A Controlled Heating System for Encaustic Monotype
PY 681 Final Project Proposal
Leah Pillsbury
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Abstract
Encaustic monotype is a printmaking technique that was developed by Dorothy Furlong Gardener in the early 1980s. The technique combines the quickness of monotype on an etching press with the texture and bold colors that one can achieve by painting with melted wax. I propose to build a hot plate to be used for encaustic monotype that will heat evenly to the desired temperature without overheating. Overheating results in improper wax melting and flow for painting as well as the release of toxic fumes, so avoiding it is of utmost importance.

Technique
An anodized aluminum plate is heated to 170 degrees F and then encaustic paint is applied directly to the plate. It melts and the artist has significant freedom to work with the wax at that temperature. When the desired image is achieved on the plate, the artist lays a piece of absorbent paper on the warm plate and transfers the image to the plate (see Figures 1-3)


Figure 1: Encuastic painted design on heated aluminum plate

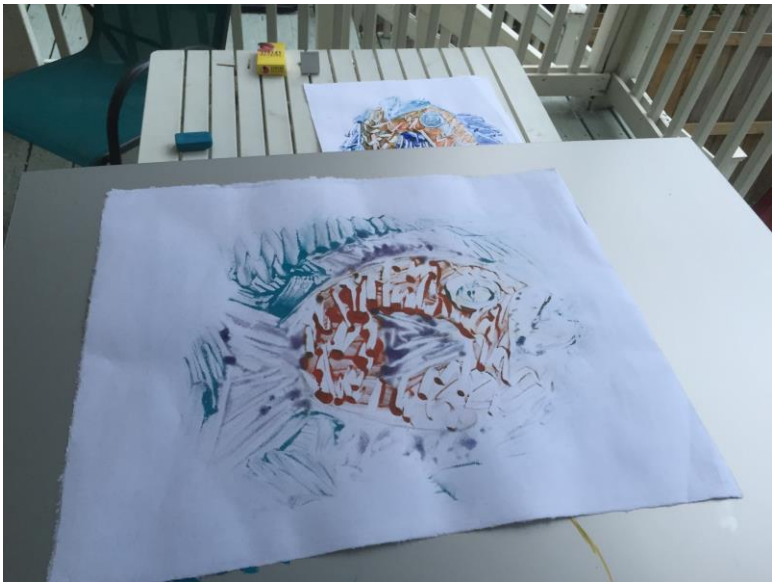

Figure 2: Printing the encaustic monoprint on paper

Figure 3: Final prints

The techniques that artists currently use to heat the metal plate are inefficient and often result in overheating. Either they build an insulated box below the metal plate with incandescent lightbulbs attached to a dimmer to generate heat or they put the plate over a hot plate. Either technique involves continuous temperature monitoring and the risk of exposure to toxic fumes.

I propose to build a unit with electric heating elements and a temperature sensor that feeds into a microcontroller in order to ensure even heating without overheating.

Relevance
I am an artist who enjoys printing with this technique and I am also the Print Shop Lead at the Artisans Asylum in Somerville. In order for myself and others to enjoy printing with this technique, I need to perfect a system that can be used safely at ambient temperature, provided the artist works in a setting with proper ventilation.

Design and Parts List
The basic elements are a microcontroller, heating elements, and a temperature sensor. I already have many of the pieces except for the heating elements, the relay, and thermocouple.

I considered two possible designs for this project. One is to create an insulated box and place an off the shelf hot plate and some small computer fans in it and cover the box with the aluminum sheet. In this design the hot plate heats the air which heats the plate. This design is nice because I already have some small fans and a hot plate. It is not my first choice because it is inefficient to heat air and then heat the plate by convection. Also I worry about fire risk inside the box and the size of the whole apparatus since the box would have to be several inches high for there to be enough air space between the hot plate and the aluminum sheet.

My first choice design would be to attach silicon rubber heating elements, the kind used for 3D printing beds, to the back of the aluminum sheet. This design is superior because it eliminates the need for a large box and fans and transfers heat to the plate via conduction. The heating elements also come with the built in insulation and that seems safer for extended use. I have contacted one manufacturer and need a bit more information about wattage and price.

Table 1: Part Requirements

Part	Quantity	Specifications	Status
Anodized aluminum sheet	1	1/8 in thick and 23 ¾ x 36 inches square area	Already have it
Arduino	1	Arduino Genuino Uno	Have it in eLab
Arduino 5V power	1	Plugs into circular port	Already have it
Heating elements	4	3 X 24 in rubber silicone heating strips	Want to purchase something like the ones available at https://www.omega.com/pptst/SRFR_SRFG.html Already emailed manufacturer asking about correct wattage. Need to find pricing or maybe we already have some?

Thermistor or thermocouple	1	Works with Arduino	Need to find one that can accurately measure in the 76 °C range
Solid state relay	1	Works with Arduino, can toggle heating element on and off based on thermocouple readings	Need to find one
Stand	1	Probably make out of wood or PVC; something that won't burn or conduct	Plan to construct from available parts