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‘Material Matrixes: Building on a history of improvisational developments in print technology’

A teapot it is a print - glass is ink – lacework is a silkscreen

Ignore fixed conventions; construct your own concept of discipline drawn from anywhere to fit your own needs.

For this paper, and using my practice as a printmaker alongside other cases, I aim to illuminate how the development of technology is not an eureka moment but comes from a kind of free thinking that eschews preconceived boundaries to be creative using existing subsets of technology. I also aim to show how this cycle of development once initiated, has a tendency to gravitate towards an unhealthy resolution that determines stasis and can lead to creative redundancy.

What do I mean by ‘Material Matrixes’?

The etymology of the word ‘matrix’ links printmaking with moulding, through the early production of cast type. Printing and casting are two systems, which are at the heart of my own work. They have so much in common that we can think of them as conceptually residing in the same category. At the heart of both is a matrix, from which repeatable visual information is produced. ‘Material matrixes’ is the term I use to rethink this relationship beyond the confines of our conventional descriptors.

For this paper I would like to explore the notion of the material matrix as a nexus, which has determined hybrid practice within the applied arts. Through new approaches in the way we think of developing technology we can deconstruct conventional material and process boundaries in order to describe a new way of considering the creative life of applied art printmaking practice.

Fixed Means Broken

‘Tradition’ is a ‘closed, prescriptive’ methodology for practice.

To expand on this, I would like to consider the relationship between fixity and fluidity in the developmental cycle of technology.

Charles Jencks; author of the 1972 book ‘Adhocism’[i] stated in his 1972 essay on ‘Mechanical, Natural and Critical Evolution’: - ‘Contrary to some theories, both design and nature are radically traditional’ (Jencks, 1972). Jencks uses the word here in both positive and negative terms, positive to describe existing subsystems of technology that can be used at the outset of the creative development of new technologies, but that also become negative ‘fixed’ ideas towards the end of this cycle.

He says that in this early period of the developmental cycle there is a creative 'hodgepodging' (Jencks, 1972) of pre-existing mature technologies: 'All creations are initially, ad hoc combinations of past subsystems; "nothing can be created out of nothing." (Jencks, 1972) Process evolution is not a series of eureka moments but subject to more subtle agents of change. It is at this early stage that pre-existing subsystems or traditional approaches become un-harnessed from their normal context and are employed in a more creative adaptable way to produce new knowledge.

Jencks uses the bicycle as a case study. Beginning with an initial 'ad hoc' amalgamation of parts, gathered from what is 'to hand', the development then moves into a stage of refinement where particular aspects become designed specifically for the purpose, and finally after another phase of interrelated development, between varying designs leading to standardisation, the cycle and bicycle reach a point where the evolution has ended in a stabilized, totalistic norm: it has become fixed - and herein lays the problem: fixity. Technology becomes a 'tradition', fixed in its tracks. This can be a strength as production steams ahead at full speed but can also be extremely problematic if it's necessary to come away from those tracks and head out in a multitude of new directions.

Josiah Wedgwood was once one of the most prominent and inspirational innovators of ceramics technology. The recent history of his company is a story of the latter part of this life cycle of technological development.

A mixture of the reliance on traditional approaches for their associated provenance and the prohibiting expense of changing to an innovative approach to development has meant that the company has become a commercial dinosaur struggling to retain its past impact in a highly competitive market. One of the technologies that the company developed, multi-bomb printing, is a production method only made possible by using highly specialised equipment. Based upon the simple premise of an etched printing plate, the company assembled a team of material scientists, engineers and other experts to make the necessary innovations to develop a full-colour system that would offset printed images directly into complex bowl forms[ii]. Innovations such as these are a double-edged sword. They allow for mass manufacture but also trap production. They are closed systems so over engineered for one purpose that they fix production to a specific totalistic result.

Creative adhocism in the early life of forms

If the problem is fixity then the key to overcoming these issues lays in new approaches that embrace technological improvisation, versatility and adaptation. These approaches are keenly present at the beginning stages of a technology's initial development.

In the recent book, 'The Gutenberg Revolution' (2002), John Man can be seen to support Jencks idea that 'nothing can be created out of nothing' stating: 'Ideas seldom jump into the mind from nowhere.' They 'are seeded in frameworks of previous growths and need those same frameworks to flourish'[iii] (Man, 2003). Man continues to describe in his chapter 'Something in the Air', how Gutenberg's innovation in printmaking is only made possible by pre-existing materials and technology that 'almost' came together on a number of prior occasions.

Applied to Jencks' cycle of technological development, 'adhocism' was at the very heart of Gutenberg's contribution to technology, his innovation brought together ideas that came from his observations of a number of very different technologies that were already viably operating: punch-making, casting, metallurgical skills, wine- and oil-pressing and paper-making to name the most essential. Gutenberg's innovation was a culmination of things that, as Man puts it, were 'in the air'. His brilliance was in his creative 'hodgepodging' of allied technologies rethought and reconfigured to produce an entirely new concept.

Jencks 'case for improvisation' is a manifesto for this approach to creative innovation within the early cycle of technological development, he states: 'A purpose immediately fulfilled is the ideal of adhocism; it cuts through the usual delays caused by specialization, bureaucracy and hierarchical organization… By realizing his immediate needs, by combining ad hoc parts, the individual creates, sustains and transcends himself' (Jencks, 1972).

Even something as world changing as movable type can eventually face redundancy and complexity has a hand in this; the simpler the technology the more versatile it is. The knife and hammer are tools that have and will be with us forever, and generally speaking the less complex a technology the more versatile it is.

As a print process the stencil screenprinting system is by far the most versatile and adaptable of all. The well-known image of the silhouette of hands made by early cave dwelling societies is a powerful trace of creativity that still speaks to us over many thousands of years. By blowing pigment from the mouth, using the hand as a stencil to block the paint, an image is printed onto the rock surface. This is the embodiment of the simplest approach to making a print. To block or allow pigment to pass through a masked out shape is so versatile a method that it has remained in a constant state of development, with new uses being found throughout the history of technology.

< Figure 1, caption: Katagami stencil with silk thread ties >

The development of the offshoot of this technology that has come to be known as screenprinting is a paradigm of Jencks adhoc development of technology. A textile artisan in Edo period Japan needing to bypass laws governing the decoration of garments expanded the potential of the open stencil by creating extremely complex designs that employ free floating areas. To overcome the issue of structural integrity he used silk threads, readily available in his textile workshop, to tie these fragile stencil elements together[iv]. Upon the opening up of Japan to the West these stencils found their way to America. Printers there advanced the technique further by turning to a by-product of the massive flour milling industry where they used an almost scientific system of different mesh grades used to sieve flour[v]. Adapting the system from the Japanese hand-cut stencils tied together by threads, they painted stencil masks directly onto the mesh instead. Many different tools were trialled ad hoc to push paints through this mesh, rollers, aerographs and brushes until eventually the squeegee, another commonly used tool, was found to be the most effective[vi].

<Figure 2, caption: Sample grades of Swiss made flour-milling mesh as used in USA>

Standardization occurred but is held off from becoming fixed by the versatility of this simple print system. Further ad hoc developments adapt the process to print a vast array of materials onto a multitude of surfaces. Butter is printed onto bread, chocolate onto pancakes, objects such as glass bottles have labels directly screenprinted onto them using homemade jigs[vii], and a seemingly endless amount of new applications are developed.

Closed systems such as Wedgwood's multi-bomb technique built upon closely guarded industry secrets, specialist knowledge and highly engineered equipment are flawed in comparison to a system like the stencil screenprinting process, which in today's terminology could be considered as 'open source' technology with all the variation that brings.

Old Allies - New Uses

Another agent that ensures fixity is the concept of categorization, a labelling of technology that while necessary for description can lead to closed approaches of prescription and obstructive boundaries to innovation.

In his 1904 publication 'Ornament and its Application' the Designer Lewis Day suggests the removal of preconceived discipline boundaries thinking instead through 'Allied Processes'[viii]. To open our minds to this idea Day asks us to consider the printing stencil to be the same, in principle as fretted woodwork, and other practice examples where an 'aperture' is created. He re-titles this new field as 'À Jour', describing the aperture using the concept of 'to allow light though'. He expands these allied associations by reflecting that the 'ties' used to join an open stencil are the same concept as those ties used to construct lacework.

<Figure 3, caption: Pages from Lewis Day's 'Allied Processes' from 'Ornament and its Application>

Thinking in this way about the sub-systems of technology imbedded in printmaking practice allows us to think widely about the cross-fertilization of process principles. Using this approach we can update Day's century old À Jour family to include a new set of technologies such as recently developed CAD CAM cutting processes like laser cutting, vinyl cutting and water-jet cutting. We can create a new conceptual set based upon the idea of working within the Cartesian geometry of xyz, to bring together CNC Machining with the various 3D Printing techniques that operate in this plane.

The idea of a discipline is crucial when a student is trying to understand the vast complexities of working through materials and processes to develop a practice. Once this has been achieved to a level of competence the practitioner can start to innovate through discarding this framework of convention. Rather than thinking within a prescribed discipline it is more relevant to redefine a personal discipline that relates to the most relevant subset of allied technologies: materials, processes, people, ideas and histories that build to form conceptual 'allies'. It is to the idea of rethinking 'histories' that we move our re-evaluation to next.

Technology…'always becoming'

Thirty years on from Lewis Day's publication the printmaker and historian Henri Focillon wrote 'Vie des Formes'[ix]. Through this work he rejects the conventional chronological approach to history in favour of discussing the development of creative practice as in constant flux, a fluid and dynamic ever-evolving life 'always becoming…and tending towards realization' (Focillon, 1989. Translated by Charles B. Hogan and George Kubler.)

Focillon's book offers an alternative way of thinking that rejects any standard framework in order to make connections that cross boundaries, linking back and forth through time to weave a more relevant 'life' story. Using his approach to creative development all is valid, historical precedents can be returned to, as with Jencks prior subsystems, and processes 'allied' to a technology's basic principles can be fed into the progression as suggested by Lewis Day. With Focillon a critical framework is established to accommodate new discipline structures.

'…how active and animate a concept is that of technique.' Focillon states and he revels in the creative destruction of a masterpiece as an engraved plate becomes worn away through its own production. 'Forms never cease to live. In their separate state, they still clamour for action, they still take absolute possession of whatever action has propagated them, in order to augment, strengthen and shape it.' (Focillon, 1989. Translated by Charles B. Hogan and George Kubler.)

My Practice

In the examples and cases of open systems mentioned above and in the ideas of Focillon, Day, and Jencks I find the authority to validate my opinion that it is crucial to try to keep creative production in the early versatile, improvisational stages of development, looking in all directions to other allied approaches as valid contributors to innovative practice.

I worked for 14 years as a commercial screenprinter for the textile industry, bringing my experiences and skills from those materials to influence on work with other materials such as ceramics, glass and concrete. The work that I do is based upon the premise of adaptable versatility inherent within both screenprinting and moulding processes. I have looked to history, different modes and scales of production, allied processes and used an ad hoc approach to constantly inject life into the technology I use, and aim to keep it at an early improvisational stage of development. In support of this paper I will use a number of cases from my own practice to illustrate this approach.

When I was invited to undertake a residency at the Northlands Glass Centre in Scotland I had had very little experience with glass as a medium. I approached the area as a printmaker and thought of the glass frit powders as graphic pixels. An open interdisciplinary outlook gave me a number of starting points, such as deep etching the glass to ink it up like a print plate. I am always interested in how print can come into the third dimension and the deep etch gave a low-level physicality to the work. I built upon this physicality by looking sideways to laser-cutting technology. Observing how the laser could cut accurate stencils for me 'À Jour' I began to work

with ceramic fibre blanket, a pre-existing refractory material. Cutting this thick fibre material allowed me to create stencils with a deep shoulder, adding a vertical dimension that could be stepped to create heavy material layers. At this point printing and casting become entwined as the stencil is built upward and becomes a mould. As I have explained this is an area that I am deeply fascinated by and is central to my research.

< Figure 4, caption: Laser-cut ceramic fibre blanket stencil/mould >

My most expansive exploration into this area of the print/mould matrix was undertaken as a PhD collaboration between the Royal College of Art and the V&A Museum[x]. For this project I reappraised the conventional ceramic transfer (decal) technique that employs paper as a carrier and a gelatine-like transfer substrate in order to fuse ceramic printed pigments onto complex forms.

For my re-thinking of this technology I replaced the paper and gelatine substrates for a flexible textile carrier. This allowed me to produce a number of elements that could be fitted and stitched together to form a flexible printed mould. When filled with porcelain the clay form and the printed image move together with the surface print inflecting the movement of the underlying form. This integration is made complete by firing the work to 1240 degrees whereupon the fabric burns away to leave the bright underglaze colours on the ceramic surface, recording the movement given to it in the making process.

<Figure 5, caption: 'Tree of Life' - Screenprinted in-mould decorated porcelain >

A large number of the small innovations that I made came from pre-existing technologies applied to a novel context. This is what Jencks talks about when he discusses the use of existing sub-systems used ad hoc to generate new approaches.

I used this approach for my glasswork, to develop the idea of using stencils to build physical dimension in the glass. Recalling my historical research into screenprint technology I looked to the approach used in the Japanese Katagami Printed textiles[xi]. The very coarse mesh support used in combination with cut stencils inspired me to deconstruct what has become the conventional screen and rebuild it for my own ends.

Looking this time to a different CAD CAM technology I made my stencils using a computer aided vinyl cutter, developed for the sign-writing industry. This gave me very strong, stable and sticky-backed stencils. For my screen mesh I bought mosquito net made from strong, flexible, cotton to provide a good bond with the stencil, with the additional quality of a very open mesh to allow the glass to pass freely through. Replacing my squeegee with a tea strainer and working directly onto the kiln shelf I was ready to build up layers of prints informed by the way that 3D printing technology puts down layers to build into a form. The design and colour of each layer can be changed at any point when dusting glass powder through these simple screen stencils, allowing me the opportunity to make decisions throughout the making process. Once more looking outside my practice to 3D printing technology, as I built ever higher, I recognised the need to support the glass powder. So I dusted a support material through as a reverse image

This material remains inert during the firing of the glass and can be vacuumed away afterwards to reveal the glass object inside. Once more the idea of printing and moulding combine as the screen-stencil matrix produces a series of prints, which fuse together within the mould matrix turning image into object, questioning whether the result is print or cast or both.

<Figure 6, caption: 'Hive II' - Analogue 3D Printed glass, using stencil/mould matrix >

New hi-tech systems: open/closed?

Recent advances in digital technologies have ushered in a new period for printmakers. In some respects they are exclusive technologies in that they use highly engineered equipment. To use them creatively you need to know something about the software or even the code used. But with recent developments, a kind of adhocism has come into play with the development of accessible equipment that can be intervened with and adapted such as the Makerbot[xii]. While the open source printer Pwdr[xiii] offers users a whole new range of powdered materials to print with, such as gypsum, concrete and, as with another recent project by CandyFab[xiv]: 'sugar'. Open source programming and software have added to this accessible versatility to allow this relatively new technology to be explored as a much more open system than had originally seemed the case. It is also possible to take influence purely from the principles involved as I have shown, simply building up layers of printed materials need not be the reserve of the digitally driven practice. Like myself there are many practitioners and institutions exploring analogue versions of this 3D printing technology, such as Philippe Malouin's collaboration with the ceramic manufacturer 1882 Ltd [xv] and dpz's analogue 3D clay coiling machine based in the Academy of Fine Arts at Saar[xvi].

In conclusion: practice, is a series of adaptations that become assimilated into convention. Traditional approaches and an insistence on 'the way' to do something do not breathe new life into a discipline, it is only through thinking of technology as fluid, improvisational and adaptable to current needs that we can keep practice alive and vibrant. Day's, Focillon's and Jencks' ideas on the creative use of allied and ad hoc subsystems of technology offer a paradigm for the continual regeneration of technology, which is the antithesis of closed system approaches and a vital antidote to stasis and redundancy within a discipline.

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[viii] Day, Lewis. (1904) *Ornament and its Application.* London: Batsford.
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[xi] Observed in detail on visit to V&A Far Eastern Collection. Example - Museum number: D.957-1891
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