

Caged

ABSTRACT

In this paper, I describe the Interactive Light Sculpture *Caged*, its concept, hardware and software process.

Categories and Subject Descriptors

D.3.: arduino, C++ .

General Terms

Algorithms, Performance, Design, Experimentation, Human Factors

Keywords

LED, LED matrix, interactive, sculpture, light, sound responsive, arduino.

1. INTRODUCTION

CAGED

Media: Vocally Interactive Light Sculpture (copper, LEDs, silicon, microcontroller)

Size: 36cm³

<http://www.interpolations.org>

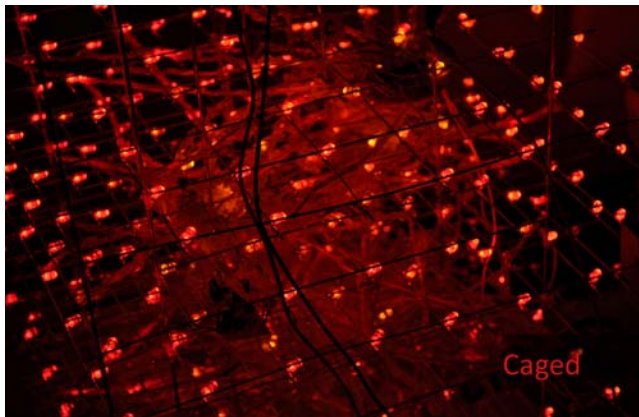


Figure 1. Caged (Niemczyk, 2010)

"Make me mad. Kiss me off. Shout me down. Let it ALL out. Throw a fit. Lose your temper. Insult me. Let me have it. Go on, get shitty. Scream. Take your ball and go home. Vent. Try and

stop me. That's right, have a temper tantrum. Bitch me out. Yell at me. Anger me. But remember, I have a temper too.

Anger is power. Anger is motive. Anger is trapped. Or not.

Red, focused anger. Responsive, lashing back. My projects over the last two years have all dealt with mood extremes and the effect of society on the individual. I can give you the reasons and inspirations for both the subject matter and the medium in a five minute blurb, but upon reflection of the work should you consider my circumstances, or your own?

Look within yourself. Take criticism, digest it, swallowing only those pieces making sense in a way important to you personally. Spit the rest out like a bad taste. Personally, if I wanted to work for someone, to follow orders and take directions, this isn't the path I would have chosen. When I become famous I will rewrite this and graciously thank those under whose guidance I became what I am. Until then it's mine to hold or to crush.

Some people inspire with their thoughts and desires. Sometimes they frighten me. Most times they bore or anger with their analytical pigeonholing of who we are, where we are placed, what we deserve. More people need to spend more time in thought, carefully considering their actions and the resulting consequences. While it's not my job to judge or dictate others, it is important for me to reflect and compare my own thoughts with differing opinions, and portray my conclusions in my work. *Caged*, as part of my *Interpolations* project has been an attempt to portray personality in a postmodern, digital manner. Separated into electrical pulses and impulses, coarse and beautiful. Personalities absorbing, personalities adjusting, personalities rejecting and responding. Human in essence. yet taking into account what programs us, motivates us. Myself - and by extension - us. Where there is one question, one spark of rage, there are thousands. Just Google it, discover your lack of uniqueness. Art is repetition with an occasional new take on the same old story. Myself, I try to lose myself in that vision, make it personal. Whatever that really is.

Do I even want to be part of the art world? With its boxing and categorizing. Do I want to be poked and prodded, in turn courageous and reluctant? Do I want to slog through the mud that sticks to so many, weighing their vision by necessity. Some days I want to get out and show them, conquer, many more days I want to roll into a ball and sleep. Often, I want to scream.

That's my story. What's yours?

Gör mig förbannad. Brülle mich nieder. Избичуј ме. Desfógate conmigo. Gjør meg pissesur. Ξεκούφαρέ. جومو یتون یم اگه. ری-بگ. Yürü git işine! Anna tulla kaikki vaan. Skitförbannad.

Versuch's und stopp mich. Tokförbannad. Δόστου να καταλάβει. Delirtme beni! Дери се на мене. Anger me."

2. THE PROCESS

It's a different thing altogether to write about anger in the cold light of day months after the heat of the experience. Of course, I can still remember – who can't identify anger whether or not they are actively participant in the emotion, but the memory and the actual experience are severed irrevocably by detachment inviolate. There is no true compromise to the fact that a later recital is no more than a facsimile of the true emotion; no more related than a beach photograph is to the bodily experience of standing near the sea.

Even considering this, there are glimmers of truth to be found here. While the above reflections are confined strictly to language and only describe in limited scope the feeling, they do convey the pathways, logic and direction in which my mind sorts its process. More important to this telling though and after a fashion, more real, is the artwork "*Caged*". As a representation of the vision of that anger, it is an attempt to characterize the actual possession of anger, an attempt to explain visually the color, feeling, the internal scream of anger.

As I worked on the piece I occasionally caught a glimpse of the anger that inspired it. As I built upon the nervous structure encased in silicon, I feel the connection and energy that anger incurs – fleeting, violent, rational and irrational. To many, anger is a daily companion that requires watchful management, only let out of its box occasionally when reason admits its necessity or there is no witness. That however, is the everyday anger, probably best termed annoyance. Bad drivers. Inefficient systems. Being on hold. Cable television operators. Unclear directions. People who leave cabinets and drawers open. Waiting on cold rainy street corners for people who are late. Airlines. These are the ingredients of everyday anger.

The anger that inspired *Caged* refers to is a whole different concept – the kind of anger that burns and grows, remaining internal but flashing dangerously at the smallest provocation. When those occurrences happen that interfere with the basic methods and structure of life, challenging basic self esteem and eroding confidence in native ability – the resulting rage can either extend the damage or heal the soul. That is the anger *Caged* is to portray; the state where the smallest incident provokes a response.

Caged is a wire-framed cube of red lights, well structured, confining. In direct contrast to the highly organized light matrix, the inner depths portray, they a complex and organic neural system, responding to its environment with ever changing patterns of light.

Caged was built from LEDs. Using copper wire stripped from cable and straightened carefully, the only connections between the wires themselves would be that of the LEDs. The actual process of putting it together, although made easier by the creation of a fixture, was still tediously slow yet methodical. When I initially envisioned the project I saw it as much larger. The progression on this was very different from my other projects though, and as I thought more and more about the anger itself, it

became for me something compressed, something to hide. Something that would fit within a small space, confining, burning silently. Not generally something that would remain exposed in a large open area, That kind of exposure may cause a flash of violence, but would burn out too quickly, needing nurturing, and careful feeding to stoke it to a constant burn.

To reflect on the anger and cherish it within is the purpose of *Caged*. The program feeds it regular morsels to keep it alive, to focus its attention. Occasional thoughts transmitted to the structure flare activity independently of its environment. Who among us has not felt anger from the simple memories of an earlier event, changing our attitude or expression enough that those close to us will question if we are alright? Or lain in bed rehashing the week's events and frustrations? But the real action, or could it be called reaction would be to outside stress. Others, not aware of the situation, who intrude within our anger, our anger taking itself out upon the innocent. The simple sound of conversation causing a flash of irritation. *Caged* reacts to this directly – but only for a short period of time, calming down, quieting quickly. Direct interpolation or interrogation, loud reprimands, direct anger directed to the work prolongs the activity proportionately, even exponentially. Even so, an occasional random break will occur, resetting the emotion, like a stroke of reason or rational thought, a reality check.

The physical.

It started with a few drawings...

It became readily apparent that 'floating' 512 LEDs was going to be tricky in this work. The LEDs weren't attached to each other and would require over 1000 solder joints. Separation between the vertical and horizontal conductors had to be maintained. Special care would have to be taken in the numbering and tracking of rows and columns because of the way it was to interface with the software and enable the placement of the different colors in specific positions.

The aesthetics needed to be worked out first – then a complicated system of negotiation between technical reality and aesthetic determination ensued. With the aid of an engineer specializing in electronics, spend what seemed like vast amounts of time putting my artistic aspirations into place. After hours of analysis, bargaining, even arguments, we were able to come to grips with a design that realized the essential elements of the work I had initially laid out. In the end the difference between what I intended and the final project were slight, demonstrating an improvement in my skills and understanding a big part in the process, and his adjustment to working in an art environment.

Eight 8 x 8 light matrices were constructed with the aid of a fixture using the copper structural wire to carry the signal. Once these were complete the circuit boards were designed to fit within the small spaces available. For those unfamiliar with the process - after the layout is designed, a negative copy is printed onto transparent plastic (such as that used in the past on overhead projectors). Once the printout is ready, the process for making circuit boards is identical to the process used to burn and etch copper plates for printing, in fact, one material commonly used for copperplate is actually manufactured for printing circuit

boards, the essential difference being the depth of the etching. After attaching these to the matrices to the layers and the wiring arranged and soldered the first tests of the electronics were run – a process that brought out remarkably few problems and adjustments.

Next came the process of attachment of the layers together. Before the attachment began however, the process of adding the silicon was begun. In comparison to the process so far, this was fun. Able to play, I got a little carried away, and as I found out later, prematurely covering the boards that had been made (and tested) earlier.

For support in the cube, welding rods were used vertically, and heat shrink tubing was used to prevent shorts. The levels were attached one by one, and dental floss was used to attach the heat shrunk support rods. Dental floss was used due to its maintenance of the knots in the tying process... all together there were 320 knots tied; a complex and time consuming project made at least somewhat simpler by its waxed surface. As each layer was tied on the software was modified to test the current number of layers, this prevented having to go back and work in-between densely fitted layers to repair any flaws.

It should be noted here that to reduce the amount of wires required for power, ground, signal, etc... four of the support rods were used to carry them. Ground, power, clock and data load, as well as 12 v to drive the LEDs themselves were carried through the centermost rods.

Next came the software. The software I used was a modified version of what I had used in the previous project titled SELF (Niemczyk, 2010). Written in a combination of the Arduino language and C++, several of the critical pieces are posted in the included index. Two specially designed boards containing microphones and a preamp served as analog input sensors. The advantage to these was the built in averaging circuit that eliminated the need for a software averaging filter. The most difficult part of the software was the act of stuffing the data through the matrices – written in C++ this is included in the index. After much annoyance and some serious overreaction, the basic program worked, and it was a simple task to set the John Conway's Game of Life (Gardner, 1970) modification in and work on appropriate seeds. Voila. It was beautiful.

Caged includes 44.8 meters of 1.5 mm sq copper wire, 28.8 m copper brazing rod, 73 m small gauge wire for the signal wires from the boards, to the LEDs, 528 LEDs, 80 m dental floss, 5.5 m shrink tubing, 1100 solder connections., 8 LM3915 matrix drivers, 4 microphones, an assortment of capacitors, resistors, and various other electronic components, 2 transistor sound level circuits, 1 boarduino, and surprisingly little blood loss.

Caged is intended to be shown in a relatively dim, close location. Pictured above is the piece installed at Röda Sten, in Gothenburg, Sweden, 2010. The work was displayed in a deserted stairwell, inviting patrons to explore the forbidden, and to vent their anger, use their own voice.

3. INDEX

3.1 Matrix Push

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Please give credit to Karen Niemczyk, Robert Niemczyk and Brandon Niemczyk if you use or pass on this code./*

*/*This is the LED driver initialization code. There are eight LM3915 LED matrix drivers (connected in series as described in the data sheets) that must be properly set up and initialized before they are used.*/*

```
void initLED(int n)
{
  sendInitData(0x0B, 0x07, n);      /*Use all 8 digits*/
  sendInitData(0x0A, 0x0F, n);      /* Intensity*/
  sendInitData(0x09, 0x00, n); /*Decode mode = individual
                                LEDs*/
  sendInitData(0x0C, 0x01, n) /* Normal operation – no
                                shutdown*/
  sendInitData(0x0F, 0x00, n); /* Normal operation – no test
                                mode*/
}
```

```
void sendInitData(char address, char data, int loops)
{
  int i;
  digitalWrite(LATCH, LOW);
  for (i=0; i<loops; i++)
  {
    shiftOut(DATA, CLOCK, MSBFIRST, address);
    shiftOut(DATA, CLOCK, MSBFIRST, data);
  }

  digitalWrite(LATCH, HIGH);
  delayMicroseconds(5);
  digitalWrite(LATCH, LOW);
}
```

/ The following routine initializes the matrices that are used by the modified Game of Life code. There are two matrices used in the GoL processing - one that actually contains the active GoL matrix, plus a copy of that matrix that is used later as the basis for what is output to the LED driver chips.*/*

```
/* InitMatrices to be placed in final 'void setup' routine. Clears
all the entries in 'world' to zero (0)
for now, this just sets up an initial array to feed into Brandon's
Char-to-Bit array converter
so it can be piped to the LED output routine*/
```

```

void initMatrices(int ROW_INIT,int COLUMN_INIT)
{
    int i, j;
    for (i = 0; i < ROW_INIT; i++)
    {
        for (j = 0; j < COLUMN_INIT; j++)
        {
            world[i][j] = 0x00;
            worldcopy[i][j] = 0x00;
        }
    }
    // Add initial 'plant seeds' code here to start the cycle
}

/* doConversion needs to be declared before it's used or else gcc
doesn't know the types of the arguments*/
char *doConversion(char input_matrix[][COLUMNS]);

/* since we only work with one matrix at a time, instead of
allocating space in the conversion routine, use this pre-allocated
space
*/
char converted_world[ROWS];
char* doConversion(char input_matrix[][8])
{
    char *result_matrix = converted_world;
    int i, j;
    for(i = 0; i < ROWS; i++) {
        char *row = input_matrix[i];
        char bitarray = 0;

        for(j = 0; j < COLUMNS; j++) {
            if(row[j] > 0) // it's a 1
            {
                bitarray |= 1 << j;
            }
        }
        result_matrix[i] = bitarray;
    }
    return result_matrix;
}

```

//////////////////////////////// LED output routine //////////////////////////////////

/* The LED output routine takes the output of the 'doConversion' routine and sends out the data to the matrix drivers for the cube to display. */

```

void ledOut(char *GoLbits, int loops)
{
    char i;
    int j;
    for (i = 0; i < 8; i++)
    {
        digitalWrite(LATCH, LOW);
        {
            for (j = 0; j < loops; j++)
            {
                shiftOut(DATA, CLOCK, MSBFIRST, i+1);
                shiftOut(DATA, CLOCK, MSBFIRST,
GoLbits[(i+(8*j))]);
            }
        }
        digitalWrite(LATCH, HIGH);
        delayMicroseconds(5);
        digitalWrite(LATCH, LOW);
    }
}

```

I am not including the Game of Life (Gardner, 1970) program as it is not my creation. There are many versions readily available on the internet.

4. ACKNOWLEDGMENTS

Thanks to Robert and Brandon Niemczyk for their support and contributions to the coding.

5. REFERENCES

- [1] Niemczyk, K. 2010. Niemczyk SELF. *Interpolations*. http://interpolations.org/self_doc.php.
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The fantastic combinations of John Conway's new solitaire game "life". *Scientific American* 223 (October 1970): 120-123.