’s essay is his mixed feelings about the artiture objects being exhibited, and, more generally, the productive ambiguity of craft as pastoral.

**SOURCE USED IN EXCERPT**

I should add, in closing, that this book has been written partly in a spirit of instigation. I have mostly discussed the relation of craft to the avant garde, and have devoted comparatively little attention to "traditional" craftspeople who occupy a proudly conservative position. This is because, frankly, I do not think that all craft demands critical analysis. A modern object that ticks all the craft boxes – an object that simply is supplemental, material, skilled, pastoral, and amateur – may be fascinating from the perspective of a historian, but it does not necessarily present an interesting case for theoretical discourse. So, when a maker insists that the best way to understand their object is to use it, I am sometimes inclined to agree. My two most prized possessions are a Warren MacKenzie bowl and an Art Carpenter Wishbone chair. I wrote much of this book sitting in the latter, only a few feet from the former, and looking at both in the idle moments between sentences. I would hotly dispute any claim that either of these objects is culturally insignificant, aesthetically unsatisfying, or otherwise valueless. The histories of such objects, and the people that made them, are long overdue. They should be written with as much sensitivity and care as craft historians can summon. On the other hand, to write those histories accurately, we must concede that they occupy a safe position in the landscape of the visual arts – a lagoon, perhaps. We should all be glad for the availability of such an option, but that feeling should not necessarily make us feel compelled to "interpretation" per se. For the historian, theorist or critic who is interested in the problem of craft, the challenge is not to subject every crafted object to an equivalent degree of analysis, but rather to identify and justice to the reality of craft’s position within modern culture. Above all, this means resisting the impulse unthinkingly to celebrate craft in all its manifestations. Thinking through craft is a useful exercise.
For an art historian like Adamson, it might be worth stating explicitly that not all craft objects present interesting cases for theoretical discourse. From a more designerly point of view, it seems rather straightforward that craft and design objects are primarily made for use and also best understood in use.
The aesthetics of mass products is too narrowly conceived if it is focused only on visual qualities. This would be to misunderstand how it is used, for products are then treated in effect as artworks, which are usually looked at rather than touched. The word ‘design,’ too, invites associations with art rather than with useful things (cf. Muller 2001, 145). I shall devote the rest of this chapter to a much broader conception of this aesthetics. When conceived as pertaining to the realm of the sensual and not only to the realm of the beautiful, the aesthetics of objects of use is potentially richer than that of many artworks. The sensory relations that are possible in the case of useful objects reach beyond the visual, for such things are meant to be used rather than just looked at. The aesthetics of products concerns the practical dealings with them and involves their bodily presence, rather than just what they look like or signify, or how they are to be interpreted or read. Linking aesthetics to practical dealings with things makes it possible to draw a direct connection with the analysis of technological mediation developed in the previous chapters, which made clear that mediation occurs on the basis of practical dealings with things. When things are used, people take up a relation to the world that these things, thanks to their “handiness,” coshape. In this coshaping, not only does the human interaction with products have a sensory character, so does the human-world relation that is mediated by the products. Human experience and existence can only acquire a specific shape on the basis of sensory perception and sensory dealings with the world.

Industrial design is occupied with the aesthetics of products. By extending the domain of aesthetics to include the sensorial in the broadest sense, therefore, it becomes possible to give the notion of mediation an explicit place in the industrial design process.
Here is another take on the insight that the aesthetics of craft and design objects are constituted in use rather than through visual analysis, this time from a post-phenomenological philosopher.
Craft quality is other than efficiency

Garnett, 1933, p. 97.

Let it be granted at once that mechanical processes are more efficient, more expeditious, and more economical than hand processes. It will save trouble, perhaps, if these virtues (if virtues they be) are lumped under the general term of efficiency. The point is – and it seems to me absolutely irrefutable – that efficiency has nothing whatever to do with goodness. If a piece of printing is good – possesses the quality of goodness – it is so by virtue of taste and skill (which includes tact), and these no machine can possess or impart. Without taste and skill, however, not all the efficiency in the world (including Germany) would suffice to achieve goodness.
The craft of printing was challenged by industrialization and mechanization already in 1933, and provided the opportunity to argue in defense of skilled manual craft. You might feel that the argument is a little shaky – a machine can never possess taste, skill or tact, therefore mechanical printing can never be good – but the pastoral position should be quite familiar. It is interesting to note that hand printing has made a huge comeback in recent years within graphic design and visual communication, connected perhaps to a more general surge of interest in traditional craft and authenticity.
We will first take the evidence from the machine. You, reader, are at the present moment looking at printed matter that has been impressed on this sheet by means of modern machinery. It is (as in writing these lines I am confident it will be) an expression of efficiency, seemliness, decorum, and grace. In so being, it performs not only its major function of communication, but possesses the added value of being well done and of offering you and others a visual pleasure. There is, however, one thing that this seemly, although banal, presentation cannot do, at least in any ultimate sense: it cannot ennoble or glorify the text. Not that ennoblement or glorification is the most useful or important function of printing (though it is its highest), nor that the text is worthy of it (pace you men of science!), although it is expository writing and, as such, unlike literature and even less than journalism, it possesses no intrinsic value apart from its meaning and message. Machine processes are good enough for mere information, unless indeed the information happens to deal with the humanities, in which case it may be as worthy of the hand-press (that is to say, of glorification) as the most exalted poetry or prose.

The greatest ennoblement that can be accorded to language is to cut it on enduring stone, not by the efficient means of a stencil and sand-blast, but with a chisel in the hands of a devoted craftsman; to cast it in bronze, from sand or wax or plaster shaped from a bands-wrought pattern; or to inscribe it (by hand) in letters of burnished gold on purple vellum. The greatest indignity that can be visited upon language is, if we omit the typewriter, to print it on wood-pulp paper, in a degraded type set on a slug-casting machine, by means of a high-speed power-press. Between these two extremes lies our gamut. I maintain that, other things being equal, hand processes are higher in the scale than machine processes. The three major functions of printing are (1) to exploit or sell, (2) to inform or edify, and (3) to ennoble. All these functions printing has performed both by means of hand methods and machine methods. But, after all, is there not something anomalous about ennoblement by machinery – mechanical glorification – a makeshift glorification in the interest not of beauty, which alone truly glorifies, but of efficiency, which must always, at least in a spiritual sense, degrade?

Garnett, 1933, p. 100.
Printing is an interesting example of a mode of production that mediates previously created content in the form of text (and image). Garnett argues that the care inherent in the skilled craft of the hand-press serves to elevate the content of a print, whereas mechanized high-speed printing is equally indignified.

I do not know whether it was possible in 1933 to tell the difference between a hand-printed and a machine-printed book, but I imagine that it was. Would it even matter, though, as long as the author and the reader could still learn somehow that the text had been ennobled by skilled hand printing?
Before I speak in detail about the stitching, something remains to be said about the much disputed question of the flat or hollow back. The volumes of the fifteenth and sixteenth centuries were so made and were generally replaced by the leather was glued directly onto the back. The method of stitching in the headband was generally abandoned during the sixteenth century and replaced by the use of the silk headband. In the seventeenth century the bands were sawed in for the first time to obtain smooth backs without any raised bands. During the eighteenth century there was invented the hollow back, in order to protect and increase the durability of the gilding which, on a tight back, must follow every movement of the leather. During the nineteenth century the most far-reaching deterioration was brought about by the use of sewing two-on on sawed-in bands, by the use of false, glued-on bands and the patched-on woven headband.

The road to deterioration of binding methods went, therefore, from the tight to the hollow back. The final product of this development is the binding with sawed-in and false, superimposed bands, which even today has not entirely disappeared and is still recommended for some of our textbooks. This type of binding is the product of a long-drawn-out evolution, in the course of which an inventive spirit, bent only on destruction, was at work. Its incentive was the desire for time- and labor-saving devices, born in a time filled with falsehood and unreal values, together with the demand of the customer for bindings that looked costly, but could be acquired for less and less money. As we have pointed out, the earlier invention of the hollow back had originally different reasons. Because of the considerable drawbacks of the tight back, in many cases the invention of the hollow back was further developed in our time. Today one frequently binds books with

Evolutionary deterioration

Wiemeler, 1933, pp. 149–150.
A properly constructed book consists of a set of leaflets called signatures, each containing about four folded sheets yielding sixteen book pages. The signatures are sewn together on supporting tapes or cords reaching across the spine, then mounted within boards that are covered with a material such as leather. The original way of doing this was to fix the leather straight onto the sewn spine, and the supporting cords would be visible and palpable as raised shapes on the back of the finished book. Moreover, the sewing thread would go all the way to the ends of each signature and knots would be made at the ends to secure the sewing.

Over the years, bookbinding technique developed the invention of a loose piece of card stock covering the spine (what Wiemeler refers to as the hollow back). To maintain the decorative value of the raised cords from olden days, bookbinders started adding stripes of board to the spine cover before applying the leather. Similarly, the sewing of signatures was simplified and instead colorful pieces of woven band were glued to the ends of the sewn spine as another decorative tribute to older techniques. You can still find these headbands today under the spine cover of any hardcover book.

Almost a century ago, Wiemeler bemoans the adoption of “time- and labor-saving devices, born in a time filled with falsehood and unreal values.” The notion of authenticity remains highly relevant to understanding the nature and cultural currency of craft, and the romantic rhetorics grounded in more or less historically accurate pastoral accounts also seem familiar to this day.
Craft is deeply embodied

Pallasmaa, 2009, pp. ca. 44.

Whenever I see the total correspondence and unexplainable affinity of a craftsman's persona, his/her hands and his/her workshop environment, I am deeply moved. The unity of a shoemaker's professional world and his hands, the dark workshop of a blacksmith covered by soot and the smell of burning coal, the fully integrated atmosphere of a cabinetmaker's persona, his tools, shop and the clean smell of wood, as well as the unity of the orderly and hygienic reception room of a dentist and his/her gloved hands, or the completeness of the highly technologised operation room of a microsurgeon and the masked doctor, all express the marriage of an individual and craft, responsibility and pride. This unity reflects dedication, determination and hope. Each one of these individuals has trained his/her hands for the highly specialised task and made a pact with the trade for the ultimate destiny of his/her life.
I find myself inspired when I read this passage, and thinking fondly of my own bookbinding workshop. There is something very appealing about the personal authenticity of craft, craft practice and spaces for crafting.

At the same time, it is hard not to read Pallasmaa as a romantic account of an ideal that may not always correspond to real-world craft and craftspeople (“dedication, determination and hope”!). Is this an example of scholarly idolization of what we academics don’t have, in spite of having so many other privileges – the pleasure of effecting immediate, tangible and lasting change in the material world?
How come, then, that the slide in the work of the drawing hand both in and out of writing has been transmuted into a continuum from picture to text, where every gradation of figure, part text, in varying proportions - the comprehension of which depends upon twin operations, of seeing and reading, or showing and saying, which are fundamentally incompatible? The answer, I believe, lies in our modern tendency to assimilate the picture to the photograph and the text to the typewritten or printed word. Hand and eye have been replaced by keyboard and camera. In drawing, as we have already seen, the pencil serves as a transducer, converting the kinaesthetic awareness of the draughtsman into the flow and inflection of the line. I referred above, in the words of John Berger, to the difference between the drawing and the photograph: to repeat, the still camera arrests a moment in both the consciousness of the photographer and the things that hold his attention, and effects an instantaneous capture, of the latter by the former. And as we saw from Heidegger’s diatribe against the typewriter, reviewed in Chapter 8 (p. 122), this machine does something similar, breaking up the flow of manual gesture and the corresponding letter-line into discrete and momentary “hits.” As the poet Billy Collins explains (cited in Pallasmaa 2009: 111), “the keyboard, to me, makes everything kind of look done ... writing on a page gives me a feeling of fluidity.” That is why he always writes with pen or pencil. For my part, I asked the students taking the 4 As course to experiment with using handwriting to record their observations, and to compare their experience with using a keyboard. They reported, with a degree of unanimity that was remarkable, that writing by hand brought them closer to and into greater sympathy with the observed. My own experience is much the same (Ingold n.d.)
The argument that direct bodily engagement fosters deeper involvement with a material (than shaping it using more distanced means of manipulation) is easy to embrace.

An example of my own is a course I teach on advanced visualization design. The first assignment I give to the students is called A Week in Life. It is more or less a direct adaptation of Giorgia Lupi and Stephanie Posavec’s *Dear Data* project, and in our version the task is to collect data for a week on an interesting aspect of their own everyday life, then design a hand-drawn visualization of that data. We tend to find that the direct bodily engagement with data collection as well as visualization creates a sense of the value and meaning of the data, something that can otherwise be overlooked when downloading data files and pouring them into powerful visualization tools.

**Sources used in excerpt**


Hand making and production techniques may in fact become mistaken for being digitally produced and mark of the hand may also become less recognizable as material knowledge loses ground. Yet it is often subtle differences, irregularities, acquired through analogue making processes that are acknowledged for adding rarity, identity, character, charm and (on occasion) emotional, possibly monetary value to an artefact. Such coveted qualities remain largely absent from entirely digitally produced object forms.

Harris, 2012, p. 108.
It is a straightforward observation that the marks of the hand, the diversity, testify to the authentic origins of a crafted object and thus asserts its superiority over machine-produced objects along at least some aesthetic dimensions of valuation.
As we have already remarked, workmanship provides formal elements, and important ones, which are outside the control of design: of what, for practical purposes, can be conveyed by words or drawing. These are, of course, short-range elements. Most of them are still at, or little above, the threshold of recognition at those close ranges at which we normally see the components of our environment when we are using them: in a room, in a vehicle, in a street, on a bench or table, in our hand. For most of your life the parts of your environment which you are looking at are likely to be at close ranges of that sort; not on a hilltop, or in the distance, or as seen in the photographs in architectural magazines. It is for this reason that the art of workmanship is so evidently important. It takes over where design stops: and design begins to fail to control the appearance of the environment at just those ranges at which the environment most impinges on us.

A thing properly designed and made, continually reveals new complexes of newly perceived formal elements the nearer you get to it at every approach. A rubbish heap also will continually reveal new formal elements as you approach it, and of the most diverse sorts, but since there are no ordered relationships between them there is no quality of art about it.

Now, many of the formal elements revealed on a close approach to any thing, even if it is of the finest workmanship, are commonplace; but then most formal elements in themselves are commonplace. It is in the relating of them to each other, and often in the subtlety of those relations, that the art lies. In general, of course, there is far less scope for new formal invention in workmanship than in design, because the possible ways of relating the familiar formal elements which recur in workmanship are often few. The scope varies according to the technique. But, if there is little scope for innovation, that does not impugn the importance of workmanship to art. Art has nothing to do with the fact of new invention, it resides in the quality of what has been invented; and whether the invention was made recently or not is irrelevant to the standing of the work of art. We do not burn our Rembrandts. Novelty can be exciting and delightful in art as in other affairs, but art exists in its own right, independently of novelty.

In the art of workmanship, then, we seek to diversify the scale of those formal elements which begin to be distinguishable at close range and also – in season – to diversify the forms themselves by allowing slight improvisations, divagations and irregularities so that we are continually presented with fresh and unexpected incidents of form.

Diversity is a key aesthetic in craft.

Time to turn to David Pye again, as he highlights the difference in scale between talking about aesthetics in design and aesthetics in craft. In design, there is always room for innovative form and appearance. Sometimes, formal innovation is even the main reason for doing design as well as the main grounds for judging its outcomes. Craft, on the other hand, appears severely limited in terms of its expressive possibilities.

However, this does not mean that craft is a mechanical translation of design intentions into a material realization. The workmanship of risk (p. 40) that, in Pye’s analysis, constitutes craft offers liberties to compensate for the risks.

And the expressive liberties of craft lie in the inevitable variations that are distinguishable only when looking closely, the traces that even a skilled hand leave of its work. In short, craft is characterized by fine-grained diversity and this may even be used intentionally to yield “fresh and unexpected incidents of form.”
The Process Artists [ca 1966-72] had a very specific idea of what “process” meant, and it had nothing to do with the unleashing of psychological content achieved through the chance operations of Surrealism. Neither did it involve the grand gestures of Abstract Expressionism or the industrial fabrications of Minimalism. In place of these models of art making, Process Artists aimed to limit their productions to what is best called “facture.” This useful term, which is associated with materialist tendencies in Russian Constructivism and German modernism, was summarized as follows by the Bauhaus instructor Laszlo Moholy-Nagy: “the way in which something has been produced shows itself in the finished product. The way it shows itself is what we call facture.” While artists like Moholy-Nagy devoted a great deal of attention to this principle, bringing it to the making and analysis of not only sculpture but also painting, photography, and other media, it was not until Process Art that an attempt was made to restrict the art work to facture alone. This meant conceiving of a work as a residuum of the process by which it came into being.
An art historian could use the term *facture* to talk about the mark of the hand in craft. In the fine arts, there have been movements taking this far beyond diversity. Adamson points to Process Art where the making process was seen as the actual art work, and the piece (such as a drip painting by Jason Pollock, for example) was merely a trace of its process of creation.

It might seem hard to imagine a craft practice focusing entirely on the making process and disregarding the finished object. But what about the kind of craft that is undertaken as a meditative activity, or a social activity, or a way to pass the time? The intention is admittedly different, as the makers in these cases probably have no aspirations towards artistic expression by pushing the conceptual boundaries of the establishment. But there is, after all, a shift of focus from the object to the process of making it – craft work as “facture alone.”

**Source used in excerpt**

At this point, taking simplicity, systems and ubiquity as the cue, it would be easy to argue that what gives “craft” its distinctiveness from technology is that technology has become so predictable that its aesthetic is predictable, even boring. Meanwhile, the familiar argument in favour of supporting craft is its potential to provide variety and an unexpected diversity of form and texture.

To some extent the path of “looking different” is the one that many practitioners, advocates and curators of craft have chosen to take as the platform for “why craft matters.” But it is important to recognise that looking different is a choice for the crafts, it is not a necessity. There is no essential reason why the products produced by a process of the workmanship of risk should look different from those produced by the workmanship of certainty.

Contrary to expectations, the appearance of the product of the workmanship of risk and that of certainty is often so similar it is hard to tell them apart. Consider a minor example. Anyone who has ever dented his or her car is pleasantly surprised by how neat and machine-like the finish created by the panel-beater and paint-sprayer can be. Indeed, there are many examples of handcraft or craft producers mimicking machine-produced wares. More recently, machines have begun to produce objects that mimic handcraft and craft ware.

The elusiveness of “craft” versus “machine-made” appearance is illustrated by George H. Marcus in his book *Functionalist Design*, in which he discusses the Bauhaus in terms of handcraftsmanship applied to the production of prototypes for industry. He describes two teapots made by Marianne Brandt in 1924 in the Bauhaus metal workshop: “one, made of silver, clearly reveals its handcrafted nature in the repeated marks of the hammer that cover the surface...
Of course it can be argued that craft does not have to be diverse, in the sense of exhibiting irregularities and “marks of the hand.” It is perfectly possible to come up with example objects of craft origins that look and feel like they were made by a machine.

But that is not the point, I guess. It is rather a question of craft having the ability to create attractive diversity when appropriate, and of craftspeople being able to use diversity as an artistic (or commercial) strategy.

Related to this is another approach, which superficially seems like the exact opposite, where an object is known to be hand-made, yet appears perfect (as in: free of imperfections) in its execution. The level of craft skill manifested in such an object can be a source of marvel and appreciation in itself.

**Source used in excerpt**

Two rather different ideas of truth to material seem to be current. The first has been well summarized in a broadcast by David Thompson. He said that the idea “in its simplest form means that the sculptor feels obliged to respect his medium to the extent of bringing out in every way he can the stoniness of stone, the metallic quality of metal, the grain and growth and organic properties in wood.”

The second idea is that any given material takes, or can be made to take, certain shapes easily or directly. These unforced shapes are natural to it and are the right shapes to aim at. You must not torture your material.

The two ideas have in common the notion that every material has, as a matter of objective fact, a specific nature, a fixed set of inherent properties, which can be expressed or suppressed when it is used: rather as though it were a child being brought up. They are both essentially concerned with design, and insist that the material shall not be shaped or otherwise treated so as to suppress the set of inherent properties which constitute its nature.

The first idea does not tell us how inherent properties are to be expressed but merely that they should be. The second idea, more specific, is that the only, or at any rate the best, way to do it is to make those shapes which come easily.
Harmony with the material

Pallasmaa, 2009, pp. ca. 50–51.

Wirkkala, another master of form, expresses exactly the same concerns:

“All materials have their own unwritten laws. You should never violate the material you’re working with. The designer’s purpose is to be in harmony with the material. The craftsman has the advantage that at every stage of the work his material is in his hands to feel and command. In industry, the material is constantly subordinate to some preplanned law and machinery and once the job has begun it’s difficult to make changes.”

The Finnish sculptor Kain Tapper (1930–2004) relied on the feel of his palms rather than his eyes in finishing the fluidity of the shape or the rhythm of the surface texture in his wood and stone sculptures. He liked to polish his stone pieces at the shoreline of a lake because he felt that the horizontality of the water surface and the definitiveness of the horizon line sharpened his eyesight and tactile sense. His subtle wood reliefs could be called “tactile paintings” as they address the hand and the skin as much as the eyes.

In another context, Wirkkala speaks about the interaction of two hand activities, drawing and model making: A drawing or sketch is an idea which provides the basis to start work. I make dozens – sometimes hundreds – of sketches. From
Working with your hands in traditional craft will enable you to feel and command the material at every stage, thus making it straightforward to assess which shapes come easily (as Pye puts it in his discussion of truth to materials on p. 130). Shaping digital materials in the context of interaction design certainly does not have the physical and tangible character to it; nevertheless, it seems to make sense to me talk about feeling the material and making the shapes that come easily – and not entirely as only a metaphor. I seem to remember that sometimes when sketching through programming, there was a clear sense of which interactive forms would come more easily and be in harmony with the overall mode of interaction I was trying to envision.
This domain of quality is usually talked of and thought of in terms of materials like marble, silver, ivory, ebony. We talk as though the material of itself conferred the quality. Only to name precious materials like thrones and lumps does it evoke a picture of thrones and treasures. It does not evoke a picture of gray boulders on a dusty hill or logs of ebony as they really are – wet dirty lumps! Material in the raw is nothing much. Only worked material has quality, and pieces of worked material are made to show their quality by men, or put together so that together they show a quality which singly they had not. "Good material" is a myth. English walnut is not good material. Most of the tree is leaf mold and firewood. It is only because of workmanlike felling and converting and drying and selection and machining and setting out and cutting and fitting and assembly and finishing – particularly finishing – that a very small proportion of the tree comes to be thought of as good material; not because a designer has specified English walnut. Many people seeing a hundred pounds worth of it in a London timber yard would mistake it for rubbish, and in fact a good half of it would be: would have to be.

So it is with all other materials. In speaking of good material we are paying an unconscious tribute to the enormous strength of the traditions of workmanship still shaping the world even now (and still largely unwritten). We talk as though good material were found instead of being made. It is good only because workmanship has made it so. Good workmanship will make something better out of pinchbeck than bad will out of gold. Corruptio optimi pessima! Some materials promise far more than others but only the workman can bring out what they promise.
We have noted that the hand works in two directions: part effector and part probe. When enhanced by a tool, the hand remains such a two-way conductor, but its powers become narrowed and intensified. That is, when using a tool we can sense some things better, and we can alter some things better, but others not at all.

Normally this specialization occurs in terms of a medium. Tools are means for working a medium. A particular tool may indeed be the only way to work a particular medium, and it may only be for working that medium. Thus a medium is likely to distinguish a particular class of tools. For example, a material that is workable by chipping away at it incrementally gives rise to chisels that are a nature from a medium, McCullough, 1996, pp. 62–64. Ific tools and the resulting artifact: a painting. The artifact, more than the medium in which or tools by which it is produced, becomes the object of our work. The presence of an artifact is more important than any clear-cut distinction between tool and medium. Artifact, tool, and medium are just different ways of focusing our attention on the process of giving form.

Many tools, especially tools that operate on symbols, do not work a medium so much as they assist observations, make measurements, or interpret scores. We usually refer to such tools as instruments. Although there may be a craft of scientific measurement or musical performance, let us focus on tools that work a medium to produce a lasting artifact. As mentioned earlier, it is the craft that involves continuous operations on a workable medium which is most compelling. But this does not rule out our consideration of an abstract medium: our scope includes abstract artifacts produced by means of continuous operations (e.g., direct manipulation) in symbolic media.

Nor does it eliminate consideration of instruments, for many form-giving tools that demand highly refined practices are understood as instruments. We are simply limiting the focus to the interplay of the effecting tool and the workable medium. In many refined practices, the perception of a medium surpasses any perception of tools. If a medium is a realm of...
The conventional notion of a tool is more or less straightforward: A tool works a material, or a medium, to produce a lasting artifact. Something that is used in a tool-like way but produces, e.g., measurements rather than works the material directly is called an instrument.

With respect to interaction design, it is not quite as clear. Our materials are mostly intangible, “immaterial”, and it is more difficult to say what it means for a tool to work the material. Still, it can and should be argued that different tools are good for different things also in the crafting that goes into interaction design.

A timely example might be the design of partially autonomous systems based on machine learning for interactive use. Such systems can perform classification and other tasks remarkably well in most cases, but they fail in unpredictable ways when they fail and they are generally not possible to reverse-engineer for more systematic prediction of their behavior. The only reasonable approach seems to be to experiment with specific instances by varying, e.g., the training data and the parameters and mechanisms of the learning algorithm being used. The “tool” for this approach is a machine learning development framework, and the resulting pattern of making moves and paying attention to the outcomes is not entirely unlike how a physical tool works a physical material in a craft context.
Thus the best way to begin understanding any medium is as a range of possibilities. Within traditional material craft, this is often articulated in terms of structure. Wood has a grain, paper is imbedded with a tooth; metal has temper. Understanding of structure is implicit; it is learned through experience. Although this becomes everyday knowledge, it does not become formalized. For example, there are lumber grades based on the number of clear faces on a cut piece, we still have no formal scale or gradation for describing the texture and grain of wood. Moreover, the understanding is in terms of workability and practices, rather than according to any theoretical constitution. Thus people worked metals for centuries without any notion of lattices and free electrons. Acute knowledge of a medium’s structure comes not by theory but through involvement. For a medium to be engaging, it must be dense...

Density supports engagement not only through continuity but also through variety. Only countless subtle differentiations of conditions will yield a heightened, satisfactory practice. A rich medium offers such an extent of possibilities that no one author or piece can incorporate them all, and only this is enough to sustain continued exploration.

Thus the attuned craftsman asks, “What can this medium do?” as much as “What do I wish to do with this medium?” It matters that one works in a medium whose properties suit one’s purposes: sometimes a more forgiving medium; sometimes a more rewarding medium; occasionally rigor for rigor’s sake; but always a medium whose intrinsic advantages are appropriate to the task at hand. An experienced craftsman knows how to choose the right medium and to push it as far as it will go – and no further.
McCullough emphasizes the richness of a medium, or material, as an important condition for stimulating continued exploration and thus engagement in craft. “Richness” here refers to offering a broad range of possibilities, treatments and outcomes. I find this to be a valuable addition to the more foundational observations of how a material’s structural properties influences the craft.
Tools evolve gradually through a process of small improvements, use and rejection. The finest tools are a result of a timeless anonymous evolution, and especially identifiable designer tools usually remain as momentary curiosities that do not become part of the real ancestry of the particular tool. Musical instruments, specifically conceived by designer professionals, exemplify these aestheticised curiosities. All great works of art similarly become an inseparable part of the tradition of the art form in question instead of being mere individualistic inventions. Great tools are moulded by the hand and its action directly. Centuries of continuous work have refined the basic tools – knife, hammer, axe, saw, plane – beyond improvement by an individual self-conscious designer, guided by intellectualised ideas of function and beauty. The development of tools in various cultures makes a mark on their specific “DNA”, as it were, that guides their evolution, resulting in a sense of relatedness. Like the human hand, the tool is generic and specific at the same time. It is possible to identify the genetic line of Japanese tools, for instance, as clearly distinct from the Scandinavian or North American family of tools; the performance and appearance of the tool unavoidably reflects the culture’s particular attitude towards work and the social value placed on the work.

Tools possess a special and unarguable beauty. This is a beauty brought about by absolute causalities instead of being a materialisation of an aesthetic idea. Even the earliest stone tools express their use in the grip of the human hand and they convey the unarguable pleasure of perfect functionality and performance. The beauty of tools reflects the same pleasure of inevitability as living creatures; indeed, they possess the beauty of the human hand itself, the most perfect of all tools. Traditional tools, devices and vehicles developed in contexts where access to limited materials is limited, such as in the various Eskimo cultures, project a specially convincing and touching beauty that unites aesthetic pleasure with the pure joy of discovery.

Qualities of tools

Pallasmaa, 2009, pp. ca. 40–41.
Let us then say that, where the naked eye can detect no disparity between achievement and idea, the workmanship is “regulated” or, in cases of extreme precision, “highly regulated”. Where slight disparities can be detected let us say that it is ‘moderately free’. Where there are evident (and usually intentional) disparities, as often seen in woodcarving or calligraphy, let us say the work is “free.” And, where we should ordinarily call the work rough, let us call it rough; remembering always that rough does not necessarily imply bad.

The term “regulated” is apt, whether applied to the workmanship of risk or that of certainty. On the other hand, the workmanship of certainty is all but incapable of free or rough work in the present; but it must be remembered that, where construction is involved in the making of something, then although components may be made by the workmanship of certainty, they will still nearly always have been assembled by the workmanship of risk. Regulated work is then possible, but, in quantity-production, bad is more probable, as in the case of the glass frame just cited.

Regulation is achieved in the workmanship of risk in three different ways, separate or combined. The first is dexterity: which means sheer adroitness in handling. The old-style shipwright with his adze can get a nearly true flat surface or a fair curve without any apparent guide, simply by coordination of hand and eye. Secondly, gradualness: the shipwright with his adze does not finish off the surface by removing handfuls of wood at each stroke, but in short light strokes taking off the wood in thin shavings. Lastly, shape-determining systems: such as jigs, forms, molds, gauges.
In the context of Pye’s distinction between workmanship of risk and workmanship of certainty (p. 40), the notion of regulation seems to relate to how much the risk can be reduced in workmanship of risk. Or, to put it differently, how similar the results of workmanship of risk can be to those of workmanship of certainty.

The tools themselves can also play a regulatory role in (material) craft. A very simple example, also mentioned by Pye, is the pair of scissors which actually contains its own shape-determining system. You can hold the inside of one blade against a given edge and make a new, perfectly straight cut in perfect alignment with the edge.
Qualities of craft (contemporary)


Quality of embodied activity: The satisfaction of physically working with particular materials and tools was a key feature of skilled handwork.

Quality of material-driven innovation: As craft progresses, our participants described the process of finding their way...

Quality of tradition: Craft lives and evolves: Craft often carries connotations of tradition and even bygone eras. However, echoing recent cultural heritage research [18], our interviewees frequently stressed that craft is not a dead skill from the past to be preserved, but rather that craft participates in everyday life and evolves over time.

Quality of professional satisfaction & workmanship: As a verb, craft signifies a way of seeing and working with materials involving integrity and respect, as Penny says, “I don’t really care if people think it’s craft or art. It doesn’t matter. What matters is that it has integrity.” The concept emanates an abstract “seamless” quality that is articulated clearly “and not encumbered by bulky craft,” as Luke puts it. Through this open inscription and symbolic investment, craft both forms and performs meaningful interactions. Craftsmanship, in this sense, involves perceivability: removing the unnecessary elements of work so that only the “honest” materials and techniques remain.
The article by Bardzell et al. reports on a series of interviews with master practitioners of traditional crafts. It was presented to the interaction design community at a DIS conference, and it seems to validate a very traditional understanding of what craft is and why it matters to contemporary practitioners.

**Source used in excerpt**

Simplicity can be challenged


Certainly, simplicity represents a goal in craftwork – it’s part of the measure of what David Pye calls “soundness” in a practice. But to make difficulties where none need be is a way to think about the nature of soundness. “It’s too easy” is a test of “there’s more here than meets the eye.”
These remarks are made in the context of Frank Gehry’s designing the Guggenheim Museum in Bilbao. The design process involved prolonged exploration of materials and fabrication processes for a building shell that would flow organically along an irregular site and make the light bounce off the building to soften the enormous mass. When finally arriving at a solution involving quilted titanium, it was also found that structural stability could be rethought and that construction elements could be thinner and lighter than previously expected.

It is not entirely clear to me what this has to do with simplicity in the usual sense of the word. I do not quite see how this is a case of “making difficulties where none need be” – for the architect, the difficulties most certainly needed to be, and they were necessary to overcome in order to approach the intended results.

But I guess there is still a point that can be made around apparent simplicity. It might seem that the Guggenheim Museum is simple and honest as it stands, just like it should be. The final result does not speak about the complexity of its creation, and this, I think, might indeed be a recurring quality of well-crafted things. As my mother-in-law used to say when arguing for doing something carefully and well, after you finish then there is no telling how long it took to do it.
Extraordinary skill in art


In a way, Woffenden is only pointing out the obvious: a material cannot provide a full accounting of design, intention and action, no matter how desperately an artist wills it. It will always remain partially resistant. Not can it be rendered entirely “optical.” Woffenden’s Breath is the anti-Chihuly. There are no easy pleasures here, only an elegant limning of the relation between a striving body and some troublesome material. What we are left with in the end is facture as a material contingency, in all its open-ended, unpredictable pathos. In Breath, the most demanding of craft procedures is reduced to a single, comically elementary puff of air. One might well ask: is this what advanced thinking through craft must look like? Is there no place in the climate of post-conceptual art for work grounded in extraordinary skill? The next chapter will take up this question, which, like that of craft’s materiality, admits of no simple answer.
The piece called *Breath* that Adamson discusses here in the context of craft skill in art (or the lack thereof) is a frosted glass dome with a single balloon-like shape protruding into its core. It is scientific or mathematical in its expression, lacking expression and masterful technique, described as more or less completely conceptual.
Pottery is a craft particularly noted for skeuomorphs. The painted or incised designs encircling clay pots are often the last vestiges of basketry structures that were used in the early development of pottery to support the walls of the vessel prior to firing. In other cases decorations are remnants of cords or lashings that were once tied around the pots so that they could be carried more easily.

Skeuomorphism is not a thing of the past nor is it limited to traditional crafts. It is found today in countless articles being made from plastic for the first time. Plastic, which can be molded into almost any shape and color, will most often be given a form dictated by the conventional shape of the artifact. The first plastic water pails were patterned after their galvanized steel predecessors. The first plastic baskets appeared in shapes that were originally determined by the reeds and wood splints from which older baskets were fashioned. Only somewhat later did plastic pails and baskets assume forms that were relatively free from the influence of sheet metal and plant material.

Skeuomorphs, routine innovations, and random variations all highlight the conservative aspect of handicrafts. According to design theorist Christopher Alexander, resistance to change is the essence of the traditional crafts and the source of their strength. Alexander identifies two general approaches to the design and making of new artifacts. The first, associated with primitive societies and handmade things, is an unselfconscious process. Craft skills are passed on by experienced workers conducting demonstrations and by novices doing a trial-and-error copying of existing artifacts. Because the knowledge of such crafts is not summarized in a written text or put into extended oral form, there are no general theories to be studied. One learns by doing, and what one learns to do is what has been done in the craft for many years, perhaps
A skeuomorph in general is a derivative object that retains as ornaments elements of what used to be functional components of the original objects. The “false bands” of hollow back books is a fine example of skeuomorphism – purely ornamental structures on the back of the book, referring to the cords that hold the spine together and that were visible on the back of older-style tight back books (see p. 116 for more bookbinding details). Skeuomorphism can be understood as a material manifestation of the traditionalism of craft.

Amusingly, “skeuomorphism” has also been a household word in interaction design for at least ten years now. Here, it is used to denote visual elements of interfaces that look like their physical counterparts. In graphical user interfaces on computer screens, there are icons and objects that look vaguely like physical pushbuttons, documents, folders, trash cans, and so on. When they are drawn with some vague suggestion of three-dimensionality and in a slightly more naturalistic manner, the result is said to be skeuomorphic. There are even trade experts identifying visual epochs of graphical user interfaces, from Skeuomorphism via Flat Design to … Neumorphism!
Practical knowing
Time and again in the course of our journey we have encountered various fundamental tensions and alternations which characterise action and knowledge in action. It is in relation to them that I have referred to a dialogical structure, in the form of an open, always unfinished, dialogue. The goal now is not to add any new tensions, but to structure the ones we have already considered in such a way that some of them can be seen as more fundamental than others.

In attempting to be systematic, I have settled on four “polarities.” Each of them has a number of different faces, which means that the formulations I have chosen may be replaced by others. Knowledge and knowledge formation in action are distinguished by an alternation between the “poles” in these polarities:
(1) part – whole;
(2) commitment/involvement – detachment;
(3) criticism – confidence;
(4) action – reflection.
Craft is a practical philosophy

Dormer, 1997c, p. 219.

The reason for calling craft a practical philosophy is that almost nothing that is important about a craft can be put into words and propositions. Craft and theory are oil and water. Because of this some people might question whether craft should be called a philosophy at all. But a disciplined craft is a body of knowledge with a complex variety of values, and this knowledge is expanded and its values demonstrated and tested, not through language but through practice. It makes craft difficult to write or even talk about with clarity and coherence.
Dormer takes a strong position when claiming that “almost nothing that is important about a craft can be put into words and propositions.” Tongue in cheek, you might ask whether his own writings about craft are not very important then, and why he would bother publishing them.

On a more serious note, I think it is safe to say that craft is mostly based on practical knowing. And the questions of what constitutes practical knowing, whether it can be articulated, and whether it can be made intersubjective in ways other than master-apprentice practicums, are all perennial ones. Most of the excerpts in this section deal with exactly those questions. I personally feel that there are important aspects of craft that can be put into words and propositions, and that this is something we should probably do more of. Recent developments in design research, and specifically the emerging research approach of Research Through Design (RTD), seem to represent important steps towards a scholarly community producing “theory” and at the same time giving practical knowing the recognition it deserves.
The hand-printed sheet, when properly achieved, possesses two qualities that the machine-press can at best but approximate – a liveliness and sparkle to the eye and a slight but resul...
An attempt to account for the practical knowing in the time-honored, more or less extinct craft of hand printing that has recently been trending remarkably strongly in graphic design as a part of the general reappraisal of traditional crafts. In relation to Dormer’s point that the important aspects of a craft cannot be conveyed in words (p. 156), we can simply note that reading Garnett’s description can help us better appreciate what the hand-printer does and why, but it could never enable us to do the hand-printer’s work. Words are great for knowing-that and knowing-why, but not for knowing-how.
What then is the relation between thinking and making? To this, the theorist and the craftsman would give different answers. It is not that the former only thinks and the latter only makes, but that the one thinks through the substance of the material world and the other makes through his thinking in his head, and it is the way of the craftsman, by contrast, to allow knowledge to grow from the crucible of our practical and observational engagements with the beings and things around us (Dormer 1994; Adamson 2007). This is to practise what I would like to call an art of inquiry.

In the art of inquiry, the conduct of thought goes along with, and continually answers to, the fluxes and flows of the materials with which we work. These materials think in us, as we think through them. Here, every work is an experiment: not in the natural scientific sense of testing a preconceived hypothesis, or of engineering a confrontation between ideas “in the head” and facts “on the ground”, but in the sense of prising an opening and following where it leads. You try things out and see what happens. Thus the art of inquiry moves forward in real time, along with the lives of those who are touched by it, and with the world to which both it and they belong. Far from answering to their plans and predictions, it joins with them in their hopes and dreams. This is to adopt what anthropologist Hirokazu Miyazaki (2004) calls the method of hope. To practise this method is not to describe the world, or to represent it, but to open up our perception to what is going on there so that we, in turn, can respond to it. That is to say, it is to set up a relation with the world that I shall henceforth call correspondence.

Anthropology, I believe, can be an art of inquiry in this sense. We need it in order not to accumulate more and more information about the world, but to better correspond with it.
What Ingold talks about in terms of correspondence with the world is familiar to anyone who has practiced design or craft – the thinking and the making proceed together, producing insights on what works and what doesn’t work as well as on which way to move forward. This can be captured in the concept of sympoiesis (p. 38), or co-creation involving the human as well as the non-human actors; designer and craftsperson as well as materials and tools.

**Sources used in excerpt**


Knowing is in the making

Piper and Townsend, 2015, pp. 8–9.

Two types of knowledge converge in skillful practice; technical taught principles (explicit knowledge) of a craft discipline are combined with knowledge derived through engagement with materials and process, known as – embodied (or experiential) knowledge (Lehmann 2012; Polanyi 1966). Dreyfus and Dreyfus (1988) state that in the progression from novice to expert maker, rules are made meaningful through experience, and experience and knowledge evolve into intuitive action and practiced understanding. The acquisition of skill and skillful making involves mind, body and material; it is “an embodied tactile journey” (Pallasmaa 2009: 109), where “knowing” is inextricably linked to the act of making.

“Making” frequently involves the use of a tool(s) to facilitate or assist in the manipulation and shaping of materials. Using the tool, the maker is able to experience the material and form the object, transferring and externalizing ideas from mind, via the body and tool, to the material world (Malafouris 2013). Skillful use of such tools has to be learned; the maker has to negotiate and learn, through experience, how to handle and control the tool, and in doing so develops a relationship with and comes to “know” their materials.
The dichotomy of experiential and explicit knowledge comes in many forms, and perhaps the exact labels are not so important. What is important, I think, is that practical knowing exists as a distinct type of knowledge, and that there is no final border between experiential and explicit knowledge but rather a fluid dimension ranging from less to more articulation.

**Sources used in excerpt**


In textiles as well as other material-designated disciplines, craft is understood not only as a way of making things by hand, but also as a way of thinking through the hand manipulating a material (Nimkulrat, 2010, p. 64). Craft is thus “a means for logically thinking through senses” (Nimkulrat, 2010, p. 75) This understanding follows the notion of craft as “a way of thinking through practices of all kinds” (Adamson, 2007, p. 7) and “a dynamic process of learning and understanding through material experience” (Gray & Burnett, 2009, p. 51). Hence, the process of making material objects by hand can be identified as one way of thinking intellectually (Sennett, 2008, pp. 149-153). Since the knowledge of craft, or how a material constructs an artifact, is not necessarily available in words or illustrations, practitioners are required to perform individual practices and observations while working with materials (Rowley, 1997).

Similarly, design knowledge exists in designing activities, in which designers, their creation processes, and resulting artifacts are involved – it is considered a “designerly way of knowing” (Cross, 1982, 1999). Knowledge of a creative practice thus lies in and can be acquired from within the practice itself. In other words, thinking and knowing are inseparable from making in any craft or designerly practices.
The concept of “designerly ways of knowing” introduced by Nigel Cross is a productive way to connect craft and design, in the sense that it foregrounds the commonalities between the two practices in terms of practical knowing.

**SOURCES USED IN EXCERPT**


The quality of being set down may be understood as being what we might call “thrown”, that is, executed at a particular moment, with a particular degree of skill, and with particular idiosyncrasy to the result. This suggests a focused action, at which moment the focused skill of the hands becomes critical, interrupting a more usual state during which time the hands quietly probe. The most essential part to Focillon’s argument is that form giving is a two-way process. “The hand knows that an object has physical bulk, that it is smooth or rough, that it is not soldered to heaven or earth from which it appears to be inseparable. The hand’s action defines the cavity of space and the fullness of the objects which occupy it. Surface, volume, density, and weight are not optical phenomena. Man first learned about them between his fingers and in the hollow of his palm.” (Focillon 1934, p. 162) Whereas the eyes stay focused on the outer surface of things, hands have a way of getting inside, and so they contribute more to our belief in the reality of the world.

Hands also discover. They have a life of their own that leads them into explorations. For example, a sculptor’s feel for a material will suggest actions to try, and places to cut. Learning through the hands shapes creativity itself. “The hand is not the mind’s docile slave. It searches and experiments for its master’s benefit; it has all sorts of adventures; it tries its chance.” (Ibid., p. 180).
The fundamental differences between eye and hand, between seeing and “handling”, are at the core of understanding traditional craft and its notions of material and form. If we take this literally, then the only kind of interaction design that could learn from craft would be the one where we shape physical objects. However, it would seem that this is too limited a view, and that there are in fact valuable lessons for us to learn from craft also beyond the physicality of the hand and the material.

**Source used in excerpt**

If manual ability has a way of defying explanation, that is because it is based not in language but in action. Skill is participatory. This same basis makes it durable: any teacher knows that active participation is the way to retainable knowledge. In this regard skill has intrinsic, personal worth. It is an achievement. Almost any practiced person values her skill above and beyond what it is good for producing, as though there were psychological benefits to mastery itself. For example, the circumstances of practice are often themselves a source of satisfaction. This is because skill is sentient: it involves cognitive cues and affective intent. It is also very habitual. In particular, it develops an intimate relation with certain contexts or tools, which makes it individual. No two people will be skilled alike; no machine will be skilled at all. Of course the latter is debatable if we accept simple mechanical or deductive capacity as skill – but we are maintaining that there is a sentient component too. One way our sentient activity differs from the action of machines is play. We putter about in our studios. We enjoy being skilled. We experiment to grow more so. Skills beget more skills.

In sum, hands are the best source of tacit personal knowledge because of all the extensions of the body, they are the most subtle, the most sensitive, the most probing, the most differentiated, and the most closely connected the mind. They deserve to be admired.
assess a situation, to act upon it immediately and to evaluate its impact.”

This tallies with how surgeons see themselves:

“Surgeons have always been craftsmen. Their work is essentially manual, but it is also a craft. It requires the ability to think, to predict, to anticipate what might happen next. It is a craft that can be learned, but it cannot be taught in one day. It takes years of practice to become proficient.”

Teaching hand skills in surgery

It is achieved through experience but mere experience may not simply be the answer; experience can mean making the same mistake over and over again. Gradual progression that is closely supervised is essential. Those who teach surgery are practitioners who teach by example and are not ashamed to use the words “training” or “craft.”

J. W. Rodney Peyton, a surgeon with a longstanding commitment to education, has described the necessary stages of teaching and learning a procedure.

1. Demonstration of the skill at full speed with little or no explanation.
2. Repetition of that skill with full explanation, encouraging the learner to ask questions.
3. The demonstrator performs the skill a third time, with the learner providing the explanation at each step and being questioned on key issues … the demonstrator provides necessary corrections. This step may need to be repeated several times until the demonstrator is satisfied that the learner fully understands the skill.
4. The learner carries out the skill under close supervision describing each step before it is taken.

This degree of meticulous supervision does not appear to be the norm in university courses or museum placements.
The teaching and learning procedure described in this excerpt comes from a field where craft is practiced within what we might call scientific, or even scientistic, structures. That sounds kind of familiar.

**SOURCE USED IN EXCERPT**

Pye’s most well-known distinction is that between the workmanship of risk and the workmanship of certainty. This was a purposeful reframing of the dichotomy between craft and industry, or hand and machine. The great advantages of Pye’s terminology are its accuracy, mobility and flexibility.

In the workmanship of risk, “the quality of the result is not predetermined, but depends on the judgment, care and dexterity which the maker exercises as he works.” There is nothing here about a categorization of a certain type of work or product, and Pye insisted that the workmanship of risk was just as important to the operation of certain huge factories as small artisanal shops. Partly, this is because the relation between risk and certainty is relative rather than absolute. Total certainty and total risk are rarely observed, and intermediary positions between the two can be achieved through means as humble as a pair of scissors (which helps the user to cut a straight line) or as complex as an injection-molding machine. Within this elastic framework, Pye was willing to make some place for the concept of skill, but only in a very limited way. He saw it as the capacity to achieve constraint manually within the workmanship of risk.

In slicing bread, for example, the skill is in holding the knife continuously parallel to the plane of the cut. The force applied does not count as skilful because it does not affect the result. Skill, then, is the human equivalent to a jig in woodworking or a mold in ceramics – it is control within a productive operation, the ability to reduce error. While there are certain corollary rules that attend skill, such as the fact that it tends to be compromised by increased force or speed in the operation, it is essentially a simple matter: purposefully constrained physical action. The product of such action could be a craft object like the wooden bowls that he himself made – objects that, in their obsessively regular application of free workmanship, seem

Adamson, 2007, p. 73.
Methods do not replace sensibility

*Kolko, 2011, p. 81.*

Based on my experience in reviewing portfolios from recent business school graduates, I would argue that one of the most fundamental failings of design-thinking education is the lack of craftsmanship. Students don’t appear to have developed an innate sensibility for making, and at the same time they don’t appear to have developed an intimate understanding of the medium they are responsible for shaping. Instead, they are equipped with a toolkit of methods. And while there is nothing wrong with a method in the context of medium and craft, it’s worth reflecting on why Chris Alexander and John Chris Jones abandoned the methods movement in the 1960s and 1970s. Alexander explains: “I have been hailed as one of the leading exponents of these so-called design methods. I am very sorry this has happened, and want to state, publicly, that I reject the whole idea of design methods as a subject of study, since I think it is absurd to separate the study of designing from the practice of design. In fact, people who study design methods without also practicing design are almost always frustrated designers who have no sap in them, who have lost, or never had, the urge to shape things. Such a person will never be able to say anything sensible about ‘how’ to shape things either” [5].
The insights from the founding fathers of the design methods movement, however aptly formulated, do not seem to have extinguished the notion that methods carry and convey practical knowing. I encounter it more or less every day, in contexts of professional practice as well as education and research, and I share Kolko’s reservations entirely.

For me, a method can be a learning device or scaffold when approaching and appropriating a practice. It can be a useful means of coordination and communication in multi-party projects. But I have never seen a method representation that in itself can yield skilled practice. Kolko points to the necessary sensibility for making and for the materials to be shaped. In an interaction design context, I could also add the important role of an internalized repertoire of structural, formal and experiential design concepts.

**Source used in excerpt**

That flat assertion is all the more remarkable given that Pye’s book is the most compelling technical discussion on skilled work ever written. In a perceptive evaluation of his work published in 1982, Christopher Frayling and Helen Snowdon pointed out that Pye’s great breakthrough was to “divorce manual skill from mental skill (know-how), going directly against the grain of established Arts and Crafts opinion.” His method was to reserve the term “workmanship” for purely physical procedures such as the actual moving of a hand plane over a board in order to smooth it, or the pressing of fingers into wet rotating clay in an attempt to make a bowl, and then to subject the mechanics of those procedures to rigorously literal analysis. In so doing, Pye was able to vacate the idea of skill from its moral overtones, and thus to depart from the established tradition of modern craft theory.
Source used in excerpt

We are accustomed to think of making as a project. This is to start with an idea in mind, of what we want to achieve, and with a supply of the raw material needed to achieve it. And it is to finish at the moment when the material has taken on the intended form. At this point, we say, we have produced an artefact. A nodule of stone has become an axe, a lump of clay a pot, molten metal a sword. Axe, pot and sword are instances of what scholars call material culture, a phrase that perfectly captures this theory of making as the unification of stuff supplied by nature with the conceptual representations of a received cultural tradition. “Material culture”, as Julian Thomas (2007: 15) puts it, “represents at once ideas that have been made material, and natural substance that has been rendered cultural.” In the literature, the theory is known as hylomorphism, from the Greek hyle (matter) and morphe (form). Whenever we read that in the making of artefacts, practitioners impose forms internal to the mind upon a material world “out there”, hylomorphism is at work.

I want to think of making, instead, as a process of growth. This is to place the maker from the outset as a participant in amongst a world of active materials. These materials are what he has to work with, and in the process of making he joins forces with them, bringing them together or splitting them apart, synthesising and distilling, in anticipation of what might emerge. The maker’s ambitions, in this understanding, are altogether more humble than those implied by the hylomorphic model. Far from standing aloof, imposing his designs on a world that is ready and waiting to receive them, the most he can do is to intervene in worldly processes that are already going on, and which give rise to the forms of the living world that we see all around us – in plants and animals, in waves of water, snow and sand, in rocks and clouds – adding his own impetus to the forces and energies in play.
Anyone who practices design sketching or craft knows that progress, ideation and insights happen where the pencil meets the sketchpad or the hand meets the material. Hylomorphic accounts of the process are simply inadequate, and they may even be misleading if they are used to suggest methods or approaches that assume ideas to form completely in the mind before being executed in an external medium.

**Source used in excerpt**

Forces and materials (against hylomorph)

Ingold, 2013, p. 45.

Our investigation into the curious case of the Acheulean biface draws us inexorably to the conclusion that the essential relation in a world in formation (as distinct from a world that we look back on, as though it were completed long ago), is not between form and matter but between forces and materials. In this, I once more take my cue from Deleuze and Guattari (2004), for whom – as we saw in the last chapter – the refutation of the hylomorphic model has been a centrepiece of their intellectual project... In both cases, to borrow the words of Deleuze and Guattari once again, it is a question of “surrendering” to the material and then “following where it leads” (Deleuze and Guattari 2004: 450-451).

This leaves us with a picture of making altogether different from the “construction kit” view proposed by Holloway and others, according to which the maker begins with a plan or template and a finite set of parts, and ends when the final piece is put in place. In this view, the process of making is a concatenation of separate steps that follow one another like beads on string. In the view we propose, by contrast, the process of making is not so much an assembly as a procession, not a building up from discrete parts into a hierarchically organised totality but a carrying on – a passage along a path in which every step grows from the one before and into the one following, on an itinerary.
Sources used in excerpt


In the normal course of events, Dreyfus writes, “an expert does not reason. He does not solve problems. He does not think. That is what makes him an expert. He does what normally works and, of course, it normally works.” Only the person who is not an expert has to analyse matters, has to think. The expert _reacts_ immediately to a particular situation. The relationship between the situation and an appropriate expert response is what Dreyfus and Dreyfus call “holistic pairing.” This means, if I have understood it correctly, that the expert sees the whole situation, recognises it immediately without analysing it or reflecting on it, and responds directly at an instinctual level. It may however, take many years of training and practice before the right instinct is acquired. To borrow a cogent metaphor from Harald Grimen, we could say that situations have faces. We learn to recognise faces without analysing their features.

The philosopher Gilbert Ryle wrote insightfully about “knowing that” and “knowing how” in his book _The Concept of Mind_. Unfortunately, this dichotomy has subsequently been adopted without reflection as a fundamental scheme for much epistemology. The problem Ryle was working on has been lost sight of and the scaffolding he erected has been elevated to the status of the building itself (which is, moreover, typical of much analytic philosophy). Ryle is keen to emphasise insight and (re-)learning in relation to what he calls “intelligent performance” and “intelligent practice” – what I call knowledge in action. A key aspect is that in intelligent practice one consciously controls and is responsible for what one does. This agrees with Thomas Tempte’s assertion that craftwork is not manual work but involves taking a series of decisions, frequently very difficult ones. It is wrong to see the actions of the expert solely as a response to particular situations.
One important point here for the purpose of discussing practical knowing might be that practice entails continuous decision-making.

**Source used in excerpt**

A good concept is like flypaper, everything sticks to it, Adorno is supposed to have said. Many people in working life identified with they Swed and knowledge started to feel that they could stand up for their experience and knowledge without being forced to articulate them in words. The effect in Sweden was for the concept to serve as flypaper. It captured what it was supposed to – and a lot more into the bargain. The term “tacit knowledge” had a liberating effect. It has, however, been used – and even misused – in a host of different ways. “The concept of tacit knowledge needs to be purified,” Bo Göranzon wrote in 1988. There is still work to do. This section of the present chapter is intended as a contribution to both purification and criticism of the notion. It is primarily concerned with the strange view of language and knowledge which appears to lie behind a division of knowledge into the tacit and the explicit.

This view of language and knowledge is a deeply rooted one. It is even manifested when many of those who “know better” write about description and articulation. It reveals itself, for example, when it is said that “thoughts can only be incompletely described with words.” Another variation is that there is always a “gulf” between the description and the reality being described. In statements of this kind, description is made to seem a clearcut matter without any allusion being made to methods of description, language, point of view, and above all to intention, or to their being presupposed. And we are often led astray by the image of thoughts and ideas as having an autonomous existence, independent of language, as objects which one tries to fit words and phrases to, as though what was at issue was to find the most naturalistic depiction, or the most realistic photograph, possible. This image is a false one.
**Source used in excerpt**

It is a fact, declared Michael Polanyi, introducing a series of lectures on The Tacit Dimension, "that we can know more than we can tell" (Polanyi 1966: 4). Polanyi was referring to those ways of knowing and doing that grow through the experience and practice of a craft, but which adhere so closely to the person of the practitioner as to remain out of reach of explication or analysis. His argument was that knowledge of the sort that can be rendered formally and self-consciously explicit is but the tip of an iceberg compared with the immense reservoir of know-how that lies beneath the surface and without which nothing could be practicably accomplished. Whereas Polanyi, however, was primarily interested in what it means to know, my concern just now is with what it means to tell. In his reflections on the nature of personal knowledge, Polanyi seems to have assumed that telling is tantamount to putting what one knows into words, in speech or writing, and that this entails two things: specification and articulation. Thus he regards as the unspecifiable part of knowledge “the residue left unsaid by defective articulation” (Polanyi 1958: 88). In this chapter I want to argue, to the contrary, that we can tell of what we know through practice and experience, precisely because telling is itself a modality of performance that abhors articulation and specification. It follows that personal knowledge is not quite as tacit as Polanyi thought. Part of the problem is that the term “tacit” has many shades of meaning, ranging from the silent through the unspoken to the implicit. What remains unspoken need not be left unvoiced; nor need what remains unwritten be left without any inscriptive trace. Moreover, what is not explicated may still find expression in spoken or written words. As anthropologists who have worked with skilled practitioners are all too aware, their mentors are often inclined to expound upon their crafts vociferously, demonstrably and at very great length. The figure of the silent craftsman who is struck dumb, when asked to tell of what he does, or how he does it, is largely a fiction sustained by those who have a vested interest in securing an academic monopoly over the spoken and written word.

Source used in excerpt

A reading of Sturt on tacit knowledge

Frayling, 2011, pp. 40–43. This type of knowledge might be difficult to grasp – especially for an outsider – but it could be articulated and, with time and patience, it could be communicated as well. The other type of knowledge was, by contrast, made up entirely of tacit rules and understandings which were impossible to articulate in a formal way, simply because they only arose from the experience of living for a long time among a particular group of people, or what modern sociologists of science call “an invisible college.”

The more Sturt tried to pin down this knowledge – to describe the tacit understandings and reduce them to a set of “scientific” axioms – the more remote and complicated they seemed, and the more he was tempted to call them magic.

Again, it was partly a matter of his frame of mind: he thought he was after bits of information, or “material” for his books, when in fact he was learning a kind of language. It was no use sitting in his study to learn it, agonising about whether or not it had anything to do with “art” – there was no substitute for spending a lot of time working in the wheelwright’s shop, until these tacit understandings became second nature to him as well. At first, Sturt thought that the wheelwrights were deliberately keeping information from him, that they were too inarticulate to tell – anything to explain why so much seemed strange to the schoolmaster. What particularly irked him was
The book by Sturt is a famous and often cited example in discussions of tacit knowledge and skilled craft. What Frayling is trying to pinpoint here, I think, is where the border was for Sturt between potentially articulatable knowledge and sheer practical knowing in the specific knowledge domain of the wheelwright’s shop.

**Source used in excerpt**

Sturt, G. (1921). *The wheelwright’s shop.*
Another nurse told Ingela Josefson about a newly operated patient who at first seemed to her to be doing relatively well, although later she could see that there was something amiss. The chief resident examined the patient and said that there was nothing to worry about. The patient died two hours later.

I could see that something was not right, said the nurse, and she added that during her working life – she had been working for more than thirty years in the same post-operative ward – she had probably experienced similar events: “I may have forgotten many of them but they would still remain with me as part of my skills.” This is not to imply that her knowledge is infallible. No knowledge is.

Ingela Josefson comments:

The ability to see that something is not right although all the medical tests are normal is a skill that cannot be acquired through studying books. Propositional knowledge can provide us with an overall orientation but the mastery of seeing is only acquired in practice.

Finding accounts of similar experiences from other fields is not difficult. We saw some examples of “tacit knowledge” in chapter 1. Seeing, doing, and being are, one might say, the tacit forms of knowledge. Attentiveness continues to play a key role here.
But in an old car, the idea of resistance as something simple and unitary, as the letter R, can get in the way of the kind of perception required to notice the actual sources of resistance, and say it is clear from Ohm's law, nor does it refer to the particular sources of corruption. Such as rain. During one of those rainy weeks when he keeps having to wipe the mud off his boots and peel a clammy shirt off his shoulders, an experienced mechanic facing an ignition problem in an older car is likely to reach for some WD-40 and spray it in the distributor, to displace moisture from the contact points. On the other hand, if his hair is full of sand that has been raining down in little micro-avalanches from the recesses of a truck up on the lift, he is likely to intuit that the driver has been off-roading in the local dunes, say, and reach instead for his compressed air to blow debris out of the distributor. I say “intuit” rather than “conclude” because he may not draw any explicit connections in his mind between muddy boots and remedy A, on the one hand, and sandy hair and remedy B, on the other. Rather, he is familiar with typical situations, and their typicality is something of which he has a tacit knowledge. This tacit knowledge seems to consist of recognizing patterns, and the causal patterns of the ignition problem are mirrored by patterns in his own bodily motions: periodically scratching the sand out of his scalp, or peeling a clammy shirt off his shoulders.

Ohm's law is something explicit and rulelike, and is true in the way that propositions are true. Its utter simplicity makes it beautiful; a mind in possession of this equation is charmed.
Tacit judgment


Bob is used to looking at something, say an internal engine part, and making a judgment about it based on experience – for example, looking at the first signs of glaze on a cylinder wall and judging whether it needs rehoning. Pressed to justify his decision, he might say, “I’ve seen them look like this and go another ten thousand miles without any loss of compression.” The experience Bob relies on is very much his own; he is not following a set of instructions. When a mechanic makes this kind of judgment, he is relying on a tacit integration of sensual knowledge, by which he subconsciously refers what he sees to patterns built up in his mind through long experience. He does just what a firefighter and a chess master do.
My leitmotif is knowledge as a form of attention, attention in action. The lifeworld is characterised to a great extent by the fact that it is not paid attention to. Almost as a matter of definition, the lifeworld is made up of ways of acting and preconceptions that are so self-evident they “go unnoticed.” The same can be said of tradition – “tradition” and “lifeworld” both cover much the same ground but tradition emphasises what is transmitted from one form of another (as a Swede, as a carpenter, etc.) in such a way that an identity in one form or another (as a Swede, as a carpenter, etc.) is retained. Thus the equation follows: Lifeworld and tradition are bound up with that to which attention is not paid. Knowledge is bound up with attentiveness. Can this equation be solved? Not without certain tensions remaining unresolved. But we can get a good way down the road. Routine and tradition make attentiveness possible by taking over what are known as “routine matters” and “routine thinking.” Routine and tradition provide a form of certainty in action, and in being, which has both more subjective aspects – trust in oneself – and more objective ones – frequent success in what one intends or plans to achieve. Bo Göranzon has emphasised the importance of certainty in action as a crucial part of professional knowledge. Certainty also makes possible greater freedom and variation in action; it provides a security which makes it possible to go beyond “the standard routine” and this provides greater scope for the training of the attention, and hence, the continued formation of knowledge. Limits can be attended to. Certainty is also a pre-condition for learning from failure, in the sense that it helps one to find the courage to continue. Routines can be broken and traditions surpassed as a result. This helps to make clear that routine and tradition do not exist in a simple relation of opposition to attentiveness and knowledge.
One thing that I have said more than a few times, in my role as design teacher as well as my role as a father, is that it is good idea to know the rules first before you start breaking them. This is a cliché in many ways, of course, but I still find that when someone who masters a particular rule or convention breaks it, the results are usually more profound and rewarding than when the same convention is broken in ignorance. Molander’s discussion of certainty in action seems to relate to this question of skilled vs unskilled breaking of rules.
Appreciation is a participatory practice, culturally positioned, and without explicit rules or grading. Here there are parallels to skill. Polanyi (1958) suggested connoisseurship as a dimension of expertise, like skill, can be acquired through practice but not explicitly taught. To become a connoisseur, you must go through a long course of experience under the guidance of a master. We don’t just see; we study; we learn. Anything less would be mere apprehension, or mere projection.

Appreciation also incorporates intent. This may be unstudied disposition: as the critics say, “dogs see dogs.” However, more usually intent is a matter of willful receptivity. For example, the difference between hearing and listening to a piece of music might be its relation to the last piece listened to, and this is why many people prefer media in which they get to choose the programming. Intent lets us decide the context in which we receive a piece: we might say that is lets us look at a medium or through it. For example, we might return to the theater to see a play a second or third time to study it at different levels, for example, the acting, the direction, or the lighting. Such intentional appreciation has a close relationship to craft. It doesn’t hurt to have first-hand experience with the making. More specifically, the interpretive process centers on familiar categories of forms within an acquired medium. We might say that appreciation can be within a genre or of a genre. The Parthenon is great primarily in relation to so many other Greek temples. Greek temples are great because they gave us so
SOURCE USED IN EXCERPT

5. What we call our “highest,” or most abstract, concepts may not seem to be based on aspects of our sensorimotor experience, but this is an illusion. Concepts that we think of as utterly divorced from physical things and sensorimotor experiences (concepts such as justice, mind, knowledge, truth, and democracy) are never really independent of our embodiment, because the semantic and inferential structure of these abstract concepts is drawn from our sensorimotor interactions, typically by cross-domain mappings (conceptual metaphors). This is the only way it could be for a creature with a body-mind who has neither a disembodied ego nor an eternal soul, for there is no nonbodily entity or process to perform the abstraction.
Why was manual calculation so important? Bo Göranson brings the threads together in the following way:

Firstly, it was not a question of purely mechanical calculations but of calculations that were interspersed with plausibility judgements. Calculations combined with judgement to form a whole. One could not therefore draw a clear line between routine and complex operations.

Again, calculation can give one a deeper knowledge of the data collected at the inventory stage. When the forest ranger uses this material in his calculations – and not until this point – he gets a total picture, an overview. This overview emerges naturally, effortlessly; the forest ranger sees the proportions, the factors that weigh heavily, the effect a variation will have.

The overview produced by the calculation process is also important when the forest ranger makes his inventory in the field, enabling him to take into the forest, so to speak, the impression of his in-depth understanding and the result of his reflections.

Bo Göranson has put his finger here on something I would call an illusion with a great many negative consequences (in mathematical didactics to name but one of the areas affected); that is, the belief that – because one can learn to count as an isolated activity – that is what one is doing when one counts (makes calculations) as part of various other activities. This is not what one is doing, “calculation” cannot be separated out. As a result, one aspect of the holistic character of action can be seen very clearly in the case of the forest rangers. Belief in the separability of calculation is bound to have been strengthened by the mechanisation and computerisation of the process of calculation. “The mechanisms of calculation” have been projected into the human being, which is why it appears as though there were a separate process going on there. This is one form of introverted thinking.

The summary made by Bo Göranson and quoted above provides a useful illustration of what Donald Schön calls reflection-in-action but which I prefer to call attentive action with several living alternatives – attentiveness in action alternating with reflection leads to learning in action.
SOURCE USED IN EXCERPT

The piece of furniture must be imbued with every care, with a sense of responsibility and a sense of honour, in such a way that it says something important about the holistic nature of action. Care of an object, for example, should be determined by these aims. This is a whole which determines the parts; it lends a specific meaning to the various elements of the work. What we are considering here is first and foremost the wholeness of the work. The work forms part of larger wholes. Thomas Tempte sees the cabinetmaker’s work as part of a tradition. This pervades the whole of his professional activity, not just his production of furniture but also his research into the professional skills of others. We could, no doubt, locate what he does within even greater wholes and so enlarge the hermeneutic circle. [...]

Knowledge as a form of attentiveness: this is an attentiveness that has both its sights and a firm foundation in the particular whole which characterises an action and a context of action (Seeing both the wood and the trees). Thinking in wholes is also an important part of the holistic nature of action. In the design studio Quist is always encouraging Petra to switch between the part and the whole in her sketching and thinking. It is this that she is learning to do. [...]

There is nothing to suggest that the expression “having the whole boat in his head” is of any importance to the agent himself, to Gösta, in the course of practising his professional skills. This is, however, the case in another instance involving what appears to be an equally metaphorical image, I am referring to the internal weather picture that Maja-Lisa Perby has described in several publications.
SOURCES USED IN EXCERPT


Let me return for a moment to the example of kite-flying. Following Pickering, we had assumed that what we were witnessing was an interaction between a person (the flyer) and an artefact (the kite). The question, then, was how the kite could exert any kind of agency, and in order to explain this we had to bring in the air. Our conclusion was that you cannot dance with a kite without introducing the air as a ‘third party’.

There is, however, a snag in this argument. For how can air possibly be regarded as an agent? The very idea of agency, as we have seen, is the corollary of a logic of embodiment, of closing things up in themselves. But air cannot be closed. More than any other element, as the philosopher Luce Irigaray reminds us, air is ‘opening itself’ (Irigaray 1999: 8). The flow of air — the very antithesis of closed upon itself, the animate-person that lives the flight — can only be understood if we allow that in flying a kite, it is not a dance of agency. It is a dance of animacy. And in this dance, flyer and air do not so much interact as correspond. The kite, in effect, sets up a correspondence between the animate movements of the flyer and the currents of the aerial medium in which he or she is immersed. It is not that you need air to interact with a kite; rather, you need a kite to correspond with the air.

A moment’s reflection, moreover, indicates that the same is true of what happens at the potter’s wheel. This is not, as we have seen in the parallel case of brick making (Chapter 2, p. 25), an imposition of form on matter but a contraposition of equal and opposed forces immanent respectively in gesturing hands and wet clay, set up thanks to the rotations of the wheel. You do not, then, need clay to interact with the wheel, but you do need a wheel to correspond with the clay. In both cases, of pottery and kite-flying, the mindful or attentive bodily movements of the practitioner, on the one hand, and the flows and resistances of the material, on the other, respond to one another in counterpoint. As with any dance, this should be read not laterally, back and forth, but longitudinally as a movement in which partners take it in turns to lead and be led or — in musical terms — to play the melody and its refrain. In the dance of animacy, bodily kinaesthesia interweaves contrapuntally with the flux of materials within an encompassing, morphogenetic field of forces.

The dance of animacy

SOURCE USED IN EXCERPT

The work of sketching can be seen as a paradigm of what Schön refers to as problem setting, framing and naming. Meaning is created. The intentions and the ends are developed as part of this process, they are not given in advance. This is one of the things that makes the metaphor of the conversation so apt. The structure is dialogical. Making a slight alteration to some words of Johan Asplund which I have already quoted on several occasions: the architect (the designer) does not know what she has done or what she is striving towards until the sketch has responded, it shows her what she has done and what she is striving towards. This must, of course, be seen in a perspective of pre-understanding and pre-striving. Schön is very much aware that what is involved is a circular or spiral structure. This is a hermeneutic circular structure, even though Schön uses different wording to describe it.
The answer is the same in every case. In the dance of animacy, cello, toggle, kite and wheel are all examples of what we could call transducers. That is to say, they convert the ductus – the kinetic quality of the gesture, its flow or movement – from one register, of bodily kinaesthesia, to another, of material flux. In the vibration of bowed strings, amplified by a soundbox, the cellist’s manual gesture is rendered audible, as melody. In the sliding of the toggle, the herdsman’s throw is cast as a loop of rope. In the rotation of the wheel, the potter’s hand and finger movements are registered in the contours of soft clay. And finally, in the kite, slicing the air like an axe through wood, following its undulations and torsions, the running of the flyer becomes a line of flight. In each case, the transducer slides along the thread of time, like a toggle on a rope, ever present on the threshold of emergence of things. It is this ever-presence that lends it an aura of immutability.
Langer is saying that when we are actively listening to music, we imaginatively enter into its “motion,” experiencing all of the ways it moves, swells, hops, rushes, floats, trips along, drags, soars, and falls. This musical soaring, floating, or falling is experienced by us as our felt flow of experience. We feel it in our vital, tactile-kinesthetic bodies. When the music builds up tension (for example, as it moves pitchwise from the lower through the middle to a high range), we experience that tension in ourselves. If we didn’t, music would never move us. Langer sums this up: “A work of art presents feeling (in the broad sense I mentioned before, as everything that can be felt) for our contemplation, making it visible or audible or in some way perceptible through a symbol, not inferable from a symptom. Artistic form is congruent with the dynamic forms of our direct sensuous, mental, and emotional life” (Langer 1947, 25).
The problem has already been touched upon. The craftsperson cannot very easily explain the rightness of what she or he has achieved; other people have to recognise it. They have to see it easy, Dormer, 1997c, pp. 228–230. person as naive. And then, because we have made our minds up that craftspeople do not understand the real meaning of what they are doing, we look elsewhere for explanations and in so doing miss the integrity of a whole other world of knowledge – that of the craftsperson. Ironically, it is one of this century’s leading theorists and philosophers who comes to the rescue of the “traditional” craftsperson. Craft, as I have defined it, with making as its central activity, is all bound in with tacit knowledge and connoisseurship – knowledge that cannot be described very easily but which can often be demonstrated. Because it cannot be described in a language it will not easily be theorised and it is very hard to draw down into general principles. But the facts of the knowledge can be demonstrated through example and comparison. And it is here that the most fashionable Western philosopher of the twentieth century, Ludwig Wittgenstein, comes to the rescue because he recognised the fundamental distinction between knowledge that can be described in words, and knowledge which can only be shown. On 19 August 1919 Wittgenstein wrote to Bertrand Russell that the cardinal problem in philosophy was the difference between what can be expressed theoretically in propositions – language – and what cannot be expressed theoretically but only shown. What can only be shown cannot be written about, and to those who think
Source used in excerpt

Hantverk värderas lägre än vetenskap
von Wright, 1986/1988, s. 68.

EXEMPLARY TRANSLATION
The technological blessings promised by Bacon and others to follow the new science were perhaps surprisingly slow to materialize. The historical origin of our technology is craft rather than science. The technical skill of the craftsperson is based on another social tradition than scientific research. The fact that the skills of the hand and the skills of the mind have been socially valued differently, may partly stem from a view on physical labor that we have inherited from antiquity. A “free” man should not have to work with his hands. Physical work was seen as “slave labor.” An echo of this cultural heritage is preserved in our language to this day.
Food is the continuum in the Song of the Gavilan. I mean, of course, not only your food, but food for the oak which feeds the buck who feeds the cougar who dies under an oak and goes back into acorns for his erstwhile prey. This is one of the many food cycles starting from and returning to oaks, for the oak who gives your med e quail o daily

Science reduces the buck who feeds the cougar who dies under an oak and goes back into acorns for his erstwhile prey. This is one of the many food cycles starting from and returning to oaks, for the oak who gives your med e quail o daily


There are men charged with the great duty of examining the construction of the plants, animals and soils which are the instruments of the great orchestra. These men are called professors. Each selects one instrument and spends his life taking it apart and describing its strings and sounding boards. This process of dismemberment is called research. The place for dismemberment is called a university.

A professor may pluck the strings of his instrument, but never that of another, and if he listens for music he must never admit it to his fellows or his students. For all are restrained by an ironbound taboo which decrees that the construction of instruments is the domain of science, while the detection of harmony is the domain of poets.

Professors serve science and science serves progress. It serves progress so well that many of the more intricate instruments are stepped upon and broken in the rush to spread progress to all backward lands. One by one the parts are thus stricken from the song of songs. If the professor is able to classify each instrument before it is broken, he is well content.

Science contributes moral as well as material blessings to the world. Its great moral contribution is objectivity, or the scientific point of view. This means doubting everything except facts: it means hewing to the facts, let the chips fall wherever they
Det finnes knappast en etisk benämning, som icke betecknar en så oändlig mångfald af själstillstånd och så vidt skilda, att den ena ändan af deras rad ligger i urbarbariet och den andra inne i framtidsljusningen. De allmänna orden är här värdelösa eller kunna endast tjänstgöra vid det allra första högst obestämda angifvandet av läget; och en diskussion på grundlag af dem har intet bestämdt föremål. Det är ett alltför vanligt skådespel, att medan vi demonstrera med definitionsburen i hand, flyger fågeln, som vi tro oss hafva, ännu i det fria.

Excerpt translation

There is scarcely an ethical label that does not refer to such an infinite multitude of spiritual conditions and so widely diverse that they range all the way from original barbarism to the dawn of the future. General words are useless here, or may serve only in a first preliminary assessment of the situation, and any discussion based on them will be lacking in precise topic. It is far to common to witness a demonstration with the definition cage in hand, while the bird we expect to have is still soaring free.

Do not be too rash with your definitions. You want the truth in your hand; very well – if you can! The secret of life is like a bird in the forest. Do not join the ones who rush clumsily ahead to catch him dead or alive. You should approach gently and be still – and then you will hear him sing!
A distinguishing feature of knowledge in action, knowing in action, is that knowledge formation involves both a creating and a maintaining of the identity of an action – and, hence, the identity of individuals as agents and beings. This is not knowledge about something, distinct from the process of knowledge formation. I learn to do something at the same time as I learn what I am doing (and have done). As I learn more “about” what I am doing and improve my knowledge in action, I also change the very identity of my actions, what I am doing. It must follow that what we are dealing with is personal knowledge, tied to the individual agent. It is through reasons, in the broad sense, that the identity of actions is created and maintained. In this light, it is almost self-evident that skilful action is identical with acting with good reason. Giving reasons is never simply a matter of looking back at what has occurred, reasons also direct or orientate continued action. Good reasons lead onward in a positive way. In this section I shall explain, and to some extent defend, the formulation “knowledge in action is identical with acting with good reason.”

Acting with good reason is justified action, the action was correct – according to the kind of judgement that is made after or in the course of an action. I will frequently be making use of the verb “justify” since it is associated with a condition that is usually formulated for theoretical knowledge; only a justified conviction can constitute knowledge – this, too, is a requirement for good reason.
The subject and context of this paper arises from the major Arts and Humanities Research Council project, “Past, Present and Future Craft Practice” (PPFCP, 2005–2010) led by Professor Georgina Follett and Dr Louise Valentine. The position of this research project is to ask, “Is there a future for craft?” At its core is the principle of craft as, “the scientific examination of techniques, technologies and materials harnessed through the indexical mark of an individual producing unique knowledge and insights via a lifetime journey of practice” (Valentine and Follett, 2010:2). This is an alternative view to the majority of existing discourses for craft, which emphasize the handmade element and technical dexterity. Communication of craft during the twentieth century predominantly emphasized material specialism, its associated technical attributes, social and historical relevance as a product and lifestyle (Dormer, 1998; Harrod, 1999; Needleman, 1993; Pye, 1971; Robertson, 1961). This contributed to craft being primarily perceived and understood as skilful making rather than an intellectual activity. Material and technical mastery are important components, however, in this research the driver of craft is vision and concept.
Sources used in excerpt


Analys och syntesen äro tvenne strömningar som ideligen mötas, som den ena tråden i en väfnad möter den andra. Man kan säga, att de förutsätta och intermittera med hvarandra som in- och utandning (Goethe), men i själfta verket äro de ännu mer intimt förbundna, så att hvarje syntes på samma gång är en analys, en isolering (jfr sid. 25), och tvärt om. Båda dessa riktningar äro att iakttaga alltid och samtidigt. Men detta hindrar icke, att stundom den ena kan förhärska, stundom den andra. Det kan hända att analysen går i förväg för syntesen, såsom förhållandet är, då vi hafva ett överflöd på material, på detaljforskning, som icke funnit ett bestämdt mål; och det kan hända att syntesen ilar före och i dunklet uppfångar, så godt den kan, ett sammanhang, innan den analyserande undersökningen kommit dit med sin lykta.
Excerpt Translation
Analysis and synthesis are two streams that continuously meet, like one thread of a fabric meets the other. You could say that they require and interact with each other like breathing in and breathing out (Goethe), but they are actually even more intimately connected, such that every synthesis is at the same time an analysis, an isolation, and the other way around. Both of these directions are to be considered at all times. But this does not stop one of them from dominating in certain situations. It might be that analysis precedes synthesis, as in cases where we have an abundance of material, detailed research, that has not found its specific target; it might also be that synthesis rushes ahead to sense meaning in the shadows, as best it can, before the analytical investigation has been able to make it there with its torch.
I would like to describe the knowledge-in-action and reflection-in-action that Schön refers to in the following way:

The skilled practitioner is **attentive**, paying attention as **part of her action**. She has the ability to **keep several alternatives open as living possibilities** in her action. Schön himself expresses this in almost the same way when instead of reflection he refers to a "double vision" which involves "the capacity to keep alive, in the midst of action, a multiplicity of views of the situation." The skilled practitioner also maintains an overview of the situation: she knows what has occurred and happens to be an **overview of what may happen**. She is prepared to change her way of acting. In certain cases one could say that the practitioner tests her way forward – Schön calls this "experimentation." And since the practitioner is paying attention, she is also learning at the same time, which involves changes to her repertoire of models and experience. In essence the "reflective practitioner" is the **attentive and learning practitioner**.

It is a key insight that one's own action can be the source of knowledge in action, in the course of the action itself. One discovers what one is doing while one is doing it. And the more experienced and skilled the practitioner is, the more she can focus her attention, since she is learning to see better, and the more freely her attention can roam – since more and more matter are becoming routine.

Schön refers to a distinction between the familiar and the surprising as a means of distinguishing between knowledge-in-action and reflection-in-action. This cannot be maintained, given his own preconditions, since knowledge in action is based on a repertoire of examples, images, understandings and actions (and possibly other things as well), a new situation is seen as something in the repertoire. This is not mechanical or formal application, there is always – in principle – an element of creating something new: each situation is considered unique.

Cleaning up Schön’s concepts

Molander, 2015, pp. 162–164.
Sources used in excerpt


As well as using their bodies, haptic sense and previous embodied knowledge from other craft-related domains, the students in Case 3 (Publication IV) created their mental images relying on previous tactile experiences and the tactile memory of materials. As mentioned earlier, the research at hand therefore suggests that the mental image also includes embodied tactile memory that is based on previous experiences with the imagined materials. This conclusion is supported by the research of Akter Ahsen (1984), who in his work on mental imagery also included the somatic (bodily) realm in his triple coding model: Image-Somatic-Meaning (ISM). Further, recent research on designers’ ideation process supports the inclusion of multimodal material inspirational sources as part of the creation of the mental image in the ideation phase (Laamanen, 2016, p. 45). Design researcher Tarja-Kaarina Laamanen (2016) came to the conclusion that mental images needed in the ideation process of designers are created from sensory, perceptual, language and material elements (p. 45).
The finding that tactile experience of physical materials can become generative memories in design ideation seems intuitively familiar and appealing. For instance, I find it quite easy to remember the way different types of leather feel to the hand, and to use those memories when thinking about the design of a new leather-bound book. (Even though I have to confess that the tactile memories to me seem to be mixed up with olfactory ones – different leathers have different smells, and those do come to mind as well in my design deliberations.)

For our purposes here, it is interesting to think about how far Groth’s work would extend into interaction design. I would argue that even certain types of (non-physical) interaction have quasi-tactile properties related to aspects like the rhythm, shape and extent of input motion, and to spatial display configurations. And if you limit the discussion to tangible interaction and haptic interfaces, then there is of course no question that Groth’s finding is immediately relevant.

**Sources used in excerpt**


An overarching finding of the entire study was surprisingly the many different levels and notions of emotions that surfaced through and in connection with haptic experiences. It may be said that emotions related to haptic and tactual [sic!] experiences in a making process with material affect and regulate risk assessment, decision-making and problem-solving. Emotions also aid the maker in applying the right amount of attention and caution in the management of critical incidents. Previous experiences are stored and reactivated (by somatic markers), reminding the maker of the available opportunities and risks (affordances) related to a situation. When there are no previous experiences to lean on, as in the meeting of new material properties, similar previous experiences are related to instead. In this way, a form of re-knowing of previous knowing aids in overcoming challenges.
Goodman introduced terminology to distinguish fine arts on the basis of notation. Arts such as painting for which the artifact is the work and there exists only one original he calls "autographic." Arts such as music where the notation carries the work and multiple instances are possible he calls "allographic." (Goodman 1976, p. 113) We may note that the latter is more abstract. One route to abstraction is to incorporate formal notation.

At first consideration, traditional crafts are purely autographic. They lack notation, are made by hand, and produce no two pieces exactly alike. Yet if we discount the exception of the masterworks, and concentrate on routine artisanry, we find a different situation. Here among the countless indifferent pieces made according to any one trade, one piece is as good as the next. Although the pieces are not identical, or modular, like machine-made wares, nevertheless they are effectively interchangeable. No one stands out as the original, and certainly there are no forgeries. Here one might argue that the intellectual property is not so much the artifact as the tradition by which it is made—such was the stuff of apprenticeships. As we have noted, this tradition is tacit. Even in the unusual case where there exists a written specification or a drawing, that notation is not considered the work. The work of craft is neither the design nor the individual artifact: it is the tradition of the very production. It is the presence of many objects identical in their conception, and interchangeable in their use, but unique
SOURCE USED IN EXCERPT

The role of artifacts in research

Seago and Dunne, 1999, p. 16.

The methodological strategies employed by the research projects reviewed above seem to offer some solutions to the problem of the role of the object/artifact in research by project. As experienced craftsman, graphic designer, and product designer, respectively, Ferguson, Johnson and Dunne acknowledge that there is a kind of tacit knowledge creative professionals possess which cannot be separated from their perception, judgment, and skill. However, rather than arguing that a radically new electronic product or a new method for producing metals can be constituted as providing new knowledge “in themselves,” Johnson, Dunne, and Ferguson situate their discoveries in a research context. All three of these doctoral programs have been conducted as systematic research activities and contain explicit data. The record of the conduct of both programs is “transparent” in the sense that a future researcher could uncover the same information, rehearse the arguments expounded and, to a lesser or greater degree, produce the same results. In all three projects, the data employed and the results obtained are validated and related to a review of previous research in appropriate fields. In short, if research in “any” discipline can be described as a systematic inquiry whose goal is knowledge, then Ferguson, Johnson, and...
This article was published well before the current wave of interest in research through design (RTD) and how the processes of designing and making can play central roles in the production of knowledge that is academic research. The examples it provides and the authors’ insistence on designer-researchers providing “transparent” accounts of their processes are still most valuable. The hint at repeatability that lies in the phrase “to a lesser or greater degree, produce the same results” seems more dubious to me.
We differentiate research artifacts from design practice artifacts in two important ways. First, the goal of interaction design research is to produce knowledge for the research and practice communities, rather than make a commercially viable product. Therefore, research projects that take this research through design approach will likely de-emphasize certain perspectives in framing the problem, such as the detailed economics associated with manufacturability and distribution, the integration of the product into a product line, and the effect of the product on a company’s identity, etc. In this way, design researchers focus on making the right things, while design practitioners focus on making commercially successful things.

Second, research contributions should be artifacts of invention, representing novel integrations of theory, technology, needs, and context rather than incremental modifications to products that already exist in the research literature or commercial markets. Novelty makes particular sense in the interaction design space of HCI. Meteoric technological advances in hardware and software result in aggressive invention of novel products in HCI and interaction design domains that are not typically experienced in other design domains. For example, while appliance designers might find themselves redesigning a
The criteria that Forlizzi et al. offer to assess the artifacts produced in the course of research through design correspond to two of the three general criteria that I think are behind more or less any specific research methodology.

The first one is novelty ("research contributions should be artifacts of invention").

The second one is relevance ("making the right things"), which can in turn be divided into internal relevance for the academic community engaging with the proposed knowledge contribution, and external relevance for specific use situations and for society in general.

For me, the third general criterion is groundedness: the extent to which knowledgeable readers can assess the way the artifact was made, and the rationales behind its making, in order to determine for themselves whether and how to appropriate the proposed knowledge contributions. This is essentially what Seago and Dunne are aiming at when advocating a “transparent” research process (see p. 236).
Artifacts as knowledge... Durrant et al, 2015.

Possibly with an exhibition or “demonstrator” component that is often non-archival. Further, the opportunities afforded by the traditional-format paper presentations is at times at odds with the experiential insights from the conference conception, through to the event itself and post-conference reflections, alongside the reflections fed back by conference delegates.

RESULTS: We have found the roundtable format continues to function well for creating a discursive interactional context. However issues arose around the crucial nature of the session chair’s role in enabling rich and multi-voiced discussion and how presenters’, organizers’ and delegates’ voices were captured and documented, with implications for further developing the conference design. Looking forward, there are also questions raised about: balancing the stringency of a rigorous review process with provision of an encouraging platform for early-career researchers; and balancing the need for clear criteria and formatting standards (for assessing quality and rigor in submitted work) with the “openness” of the submission template and formatting guidelines (to encourage pioneering developments in visual argumentation).

IMPLICATIONS: The article provides a valuable resource for practice-based design researchers who are committed to generating research understanding through applied endeavors (making things) and/or writing. This includes designers who...
The authors address the question of how artifacts resulting from research through design can come into play more forcefully in the context of an academic conference. The format they propose is called Rooms of Interest, and it strikes me as a very promising challenge to conventional monological presentations when it comes to design-based research. When it works well, it feels more like a design crit than a lecture, with a sense that knowledge and insights are actually produced in the room.

There are unresolved issues of scalability and dissemination, of course, but I think it is necessary to realize that communicative formats need to be shaped from the specific topics and needs of the discursive community involved (rather than being routinely inherited from communities addressing other communicative situations).
In Part II of this book, Philosophy From Things, I continue to elaborate this “postphenomenological philosophy of technology” via a critical discussion of the work of contemporary thinkers including Don Ihde, Bruno Latour, and Albert Borgmann. In contrast with the transcendentalism of classical philosophy of technology, I articulate an approach to technological culture that attempts to understand the concrete role of technological artifacts in human existence. The key concept of this approach is “mediation.” This concept allows us to escape from two “common-sense” approaches to technology, which regularly frame the discussion, and which, as we shall see, can be found in the work of Jaspers and Heidegger as well. The first is the instrumentalist view that technology is a neutral means to achieve human goals be they good or evil; the second is the substantivist conception that technology is not neutral but a determining and controlling influence on society and culture. When technological artifacts are looked at in terms of mediation – how they mediate the relation between humans and their world, amongst human beings, and between humans and technology itself – technologies can no longer be pigeonholed simply as either neutral or determining.

On the one hand, the concept of mediation helps to show that technologies actively shape the character of human-world relations. Human contact with reality is always mediated, and technologies offer one possible form of mediation. On the other hand, it means that any particular mediation can only arise within specific contexts of use and interpretation. Technologies do not control processes of mediation all by themselves, for the forms of mediation are always context dependent – otherwise we would be back at the technological determinist view. To return to the example of microwave ovens...
Why is craft intellectually inconvenient in modern and contemporary art? Why did it go out of fashion as an interesting concept and activity to argue about and to practise? Certainly the highly intelligent but at times Swiftian scepticism that has constantly probed and taunted the question of what art is has had its effect on crafts over the last seventy years. The questions tempt and beguile us with their implicit answers: why should art be this? Why does art need craft? Why make something when you find a ready-made and present it as art? It is your ability to choose and select, not your ability to make, that marks you as an artist, as a connoisseur. Why have the object at all? And in the face of these questions craft in art collapsed. Craft just seemed so tedious because it was almost inelegant in its demands.

There has also been an assumption that ever-improving technology replaces craft. In some areas technology has indeed replaced craft in efficiency and aesthetics: ask almost any devotee of the top ranges of BMW motor cars. Or indeed ask the owner of a pair of Nike shoes. What they drive and what they wear is art.
föret i portgången var kärvt och misslyckandena många och flagranta. I Europa funnos vid denna tid icke så få konstnärer, som kallade sig bokkonstnärer, och som skilde sig från alla andra att få De k

Det var ju inte så länge sedan något av denna tankegång realiserades av den store William Morris. Även för honom stod kunskapen i hantverket som något absolut väsentligt. Först på denna grundval kunde en konstnär skapa och reformera. Denna tanke upptogs av bokkonstnärerna från det begynnande århundradet.
De studier, som de nya reformatorerna i England, Frankrike och Tyskland bedrevo under detta nya sekels första decennier, hade väl som resultat förvisso mycket pastischgods, men för dem var pastischen icke någonting annat än ett medel att komma i kontakt med den förlorade traditionen, ett sätt att få inspiration. Ett bevis på hur litet detta pastischverk betydde kunna vi se i det faktum, att de flesta av dessa konstnärer mycket snart vände sig från det typografiska ytterverket och ornamentiken och koncentrerade sitt intresse på det väsentligaste i all bokkonst: bokstävskonst och typsnitt.

Under ett sådant nytt och mödosamt arbete, som kräver så mycket tekniskt kunnande tillika med en ständigt skapande men ändå av så många praktiska detaljer tyglad fantasi, växte uppgiften ut till helt andra och större proportioner. Att
Excerpt translation
... it was a rough start, and there were many conspicuous failures. There were quite a few artists in Europe at the time calling themselves book artists and standing out from other artists by their dedication to grasp the technical foundations.

Their sentiment was artistic, but they understood that professional insights and knowledge were essential for innovation and the creation of lasting value. At this time, book arts had a long history of amateurish attempts leading the field astray in many ways. For once, it was decided to learn from history and try to improve.

Similar ideas were realized not so long ago by the great William Morris. Also for him, craft skills formed the necessary basis for artistic creation and reformation. The book artists of the early years of the century embraced this idea.

The studies that the new reformers in England, France and Germany performed in the first decades of this new century certainly resulted in much pastiche work, but for them the pastiche was nothing but a way to get in touch with lost traditions and to be inspired. An example of how little the pastiche meant is found in the observation that these artists soon turned away from typographic surface and ornament to focus on the most essential parts of all book art: letter art and typefaces.

This new and demanding work, that requires much technical knowledge combined with an always creative but also practically restrained imagination, grew into a task of completely different and much larger proportions. To ...
In the case of skill, matters are yet more complex. Skill, narrowly conceived as “knowing how to make something,” is obviously at issue in the creation of any art, even the most "dematerialized" of conceptual works. Indeed, when an artwork is not made to the standards a viewer might expect (however those standards have been determined), skill becomes all the more present as a consideration. It is most conspicuous in its absence. And yet artists often casually denigrate skill, as if it were beside the point. Jackson Pollock voiced a typical attitude: “it doesn’t make much difference how the paint is put on as long as something has been said. Technique is just a means of arriving at a statement.” The British sculptor Helen Chadwick, meanwhile, was even more forceful: “I feel, like a lot of contemporary artists, distrustful of the conceit of the artist’s hand – this talented hand, able to toss off these beautiful creations.” Skill is a precondition for all art making – one might say, its craft foundation – but at best, it seems to be taken for granted. At worst it is an outright embarrassment. Why is this? How has this apparently hypocritical position become the norm in modern art production?
Design, innovation
That runs on to the next question, I think: can you be a good designer if you’re not a good maker? Well, undoubtedly the answer is yes, you can; one has known people who could – Kaare Klint, who was perhaps the greatest furniture designer of this century, so far anyway: I don’t think he ever made anything, but all the Danish designers and cabinet-makers used to say about him, ‘Klint has never made anything, but we all go and ask him how to do it!’ Because he knew: he knew it absolutely backwards. Moreover, although he didn’t have, apparently, a very acute ability to visualise the effect of what he was designing, he did know his own limitations and he would design a piece of furniture and have a model made of it – quarter full size or one-fifth full size – put it on the mantelpiece and look at it for a year before he put it into production, so as to really make up his mind whether he’d done as much towards it as he could.

Frayling: It’s surprising you should say that about designing and making, because there are points in your book when you imply that you can only really be a good designer if you can fully understand the possibilities of the materials you’re dealing with; which seems to me – to take it one step further – a sort of understanding that can only emerge if you have experience of working with the material.

Pye: No, I don’t believe it is; I don’t think so. I don’t say that people who can do the thing are common, I shouldn’t think they are at all, but they do exist. Dick Russell, who was the first Professor of Furniture at the Royal College of Art, he was pretty near as good as Klint. But there is one thing to be said about it: both Klint and Dick Russell designed nearly always with the same makers, throughout their lives – Kaare Klint worked with Rudolf Rasmussen, and Dick Russell with the makers at Gordon Russell Ltd. And when you work with a maker as closely as that,
The excerpt is taken from Frayling’s interview with David Pye, who figures prominently elsewhere in this collection. They approach the core question of whether you have to be a good maker to be a good designer in the field of furniture design. Pye refers to examples of outstanding furniture designers who were not skilled in the crafts but worked closely with the same makers for long times in order to “fully understand the possibilities” of the materials they were dealing with.

The obvious analogy for us here is whether interaction designers need digital-material craft skills such as programming and electronics. Both sides of the issue have been argued recently (see excerpts in the final section, e.g., pp. 388 and 390). My own take is that it seems to depend on the goal of the design work. Explorative design aiming at finding and assessing new forms of interaction can benefit from crafting. On the other hand, the kind of design that draws on combining recognized interface components and interaction techniques (what Cooper calls idiomatic design) can be done successfully by designers who are not makers.
Most designers – such as glass artists or furniture designers, not to mention architects – rarely make the objects they design themselves. Consequently, they need to understand the possibilities and limits of the materials and crafts, and communicate their ideas and intentions to the specialist craftsman, whose hands become the designer’s surrogate hands in the execution of the work. The architect often needs an entire army of surrogate hands, both in the studio and on the construction site, to execute his work. In the case of the unique glass objects that Tapio Wirkkala designed for Venini in Venice, the Finnish designer collaborated with the knowledge and skills accumulated at the Murano factories through several generations of Venetian master glass-blowers. The shared knowledge of the material, the shared ambition to perform at the limit of the capacity of the craft and one’s personal skill, and the logic of the work itself provided the syntax for the unspoken language between the Finnish designer and the Venetian maker. In fact, the designer’s collaborator was the ageless tradition of his art, rather than any single individual craftsman.
Small studio practices around the world often embrace a craftsman-like ethos and maintain an intimate, tactile connection with the work. Renzo Piano is surely one of the most sophisticated High-Tech architects today, but he has deliberately maintained a craftsman’s approach to the process of architectural design, experimentation, and execution of the work. Piano explains his craftsmanlike working methods as follows: ‘You start by sketching, then you do a drawing, then you make a model, and then you go to reality – you go to the site – and then you go back to the drawing. You build up a kind of circularity between drawing and making and back again.”

The architect’s approach here seems to be close to the working method exemplified by Tapio Wirkkala. The important aspect of the process is its “circularity”, the constant shifting of viewpoints from the idea to the sketch, the model, a full-scale test, and back again. As a consequence of this arduous and complex process, the building exists as a full immaterial mental construction long before the actual construction work begins. In fact, the building has often been built and tested as a mental construction in several alternatives before the final concept is chosen.

Tireless repetition is an essential feature of Renzo Piano’s way of working. “This is very typical of the craftsman’s approach. You think and you do at the same time. You draw and you make. Drawing [...] is revisited. You do it, you redo it, and you redo it again.” Piano has appropriately named his studio “Renzo Piano Building Workshop” to reflect the idea of teamwork, and to suggest the long traditions of craftsmen’s and artists’ workshops since the Middle Ages with their intimate relationship between the master, apprentice and work. The feeling of the workshop of a medieval guild of sorts separates Piano’s workshop, reflecting the materiality and physicality of things as well as physical labour, from the neatness and sterility of a businesslike architect’s office of today.

In my view, the connection with the processes of making continues to be seminal, and a wise architect today searches deep personal friendships with craftsmen, artisans and artists in order to reconnect his/her intellectualised world and thinking with the source of all true knowledge: the real world of materiality and gravity, and the sensory and embodied understanding of these physical phenomena.
It is clear that a fruitful understanding of the relationship between traditional craft and traditional design disciplines can be grounded in the physical materiality of the workshop, the tools and the materials.

Interaction design, on the other hand, takes place mostly in spaces characterized by what Pallasmaa calls “the neatness and sterility of a businesslike architect’s office of today.” Actual explorative work in tangible interaction and physical computing, where traditional notions of craft and design materiality can be directly applied, accounts for only a small part of interaction design practice. We need to go beyond notions of “the real world of materiality and gravity” as “the source of all true knowledge” in order to grasp what interaction design can learn from craft.
Traditional design cognition studies put forward an idealised view of the designer’s sense-making that emphasises the cognitive characteristics of the design practice (Gedenryd, 1998, p. 2). By emphasising the thinking capacities of the designer, as described by Dormer (1993, 1991) and Lawson (1980/2005) (see page 15), we are contributing to a skewed view of the making practices as they are left with providing only the material implementation phase. This thesis proposes the view that the act of making is an act of sense-making. Further, it proposes that planning a design includes a mental crafting that relies on previous bodily experiences and material skills. Therefore, the second theoretical implication of this research is that design processes include embodied knowledge even in the cognitive and immaterial stage of creating mental images of the intended physical designs.

In addition, the aspect of material agency is not revealed in a design process that relies solely on cognitive activities and representations. In contrast, there is a notion of thinking through making/material/hands in many fields of the making practices. Design researcher Nigel Cross (2011, p. 4) writes in his book Design thinking: “In traditional, craft-based societies the conception, or ‘designing’, of artefacts is not really separate from making them; that is to say, there is usually no prior activity of drawing or modelling before the activity of making the artefact. For example, a potter will make a pot by working directly with the clay, and without first making any sketches or drawings of the pot.”

This is the case in many material-based contexts where the practitioner has embodied the material properties and affordances. In this context, the process from material...
When considering design in physical materials, Groth’s work suggests that the bodily experiences and material skills of crafting enables designers to engage embodied knowledge when “creating mental images of the intended physical designs.” An everyday illustration of embodied knowledge in mental imagery might be how easily and accurately you can imagine the act of opening the front door to your house or apartment: the force required to depress the handle, the slight threshold in the handle’s trajectory that you need to overcome by applying a little extra force, the feeling of reaching the handle angle where you can start pulling, the inertia of the door as it starts moving towards you, and so on.

It seems quite appropriate to me to think about embodied knowledge also in interaction design.

**Sources used in excerpt**


In my view, the discipline of architecture has to be grounded on a trinity of conceptual analysis, the making of architecture, and experiencing – or encountering – it in its full mental, sensory, and emotional scope. The point that I wish to emphasise is that an emotional encounter with architecture is indispensable both for creating meaningful architecture and for its appreciation and understanding. Design practice that is not grounded in the complexity and subtlety of experience withers into dead professionalism devoid of poetic content and incapable of touching the human soul, whereas a theoretical survey that is not fertilised by a personal encounter with the poetics of building is doomed to remain alienated and speculative – and can, at best, only elaborate rational relationships between the apparent elements of architecture. But there are no “elements” in artistic phenomena, as the parts derive their entire meaning from the whole.
The future of crafts depend on design


The whole future of the crafts turns on the question of design. If designers will only come to recognize it, the crafts can restore to them what the workmanship of certainty in quantity-production denies them: a chance to work without being tied hand and foot by a selling price; the chance to design in freedom. There is nothing more difficult and more necessary for the modern designer to attempt.

If the crafts survive, their work will be done for love more than for money, by men with more leisure to cultivate the arts than we have. Some of them will become designers, some not: that is not important: a designer is one sort of artist, a workman another. Instrumentalists do not feel any sense of inferiority because they are not composers. But the scale of what craftsmen could achieve by concerting their efforts, and the opportunity it would give designers, would be something not dreamt of.
This has not happened because the distinction between workmanship and design is a mere matter of terminology or pedantry. The distinction both in the mind of the designer and of the workman is clear. Design is what, for practical purposes, can be conveyed in words and by drawing; workmanship is what, for practical purposes, can not. In practice the designer hopes the workmanship will be good, but the workman decides whether it shall be good or not. On the workman’s decision depends a great part of the quality of our environment. Gross defects of workmanship the designer can, of course, point out and have corrected, much as a conductor can at least insist on his orchestra playing the right notes in the right order. But no conductor can make a bad orchestra play well; or, rather, it would take him years to do it; and no designer can make bad workmen produce good workmanship. The analogy between workmanship and musical performance is in fact rather close. The quality of the concert does not depend wholly on the score, and the quality of our environment does not depend on its design. The score and the design are merely the first of the essentials, and they can be nullified by the performers or the workmen.
The analogy is quite straightforward between how the quality of a design depends on its realization and how the quality of a musical score depends on its performance. Good design requires an understanding of the craft and the materials, just as good musical composition requires an understanding of the expressive and performative capabilities of an orchestra (I presume). And a good design can be ruined by poor workmanship, just as a good score can be ruined by a poor performance.

It might seem that the analogy is defective, since Pye talked elsewhere about how good designers work with the same makers for many years (p. 252) whereas I presume that musical composers normally don’t write for a specific orchestra. But I think the answer lies in Pallasmaa’s clarification (p. 254) that the designer collaborates with “the ageless tradition of his art, rather than any single individual craftsman.”
This thought-provoking separation of craft practices into two categories with their distinct ethical connotations also applies to architectural practices today. Most practices apply rather established and tested standard methods and solutions throughout their work, while more ambitious and courageous studios tend to experiment with novel structures, forms, materials, details, and their combinations. These practices are willing to employ a "workmanship of risk." The "risk" usually implies the mental uncertainty of advancing on untrodden paths, as the actual risks in relation to safety, durability, appearance and suchlike can usually be minimised by working experience, careful calculations, research, experimentation, and laboratory or prototype tests. The risk is directed to the architect’s own persona, values, beliefs and ambitions – one’s self-identity as an architect and professional. The creative state is a condition of haptic immersion where the hand explores, searches and touches semi-independently.

*Pallasmaa, 2009, pp. ca. 66.*
Pallasmaa is one of many design and craft scholars who has been inspired by Pye’s concepts of workmanship of risk and workmanship of certainty. Writing about architecture, Pallasmaa makes the point that there is clearly a group of studios standing out as more experimental, searching for novelty in terms of “structures, forms, materials, details, and their combinations.” Further, he identifies such practices as workmanship of risk even though they employ all the certainty-oriented methods of industrial production such as calculations, research, prototyping and testing before actually building their structures.

The risk lies instead in having to endure the mental uncertainty of creating something that is not already well-known and established in terms of function and aesthetics, and that could conceivably fail in the eyes of customers, critics and the general public.

Perhaps this is stretching Pye’s concepts too far from its original intentions, but at least for me it resonates with the urge of an academic designer-researcher to explore novel possibilities and to propose previously unseen ideas. I am quite comfortable thinking of that as a process of some risk – I may not have to scrap quantities of precious physical materials after ruining a piece on the workbench, but I am clearly risking time, effort and reputation in the process.

There is also my conviction that the more you want to explore novel possibilities in interaction design, the more you actually need to work on the actual materials. When you leave the idiomatic realm in order to find and assess new forms of interaction, I think that wireframes and enactments can never substitute for actually crafting in code and other digital materials. And this takes much more time and effort, hence the risk is notably greater.
Two cultures of form-making

Alexander, 1964, pp. 32–33. The dream of innocence is of little comfort to us; our problem, the problem of organizing form under complex constraints, is new and all our own. But in their own way the simple cultures do their simple job better than we do ours. I believe that only careful examination of their success can give us the insight we need to solve the problem of complexity. Let us ask, therefore, where this success comes from.

To answer this question we shall first have to draw a sharp and arbitrary line between those cultures we want to call simple, for the purposes of argument, and those we wish to classify with ours. I propose calling certain cultures unselfconscious, to contrast them with others, including our own, which I propose to call selfconscious.

Of course, the contrast in quality between the forms produced in the two different kinds of culture is by no means as marked as I shall suggest. Nor are the two form-making processes sharply distinguished, as my text pretends. But I have deliberately exaggerated the contrast, simply to draw attention to certain matters, important and illuminating in their own right, which we must understand before we can map out a new approach to design. It is far more important that we should understand the particular contrast I am trying to bring out, than that the facts about any given culture should be accurate or telling.
Alexander’s proposed dichotomy was made in the context of architecture, and it essentially separates “unselfconscious” cultures where “every man builds his own house” from “selfconscious” ones where design and production are distinct practices. It may seem archaic, but it actually has some relevance in the context of pastoral framings of craft (see, e.g., p. 104) as well as recent interaction design hypes around making (p. 438).
What is problematic is the way that the foundations are not developing nearly as much, and certainly not in the same way as our practices. Over time, this tension is becoming increasingly pressing, but we move on, adding new design practices to our family as we respond to emerging needs and opportunities (product design, interaction design, service design, experience design, sustainable design, social design, etc.). Still maintaining the idea that what we do rests on an artistic foundation, we eventually get to a point where it becomes difficult to explain how these foundations actually support practice. By now, we are used to this, but we still encounter its effects, as when trying to explain why people who seemingly have their disciplinary foundation in the visualization and materialization of prototypes intended for mass production are also the ones to lead and structure social innovation, rethink health care, address the effects of massive urbanization, or redirect everyday routines toward a more sustainable development.

Then, as so many other times when in doubt, we instead turn to methods and process to articulate and explain what we do – as if that would somehow make the issue of conceptual foundations disappear. And so, not surprisingly, and despite the dramatic changes in scope, impact, role, and objectives, the design community keeps celebrating pure design form in the same ways that it has done for a century, in exhibitions, magazines, and other such venues – much as its siblings born out of engineering contexts continue to celebrate the marvels of new technology in trade fairs, conferences, and more.

Design is expanding to address all kinds of situations and challenges, many of them distinctly non-material, but still Redström feels that the field seems to be building its foundations on the material and formal: “the design community keeps celebrating pure design form in the same way that it has done for a century.” There is clearly a tension here that has great implications for the future of design.
On a more general level, haptic and tactile experiences were found to be important, both in the designing and the making process. When a craft or design practitioner knows his material, tactile aspects have a better chance of being communicated tacitly in the final product in the way the designer intended them to be conveyed rather than in an accidentally fortunate (or unfortunate) way as exemplified in the students’ work in Publication IV and also in Ackerman’s study on psychological effects. However, when material exploration, prototyping, crafting or production of a design is considered to be separate from the thinking or “designing” process, as Dormer describes (page 15), and as is realised in the case when designs are produced in an industrial setting without the control of the designer, there is a risk that the end product will be lacking in material quality...

Although virtual making environments are constantly evolving to encompass greater sensorial and haptic engagement, embodied knowledge must be in the person, not in the computer, to be utilised in the way that was intended. The tactile experience of for example tableware is of outmost importance and defines the quality of the product. In this context, the designer benefits from gaining good skills and embodied knowledge of materials and technical processes simply to be able to construct a design in his or her mind that will be close to what is realistically possible to manufacture, also taking into account the tactile qualities. Instead of maintaining an idea that craft represents making, and design represents thinking, design activity benefits from craftsmanship that is integrated into the holistic design process of the designer. In this way, the designer is better prepared for material constraints emerging in manufacturing processes, and better in control of the entire production and the quality of the final product.

Design benefits from craft

Sources Used in Excerpt


A socioeconomic theory that predicts the kinds of craftworkers who are likely to innovate has been formulated by sociologist George C. Homans. Homans assumes that the craft is pursued to earn a living and consequently that social and economic factors combine to impede or accelerate an existing tendency for innovation. For the sake of analysis, he divides craftworkers into three status categories: high, middle, and low. Of these groups, the middle rank is the least likely to introduce an innovation. Those at the bottom of the hierarchy have little to lose by making novel artifacts; they can only hope it will help sales and bring attention to themselves. If they fail, they cannot slip to a lower ranking. Workers with the highest status innovate in order to prove their superior abilities and maintain their position of leadership. They have the leisure, authority, experience, and freedom to experiment. Caught between these two innovating classes, the members of the middle group take a conservative stance. They have more to lose than those below and do not feel the pressures to perform of their superiors. Fearing that innovation might jeopardize their position, they uphold the status quo in craft practices.

This theory has been corroborated by studies made in Africa and Latin America. Among the Ashanti of what is now Ghana in West Africa, wood-carvers situated in the middle group do not innovate. Rather than waste time and resources on novel ventures, the average carver turns out replicas of well-known traditional pieces for which there is a ready market. Innovation, which is left to the high and the low, takes two radically different forms. The lowest-ranking carvers, with few skills and a marginal position in the market, strike out on new paths by mimicking the styles of other African tribes or producing fantasy objects that cater to a Westerner’s notion of African “primitivism” and have no basis in indigenous art. The master
Technology is as old as humankind. It existed long before scientists began gathering the knowledge that could be used in shaping and controlling nature. Stone-tool manufacture, one of the earliest technologies, fl ourished for over two million years. The makers of stone knives and axes were successful because experience had taught them that certain materials and techniques yielded acceptable results, whereas others did not. When a transition was made from stone to metal (the earliest evidence for metal working has been dated ca. 6000 B.C.), the early metal workers, in a similar fashion, followed empirically derived recipes that gave them the copper or bronze they sought. Not until the late eighteenth century was it possible to explain simple metallurgical processes in chemical terms, and even now there remain procedures in modern metal production whose exact chemical basis is unknown.

In addition to being older than science, technology, unaided by science, is capable of creating elaborate structures and devices. How else can we account for the monumental architecture of antiquity or the cathedrals and mechanical technology (windmills, waterwheels, clocks) of the Middle Ages? How else can we explain the many brilliant achievements of ancient Chinese technology?

The arrival of modern science did not put an end to endeavors that were primarily technological; people continued to produce technological triumphs that did not draw upon theoretical knowledge. Many of the machines invented during Great Britain’s Industrial Revolution had little to do with the science of the day. The textile industry, at the heart of eighteenth-century economic growth, was not the result of the application of scientific theory. The invention of John Kay, Richard Arkwright, James Hargreaves, and Samuel Crompton, which were
Excerpt translation
Highly developed technology may exist without actual technology, i.e., without the theoretical understanding of the mechanisms of nature. The most impressive examples might be the great buildings that remain as monuments of lost cultures, such as the pyramids of Egypt, the Roman aqueducts, and the house walls in Cuzco. But history also teaches us that there may be advanced science without technical applications. The scientific culture of the Antique is the best example of this. You could indulge in a little wordplay to say that Greek science was an expression of the sensibility of homo sapiens, but not of the rationality of homo faber. The former may also be called wisdom, the latter skill. Between the two lie the form of reason we call knowledge, which is required for wisdom not to be impractical and for skill to be theoretically comprehensible.
In the context of his Experimental House at Muuratsalo (1952–53), Aalto points out the importance of experimentation and play in his design method, while at the same time emphasising the sense of responsibility:

[I have] a firm conviction and instinctive feeling that in the midst of our labouring, calculating, utilitarian age, we must continue to believe in the crucial significance of play when building a society for human beings, those grown-up children. The same idea, in one form or another, surely lies at the back of every responsible architect’s mind. A one-sided concentration on play, however, would lead us to play with forms, structures and, eventually, the body and soul of other people; that would mean treating play as a jest [...] we must combine serious laboratory work with the mentality of play, or vice versa. Only when the constructive parts of a building, the forms derived from them logically, and our empirical knowledge is coloured with what we might seriously call the art of play; only then are we on the right path. Technology and economics must always be combined with a life-enhancing charm.
needs to be re-valued within a culture of mass-produced-and-consumed products. The integration of the above groups of techniques, skills and methods of production (hi-tech performance/low-tech making; tradition/innovation; old/new manufacturing; matter (ceramics, hardware) and information (software)) also re-position the value of the hand-made and the use of hand tools as evidence of human skill and expression. If technological advance and industrial processes have generally dominated objects as everyday commodities, craft and the handmade embedded different kinds of values in objects. Yet approaches that use technologies that are new to ceramic practice validate the co-existence of craft and digital technology and redefine craft and consumer products in the digital revolution. In reflecting on the role of craft in the twenty-first century, Gerard Briscoe (2014) observed that craft contributes to the re-defining of objects' value in a culture of increased production.

In this view, the project was embedded within the contemporary debate on the nature of craft as it examined the intersection of traditional ceramic techniques and digital processes. In aiming to create connections between craft-and-digital making, the project focused on the fabrication of form by considering a (digital) modelling technique to mediate between craft and digital production. Therefore it was relevant to evaluate how a digitally-aided production becomes a craft, and how engagements with the processes of making are influenced by technology from a maker's perspective. Furthermore, since digital technologies require an appropriation, manipulation and a change of production and fabrication methods and tools, it is important to learn how this adoption of thinking in a different medium makes digital craftsmanship relevant in the contemporary culture of studio ceramics.
Source used in excerpt

Briscoe, G. (2014). Speakers’ Corner: Making, materials and tools. At MAKE:SHIFT Conference exploring craft and innovation, Ravensbourne, London. [No archival publication seems to be available, presumably Ionascu is referring to a conference presentation.]
Appreciation of craft

Pallasmaa, 2009, pp. ca. 45.

The tradition of craftsmanship is clearly gaining increasing value and appreciation in today’s reality of the technological world, mechanical production, and the regrettable loss of the touch of the human hand in our mechanically mass-produced products and environments.
Free workmanship is one of the main sources of diversity. To achieve diversity in all its possible manifestations is the chief reason for continuing the workmanship of risk as a productive undertaking; in other words for perpetuating craftsmanship. All other reasons are subsidiary to that one, for there is increasingly a vacuum which neither the fine arts nor industry and its designers are any longer capable of filling. The contemporary passion for anything old, for junk and antiques, is no doubt symptomatic. The crafts in their future role may yet fill the vacuum but only if craftsmen achieve some consciousness of what they are for, only if they will set themselves the very highest standards in workmanship, and only then if they attract the voluntary services of the best designers. Workmanship and design are extensions of each other.
The future of craft is a source of concern for many. Mass production has largely replaced craft production; consumer products can be made more efficiently and cheaply through mechanized production.

Could it be that diversity is attractive enough as an aesthetic trait to motivate a continued demand for craft, in times when it is hard to find financial or practical reasons for forgoing mechanized production?
Best to market requires craft


Best to market, particularly in high tech, comes about only through craftsmanship. And craftsmanship is all about quality. The goal of craftsmanship is to get it right, not to get it fast. The ultimate measurement of craft is not speed. It’s quality. How good is it. It’s a pure measurement. And a delightful measurement. Craftsmen – craftspeople – do it over and over, until they get it correct. And in their training, in their apprenticeship, they build things over and over, learning how to do things correctly, so they can bring enormous expertise to create successful products, and thus the training of craftsmen is a long and drawn-out personal process.
This observation from twelve years ago feels even more timely today, when there are also plainly obvious reasons to question first-to-market consumerism on the grounds of planetary boundaries considerations.
Craft revival is based on a nostalgic myth

Robert Blauner in his influential writings on *Work Satisfaction* and *Industrial Trends* has commented on some of these contrasts, which lie hidden at the centre of many a history of craftsmanship:

“It is remarkable what an enormous impact this contrast of the craftsman with the factory hand has had on intellectual discussions of work and workers in modern society, notwithstanding its lack of correspondence to present and historical realities. For, indeed, craftsmen, far from being typical workers of the past era, accounted for less than ten per cent of the medieval labour force, and the peasant, who was actually the representative labourer was ... practically no more than a working beast ... In modern society there is far greater scope for skill and craftsmanship than in any previous society.” ... The myth of the happy artisan – like the “artist craftsman”, craft guilds to which select potters could belong, and the confusion of rural workers with guild craftsmen – did not exist until the nineteenth century, when it became part of a romantic reaction against the spread of industrial capitalism. And the history which underpins much of the “craft revival” is, in fact, nostalgia masquerading as history.
The calling out of nostalgic myths around “happy artisans” is certainly relevant for understanding the cultural position of craft today and in the future. However, it is not equally clear to me how much this cultural and conceptual heritage would influence a discussion of interaction design through a craft lens. My sense is not that the pastoral narrative has been very influential in such discussion thus far.

**Source used in excerpt**

Conran on craft revival


Taken together, these examples provide ample validation of Terence Conran’s epigrammatic observation: “the crafts revival is a very tangible metaphor of a culture at odds with the very industrial principles that made it possible.”
By craft, we seek to address the revival of the “handmade” as an arguably complex currency within textile practice and contemporary culture. From traditional economies of “making-by-hand” to new technologically informed modes of making, “craft” is exercising its diverse skills and practices on a global and local scale, for different causes, initiatives and audiences. As part of an expanding landscape of both commercial and public sector platforms, contemporary applications of the handmade can serve to generate new experimental modes of thinking and making which not only challenge our preconceptions of what craft is, but also what it has the potential to evolve into. This is not solely relegated to the historical, material and technical developments of the handmade as a distinct mode of practice-led research. Craft is also established, received and played out in the world, through the channels of collective endeavour and co-creative exchange.

Bailey & Townsend, 2015, pp. 157–158.
There is an emerging understanding of craft where we see the people-formerly-known-as-customers engaging in reusing, repurposing, tinkering and making. This seems very timely to me, and very much in line with recent waves of interest in maker movements and fab labs within interaction design.
The head: a more thoughtful, reflective attitude towards craft and design – research into craft, research through craft, craft as research. The workshop as laboratory. An explicit exploration of the links between the crafts and sustainability; small is beautiful; local is lekker; customisation; a critique of anonymous marketing; mass customisation; the importance of the distinctive kinds of knowledge and skills arising from the crafts. The hand: the modern crafts, with their proliferation of subdivisions that would make even Polonius dizzy; including craftspersons, makers, artist-craftspersons, designer-craftspersons, designer-makers, applied artists, decorative artists, theatrical-historical-pastoral and so on. These can now be seen as a range of possibilities rather than as inhibitors: the crafts as spectrum and the more inclusive and varied and versatile the better, as part of a culture of innovation. What distinguishes them, makes them highly visible is the care with which things have been made, the fact that they have been made by one human being for another, the individual “take”, the use of materials and the thoughtfulness of their design. They can represent an ethical statement, but they needn’t. In addition, there are the possibilities of batch production allied to customisation, and the crossovers between the crafts and digital technologies – a way of reuniting the crafts with manufacturing and with “industries of one.” Plus the confident reintroduction of the crafts into the intellectual debates of the moment, around the creative industries.

The heart: which has nothing to do with sentiment, but rather with having one’s finger on the pulse of what is going on in the broader visual culture and in the creative industries. We’re told that our economy will, in the future, be partly driven by “information” and “intellectual property.” Well, our new Bauhaus will provide distinctive versions of both. Our students

Head, hand, and heart

Frayling, 2011, pp. 142–144.
The association of head, hand and heart is Frayling’s blueprint for a new Bauhaus adapted to contemporary times. Its role would be to form a crucible for the sort of knowledge that modern society and modern economy need and want, and to reflect on its implications.

It is interesting in this context to note the recent (September 2020) announcement by the European Commission to launch “a new European Bauhaus” to kickstart a new cultural and sustainable movement in Europe in the wake of the pandemic.
The idea for All Makers Now? emerged from research undertaken by the digital crafters in the Autonomatic research group at Falmouth University.

The conference agenda proposed and critiqued a new vision for craft where makers everywhere can harness the power of digital technologies to create, cocreate, collaborate, make and sell. Using a FabLab or Makerspace anyone can be a craftpreneur, can’t they? Coming at this digital crafting capability is a bigger cultural agenda: how do we make more fluid and meaningful connections between our networked digital and physical worlds? What do we need to make digital things well, to make them fun, make them work, to delight, challenge, entertain or educate? What role does craft have to play in rethinking the limited physical characteristics of smart devices?

The conference brought together creative professionals and academic researchers investigating craft in new contexts and its potential to contribute to contemporary social, environmental and cultural challenges. Broadly speaking the conference covered three main themes:

- **Materiality and Aesthetics**: creating extra-ordinary and otherwise unobtainable digitally designed and made objects.
- **Enhancing the Object**: making out of the ordinary digitally networked things that facilitate new forms of user engagement and participation.
- **Democratising Technology**: widening access to digital tools and support for designing and making things using the internet and digital manufacturing technologies.
The proceedings of the All Makers Now? conference from 2014 illustrate how the field of craft approaches the digital materials and practices, responding to challenges and demonstrating the relevance of established knowledge to the emerging movements of digital making and fabrication. Many of the excerpts in this section address topics that come to the fore when craft traditions and craft research deal with the increasingly digitalized landscapes of design and manufacturing.
For some, the words “digital” and “craft” don’t marry naturally in the same sentence. Digital processes are often assumed to be too linear, rigid and mathematical to fit the more human-centred definition of craft – where time, patience, evidence of hand skill, rarity, chance, snap decisions and risk of failure are all contributing factors to an object’s charm and value.

Contemporary craft need not be defined by genre, it can include a wide range of media, but whatever the medium, craft practice is at the core of the making process. It is a combination of hand, mind and eye – the technical mastery of tools, materials, aesthetic sensibility and design skills.

The question remains: how can craft practitioners manipulate technology to create a unique visual language? How can one shape the technology to the user, rather than being constricted by established data algorithms? Or should practitioners be investing in understanding and developing their own code? Does the software’s standardised toolset risk eroding the autonomy of the individual? And if so, can the software and hardware somehow be unraveled, or even hacked?
From Ruskin’s “tendency to suggest ways forwards by looking backwards” (Adamson 2010: 139) to McCullough’s (1998) forward thinking Practiced Digital Hand, the status and definition of “craft” has been an ongoing debate, the main bone of contention being around the use of technology (any machinery) versus the use of the hand. Both Pye ([1968] 1995) and Dormer (1997b) acknowledge that technology and craft exist side by side and are interdependent within certain practices. Most craftspeople have historically used tools (technology), but what has changed is the extent to which people are in control of those tools.

During the last ten years, the emergence of more accessible digital tools has beguiled and challenged a genre of maker, which has ignited debate around the topic of craft and computing. (Harris 2012: 92)

For example, a knitwear designer may work on knitting pins, manual knitting machines or domestic electronic machines, where each places the user, to varying degrees, in control of the process, which the authors argue can be described as a form of craft. To adopt one definition offered by Dormer, “craft means a process over which a person has detailed control, control that is the consequence of craft knowledge” (1997b: 7).

In contrast, a knitwear designer working in the industry today now rarely interacts with the process of knitting, only that of designing. The aesthetic and technical elements of the craft of knitting have been pragmatically separated into two distinct roles, designer and technician. If a designer has been trained specifically in knitwear design they will be able to draw on their experiences and craft knowledge, but as they rarely engage directly with the machinery they can no longer be described as a craftsperson. To use Pye’s ([1968] 1995: 20) terminology, they are no longer engaging in the “workmanship of risk” but rather
Sources used in excerpt


Drummond Masterton, a maker engaged with digital technology, strives to know his tools in the same way as any other craftsperson, forming an in-depth understanding of the software. He is wary that the standardized tool sets embedded within software, the “distributed knowledge” (Dormer 1997a: 139), can undermine the autonomy of the maker and lead to uniformity (Masterton 2007; Dormer 1997a), and therefore he takes time to master the software so that he can take on an exploratory approach to the process. The complexity of the software for seamless garments has necessitated a rationalization of the process of programming, in the form of a database of predetermined garment shapes. In order to create viable, seamless garments cost-effectively in the knitwear industry today, skilled technicians (programmers) can become merely information processors carrying out “goal-directed, plan-controlled action” (Wright and McCarthy 2004: 30). The software is such that it is possible to engage with it on many different levels depending on the skills of the programmer and the context in which they are working. It can be used as an “information-processing model”, using the “workmanship of certainty” (Pye [1968] 1995), choosing a garment from the database and allowing the software to do all the work. However, there is also the possibility to take a “practice” approach and build programs from scratch, to create individual digital artefacts that embody the experience and knowledge of the user. For this research Taylor is adopting a practice approach to the technology, treating the programming as a new form of digital craft, drawing on her existing knowledge, both explicit and tacit. Yang (2010) took on the role of “Designer Interpreter”, and similarly, Taylor re-amalgamated the technical and design elements of knitwear into a single role as a “Technical Designer.” In this way, she is able to
Digitalization of production seems to make the mechanization of craft more open to modification and even hacking, if I understand this excerpt correctly. If this is the case, it could offer new possibilities to cross the boundaries between workmanship of certainty and workmanship of risk, enabling the emergence of a new kind of craft practice.

**Sources used in excerpt**


As creative computing becomes more accessible and capable, makers are beginning to merge 2D, 3D and interactive digital media into the broader vocabulary of processes and materials, softening the presence of digital in the development and production of craft, a necessary shift for craft to maintain its respected value. Bunnell cites: “The skilled and sensitive human interaction with technology that is involved in poetic object making is arguably central to the maker’s art. A direct relationship with tools enables the maker to engage intimately with materials and process to create finished objects with a high degree of autonomy and control over quality.” (2004:2)

Case studies: The following case studies represent a progression in contemporary making with recent works that capitalize on the computer’s innate capability, and yet also begin to belie computer origin, resulting in novel methods that balance conceptual, material and digital proficiencies. In some cases this fusion of approaches has opened up new kinds of practice, expanding the remit of the maker into unexpected professional territories.
Source used in excerpt

Rapid prototyping, digital craft


Take rapid prototyping. [...] This is transforming the design and making of objects. Instead of taking individual elements and assembling them through making – the Victorian grammars, the Arts and Crafts model and the Bauhaus basic course – the information on the screen embodies research, experience, and the understanding of materials. You still need intimate knowledge of materials, of course, but the tacit knowledge of the maker is beginning to precede the concept in some areas. The subsequent making of the prototype is becoming purely mechanical. The one-off crafts are again confronting the challenges of manufacturing. “An industry of one.”
Here we see the opposite view, where rapid prototyping (referring to computer-controlled fabrication of physical models from computer drawings) is viewed as a black box turning the making of the model “purely mechanical.” More recent accounts from within the craft disciplines seem to suggest that digitally controlled production is rather more open for experimentation and craft-like intervention than previous generations of manufacturing technologies (see, e.g., pp. 308, 312 and 314).
How to craft with digital prod tech


Cheating the technology: Using tacit knowledge from their embedded print and knit craft knowledge in order to find ways to control the system in order to achieve desired results.

Understanding material behaviour: It is not possible to choose materials for aesthetic and tactile properties alone when using such transformative technologies. The behaviour of fibres under the conditions of the process become the leading feature of the selection process.

Creating moments of reflection: Digital technologies are not often designed with experimentation of process in mind. Designers need to find ways to get closer to the process in action in order to reflect and evolve their practice.

Embracing new tools and scientific methods: Often new skills borrowed from a scientific field become essential to deepening understanding and developing a new techno-craft approach.

Developing ways to record and analyse results before, during and after processing: Complex processing parameters including technical, material and craft methods need to be carefully recorded in order to make results repeatable and transferable.
My project is concerned with developing more direct control of processes that are typically automated by CAD software and CAM tools. I believe the use of these standardised tools limits the ability of the maker to create unique visual vocabularies. It is possible to view the aesthetic qualities emerging in the new genre of 'digital craft' — such as the use of triangulation and the quality of line produced by generic pre-set machine parameters — as a temporary phase in the digital craft timeline. As more makers adopt digital technologies, we may discover that these visual aesthetic qualities are more attributable to the technology rather than being understood as unique. The author believes it is therefore important for makers wishing to further their practice in this field to seek ways in which they can gain greater control over the processes and tools they are using.

This paper presents research that explores ways in which programmed mathematical elements in 3D CAD can be deconstructed and manipulated throughout the design and production phases.

This paper aims to offer other makers methods which allow the potential for 'hacking' into code in order to expand the possibilities for control and creative engagement with digital tools and thereby offering more unique opportunities for developing visual vocabularies than using standard toolsets alone.

Summary: A practice based research project that aims to establish new methods for makers to deconstruct standardised toolsets in CAD and CAM software in order to achieve a unique level of visual aesthetics.

Craft remains skilled work applied toward practical ends. It is indescribable talent with describable aims. It is habitual skilled practice with particular tools, materials, or media, for the purpose of making increasingly well executed artifacts. Craft is the application of personal knowledge to the giving of form. It is the condition in which the inherent qualities and economies of the media are encouraged to shape both process and products. It is not about standardized artifacts, however. It is not industrial design. It remains about the individually prepared artifact, which is newly practical due to digital computing. Craft is certainly an application of skill, and it may yet involve the skilled hand.

Thus the defense of skill may no longer remain a losing philosophical position. If previously it was usual to assume that computation would only worsen the hand-mind splits engendered by industrialism, now we might reconsider this problem. We might observe how software usage is restoring some respect for mastery. We might also note the invention of technologies that support the subtleties of the hand. Although most people have failed to perceive in the technology’s fledgling states any capacities for new kinds of active skill, perhaps it is still early in the game, and many of these views may well shift.
McCullough’s observations must be considered prescient when it comes to identifying the new respect for mastery that software usage brings, and that more recent work in the field of craft and craft research illustrates quite clearly (see, e.g., pp. 308 and 314).

Another potentially important idea in this dense passage is that digital design and production enables individually prepared artifacts. This has been the essence of much recent hype around fab labs and 3D printing, and I think it can also be fruitfully connected with ideas around creative empowerment beyond consumerism (see p. 294).
Digital craft is (some) risk

Tradi as th have artefa Nimkulrat et al., 2019, p. 4. tion at the end of the process (Zoran and Buechley 2013, p.6). Today, craftspeople can access digital tools and digital fabrication, tapping into processes whereby an object is designed on a computer, and then automatically fabricated by a machine. Craftspeople have the “right approach, skills and mindset” to affiliate themselves with digital technologies (Campbell 2007) and explore the close relationship between digital work and craft practice (McCullough 1996). McCullough sees craft expanded by digital media, which has the capacity to “reunite visual thinking with manual dexterity and practiced knowledge.” Craft researchers continue to widen their view from a traditional making practice to – as Dormer (1997, p.140) noted over 20 years ago – “craft as knowledge that empowers a maker to take charge of technology.”

The subjective decisions of the maker remain necessary for the production of digitally produced artefacts, which in turn reflect their makers’ skills, perspectives and values (McCullough 1996). In this sense, digitally fabricated work is at risk in a similar way to handcrafted work. The difference lies in the digital craft practitioners’ accessibility to the resulting material artefacts and also a rich history in the form of editable digital files. This implies considerably less risk in digital craft than in an analogue one.
The authors’ reflections on digital tools and fabrication in craft are similar to how design can be seen as workmanship of risk (see p. 266).

**Sources used in excerpt**


We aim to inform and explore – with the goal of supporting the design of novel tools – the creation and facilitation of forms of hybrid making that result in interactive creations, which, for example, can respond to a person’s interaction with them, can change or evolve over time, can be different in different situations – for example, when different people are present in a room – or can be edited as new media becomes available or as someone’s interests or preferences change. This means that both crafting process and result will include both physical and digital elements. These forms of interactive hybrid making will be referred to as “hybrid crafting.” We are interested in people’s everyday crafting practices, rather than those of “the certified genius” [2, p. 75], which is in line with Sennett’s view that craft “names an enduring, basic human impulse, the desire to do a job well for its own sake”, which can be anything from playing a musical instrument, to teaching, to bricklaying and which goes beyond manual labour [6, p. 9]. Following Csikszentmihalyi’s definition of creativity [7] – employed by Gauntlett [2] to address everyday making – we include in our notion of everyday crafting “making [anything] which is novel in that context” [2, p. 76]. This includes creating something from scratch but also using existing materials or objects, physical or digital, in new ways. In fact, we are interested in how personal digital media, for example, photos or audio files – existing digital materials – may be used in hybrid crafting. As such, our definition of hybrid crafting is: “everyday creative practices of using combinations of physical and digital materials, techniques or tools, to make interactive physical-digital creations.”
I find it more than a little curious that the authors dismiss the foundations of craft with a sweeping reference to “the certified genius.” The focus of the work they present is on tools and other technical ways of enabling the making of things using a combination of physical and digital materials. This is certainly valuable, and very much in line with recent maker movements and their emphasis on creativity and empowerment, but to me it does not justify redefining the notion of craft. It would seem more sensible to define their approach as “hybrid making” rather than “hybrid crafting.”

**Sources used in excerpt**


Yet people designed and crafted artifacts long before the digital age. Design requires much more than the skills needed to use technical devices as part of the creative process. It integrates diverse sets of tools to fulfill technical needs or constraints while embodying meaningful symbolic and aesthetic values. Many designers, though, cannot explain or define their processes. Dedication and investment are the keys to mastering creative skills, whether they are the skills of a computer programmer, a wood carver or a potter. Nevertheless, in the last 20 years, researchers from the computer graphic and human-computer interaction communities have been studying ways to shorten the learning curve of manual creative tasks, by developing tools that allow novices to draw with computer assistance [6], or automating part of the creative process. These approaches assume that aesthetic appeal can be reduced to a finite set of quantitative criteria [7] or that the primary purpose of design is to satisfy technical needs [8]. Within the SIGGRAPH 2015 Hybrid Craft exhibition, we wish to focus on a holistic addition to contemporary making, showcasing skilled makers who use digital creative technologies. Rather than highlighting the machine, the algorithm or the economic narrative, we present unique makers who use digital design, fabrication or interaction technologies as part of their creative palettes, integrating them with other tools, techniques and making traditions: these are the makers of Hybrid Craft.
Another approach to the notion of hybrid craft (compare p. 320), this time drawing on a more substantial understanding of craft as constituted by dedication and investment. The emphasis on skilled makers who use digital technologies seems more viable to me than the emphasis on accessible tools for hybrid materials when it comes to advancing the discipline of interaction design.

**Sources used in excerpt**


The proximity of tools also plays a role. Due to the site of the lab where they were working and the tools available to them, Nimkulrat and Oussoren were able to easily move from one means of making to another as desired. Proximity also allowed these two skilled craftspersons to embark on means of making unfamiliar to them. In this case, proximity of differences lends certain permissions and a “naive expertise” to the novice user (Wakkary et al. 2016). This “naive expertise” mitigates expectations of the digital in the translation to analogue form. Collaborative research through design practice acts and actions were integral to form development whilst inherent differences in material practice and expertise afforded reflection-on-action (Schön 1983). Both craft practitioners shared distinct knowledge sets and understanding relevant to their original practices no matter how foreign a setting the Gravity Sketch VR 3D modelling interface presented. Moreover, both virtual and material artefacts produced by Nimkulrat and Oussoren and the process of making them played a significant role in knowledge creation, transfer and sharing. Outcomes produced by Nimkulrat provoked Oussoren to make meaning in new ways relative to his own long-standing craft practice. Oussoren began to consider parallel workflows and engagement with materials and tools. This recalls Sennett’s sentiment that for craft practitioners, meaning is made through the process of making material artefacts and also in the act of observation (Sennett 2008).
The work reported here is a case study of collaboration between a physical and a digital craftsperson, focusing on the roles that digital tools can play in bridging the gap and stimulating new forms of making-as-thinking. What emerges is some kind of outline of genuinely hybrid crafting.

**Sources used in excerpt**


Craft-based RTD

Koulidou et al., 2019, p. 1.

Taking a research-through-design with craft sensibilities approach we present design propositions in the digital age that value the complexity and uniqueness of being human.

[...]

Building on our previous work on poetic qualities of interaction with digital jewellery we offer a reflective view on how digital jewellery can challenge our expectations of digital connectivity, sensor functionality and location awareness and we discuss the material qualities of the piebly [sic! Should be “pieces by”?] unfolding the narratives associated with their function and form.

[...]

By contrast, this research offers a focus on atypical personal interactions in order to address a different range of questions and potentially open up our expectations of the digital.
The approach that the authors call “research-through-design with craft sensibilities” seems to illustrate a way for the practical knowing of craft to start making its way into interaction design research.
Craft-based RTD

Miller, 2019, p. 1.

This paper presents material artifacts created at the early stages of a practice-based PhD – the focus of which is to highlight, through practice, a third space that emerges as disciplines intersect – specifically textile design and material science.
CAD can break architectural drawing


The architect Renzo Piano explains his own working procedure thus: “You start by sketching, then you do a drawing, then you make a model, then you go to reality – you go to the site – and then you go back to drawing. You build up a kind of circularity between drawing and making and then back again.” (Robbins, 1994) About repetition and practice Piano observes, “This is very typical of the craftsman's approach. You think and you do at the same time. You draw and you make. Drawing ... is revisited. You do it, you redo it, and you redo it again.” (Ibid.) This attaching, circular metamorphosis can be aborted by CAD. Once points are plotted on-screen, the algorithms do the drawing; misuse occurs if the process is a closed system, a static means-end – the “circularity” of which Piano speaks disappears.
I find it hard to see why the circular practice described by Piano could not be upheld using digital tools. Perhaps it is a question of how closed and limited the architectural drawing tools were 25 years ago, compared to what is available today (see pp. 332 and 334).

**Source used in excerpt**

Seemingly on the basis of such advances, programming culture has been rediscovered in architecture. Consider some reasons why.

Advances in digital fabrication must be first among these motives. Simply put, there is now far more incentive to express design in terms of a few variables based on the machining process. Whether in the schools, design-build practices or new niches in the just-in-time supply chain for a rapidly building world, rapid prototyping and computer-numerically controlled (CNC) machining have become competitive necessities.

Second, the theoretical basis of cultural expression in form is increasingly informed by a domain of knowledge that appears relatively comfortable with notions of generative algorithmic beauty: namely biology. Especially with respect to growth and emergence, but also with respect to the harmonies and recursions of static biomorphic objects, this present fashion in architecture has a greater need for coded formulations.

In addition, more people (and most management gurus) know that information technology and organisational change are just two sides of the same coin. Task automation gives way to strategic reconfiguration that legitimises creative work in more circles, and creates niches for new kinds of practice in the delivery of customisable design.

And finally, and perhaps most widespread culturally, the crafts of personalising one’s workspace and scripting one’s intellectual pleasures have become far more distinct in the generation of designers who grew up with computing. The bloat does not seem to bother so many of them, and the interruptions and multitask, fragmented attention may actually be felt as an advantage. Some of these designers have excellent training in algorithmic structures, even.

Given the visual interfaces of better software today, with the

Architecture rediscovers programming

McCullough, 2006, p. 15.
The ability to craft tools that address both the practical challenges of building design and the human capacity to imagine new forms is a fairly recent development. As specific programming languages become less mysterious and easier to master, "home-made" software will most likely become a familiar part of design culture. This move by the design community to take an active role in the production of code transcends the limitations of prefabricated software tools.

To a great extent this shift is becoming a necessity. Large, unanticipated gaps in the computer-aided design and construction process can only be bridged by the creation of special software. Many of these tools cannot be anticipated in advance by outside developers since the most imaginative projects begin with ideas that exceed ordinary expectations. In order to connect different production processes, materials and fabrication devices, new tools are required. In fact, as architect Haresh Lalvani has demonstrated in his collaboration with Milgo/Bufkin (see his interview with John Lobell), unexpected functions for standard digital-fabrication equipment can be created simply by writing code.

In academia, students and teachers have been increasingly drawn to the possibilities of proprietary software development. For many architects programming has become the new drawing. In the carbon-fibre chandelier project designed for the lobby of Pratt Institute’s new School of Architecture, complex EPS moulds for hand-laid composites were produced using a large-scale computer-numerically controlled (CNC) foam-cutter. In order to precisely construct the necessary 3-D shapes, new software was developed to coordinate the movement of the machine’s rotating bed with the controlled trajectory of its servo-controlled hotwire. The ability to link disparate material practices (foam-cutting and advanced composite construction)
Written even before Sennett’s book (see p. 330), this rather seems to suggest that digital tools even open new formal and structural possibilities to architects thanks to their programmability.
This article presents code as a technical and discursive construct. Code is hereby not considered a normalising restriction of architecture, but rather as a site where a recoding of architecture may occur. The strategy of coding and recoding embraces the free play of symbolic code, as it impacts on architecture's traditional coding systems and their standardised, prototypical material realisation. Computation allows for the emergence of form and space independent of such traditional constraints, and thus allows us to arrive at alternative formal and spatial conceptions, which decode and, at the same time, recode architecture.
Interaction design and craft
Several definitions have been attempted in this nascent field, which spans a wide range of practices from digitally assisted design of physical artifacts [9, 33, 46, 52], fashioning of computational physical artifacts and materials using traditional craft practices [12, 33], production of digital artifacts, e.g. code [8], merging of digital and physical media and practices [27, 33, 63] as well as artifacts emerging from within Maker and DIY culture [3, 53]. Terms such as Hybrid Craft, Digital Craft, Technocraft, and Computational Craft are used to describe this somewhat fuzzy area often used interchangeably, sometimes describing distinct areas. The ambiguity in HCI of what precisely constitutes Hybrid, Digital, Technocraft or Computational Craft, seems to at least partly stem from discrepancies of the definition of craft itself, which is at times interpreted as denoting traditional, i.e. pre-industrial fabrication methods [12], sometimes as signifying any kind of physical making, extending to simple manipulation and reassembling of physical objects [27], application of software in the fabrication process [46], to constituting a particular methodological approach and way of thinking in a creative context [23]. These discrepancies also mean that it is hard to establish a common frame of reference.
It certainly seems like the HCI field is curious about craft, and that it approaches it in many different ways – with more or less thorough understandings of the traditions, foundations and bodies of knowledge that craft entails.

For me, this is rather in keeping with how HCI, and specifically the CHI community, has been dealing with other related fields over the years. I seem to remember HCI researchers proudly announcing the “eclectic” approach of their field already in the mid 1990s; another name for it could be superficial cherrypicking.

[The sources used in the excerpt are too many to fit on this page.]
This line of research has family resemblances with another adjacent body of HCI work that coincided with the field’s interest in making and was focused specifically on questions of materiality, e.g. (Blanchette, 2011; Dourish and Mazmanian, 2012; Robles and Wiberg, 2010, 2011; Rosner et al., 2012; Wiberg et al., 2013; Bergström et al., 2010; Vallgårda and Redström, 2007). This work draws attention to the material configurations that enable and constrain the digital, which includes not only physical stuff and infrastructures, but also “historical particularities, cultural specifics and political consequences of information work” (Dourish and Mazmanian, 2012, p. 4). Others were focused on how an engagement with makers of non-digital things could rework dominant frames of design. Rosner and Ryokai (2009), for instance, developed a system for knitters called Spyn – an information-sharing system that associates digitally recorded messages such as geographic locations to positions on knit fabric – to understand how people appropriate digital technology in craftwork. This, they argued, could in turn open up HCI design; approaching technology through craft, the authors argue, knitters didn’t just highlight technological expertise, but also the care work done between people, places and technology. A study of knitters and crafters, here, is offered for HCI to challenge false binaries between the “material and immaterial constituents of the social world” and enable a move from the study of objects to a study of “future-directed, transformative potential of materials” (p. 203).
It is argued that the HCI interest in craft has two strands, one focusing on materiality and the other on craft practices. My sense is that the first one is the dominant one.

**Sources used in excerpt**


We saw the major success of the workshops was that they provided a productive step toward nurturing and developing a stronger culture of design research at CHI grounded in actual designed things. At the conclusion of each workshop, there was a strong desire and eagerness among participants and organizers to do it again next year. They provided a rare and highly productive venue at CHI for established and emerging design researchers to engage in dialogue and exploration of their own things, as well as things coming from studios and labs around the world. The most important outcome centered on strengthening and refining a culture for designerly ways of engaging, debating, and discussing research artifacts.
CHI (pronounced kai) is short for Human Factors in Computing Systems, an academic conference on human-computer interaction that was started already in the early 1980s. It is not a design conference, and the CHI community is far from a design community, but it regards design as one approach among many contributing to the overall aim of making digital systems better for people to use.

Many of the excerpts in this section of the collection are taken from researchers who I guess would consider themselves members of the CHI community. It is a large community and the CHI conference with its adjunct venues has become one of the primary places to look for academic approaches to interaction design. Thus it also provides many of the examples of current academic thinking about the relation between craft and interaction design.
This workshop is dedicated to gather and help define the field of scholarship and practice around craft and HCI. We aim to facilitate a wide-ranging discussion of emerging interests and concerns across the thematic categories of artefacts, tools, and environments. This work includes diverse approaches to the development of computational technologies around craft as well as deep empirical and theoretical investigations of craft legacies. The workshop connects an international and interdisciplinary group of researchers, craftspeople, artists, designers, and theorists from within and beyond academia. In particular, we aim to:

- Gather a community of scholars and practitioners examining the entanglement of craft and computation with the hope of scaffolding intellectual development and community.
- Create a road-map for future scholarship and practice.
- Produce an exhibition and online repository of our work for the CHI 2019 audience and beyond.

The output of the workshop will be a point of reference for new research endeavours connected to crafts and HCI. Its multidisciplinary foundation builds on a rich existing HCI tradition around electronic-textiles, making, and digital fabrication to impact a broad array of connected practices and disciplines.
IxD loves craft because...


Most recently, “the material turn” has marked its place in the history of interaction design through an expanding interest in the development and use of new material-oriented methods and approaches to interaction design – ranging from craft-based approaches to maker cultures to a growing interest in materials, stuff and repair. In terms of theory development in HCI, “the material turn” has not only manifested itself as a growing interest in articulating how the combination of physical and digital materials in design projects expands the design space for interaction design – ranging from notions of ubiquitous computing to tangible user interfaces – but more profoundly, it has also led to theoretical discussions on how we can understand interaction design in terms of its materiality.
In the construction of human-computer interfaces, a craft perspective [design and implementation unified] is not only in evidence but inevitable. Several recent attempts to make psychological theory more relevant to HCI practice suggest the same model of the HCI design problem: to change, by the introduction of a new artifact or the modification of an existing one, an ecology of tasks and artifacts whose behavioral properties are so complex as to be difficult or impossible to predict with accuracy or detail...

This problem is often experienced by the designer as a problem of “details.” ... For instance, Erickson (1989) is devoted almost entirely to the discussion of such unexpected problems in several CSCW systems, including difficulties with seating arrangements, the unexpected desirability of ambiguity in office communication, and the inadvertent usurping of a corporate status hierarchy...

Experiences such as those described in Erickson's paper, although still largely undocumented in the HCI literature, are pervasive and lead to statements like this, from Wixon, Holtzblatt, and Knox (1990):

Principles alone are not enough in the design of artifacts. Design involves not only a broad architecture but a myriad of details which are not obvious until observed in practice. Carroll (1990) agrees: An important body of work in current HCI stresses that designed artifacts cannot be understood apart from the situations in which they are used... These investigators emphasize that even small details can have substantial effects on the usefulness of an artifact, that such details emerge from the situation of use, and hence can be neither predicted outside of that context nor meaningfully abstracted from it. Schön (1983) argues that the problem is one of expectations. He has seen the same phenomenon in other design disciplines,
Already in 1991, Wroblewski developed a craft perspective on HCI based on the ideas that design and implementation could not be separated, that artifacts and their use are ultimately situated, that the details determine the overall quality of the (software) product, and that the practice amounts to shaping the digital materials. The word “prescient” couldn’t be more appropriate. It is strange, and a little sad, that the piece shows only 59 citations in Google Scholar (at the time of writing, i.e., December 2020).

**Sources used in excerpt**


In this chapter, I have considered the notion that building human-computer interfaces is a craft, with all the advantages and disadvantages that that entails. My main points follow:

1. A craft is any process that attempts to create a functional artifact without separating design from manufacture.
2. Significant by-products of the craft process are new tools and materials as well as the intended artifact. The distinction between tools and materials begins to dissolve when viewed this way.
3. Creating software is sometimes, but not always, a craft. The degree of variability in practice is due to the availability of a reliable specification.
4. Creating a human-computer interface is usually, and perhaps always, a craft, because of the investigative nature of each designing.
5. Productive HCI research can take the form of facile tools and responsive materials, articulate craftsmanship, or craft-methodology.
6. We can begin to codify operational design knowledge by searching for and articulating design economies at work within individual interfaces.
7. Two approaches to teaching HCI as a craft are apprenticeship and exposure to paradigmatic examples.

The future of software practice and HCI construction belongs to those who take their craft most seriously and least respect the bounds of tradition, be they craft or science. I have argued that it is instructive to study other craft and design professions, but we must also be mindful of the limits to such analogies. Fundamentally, the materials shape the craft. Computer programs are unlike any other material, and the form of craftsmanship in software will surely be unique.
In 2006, I wrote a chapter about Wroblewski’s paper for an edited collection. Some of my comments still seem valid:

“As I have attempted to explore the directions suggested by Wroblewski fifteen years ago, I have found that the temporal/spatial nature of the material implies a number of specific issues. First, there is the question of an aesthetic of interaction design. Aesthetic concepts from graphic design and product design do not capture the feeling of use over time – how the interactive behavior of the digital artifact is experienced. Secondly, the practical work of interaction design demands new sketching techniques that are as fluent as pencil-and-paper sketching of form but captures temporal qualities in richer ways. Finally, and related to Wroblewski’s points 5 and 6, we are only beginning to understand the ways in which an articulate craftsman can communicate in professional and academic settings.”

See also p. 408 for more on temporal and spatial form in interaction design.
Instead of inventing yet another novel approach for careful design, it might as this point be good to stop and reflect on the existing accounts of careful design in close relation to the materials at hand. That is, we can seek a careful approach to interaction design that can also work as an approach to doing material-centered interaction design. Here, the growing interest in craft-based approaches to interaction design surfaces as an interesting candidate. Craft is a material-centered way to give form, and is also a careful approach in terms of the outcome of the design process, how the final product is designed, and how the material is treated during the process. Good craftsmanship is to a large extent a careful process in which different material properties are carefully considered and utilized in the process of design.

Even though craft has its roots in other material-centered design traditions (not least wood, iron and glass), it still bears an interest for a material-centered approach to interaction design. This is because craft is based in a sensitivity to materials: a sensitivity that includes attention to details and a developed sensitivity to material properties.

I do not see craft and design as synonyms, nor as mutually exclusive. Instead, I view them as complements to each other: I see design as an overall approach and process, whereas I view craft as a specific attitude toward and way of working with materials in the design process. From that viewpoint, a focus on craft underscores the fact that a design needs a good understanding of the materials at hand.
Wiberg, who is one of the main advocates of the “material turn” in HCI, seems to have an understanding of craft that is more or less exclusively predicated on the materiality of making in the context of design.
Another important line of making research problematizes the conceptualization of making as an engineering and innovation only project and foregrounds instead the notion of “handwork” — century-old practices of human creative work such as cooking, knitting, weaving, ceramic making, metalwork, carpentry, sculpturing, etc. Handwork is used to explore how such intimate and sensual engagements with materials and tools that has been a significant part of human history and culture could impact the development of the next generation of digital artifacts, open-source hardware toolkits, and the reconceptualization of craft, making and engineering. Drawing from craft theorists such as Malcolm McCullough (1996), Glenn Adamson (2007), Howard Risatti (2007) and Richard Sennett (2008) among others, HCI researchers and practitioners seek to (1) reveal empirically novel forms of creative expression often overlooked or even considered illegitimate in dominant narratives about making and (2) on a theoretical level, engage in the task of reimagining making that better accounts for historical practices, materials and manual skills and labor, and aesthetic meaning and quality. What emerged is a series of rich ethnographic and design accounts, from knitting (Rosner and Ryokai, 2010), gardening (Goodman and Rosner, 2011), book restoration (Rosner and Taylor, 2011), craft and quality (Bardzell et al., 2012), to leather work (Tsaknaki et al., 2014) among others. These, along with a growing body of work in HCI situate the discussion of contemporary rapid fabrication advancement with traditional slow crafting processes and practices to explore the potential and implication for a more productive integration of the two for future interaction design and experiences.
**Sources used in excerpt**


Starting with the material studies literature (e.g., [28]) and studies in material culture (e.g., [17, 27]), we find a good set of examples of how social and cultural contexts can be understood and theorized through the methods used for close-up studies of artifacts, handmade objects, and ancient materials (see, e.g., [12, 16, 26, 27, 46]) … we also find forward-looking and design-oriented studies in which the same closeness to the materials at hand with the same sensibility for material form and properties has been applied for the purpose of generating new ideas for design, for inspiring new form-giving activities and for the creation of new objects… Currently, there is an increasing interest in the field to take this “closeness to materials” approach one step further. We notice the interest in how the field is increasingly borrowing methods from craft and by using craft as a way of thinking through material (e.g., [33]). We also see how these methods of craft are currently being applied in interaction design research projects (see, e.g., [8, 23, 33]). In putting a particular emphasis on the methodological importance of closeness to the materials at hand and in underlining the importance of actively working with these materials, the field applies craft and craftsmanship as methods for exploring how HCI and interaction design can be advanced through research that advocates a knowledge-generating process inseparably intertwined with, and enabled by, a material discovery process.

[…]

Switching back now to more practically oriented, but still material-centered, approaches to interaction design, we should acknowledge the “sketching in hardware” approach explored by, for example, Moussette and Banks [29] and Sundström et al. [42]. In short, the “sketching in hardware” approach highlights the importance of explorations through an intimate relationship...
More on the materiality approach to craft.

[The sources used in the excerpt are too many to fit on this page.]
Craft practice is highly relevant to design in a digital age. This relevance hinges largely on the concept of beauty that lies at the heart of craft, which is fundamentally at odds with the more superficial approach that is evident from much design literature. We have sought to demonstrate that far from being a skin-deep exercise in product styling, beauty is an experience of enchantment that arises from an intuitive non-reducible creative process centred on empathy and defined by a vision of relevance and "rightness." We have argued that craft possesses those very qualities and provides the conditions to allow beauty to be experienced by maker and user. Craft, while it is rooted in the making of physical objects, provides the conceptual and empathetic means of addressing a far broader range of experiential issues that extend the relevance and value of emerging technologies.

The design beauticians’ obsession with product styling and aesthetics appears to miss the whole point of beauty, which is not to move products away from ugliness, but from something far more fundamental. As Kirwan argues: “The true opposite of beauty is not ugliness – itself an identity of being and value – but rather the dissociation of being and value and their separate appearance as such, that is vulgarity. For beauty is not something that stands for something we can attain; if it were it could not be the in itself which, by all accounts, both metaphysical and ocular, it is.” (Kirwan, 1999, p 49) This statement suggests that it is decision-making in all of the three characteristics of craft that enable it to find beauty. If we are conscious of these characteristics and the decisions inherent within them, then we can choose to guide our work towards beauty; vulgarity is suggested as a lack of intention and dissociation from value. “To craft is to care.” (McCullough, 1996)
The three characteristics of craft that enable it to find beauty, according to the authors, are enchantment, empathy and intuition (see also p. 102). The way this relates to interaction design, I believe, is that digital products can be beautiful if they are crafted carefully – with attention to detail, empathy with use situations, and respect for the material, as Wroblewski would have it (p. 352). This is far from a question of devising visually pleasing skins for predetermined function bundles.

**Sources used in excerpt**


Yet, what does it even mean to give form? What is the process? What tools do we need? Let us look at the traditional form-giving practice of a cabinet maker. Think, for instance, of her sensibility to the finess of the wood before her: the hardness, the number of knots, the smell of wood, the way it reacts when she planes, grinds, and saws. Her work demands training, experience with her tools, and substantial knowledge of the type of wood she uses. But, once skilled, she can gradually form the chair or the dresser through meticulous labor. Her work becomes a balanced negotiation between developing the form and the interaction gestalt – between aesthetics and function.

What will it take for interaction design to become an equally cultured practice? At the outset, the practice of interaction design is substantially more complex because of the presence of a dominant temporal form. The cabinet maker can to a large extent ignore the temporal form in the actual form-giving process. The interaction designer cannot. Thus, the careful negotiation of the interdependencies becomes between all three form elements at once. On a macro-level, we only know how a thing should behave over time when we have a sense of its physical expression. We only have an idea of what physical expression we should aim for when we know what contexts the things is to be used in. We only know what interaction gestalt we can aim for when we know how the physical and temporal form plays together, etc. Thus, any design task within interaction design will inevitably comprise countless small steps within each of the three form elements. To develop a practice around that we need to become familiar with each of them in the context of the others. Or put in another way, we need to start somewhere.

**IxD as a craft**

The three form elements of interaction design that the author identifies are the physical form, the temporal form and the interaction gestalt. Her argument is that they are all linked in tight interdependencies, and cannot be designed one at a time or specified separately. Instead it is necessary to approach the notion of the complete design by starting to make it. The relation to craft as a sympoietic practice (p. 38) rather than a hylomorphic one (p. 178) should be apparent.
At Austin Center for Design, we’re attempting to develop craftsmanship in the context of interaction design and social entrepreneurship. Bauhaus craft focused on fundamental knowledge elements, such as color, form, and texture; we too focus on fundamental knowledge elements. But for us, these formal qualities are no longer static compositional and formal qualities. Instead, our “foundations” focus on empathy through narrative, prototyping and public action, and inference.

Empathy Through Narrative. Narrative implies a compelling, culturally sensitive, and emotionally appropriate story that unfolds with, around, and for a given user. At the most basic of levels, this is a use case or scenario that captures the steps a user takes to achieve a goal. But more important, a narrative captures the subjective and political qualities of the society in which this goal is accomplished. Like sketching or painting, creating a narrative is a skill that is learned, critiqued, and revised over time.

Prototyping and Public Action. We continually force a culture of action, one in which the debate about what could be done or should be done is cut short by an actual prototype that can provoke action. This is a skill that requires cultivation, as most students are not used to the exposed quality of producing a critiquable thing in front of others.

Inference. Through practice, design students learn to trust informed intuition enough to provoke the action described above. This informed abduction – a logical and creative leap – is a skill learned by trying, failing, and reflecting; it requires first a deep understanding of data-driven design, and then a realization of what “just enough” means in the context of synthesizing disconnected ideas. And, like narrative and public action, inference through synthesis is learned through continual and rigorous practice.
The “craftsmanship in the context of interaction design and social entrepreneurship” that the author describes demonstrates quite clearly what interaction design might learn from craft, here in the context of a higher education environment. Empathy through narratives echoes the significance of care in crafting beauty (p. 360); the emphasis on prototyping and public action reflects the sympoietic nature of craft (p. 38). The concept of inference brings to mind the nature of practical knowing in craft, in making as well as in appraisal.
Idhe's material hermeneutics highlights challenges in communicating technological complexity, and why reductive explanations are often unsatisfying. The distance of concept from material outcome renders processual understanding increasingly abstract, often only understandable through a specialised language of scientific knowledge. In Abstracting Craft, Malcolm McCullough (1996) offers valuable perspectives on how computational design and visualisation has become an abstraction of craft. His rich discussion of conception, making and designing across hand crafted, mechanised and computational modes of production draws attention to the distinctive character of the digital artefact, that, “although lacking in physical substance, is a thing with appearance, spatiality, structure, workable properties, and a history” (McCullough 1996: 155).

He convincingly argues that despite the abstraction of computational design tools, unleashing their creative potential requires similar levels of skill and sensitivity to that required in the use of more traditional tools. McCullough suggests that a crafted approach to computing technology entails using “limited software capacities resourcefully, imaginatively, and in compensation for the inadequacies of prepackaged, hard-coded operations.” (McCullough 1996: 21). He gives an example of how a judicious implementation of “undo” and “save” functions offer opportunities for play, exploration and reflection, characteristics commonly attributed to creative practice. Computing software have further developed massive complexity and choice since Abstracting Craft was written in 1996; an array of operations across different menu structures can be combined in a multitude of ways to selectively act on elements of a design with radically different results. These may be predictable refinements of an intended form or surface, or the unexpected result of combining commands that the software developer had not intended (providing the software does not crash).
Source used in excerpt

Digital craft used to be difficult


There is nothing in Martin Lambie-Nairn’s experiences with the computer to suggest the craft fulfilment he experienced in painting Chinese willow patterns on to plates at a college or cutting out cardboard captions at the BBC. Clearly, for most designers, working on computer lacks the intuitive flow of ideas inherent in, say, silversmithing or furniture-making. “You really need to sketch and model and decide what you want to do before you go on screen”, says Gillian Crampton Smith of the RCA. And yet there is a creative dimension to realising an idea that cannot be realised using any other means, whether that idea is to create a Tyrannosaurus Rex chasing a carload of tourists or a tornado blowing up a storm in Oklahoma.

In the studios of Industrial Light and Magic, Guy Dyas reflects on his Twister assignment: “You can’t learn to be more artistic through using Photoshop, you can only learn to be more artistic and then apply that artistry using Photoshop”, he suggests. Until the computer becomes less of a machine and more of a biological extension of its user, then ascribing craftlike qualities to its process will be like looking into the proverbial eye of the hurricane.
Around the time when Wroblewski called for more facile tools and responsive materials to support the craft of interaction design (p. 352) and McCullough’s perspective on “the practiced digital hand” was new, it was probably common for the design and craft disciplines to perceive digital tools as something quite distinct from crafting physical materials.

Personally, I think the differences between manual crafting of physical materials and mediated crafting of digital materials are quite fundamental, and not something to try to minimize by focusing on the physical-material aspects of digital materials in order to make digital craft more like physical craft. Instead, I think the most valuable insights that interaction design can gain from craft are to be found among its conceptual foundations, its values and its notions of aesthetics, and its reliance on practical knowing.
In a process where the weaver acts simultaneously as designer, constructor and programmer, the research explores the inspiring, but often indefinable space between craft and digital technology by challenging the notion that “the relationship between hand, eye and material” naturally precedes the use of computing (Harris 2012: 93).
The sentence is sort of complex, but I think the point of this work is that there can be craftlike hand-eye-material relations also when computing and digital materials are involved. It brings to mind similar notions being proposed within interaction design, such as hifi sketching, sketching in hardware, or code sketching. What they all have in common is the urge to make craft practice a productive part of the design process.

**Source used in excerpt**

Considering end-user development and meta-design as a challenge, one has to move beyond the binary choice of low-level, domain-unspecifiable interactive programming environments and end-

- Turing tar pit: “Beware of the Turing Tar Pit, in which everything is possible, but little of interest is easy.” (Alan Perlis)

- The inverse of the Turing tar pit: “Beware of over-specialized systems, where operations are easy, but little of interest is possible.”

The Turing tar pit argument provides a supporting argument as to why interactive programming environments, such as Lisp, Logo, Smalltalk, Squeak, Agentsheets, and many others (Lieberman, 2001) are not ideal for supporting meta-design. These tools provide the ultimate level of openness and flexibility (e.g., Squeak is an open source implementation of Smalltalk written entirely in itself). As general-purpose programming languages, they are capable of representing any problem that computers can be used to solve, and as open systems they let users change any aspect of the system if necessary. Although these systems are useful as computational substrates, they by themselves are insufficient for meta-design. The essential problem with these systems is that they provide the incorrect level of representation for most problems (Shaw, 1989). Expressing a problem and designing a solution in these systems requires creating a mapping from the context of the problem to the core constructs provided by the programming language and its supporting library. On the other side of the spectrum, domain-specific but closed systems [e.g., SimCity 4 (Electronic-Arts, 2004)] provide extensive support for certain problem contexts, but the ability to extend these environments

Meta-design refers to the creation of conditions for subsequent design to happen; in this context, the focus is specifically on end-user software development. A classical example of end-user development is the spreadsheet, where millions of people create dynamic calculation models for their own use and that of their colleagues. Effectively, the creator of an Excel budget template is doing fairly advanced application programming without ever considering the work in those terms. Fischer and Giaccardi are exploring the possibilities to create similar conditions for end-user development also in other domains, pointing to the need to find the sweet spots between general programming environments where everything can be done but only by specialists (“the Turing tar pit” in the words of Alan Perlis) and specialized applications supporting certain tasks very well but not allowing for extension or modification. This is all somehow related to the interest in responsive materials for interaction design.

**Sources used in excerpt**


I have only recently discovered (through a passing comment that started with the startling words, 'I know what you are!') that I am a craft technologist. Upon hearing this revelation, and agreeing, I was relieved. As a PhD student studying paper electronics, I work with emerging technologies daily. I do not, however, consider myself a technologist. My experience with coding and electrical structures does not make me a programmer or an engineer. I am no artist. I design, but also play, reflect and make; I have a deep respect for material and the history of my medium. And so, when I was told I was a craft technologist, the term resonated strongly.

I define a craft technologist as loosely as the previous definition of craft: someone who navigates technology armed with a deep understanding and respect for materials. A craft technologist's material is technology. They have an understanding of its history and can work with its limitations. A deep understanding means the practitioner is exploring not just the materiality of a technology, but also the history, social and economic value, different perspectives and context. Through this extensive exploration, a craft technologist gains an empathic understanding of the digital as a material. The craft technologist's process allows for the finding of new applications and affordances through questioning materiality and limitations. A craft technologist learns by doing, making mistakes and being reflective. Crucially, they explore a material with their hands. By using their hands they gain an intimate understanding of how technologies and materials work.

A craft technologist navigates and investigates the materiality of technology through traditional craft methods and processes of play and reflection. They do not begin with a design problem to be solved, but instead start with a question. The question will be more about experience than function as they are crafting experiences rather than functions. This lies at the heart of a

Being a craft technologist


I freedom in any field that depends fundamentally on creativity.
Exploring digital technology by tinkering with it and reflecting on the outcomes seems like a fruitful way to build the kind of material knowledge that we would take for granted among practitioners of traditional craft disciplines. It is interesting that the authors emphasize not only the practical knowing pertinent to the material, but also its “history, social and economic value, different perspectives and context.”
Programming is sculpting


According to Blum (1996) software engineering with its two-step process model, separating design from implementation, is based on “hardware engineering” ignoring software’s unique properties (p. 268). For dynamic applications and those with open requirements, he maintains, we should adopt “a sculptor metaphor.” We may start with sketching and analysis, but it is not that important that we stay absolutely faithful to the original plan. We continue sculpting till we are happy with the beauty of our artefact and when we have finished, the artefact’s “delivery constitutes its as-built specification” (p. 268). This is very different from the engineering view of having a detailed specification first and then doing the implementation. For Blum, code is “the most detailed expression of the design” (p. 269). This view is shared by Reeves (1992, 1), who also maintains “that programming is not about building software; programming is about designing software.” That is why both Blum and Reeves maintain that the software manufacture, or building, is cheap, almost free, since once the design is done the building of this design is automatic and done by the computer when the program runs or is compiled. Blum’s sculptor metaphor is also in line with the concept of “software craftsmanship” suggested by McBreen (2001).
The sculpting metaphor for programming recounted by Amiri echoes Wroblewski’s concepts of responsive materials and design and implementation unified (p. 352).

**SOURCES USED IN EXCERPT**


There is a fundamental difference between teaching programming to computer science students and to art and design students. Computer science students are expected to become professional programmers who could be programming mission-critical applications in the future. Art and design students, on the other hand, are only end-user programmers who need programming to be able to create their often exploratory, experimental and artistic artefacts. They are not necessarily interested in the intricacies of the language for its own sake. Perhaps a good analogy would be the difference between teaching a foreign language to a linguist and to a tourist. The tourist needs the language to be able to communicate with people and explore the new environment and to get by. The linguist needs to understand the syntax, semantics and pragmatics of the language even if he or she never needs to communicate with a native speaker of that language.
When we shift focus from the use of computers in general art and design to interaction design, the question remains of how much programming skills, and what kinds of skills, aspiring interaction designers need. Does a “programming tourist” interaction design student have to be able to do code sketching? Is it perhaps enough for them to use tools offering some flexibility with respect to not only physical but also temporal form? Or should they aim towards deeper craft skills?

I don’t think there is a one-size-fits-all answer to such questions, but at least for innovative interaction design there is a strong argument to be made for material exploration and the level of skill that it requires.
When you craft something, you manipulate a material to do what you want, to behave in the way you desire. And when you have a mastery of that material, you can act with a strong sense of fluidity. I’ve heard artists describe this fluidity as a dance: where both partners have autonomy, but there is harmony between them. The artist knows the limits of the material, how it “wants” to move or flow, how it will react when you push or pull it, how it will change over time, how it will react with other materials, and so-on.

[...]

I’m watching one of my alumni, Ruby Ku, code the next version of HourSchool through paired programming with another alumni, Chap Ambrose. Two years ago, Ruby didn’t know how to design or code. Now, she’s achieving proficiency in both. And as a result, I see her engaging in the dance, and having moments of beauty in crafting. And as a result of that, I see her having a more thoughtful, more considered, and more nuanced opinion about digital products in general.
The fluidity that Kolko describes as a characteristic of mastering a material brings to mind the notions of the dance of animacy (p. 206) and sympoietic practice (p. 38).
In my experience, material can be a metaphor of programming language code. The creative work of implementing interactive multimedia artefacts and products using a mixture of languages has made me reflect upon the materiality of code, if it is pliable, malleable, solid, or brittle. But as much as this is my personal experience, I need to know the view and attitude in the community of practitioners, both interaction designers and developers.

[...]

Descriptive categories and concepts were induced from the collected data. These were: material (core category), rational, pragmatic, mastery, learning, and explorative. Figure 3 shows the relationship of the categories to one another and their dimensional relationship to Sennett’s concepts of craftsmanship and quality-driven [28]. The diagram depicts the categories’ relationship to the core category material. The size of the circles – except for the material category – describes the category’s saturation.
Lindell asked 33 programmers what they think and feel about their favorite programming language. The results indicate that programming can very much be considered as the pursuit of mastery of a material, and that notions of explorative conversations with the material are recurrent.

**SOURCE USED IN EXCERPT**

The Linux community might have served the mid-twentieth century sociologist C. Wright Mills in his effort to define the character of the craftsman. Mills writes: “The laborer with a sense of craft becomes engaged in the work in and for itself; the satisfactions of working are their own reward; the details of daily labor are connected in the worker’s mind to the end product; the worker can control his or her own actions at work; skill develops with the work process; work is connected to the freedom to experiment; finally, family, community, and politics are measured by the standards of inner satisfaction, coherence, and experiment in craft labor.”
SOURCE USED IN EXCERPT

Craft aesthetics of hacking

As part of this practical capacity, the very nature of hacking – turning a system against itself – is the process of using existing code, comments, and technology for more than what their original authors intended. This is the paradox of constraint. Since many technical objects are simultaneously bound by certain limits yet exhibit potential excesses (Star and Griesemer 1998), during the course of their existence, they can be exploited and redirected toward new paths of functionality by acts of hacking. Hackers are thus attuned not simply to the workings of technology but also seek such an intimate understanding of technology’s capabilities and constraints that they are positioned to redirect it to some new, largely unforeseen plane. They collectively and individually derive pleasure in outwitting constraint. In essence, hacking follows a craftlike practice, it is predicated on a stance of craftiness to move the craft forward. Hacking is where craft and craftiness converge.

[...]

Out of this routine form of technical activity hackers have constituted an expansive pragmatic practice of instrumental yet playful experimentation and production. In these activities the lines between play, exploration, pedagogy, and work are rarely rigidly drawn. Sometimes hackers will be motivated by a work-oriented goal, as is/was the case with DMH. At other times, they are motivated to hack for the sheer pleasure of doing so, as Espe emphasized. In either case, frustration and pleasure are fundamental to hacking.
The “craftiness” that converges with craft in the practice of hacking refers to resourcefulness in overcoming challenges, and to learning through exploration and discovery.

**SOURCE USED IN EXCERPT**

The primary arguments against designers coding are as follows:
You can know without doing. There are many examples of coaches, choreographers, trainers, and executives who direct the work of practitioners without ever actually doing it themselves.
Performing a task does not automatically teach you the implications of performing it. Just because you code, it doesn’t mean that you automatically understand the effects of your code on others, or on the organization.
There is a tremendous breadth of skills, tasks, and job roles in the software development world, and making assertions in the simplistic duality of “designers” or “developers” fails to recognize the complexity and nuance of these roles.
Why are we even asking this question? It always seems to be posed by the practitioners with the least empathy for others, asking for empathy from the far more empathetic group, while ignoring the truly important challenge of empathizing with the user.
The one argument to make that favors designers coding is really just a broad generalization that doing someone else’s job for awhile is a good way to gain an understanding of the challenges that person faces. So, yes, it is generally a good thing for designers to spend some time coding. Of course,
The argument seems to be made in a business context, and specifically one where user-centeredness is the first priority. It is easy to agree that designers don’t need to code, as long as those designers are focusing on studying users and use contexts with a view towards devising appropriate technical support for identifiable tasks. However, matters seem quite different when designers are engaged in the exploration of innovative possibilities.
Rudimentary coding skills are key for any designer in the digital space. But then again, understanding users and being able to use that understanding in various creative ways to come up with ideas for, shape, and build new things are things that have always been asked of good designers. In some sense, this ability is design – it’s not new by any means. 

[...]

Over the last 10-15 years or so, designers have tended to try to team up with business people rather than engineers to make design happen on a larger scale, and speaking through Powerpoint is just one aspect of that. This is all good and has perhaps helped move design up the food chain, but I think that one of the points Maeda is making is that design also needs to reconnect with the engineers to make their ideas come to life. This requires coffee script and C#, not sanding paper and scrapers.
One of the points here is that ideation, shaping and building of new things requires engagement with the materials, even though it is not clear what “rudimentary coding skills” means in the context of skilled craft.

There is also another point, however, which is the reminder that making for designers forms a bridge to “the engineers.” Fallman suggests that this connection may sometimes have been left behind in the struggle for design to become part of the business conversations in companies and organizations.
Through our analysis of the material aspects of interaction design discourse we have aimed to contribute to an understanding of how materiality constrains and enables what can be expressed and designed, and thereby provides a starting point for a conceptualisation of agency in interaction design. Actions of people and material together contribute to the “doing” and the forming of a designed object. It is through the unfolding of such transactions that agency emerges. Agency is thus not a property of each individual actor, neither is it a pre-given property of an artefact. The agency of a design material does not merely depend on its physical qualities, but is an emergent relationship. In comparison to metals, which cannot only be characterized by different degrees of conductivity and ductility, the different properties of various design materials reflect the way they are actually used within design processes.

In our analysis, we have illustrated how such qualities emerge, while regarding them as emergent issues of agency rather than affordances. The difference, we argue, is not merely linguistic, but concerns the way we consider the role of materials in interaction design. For instance, if the affordance of clay suggests to designers that it can be moulded, the notion of agency enables us to consider the way that the clay continuously shapes and reconfigures the on-going dialogue between materials and designers. It is in this process of doing and performing that the design object emerges, in the case considered, in the shape of a bird. The notion of agency allows for reflection on the creative intra-actions whereby a lump of clay has played a part in the design of the concept of a twittering bird.
The concept of “agency” is suggested to go beyond the passive malleability of “affordance” and explain the responsive nature of materials in craft-like processes. The authors seem to be arguing for the importance of responsive materials in interaction design.
paradigm has rested on such grounds. The representation-driven paradigm has been strong and we have developed representations of information flows, states and activities – and we have established a design profession and developed design methods to guide us in the creation of models of our world that the computer can process and present back to us in the form of user interfaces. This approach of making abstractions of the world around us, rather than modeling computing as a concrete material of the everyday world, has been the backbone of design tradition all the way back to the early days of computing. Along with the vocabulary of “representation,” as a notion that addresses the connection between something observed with a model of the thing observed, we have introduced “metaphors” and “symbols” to make it easier for users to understand how a particular representation relates to what it represents.

In relation to this representation-driven history of human-computer interaction (HCI) and interaction design, the recently acknowledged “material turn” in our field marked a significant shift. Initially, the “material turn” in the field of interaction design looked like nothing more than a shift towards “materials” as a term to talk about physical user interfaces, tangible user interfaces, and most recently the Internet of Things where computing could be integrated in physical objects. However, and far more important in relation to the design tradition underpinning our field, the “material turn” also marked something much more fundamental. It marked both a shift away from our tradition of working with representations in computing and a shift towards ways of making computing part of what is real.
There is an important clue here to understanding why so much of HCI’s interest in craft seems to be channeled into physical materiality and tangible user interfaces. Wiberg points out that the history of HCI is all about representation, meaning visual abstractions of information on two-dimensional surfaces. For example, the seminal concept of direct manipulation in actuality referred to the moving of a plastic puck on the table surface to control a pointer shape on a screen to select and move image elements representing the information pertinent to the task at hand, all this in an attempt to reduce the gap between user’s intentions and the means available to carry out those intentions. I suppose it is an open question how “direct” and how much “manipulation” this really was, but compared to the text-based command language interaction that was prevalent at the time, it was clearly a significant leap.

The emergence of spatial and physical interaction surfaces provided the opportunity to focus on more direct interaction between users and the objects of their concern. The “material turn” thus became a way for HCI to go beyond representational approaches towards making computing more real (as Wiberg puts it), as well as a productive frame for interdisciplinary collaboration with other design disciplines.
About half a century ago, when material science became a discipline, material development had already extended beyond traditional materials such as wood, glass or metal. Incorporating knowledge from chemistry, physics and engineering, new materials such as polyvinyl chloride (PVC), fiberglass and plywood could be developed as a whole, in terms of an expanding range of specific functional and performative potentials (Gordon 2006). Many were invented for specific purposes and with such advanced properties that they could replace functions previously fulfilled by entire products. Such new materials presented challenges to design theory and practice, as materials moved from being something that could be experienced and formed through direct interaction to the performance of something determined (and designed) at the scale of molecular structure. At this turning point in design, Ezio Manzini (1989) articulated a shift from being to doing materials.

Material development has since taken another turn. Materials introduced more recently have the ability to change continuously in relation to external factors and internal programs. Typically referred to as “smart” or “computational” materials, these incorporate technological innovations from areas such as nanotechnology, computer science, electronics and established material science. For designers, this introduces new possibilities for designing the material as a whole as well as programming material performance or behavior over time. However, previous approaches no longer suffice for relating to an expanding range of complex, context-dependent functions and expressions, for which experiential references and design precedents hardly exist. Furthermore, such materials are only rarely mass-produced, existing as a realm of potential rather than as physical samples.
Developments in material science and technology are paving the way for physical materials that can behave, perform and transform over time – in short, the temporal form that was always a primary characteristic of interaction design (see p. 408) is becoming a reality also in physical/material craft and design.

**Sources used in excerpt**


During the interviews, materiality turned out to be an important aspect of instrumentality. The two composers' absorption of the software has to do with its materiality. They constantly return to talk about the materiality of the software, when asked what challenges and inspires them. It might seem absurd to talk about the materiality in software, which is often seen as dynamic and even immaterial, but still compositional software (as any software) is materialized from the low level of code and algorithms, to the interface, its metaphors and interaction, and to the sound, music and perhaps visuals that are produced as artistic output and how they connect to artistic, musical traditions. … Artists in general (and also Morten and Peter) often point to the resistance of the material as an expression of the struggle in which they engage when producing art. The struggle is seen as fundamental for the creative process by which the artist expresses himself. As such, the resistance of the material is understood primarily as a positive and even necessary premise. The resistance is due to the nature of the material which is circumscribed by the physical attributes and designs of the instruments involved as well as the historical conventions of music: genre, harmony, form, instrumentation, etc., which they reflect. Working creatively, the composer engages in a dialectical relation with his material, sometimes playing along, sometimes playing against the material, finding new ways to overcome the inherent ramifications by the use of extended, “peripheral” or non-orthodox techniques. The composer has to be attentive towards the nature of his material (e.g. his instruments) in order to express himself in an original way. In the practice of Peter and Morten, this attitude can be observed in the way they constantly examine the possibilities of the software searching for “nie erhörte klänge”. Materiality can consequently be understood as an embodied resistance in the software they have to struggle with in order to creatively use the software, and the way in which it supports their aesthetic conceptions and musical poetics. This materiality is not something to do away with in order to make more useable software, but is exactly what constitutes the software as an instrument, as something to play on and with. Both Morten and Peter stress that the way the software resists their intention and how it yields surprising and unexpected results is important for their inspiration and the creative process.

Materiality of software

Music composition software can be seen as a more or less infinitely variable material. The artists interviewed by Bertelsen et al. emphasize how resistance and friction is productive by introducing serendipity and motivating explorative work in general. There is also an element of the pride of mastery. All of this relates very strongly to traditionally grounded understandings of the driving forces of craft.

**Source used in excerpt**

This paper aims to clarify attempts to theorize materiality by introducing analytic category of material traces, which concretizes a unique location in time and space to reveal the dynamic and evocative nature of form. Whether realized as the missed stitch on a shawl or the annotations left on a text document, traces of skill, use, and time are valued for their emotional resonance in addition to the pragmatic goals in which they are embedded. They matter in terms of the specific meanings they convey, the mistakes they unveil, and the educational opportunities they afford. […] It is these multiply authored events that this paper seeks to examine in the very different social worlds of technology development. The early Read Wear and Edit Wear systems [14], for instance, produced histories of “wear” through graphical representations of authorship and readership activity, or material traces of use. By visualizing patterns of activity, the systems revealed techniques of authorship, or material traces of skill. In logging timestamps of editing activity, the systems evidenced instances of creation and durations of readership, or material traces of time. Within these embedded “histories” we find compelling remnants of interaction. These traces are not only important for assessing what we have already done; they are also subtle but powerful tools for guiding design and situating philosophy. Turning to new materialist scholarship largely stemming from the field of science and technology studies (STS) [3,9,23,24,27], we use three conceptual lenses – attributes, entanglements, and trajectories – to critically examine material traces in design practice. Specifically, we describe how traces emerged within an interaction design course titled “(Extra)ordinary Materials” using a range of substrates, from piezoresistive fabrics to leather and wood. Through the lens of attributes, traces…
Sources used in excerpt


Though the TUI and computational materiality perspectives differed in their respective foci on physical versus metaphysical takes on the materiality of HCI, both broadly speaking can be described as ontological, in the sense that they are seeking to describe what digital materiality is. The Dourish and Mazmanian piece, in raising the role of conventional signifying practices in digital photography, gestures towards the communicative dimension of materiality. The rising area of craft-related research in HCI [see also 31 and 32 in this issue], building on recent re-evaluations of the role of craft in society [33, 34], has also taken up the issue of communication. It does so through both an examination of the various materials of craft practice and the materiality of interactions with those materials. Specifically, HCI craft researchers have investigated the ways that technology and craft are increasingly being leveraged together to advance a notion of making, interacting, or working with integrity, that is, “craftsmanship”; to support individually fulfilling creative and/or self-expressive practices; and to contribute aesthetic and economic value to diverse publics [11].

In these examples, digital materials are inseparable from traditions of practice: these practices are represented in and enacted through, and by means of, digital materials. … The craft view helps explore the communicational dimension of material interactions, foregrounding ways that all aspects of interaction – including design, everyday use, and even research – are rooted in tradition. This may include the use of traditional materials augmented with new properties or traditional practices augmented by new practices, but the focus remains on communication that is rooted, in an important sense, in previous habits. The craft HCI examples provided focus their investigative gaze on entire historical traditions of creation.
Highlighting the important aspect that craft can mean more to HCI than merely encouraging tinkering with tangible user interfaces. The values of craftmanship and the connections to historical traditions may be even more important to consider when we think about how interaction design can be advanced.

**Sources used in excerpt**


To give work substance, we require a medium. The actions of our hands, eyes, and tools must be mediated. Our personal knowledge and skills must be given a habitual setting for practice.

When the tools are complex, when the artifacts produced are abstract, or when tools provide the only means of access to the medium (all common conditions in high technology), it can be difficult to say where a tool ends and a medium begins. But we can say that under skilled practice even these tools become transparent, and that a sense of a medium eventually emerges. Normally this is a more simple relation: a medium receives the work of tools. Where a tool is an effector or a probe, a medium is a substance that may be sensed or altered somehow by tools. If a tool is kinetic, and under active human guidance, a medium is static, and passively presents limits to human control. The meeting of tool and medium provides a locus for skills. As we push material around, we encounter structure. We find that we may work only in certain ways, and only at certain rates. We say that the medium has a feel, and we sense this quality only in action. Substance mediates action.

To mediate is not only to shape but also to communicate. Because a medium shapes the way a tool conducts an author’s intent, it provides a locus for expression, and becomes subject to interpretation. In this way, a medium communicates between author and audience. The more tacit expression, subtle interpretation, or latent content a medium is capable of communicating, the richer it seems. A richer medium invites interpretation. Its subtleties become subject to connoisseurship. The contexts and purposes under which it is used and interpreted create genres. In the case of craft, interpretations focus specifically on the way in which content takes form. With art, however, the relation of form and content varies constantly. Computing transforms this relation too: the same content (bits) may take many different forms quite easily, and it may do so after the fact. Of course there is considerable debate as to whether content must take material form, or whether the articulation of a more abstractly mediating substance, such as generative algorithms, may be subject to appreciation. But rather than entering a discussion on the
The design of richly informative interfaces would benefit from an account of how visual forms convey information. In this paper we suggest that the study of form-giving in Industrial Engineering might provide a foundation for such an account. We present three studies of designed synesthesia, in which objects’ forms indicate non-visible attributes such as taste or smell. These studies illustrate the rich possibilities for conveying information with form, possibilities which are routinely exploited in industrial design. We believe that similar opportunities exist for interface design, and that further studies of form-giving may help in taking advantage of them. Results of a student exercise expressing computer metaphors in 3D forms will be discussed.
Attempting to open a discussion on form and expression in HCI, many years before the community was ready for it.
Temporal and spatial form

Hallnäs and Redström, 2006.

“In the work of Hallnäs and Redström [14], computational things are characterized by, on one hand, the temporal form that stems from computational processes and on the other hand the spatial form given to these processes by other materials with strong spatial form elements. A central example is the combination of computations and textiles, in which the dynamic properties of textiles are used to manifest temporal structures generated by computational processes (cf. also [27]). Here the computations comes to expression through the textile and together they form a new type of material. One suggestion, then, is that while computational technology is material (as distinct from being immaterial), it cannot really exist on its own in free form. To resolve its seemingly strange existence in-between the material and the immaterial, and its dependence on other materials for its presence, we propose thinking of it as a type of composite: that computational technology is a material, which we have to combine with other materials in order for it to become a material we can use in design practice.”

[Quote from Vallgårda and Redström, 2007, p. 514]
SOURCE USED IN EXCERPT

Based on the observation that knowledge of materials is essential for design practice, we raised a series of questions in the introduction. In what ways can we consider computational technology as material? To what extent would such an understanding be based on computer science, and to what extent would new perspectives on this technology have to be developed to address the perspectives and issues designers deal with? How can we understand, and work with, computational technology in relation to other materials? Based on the analysis presented, we now conclude the paper with a discussion of these questions. We will also relate them to existing design practices and technological research traditions, to point to future work in this interdisciplinary field.

The analysis of computational composites as presented in sections “Computers as Material” and “Computational Composites” provides our suggestions as to how computers can be considered a material: that computers can be understood as materials in the traditional sense and that computer’s properties only become available when existing in a composite with at least one other material. We also argued that in order for design practice to come to grips with computational technology, we need to develop our frameworks beyond the one we now find in computer science, as it is necessary to deploy a new perspective on the technology.

Given the development processes toward using other materials in design, the need for such re-appropriation is not unexpected – in fact, it is what happens most of the time in the interdisciplinary context of material development.
It is true, of course, in a straightforward sense that computers are always also physical things, and that it is only through the physical manifestation that the computer becomes something for us to perceive and experience. Using that kind of argument, then, it is reasonable to say that the properties of digital materials “only become available when existing in composite with at least one other material.”

Still, it seems to me like a somewhat trivial and not very productive observation. I am not sure what it does for our understanding of digital material qualities. In many instances of interaction design, I would argue, the temporal form and the interaction gestalt (see p. 414) are more influential than the physical form in the outcome of the work. Also, I cannot see how the concept of computational composites goes together with the notational, allographic (p. 234) aspects of interaction design.
Temporality: Hallnäs et al. (2002) were probably the first to articulate a material property of computers. Since computers execute programs (compute) and since that inevitably is a temporal process, they argue that temporality would be an inherent property of computational technology. They explain that “this makes temporal gestalt the central form element of this material: as we execute programs, temporal structures are created” (Hallnäs et al., 2002, p. 158, original emphasis). Basically, this means that whenever a computer is in play the expression will be something that happens over time; it will change. We could say that the physical expression of the computer’s temporality is change. [...] Reversibility and Accumulation: Closely linked to the ability to change is the ability to change in distinct formations. Changes can be reversible or accumulative, or any combination thereof. [...] Computed Causality: The computer’s ability to compute based on an input and to make the result available through an output means that in principle it can establish any desired cause-and-effect. The computer can thereby be a powerful tool in playing with our experience of the laws of nature. Also, the computation in a digital computer offers extensive room for interpretation and reinterpretations as it consists of a system of binary events. Indeed, every input and output will adhere to the same formations of electrical charges inside the computer. Therefore, only the availability of appropriate transducers determines what is interpreted and how it is expressed. [...] Connectability: Connectability is the computer’s ability to connect and communicate with other computers. This property is founded in computers’ ability of handling protocols through attached radio devices to produce connections with other computers. It is arguable a second-degree property in the...
Source used in excerpt

From an interaction design perspective, however, the real radical shift is in how we design with these computers. The computer is no longer the center of attention, thus, what we design is no longer the interface to the computer. Rather, what we design is a thing or an environment in which a computer might be used to create certain desired effects [cf., 12]. Indeed, interaction design in a sense becomes the practice of giving form to artifacts or environments rather like any of the other design disciplines that we have known for centuries. What makes it meaningful to preserve interaction design as a special discipline, however, is the fact that the computer as a design material is highly complex and somewhat different than most other materials due to its ability to change between states — its temporal form. Hence, we still need a practice that specializes in how to craft the computational material’s temporal form in combination with physical forms and interaction gestalts.

In this paper, I unfold the interaction design practice through the trinity of the temporal form, the physical form, and the interaction gestalt. I argue how interaction design practice is about forming a whole through an ongoing negotiation between the three in form elements. I further argue, how the computational composites [13] present a way to work with the temporal form and the physical form in a process not too different from any traditional form-giving practice, thus enabling us to borrow from their experience when developing our practice. Lastly, I point to some tools and techniques to deal with the interdependencies of the three form elements and thereby also demonstrate that a form-giving practice of interaction design is already well under way.
The notion of crafting digital materials towards temporal form, physical form and interaction gestalt is intuitively appealing to me. However, there is always the question of what interaction gestalt is, other than the relational effect of form in use context. Vallgårda defines it as the performance of movement that a user does in relation to the designed thing or environment. She sees interaction gestalt as a possible effect where the form plays an enabling role. One strength of this approach is that it becomes meaningful to talk about the intended character of the interaction gestalt, in terms closely related to the user experience.

**Sources used in excerpt**


Smart and computational materials are fundamentally temporal – not only in terms of patina or disintegration, but in the capacity to assume multiple, discrete states of expression that can be repeatedly and minutely controlled over time. The temporal and responsive nature of such materials means that their spatial expression depends upon and evolves as a sort of co-production between properties intrinsic to the material and to circumstances in use. These materials come to be, or become, only over time and in context – they are becoming materials.
Our approach is based on real-scale but low-tech and low-fidelity versions of materials. Typically, these are produced in multi-disciplinary teams relating to varied concerns spanning material development, design application and human factors. Experimental design, involving prototypes and interventions, enables us to probe into potential contexts of future use and to stage discussions with potential users while the development process is still at a stage when it can benefit from such influence. The material samples that we develop and work with are meant to explore aspects of the potential or eventual expressiveness of the material, to open up a design space for understanding the consequences of a particular material for design and for use. The samples themselves might be further developed or applied but, more importantly, they are a basis for communicating ideas and experiences as well as technological possibilities within a multi-disciplinary team and with potential users. Prototypical samples help us investigate aspects of material practices of design and of use, which are difficult or impossible to communicate through language alone. To be able to create such materials, however, we sacrifice technical precision to a certain extent. In developing computational composites, for instance, we might compromise the detailed technical crafting of mechanical or electronic components so that we can more rapidly prototype and thus explore how the whole might be experienced at the scale and in the time of human perception. Of course, some of the low-fidelity characteristics of the material also translate into how we experience the material – it may not quite live up to what we would expect of the final design – but such material samples nonetheless provide a valuable basis for design experimentation and intervention into contexts of use.
Exploratory crafting in the context of interaction design needs to focus on the experiential qualities that are the most salient ones in the current state of the design process. In this case of working with new ideas for domestic furniture, it is the spatial-experiential qualities of human scale and human time that are found to be essential.
This paradox for design with respect to new and becoming materials is analogous to problems in other areas of design that are close to technology development, such as interaction design. In fact, interaction designers have been active in transforming practice in order to deal with the need for interdisciplinary collaborative work as well as experimental prototyping processes. A repertoire of techniques has been developed in order to explore material expressions and use experiences long before the final technology is implemented or even decided. For example, paper-based and Wizard-of-Oz prototypes suggest how an interface might behave or be used within various contexts (Ehn and Kyng 1991, Buchenau and Suri 2000, Mazé and Bueno 2002, Dunne 2005). These can range from low- to high-tech, from low-fidelity mock-ups to highly-resolution models, from unique one-offs to limited production runs. In addition to the expanding range of techniques in interaction design, we can also identify related materials practices – for example, as architecture operates at the intersection of craft techniques and new technologies (Mori 2002, Runberger 2008).

While, typically, arguments emphasising material practices over language-based approaches to (artistic and design) research are attempts to articulate the experiential knowledge of the (often crafts) practitioner, our argument departs in some respects. Even as we see the benefits and necessity of building on established and existing materials traditions and techniques, we also argue for recognising and making explicit emerging approaches to material practice today. Such approaches are a response to the particular challenges (as discussed, involving both technological and interdisciplinary aspects) of contemporary research and design development in the field. Indeed, the expanding range of concepts and methods...
New forms of materials – becoming materials – require explorative work that goes beyond established craft practices, it is argued. There is a similarity to the situation of designing non-idiomatic forms in interaction design, i.e., forms that are not new instances of conventional formal and interactional patterns. In non-idiomatic design, it is sometimes found that normal sketching techniques stop talking back and explorative work needs to move more closely to the final delivery materials. This often amounts to programming partial interactive prototypes in a practice known as code sketching.

**Sources used in excerpt**


But what are the dimensions of interactivity I have in mind here? What are the form factors of interaction that defines [sic!] this design space? If we think about interaction with a focus on the “in-between” and with a focus on how interaction plays out as an interact between two or more entities, as I discussed in the beginning of this chapter, these six dimensions include: (1) changes of state (dynamics) in the interaction, (2) speed of change (pace), (3) requests for input (turn-taking), (4) responsiveness to input (receptiveness), (5) single-threaded or multithreaded interaction, and (6) direct or agent-based (“invisible”) interaction.
I am not entirely clear on what this particular attempt at elaborating the concept of temporal form for interaction design is based on, or how generative it might be for interaction designers.
HCI researchers have started to investigate how to bring material explorations earlier in the design process [13, 57, 58], and how to effectively incorporate different material substrates [10, 63] and experiential forms [12, 62] into the design of artifacts of blended materiality [20]. This corpus of HCI research is informed by an exploration of emerging materials and technologies, and primarily grounded in interaction design research.

Within this corpus, one orientation is concerned with opening up a compositional sensibility in which digital and physical materials play more equitable roles [e.g., 60, 63]. Contributions to this strand of research have expanded the HCI vocabulary to speak of the ways in which materials come into relation, introducing notions such as “texture” [63]. They have also included steps in the direction of a vocabulary of material properties of computers, with descriptive terms such as “computed causality” and “connectability” [61].

Another orientation is concerned with how to bring material considerations into the design process [e.g., 13, 58]. Contributions have manifested in approaches aimed to explore the dynamic properties of a digital material early on in the process [57]. They have also manifested in articulations of interaction design as form-giving [e.g., 62], studies of material interactions [e.g., 3, 59], and a concern with experiential qualities such as “suppleness” [29] and “pliability” [39] of digital materials.

Finally, we observe a growing ecological orientation in interaction design research. According to this orientation, the way in which we perceive and experience an artifact is not just a property of the straight physicality of materials – it is also implicated in personal and social life [32]. Understanding the link between the qualities intended through the design of artifacts and the qualities experienced ‘in use’ within ecologies of material artifacts [e.g., 16, 31] requires a broader understanding of materiality.
A survey of recent work within HCI that deals with the concept of design materials in different ways.

[Too many sources are used in the excerpt to fit on this page.]
The Materials XP Framework


To facilitate this understanding, we suggest that in the situational whole in which encounters, performances, and collaborations come about and transitions from one another occur, materials are experienced at four experiential levels: sensorial, interpretive, affective and performative. These levels affect each other in a non-sequential manner.
AI as an IxD material

Holmquist, 2017, p. 32.

Thus, anyone constructing an AI-based system needs to tread lightly, manage expectations, and be careful not to overreach when it comes to AI’s capabilities. But apart from understanding the overall potential of AI, I believe there are a number of interdependent challenges that pertain more specifically to interaction design. These have to do with how designers can take the behavior of systems that rely on artificial intelligence and make it understandable for the end user.

They include:
• Designing for transparency
• Designing for opacity
• Designing for unpredictability
• Designing for learning
• Designing for evolution
• Designing for shared control.
With the recent surge of interest in artificial intelligence (AI), fueled mainly by new advances in machine learning, comes the realization within interaction design that we do not in fact have much practical knowing of partially autonomous, or “agentive”, systems as a design material. This particular list of challenges seems to be mixing different categories rather freely: unpredictability and evolution can be held to be potential material properties, in my opinion, whereas shared control and learning are more like desiderata with respect to the user experience. Finally, transparency and opacity are very generic and pervade any form of interaction design.
This provides a glimpse into what a designerly understanding of NLP capabilities might look like. In this case study, three aspects of NLP were relevant to our design, as they emerge naturally in our design activities: (1) High-level understandings of NLP’s capabilities and limits, which oriented our design ideation...; (2) NLP’s capabilities given the available data and development resources, which informed our design deliberation and UX-gain-technical-investment negotiation...; (3) Each design’s likely errors and other experiential qualities, which enabled rapid prototyping and helped us account for unexpected system behaviors.

Sketching AI as a material

Yang et al., 2019, p. 10.
More than anything else, this work illustrates to me the difficulties inherent in trying to shortcut the challenges of designing with a becoming material (see p. 418). I suppose you can argue that the authors are trying to grasp the salient qualities of the design situation at hand, but still I feel that a more craft-based approach would be much preferable.
If we have lots of different materials available, and we have good knowledge about how these different materials can be combined and integrated, then we can feel confident that we will find an appropriate material form for the interaction we imagine. However, imagining the interaction needs to come first, and then it can and will be refined through the process of trying to manifest it in material form. The implication for this reasoning is straightforward: the idea of the interaction – its form, function, meaning, and way of presenting itself – needs to be expressed in order for the interaction to then be explored through a material lens. This is what the interaction-first principle is all about.

“interaction-first”: hylomorphism

Wiberg, 2017, pp. 75–76.
The idea that design happens first in the head, then in the materials, is called hylomorphism (see p. 178). The opposite of hylomorphism would be sympoiesis (p. 38) where the act of crafting is the ideation. My sense is that hylomorphic models of design more or less entirely miss the point of talking about craft and materials.
So what are the implications of this line of reasoning for a foundational philosophy for doing material-centered interaction design? First of all, it comes obvious that creating good compositions across these different elements cannot happen without a clear idea about what kind of interaction one wants to design. That is, the intended form of the interaction being designed needs to be carefully considered in order to be carefully crafted. In order to combine visual, temporal and functional elements into a composition that constitutes a well-working interaction design, one must have first thought about the form and materiality of the interaction being designed, and then used that as a guiding idea for bringing different materials and elements together into a formal composition. One cannot start with only the visual elements or how the artifact should present itself, and then try to “add” the other elements later. When composing interaction, the interaction designer needs to move dialectically between these elements and back and forth between the materials, the parts and the whole in order to bring the composition together. For this reason, the design process is not linear but highly dynamic, and it involves many parallel activities, such as comparing different design alternatives; evaluating particular materials, elements, and
Excitement was in the air also in scholarly and academic networks. Making appeared to provide – at last – the concrete tools and methods to implement a long-held promise of the tech industry and tech research communities like Human-Computer Interaction (HCI) and Participatory Design (PD): the democratization of technology production (Lindtner and Lin, 2017). From HCI designers and researchers who saw in making a continuation of their commitment to empower users to governments across regions, large tech corporations like Intel, and venture capitalists to activists, artists, designers and tech enthusiasts, a range of diverse actors saw something of themselves in one of the key vision [sic!] of makings: to democratize technology production (Lindtner et al, 2016).

[...]

Making and its story of individual empowerment by way of democratizing tech production appeared as if it had transplanted earlier visions of open source software and user participation into hardware.
The maker movement is very interesting in relation to craft and interaction design. On one hand, it is all about the practical engagement with the material, experimenting with concrete ideas and exploring possibilities. On the other hand, there is a tendency to disregard the value of craft skill and mastery in favor of an empowerment rhetoric that is sometimes powerful, while at other times it seems mostly cliché.

**SOURCES USED IN EXCERPT**


According to Mota (2011), all of these developments echo the Arts and Crafts movement of the late 19th century. In that movement, supported by their political values, skills and tools, European artisans pushed for alternative lifestyles and livelihoods that rejected economic reforms and industrial ways that questioned the role of crafts in modern living. The Arts and Crafts movement of the late 19th and 20th centuries was, in some ways, a response to the deskilling of labor under the pressures of industrialization in Western Europe (Dormer, 1997). Antimodernists who wanted to find a way to preserve tradition sought for a “world in which there was enjoyment in labor through the regeneration of handicraft” (Greenhalgh, 2002). Recalling the tenets of the Arts and Crafts movement, advocates of crafts called upon the integration of the decorative art, the vernacular, and labor politics, pushing for a “utopian society based on creative meaningful work undertaken by all members” through revaluing the crafts (Greenhalgh, 1997, cited in and Buechley and Perner-Wilson, 2013, pp. 22–23). Hunsinger and Schrock (2016) presents a collection of tools and technologies that contribute to various “revolutions” tied to the increasing popularity of personal manufacturing practices. Mota links the increase of references to such a revolution to “a renaissance of the Do-It-Yourself (DIY) movement with a hi-tech facet.” This modern movement, Mota argues, is enhanced by “the most powerful many-to-many network the world has ever known” (Hunsinger and Schrock, 2016).

In short, some HCI research on making is tapping into a technological narrative that dates back over a century in the West. In it, newer technologies are claimed to disrupt a hegemonic force and empower everyday people: first the undesirable qualities of industrialization (in the Arts and Crafts movement), then of post-War consumerism (in the Whole Earth Catalog), next of corporate/government mainframes (in the Homebrew Computer Club), and now of mass-produced IT manufacturing (with the maker movement). “Empowering” individuals in this narrative refers to ways that control over the means of production, as well as the ideologies and values perpetuated through it, is undercut, either by redistributing the means of production to broader segments of society and/or by directly challenging the ideologies and purposes underlying it.
Sources used in excerpt


Finally, an important strand of research comprises studies of creative processes of making. With studies on knitting, gardening, bookbinding, and hobbyist repair, Rosner et al. [21, 49, 51] have contributed to understand how materials (not just artifacts) are part of the unfolding of skills and practices, and how in turn they are affected by the development of skills and practices. Traces of glue left on the side of the press of the bindery “collaborate” over time to stabilize the properties of the bindery, and to how work with the press is performed in practice [49]. Similarly, Desjardins & Wakkary [8] have explored the intimate and mutual relationship between goals, materials and competences in the practice of hobbyist jewelers and steampunk enthusiasts.

**HCI looks at making**

**Sources used in excerpt**


For example, in the process of using the laser cutter, we had to go through a number of design iterations, necessary for learning how this tool could be best used with the specific material, for making a particular design (in our case, leather corners and joints). This was a new field of exploration for us, as well as for the experienced leather craftsman, where we had to face a series of unexpected and new design challenges. Since the use of specific tools affects the way a material can be crafted, involving a laser cutter in a leather-crafting process can be seen as a new tool to craft such material. This changes not only the way traditional leather crafting is approached and practiced, but it also implies different crafting properties of leather.

An important difference between handcrafting processes and the processes with the laser cutter was that the former allowed the development of the form and design of the artifact to develop while making it. When using a laser cutter, it was necessary to imagine and know the shape, size and dimensions of the final three-dimensional object in advance, since it needs to be drawn in real scale, before cutting it with the machine. For this reason, it seems that elements of handcrafting are still necessary and helpful in initial design stages of exploring a shape and form that an artifact should have. The use of a laser cutter thereby became most useful in a later design stage, where more artifacts should be made with already tested dimensions, and in less time.

Leather crafting has a long tradition in terms of how to use specific materials and how to proceed in the crafting process. Much time is required, not only to learn and practice a specific technique at an initial stage, but also to craft every single object. For an experienced craftsman this slow exploration of an object’s form is a normal part of the process, of the
As part of the work reported here, the HCI researchers tried their own hands at leather craft. Specifically, they designed an audio playback device with pushbuttons covered by leather and then expressed their surprise when people had difficulty finding and pressing those buttons.

I am certainly not an expert in leather craft, but I have had some experience of leather in the context of bookbinding. Even for me, it seems rather obvious that the tactile surface properties of leather have more to do with holding, sensing, stroking and smelling – and less to do with pushing buttons.

I guess you could make the simple observation that there is more to (skilled) craft than having access to the materials and the tools. The more interesting question is whether academic communities should consider craft skill as one of the assessment criteria for research involving craft and design practice. I personally think that would be an improvement upon the current “eclectic” situation.
In response to recent debates in HCI about beauty and interaction, Wallace and Press [2004] develop the sensibilities further in the context of analysis of craft practice and digital design. They explore the relationship between enchantment, empathy, and intuition by arguing that beauty has a critical role to play in facilitating our experience of digital complexity, but to regard beauty as a “stylistic after-thought” is flawed strategy. Rather, beauty is a form of enchantment (a relation between user/viewer and artifact) and is the key to personally meaningful engagements with digital technology. However, beauty and enchantment cannot be added as a “layer” to the functionality of the digital, rather it has to be at the heart of the process of conception and making: Beauty, in our view, is not found by design, rather it is discovered through craft, in the fullest sense of the term. Beauty is in the making of it, through engagement with material and process and through craft’s sensibility and sensitivities. Craft finds beauty, and design puts that beauty to work [Wallace and Press 2004, p. 4].

Enchantment is a result of an empathic engagement between maker and user and between maker and materials in the process of making, and this is at the heart of what is termed craft practice [Dormer 1997; McCullough 1998]. Craft practice orients us to the particular sensuousness of a thing and its uniqueness (sensibility 1). This offers a great opportunity, when combined with a strong empathic relationship between maker and user for constructing technologies of deep personal significance (sensibility 2). For Wallace and Press [2004], empathy is about relationships with people and also with materials and processes. The aim is to understand experiences of personal significance in people’s lives and to present fragments of it back to them. But this process of reflection is
The argument that beauty comes from craft, not design (p. 102) is connected to interaction design through the experiential quality of enchantment.

**Sources used in excerpt**


In addition to focusing on recycling, reuse, and repair [3], HCI might attend to the making of authenticity as a materially and situationally specific event. We argue that in valuing some materials over others, binders do not distinguish between form and function, content and container, or even digital bits and tangible atoms. Rather, they are attending to how a technology's materiality enables certain constructions of authenticity. It is through our continued interactions with material, and the impressions we leave on it, that deeper attachments evolve. How might we look at the interactional qualities of hardware (a mobile phone), software (tools for digital content generation) or digital content (images, videos or type), as a binder attends to those of paper, such as its grain, color, or thickness? Just as someone might cherish a leatherbound camera, might they also treasure a particular laptop, graphics card or digital photo if traces of use were left on it over time? By enabling continuous, multidimensional gestures among and within our technological practices, perhaps we can foster more historically and materially meaningful interactions.

Designing for Longevity. Following from research in cultural anthropology [7,8,9], we found that the longevity of an artifact was not only made through materials, but also through its integration in social practice. Here we stress the nuanced social configurations that enabled continued celebrations of ritual, not through static technologies but through (inter-)actions surrounding and remaking those technologies. As we consider the memory practices that carry us into the future [4], it becomes important to think about how we might revisit an Apple IIe graphics program differently from a digital photograph of a deceased parent? Might different experiences of material matter differently now that technological attachments evolve. How might we look at the interactional qualities of hardware (a mobile phone), software (tools for digital content generation) or digital content (images, videos or type), as a binder attends to those of paper, such as its grain, color, or thickness? Just as someone might cherish a leatherbound camera, might they also treasure a particular laptop, graphics card or digital photo if traces of use were left on it over time? By enabling continuous, multidimensional gestures among and within our technological practices, perhaps we can foster more historically and materially meaningful interactions.

Authenticity and Longevity in HCI
Rosner and Taylor, 2011, p. 2668
The authors draw on a discussion of restoration of books to identify qualities of authenticity and longevity, clearly evoking traditional notions of craft. It seems interesting to me to consider them in the context of interaction design, but the conceptual mapping is far from straightforward. It is clear that integration into social practices is more important than physical/material durability – longevity of digital photographs is certainly less about the compatibility of file formats and more about how they are viewed and talked about, by whom and when. To me, it rather seems that the question is whether online socialities are fundamentally commensurable with physical-place-and-time ones when it comes to questions of authenticity and longevity. It might be that there is still some conceptual work to be done before notions drawn from physical socialities can be generative for interaction designers (unless we limit our consideration to tangible interfaces, of course).

**Sources used in excerpt**


Worn media

We offer our design and deployment of Broken Probes as a methodology for eliciting insights into how broken objects and acts of breakage may be given new life through their integration with ubiquitous computing technologies. Based on these developments, we introduce the genre of worn media – a variety of computational material with which to frame and critically examine the manifestation of wear among digital things. We end by discussing how the genre of worn media sensitizes designers and Ubicomp researchers to issues of incompleteness, impermanence, and imperfection to help account for the ethical, material, and historical terms of endurance in a digital age.
A material-aesthetic perspective allows the mediating role of products to be anticipated, with particular attention to their sensorial aspects. In connection with the ambition to create a durable relation between people and products, it allows the formulation of the design criteria of transparency and engaging capacity. Transparency promotes attachment to a product, for human relationships with it do not need to end when the product breaks. The engaging capacity of products invites attachment during the product’s use by allowing trusted interaction with it and by involving people in the functioning and aging processes. In both cases sensorial relation with objects as material artifacts arises, through which people are actually engaged with the very product that is present here and now. This engagement, supported by functionality and significance, amounts to a condition for a durable relation with these things.

The attachment to products that can arise by virtue of their transparency and engaging capacity is different from the emotional attraction particular things arouse in us thanks to the memories with which they are associated or their family references. The sought-for attraction does not come about from an involvement with the meanings of objects but from the practices they make possible – they are useful objects.
The notions of transparency and engaging capacity are developed in postphenomenology with reference to physical products, that are in direct sensorial relations with their users and that wear and age in palpable ways. I feel that the concept of engaging capacity might be even more generative in interaction design, where users sometimes invest heavily of themselves into the products by customizing interfaces, learning to navigate complexity, and not the least by providing much of the informational “contents” that are stored, processed and communicated.
At Cranbrook Academy of the Arts, a heating device has been designed which is a fine example of an engaging object. It is a true thing, escaping the usual one-sided emphasis upon language and symbolism within contemporary industrial design. The heater consists of ceramic plates which have been bent to conic cylinders with different radii. The cylinders are placed concentrically, and can be adapted with the aid of an accessory, in order to radiate their heat in the correct direction. This heater is not only very beautiful, it is above all engaging. Users are involved in its functioning. It’s not a device you hide under the windowsill: its proper place is in the middle of the room. When in use, the ceramic plates have to be rearranged from time to time. The heater evokes playful engagement, instead of disengaged consumption of heat. In the meanwhile, of course, it also heats the room: the engagement it asks for does not make it unusable. It functions, but is more than functional; it engages but, nevertheless, it can be ready-to-hand. With products such as this, our relationship does not end when we insert the plug into the socket. They are present as things – “eternally ours.”
The Cranbrook heater example revolves around the design concept of foregrounding the infrastructure that is normally made invisible, drawing attention to the qualities and complexities of the taken-for-granted and thus being engaging. In an interaction design context, the first thing that comes to mind is the work around seamfulness which aims to question the ambition of seamless infrastructures (in, e.g., mobile connectivity) with designs foregrounding the infrastructure and making it part of the design palette.
The tactile, physical quality of a piece of traditional crafted work is a highly important element in the viewer's understanding and appreciation of the work: visual and sensual experiences combine to present to the viewer a greater understanding of the object's quality. Although the digital artefact cannot be physically touched, wider sensual experiences of a programmed piece of work play an important part in the overall quality of the artefact. A sensory experience of the object within the digital realm is manifest through the use of digital "sensations" (moving image, sound, and most notably interaction). The use of interactivity within programmed pieces of work provides a particularly interesting resonance with the human experience of seeing and touching a piece of traditional craft. Digitally programmed objects that involve human interaction (especially those that replicate physical properties such as gravity, elasticity, inertia etc.), can engage the viewer in a kind of intuitive, sensory experience that evokes the same type of emotion and delight gained from handling a well-made, physically crafted, object. John Berger describes his visual pleasure while viewing some hand-made white birds, objects that express a "respect for material", "unity and economy" (Berger, 1985 cited by Thackara, 1988, 23) of design, and the "mysterious skill" of their creator. This experience of encountering a well-crafted object that expresses the character of its material and the mysterious "how did they do that?" skill of its creator is echoed when viewing beautifully created digital artefacts (a J. Maeda or G. Levin piece, for example).
Richardson rightly considers sensate aspects of user experience in interaction design, even though the focus of his analysis is on visual representation rather than tangible interaction. I fully support the argument that “intuitive, sensory experience” of digital interactive pieces can evoke the same type of emotion and delight as handling a well-made, physically crafted object. To me, the sense of respect for skilled craft comprises how the maker understood the material, that the work has economy and unity of expression, and I can also recognize the “how did they do that?” awe that sometimes comes with really good interaction craft.

**Source used in excerpt**

Bibliography

The bibliography consists of two parts. The first contains all the sources that were excerpted in the previous pages. For each source, page numbers of its excerpts are given in brackets, serving the role of an author index. The second part is a list of other sources that I think might contribute to the understanding of craft and interaction design, but that I have not excerpted and commented.
Excerpt References


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OTHER SOURCES, PERHAPS ALSO USEFUL


Arteeva, A. (2019). Should designers code or developers design? ...Or we need a new role. https://medium.com/swlh/should-designers-code-or-developers-design-8304b43785b7


