DIGITAL LACE: PROCEDURALLY CREATED DESIGN

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ABSTRACT
Digital Lace is a set of laser-cut paper panels that explores the intersection of intentional decision-making and computer-created randomness. The project uses a set of illustrated symbols, a computer program that randomly places the symbols and rearranges them based on a simple algorithm, and laser cut paper panels that are created from the computer-generated file. The final pieces exemplify the kind of modular design present in digital design while celebrating the materiality and tactile quality of traditional art.

DESCRIPTION

Typically, the practice of design affords the designer almost complete control over the form of a finished piece. For example, a graphic designer determines the size, format, colours, typeface, reading sequence, and reading distance of a printed piece. However in digital media, the designer can make suggestions but no longer has complete control over how the final design is viewed, what information is being presented, or how the user views it on a variety of devices. Many digital designs are composed of modular elements that are remixed on demand based on the user's rather than the creator's desire (Manovich, 2005). Additionally, a large percentage of design is never realized as a physical product – it exists only on a screen for a short time.

The experimental series *Digital Lace* is a group of laser-cut paper panels that explores the tension between designer intent, randomness, and physicality. The project was intended to explore how randomized modular designs can produce cohesive and attractive final products. The project is created from three distinct elements: a set of symbols created using traditional design techniques, a computer program that chooses and arranges the symbol set into a 38 x 50 centimetre matrix, and a laser cut paper panel that is made using the file created by the computer program. To begin, the 50 individual symbols that compose the lace were created using Adobe Illustrator.

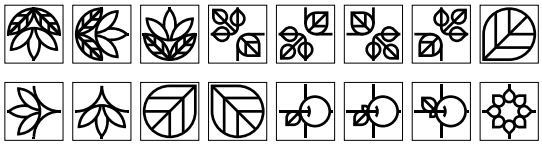

Figure 1: Sample of the symbol set created in Adobe Illustrator

These shape elements are the component of the project that relies most heavily on traditional design and illustration techniques, and employ the most authorial control. Each symbol is based around a circular cell with four connecting points located at each cardinal direction, so as a group they are able to combine into a coherent piece of 'lace'. Early experiments used a set of symbols that were completely random outside of their underlying grid; this produced a less cohesive finished result. To provide a sense of balance the symbols in *figure 1* were designed with a common organic theme.

The finished symbol files were exported as individual SVG (Scalable Vector Graphics) files, named numerically, and made available to a computer program to be arranged into the final composition.

The program that selects and arranges the symbols was created in the open source language *Processing*. The *Digital Lace* program for *Processing* is an evolution of the classic *Game of Life* programing experiment created by James Conway in the 1970s and described by Matt Pearson in the book Generative Art (Pearson, 2011).

Game of Life uses cells that are either on (black) or off (white). Each time the program runs the individual cells check on the state of their neighbours. If a cell has two or three neighbours it remains black otherwise it becomes white. If a white cell has exactly three neighbours it reverts back to black. The *Game of Life* and the *Digital Lace* program both use object-oriented programing conventions to create a grid of semi-autonomous cells that can respond to the action of neighbouring cells. Pearson shows how the original *Game of* Life program can be altered to include an infinite number of states beyond just on or off so more complex behaviours can be examined. The *Digital Lace* program builds off this base, starting with a grid of cells is randomly populated with graphics from the symbol set library. When the user clicks, each cell mathematically averages the numbers assigned to the eight cells adjacent to it. Using that value rounded to the closest integer, the program selects the next symbol file to populate that cell with. Over time this creates a grouping effect, because individual cells are working to make themselves more like their neighbours. Homogenization is prevented by randomly reassigning a number to cells whose neighbours have reached the maximum or minimum value.

Figure 2: Screenshot of the Processing environment and the *Generative Lace* program running in the background.

When the program is active, a user can click on the keyboard at any time to output a PDF (Portable Document Format) file of the symbol grid.

Collecting these files over a discrete period of time allows the user to capture a record of change and evolution over time. Once collected, the PDFs are sent directly to a laser cutter to be produced out of paper.

The finished cut pieces can be viewed individually and aesthetically as discrete artworks, or they can be arranged horizontally in space to visualize the program's progression over time. Using rapid prototyping technology like the laser cutter allows the realization of multiple incremental stages of an artwork that would be expensive, time consuming, or impossible to make with traditional production methods. *Digital Lace* leverages the best of both worlds of 'mass customization': individually unique and unpredictable designs are created using the tools of precision manufacturing.

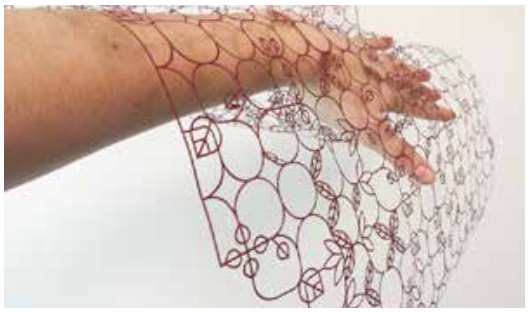

Figure 3: Finished lace panel.

The results of this project are intended to be conventionally aesthetically pleasing while exploring the intersection of intentional decision-making and computer-created randomness. The final pieces exemplify the kind of modular design that is becoming ever-present in the digital realm while celebrating the materiality and tactile quality of physical objects.

REFERENCES

Pearson, M. 2011. *Generative art: A practical guide to processing*. Shelter Island, NY: Manning Publications Co.

Manovich, L. 2005. Remixing and Remixability. [pdf] Available at: http://imlportfolio.usc.edu/ctcs505/ManovichRemixModular.pdf