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Crafting with Digital Technologies: issues in practice

Introduction

The workshop *Crafting with digital Technologies* took place in September 2013, as part of the *Making Futures 3* conference. The following paper reflects on the development of that workshop, and the context it was convened in, in order to discuss why digital crafting is a subject worthy of particular investigation. Through a presentation of the rationale behind the workshop's scope, this paper presents an outline of what the author sees as the current social trajectory of digitally-aided manufacturing technologies. It will also show how the workshop led to the identification of interesting commonalities which suggest further avenues for research across the range of digital manufacturing technologies.

Why Digital Crafting?

As with any academic event, one of the first tasks faced by the organisers of the workshops in *Making Futures 3* was coming up with a relevant working title and an outline that encompassed the central idea behind the session, whilst also enthusing potential participants. In this case the result: *Crafting with Digital Technologies*, could be claimed to be a success; the session attracted exactly the type, quality and range of submitted papers hoped for. Such an outcome was not guaranteed. Both the key terms employed – *crafting* and *digital technologies* – were nebulous in nature and open to different of interpretations. Perhaps we were fortunate in running the workshop at a time when a body of coherent practice was not just developing around some high profile manufacturing technologies, but the practitioners concerned were also recognising there was something distinctive about what they were doing, and, moreover, that they might gain something from trying to define this distinctiveness with others in the same situation. We were not the only people to notice these trends; the Institute of Making (based at University College London) convened a 3D Printing workshop in October 2013 to discuss some of the same issues. We were, however, the only group who chose to create the ideological space the conference ended up providing.

Which type of craft?

Electing the word craft in the title would always carry a risk of misinterpretation. As most readers will already know, the term has been used more often to describe a small group of defined activities and their outcomes than a particular approach to making. This restricted activity and outcomes approach was a key feature of the Arts and Crafts movement. Its leading lights assumed the mantle of arbiters, selecting the making practices that could be determined worthy of the appellation Craft. As time went on, this list became ever more exclusive (Livingstone 2005). For Arts and Crafts adherents, the selected activities carried a strong moral dimension; describing a practice as Craft, or claiming true appreciation of the Craft values the material results embodied, increasingly became shorthand for a particular way of being spiritually as much as a means of making. This perhaps reached its most coherent manifestation in Bernard Leach's highly successful *A Potter's Book* (1940), which could be considered as much a lifestyle guide as a workshop manual.

A similar approach - constructing a definition from a combination of materials and methods - has also underpinned more recent definitions. Peter Dormer (implicitly) and Greenhalgh (explicitly) chose to define Contemporary Craft as a group of material-based disciplines sanctified by twentieth-century conventions (Dormer 1997; Greenhalgh 2002). In his evocation of Contemporary Craft practice as a *Salon de Refusé*, Dormer can also be seen as an inheritor of Arts and Crafts moral posturing. Though this valorisation may have been reassuring to the practitioners that were cannonised by these commentators, the underlying *a-priori* definitions being deployed (which were based on the apparently sanctified materials and manufacturing methods) denied the possibility of any robust critical analysis or debate about the role of craft in the contemporary world. The result of this ossification was pop-up 'alternative' craft appelations such as Stitch 'n Bitch (Minahan and Cox 2007). An emphasis on the subversive and social dimensions to some making practices threw into sharp relief the staid conventions of mainstream Contemporary Craft.

In its sanctification of a limited group of manual practices and consequent inherent denigration of mechanisation, the Contemporary Craft approach could be seen as retaining another aspect of the Arts and Crafts movement: a rearguard action against the triumph of the machine and machine-made products.

As early as the 1960s attempts were made to contest this approach. In *The Nature and Art of Workmanship* (1968), David Pye not only took issue with the adoration of wobbly furniture promoted by Ruskin, he also fundamentally undermined the idea that the machine was the inevitable enemy of good craftsmanship. However, this perspective – that craftsmanship describes an approach to work, not a specific type of practice - has only recently gained a wider audience. The highest profile advocate of this school – Richard Sennett – began his book *The Craftsman* by painting word pictures of the carpenter, a laboratory technician and a musician at work (Sennett 2008). Sennett attributed the same potential craft sensibility to all makers (or re-makers and repairers) of all manner of tangible and intangible objects, including music, computer code and the human body.

Sennett's argument has a clear overlap with other writers, including Crawford (2009) and Gauntlett (2011). In all these writers' works there exists an idealism of dignity in labour and meaningful making. Rather than rail at the machine, they instead target the social forces that lead to the denigration of focusing on a making task for its own sake. The lack of any specification about what is being made, in order to prioritize this approach to making, does carry dangers. In its emphasis on inclusivity in order to acknowledge commonality, the craft-as-approach perspective risks ignoring possible fundamental differences between schools of practitioners (in terms of actions or beliefs) or underplaying unique situations within individual manufacturing disciplines. But it does have the merit of allowing social analysts (and I include here all those who want to consider their own making practices) the opportunity of being more reflexive about their own engagement with making by considering practice and products in a new and less elitist way.

In the Crafting with Digital Technologies workshop the aim was to tend towards the idea of craft-as-approach, following Sennett *et al*, rather than rely on the cannon of disciplines preferred by Dormer and Greenhalgh. The only limitation was that case studies should be able to present practice in terms of a physical product or an examination of those making a physical product. This meant contributions were accepted from architects, fine artists and industrial fashion designers, as well as glass workers, ceramicists and jewellers. It also offered the opportunity to hear from the ethnographers of digital crafters.

Welcome to the New Age of Mechanical Reproduction

It is only in the last two decades that we have seen the same level of technological upheaval as that faced by writers such as Ruskin and Morris, an experience that coloured their views and fed through into their writing. Though steam engines, mechanical looms and mechanised lathes had existed for decades within specialist environments, it was during the mid-nineteenth century these spectacular and challenging objects began to colonise public environments, with events such as the Great Exhibition and the expansion of the railways acting as bridgeheads. The increasingly rapid proliferation of mechanical power in the wider world during the nineteenth century must have been astounding to witness.

Similarly, though computers are not a new technology, until the last decade of the twentieth century they were confined and treated as specialised equipment. Many people whose day is now dominated by the opportunities and demands of the laptop (me included) began our working lives in computer-bereft factories, laboratories and offices. In comparison with digitally-controlled apparatus, in most cases pre-digital automation was a somewhat rudimentary and unreliable affair that still needed careful monitoring. Machines were powerful and accurate but not smart. During the intervening decades, digital instruments and machines have suddenly appeared in place after place, situation after situation. They have either profoundly changed the nature of the work being done, or destroyed specific types of work – such as the typing pool – entirely.

In manufacturing, digitalisation has appeared in different forms. Sometimes, as with lathing, the machinery has hybridized: a computer-operated lathe looks in part very similar to a manually-operated one. It is only the large control box bolted on to the end or side of the machine and the absence of the handles needed by the operator to guide the cutting head that outwardly proclaims this is a machine of the digital age. In other situations, such as mechanical assembly lines, entirely new objects, including the robot arm, have come into being. But it has been the manifestation of a supposedly entirely new means of producing objects – the 3D printer – that

has been the digital tipping point. 3D printers, it is now being claimed, will revolutionise manufacturing and usher in a new era of prosperity, if the anarchy that 3D printed guns will supposedly bring can be successfully averted.

Journalists' claims that 3D printing is a novel technology are, however, disingenuous. The process - creating a physical form by adding layers of material - has been used by digitally controlled machines for decades. But until recently the objects being produced were conceptualised as models, masters or prototypes rather than end products; the process was initially christened 'rapid prototyping' (Küchler and Oakley 2013). I first encountered this type of rapid prototyping machine that made models out of wax in Birmingham's Jewellery Quarter over a decade ago, and they were not new then.

What has happened in the interim is that the two main features of these machines: the digital software that defines the form and the methods of physically generating the object, have both been dramatically improved in terms of quality and range. Rather than being restricted to producing delicate wax or plastic objects, it is now possible (and financially viable) to 3D print a range of durable plastics and resins, ceramic, high-carat gold or titanium alloy. However, 3D printers that make objects from metal usually use laser sintering: the object is built by a selection, not a deposition, process. Resin printers do something similar, using lasers to selectively solidify parts of the bath of liquid resin. Rather than being a single manufacturing process, the term 3D printing actually covers a loose coalition of technologies. The only unifying factor is that every one of these technologies has proved amenable to utilisation by code generated from the same type of software.

Differentiation does not only surface in terms of type of process. Last October, Professor Richard Hague, in his lecture on 3D printing for the Institution of Engineering and Technology held at the Royal Institution, proposed that an alternative term - *additive manufacturing* – should be more widely adopted. This would describe situations where 'serious' production is involved (e.g. high-tolerance and high-material specification products for industrial or medical use). 3D printing could then be reserved for objects made by hobbyists on poor-tolerance thermoplastic depositing machines.

At the same time as Hague was attempting to reduce the reach of 3D printing, others were intent on expanding it further. Perhaps the most audacious example was the developer of a low-cost digital knitting machine, who chose to describe this well-established technology as a type of 3D printing. "Like many 3D printers, Openknit is controlled by an Arduino Leonardo board, and just like a 3D printer it follows instructions from a digital file" (3DPI.TV 2013). This claim stretched the definition of 3D printing to include all object manufacturing process which worked from digital instructions.

The digital manufacturing landscape

I had some previous experience of these 'other' technologies with a digital aspect that were now being claimed by some 3D printing acolytes. Often this had come through contact with staff at the Royal College of Art (RCA) who used them in their practice. Amongst those working with textiles, the first round of digitisation was considered to have occurred with the Jacquard Loom; all later innovations were considered as incremental developments of the same technology. In comparison with other disciplines, I found those working with weaving and knitting astonishingly relaxed about the idea of coding; as one tutor explained, the programming aspect is not too far a jump from reading or writing a knitting pattern. Yet the digital knitting machines used by some of the staff could now be programmed to do unexpected and innovative things no hand knitter was likely to attempt. Meanwhile, the print tutor in ceramics had been using digital mapping technology to create surfaces for 3D object with a similar level of formal complexity. In addition, for a restoration project he was creating 3D printed models from scans that were mirror images of antique pieces.

So in order to be inclusive in our call and hopefully draw in this range of experience we chose to adopt the loose term *digital technologies*. This would allow anyone who felt they could gain from the exchange to take part, whether they considered themselves a member of the new revolution of 3D printing or working in a domain where digital technologies were so well established they seemed unremarkable. This, we anticipated, would avoid the closing down of debate that restrictive *a priori* definitions would entail.

How Distinctive is Digital Crafting?

Reflecting on this breadth of practice raised an interesting question. How similar are the different manufacturing processes that have a digital component? Or, to put it another way, should we consider digital knitting as comparable to selective sintering of gold alloys and the deposition of plastic

filament or are they fundamentally dissimilar? To go further, perhaps laser cutting, water blasting and designing ceramic transfers using graphics software might also exhibit the same similarities as practices, even if the results look patently different. If we were to follow Plato's advice and carve nature at its joints in order to construct our categories, we needed to find where in this case the joints really were before wielding the knife.

These questions gave the planning of the workshop its focus. It would become an opportunity for practitioners to present their own experiences of using these technologies or observing or managing them being used by others. Through these presentations, questions asked of the other participants and further discussions as a group, the contributors would be able to situate what they were doing within the digital manufacturing landscape.

By offering this space, the workshop could also begin to address another interesting group of questions. Some of the presenters identified themselves as craftworkers. In most cases their education had taken place in institutions initially set up in order to promote Arts and Crafts ideals. Their craft training had been based around mastering a single type of material, the material they were generally still using in their digital adventures. So was the digital aspect of any real import in terms of their self-identity as makers? In addition, would this mature allegiance trump any possible solidarity with other makers? Other attendees had alternative educational influences, having been trained as designers or architects. Similarly, would these affiliations play a similar role in the way they related others and to the digital technologies they engaged with?

Managing Digital Crafting

For those actually engaged in making objects using any types of tools, digital or otherwise, these questions may seem irrelevant. Practitioners can be excused for a nagging feeling seeking the answers to such questions is a distraction and nothing more than an exercise in semantics. But in the longer term, how activities (and the practitioners who engage in it) become categorized can have an enormous effect on how they are perceived and supported (or not). Ultimately, a definition can nurture or cripple the activities it encompasses, becoming the reason they either thrive or fade into obscurity. It is only after a definition has become widely accepted that practitioners start to find certain avenues are opened or barred. At this point it is a herculean task to dislodge the entrenched notion of perceived limits; these now just seem to be common sense. All too frequently it is this type of common sense that informs the decisions of those who manage the resources for specific projects (and who may have little direct involvement with making *per se*).

At a previous Making Futures conference I presented a paper that discussed how definitions and practice interacted, in an attempt to uncover some of the practical implications of identifying as a Contemporary Craft practitioner (Oakley 2010). Key to this argument was the role of allegiances: which professional communities did makers believe they belonged to? And how did this affect the way they considered and approached making?

In the case studies there was a consistent factor. Such identities are not the result of the practitioners' choice. The options available are related to often long-enduring social structures that have a profound influence on the representation of specific social identities and roles. Yet these do drift over time, as well as occasionally undergoing sudden shifts or ruptures in response to specific events. At certain moments, conditions may be right for the appearance of new roles, or the dramatic expansion or reconfiguration of existing ones. In these circumstances a single influential commentator can have a far-reaching and long-lasting impact. As an example, it is worth considering how Leach's *A Potter's Book* (re-)defined craft studio practice for the decades following its publication in 1940.

I believe we are currently experiencing a similar critical period with respect to digital making. 2013 could be claimed to be the year of 3D printing. It was a major task just to keep up with the new developments and attend the key events in one country. As well as Making Futures 3 there were 3D printing workshops at the Institute of Making and the Design Museum, as well as the lecture mentioned earlier at the Royal Institute. These came on top of the usual trade shows and a rash of new product launches.

At the same time, educational institutions (including my own) were grappling with the question of 3D printing provision. In our case, decisions were being made as to how far the institution should embrace and promote 3D printing as a technology or technologies, and where in the institution's hierarchy it/they should be situated. We were faced with a slew of questions. Should 3D printing be considered an inevitable part of every taught

discipline and the machines dispersed throughout the College's workshops? Or should they be drawn together in a specialist cluster? If so, was it best to affiliate this with a specific department or treat it as separate entity? Each option carried risks: dispersion might dilute provision so far it would have no significant impact. Provision might even fall below the critical mass of viability in some areas in terms of technical support. But clustering might result in the technologies appearing remote and becoming isolated from the student's daily experience. Much of the debate was conducted in terms of the pragmatic resourcing issues: purchasing costs, operating costs and the expected maintenance demands of specific machines, provision of competent technical staff and how they could be fitted into the institution's current management and financial structure. We also faced unknowns: the level of anticipated demand from students (with or without encouragement from staff) and the level of expertise students in each cohort might arrive with and should be expected to leave with. I was acutely aware the final decisions, once embedded within the abstract structure of the organisation and manifested as knowledgeable technical support and the physical situation of the 3D printing machines, would become almost impossible to overturn. They would become the common sense of how 3D printing should be taught to RCA students. Through our abstract deliberations, we were constructing the future reality of 3D printing for the students that studied at the College.

Creating a Space for Dialogue

So the issues that were discussed at the workshop are potentially of enormous value to those charged with educating the next generation of makers as well as providing an opportunity for the attendees to reflect on their practice. The identification of some surprising commonalities in that practice – including the continued value of direct material engagement and the need to regularly materialise digital prototypes as objects-in-progress across all the disciplines represented - led to a clearer idea of what digital crafting actually meant for practitioners. The findings were at times at odds with some of the expectations of those promoting 3D printing as a manufacturing technology. For instance, the UK's Technology Strategy Board has been determined to treat 3D printing as a stand-alone, one-stage process. Its funding strategy in terms of the targets for bidders, reflects this belief. Similarly, articles discussing printing either treat the object print as almost an afterthought, or focus obsessively on the problems of filament extrusion (concentrating on the machine's, not the product's, qualities). In contrast, in their descriptions the practitioners were forever referencing their tests and trials of parts or preliminary results, in a manner very similar to more traditional crafting practice. This could turn out to be a core feature of what digital crafting (as opposed to digital industrial manufacturing) is as a performed, rather than imagined, activity.

The other obvious outcome of the workshops was the opportunity it gave participants to reflect on their practice in what turned out to be a remarkably and encouragingly sympathetic environment. Participants were able to acknowledge their initial (and in some cases ongoing) lack of understanding of how the software actually operated. An interesting point was that the programming was generally presented as a barrier to be overcome, rather than an advantage of the process. The presence of teams consisting of a programme specialist and material process specialist gave an indication of how some people had successfully resolved this problem. The commonly-felt need to see interim results as physical objects, which gradually became apparent as presenter after presenter mentioned it incidentally in their talk or in response to questions, reassured many that what they were doing was less of an aberration than the 3D print purists would have everyone believe.

The presentations also had another thread, which only became apparent when comparing the work shown with that generally produced using 3D printers and reflecting on the comments about programming. The digital crafters were all focussed on results, not the process in and of itself. Digital crafting appears to be very much a means to an end rather than just a demonstration of the machine's technical virtuosity. Instead, results were expected to be innovative and to manifest an idea preconceived by the practitioner.

Conclusion

The *Crafting with Digital Technologies* workshop was conceived as a space for practitioners and ethnographers to review their own or observed digitally-related practice and reflect on how it related to the other presentations. It adopted a perspective on craft closer to that proposed by Sennett *et al* than Contemporary Craft writers. In order not to restrict the types of computer-related making represented, the workshop took the term digital technologies as its subject.

The overarching questions that drove the workshop were: does digital crafting exist as a distinct activity and what common procedures and perspectives

can we find amongst digital craft practitioners? Two features emerged: practitioners used the processes of digital technologies for the results, rather than for a love of the process itself. In some cases practitioners even engaged with digital making technologies despite severe reservations regarding their capacity to sufficiently command the digital aspects. The second was that across all the practices represented there was a need to repeatedly re-engage with the physical object prior to the conclusion of making. Our makers felt they could not rely entirely on interaction with the virtual prototype. This led to the production of material tests and trials. The commonality of this behaviour came as a surprise (and in most cases, something of a relief) to the presenters, a fact I attribute to the general mythology of the sufficiency of the virtual design environment. These two aspects show that at the current time digital crafting appears to have a level of commonality across different digital technologies and also retains a strong measure of commonality with more traditional craft making processes. But how far the second is an artefact of the practitioners' education rather than an inherent aspect of using digital manufacturing technologies remains an open question.

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