

Optimization Analysis of Linoleum Reduction Printmaking

Cassandra Berringer

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Advisor: Clare Murray Adams

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## Intent

I am an artist, who enjoys the medium of printmaking, specifically linoleum reduction printmaking. I have had much experience with this particular type of printing, but I wanted to experiment further than just the basic cutting and printing of this process. However, I realized that before I could do that I had to know with which materials I was going to work. I had very little idea of what those materials should be; in the past they had always been provided for me in a classroom situation. More importantly, I had noticed in my past experiences with linoleum cuts, the prints did not always turn out well, meaning, the quality of the print was inadequate regardless of the aesthetics of the image or color choices. A poor quality print is one in which the ink has bled, areas simply did not print, or past layers have pulled away from the paper. Blurring and smearing, or the miss-registration of layers, are also problematic. When a computer printer prints words or images, it prints perfectly and the same every time. One of the points of printmaking is the ability to produce several copies of the same work. This cannot be done by any other medium without the aid of a camera or a computer. The ability to make several copies and my interest in creating works that appear visually identical from print to print have led me to ask myself the following questions:

- What part of the linoleum printmaking process prevents the print from being perfect?
- What factors or variables within the printmaking process affect the quality of the print?
- What combination of these variables produce the optimal result?

By understanding how the materials work, an artist can create conditions in which she is more likely to obtain precise prints and copies and less likely to receive failed results. If an artist knows exactly which procedures cause which effects, then she is better able to manipulate the

prints and cause them to look exactly how she wishes. Printmaking is a core medium that almost every artist uses or has used at one point or another in her art career. It is common for artists to experiment with different materials to find something new and creative. This can be seen in the book Jim Dine Prints: 1985-2000. Dine uses many different types of printmaking with a wide variety of papers, combining traditional printmaking techniques with other media. However, my endeavor is not one of artistic innovation, but one that optimizes the product of a process I already know.

Based on my previous knowledge and what I will discover in my exploration, I have chosen to focus on the variables I believe have the most influence on the outcome of prints. These are linoleum, ink, pressure, and paper. I have chosen a few different variations within each variable. Each are explained in depth in their own sections later in this paper.

### History

When I told people the topic for my honors thesis was printmaking, most stared expressionlessly at me. I quickly discovered this meant they had no idea what printmaking was. Printmaking emerged in first century A.D. China as a way to reproduce writings of Buddha. This early form of printed communication was created by rubbing paper on inked blocks of wood, which had letters inscribed into them (Pettersen 7; Ross 2). Images could be carved into wood as well; the first woodblock print that bore an image was in 868 A.D., China. Printmaking became common in the fourth century, and the Chinese created many books from woodblocks resulting in the name “block books” (Adams 776, Ross 2). In the sixth century, Buddhist missionaries brought printmaking to Japan. Later, textile printmaking found its way to the West. It wasn't until the late fourteenth century when the West began to use woodblocks as a way to

illustrate books and make other types of images (Ross 2). Printmaking did not become known as an art form until the late fifteenth century (Cole 126-127). Color ink was introduced to printmaking in the seventeenth century in the West, although the Chinese had discovered colored ink centuries beforehand (Adams 776; Ross 2).

Today, linoleum often substitutes for wood in printmaking. The techniques for carving a woodcut and a linoleum cut are essentially the same. My medium of choice is linoleum because it is easy to cut and has a smooth surface. However, linoleum cuts are sometimes looked down upon for their simplicity, and woodcuts are regarded more highly (Ross 46). Wood is more difficult to cut, not only due to its density, but also to its grain. This grain, some artists claim, give the print more character (Artists). Yet, major artists such as Henri Matisse and Pablo Picasso used linoleum in their printmaking (Ross 46).

### The Process

To begin the process of a linoleum cut, I choose an image. All the images I have chosen to use in this project are based on photographs that I have been wanting to use in my artworks. I transfer a drawing of the photo onto the linoleum with tracing paper and then retrace the pencil lines left on the linoleum with a thin sharpie.

This is only one of several ways to transfer images to another surface; the multiple transferring methods are explained by John Ross in The Complete Printmaker (18-20).

Then using a burin, the design is carved out. (See figure 1.) A burin is a cutter

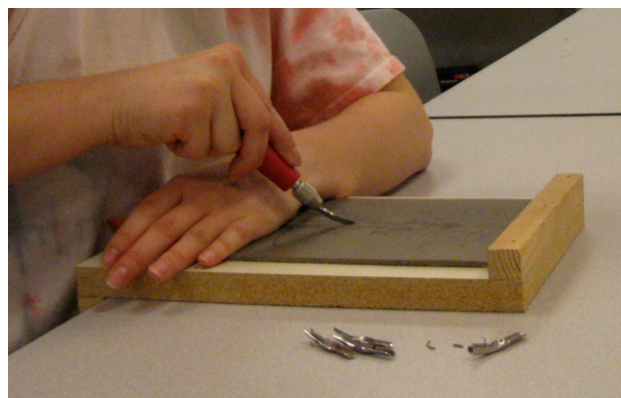


Figure 1 - I am using a burin to carve into the battleship gray linoleum on a bench plate.

with changeable blade tips of different sizes. I want to carve each of these images well because I am going to use the linoleum plate over and over to accumulate many prints. The image carved into the linoleum is the reverse of what is going to be printed. For words to print correctly, they need to be carved backwards into the linoleum. Also, the carvings in the linoleum make a negative image. The areas that have been cut out will not be printed and the paper will be left exposed, but everything that remains uncut will be printed (Petterson 14).

At this point, printmaking ink is rolled out onto a smooth surface like Plexiglas. (See figure 2.) If the desired color is not found among the containers of ink, then two inks can be mixed together with a palette knife to make



Figure 2 - Using a palette knife I mixed brown and white ink together. I am rolling out this ink onto Plexiglas using a brayer.



Figure 3 - I am rolling ink onto battleship gray linoleum using a brayer.

a new color. The ink is applied to the linoleum by a small handheld roller, called a brayer. (See figure 3.) After the linoleum is completely and smoothly covered, paper is placed on top of the linoleum. Pressure is applied to the paper and linoleum cut by either pressing down with a tool, such as a baren, or running it through a press. The paper is then removed to reveal the transfer of ink from the linoleum to the paper to make a print. This process

can be repeated over numerous times to make multiple copies (Petterson 20-22).

Linoleum cuts can be taken a step further using multiple colors by way of a reduction print. After the first round of printing, the linoleum can be cut again in different areas. The linoleum cut is inked up again with a different color. It is lined up, or registered, with a previous

print and printed. This second layer will cover up the first layer of printing except for the newly carved out areas. (See below.) The cutting can continue to a third layer and so on (Pettersen 23).



Figure 4 - The first layer of a reduction print.



Figure 5 - The second layer of the figure 4 reduction print.

A registration board is one way to register prints. This was my choice because it can be used without the help of a second person, and in the past I had found it to be decently accurate. The registration boards are square slabs of wood, which have two additional thin, raised pieces of wood on two adjacent sides of the board perpendicular to each other. A piece of paper is



Figure 6 - Registration board with linoleum.

pinned to one of the thin wood pieces and the linoleum is placed in that corner. (See figure 6.) The paper can then be lowered onto the inked linoleum. For the next layer, the process is repeated by pinning the same paper in the same holes and placing it on top of the linoleum. When the registration board is homemade, as I believe the ones I have

been using are, it may not be an exact right angle and may cause the registration, and thus the second print, to be off. To

remedy this, I always keep one designated side of the linoleum flush with the board and slide the linoleum up to the corner of the board until the other side of the linoleum hits the board. This keeps the registration much more accurate. There are several registration techniques people can

use to align paper with the linoleum sheet, including using paper as a registration sheet to line up the linoleum and paper (Pettersen 16), driving pins through the paper and linoleum, and other methods that John Ross describes in The Complete Printmaker (30-33).

### Linoleum

I worked with two common types of linoleum. The particular brand I used is the Dick Blick linoleum. One type of this linoleum is battleship gray. (See figure 1.) It is thin, but dense and smooth. Cutting is difficult because it is hard get leverage to cut, and it is easy to lose control and let the burin slip. I decided to use a bench plate to keep the linoleum in place and to give me leverage. The bottom of the bench plate hooks onto the edge of a tabletop and it also has a similar hook piece on top. (See figure 7). These hooked edges keep the bench plate stationary and the linoleum in place. (See figure 1.) The use of this aid allowed me to have more control over my cutting and get the leverage for deeper, longer cuts. However, the linoleum's firmness does lend itself well to fine detail.

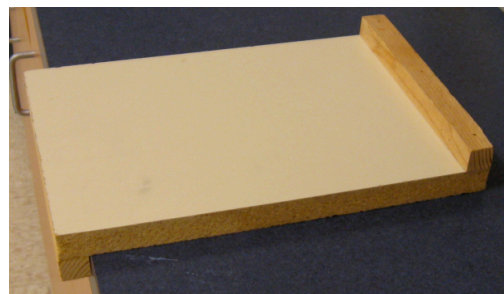


Figure 7 - A bench plate

The other type of linoleum is Wonder-Cut, is thicker and softer than the gray linoleum. It has a pebbly grain that can be felt on the surface. (See figure 23/24) Just as its name implies, Wonder-Cut linoleum is easy to carve. This makes the burin controllable, and unnecessary to use the bench plate. This linoleum is easy to cut because it is less dense, but this also makes it more difficult to create detail. Small remaining pieces tend not to stay connected to the main linoleum sheet and just fall off. It is also too easy to accidentally cut off more than what was intended. Due to the grain of Wonder-Cut, it requires more ink to cover the entire sheet. Also,

the ink on this linoleum dries much faster. This may be due to the grain, which causes more surface area to be exposed to the air than the flat surface of the gray linoleum. I found Wonder-Cut linoleum is more difficult to print with than the battleship gray.

### Ink

The ink I initially used in my printmaking procedures was some older Blick water-soluble ink that I already had on hand. I found that the physical state of the inks varied widely. Some were like liquids while others were almost to a solid state, and the ink came off in chunks. (See figure 8.) I hypothesized that this could be the different ages of the ink because they were not all purchased at the same time, or the amount of exposure to air, which dries them out.

In the past I had encountered a malfunction with the ink in printing. Occasionally, when printing a second, third, fourth, or later layer, the ink on the linoleum would pull off the ink of the previous layer to reveal the paper or earlier layers. I am unsure as to the cause of this, and I could hypothesis all day about what it could be. However, my current hypothesis is the viscosity of the ink is too high; perhaps adding water to thin the ink would help reduce the viscosity.

The viscosity of the Blick ink appeared too high when I printed on drawing paper with Wonder-Cut linoleum. The ink on the print was thick and rough textured, and it included several unprinted little specks where the paper showed through. I watered the ink down so that it would print thinner; this worked. The ink was not as thick, and it had a much smoother texture. I



Figure 8 - One of the thinner inks.



added more water and found that the ink loses so much viscosity that the paper does not even want to stay on the linoleum while printing. I discovered too much water does nearly the same thing as not enough water. It creates unprinted, blurred specks. (See figure 9.)

I conducted a mini-experiment to find the balance of how much water should be added to the ink when printing by hand to get the optimal coat of ink. I measured out a teaspoon of ink and added one drop of water from an eyedropper. (See figure 10.) After



Figure 9 – A print with too much water added to the ink

mixing them together, I printed. I then washed off the ink and added two drops of water to one teaspoon of



Figure 10 – An eyedropper and 1 tsp of ink

ink. I continued increasing the amount of water by one drop from an eyedropper, until the prints

began to move from getting better to getting worse. I found that three drops of water per teaspoon was the best combination.

Unfortunately, I then discovered that due to my many washings, the linoleum became saturated with water even though I dried it off after each washing. Printing with a water-saturated linoleum was

just like adding water to the ink. This begs the question of how

much water was I really adding at each of those steps? Even

though my experiment was tainted, it did prove that adding a few drops of water per teaspoon of ink is sometimes needed to create the optimal result. Also, from this experiment on, I was extra careful to dry the linoleums thoroughly.

For the second half of my study I experimented with two types of ink. I wanted to limit the uncontrollable variables by ordering brand new ink and not using old inks of various

unknown age. I am using Speedball's water-soluble ink instead of Dick Blick's because I have had better past experiences with Speedball. The other ink I am using is Roslow and Jung Akua Intaglio ink. It is a water-based ink made of soy that acts like an oil-based ink (Rostow). It is fabulous to work with because it is a smooth ink and rolls on nicely. There is no clumping, and it does not dry fast. Actually, the entire time I used the ink it did not dry at all. I found that it takes over 24 hours for the ink to dry on a print and depending on the type of paper the ink was printed on, it may take much longer. However, it is not as easy to clean up as the Speedball, which only needs water. The Akua requires soap and water to clean. Because the chemical makeup of this ink is different, it does not lend itself well to having water mixed into it. When I tried to do that, the ink separated into chunks and decomposed so that there was dramatically less ink than before the water was forcefully added. I found that when water is added to this ink, it makes clean up more difficult. It takes many more washes to get the ink off the tools.

### Pressure

Once paper has made contact with the inked linoleum, pressure is needed to transfer the image onto the paper. I decided to use both pressure by hand and the press to find which is the best. When pressing by hand, people can use a tool such as a brayer or a baren, which is disk-like with a handle so one can press down on the paper directly. Instead, I used a large metal spoon, a method I learned from a former art teacher, John Smolko. (See figure 11.)

Through the years, artists have gotten creative



Figure 11 – I am using a large metal spoon to apply pressure to make a print.

with what to use to apply pressure; one Roman artist even used a light bulb (15). In my opinion, the spoon allows more pressure to be applied than either the brayer or the baren.

Using the press is the other option. The pressure of the press can be adjusted to whatever level I wish. Unfortunately, the press I am using has no markers indicating the pressure at which it is set. Therefore, I developed a measurement system to keep track of the pressure of the press.

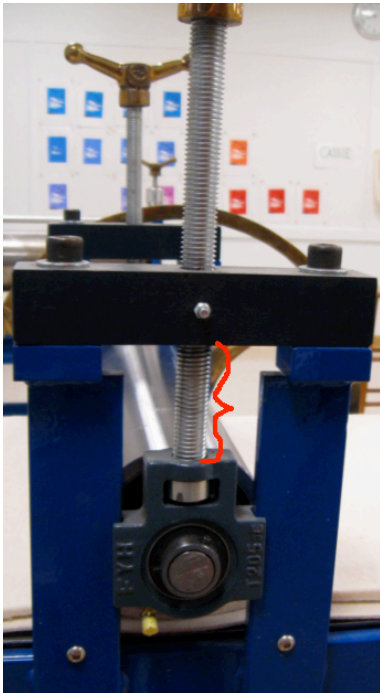


Figure 12 – A side view of the press. The red line indicates the space that I measure.

There is a space between the barrel of the press and the metal bar that holds the pressure rod in place. (See figure 12 and 22.) I measure that space using a ruler. The greater the pressure, the lower the barrel and the larger the space that I am measuring.

The lighter the pressure, the higher the barrel and the smaller the space. I measure the space using the smallest unit of measurement that is available to me, which is sixteenths of an inch. I had determined that after each 180-degree turn of the pressure adjuster knob, the pressure would change by one sixteenth of an inch. The notation I used looked like so: 2

$(\frac{9}{16})''$ . I am not adjusting the pressure a full 180 degrees each time; sometimes I only adjust the pressure 45 degrees at a time.

To indicate this within the notation, I use decimals within the fraction, even though that creates an improper fraction. I also write all the measurements over sixteen, regardless of whether the fraction could be reduced further or not, so that every pressure can be easily compared. An example is  $2(\frac{10.25}{16})''$ . I have gotten this specific so I can keep track of what I am doing and be more specific in my comparisons of pressure. Some of my numerical values may be a bit off,

but I believe this method allows me to keep track of the pressure the majority of the time and allow for a mostly accurate comparison of the pressures of prints.

### Paper

I chose to use four different papers. Each of the papers I chose represents a category of paper: drawing paper, printmaking paper specified for linoleum cuts, printmaking paper not recommended for linoleum cuts, and Japanese paper. The first is common white drawing paper. I wanted the second and third papers to be name brand printmaking papers to see if they really do have the quality that the companies are claiming. Because I really had no idea what I was looking for, I went to Pat Catan's and felt the papers they had. I knew I wanted at least one of the papers to be a soft paper that would be sensitive to the printing. I found that in the BFK Rives paper. It is made by Canson, a famous French papermaking company. BFK Rives is mould made paper that is versatile and recommended for linoleum cut use (Canson). Mould made paper uses the same materials as handmade papers, but it is machine manufactured (Pettersen 14). One of the most famous papers is Arches Cover. It is not known for its use in relief printing; however, Jim Dine used Arches Cover in many of his wood prints (Carpenter 101). I wanted to find out if this paper would work for linoleum cut printmaking. It is a heavy mould made paper with a grain that is also made by Canson (Canson). Lastly, I have been hearing for years that Japanese handmade papers are great for relief printmaking. However, there are many to choose from. In the Dick Blick catalogue alone, there are ten different Japanese papers, and each one a little different (159).

I researched Japanese papers, washi, so I could make an informed decision. Washi, is very thin, like tracing paper. Authentic washi is made from the inner bark of one of three plants,

kozo, mitsumata, or gampi (Japanese Paper Place). Unryu paper is made from kozo and comes in large sheets. I was drawn to its signature long swirling fibers that are added to the paper, hence the name “unryu” meaning “Cloud Dragon Paper” (Dick Blick 159).

I learned a lot about the Unryu Japanese paper through my experimenting. It has two different sides; one side has a soft texture with the fibers exposed, and the other side is very smooth. I had no idea which side was the correct side to print on, so I guessed the textured side. I guessed wrong; the correct side to print on is the smooth side. When I attempted to print on the other side, the paper did not pick up the ink well. Also, I was unable to rub the back of the paper because it would roll up under my fingers and start shredding with fibers coming off. I tried everything I could think of, but nothing could rub the back without damaging the paper. Thankfully when I print on the correct side, I do not have any of those problems. I have to be careful and gentle when rubbing this paper, though, because it tears easily and can make unwanted holes in the middle of the print. When printing with the Unryu paper, I can see the linoeum through the paper, and as I press the paper into the ink those areas get darker. (See figure 14.) Then when printing another layer, I can see when the print was lined up with the previous printing or when it is off, not that I can do anything once the print is down on the ink, however.

One advantage to printing by hand is that I can peek. I can lift up an edge of the paper to see if I am pressing hard enough or if I have missed any spots. (See figure 13.) I am not able to do this with the washi because it is so light; it will not set back



Figure 13 – I am peeking at a print after applying some pressure.

down in the same place. Since the paper is so thin, it gets badly crinkled when run through the press. I found a remedy to that. Before the linoleum is run through the press, a sheet of paper is placed underneath the linoleum and one is placed on top of the linoleum. (See figure 14.) These

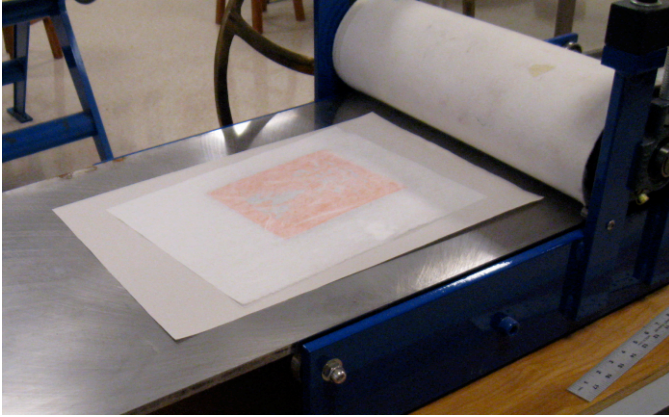


Figure 14 – An inked linoleum with a sheet of Unryu paper is set on a protective newsprint sheet. They are sitting on the press bed before having the top protective sheet placed on top. The ink can be seen through the thin Unryu paper.

are to protect the press from the linoleum and any excess ink. Usually newsprint is used as this paper because it is the cheapest. However, it is also thin. I have found that in most cases when the printed paper is crinkling due to the press, if the newsprint is replaced with a thicker, stiffer paper like drawing paper, the printed paper will not crinkle. This problem occurred

most of the time with the washi, but occasionally it happened to the other paper, as well. I also discovered that when I press the washi down with my hands, the ink actually seeps through the paper and onto my hands. I had to be cautious not to get ink on anything else. The ink seeping through the paper was especially evident when printing on the press. So much ink would be pressed through the paper that the drawing paper on top could almost be considered a full-fledged print. Lastly, as the ink dried it pulled and caused the paper to wrinkle and warp. This was especially true when using Speedball ink. When I pinned up a printed Unryu paper, I used eight pins, instead of my usual four, to pin every corner and each side. This helped keep the paper flat.

### The Experiments: Selecting the Variables

I orchestrated four experiments within my study of linoleum reduction printmaking. The main point of the first two was to identify the variables within this type of printmaking; the last two were concerned with experimenting with the selected variables. While I was working through the process of linoleum reduction printmaking, I was extra observant to everything I was doing so that I was better able to identify the variables within this process. Then, based on that information and other observations, I chose what I believed to be the most important variables within the process and conducted the second two experiments by varying those chosen factors.

My first study did not go quite as planned. I adjusted my procedure numerous times on the fly based on new developments. I encountered my first hiccup immediately as I had completely forgotten about the very first variable, the linoleum itself. My advisor, Clare Murray Adams, asked me what linoleum I was going to use, and I had assumed I was going to use Wonder-Cut linoleum. However, she suggested I try the battleship gray linoleum as well. By adding a second type of linoleum, I added a whole new part to my experiment.

In the first two experiments I attempted to limit the variables as much as I could, based on what I already knew. I made prints only using one type of ink, Blick water-soluble ink, and one type of paper, white drawing paper. At this point I had planned to use the first two experiments to discover whether pressure by hand or by press was more effective so that I would only need to use one of those options for the second two studies. However, I discover that both have their advantages and disadvantages. In the end I chose to include both in all of my experiments.



Figure 15 – Good print from the press.



Figure 16 – Badly smeared print.

The goal of these particular studies was to find the variables and get myself reacquainted with the linoleum cut printmaking process. In the first experiment I used battleship gray linoleum and created 20 prints. I made more prints than I had originally planned to in relearning this process. I first tried the press because I hypothesized that it would produce the best results. I found at the pressure 2 (11.5/16)'' the ink on the print was the most solid. (See figure 15.) Any lighter and there would be specks of unprinted areas where the paper was showing through the print. When I tried using the spoon to apply pressure, the paper just slipped around on the linoleum and produced a smeared print. When I attempted to hold the paper still, it would still smear a little. (See figure 16.)

I cut out more linoleum from my block for the second layer. I had to cut away the majority of the linoleum in order to get the desired image, which left only a little of the linoleum intact.



Figure 18 – A good second layer print using the spoon for pressure.

(See figure 19.) This affected how the linoleum was printed.

The effectiveness of the press and the spoon switched roles. When I printed this minimal area with the press, the paper slipped. The ink did not remain in the non-cut out area, but gushed outside the edges. (See figure 17.) No matter how light I set the press, the ink gushed out, slipped, or only partially printed. The best pressure I could determine

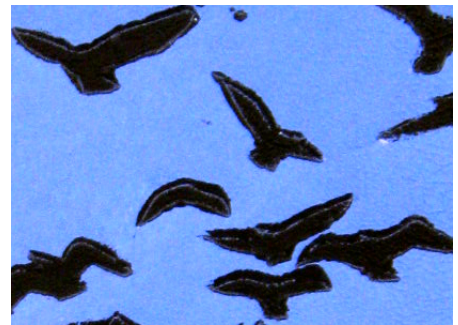


Figure 17 – Ink gushed out around the bird printed areas.



was 2 (11/16)". This indicates that the pressure needs to be lightened as layers progress. When I used the spoon on the paper and linoleum, the ink printed well, as not much pressure is needed. (See figure 18.) I also found that using the press slightly crinkles the paper and does even more so when the press is used twice on a print. However, this was before I learned to replace the protective sheets of newsprint with drawing paper. Lastly, I encountered a slight peeling problem with one of my prints, but only a few minute spots were affected.

How much linoleum has been cut out seems to be a determining factor in the kind of pressure used: by hand or with the press. My conclusion in this area is that when there is a large area that is inked, the press tends to be a good choice. Applying pressure by hand takes so much muscle and effort that accidentally moving the paper is a common, unwanted side effect. On the opposite end, when a small area of inked linoleum is left (see figure 19), the press is unable to hold on to the print as it goes through, moving the paper while applying too much pressure. A lighter touch by hand is easy to keep the paper in place and smoothly rub.

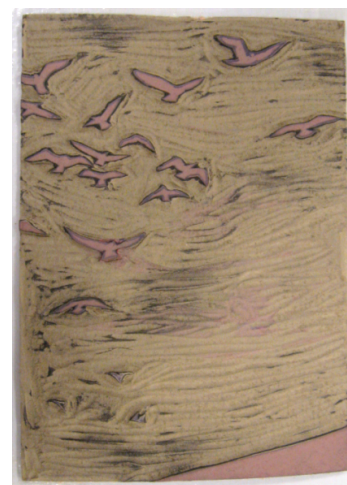


Figure 19 – The final cut on a battleship gray linoleum after printing. Only the birds and bottom right corner are in tact.

I continued my search for variables into my second experiment using Wonder-Cut linoleum where I created 20 prints. Printing by hand I had no problems with the paper slipping. However, the prints did tend to have many unprinted specks throughout the printed areas. (See figure 20.) It is at this point that I chose to experiment with adding water to the ink, discovering that adding a little bit of water is helpful only when printing by hand. When I printed using watered down ink on the press, the print was splotchy with lighter and darker speckles. Even

though I was able to achieve a good coat of ink with pressure by hand, using the press on 2 (9.75/16)'' was much less work.

I cut much of the linoleum out for the second layer with only a little linoleum remaining. I found that the press printed a good solid coat, without much gushing, at pressure 2 (9.25/16)'. The paper only crinkled a little. I attribute this to the fact that the pressure is not as great as when using the gray linoleum because it is thinner than Wonder-Cut.

Printing by hand did not work quite as well as it did

with the press. Some specks were left unprinted, and adding water did not seem to change anything. There are a few prints that have peeled away spots. One print has numerous small areas and one large area about two inches by a half-inch where the ink peeled away. (See figure 21.) At this point I hoped to gain more insight as to why the ink does this when I conduct later studies, but I found that under no other circumstance does the ink ever peel off. Thus, I must



Figure 21 – The peeled away ink is the white area within the black waves.

conclude that this is due to the combination of using the Blick water-soluble ink on the white drawing paper.

Although the ink peeled once using the battleship gray linoleum, it happened more frequently with Wonder-Cut, meaning that Wonder-Cut linoleum may have contributed to this phenomenon.

I found more variables than I had been expecting within this printmaking process. The following is a list of variables I discovered over the course of my first two experiments:



Figure 20 – A final print from experiment two. There are some tiny white specks on the right hand side of the print.

linoleum, ink type, ink brand, registration technique, paper type, type of pressure, amount of pressure, dryness of ink, and how many layers of ink have already been printed, the amount of water added to ink/viscosity of ink, water saturation of the linoleum, and the amount of ink on the linoleum. The last variable I discovered was when the ink began to dry on the linoleum and the next coat of ink caked up on it making the next print thick and spotty. I have not yet tested what effects most of these variables have on a print or if they have any effect. I merely found points within the process that could change and thus could affect the print.

I did research to find if there were any other variables I was missing which affect the visual appearance of a print. In The Instant Printmaker by Melvyn Petterson and Colin Gale, the authors describe the different materials that are used in printmaking. These tools can be substituted for other versions that may or may not affect the final version of the print, but they do

have some bearing. The brayer is a variable because how the ink is applied and how much is applied to the linoleum surface can affect how much ink is printed and what kind of texture results (9). Press blankets are thick cloths that lay on top of the press bed and protect the press barrel and the linoleum or whatever material that is being printed (11). (See figure 22.) The

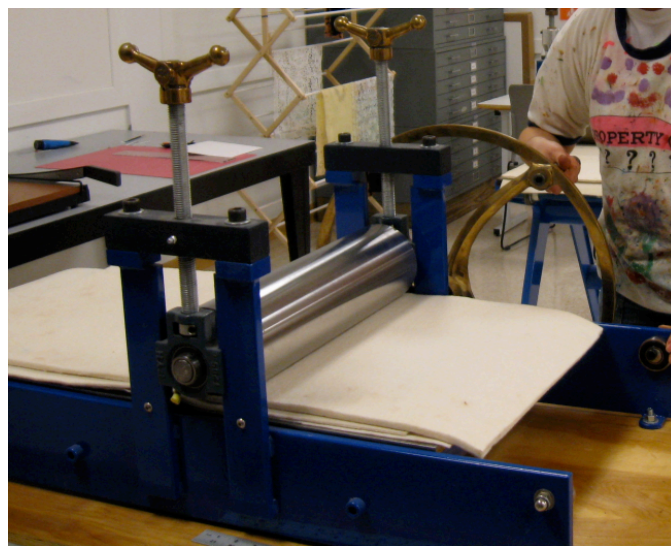


Figure 22 – I am turning the wheel of the press to run a print through. The white press blankets are between the silver barrel and the print.

quality and thickness of these sheets can affect how much pressure is needed for the prints and how the pressure affects the prints. Paper has many variables within the realm of “type.” Paper

can be machine-made, handmade, or mould-made. Paper has different weights and different amounts of sizing. Sizing is how much glue is in the paper to give it strength (14).

Out of all the possible variables I have discussed and researched, I chose the ones I believed to have the most significant influence on the outcome of prints. The variables I chose are type of linoleum, type of ink, type of paper, type of pressure, amount of pressure, and viscosity of ink. I conducted two first studies instead of just one because I was experimenting to see which linoleum I would like to use. Even though I determined the battleship gray linoleum printed the best and with the least complications, I may use Wonder-cut linoleum in the future because it is easy to cut. I wanted to find the optimal combinations for that as well. Thus, I decided to make linoleum a chosen variable instead of a constant. I am using both types of linoleum and making both of them reductions. I am also using two types, or more accurately, two brands of ink Speedball and Akua Intaglio. Due to the varying results, I will experiment with both the press and applying pressure by hand in the second two experiments. I will also add water to the ink when I think it may be helpful, which will affect the viscosity of the ink. Lastly, I am using the four different papers: drawing paper, Arches Cover, BFK Rives, and Unryu paper.



Figure 23 – Cut one of Wonder-Cut linoleum of experiment two.



Figure 24 – Cut two of Wonder-Cut linoleum experiment two.

The Experiments: Using the Chosen Variables

The shift of my study now moves from finding variables to using those variables to determine what combination produces the best printing result. By constructing a tree chart, I set up my experiment. (See figure 25.) I will try each linoleum with each ink, every paper, and both

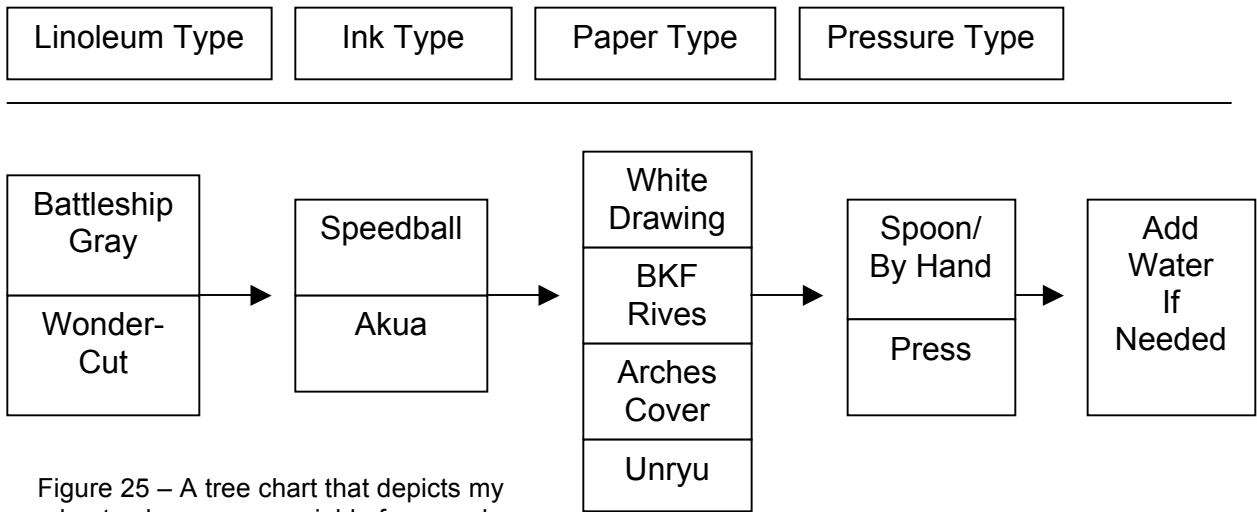


Figure 25 – A tree chart that depicts my plan to choose one variable from each category for my last two experiments.

types of pressure, and then add water to the ink if necessary. I also set up a table to record my observations in an organized manner. (See figure 26.) I realized that I had already fulfilled the needs of using the Speedball ink on the drawing paper since the Blick and the Speedball water-soluble inks are nearly identical. Looking back to what I had already done, I filled in the necessary squares on my chart.

I wished to experiment with both the first and second layer of the linoleum, and I wanted the first layer imagery to be able to stand-alone and make sense without the second layer. I chose images with which I could do this. In all the prints

Figure 26 – A table that I created to record observations. The table size is 15 1/2 x 21 inches.

that I intended to have, only one layer I used black ink. There are a couple reasons for this. First, it has historically been the color for a single layered print, and it clearly distinguishes the ink from the paper (Adams 776). The other reason is that I had hoped that I would be eliminating an uncontrollable variable if I ordered all new ink from the same company. I was wrong. All my inks were very different in their viscosity and thickness from each other. Thus, by always using the same color I am keeping a constant. Unfortunately, when I change to a different color for the reduction print, the consistency of my ink is different. Instead of the age of the ink making a difference, perhaps it is the color pigment that creates the viscosity difference in the inks.

I began with the battleship gray linoleum and the Speedball ink and tried each paper. For each linoleum-ink-paper combination I found the best type and amount of pressure to use. Once I found that, I made a few colored registered prints that I could use for the second layer. Then I went on to Akua ink and repeated the same process. I then carved the battleship gray linoleum for the second layer print. I added a second layer to the prints that I had designated as such. I then followed the exact same procedure with Wonder-Cut linoleum. These second two experiments totaled 190 prints.

### The Results

I am not going to recount everything that happened in every variable combination. That is not my main concern, and those details can be seen on my chart. Even with all my earlier preparation work, I still discovered a variable I had not considered beforehand. The amount of ink on the linoleum when printed affects the quality of the print, especially with battleship gray linoleum on the Arches Cover with the Speedball ink. For that particular combination, pressure

seemed to have very little affect on the quality of the print, but the amount of ink applied to the linoleum did. I had to roll the ink on relatively thickly. I have realized though, on most prints, the amount of ink applied is important. Too much ink causes gushing and splotches, but too little ink means some of the image does not print.

My experimentation with Wonder-cut linoleum produced failed results. When I applied pressure by hand, the paper would slip despite the type of paper almost every time. It is nearly impossible to work with Akua ink on Wonder-Cut linoleum. Sometimes it felt like I was trying to print on ice; it was so slippery. I had better luck with the press, but when I would try to transfer my print from the registration board to the press, the paper would almost always end up moving and smearing the print. (See figure 27.) This became even more true when I printed the second layer of Wonder-Cut linoleum using the press. However, it wasn't just the slipping that was frustrating; the registration of the prints was proving difficult, as well. (See figure 28.) Out of the 25 Wonder-Cut second layer prints, only one completely registered correctly. I did not have nearly this amount of difficulty with any of my previous three linoleum reduction print series. Yet, that opened my eyes to the idea that perhaps I should have looked into different registration



Figure 27 – A blurred, single print with Akua on Wonder-Cut in black ink.



Figure 28 – Miss registration of the second layer of a Wonder-Cut print using Akua ink.

techniques more to find one that had a high accuracy rate.

Notable results deduced from the studies I have conducted for Wonder-Cut linoleum are presented below:

- The best combination of variables for a reduction print is the Japanese paper with the Speedball ink, using either the press or by hand. This is the only combination in which the ink actually sticks well to the paper. (See figure 29.)
- A second good print combination for a reduction print is the Speedball ink on Arches Cover with the press.
- I managed to get one good reduction print out of Akua on drawing paper.
- The Speedball worked much better than Akua with Wonder-Cut linoleum.
- Many good single prints using the press were produced in every combination.
- The best single prints are using Speedball ink on the printmaking papers Arches Cover and BFK Rives.
- Surprisingly, using Akua ink on drawing paper printed well when water was mixed into the ink.

Battleship gray linoleum printed well with almost every combination of variables. Below is a more specified account:

- This linoleum printed consistent, smooth, solid coats of ink with the Akua ink on every surface when using the press.



Figure 29 – Perfect registration of a Wonder-Cut print using the Speedball ink on Unryu paper.



- The press tended to be more effective than applying pressure by hand.
- The two most successful reduction prints were the BFK Rives and the Unryu with the Akua ink.
- The least successful prints were the Speedball on Arches Cover. Most of the prints were riddled with unprinted specks of paper.

What I looked for in the overall best combination of variables was a consistent solid coat of ink that does not gush for single or multiple layers. This requirement was met using the battleship gray linoleum with Akua Intaglio ink on Unryu paper at a high pressure on the press. (See figure 30.)



Figure 30 – One of the best prints of my study. A battleship gray print using Akua ink on Unryu paper.

### Conclusion

230 prints later I came away with more than numerous charts and lists of data, but a valuable learning experience. Even though there is a science to some art techniques, science cannot contain art. As much as I wanted to create a scientific and mathematical approach to structure and quantify printmaking it became difficult to do so. Many of the variables I uncovered cannot be quantified accurately. Even when I tried to keep certain variables controlled and constant, I humanly could not keep everything that exact. When I would get caught up in the exactness of some of my experiments, I had to remind myself that this is not a laboratory science experiment, but is still art. There is an ebb and flow to art that cannot be

contained within a box. Although there were several frustrating moments, overall I enjoyed the process. I truly am a printmaker at heart because I found those consecutive hours of working on prints to be tranquil. If I could just do printmaking and listen to music all day long, I would.

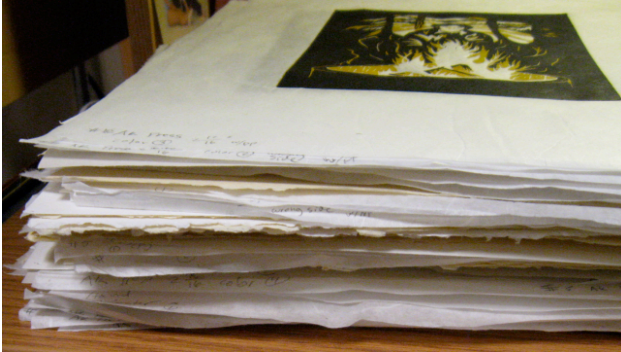


Figure 31 – All 190 prints from the last two experiments alone stacked together in one pile.

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