Advancing the Sustainability of Letterpress Print Production in the 21st Century

Stephen M. Treadwell Jr.

University of Central Oklahoma

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By

Rukmini Ravikumar, Committee Chairperson

Amanda Horton, Committee Member

Christopher Domanski, Committee Member

Abstract

During the 21st century, letterpress printing saw the start of a revival in its use as a craft. Graphic designers and artists as well as the institutions that taught them are supporting and adopting this antiquated printing technology in hopes of sustaining its history and its unique abilities as a press to add tactility to the print production process. The major threat to the sustainability of letterpress print production and its continued revival as a craft lies in the high costs of outsourcing plates. This study asks the question, can letterpress plates made from non-traditional media help sustain letterpress print production and hypothesizes that the 3d printing and laser engraving technology of the 21st century can produce letterpress plates that are comparable in print quality to the industry standard of photopolymer plates used in letterpress print production.

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Definition of Terms

3D Printing-A process of making three dimensional solid objects from a digital file ("What is 3D printing?", 2015).

Craft-A new interest in making and doing, encouraging an appreciation for experimental and small-scale interventions (Bean J. & Rosner D., 2012)

Halftone-The translation of tonal information into a bitmap system of various sized (amplitude) dots to simulate a continuous gradation of value (Grabowski, B. & Fick, B., 2009, p.231)

Laser Engraving-(technology in which) a laser beam is used to ablate a solid, following predetermined patterns (Leone C., Lopresto V., De Iorio I., 2009. p.161).

Letterpress-A printing method relying on the assembly of metal type characters and etched images into a matrix which can then be inked (Gatter, M., 2010, p.155).

LPI (Lines Per Inch)-The standard measurement of halftone resolution. It refers to the number of rows of halftone dots there are per inch (Gatter, M., 2010, p.155).

Offset Printing-A printing method in which the image on a plate is transferred to an intermediate roller prior to final transfer to the paper (Gatter, M., 2010, p.155).

Photopolymer Plate-Type of printing plate technique for (letterpress and) offset plates where the plate is exposed using light from a laser (Johansson, K., & Lundberg, P., 2007, p.439)

Plate-A sheet of, typically, aluminum or zinc coated with a photosensitive emulsion. When developed, either the remaining emulsion or exposed background attracts ink (Gatter, M., 2010, p. 155).

Printing Revolution-Inventors applied mechanical theory and metal parts to the hand press, increasing its efficiency and size of impression (Meggs & Pervis, 2006, p. 140)

Relief Printing-Printing that takes ink from the top of the matrix (Grabowski, B. & Fick, B., 2009, p. 232)

Sustainability-A reason (a norm) for humans to take action, to feel connected to the future and to believe they can change things (McGregor S., 2013).

Type High-The height of the (plate) body is .918 inches (Craig, J. & Meyer, S., 1980, p. 23).

Typography-The art and craft of designing with type (White A., 2005., p. 207)

Introduction

Letterpress printing has been experiencing a revival in the late 20th and early 21st century. During this revival graphic designers, artists, and artisans are adopting this antiquated printing technology in a hope to sustain its revival as a craft. Unfortunately, the cost to outsource printing plate production is hindering its continued revival. With the high cost of platemaking, the sustainability of letterpress is threatened, causing the remaining presses in existence to be discarded much like they were in its first decline. This study asks the question— can letterpress plates made from nontraditional media help sustain letterpress printing?

The review of literature describes what letterpress printing is and the events that led to its invention. The printing revolution is discussed in its relation to craft, print production, and how letterpress printing has been viewed as a printing technology. The viewing of letterpress as a technology eventually led to its first decline and how viewing it as a craft helped with its resurgence and popularity. Letterpress is then compared to other crafts that survived industrialization with accompanying views from William Morris. The current state of letterpress is analyzed with an analysis of factors affecting its sustainability.

The methodology for this study involves experiments and qualitative comparisons with 3D printed, laser engraved and photo polymer plates to assess quality, aesthetic, cost, access and overall sustainability of the craft. The experiments provide an affirmative answer to the research question.

Literature Review

What is letterpress?

To first understand what letterpress is, we must learn what historically preceded letterpress and inspired it's invention. Letterpress is a mechanical printing press that uses a form of relief printmaking and was originally designed to use moveable type.

Relief Printmaking.

Defined by Grabowski and Fick (2009), relief printmaking is a subtractive form of printmaking in which material is carved away from the top of a sheet or block of material. The material that remains is inked and used to print. The material used for printing is normally one of the following: wood (hard and soft), linoleum, MDF (Medium Density Fiberboard), PVC (Polyvinyl Chloride), HIPS (High-Impact Polystyrene). Relief printmaking dates back to ocher earth hand-prints found in prehistoric caves. The use of wood as a material, known as woodcut, dates back to ninth century China. During the mid-fifteenth century the development of large-scale papermaking allowed for relief printmaking to become an economical form of mass production of religious and informative imagery (Grabowski & Fick, 2009, p. 75-77). It was this push for mass production that led to the development of the first movable type in China.

Chinese Movable Type

"There [is] archaeological evidence in China dating back as early as 1041, claiming the oldest movable type found. These were in the form of individual symbols made of fired clay with the possibility of the order being alternated to either indent into the earth, rub from, or print signs" (Flynn & Vincet, 2010, p. 11). According to Beardsley(1994) one of these early inventors of Chinese movable type was "The Chinese inventor Pi Sheng [who]had made

movable type in clay in the early part of the eleventh century" (p. 3).With the development of clay movable type came the development metal type and printed books. As stated by UNESCO (2001) The Jikji, a collection of Zen Buddhist teachings), was printed in July 1377 in Cheongju city and is our oldest evidence available of books printed with movable metal type (United Nations of Educational, Scientific and Cultural Organization [UNESCO], 2001). News of this style of printing began making its way from Eastern Asia to Europe, where it sparked an idea for Johannes Gutenberg.

Johannes Gutenberg

"[His] idea was to make for his printing needs a movable type with sufficient numbers of each character to allow whole pages of a book to be laid out at once. And, as he had in mind to print many pages in many copies, it was important that the type be sturdy and uniform. He was a goldsmith by trade, so it is not surprising that he decided to cast the type in metal" (Beardsley, 1994, p. 3). Flynn and Vincet (2010) go on to describe the Gutenberg press in their paper:

> In the 15th century the German printer Johann Gutenberg adapted the technology of the wine press and invented the printing press. This held individual letters that had been molded and poured in a metal alloy so that the flat shape of the letters were able to be placed alongside one another at the same height to construct words to form a sentence. The lines of type could then be continued to carry on below one another to complete a column of a page of text. Ink was then applied before pressing into the paper in order to print. Because the components of the words existed individually, it was then possible to dismantle them and reuse them to compose and print a different page of text. (p.103)

There's no question to whether mass production was a key influence in Gutenberg's development of letterpress printing. The evidence is apparent with his first major publication,

known as Gutenberg's Bible. According to UNESCO (2001) Gutenberg's Bible was printed on vellum, with 42 lines per page, 1282 pages total. A total of 30 were printed in Gutenberg's print office in Mainz (UNESCO, 2001). Gutenberg mass produced a religious text in a time where it had only been copied by hand and owned by the wealthy. He made it plausible to mass produce text so books could be owned by all. Thus the printing revolution began.

The Rise and Fall of Letterpress Printing

What did letterpress bring to print production?

The invention of the letterpress created an entire career field of printing. Before the term "Graphic Designer" ever existed, there was the profession of the printer. Printers were men or women who owned or had created their own press for printing. Printers did much more than just printing, they chose the message, set the type, and proofread. Printing become more than just a career, it became a craft, one that had to be mastered for the best results. To become a Master Printer, children and young adults would apprentice with printers to learn the trade by hand. A mastery of this craft allowed a printer to become credible for his or her speed and quality.

Letterpress print production also brought with it the mass production of all text. After Gutenberg's Bible, books of all kinds began to be printed. People who had not had a public voice now had a way to get their thoughts, perspectives, and creations published. The mass production of books made way for newspapers. With the production of newspapers, daily news was now accessible to the general public.

With a large market craving the printed word began the creation of new presses, printing presses that would increase the amount of printed impressions per hour. During the industrial revolution we saw the first major shift from the Gutenberg style letterpress to the Stanhope style press. Lord Stanhope built his press out of cast iron that reduced the force required by 90% while

increasing the size of the printed area. This doubled the Gutenberg style press of 240 impressions per hour (Wolf, 1974) to 480 impressions per hour (Bolza, 1967). Thus began the shift to machines with faster and faster impressions per hour. At this point in time letterpress printing is no longer looked at as simply a craft, it's now looked at as a technology. When viewing letterpress as a print based technology, our goal is to create machines that can produce the maximum amount of impressions per hour. Letterpress is now a means to an end. It is the final step in production for the printed word or image. As a means, it's only value lies in it's ability to produce the most amount of impressions per hour, as time is money and in the Post Industrial Revolution world. In 1910 Washington Rubel created an offset printer that would print more sheets per minute than any letterpress printer could hope to keep up. On top of that the amount of time and expertise to set up a print job was vastly reduced. Letterpress would continue on as a less popular form of mass production printing until the introduction of Dot Matrix and Laser printing in the late 1960s.

Letterpress is obsolete, what now?

With letterpress obsolete as a mass production technology it had only one leg left to fall back on, craft. The definition of craft within letterpress had to be altered. Letterpress has the ability to do something no other printing method can reproduce. If enough pressure is applied, letterpress machines will leave an impression of the printed material in the paper, this is known as a "bite". Traditionally this type of printing was frowned upon in letterpress printing. Master printers prided themselves on their ability to "kiss" the paper. Biting the paper showed a lack of mastery over the machine. Yet now the bite of the machine is the one thing that was able to save it. In the 1990s letterpress printing began to see a revival, partly based on the fact that Martha Stewart Living began showing photos of of letterpressed wedding invites.

What is the current state of letterpress in the 21st century?

During the 21st century we've seen the development of photopolymer as a platemaking process. This process uses photo negatives to burn images and text into UV sensitive photopolymer. The photopolymer is then rinsed and you're left with a sheet you can now use for printing.

Its currently in a healthy revival with it being adopted by niche print shops, graphic designers, artists, and public institutions such as universities and colleges. The question is, how long can letterpress survive this revival. Will it lose momentum, stumble, and fall? If so, how can we sustain it revival and prevent it from falling back out of popularity?

Rebranding Letterpress

Letterpress can no longer view itself as simply a printing method. In Marty Neumeier's book, The Brand Gap, he states, "Become the number one or number two in your space. Can't be number one or number two? Redefine your space or move to a different one" (Neumeier, 2006, p. 151). To keep advancing, letterpress has to rebrand itself and embrace what makes it unique, its craft.

In the same book on brand, Neumeir suggests when branding we have to ask ourselves three questions. One, who are you? Two, what do you do? Three, why does it matter? The first question is often easy, the second is important, but the third is what counts. Unless you have compelling answers to all three, you don't have a brand. (Neumeier, 2006, p. 31)

We must set out to answer these questions compellingly to successfully rebrand letterpress. The first one, who we are, we already know. Letterpress is an antiquated printing technology that started the printing revolution. What does letterpress do? Letterpress uses a form of relief printing to literally press itself into the paper, leaving an impression. Why does it

matter? It matters because with a press, a single person can mass produce artwork with a style and method not achievable by any other printing medium while also sustaining a craft and preserving history. Letterpress printers do this because they believe what letterpress can do is truly special.

Why is that third question the most important though? Simon Sinek (2009) states that the reason Apple is a truly successful company is that their whole branding message starts by asking, "Why?" This "why" has nothing to do with their "what". What they do, make computers, is not nearly as important as their "why". If Apple started their messages with what they do, it would look more like "We make great computers. They're beautifully designed, simple to use and user-friendly. Wanna buy one?" This is a problem because this is how most companies start sales pitches. Instead if we start with the "why" the message comes out clearer and more unique, "Everything we do, we believe in challenging the status quo. We believe in thinking differently. The way we challenge the status quo is by making our products beautifully designed, simple to use and user friendly. And we happen to make great computers. Wanna buy one?" This second pitch feels completely different than the first and is a much stronger message. Copying what Apple does, their designs, or how they create them will never make a company similar to Apple. Their "why" is what inspired brand loyalty. People don't buy what you do, they buy why you do it (Sinek, 2009, p.40-41).

Letterpress printers must embrace this view. Letterpress needs to continue to brand itself as a craft, and its printers as craftsmen. These letterpress craftsmen can single-handedly mass produce design, artwork, and communication while sustaining the craft and history of letterpress.

Value of revival of letterpress as a sustainable craft.

There are many values to the revival of letterpress as a sustainable craft. For graphic designers, the value lies in education. Typography terminology that is taught and used today by digital programs and professionals is derived from typesetting by hand, which originated with letterpress and its movable type. This terminology is further reinforced when taught with physical examples of typesetting. It grounds this information rather than solely relying on it to live within the programs as numbers and figures illuminated on screens. Another major value lies in the preservation of the knowledge and history of the craft. The history of mass communication, typography, and graphic design has deep ties in the craft of letterpress printing. Letterpress printing is an active time capsule of this history. By sustaining the craft, the teaching and sharing of its history and craft will remain active and accessible for generations to come.

Methodology

Problem

What is the largest threat to letterpress's continued revival as a craft? Letterpress's largest threat to its continued revival as a craft is the cost and time of the creation of printing plates. While the invention of photopolymer plates aided in the revival of letterpress, the reliance on their production for printing is hindering the growth of letterpress as a craft.

This study focuses on this hindrance occurring for those who are currently treating letterpress as a craft, not solely as a printing method. These letterpress craftsmen are typically consisted of graphic designers, artists, and artisans. It's common for these letterpress craftsmen to own their own press, create or design the subject of the print, order the printing plate, and complete the printing themselves. If we were to omit the ordering of the printing plate, this process could be completed single-handedly by the letterpress craftsman in his or her shop.

During this era of letterpress, letterpress craftsmen rely on ordering plates through an outside source rather than create plates in-house. This time and convenience of creating plates in-house does not outweigh the costs of owning and maintaining photopolymer platemaking equipment and obtaining formal training in platemaking. For this reason, it is currently in the better interest of a letterpress printer to outsource the platemaking as maintaining a letterpress print shop can be costly. "The leader of the English Arts and Crafts movement, William Morris, called for a fitness of purpose, truth to the nature of materials and methods of production, and individual expression by both designer and worker" (Meggs & Pervis, 2006, p. 167). Approaching letterpress the same way Morris did the Arts and Crafts movement, designer and worker have become one, but the truth to the nature of materials and methods of production are no longer there. When the craftsman takes himself/herself out of the equation, as one does when outsourcing plates, it is not being true to the methods of letterpress and is diminishing itself as a craft.

To continue this revival of the craft, the issue of outsourcing plates is a problem that needs to be addressed. As mentioned before, photopolymer plates are currently the least expensive form of platemaking, this does not negate the fact that they themselves are also expensive. Boxcar Press is the industry's most popular photopolymer platemaking source. To give an example of the high costs of photopolymer platemaking, the following quantitative data for their pricing was obtained from their website, www.boxcarpress.com. The cost of an 8.5 inch by 11 inch design was used as an example for cost.

- Cost for 0–200 square inches - $.66 per square inch
- Cost of 8.5 in x 11 in Photopolymer Plate - $61.71
- Cost of Shipping - $8

- Total Cost - $69.71

As shown, the cost for one 8.5 inch by 11 inch plate can run $69.71. This is extremely high considering that if the letterpress craftsman was to want to create a two-color print, the price is ultimately doubled. Besides the high price of this single plate, the shipping cost calculated only includes UPS ground, which can take five to eight business days. Boxcar Press does offer free day shipping on orders over 120 square inches. If the printer wishes to have the printing plate rushed, same day shipment, a minimum cost of $45 or 40% is charged. Whichever cost is greater, is the one applied. For the example above, that would change the total cost of that plate to $106.71. The printer has the option to halt their craft for five to eight business days and save on cost, or they can choose to forgo the wait and pay the higher cost.

This is a major problem for the craft of letterpress. The added middleman for outsourcing plates hinders the letterpress craftsmen's creation process by either adding extra costs or slowing production down. These options are often weighed and considered during the creation process. Letterpress craftsman are hindering their creativity when factoring in added costs and time, meaning that some projects never develop past their initial ideation stage. This is also reflected by having to forgo larger color palettes or larger size formats. Letterpress craftsman are known for their ingenuity and ability to make few colors seem like many with use of color overlays created through different opacities in ink. These limited color palettes have even become a characteristic associated with letterpress artwork and design. This characteristic, along with size constraints are also what prevents many others from joining the letterpress revival. You see far more printmakers go the route of screen printing and other printmaking methods because of this.

How do we omit the problem of outsourcing printing plates if owning and operating photopolymer platemaking equipment is not an option for letterpress craftsmen? We should look

at how the craftsman and designer Charles Eames approached designing and crafting furniture in the 1960s. When designing furniture, Eames' ideal was "the best, for the most, for the least" (Cohn, 2011). Eames wanted to create the best furniture, accessible by the most amount of people, for the least amount of money. There's a similarity in Eames' ideal and that of an ideal of letterpress craftsmen. As a craft, letterpress needs the best quality printing plate possible, that's easily accessible by most printers, that costs the least amount of money to produce. At the moment, that is the role of the photopolymer plate. Instead of aiming to change the photopolymer platemaking method, the craftsmen should learn from the failure of Charles Eames and Eero Saarinen. Eames and Saarinen entered the Organic Furniture competition. They aimed to create a single shell molded plywood chair. Unfortunately, the plywood could not take the stress of the angles and would crack during production. "They designed the look of it without designing the substance of it." (Cohn, 2011) The wood being the problem, not the design of the chair. This is the same type of problem letterpress craftsmen have. Their initial designs can fail to work with letterpress print production due to budget limitation imposed by the costs of photopolymer plates. Ray and Charles Eames eventually redesigned the single shell molded plywood to be crafted out of multiple pieces of plywood. While the redesigned chair remains a design icon, it was ultimately a compromise of the initial design. This lead to the Eames creative ingenuity of using using fiberglass as a crafting material to create designs that would have been otherwise been compromised if they had attempted to craft with wood instead.

With the advancement and accessibility of 21st century technology, the need to reevaluate the platemaking process of letterpress craftsmen is at an all-time high. The question we must now ask is can we replace the photopolymer platemaking process that was invented

during the 1980s with a nontraditional media platemaking process to help sustain the craft of letterpress printing?

Nontraditional Platemaking Process

It's been established that photopolymer plate production is the common traditional platemaking process currently in use among letterpress craftsmen. During the 21st century the technologies of 3D printing and laser engraving have seen a rise in quality, affordability, and accessibility. These two technologies have the possibility of becoming nontraditional platemaking processes because of these advancements.

Hypothesis

The 3d printing and laser engraving technology of the 21st century can produce letterpress plates that are comparable in print quality to the industry standard of photopolymer plates used in letterpress print production.

Research Design

This study uses two types of 3d printing technologies and three types of laser engraved materials to attempt to gain qualitative evidence that nontraditional platemaking methods can obtain comparable quality to the traditional platemaking method of photopolymer.

Qualitative Comparison Rubric

A qualitative comparison is being used to find evidence to support the hypothesis. The qualitative comparison will use a photopolymer plate testing the suggested limitations when preparing artwork for ordering photopolymer plates from Boxcar Press as a basis for comparison. A rubric was created for this qualitative comparison to grade the effectiveness of the nontraditional platemaking processes when compared to the photopolymer platemaking process.

The final grade from the rubric will determine the effective ability of these new processes to mimic the limitations of photopolymer plates.

Test Plate and Rubric

A test plate being used as the basis for comparison with the nontraditional plates. The test plate being used is a 4.9 inch by 4.9 inch KF 95 photopolymer plate ordered from Boxcar Press. This specific plate was chosen because its low cost and ability to hold fine detail. The goal of the test plate will be to visually show the maximum design limitations of photopolymer plates as suggested by Boxcar Press. The rubric will be derived of the limitations of the photopolymer test plate.

Halftones

Halftones are capable of printing at 133 lines per inch, but the difficulty of printing such line density would prove increasingly difficult even with a photopolymer plate. For this reason, Boxcar suggests that the lines per inch not be any denser than 100. The maximum desired density of 100 lines per inch will be represented on the test plate as well as lower densities of 75, 50, and 25 (Figure 1). The halftones consist of a black to gray gradient to show the decreasing dot size within the halftone pattern.

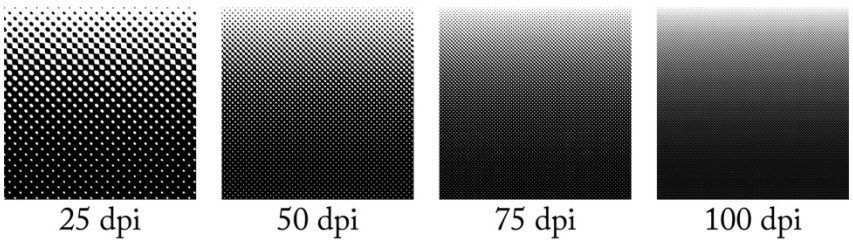


Figure 1

When grading the halftones, a single point will be given for the successful printing of each density with a total of four points possible. Points will not be withheld due to a

nontraditional plates inability to print partial elements of the smaller halftone dots at the edge of the gradient. What's being graded is the ability to print an overall smooth gradient in that degree of density. The pattern must hold up and have the capacity to hold ink but not gum up. There should be a clear representation of a gradient value change.

Solids

The ability for the nontradional plates to hold ink properly is crucial for successful printing. Photopolymer plates and all letterpress plates in general create a mottled effect when printing. A mottle is an uneven ink coverage effect that appears in large blocks of solid ink areas when printing.

When assessing the quality of solids and crisp lines in the non traditional plates, a large circle (Figure 2) will be used to assess the quality of the ink coverage large solid areas. Four points will be given for the successful printing of similar or better ink coverage to that of the photopolymer plate. Three points will be give for a slight increase in mottling. Two points will be given a medium increase in mottling. One point will be given for heavy mottling. Zero points will be given for an unwanted texture that occurs instead of mottling.

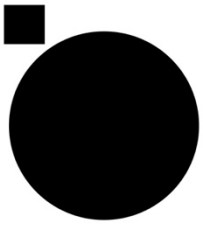


Figure 2

Crisp Lines

Letterpress plates have the ability to print smooth curves, crisp straights, and sharp vertexes. The shape of the ampersand, the large circle, and the small square on the test plate (Figure 3) will be used to analyze the quality of line crispness of the nontraditional plates to the

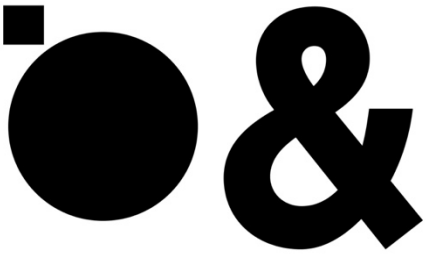


Figure 3

photopolymer plate. Four points will be given for matching the same level of crispness completely to that of the photopolymer plate. One point will be deducted if curved lines do not appear smooth. One point will be deducted if vertexes do not appear sharp. One point will be deducted for non crisp straight lines. Zero points will be given in the event of major breaks in exterior shape form.

Line Weight

The smallest line weight suggested by Boxcar Press is .25 pt. for the KF 95. The following range of line weights will be tested (Figure 4): .25 pt., .5 pt., .75. pt., 1 pt., 2 pt., 3 pt., 4 pt., 5 pt. One point will be given for the successful printing of each unbroken line. Points will not be withheld for mottling or poor edge crispness.

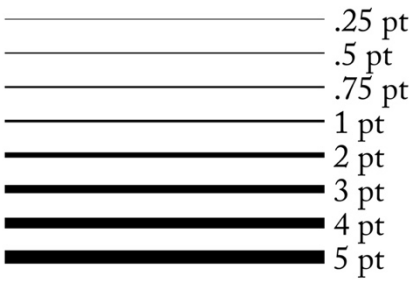


Figure 4

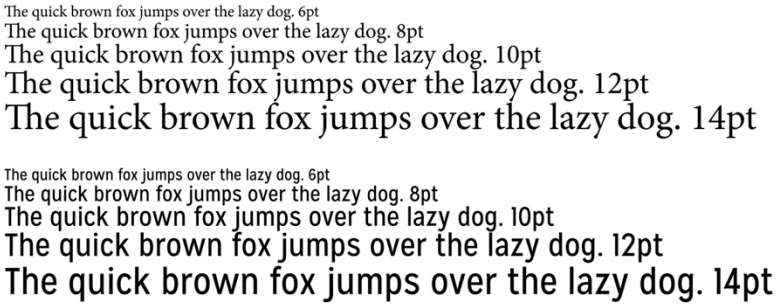


Figure 5

Text Weight

Boxcar suggests that typefaces should be no smaller than 6 pt. for photopolymer platemaking. This takes into the limitations of line weight into account as well as readability. Counters within letterforms can fill along with broken letters. This limit will be tested with both serif and san serif fonts. The following text weights will be tested in both styles(Figure 5): 6 pt.,

8 pt., 10 pt., 12 pt., 14 pt. One point will be given for the successful printing of each line of text. Points will not be given in the instances of lost and broken letters. There is a maximum number of 10 points available.

Nontraditional Platemaking Methods

Plates will be made with both 3D printing and laser engraving. Photopolymer plates are normally backed by adhesive and are attached to a base to raise their height to .918 inches. This number is what is considered type high. This is referred to as type high because it is the consistent height among metal and wooden type. Presses were built to accommodate this specific height and for that reason anything below .918 inches will not print. This allowed the letters to print but not their bases. The same height needs to be achieved for the nontraditional plates.

Figure 6

The photopolymer plate will not work for the nontraditional plates due to their increased thickness. The plates will be mounted to three-quarter inch plywood (Figure 6) with adhesive strips (Figure 7). Sheets of paper will be stacked under the plywood bases for minute adjustments to achieve .918 inch height.

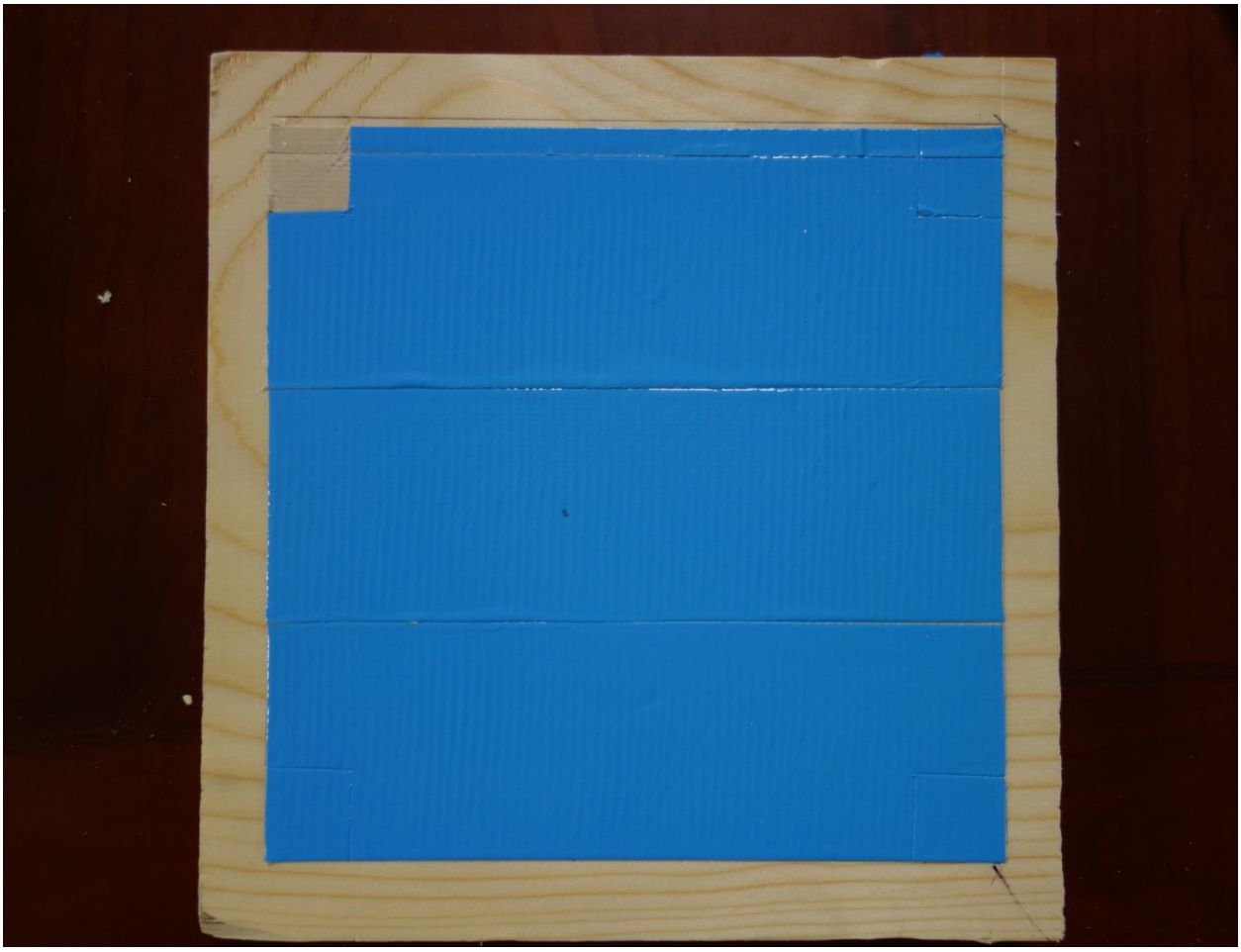


Figure 7

Laser Engraving

A single laser engraver was used for this case study, a Kern 5250. Due to the similar quality, technology, and specifications among the consensus of laser engravers currently on the market it was not deemed necessary to test multiple brands of laser engravers. Instead three different materials were chosen to be laser engraved into printing plates: untreated 1/8th inch

hard oak plywood sheet (Figure 8), a Speedball unmounted linoleum carving sheet (Figure 9), and an acrylic sheet (Figure 10). These materials were chosen because of their regular use in traditional printmaking as well as their accessibility, affordability, and ability to be safely laser engraved.

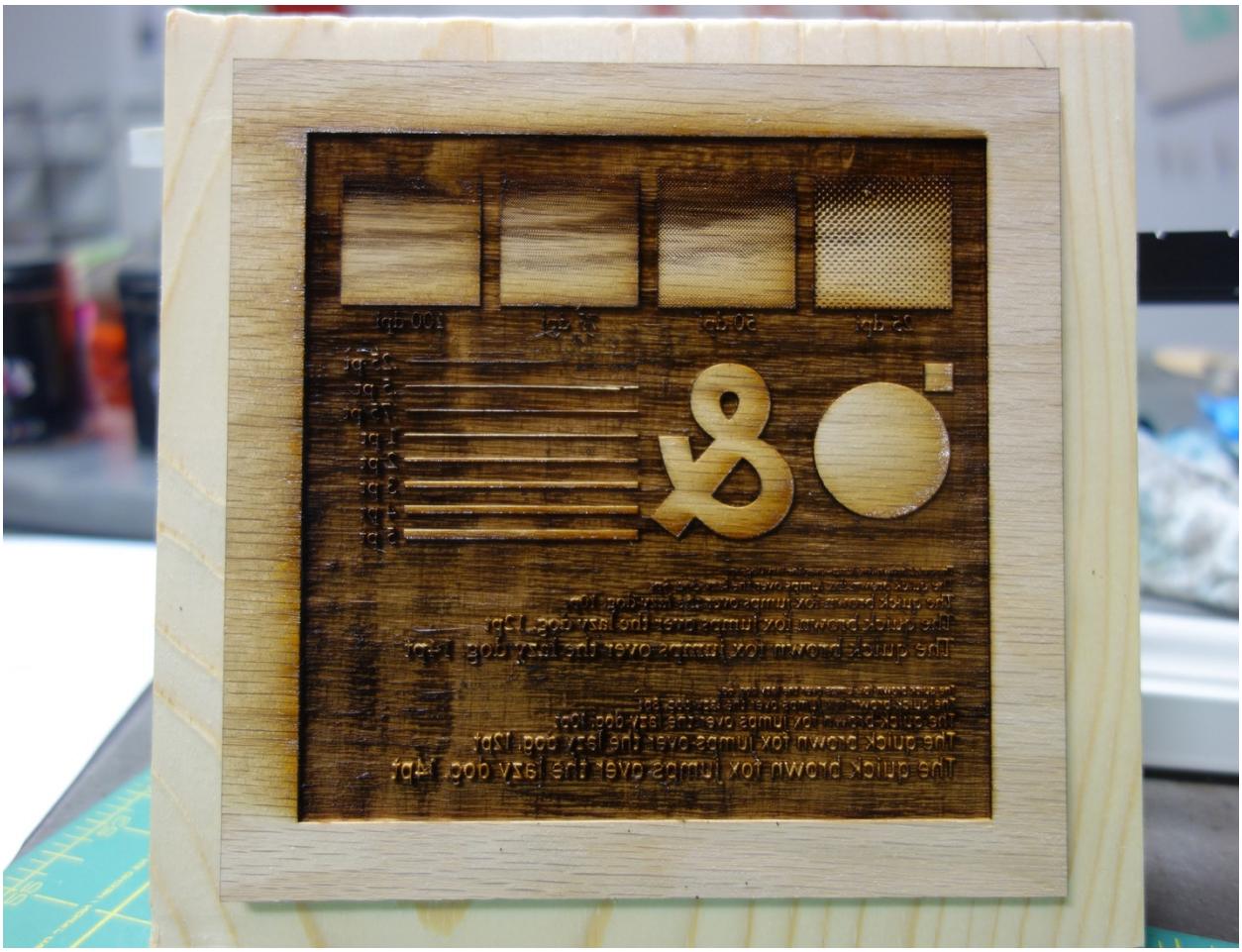


Figure 8


100 dpi
75 dpi
50 dpi
25 dpi
.25 pt
.5 pt
.75 pt
1 pt
2 pt
3 pt
4 pt
5 pt
The quick brown fox jumps over the lazy dog. 10pt
The quick brown fox jumps over the lazy dog. 12pt
The quick brown fox jumps over the lazy dog. 14pt
The quick brown fox jumps over the lazy dog. 8pt
The quick brown fox jumps over the lazy dog. 10pt
The quick brown fox jumps over the lazy dog. 12pt
The quick brown fox jumps over the lazy dog. 14pt

Figure 9

Figure 10

3D Printing

The two types of 3d printing technologies used in the case study are Z Corporation's ZPrinter 650 and Form Labs' Form 1+. Both 3d printers use different materials and building method technologies.

ZPrinter

The ZPrinter uses a HPC, High Performance Composite, as its building material. This type of printer was chosen because of HPC being able to hold tight details and its high build volume capacity. The ZPrinter's maximum build size is 10 inches by 15 inches by 8 inches, a total of 1200 cubic inches. This large build size accompanied with the ability to print multiple models at the same time using layers could give letterpress craftsmen the ability to make multiple printing plates at the same time.

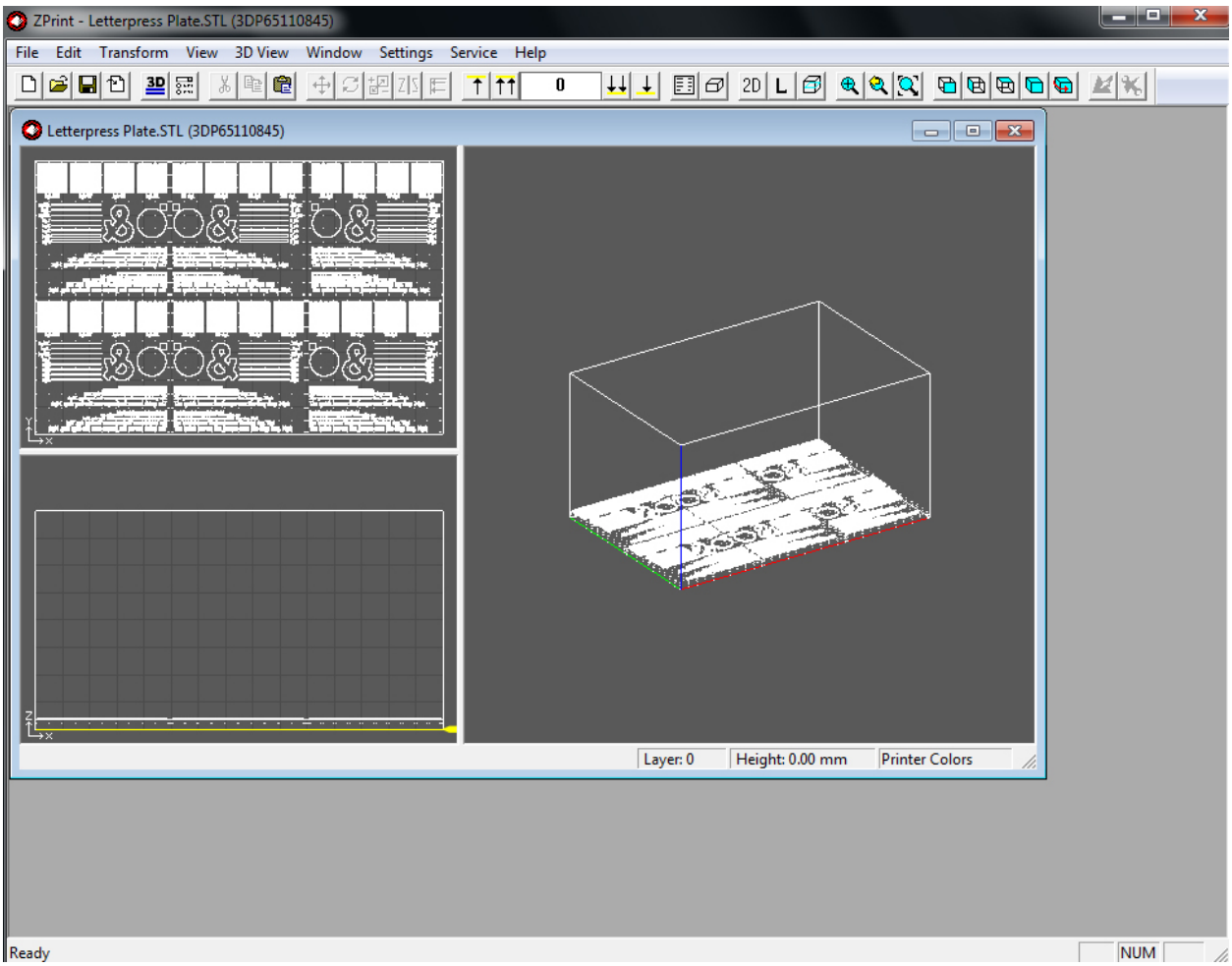


Figure 11

The plate model must be loaded into the print software on the computer connected with the ZPrinter (Figure 11). With the ability to print in layers, multiple plates were printed at the same time. It took approximately forty minutes to print six plates.

Figure 12

The excess powder had to be gently vacuumed out of the base to expose the plates for removal (Figure 12).

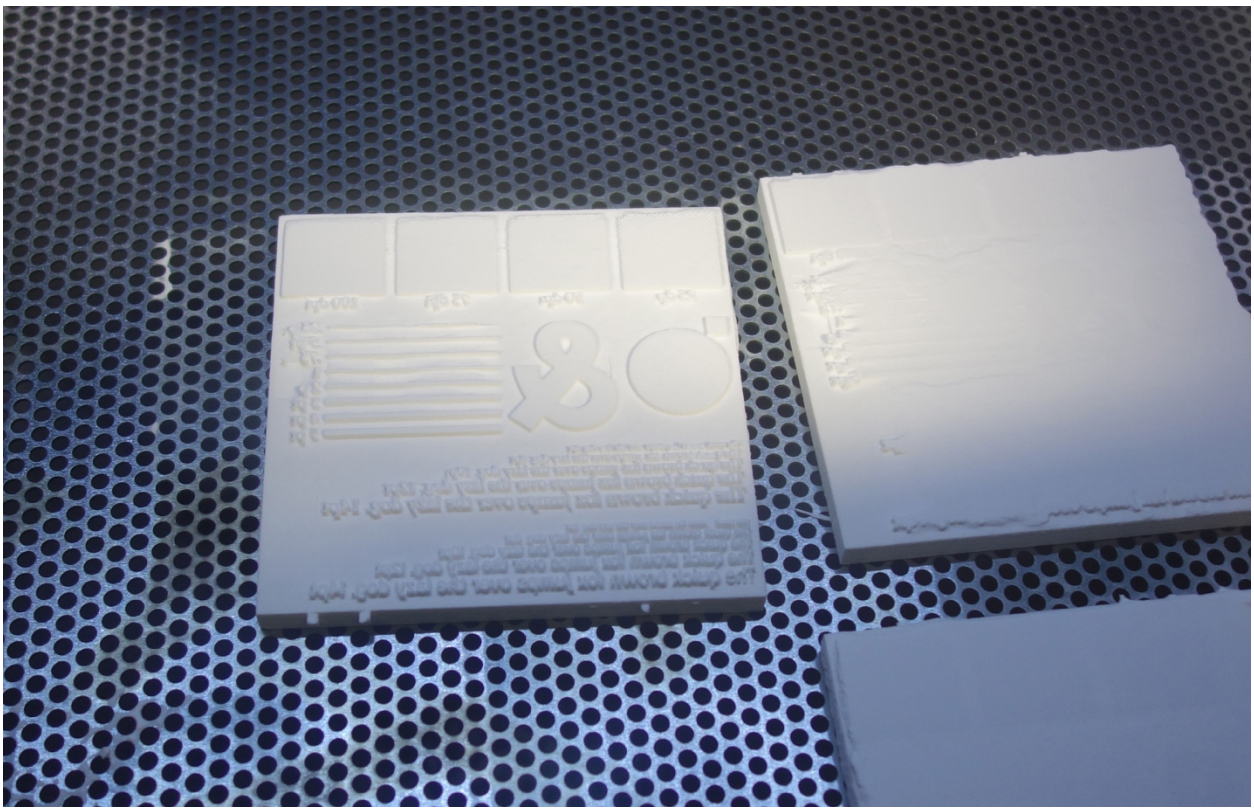


Figure 13

The remaining powder is then removed with a high pressure air wand in a separate chamber (Figure 13). Extreme care is required during these initial steps in the platemaking process. The powder forms are solid enough to move and hold, but are still extremely fragile until coated in the finishing compound.

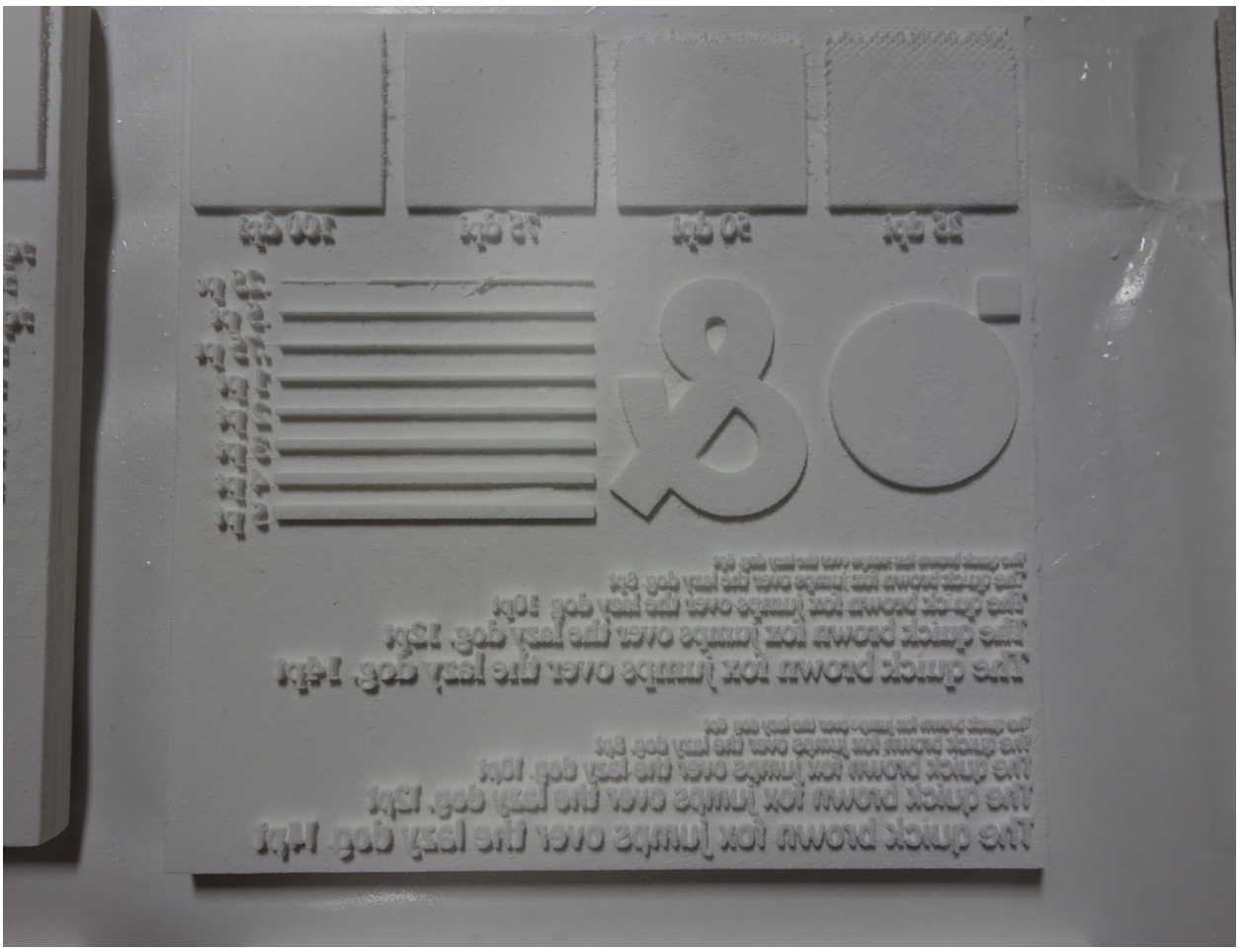


Figure 14

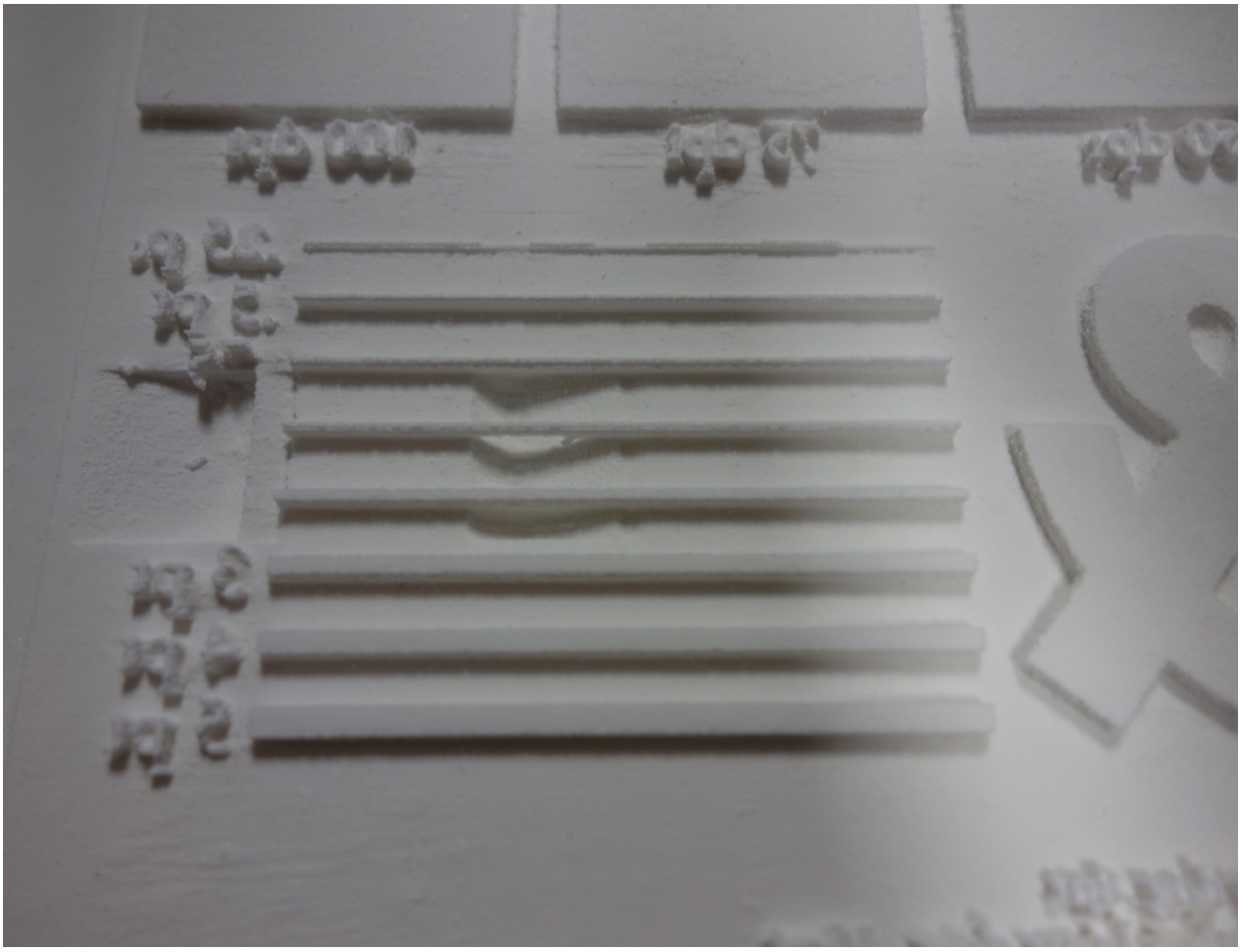


Figure 15

Fine details can be vacuumed and blown away (Figures 14 & 15). The plate must be placed in a plastic container that does not react to the liquid finishing compound. Rubber gloves must be worn as the compound can act like an industrial super glue and adhere your skin to objects or itself if not careful. Small amounts of gas form during the reaction process and a respirator is also required.

Figure 16

The compound is applied to all surfaces of the plate evenly (Figure 16).

Figure 17

Once coated the plate needs to be placed on a coated butcher paper or similar plastic to cure (Figure 17). The plates surface will increase in temperature during the chemical reaction process that seals the plate, at this time it becomes to warm to handle by hand.

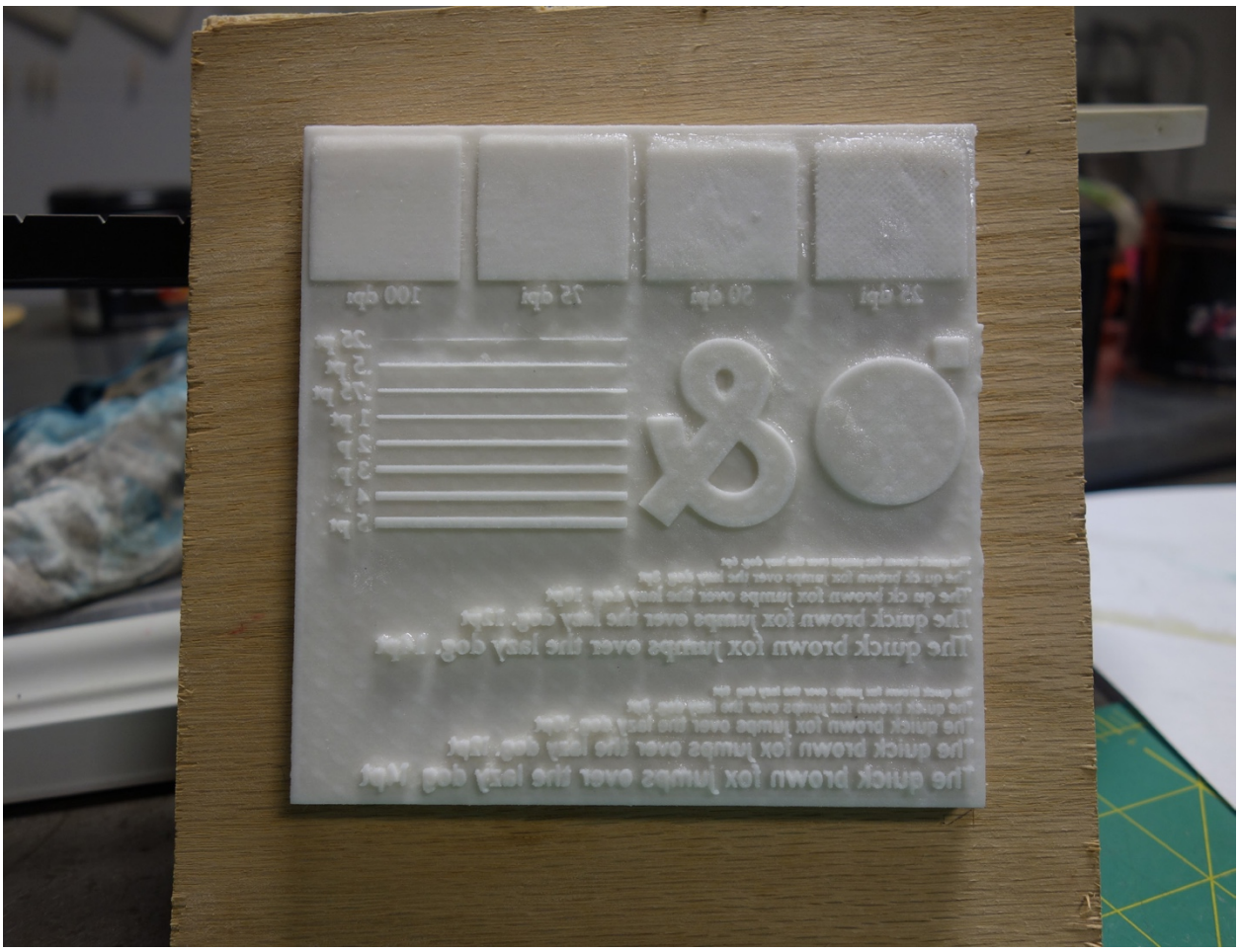


Figure 18

This process is more hands on than the other nontraditional processes. This allows for more human error, but is also the most craftsman-like of all the methods. (Figure 18)

Form 1+

The Form 1+ uses a photopolymer resin as a building material. This 3D printer was chosen because it shares the same material used in traditional photopolymer platemaking. Due to the material similarity it is possible that the quality of plates made with this printer would be equivalent to the quality of current photopolymer plates. The Form 1+'s maximum build size is 4.9 inches by 4.9 inches by 6.5 inches, a total of 156 cubic inches.

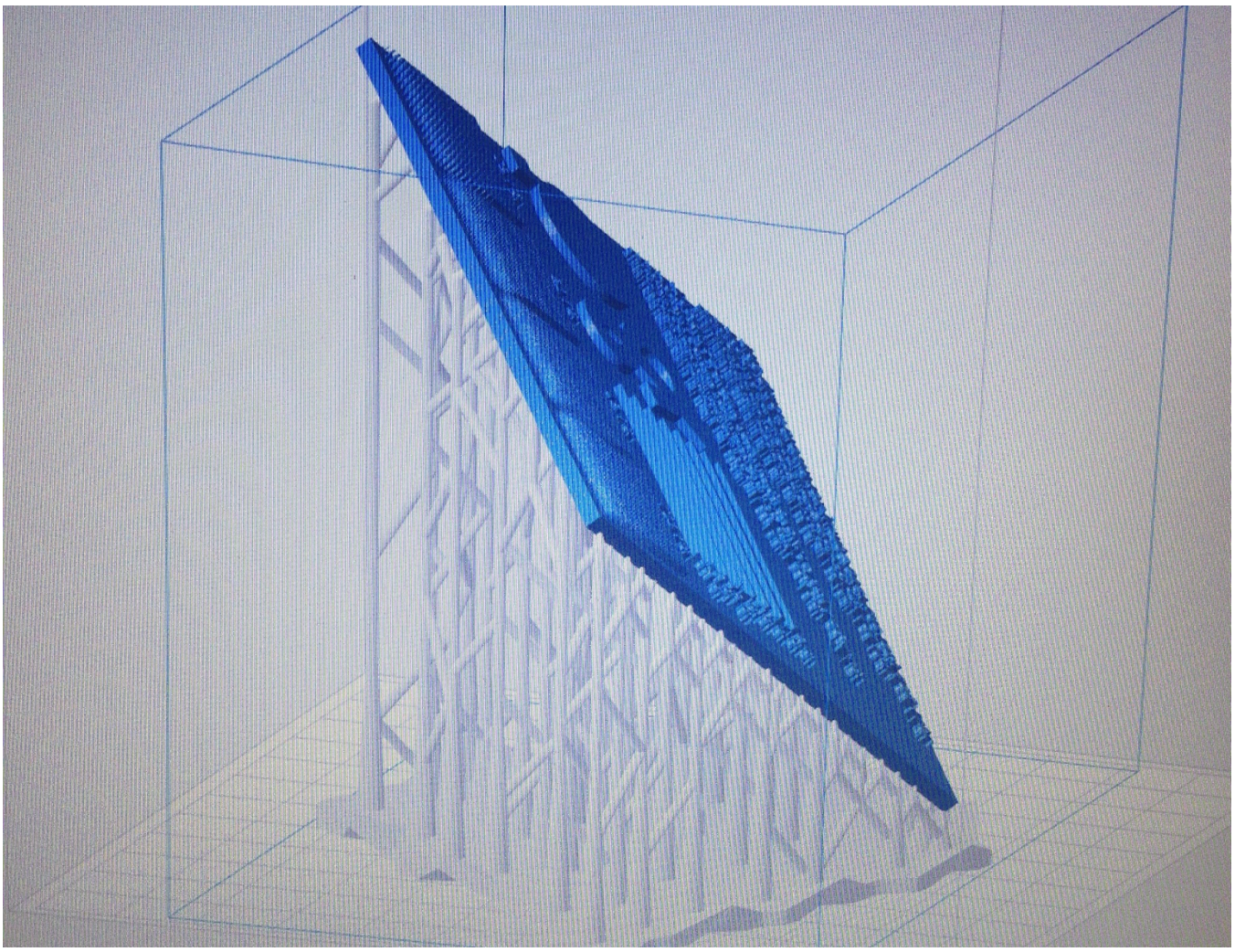


Figure 19

The plate model is loaded on the print software on the computer connected to the Form 1+ printer (Figure 19). The software helps create support structures for the plate model.

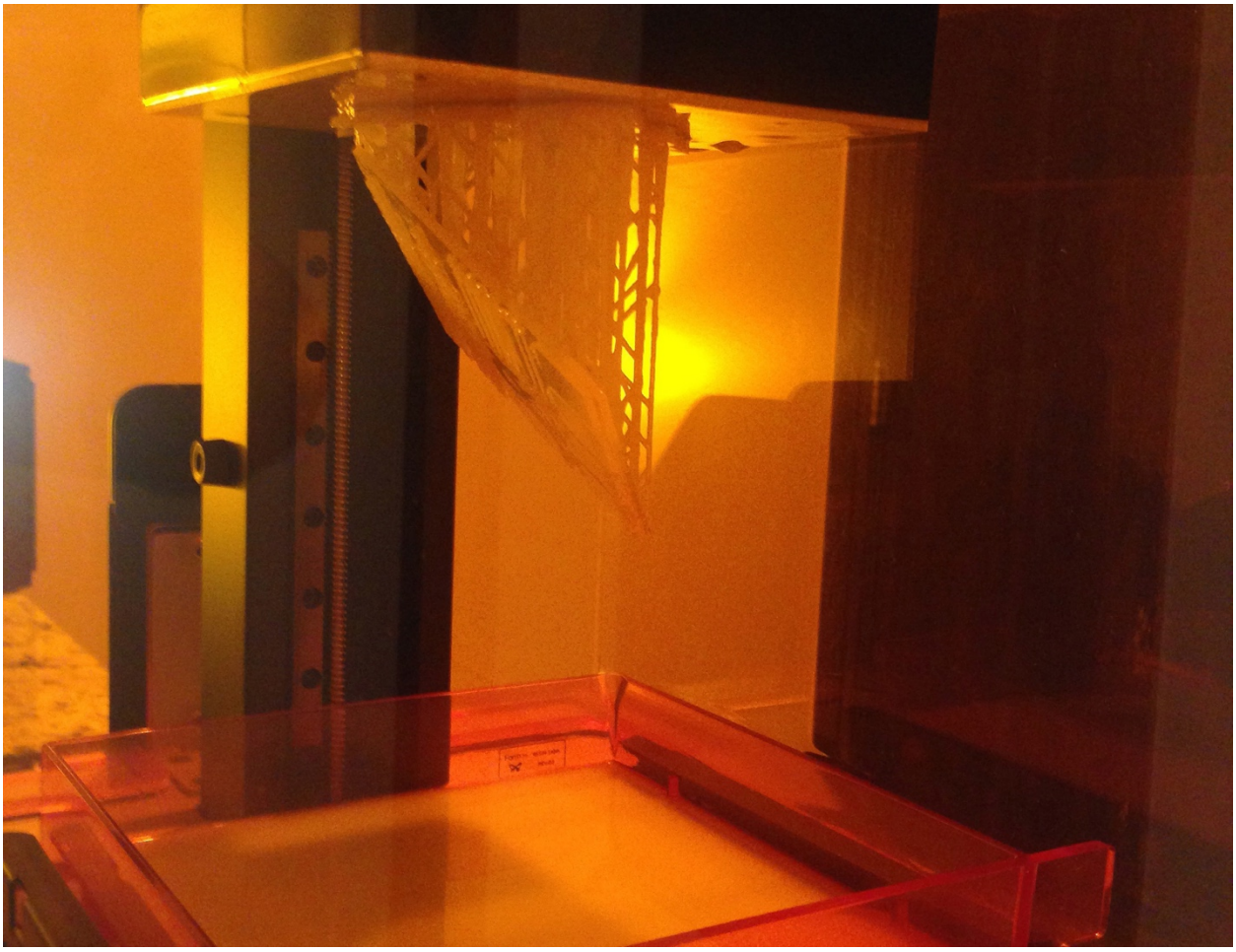


Figure 20

The Form 1+ printer uses UV light to cure layer by layer as it extrudes the model from a pool of liquid photopolymer (Figure 20).

Figure 21

The plate is then dipped in alcohol for curing and cleaning away uncured photopolymer liquid (Figure 21). Unfortunately, the Form 1+ had trouble printing the plate at its native size and had to be reduced to be printed.

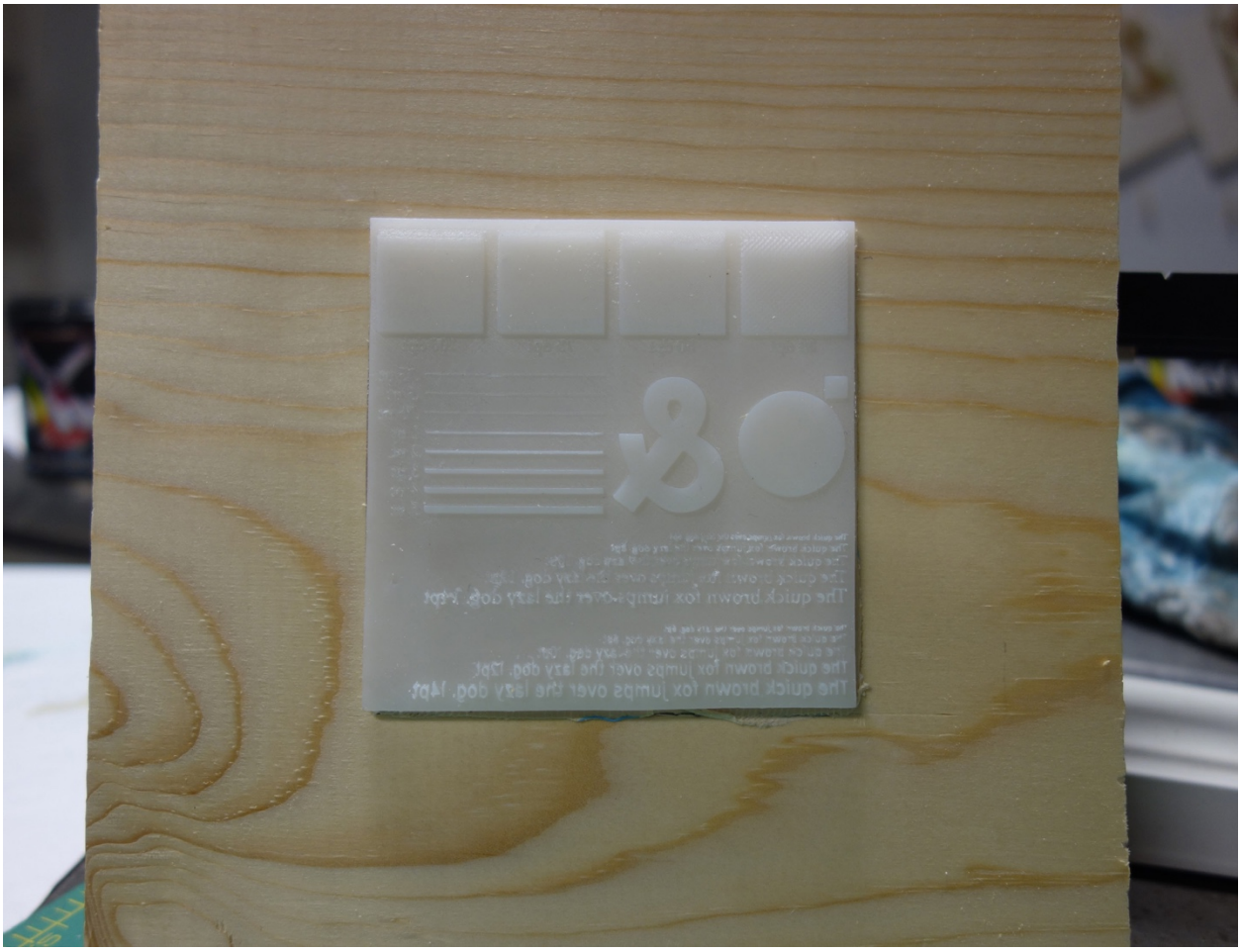


Figure 22

The test plate was printed at 72% (Figure 22) and although this will skew the results in the detail sections of the rubric, it will give evidence for its future potential.

Results

Oak Hardwood

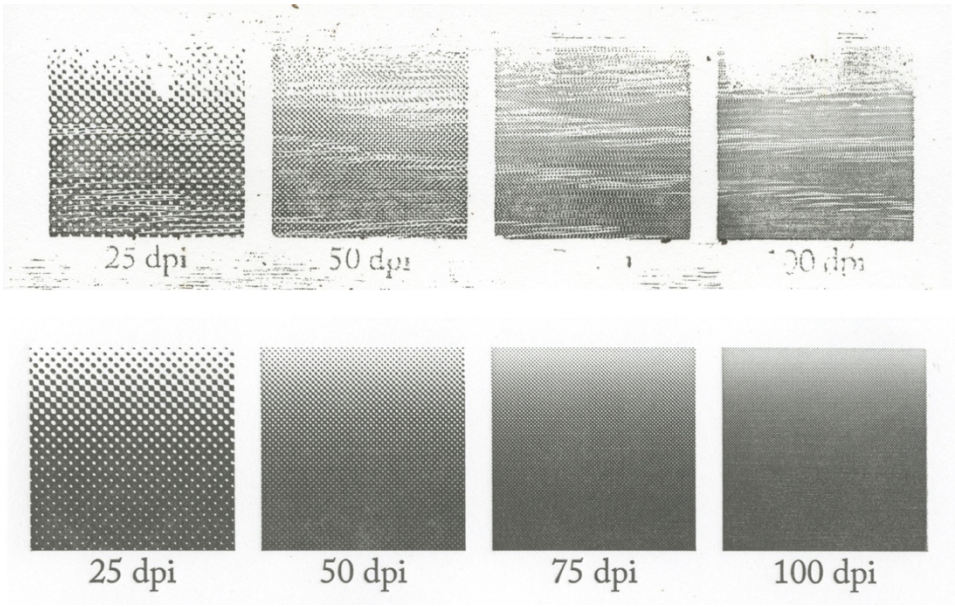


Figure 23

The Oak Hardwood had trouble printing the halftones successfully. The texture of the grain of the wood disturbed the subtle textures of the halftone. Large lines are missing out of the halftone patterns because of this (Figure 23). It receives zero points for the reproduction of halftones.

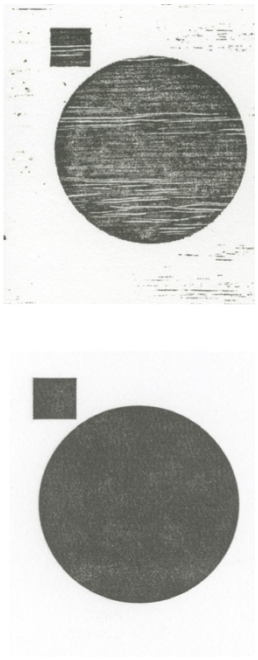


Figure 24

The wood texture also hinders the oak's ability to reproduce solids (Figure 24). The unwanted texture causes it to receive a 0 in solid printing quality.

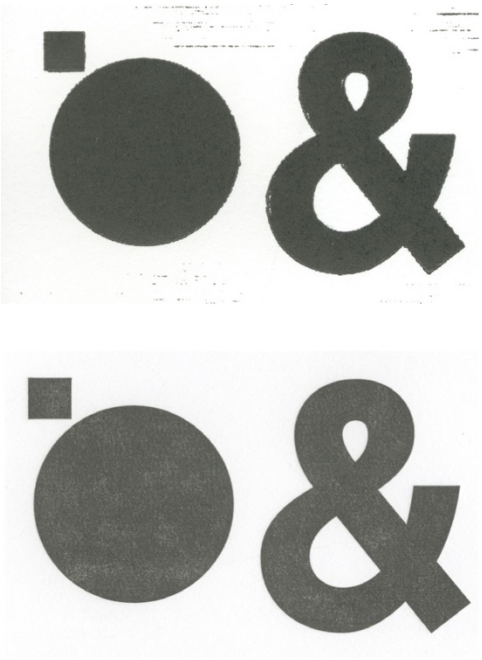


Figure 25

The line quality is fairly crisp with the exception in breaks due again to the oak's texture (Figure 25). With these breaks causing slight distortion in areas, the oak receives 3 points for line crispness.

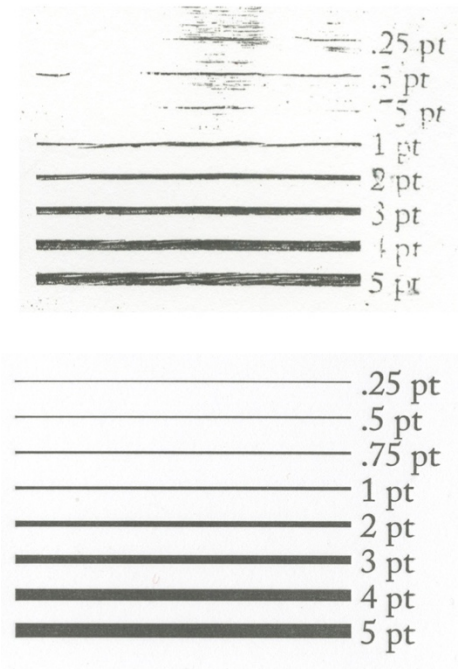


Figure 26

The oak plate receives 4 points for line weight reproduction. It is able to achieve and hold down to a 2 pt. weight, smaller weights in that break and waiver (Figure 26).

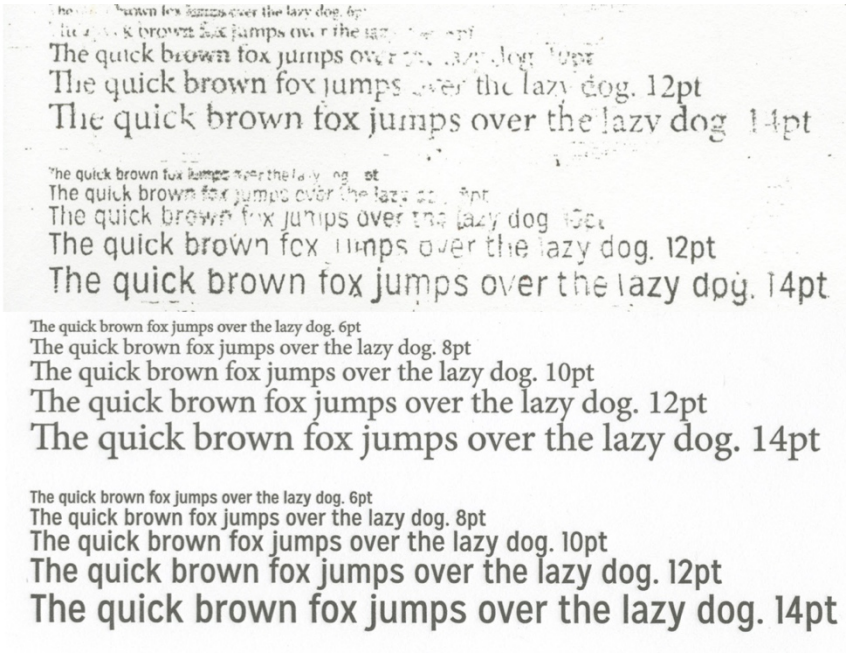


Figure 27

The oak plate cannot wholly reproduce a single line of text. Letters break off or do not print completely (Figure 27). It receives zero points for text weight quality.

The oak plate earns a total of 7 points for its quality. It is 23% the quality of the photopolymer plate. Small details are fragile on the wood plate causing them to break off during the printing process. Between its fragility and unwanted grain texture prevent the plate from becoming a suitable replacement for photopolymer.

Acrylic

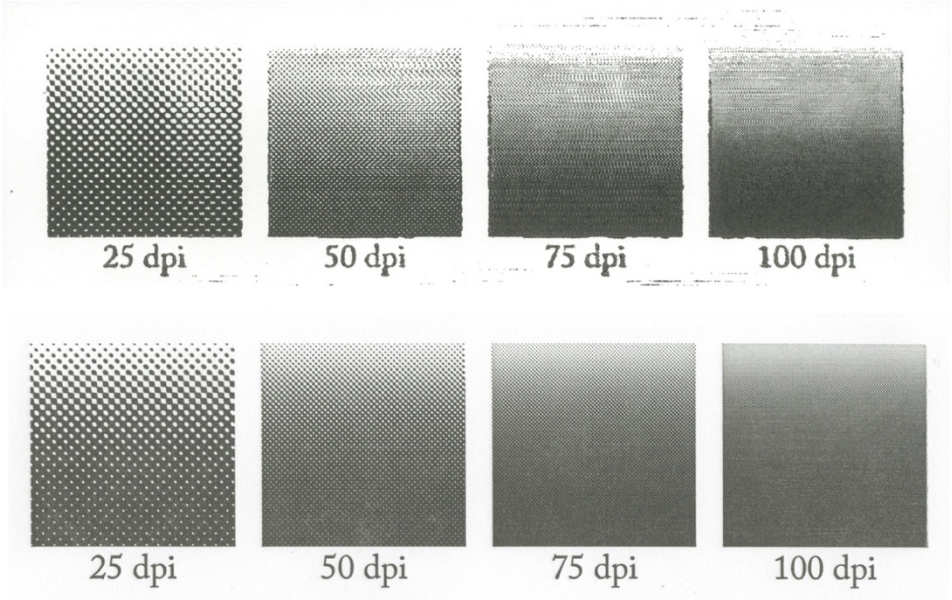


Figure 28

The acrylic plate holds all four halftone pattern densities well and receives 4 points for the section. There is slight mottling in their appearance, but that patterns hold tight (Figure 28).

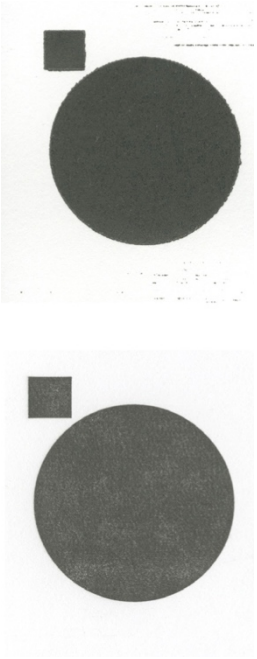


Figure 29

The acrylic holds ink extremely well and even on its surface. The solids print with minimal mottling and are superior to that of the photopolymer (Figure 29). The acrylic receives 4 points for its ability to reproduce solid blocks of ink.

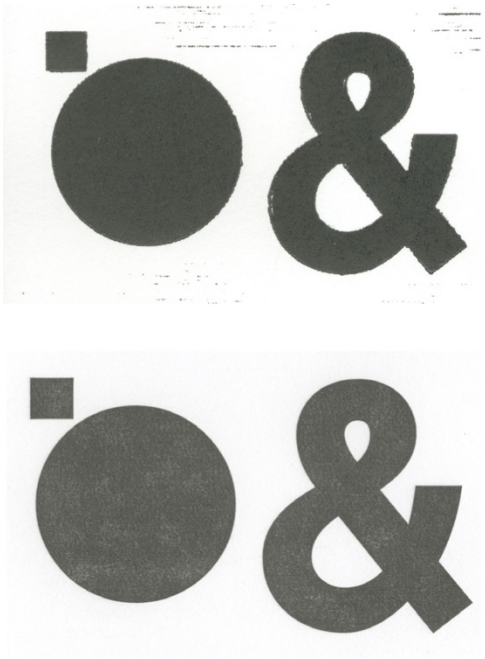


Figure 30

Line crispness suffers on the acrylic plate. Edges appear rough on both curved and straight edges (Figure 30). The vertexes appear rounded and unable to hold sharp corners. For these reasons the acrylic is given 1 point for line crispness.

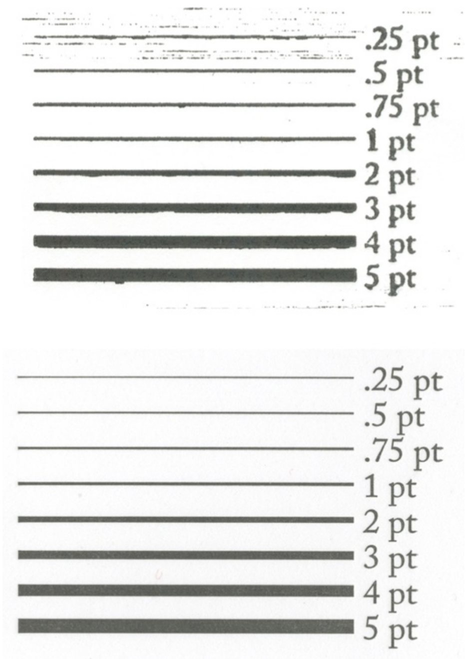


Figure 31

The line weight quality of the acrylic holds up extremely well (Figure 31). All eight lines print unbroken, with the .25 pt. line only looking a little rough due to line crispness quality. The acrylic is awarded 8 points for line weight quality.

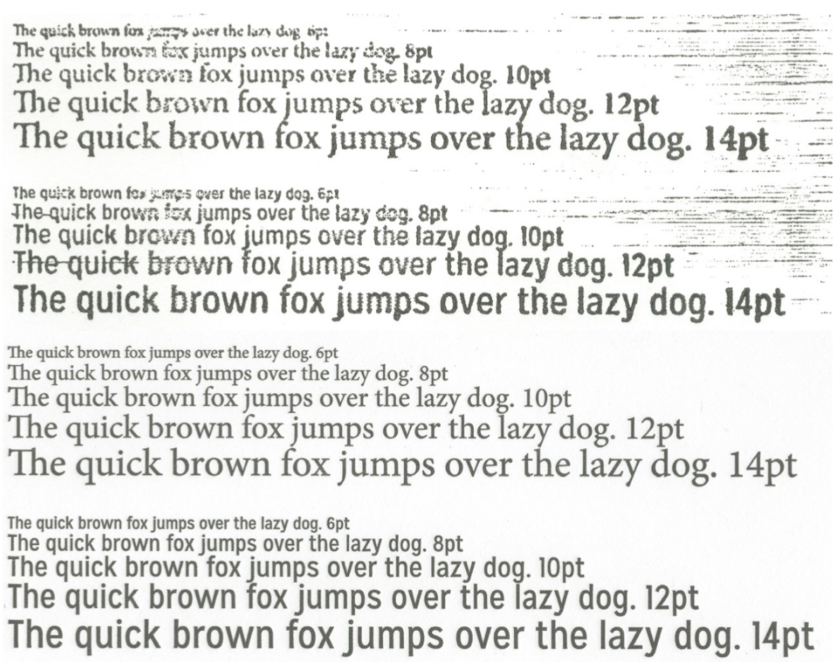


Figure 32

Text weight suffers on the acrylic plate (Figure 32). It holds the quality in the 14 pt. and 12 pt. serif typeface and begins to lose pieces of letterforms at 10 pt. It is able to hold the quality of letters in 14 pt., 12 pt., and 10 pt. in the san serif type and begins losing letters at 8 pt. The acrylic gains 5 points for its text weight quality.

The acrylic plate earns a total of 22 points and maintains a quality of 73%. Its rough line crispness holds it back from becoming a viable option for replacing photopolymer plates. The line crispness problem is due to the build-up of excess acrylic that has been etched away during the platemaking process.

Linoleum

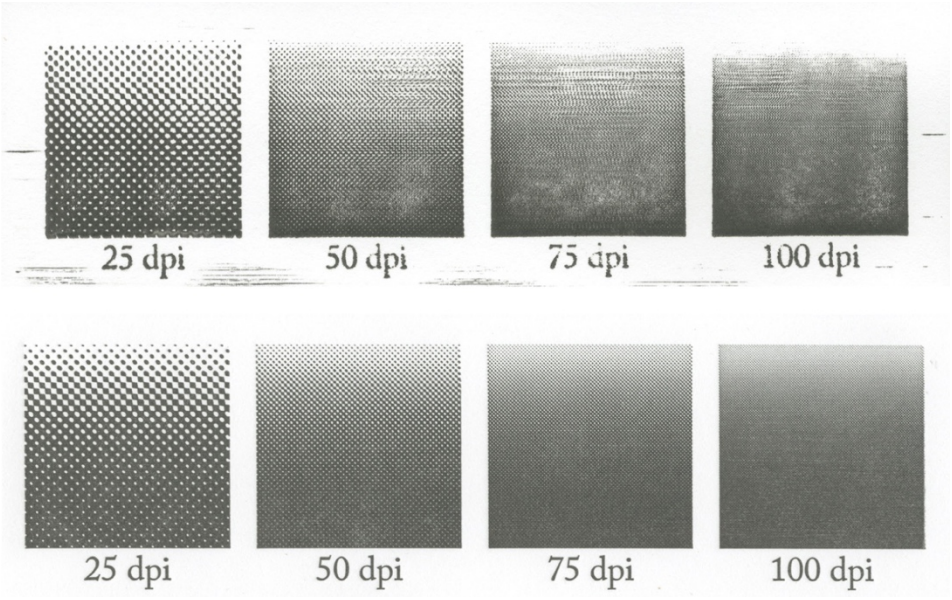
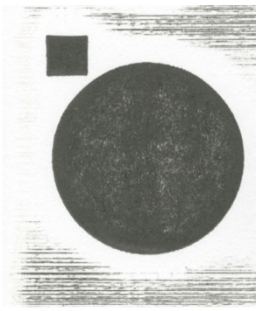


Figure 33

The Linoleum plate prints all four halftones very well (Figure 33). There is slight mottling happening but the pattern holds tight and is similar to the acrylic. It receives 4 points for halftone quality.



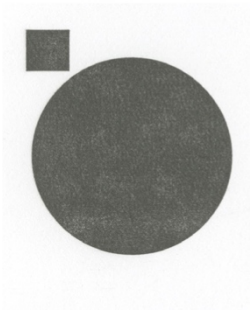


Figure 34

There is slightly more mottling going on in the solids of the linoleum plate print (Figure 34). It holds ink very well, but not quite as well as the photopolymer. It receives 3 points for solid printing.

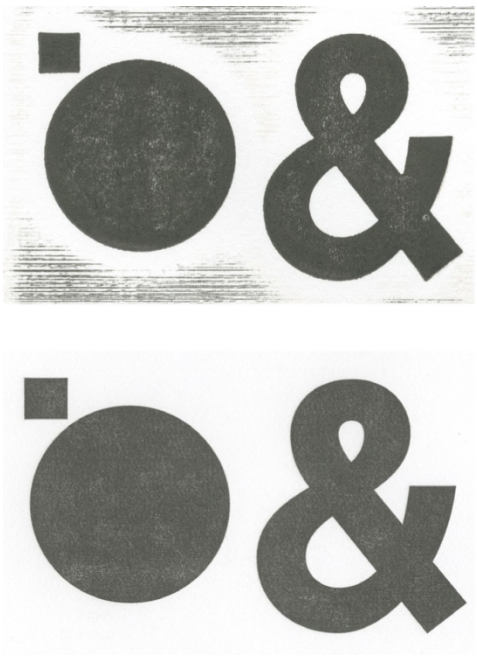


Figure 35

Line crispness only suffers in vertex areas, as they appear slightly rounded in areas (Figure 35).

For this reason, it receives a total of 3 points.

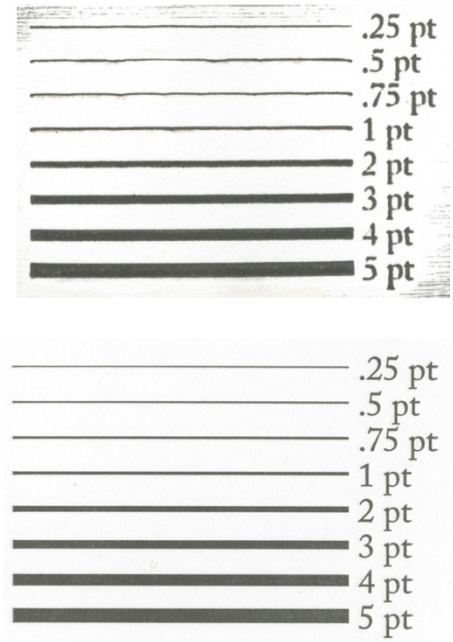


Figure 36

The linoleum plate prints all eight weights with no breaks in line (Figure 36). There is some wavering that appears to happen, but this is due to line quality and does not affect its score of 8 points.

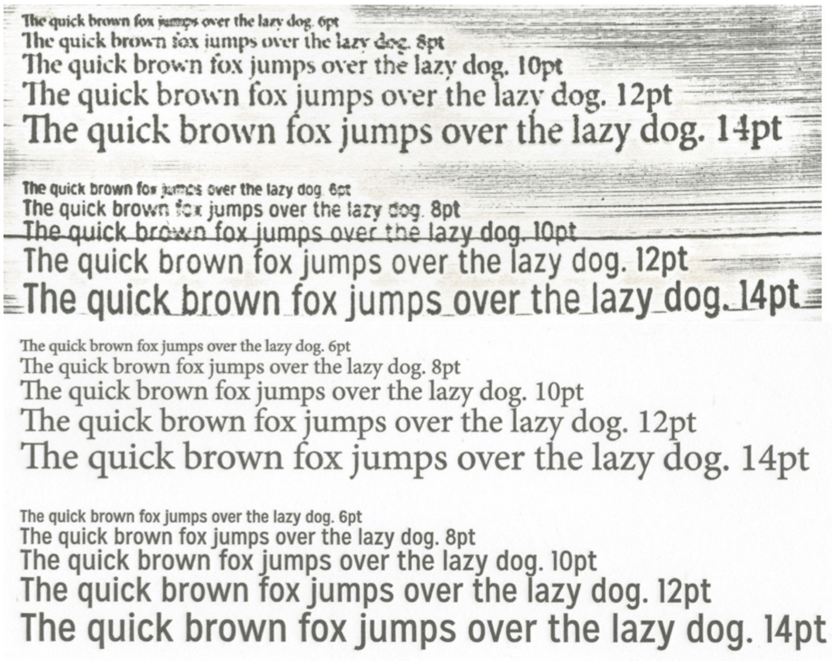


Figure 37

The minimum size text weight, 6 pt., prints fairly well in both the serif and san serif typefaces (Figure 37). Unfortunately, it suffers with the word “jumps” in both typefaces. In the serif typeface it bleeds together in the serif typeface and loses its descender in the “p” in the sans serif typeface. This happens in the 8 pt. lines as well. While it is the closest to achieve the quality of the photopolymer in this area, it is only awarded 6 points for successfully printing six lines of text.

The linoleum plate earns a total of 24 points and maintains a quality of 80%. The slight increase in mottling compared to the photopolymer cause some problems for text weight. Between this and its slight rough vertexes in areas prevent it from excelling higher.

ZPrinter

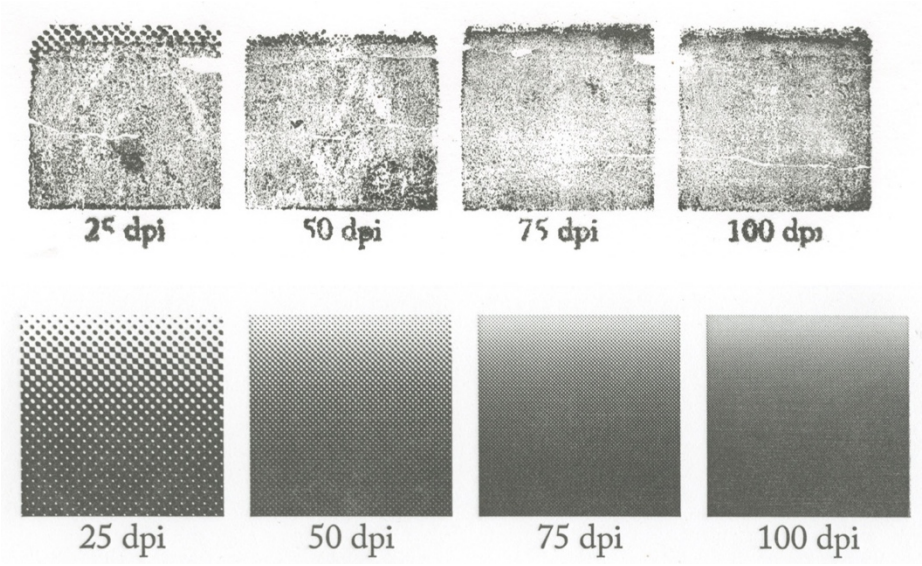


Figure 38

The ZPrinter plate has trouble maintaining halftones in all four tested densities (Figure 38). It receives 0 points in this area.

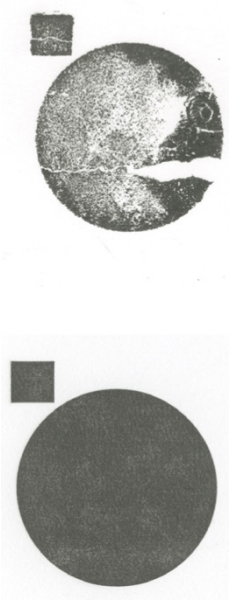


Figure 39

Solids did not hold up well on the ZPrinter plate (Figure 39). The texture did not hold ink well and caused extreme mottling. It receives 0 points in this area.

Figure 40

Line crispness suffered greatly as well on the ZPrinter plate (Figure 40). The forms broke and cracked during printing and had an overall rough appearance. It receives 0 points in this area as well.

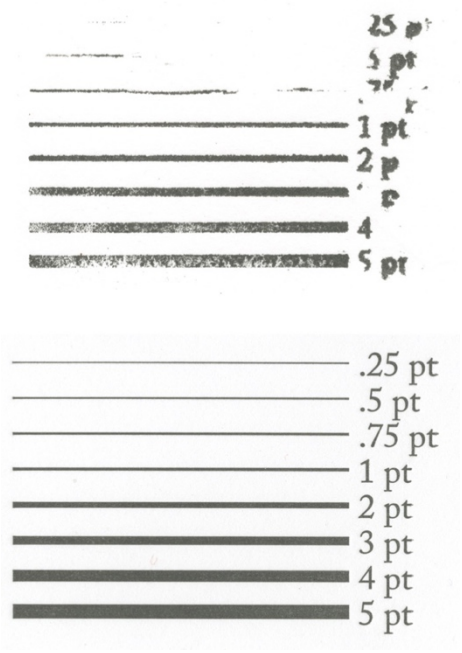


Figure 41

The plate was able to print 5 unbroken lines in the line weight section (Figure 41). There is mottling and line crispness problems, but they did not break. For this section it receives 5 points.

Figure 42

The plate printed 3 lines of text with unbroken letterforms, unfortunately most counters filled with ink (Figure 42). For this reason, the plate receives 0 points.

The ZPrinter plate earns a total of 5 points and maintains a quality of 16%. While the ZPrinter was one of the fastest platemaking methods, its increase hands on time and delicate untreated form caused it to suffer. The sealing compound was unable to hold ink well and the plates began to crush after multiple prints.

Form 1+

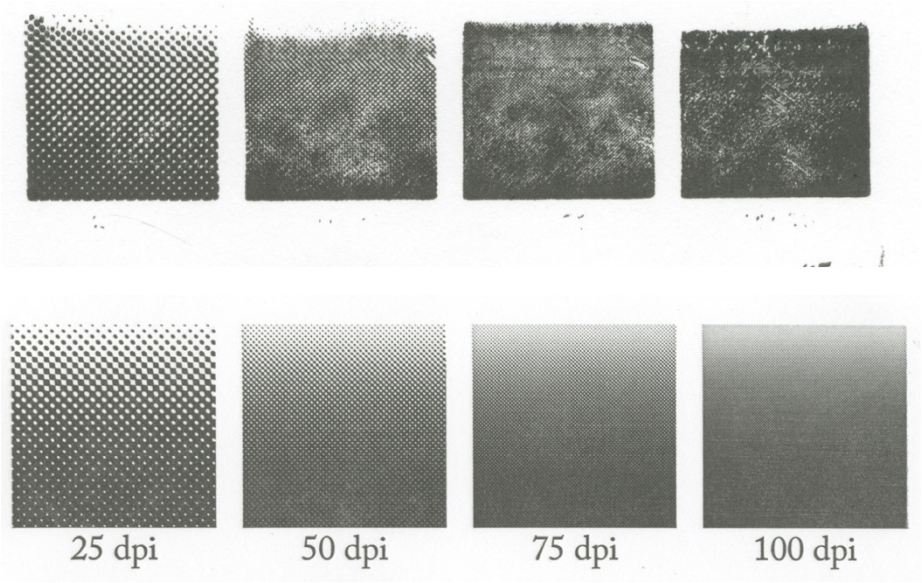


Figure 43

The Form 1+ plate held the halftone patterns well (Figure 43). The 100 and 75 line densities begin to appear more solid and for that reason it receives 2 points.

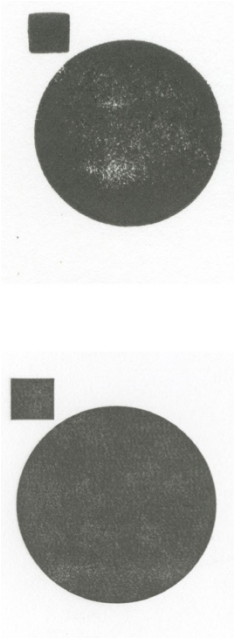


Figure 44

The solids hold up fairly well with a slight increase in mottling (Figure 44). The plate receives 3 points for solid printing.

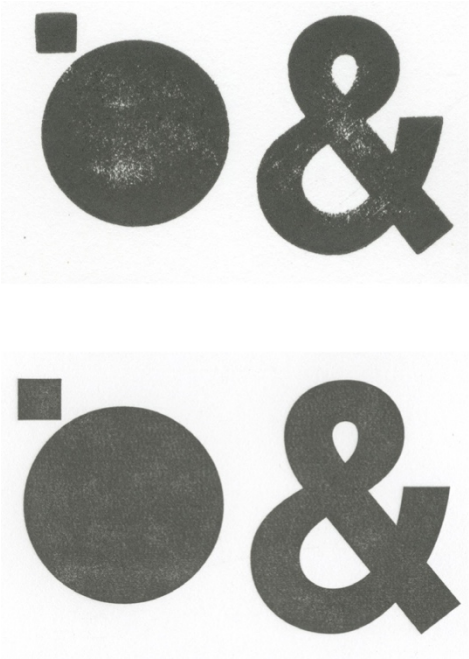


Figure 45

Line crispness is smooth all around, but its vertexes lose their sharp corners and begin to round (Figure 45). For this the plate receives 2 points.

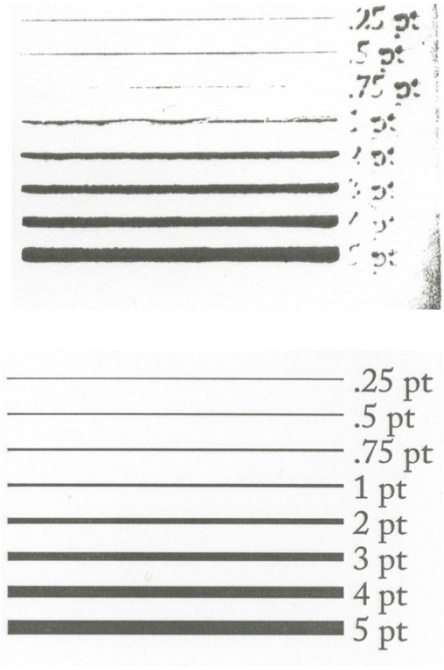


Figure 46

The plate prints 5 unbroken lines, and begins to suffer after 1 pt. (Figure 46). The .5 pt. and .25 pt. almost hold up, and the .75 point disappears almost completely. In this section the plate receives 5 points.

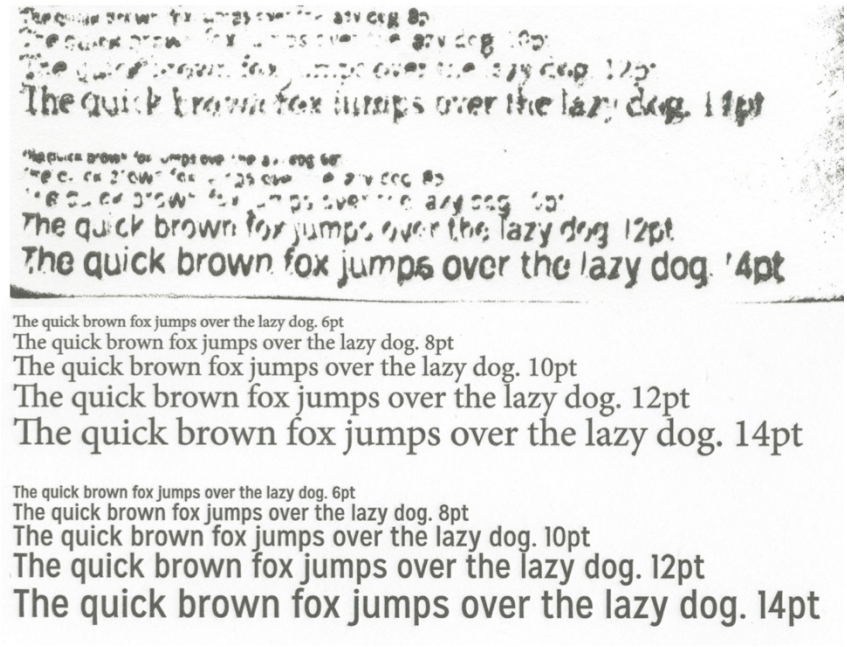


Figure 47

The plate is unable to completely print any full lines of text (Figure 47). It receives 0 points in this section.

The Form 1+ plate earns a total of 12 points and maintains a 40% quality. Remember though that this plate was printed at 72% percent size. If it weren't for the unfortunate size reduction, the plate would have received a higher score. The text weight would still suffer at full size unfortunately. The photopolymer material is slightly soft, causing complex small linework to warp and bend when too much pressure is applied.

Conclusion

This study asked the question, can letterpress plates made from non-traditional media help sustain letterpress printing and hypothesized that the 3d printing and laser engraving technology of the 21st century can produce letterpress plates that are comparable in print quality

to the industry standard of photopolymer plates used in letterpress print production. At this point in time these nontraditional platemaking methods are not one hundred percent comparable in quality to that of photopolymer platemaking. The laser engraved linoleum plate was the closest nontraditional method to come close to the full quality of current photopolymer plates with 80% quality and acrylic not far behind at 73%. With further advancement in laser engraving technology these two methods have major potential for letterpress craftsmen. With adjustments in engraving depth, the linoleum could be substituted for photopolymer plates in certain applications.

The 3d printing technology of the Form Labs Form 1+ printer is getting close to the possibility of making the leap to be able to replace the photopolymer platemaking method. While it only performed a 40% quality test, it shows major potential. With the fast growing market of 3d printing and emphasis on advancement in the technology it could quickly replace the photopolymer platemaking method in the near future.

This study did not solve the problem of letterpress craftsmen outsourcing for plates, but it gives evidence that it might not be a problem for much longer. Nontraditional platemaking is on a steady rise and its continuation would help the sustainability of letterpress print production.

Limitations

While this study shows evidence in the possibility of the 21st century technology of 3d printing and laser engraving replacing photopolymer platemaking, the technology isn't there yet. This case study is smaller than it could have been due to limited access in funding to test out the different brands and technologies of 3d printing. This technology is still in an early age and larger diversity in technologies could shine light on what areas to continue to test in the future.

Suggestions for Further Research

With this being a very small case study, further qualitative research on more platemaking methods using 21st century technology could be conducted. CNC machines are currently being used to aid in the creation of new wooden type forms, but require human finishing to complete. If the technology continues to increase and become more available, it has the potential to be a viable option.

Further quantitative research could be completed to calculate reduced costs. This information could then be used to determine how to efficiently incorporate letterpress labs into graphic design pedagogy. Programs across the world have already begun the revival in academia, but many institutions are holding out due to the high costs involved. Quantitative data holds the key to persuading those who are on the fence on adopting this antiquated printing technology in the 21st century.

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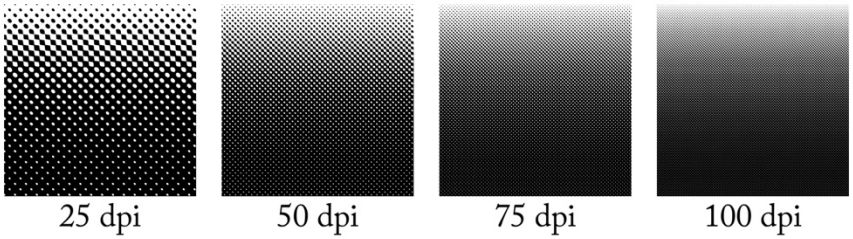
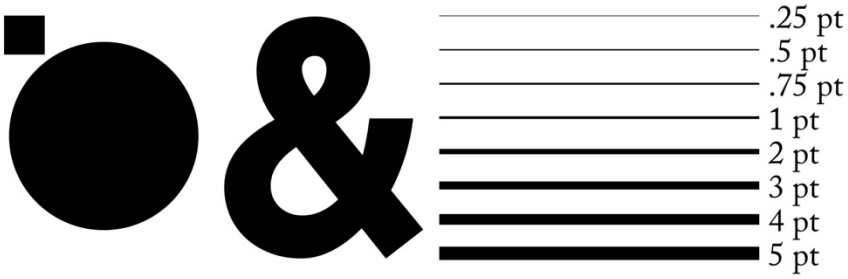
Appendix A - Nontraditional Test Plate Design

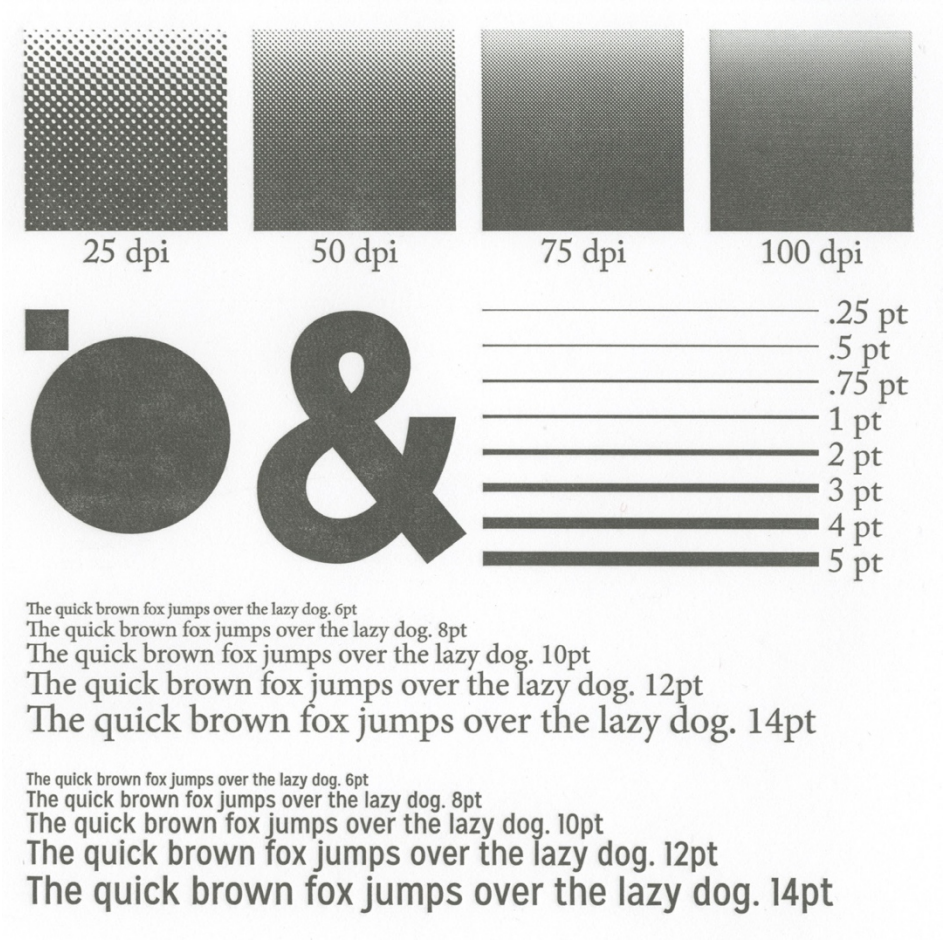




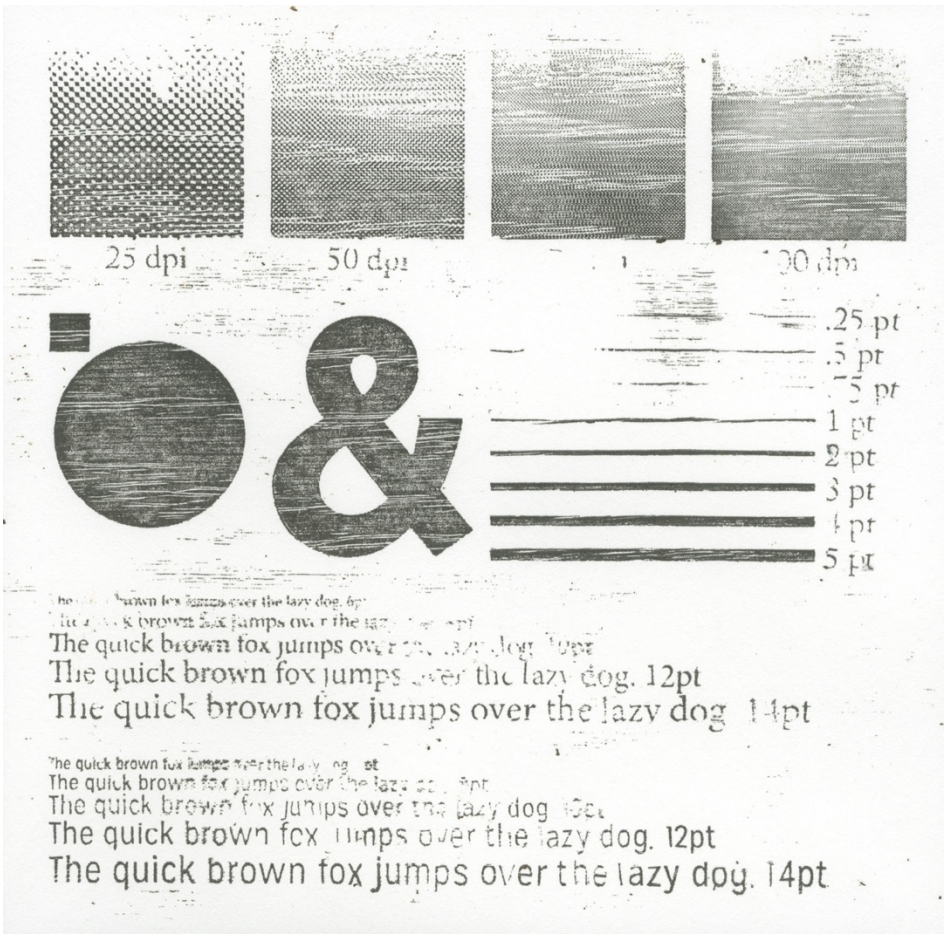
The quick brown fox jumps over the lazy dog. 6pt
The quick brown fox jumps over the lazy dog. 8pt
The quick brown fox jumps over the lazy dog. 10pt
The quick brown fox jumps over the lazy dog. 12pt
The quick brown fox jumps over the lazy dog. 14pt

The quick brown fox jumps over the lazy dog. 6pt
The quick brown fox jumps over the lazy dog. 8pt
The quick brown fox jumps over the lazy dog. 10pt
The quick brown fox jumps over the lazy dog. 12pt
The quick brown fox jumps over the lazy dog. 14pt

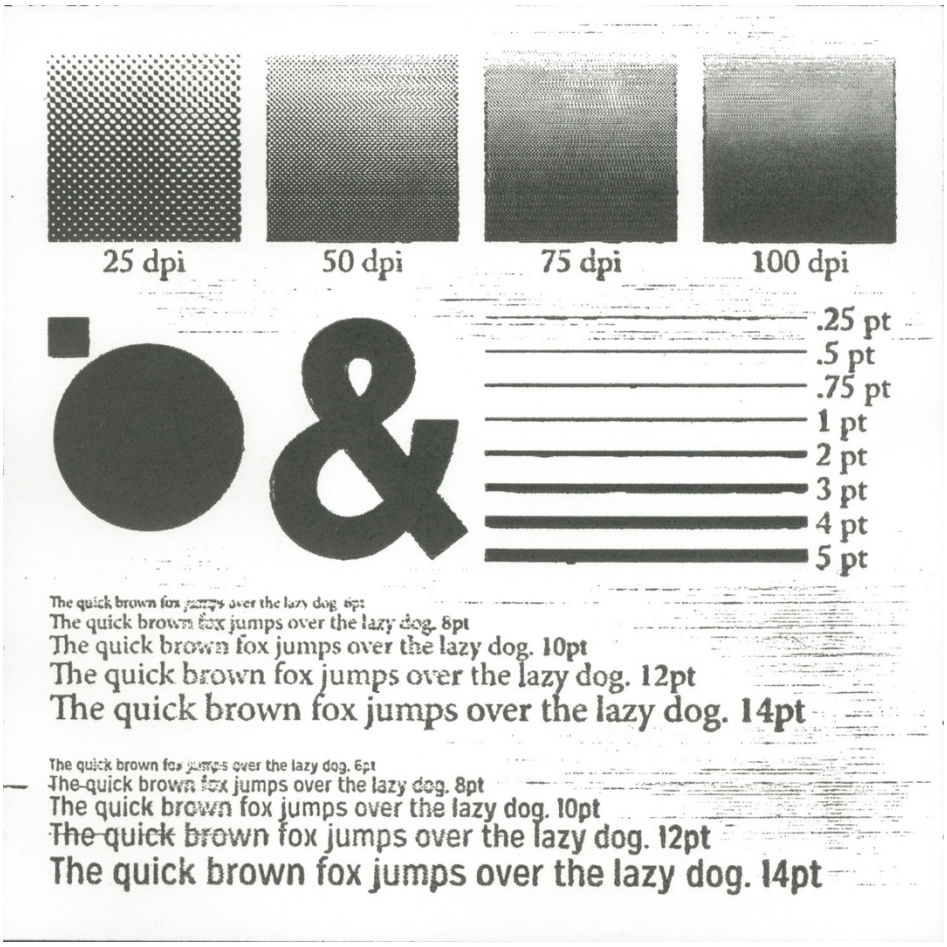
Appendix B - Photopolymer Printed Test Plate Design



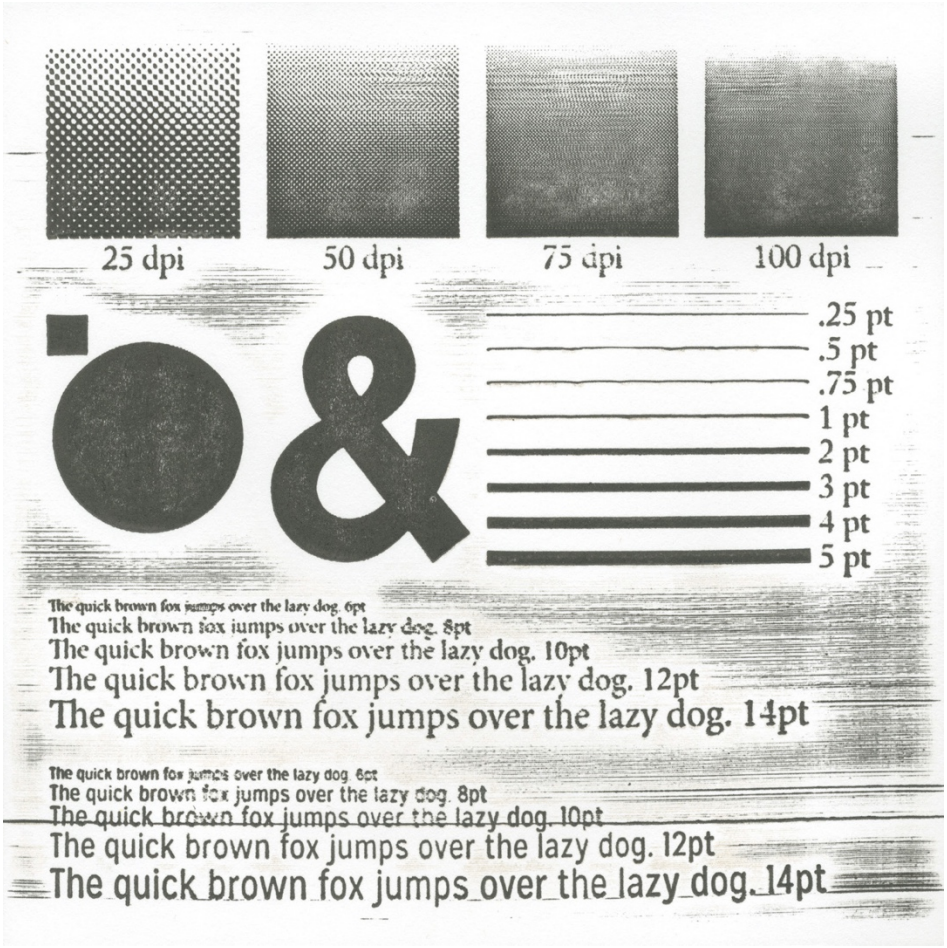
Appendix C - Oak Printed Test Plate Design



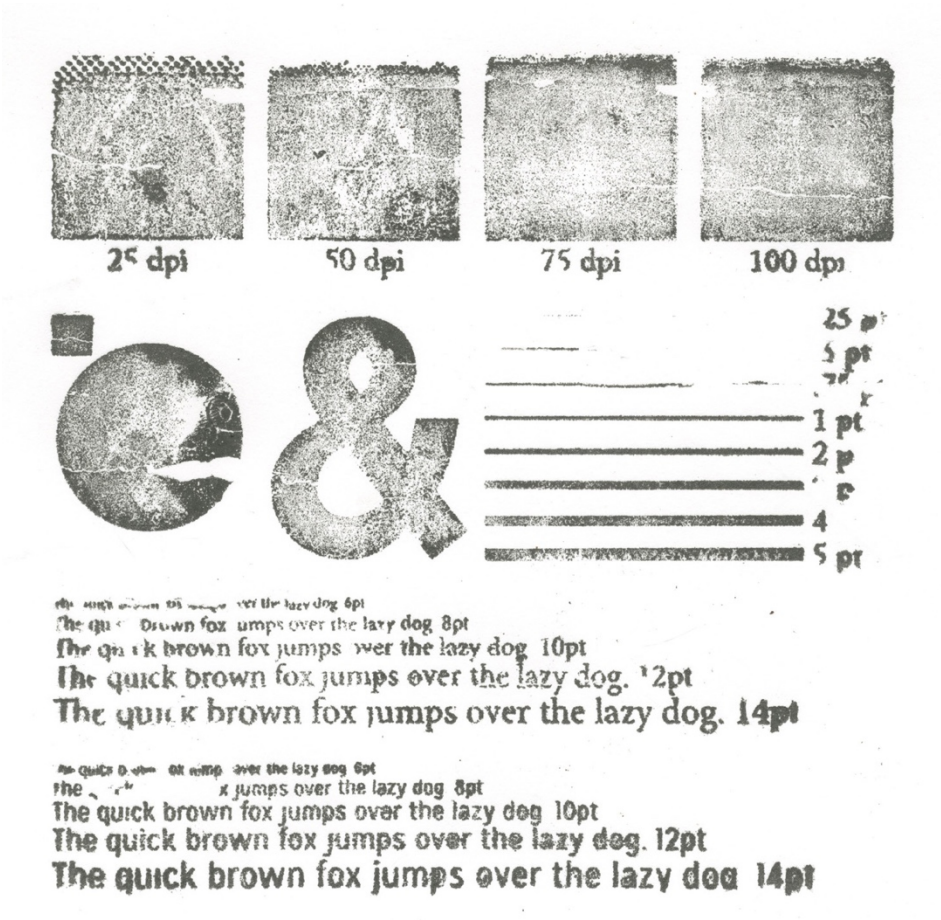
Appendix D - Acrylic Printed Test Plate Design



Appendix E - Linoleum Printed Test Plate Design



Appendix F - ZPrinter Printed Test Plate Design



Appendix G - Form 1+ Printed Test Plate Design