PLYMOUTH COLLEGE of ART

Making Futures

Print in the CAM Age

Digital Manufacture of Relief Blocks for Printing

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Abstract

Wooden letter forms, or wood type, were developed to enable large scale text to be printed alongside the more widely used, smaller metal type, which has been used to print the written word since the 1300s. Due to advances in digital printing in the twentieth century the use of manual typesetting processes began to decline, and the last trading wood type manufacturer in the UK closed its doors in the 1997. Over the last decade however there has been a resurgence in manual typesetting with craftspeople setting up their own businesses in this area, and as a result it has become apparent that there is very little documentation of the history of the wood type manufacturing industry, and very few working facilities in the UK for the manufacture of new wood type. This paper will discuss the initial outcomes of the feasibility study into whether there is sufficient documentation of wood type, its manufacture and commercial use, to conduct a more in-depth study of the history of wood type manufacture, and whether manufacturing for wood type could be set up using digital fabrication technology at Plymouth College of Art.

Introduction

Figure 1: Example of wood type, Reading University lettering, printing and graphic design collection.

The use of wood to produce single characters for printing didn't become the norm until the early nineteenth century, when demand for large typefaces for display purposes began to gather momentum (Rollinson et al. 1966)
Prior to this shift in demand, type was most commonly cast in metal using a matrix and hand mould. Whilst it is widely believed that movable metal type was invented in Korea in the late 1300s, Johannes Gutenberg was the first to create his type pieces from an alloy of lead, tin, and antimony, and these materials have remained standard in metal type casting from 1436 to the present day (Childress 2008), However, metal type tended to be on the smaller size due to its use in publishing, and large scale letter forms cast in metal were problematic due to the weight of the individual characters. When the need arose for larger letterforms for use in advertising, wood was a viable alternative for larger letterforms and became widely used as the needs of jobbing printers changed.

This is not to say that wood was rarely used for printing until the nineteeth century, only that it wasn't used for individual characters until this time. Carved decorative wooden blocks have been used for printing fabric designs since the third century BC, and the first example of wood used for printing a book was in 868 AD; the Diamond Sutra from China was made of seven sheets pasted together and printed from carved wooden blocks (Bolton 1981).

Wood has also been used for the production of decorative blocks for printing wallpaper, as well as for producing illustrations to be combined with text, and is still used today by a few remaining specialist printers. Cole & Sons for example, still produce some of the wallpaper designs in their range in this way, and have an extensive archive of printing blocks dating back to the 1700s which they loan out for short periods of time to the last remaining jobbing printers in the UK who specialize in this type of printing.

From the late 1800s to the late 1900s there were two major manufacturers of wood type in the UK: Stephenson Blake of Sheffield and De Little of York, the latter being the last surviving manufacturer in the UK. These weren't the only manufacturers based in the UK, there is evidence of other manufacturers preserved in the collections of a small number of specialist archives. Unfortunately as no major study has been done into this area as yet, the details of the other manufacturers producing wood type has been lost or are as yet uncovered.

De Little was founded in 1888 and whilst this was very late for a wood type business to start up they soon became the leaders in their field, in fact their type was of such good quality that forgeries quickly began to appear on the market, which lead to De Little stamping the bottom edge of the letter 'a' from each batch with their company logo (Bolton 1981).
Stephenson Blake started off as a metal type founder, but started to produce wood type after an employee of De Little defected and set up shop at Stephenson Blake.
In 1940 Stephenson Blake stopped producing wood letter and transferred their equipment and wood letter business to De Little, who continued to produce wood letter in the Stephenson Blake name.
The wood most commonly used was Hornbeam from France or Maple from Canada. English Sycamore was used during periods when importing wood proved difficult, such as during the first and second world wars. The wood was dried and cut into long strips of type height (23,56 in the UK) of varying widths before being measured and individual blocks cut ready for the application of the individual characters using a pantograph cutter. Once cut the blocks were then sealed in linseed oil before being sent out to the buyer and/or printer.

With digital word processing and print technology taking prominence in the print industry in the mid to latter half of the twentieth century, the demand for manual processes declined, with De Little closing its doors in 1997, and Cole & Sons closing its print workshop in the early twenty first century. However, in the last decade manual processes have been having a resurgence. Younger makers and designers are questioning how these traditional processes can inform their practice, giving their work a unique, hand-crafted quality over the more uniform, digital printing that has become so readily accessible.

Advances in computer aided manufacture (CAM) over the last two decades has seen 3D fabrication becoming more readily available to independent makers, enabling them to incorporate digital design more directly into the production of products, and streamlining the design and production process through the ability to produce accurate prototypes in a relatively short amount of time. This feasibility study essentially aimed to question whether CAM could be used to produce wood type, and through initial tests to investigate the possibilities and limitations of digital milling for larger scale and decorative wood blocks for printing. Should these investigations be successful, it could open up the possibility of preserving old designs by replacing sections or whole blocks that have become damaged, as well as allowing digital design to feed more directly into manual printmaking processes, and allow for more rapid production times.

Identifying traditional manufacturing processes

The lack of research in the area of wood type manufacture posed a challenge. The small amount of research that exists is concerned more with the style of fonts which were produced and how these changed to suit market demand. However, research conducted at Reading University Lettering, Printing and Graphic Design Collections unearthed detailed interviews with Robert De Little, which shed light on how wood type was made and where the remnants of the De Little business was located.
De Little's pantograph cutter and all the De Little templates for producing wood type are currently housed in the Type Archive in London, an archive currently closed to the public.

A pantograph cutter is essentially a movable drill bit attached to a tracing needle via a simple expanding and contracting concertina mechanism. As the tracing needle navigates the outer edges of a template, the drill bit in turn cuts the same pattern into the surface of a block of wood, which has been cut to type height. The size of the character can be adjusted through reconfiguration of the concertina mechanism, the more compact the concertina, the smaller the character, and vice versa. The templates were mostly made from metal (Southall 2005) as this ensured a reliable cut after many uses, however there are examples of card templates in the archive.

Figure 2: De Little pantograph cutter, the Type Archive, London UK.

Due to the spherical nature of the drill bit, any sharp or tight inner corners needed to be finished by hand with a chisel once the main body of the cut had been completed. Once the cut was complete the blocks were sealed in linseed oil to enable multiple inking and cleaning without the wood surface taking on any ink. Wood blocks for other purposes, such as the production of wallpaper, tended to be made from laminated wood, the design cut from one layer of wood and then adhered to a base block, or a combination of linoleum, metal or rubber on a wood base, and were cut by hand or, from the mid to late twentieth century, using a movable router and then finished by hand. Registration of each block in order to maintain a repeat was done using registration pins or bars, printed directly onto the wallpaper, which would then be trimmed off once the design was complete. Notable examples of this method of printing include the work by William Morris, as well as the designs adorning the walls of Buckingham Palace and the Houses of Parliament, all of which are still produced for Cole & Sons.

Exploring CAM

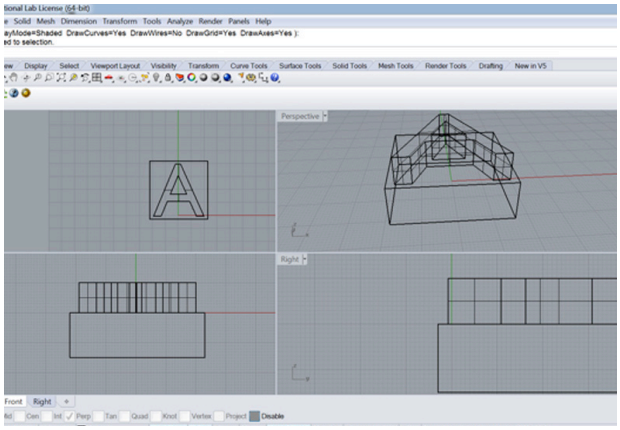

Figure 3: Gill Sans capital ‘a’ prototype using ‘Rhino’

Figure 4 : Gill Sans capital ‘a’ prototype, cut using digital milling machine at Plymouth College of Art Fab

The installation of the Fab Lab at Plymouth College of Art allowed for the investigation of whether digital technology could be used to not only cut wood type as well as other printing blocks, but be instrumental in the design of new fonts and designs which could then be cut and printed. The first test of this idea used a Gill Sans capital a, cut from boxwood which was pre-cut to type height, using the digital milling machine. ‘Rhino’ was used in planning the cut, taking into account the height of the block and required depth of the cut to enable the character to have enough of a shoulder in order for it to print cleanly once finished. The resulting cut took around forty-five minutes in total. The cut was overall a success and the block performed well during printing, however due to the sharp inner corners typical of Gill Sans, the block needed hand finishing in order to be an accurate representation of this iconic font.

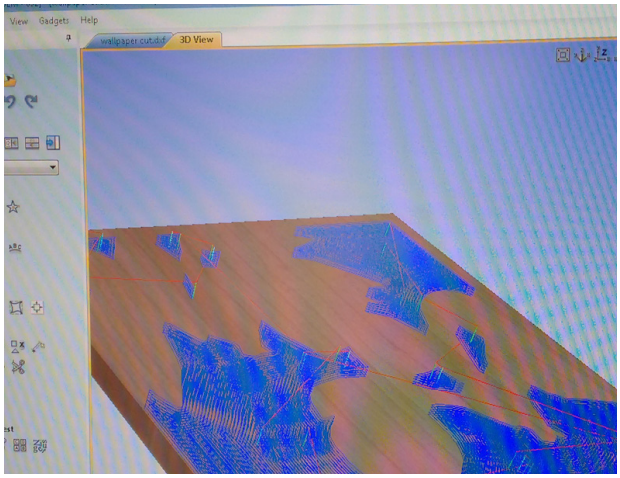

Figure 5: Wallpaper block prototype using ‘Rhino’

Figure 6: First prototype wallpaper block print test, conducted at Plymouth College of Art printmaking workshop

The second test was for a combined lino and wood block for printing wallpaper. In keeping with traditional processes the fine line work was cut out of the lino by hand before the lino was glued onto a base block of marine plywood, the plan being to cut a shoulder around the lino to ensure a clean print using the large digital router after the lino was fixed in place. This shoulder is necessary to ensure that any negative space around the design won’t make contact with the ink bath and then transfer this ink onto the wallpaper accidentally, creating areas of ‘noise’ or unwanted ink spots.

This initial test was unsuccessful due to a discrepancy in the measurements of the wallpaper block and cutting area on the base of the router, and the router cut through areas of the design by mistake. Due to this issue, the process was tweaked to accommodate for any mathematical error and the base cut was designed digitally first, allowing a series of templates to be laid out on each individual block which the design could be matched to. This actually led to greater control in terms of enabling a series of layers to be matched accurately by plotting them digitally using a grid.

The ability to use digital processes raised a question of whether cutting a halftone image would be possible for hand printed wallpaper, allowing the incorporation of complex photographic imagery into relief printing. Some notable printmakers have spent their careers attempting to capture an accurate representation of halftone, with some success, however the ability to cut a fine, spherical dot, has proved elusive using hand cutting techniques. A large-scale halftone graduation pattern was attempted on the large format digital router, with some success, however, from doing this test other issues were encountered in regards to the type of wood used and how it reacted to different artwork and size drill bits. Marine plywood, chosen for its reliability under wet conditions, coped well with straight lines, but splintered and in some cases disintegrated when circles featured in the artwork, and the larger the drill bit the more pronounced this became.

Further study

The feasibility study, and the test pieces produced, highlighted some areas for further development.

A. The wood used for the wood type and wallpaper block samples were rough approximations of traditional materials using materials which were available at the time, and from a technical standpoint the materials used were suitable to the extent of allowing the testing of ideas, but not suitable for a number of reasons. Firstly, the wood used for the Gill Sans capital a sample, boxwood, had the correct qualities in regards to printing as it has a close grain and is a dense hardwood, which will cope well under pressure, however boxwood is expensive and cut pieces of boxwood tend to be rather small due to the average growth of boxwood trees. The production of a complete font in boxwood would prove to be extremely time consuming as each letterform would require preparing and finishing individually, and ultimately rather costly.

Secondly, the wood used for the wallpaper block coped well when exposed to water during the printing process, but splintered when attempting to cut fine detail into the surface.
To build on the long established practices of wood letter manufacturers, a range of wood samples will be tested, including De Little's preferred wood types of maple, hornbeam and sycamore, as well as a range of fruit woods which are often used for wood cut or engraving, to ascertain their suitability when used with digital cutting processes.

B. In regards to conserving historical wallpaper designs by producing digital replicas or replacement sections for existing blocks, whilst referencing the common practice of adhering materials onto a base block, a further test will attempt to reproduce a series of designs using a laser cutter to accurately cut the design from a thinner material before adhering it to a base of marine plywood. This will take advantage of the moisture repelling qualities inherent in marine plywood, whilst using a more suitable material for producing fine artwork. In terms of using digital techniques to produce original designs, further tests will use digital design to incorporate the registration pins/bars into the image itself, negating the need to trim the wallpaper after printing.

C. Regarding the need to hand finish blocks cut on a digital milling machine or router due to the spherical nature of the drill bit, a series of fonts for wood type and designs for wallpaper blocks will be designed especially to take into consideration the size of different drill bits, enabling the production of wood blocks without the need for hand finishing.

Conclusion

The feasibility study aimed to ascertain whether there was sufficient archival material available to gain a clear understanding of traditional manufacturing processes for wood type in order to effectively inform practical tests using digital cutting technology, and whilst there has been no in-depth study into this area as yet, the material available has been pieced together to form a broader picture which can be referenced effectively. Through conducting this research, it has become evident that these tests in digital fabrication can be used to inform a number of disciplines and industries which use wood blocks for printing. Not only the production of new designs, but in the conservation of existing designs, enabling a preservation of historical design as well as the streamlining of production for modern designer makers. Through the conducting of further tests using a wider range of materials and the establishment of efficient working practices, digital fabrication can continue to enable printmakers to produce ever more ambitious and unique wood blocks for printing, thus enabling traditional printmaking processes to work in collaboration with digital technology to inform contemporary discourse and practices in both areas.

References

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