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Foundations of Creative Code  
DESN6002  
2017

## Process Documentation

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The idea was to create an installation artwork that would be determined by our swarm code: creating a new shape that could not be achieved without the swarm. We wanted the artwork to have qualities that would change the behaviour of the viewer within the space, to bring people out of a passive, static body experience of viewing a 2D artwork on a wall in a white cube of a gallery, and invite them into movement through the shape of an artwork. We used the swarm code to create frames, freezing the agents at points in time (every 300 frames) that we laser cut and layered into a 3D form. We used magnets and anti-magnets in the code to restrict the agents to circular parameters. As this assignment's project timeframe is only a few weeks (and without generous external funding) we have chosen to represent our installation as a maquette. The concept is that this would be a large-scale installation, built in a custom room to be put inside or outside an existing gallery such as MONA in Tas, Heidi in Vic, MCA in Sydney, etc. We created a new cylindrical gallery room to house our swarm structure, inviting the viewer to move around the room and look at the sculpture and light at different angles. The theory is that this generative installation artwork can exist in multiple galleries at once, with different frames in the swarm, so that every artwork is different and the audience can see the artwork at different galleries and have a slightly different experience each time. It would be great to see this at different galleries around Australia and share this coding artwork with a broad audience.

Originally we had intended to use the negative space that the agents “carved out” – leaving us with a donut-shape that the agents would “punch through” to create holes of light, but this shifted during our testing process. We chose instead to go with the inner form, the movement of the agents themselves, as it was a more dynamic form, and adapted the project to suit. We had planned for our maquette to be made out of MDF, but after testing with cardboard we shifted our direction, as we liked play of light through the corrugation. Our final imagined installation would be made out of steel, made to mimic the forms of corrugated cardboard. (Of course, with all our generous hypothetical patrons allowing...)

We have our maquette at a scale of 1:20. We intend for the gallery to be 8m in diameter, which means a radius of 4m, circumference of 25.13m, and an area of  $50.27^2$ m. Our maquette gallery floor is 40cm in diameter, 20cm radius, 125.7cm circumference and an area of  $1256.6^2$  cm. Our fabricated form (the central sculpture made of the swarm system) would be a maximum of 3m in diameter, and to reflect this our maximum size for our laser cut form is 15cm in diameter. Each layer would be 10cm thick, and so in our maquette our cardboard is 5mm thick. We intended for the sculpture to have 32 layers, making it 16cm tall in the maquette, and 3.2 meters tall in a realised sculpture, however we were only able to print 13 layers, so our maquette final form is 6.5 cm tall.

Please note that during our laser cutting process we had issues with the ventilation and the room was getting too smoky. This means that we were only able to laser cut about one third of our swarm project before the machine being locked down for maintenance. The idea was to have our sculpture at 32 layers, however we were not able to do so. We have included in this document the maps for the circles (with a few spare, so 37 circles in total) so you can see our intent to have a taller structure.

## ALL P5 CODE USED TO CREATE SWARM

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The swarm can be found at: [http://alpha.editor.p5js.org/andy.mullens/sketches/SkQz-I\\_gW](http://alpha.editor.p5js.org/andy.mullens/sketches/SkQz-I_gW)

The code is as follows:

| agent.js  | index.html  | sketch.js   |
|---|---|---|
| <pre>function Agent(xpos, ypos, xvel, yvel){     this.pos = new p5.Vector(xpos, ypos);     this.vel = new p5.Vector(xvel, yvel);      this.draw = function(){         //fill(1);         fill(255,255,0);         ellipse(this.pos.x, this.pos.y, 2,2);         //ellipse(250, 250, 100, 100);         // from here - drawing SVG         var c = svgd.circle(5); // circle with diameter 5         c.attr({ cx: this.pos.x, cy: this.pos.y });     }      this.move = function(){         this.pos.add(this.vel);         this.vel.mult(friction); // decelerate     }      this.avoid = function(){ // avoidance - don't get         too close to your neighbours     } }</pre> | <pre>&lt;!DOCTYPE html&gt; &lt;html&gt;     &lt;head&gt;         &lt;script src="https://cdnjs.cloudflare.co m/ajax/libs/p5.js/0.5.5/p5.min.js "&gt;&lt;/script&gt;         &lt;script src="https://cdnjs.cloudflare.co m/ajax/libs/p5.js/0.5.5/addons/ p5.dom.min.js"&gt;&lt;/script&gt;         &lt;script src="https://cdnjs.cloudflare.co m/ajax/libs/p5.js/0.5.5/addons/ p5.sound.min.js"&gt;&lt;/script&gt;         &lt;script src="agent.js"&gt;&lt;/script&gt;         &lt;link rel="stylesheet" type="text/css" href="style.css"&gt;         &lt;script src="https://cdnjs.cloudflare.co</pre> | <pre>var swarm = []; var friction = 0.96; var swarmCount = 10;  var avoidRadius = 30; var avoidStrength = 0.15;  var cohereRadius = 150; var cohereStrength = 0.05;  var alignRadius = 40; var alignStrength = 0.1;  var bigMagnet; var antiMagnet;  function setup() {     createCanvas(500, 500);     svgd = SVG('svgttest').size(500, 500);     background (50);</pre> |

```

var avoidVec = createVector(); // vector to
store avoid vector
for (var neighbour of swarm){
  var nd = this.pos.dist(neighbour.pos); //
neighbour distance
  if (nd < avoidRadius && nd > 0){// ignore
neighbours that are far away
    var pushVec =
p5.Vector.sub(this.pos,neighbour.pos); //
repulsive push away from close neighbours
    pushVec.normalize();
    avoidVec.add(pushVec);
  }
}
avoidVec.normalize(); //scale to 1.0
avoidVec.mult(avoidStrength); // multiply by
the strength variable
this.vel.add(avoidVec); // add to velocity
}

this.align = function(){ // alignment - move in a
similar direction to your neighbours
  var averageVelocity = createVector(); //
vector to store average velocity
  for (var neighbour of swarm){ // run through the
swarm
    var nd = this.pos.dist(neighbour.pos); //
neighbour distance

```

```

m/ajax/libs/svg.js/2.3.6/svg.min.
js"></script>
<link rel="stylesheet"
type="text/css"
href="style.css">
</head>
<body>
<script
src="sketch.js"></script>
<div id="svgtest"></div>
</body>
</html>

fill(255);
//draw two circles
stroke (50)
ellipse1 = ellipse (width/2, height/2, width/1.2,
height/1.2);
fill(50);
ellipse2 = ellipse(width/2, height/2, width/4,
height/4);
fill(255);
ellipse3 = ellipse(width/2, height/2, width/6,
height/6);
// rect1=rect(245,175,9,9);
// rect2=rect(185,285,9,9);
// rect3=rect(304,288,9,9);

//frameRate (20);
bigMagnet = new
p5.Vector(width/2,height/2); // put the magnet in
the middle of the screen
antiMagnet = new
p5.Vector(width/2,height/2); // the repulsion
strokeWeight(2);
stroke(20);

//create the swarm

```

```

if (nd < alignRadius && nd > 0){ // ignore
neighbours that are far away
    averageVelocity.add(neighbour.vel); // add
my neighbour's velocity
}
}
averageVelocity.normalize();
averageVelocity.mult(alignStrength);
this.vel.add(averageVelocity); // add to velocity
}

this.repulsion=function(){
var avoidVec = createVector();
var cent = new p5.Vector(width/2,height/2);
var nd = this.pos.dist(cent);
if (nd > width / 2 - 40 || nd < 60) {
    this.vel.x *= -1;
    this.vel.y *= -1;
    // var pushVec = p5.Vector.sub(this.pos,cent);
// repulsive push away from close neighbours
    // pushVec.normalize();
    // avoidVec.add(pushVec);
}
// avoidVec.normalize(); //scale to 1.0
// avoidVec.mult(avoidStrength); // multiply by
the strength variable
// this.vel.add(avoidVec); // add to velocity
}

```

```

for (var i=0; i<swarmCount; i++){
    // create a new agent with position and velocity
    // var newA = new
    Agent(random(200,300),random(100,150),random(-
    1,1), random(-1,1));
    // var newB = new
    Agent(random(200,300),random(350,400),random(-
    1,1), random(-1,1));
    // var newC = new
    Agent(random(100,300),random(100,300),random(-
    1,1),random(-1,1));
    var newD = new
    Agent(random(90,150),random(100,300),random(0,
    1),random(0,3));
    // swarm.push(newA);
    // swarm.push(newB);
    // swarm.push(newC);
    swarm.push(newD);
}

function draw() {
    //Iteration to call functions
    for (agent of swarm){
        agent.draw();
    }
}

```

```

this.cohere = function() { // coherence - move
  towards the middle of your close neighbours
  var averagepos = createVector();
  var steervec = createVector();
  var neighbourcount = 0;

  for (var neighbour of swarm){
    var nd = this.pos.dist(neighbour.pos); //
    neighbour distance
    if (nd < cohereRadius && nd > 0){// ignore
      neighbours that are far away
      neighbourcount++;
      averagepos.add(neighbour.pos); // add to
      average
    }
  }

  if (neighbourcount > 0)
  averagepos.div(neighbourcount);

  steervec =
  p5.Vector.sub(averagepos,this.pos); // head
  towards the average position
  steervec.normalize(); // scale to 1.0
  steervec.mult(cohereStrength); // scale down
  this.vel.add(steervec); // add to velocity
}

```

```

agent.move();
agent.avoid();
agent.cohere();
agent.align();
agent.repulsion();
agent.magnet(); // run the magnet
function for this agent
agent.antimagnet();

}

if (frameCount%300 == 0) svgd.clear();
// if (frameCount%300 == 299)
saveFrames("donut frame", "png", 1, 1);
if (frameCount%300 == 299) saveSVG();

}

// define saveSVG();
function saveSVG(){
svgraw =
document.getElementById("svgttest").innerHTML;
console.log(svgraw);
svgarray = [svgraw];
save(svgarray,
"donut_frame_"+frameCount+".svg");
}

// press S to call saveSVG();
// function keyPressed(){
//   if (key == 'S') saveSVG();
}

```

```
this.magnet = function(){ // head towards the  
magnet  
  tomagnet =  
    p5.Vector.sub(bigMagnet,this.pos);  
  tomagnet.normalize();  
  tomagnet.mult(0.02);  
  this.vel.add(tomagnet);  
}  
  
this.antimagnet = function(){ // head towards  
the magnet  
  pushmagnet =  
    p5.Vector.sub(antiMagnet,this.pos);  
  pushmagnet.normalize();  
  pushmagnet.mult(-0.008);  
  this.vel.add(pushmagnet);  
}  
}
```

```
// }  
// press S to call saveSVG();  
  
// if (frameCount%300 == saveFrames("donut  
frame", "png", 1, 1); //save the canvas, named  
"anthem wave flag" as a png  
// }
```

## EXPLAINING CODE

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Our idea was to restrict the agents' movement within a circle (the bounds of our sculpture) as well as keeping them away from a circle in the centre (the core of our sculpture). We also wanted them to stay close enough to each other to maintain density within the form, but not too close so that the agents clumped together to make solid blocks within the form.

*In the agent.js:*

Created function Agent(xpos, ypos, xvel, yvel) to define the attribute of each agent

Created this.draw = function() to define what we want to draw in the canvas

Created this.move = function() to define movement of each agent

Use this.avoid = function() to make sure each of agent cannot get too close to their neighbors

Created this.align = function() to make sure all of agents will move in a similar direction so that they will not crash with each other

Created this.repulsion=function() to make sure they cannot move out of the circle margin and move in the center circle

Use this.cohere = function() to define they will move towards the middle with their close neighbors

Use this.magnet = function() and this.antimagnet = function() to make them head towards the magnet

*In the sketch.js:*

Define all of variables that we need to use in the class, such as swarm numbers and friction

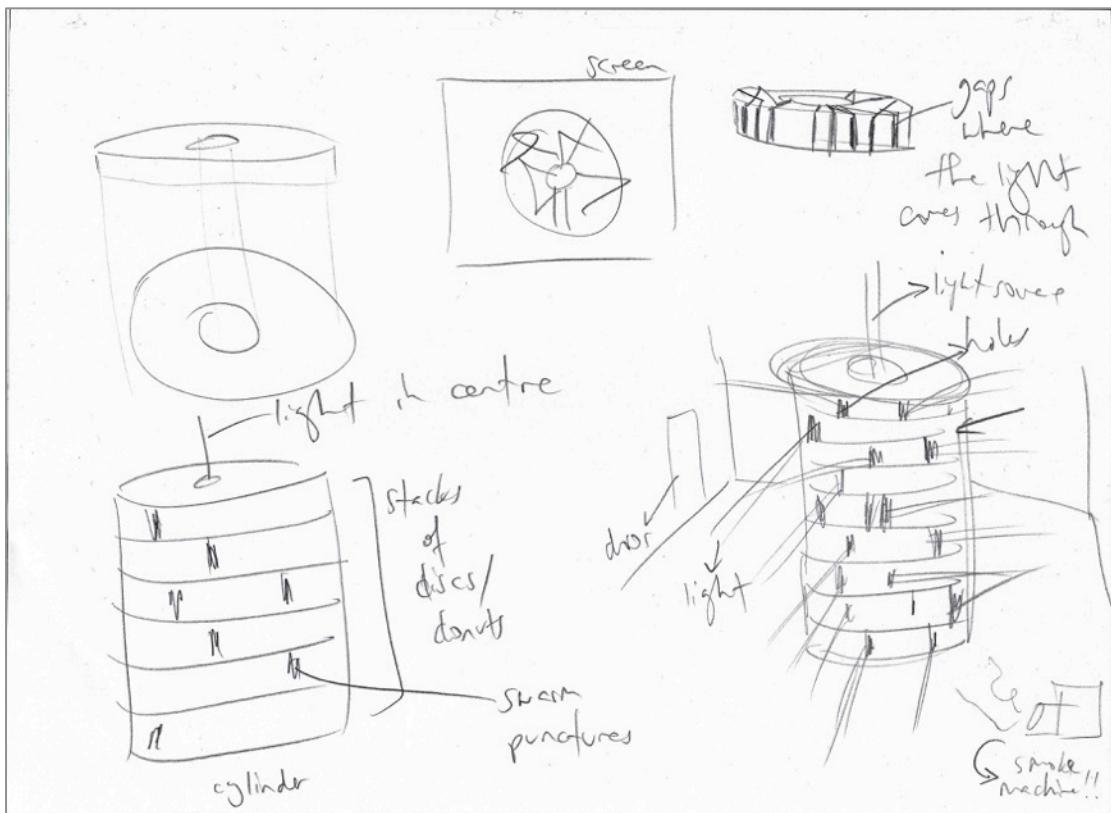
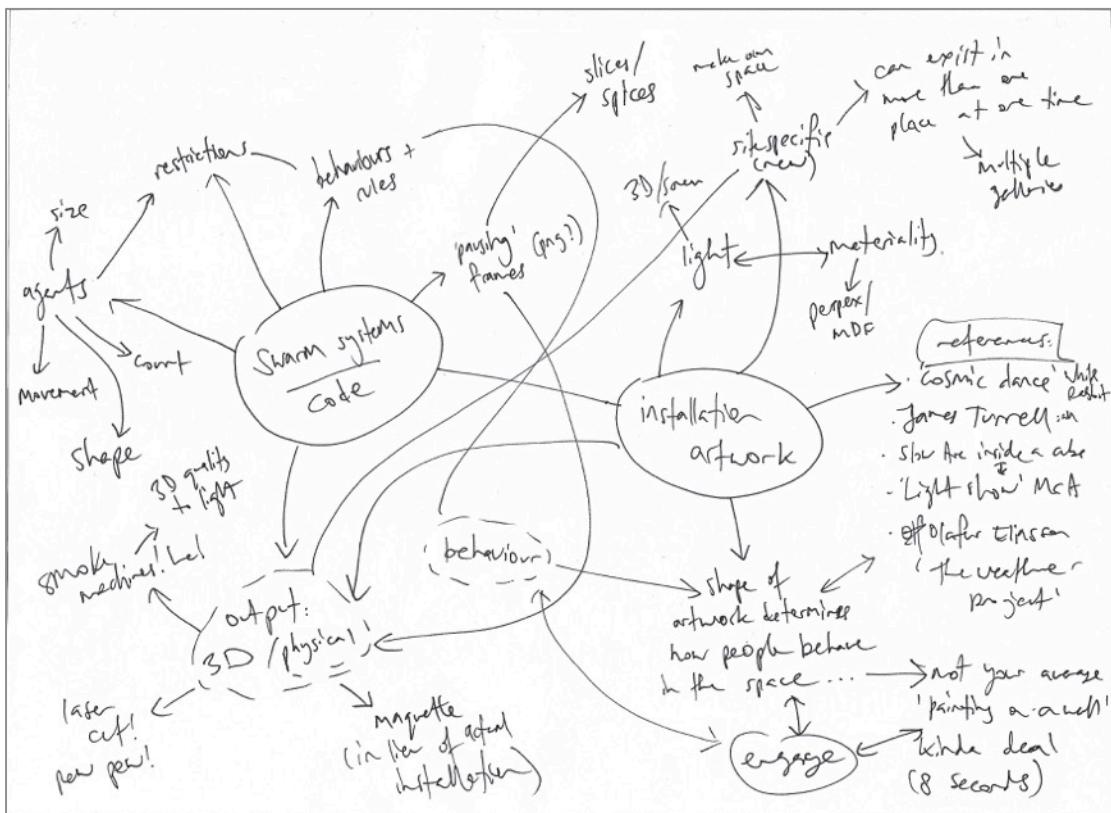
Use function setup() to define the size of canvas, three ellipses' location and iteration to create agent objects

Use function draw() and for loop to iteration call functions which we create in agent.js

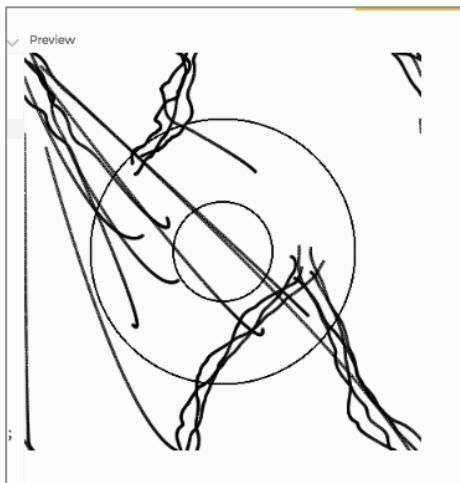
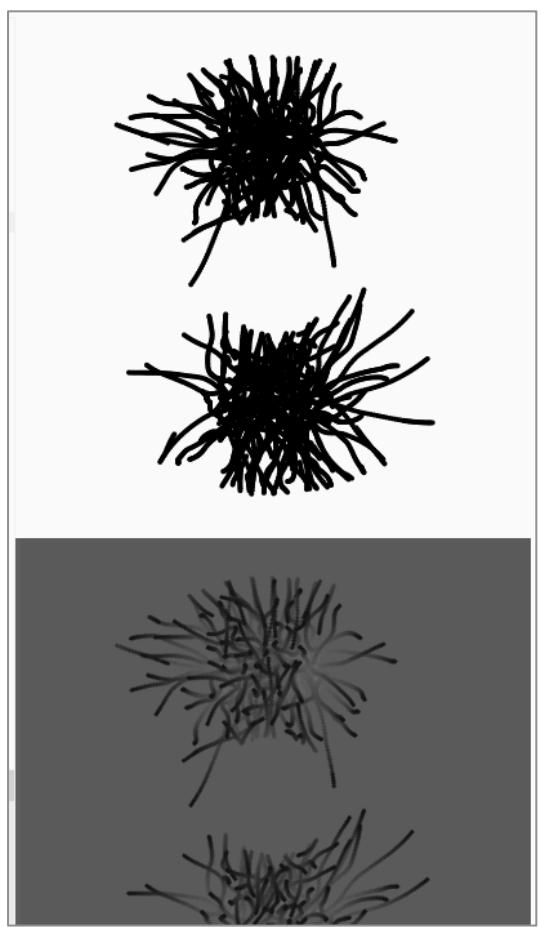
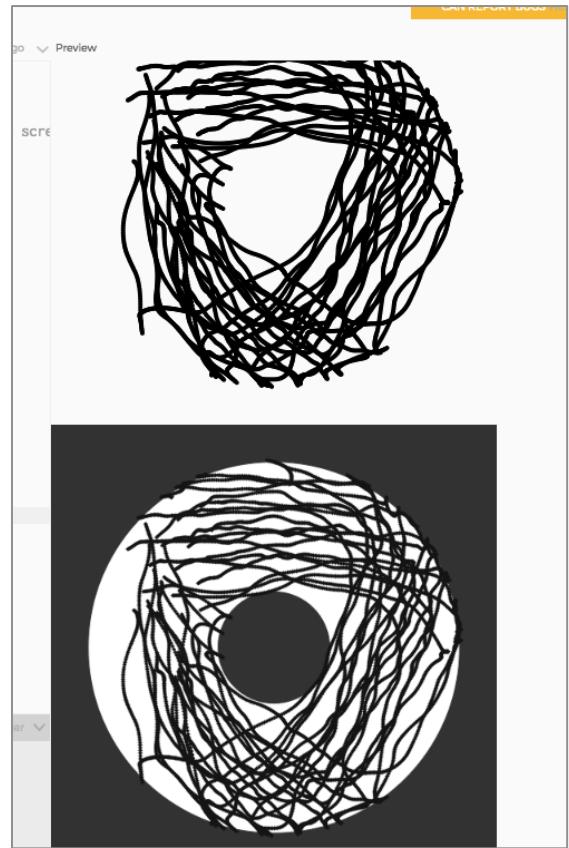
Use function saveSVG() to implement SVG save function

## PROCESS IMAGES

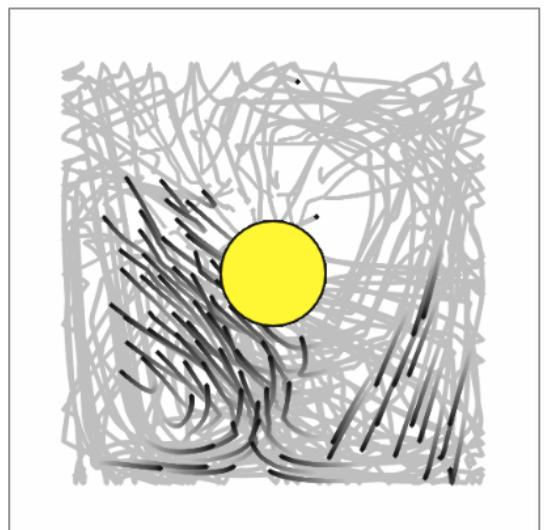
---



Initial brain storm/mind map/sketches about intent and structure



First tests of  
the swarm  
systems by  
the whole  
group



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Hello, andy.mullen!

**p5.js**

project folder sketch.js index.html style.css agent.js

```

13 frameRate (20);
14 bigMagnet = new p5.Vector(width/2,height/2); // put the magnet in the middle of the
15 //circle on the screen
16 for (var i=0; i<swarmCount; i++){
17   // create a new agent
18   var newA = new Agent(random(100,300),random(100,300),random(-1,1),random(-1,1));
19   // now add the agent to the list
20   swarm.push(newA);
21 }
22
23 print(swarm.length);
24
25 button = createButton('save'); //make a save button
26 button.position(width/80, 50); //put it at this x and y position
27 button.mousePressed(saveImages); //when the mouse is pressed on the button save can
28
29 noFill();
30
31 function draw() {
32   // background(255);
33   frameRate (30);
34   noFill();
35   // fill(255);
36   stroke (50);
37   ellipse1 = ellipse (width/2, height/2, width/1.2, height/1.2);
38   // fill(0);
39   ellipse2 = ellipse(width/2, height/2, width/4, height/4);
40   for (var agent of swarm){ // loop through the swarm
41     agent.draw(); // run the draw method
42     agent.avoid(); // avoid your neighbours
43     agent.align();
44     agent.cohere();
45     agent.magnet(); // run the magnet function for this agent
46   }
47 }
48
49
50
51
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62
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64
65
66
67
68
69

```

Console

8

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Hello, andy.mullen!

**p5.js**

project folder sketch.js index.html style.css agent.js

```

6 var swarmCount = 8;
7
8 var avoidRadius = 50;
9 var avoidStrength = 0.25;
10
11 var cohereRadius = 50;
12 var cohereStrength = 0.05;
13
14 var alignRadius = 40;
15 var alignStrength = 0.01;
16
17 // var swarm = [];
18 // var friction = 0.99;
19 // var swarmCount = 20;
20
21 // var alignDistance = 60;
22 // var alignStrength = 0.01;
23
24 // var avoidDistance = 20;
25 // var avoidStrength = 0.1;
26
27 // var cohereStrength = 0.1;
28 // var cohereDistance = 50;
29 var bigMagnet;
30
31 function setup() {
32   createCanvas(400, 400);
33   svgd = SVG('svgtest').size(400, 400);
34   background (0);
35
36   fill(255);
37   stroke (50);
38   ellipse1 = ellipse (width/2, height/2, width/1.2, height/1.2);
39   fill(0);
40   ellipse2 = ellipse(width/2, height/2, width/4, height/4);
41 }
42
43
44
45
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49
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```

Console

8

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Hello, andy.mullen!

**p5.js**

project folder sketch.js index.html style.css agent.js

```

1 var ellipsee1;
2 var ellipsee2;
3
4 var swarm = [];
5 var friction = 0.98;
6 var swarmCount = 20;
7
8 var avoidRadius = 30;
9 var avoidStrength = 0.25;
10
11 var cohereRadius = 50;
12 var cohereStrength = 0.05;
13
14 var alignRadius = 100;
15 var alignStrength = 0.01;
16
17 // var swarm = [];
18 // var friction = 0.99;
19 // var swarmCount = 20;
20
21 // var alignDistance = 60;
22 // var alignStrength = 0.01;
23
24 // var avoidDistance = 20;
25 // var avoidStrength = 0.1;
26
27 // var cohereStrength = 0.1;
28 // var cohereDistance = 50;
29 var bigMagnet;
30
31 function setup() {
32   createCanvas(400, 400);
33   svgd = SVG('svgtest').size(400, 400);
34   background (0);
35
36   fill(255);
37   stroke (50);
38   ellipse1 = ellipse (width/2, height/2, width/1.2, height/1.2);
39   fill(0);
40   ellipse2 = ellipse(width/2, height/2, width/4, height/4);
41 }
42
43
44
45
46
47
48
49
50
51
52
53
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```

Console

20

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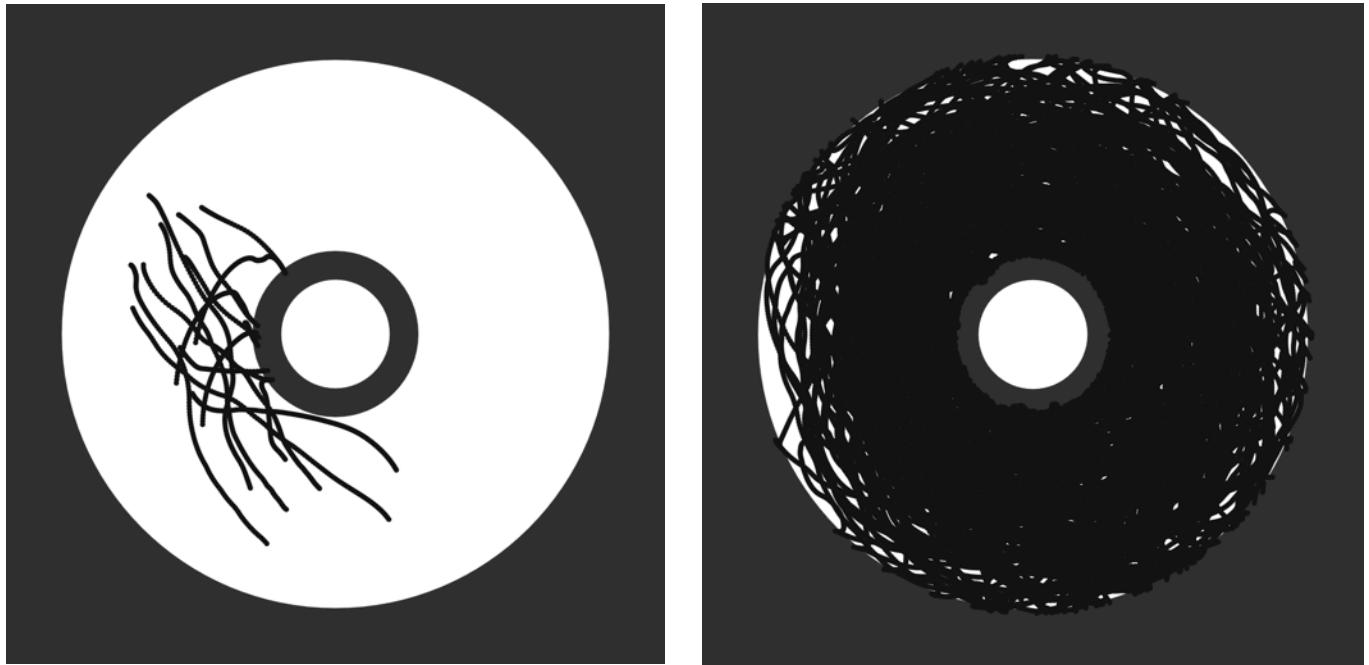
More initial swarm code development



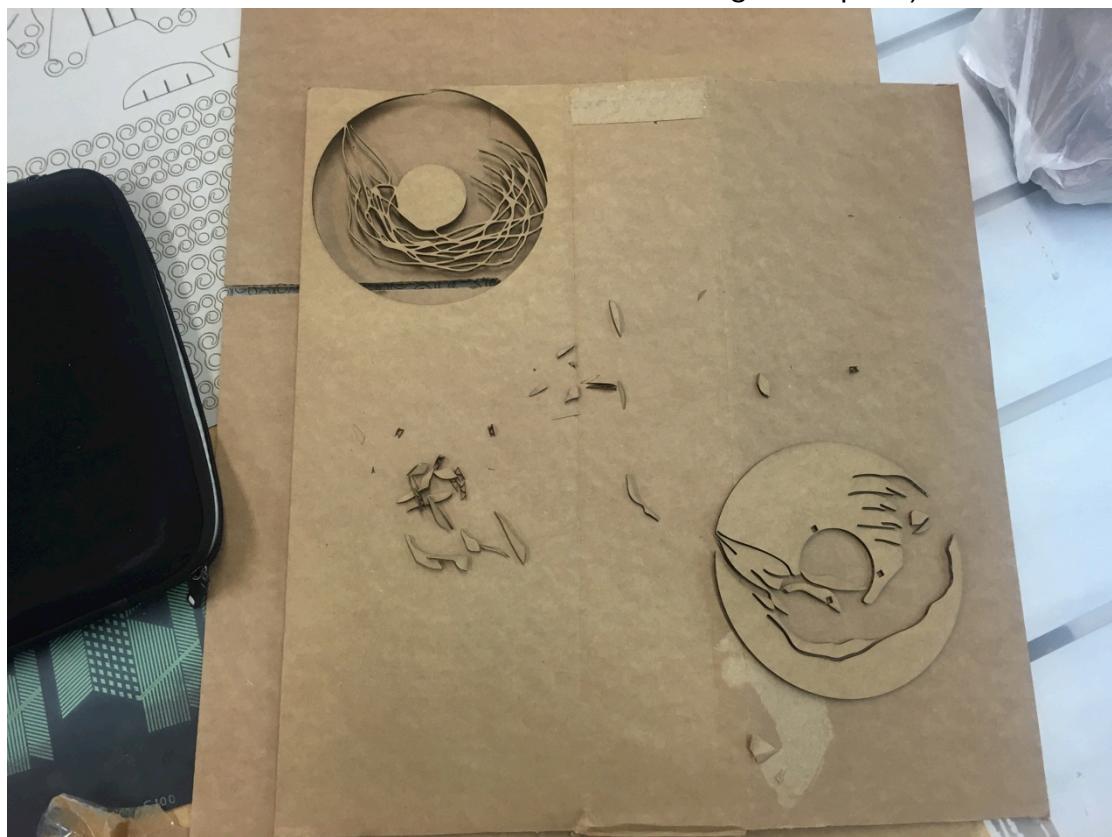
Rough physical “process sketch”  
to imagine what the final  
fabricated form might look like.  
Experimenting with light, form  
used to demonstrate layers



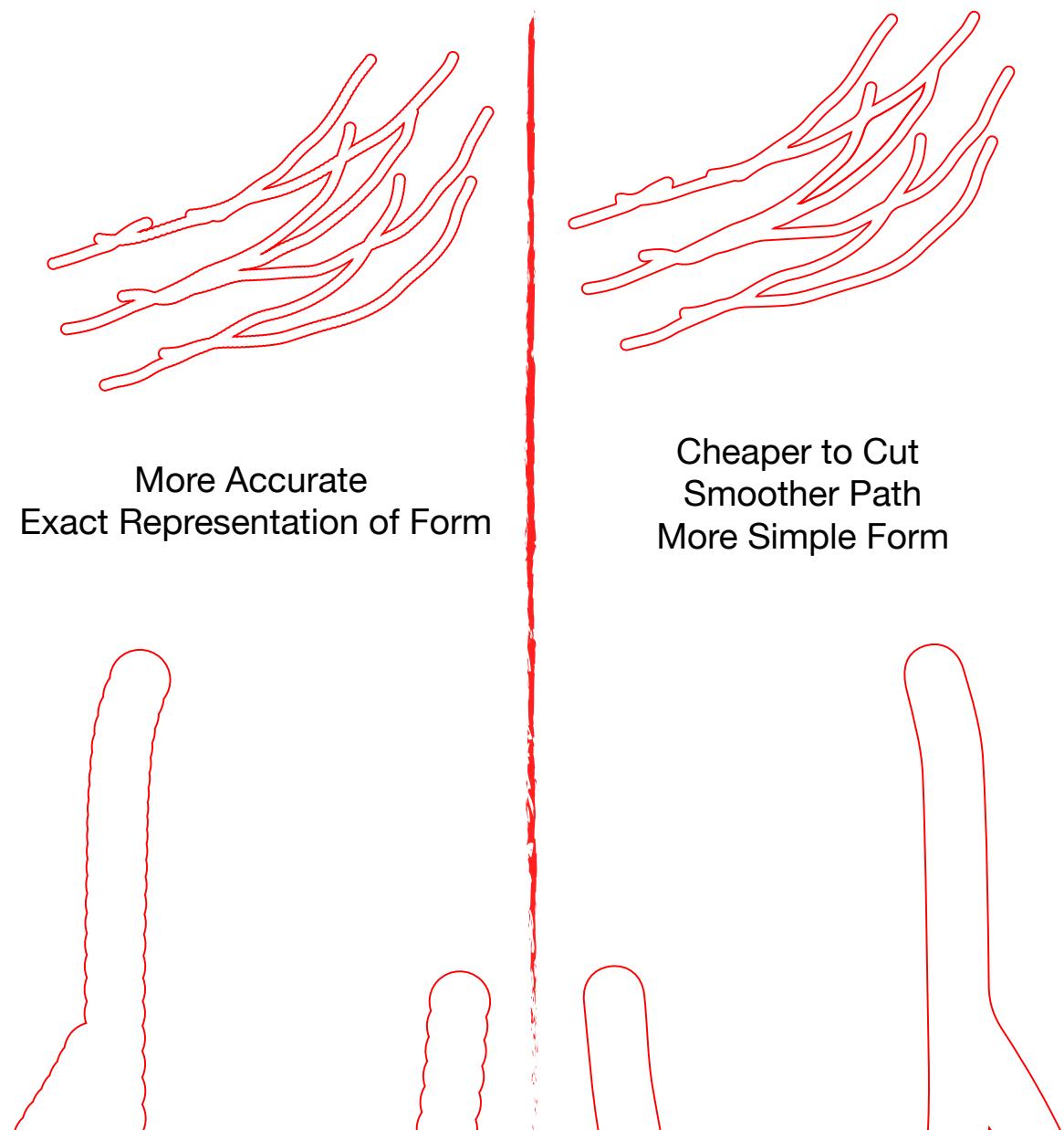
Final version of the swarm used, examples of the first and last frames:



First test of laser cut, prompting a change in direction (using the inside swarm instead of outer negative space) and material:



# SVG Path Smoothing Vs Image Trace and Simplification of a PNG File



Demonstrating SVG vs. PNG saving in illustrator for laser cut files

## Resources research

**eckersley's** ART & CRAFT 50 YEARS

SEARCH...

ART CRAFT DESIGN KIDS COPIC EDUCATION KITS BRANDS **SALE** GIFT CARDS STORES VIDEOS PROJECTS CATALOGUES

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| White A3 Pack 2<br>NOW \$9.80 \$12.25 | White A1<br>NOW \$10.90 \$13.60     |



## Osram 30W Warm White Halogen Candle Globe - BC / B22 Base

I/N: 4320576



**\$2.98**

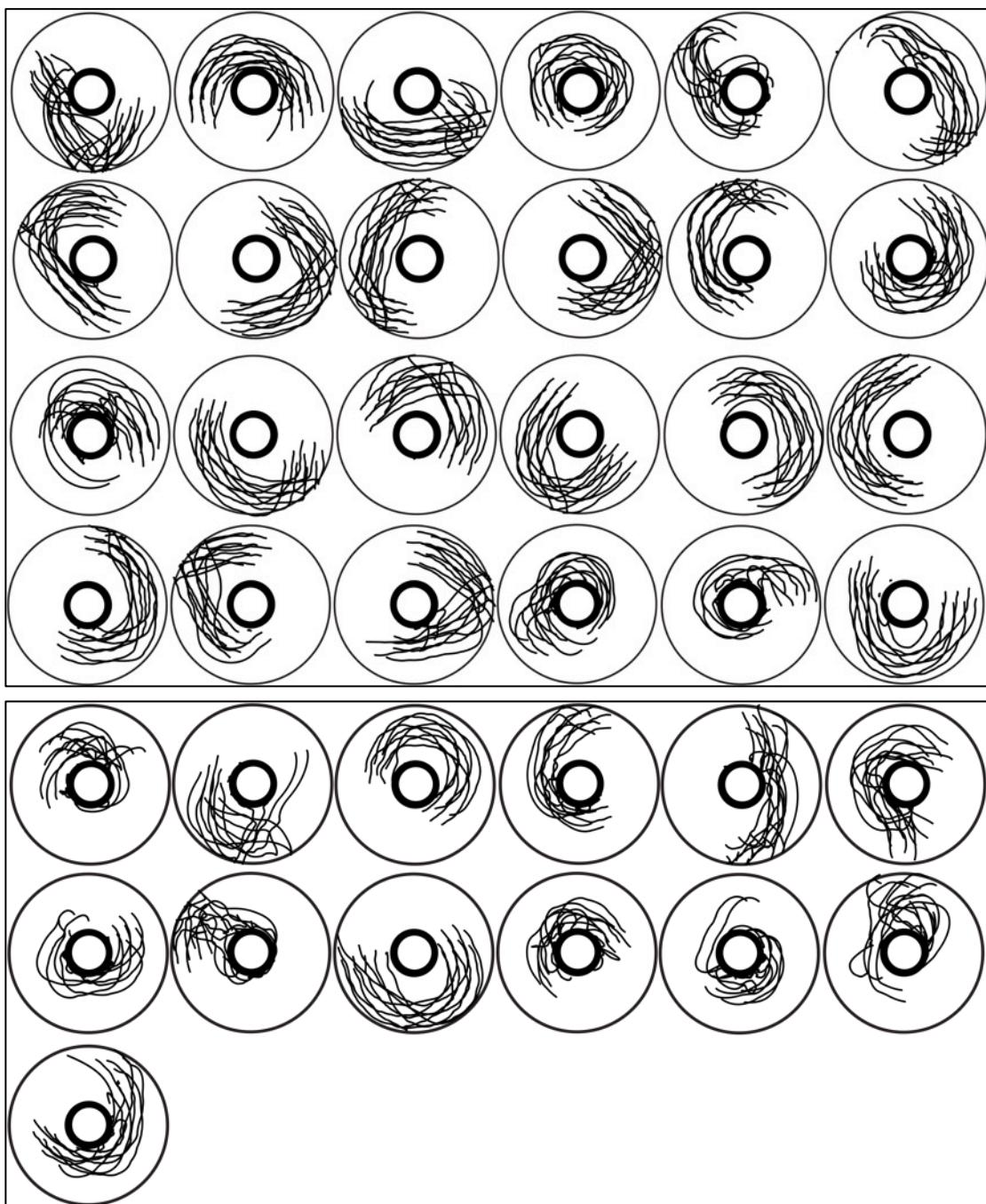
Price correct as at Mon 22 May  
2017 3:11:25

Qty:

Not all products available in all stores



Our final composite files of the swarm frames for laser cutting:  
37 circles for the laser cutter:





The final fabrication of  
our swarm system,  
laser cut into  
corrugated cardboard,  
layered and bonded  
together.



## FINAL REALISATION OF MAQUETTE

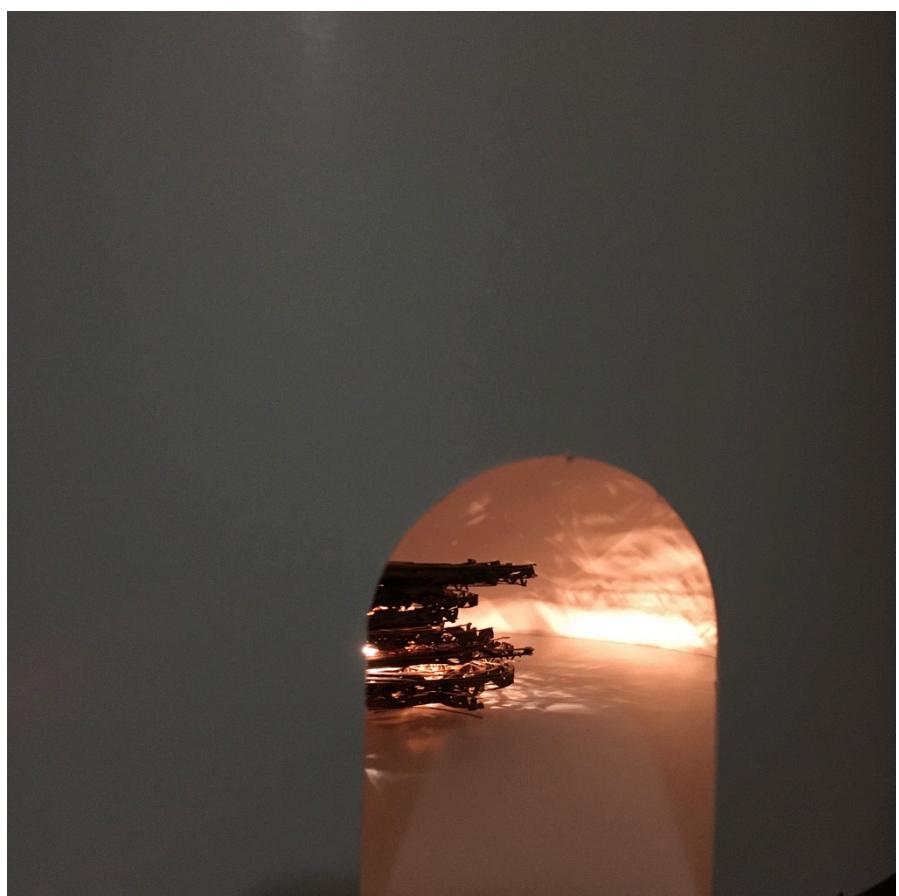
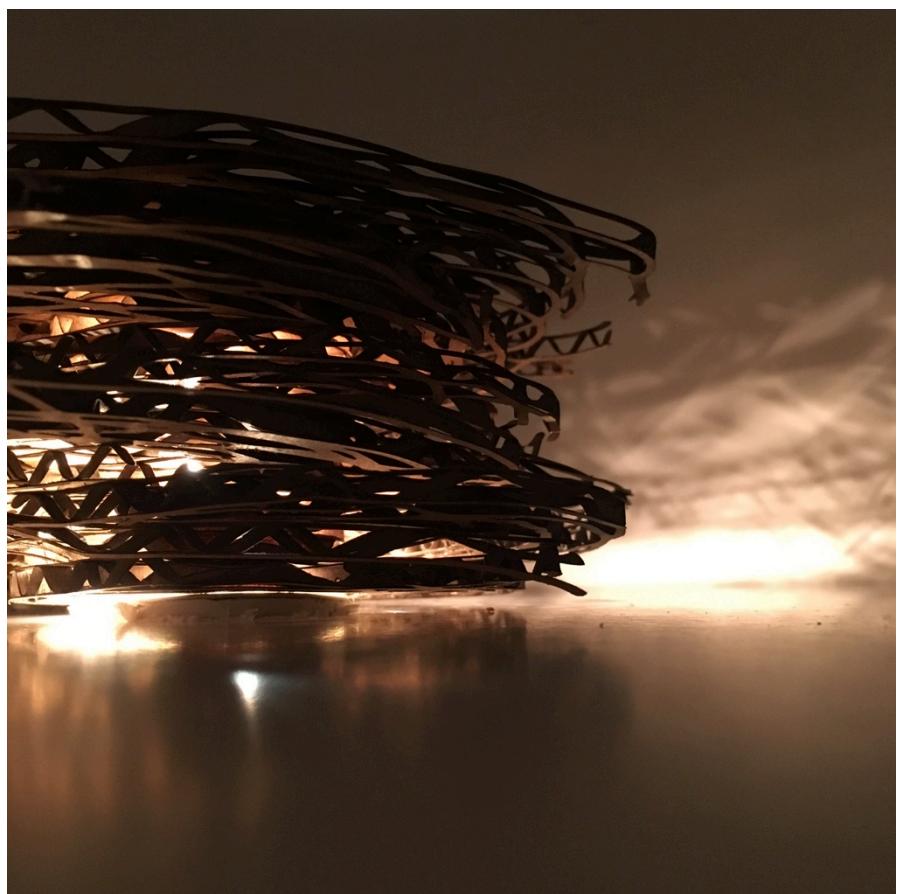
---



Photos taken from inside final maquette // from birds eye view // inside from “audience” view // outside maquette from the doorway. For video see PP.









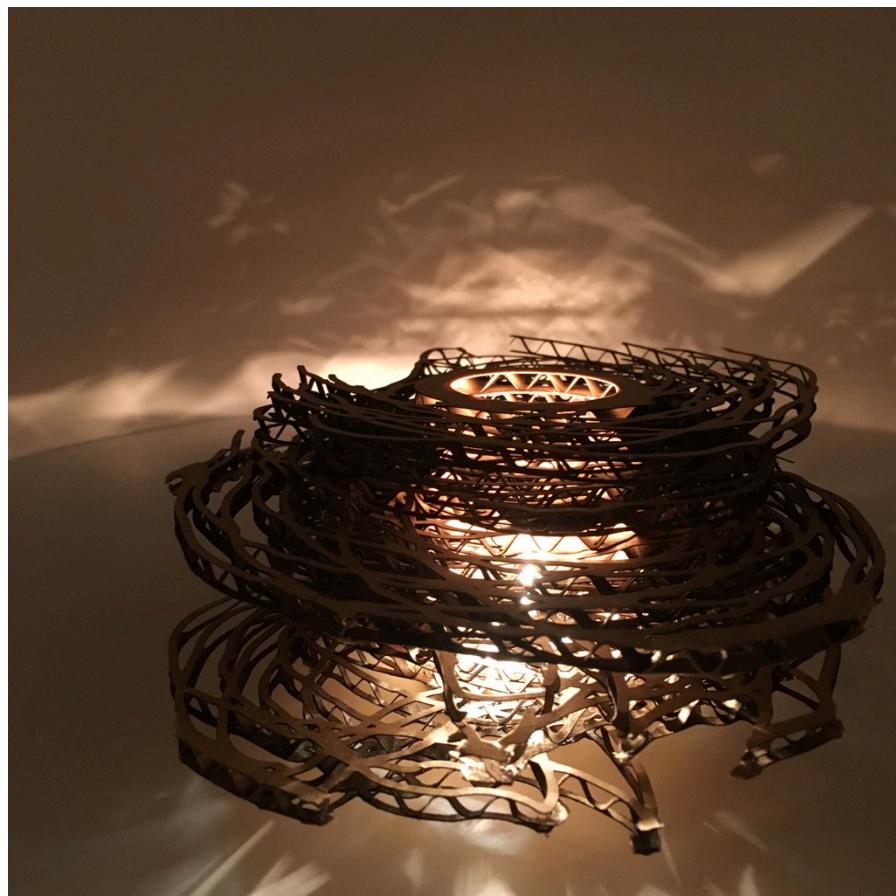


Image of inside the final maquette, without the light source

## GROUP ROLES + CONTRIBUTIONS

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As a group we all worked really well together. We all had different reasons for being in the class, we all had different backgrounds and strengths, and we each developed our skills in coding and stretched our brains. We can confidently say we all contributed enthusiastically and equally. From our different backgrounds we all were able to contribute to the group skills from our respective areas. Jieming was comfortable in the realm of coding but in different languages outside of javascript, Pat was highly skilled in design programs such as Adobe Illustrator, and Andy was across research and artwork development. As for the code we collaborated on this quite a bit. After we first developed the concept, we all went away and worked on our own versions of the code, to see how each person problem-solved and developed the concepts we wanted to communicate. Then we met up and looked at the codes and took the best elements from each to make a swarm that behaved in the way that we wanted. Each time we needed to tweak or change something about the swarm, we passed the code around between ourselves, adding and changing elements as needed. This resulted in the final code being a piece of work that we developed together and all made contributions to.

As further evidence of our group work, we made use of networking technologies, using a OneDrive shared document (see screenshot and link attached). This was incredibly useful as it allowed the group to share references, links to code, screenshots, write concept ideas and ask questions. We also collaborated through Trello for splitting the workload into individual assignments with personal deadlines, effectively breaking up the workload and clarifying everyone's individual roles within the project. Working as a team we played to each individual's strengths for each task required. Pat's design skills were incredibly useful for creating the files for the laser cutting of the final frames, Jieming's knowledge about the parameters of code were highly valuable when we were problem-solving the circular "bounding box", and Andy's love for the maquette, skills in writing and concept development all led to a highly articulated design. We constructed the maquette as a team during our out-of-class meetings, and drank a lot of coffee together.

**Creative Code Assignment 2**

Pat Rose

- Create Workflow doco (May 29)
- Make the file an SVG (May 11) (1 comment)
- Add Functions push + Pull Magnets (May 16)
- Export the File? as frames (May 16)
- Create 3D Generate Form in Rhino (May 16) (1 comment)
- Send Laser Cut files to Design Department (May 17)
- Laser Cut Files (May 18)
- Laser Cut scale Model @ 1: Something (May 20)
- Magnatise Sketch
- Optional: Walkthrough in Lumion (May 22)

Jimmy Hu

- Finalize Sketch (May 14)
- Add Repulsion (May 10) (1 comment)
- Create Circle Parameters (May 14)
- Add Referencing for any research (May 10) (1 comment)
- Save Screen shots and Share with group (May 10)
- Annotate whats happening (May 20)
- Make the code with SVG (May 10)
- Add PNG Bump out functionality (May 16)
- Prepare cutting materials (May 19)

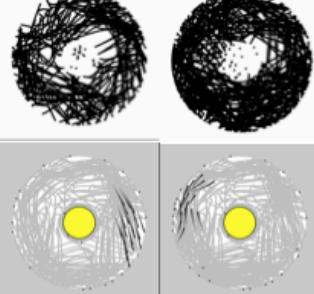
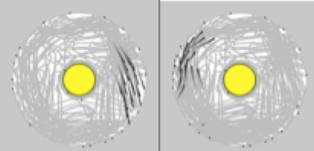
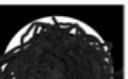
Andy Mullens

- Clarify report w/ M + G (May 10)
- Send Pat Gallery/Market Dimensions. (May 12) (1 comment)
- Get rough "Concept" Model Going" (May 17)
- Bring Lights on Cords (May 16)
- Writing of presentation w/ individ. parts (May 23)
- PowerPoint Presentation (May 23)
- IKEA trip for LED light strips (May 16)
- Process Documentation: write (May 23)
- Purchasing of MDF/cardboard
- Writing of reflective report (May 30)
- References

Add a list...

Add a card...

Link to the collaborative OneDrive document:  
[https://1drv.ms/w/s!ApIV00mx0M\\_mkscPopjMUkEv3z32Rg](https://1drv.ms/w/s!ApIV00mx0M_mkscPopjMUkEv3z32Rg)  
Screenshot of the OneDrive document:

| <p><b>Swarm</b> - layering light/ putting ring on it</p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <thead> <tr> <th style="width: 10%;">What's the Aim?</th> <th style="width: 30%;">Thoughts</th> <th style="width: 60%;">Thought by <a href="#">Jieming Hu</a></th> </tr> </thead> <tbody> <tr> <td>Installation art, functions of light</td> <td><a href="#">Swarm</a></td> <td></td> </tr> <tr> <td>What's the context? (<b>where</b> are we doing it)</td> <td>Site Specific:<br/>For the <a href="#">AIA</a> Brand new space that can be built inside/outside of existing gallery</td> <td>1. <a href="#">Swarm</a> Museum<br/>2. 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Generate a swarm<br/>Programs to simulate the movement of star<br/>3. Generate a swarm<br/>Programs to simulate fireworks view</td> </tr> </tbody> </table> <p>1. <a href="#">HACKING/PROTOTYPING</a><br/>2. <a href="#">REPRESENTATION/MANIFESTATION</a><br/>3. <a href="#">APPLICATION/OUTCOME/CONTEXT</a></p> <p>Notes:<br/>   Raum Stock<br/>   Lives Moves around<br/>   Possibility of language of slice type forms <a href="#">random</a> series of 2D objects?<br/> <b>ideal work</b><br/>   Quality of light through laser cutting;</p> | What's the Aim?   | Thoughts  | Thought by <a href="#">Jieming Hu</a>   | Installation art, functions of light | <a href="#">Swarm</a> |  | What's the context? ( <b>where</b> are we doing it) | Site Specific:<br>For the <a href="#">AIA</a> Brand new space that can be built inside/outside of existing gallery | 1. <a href="#">Swarm</a> Museum<br>2. Cultural Museum | What's the Point? | Experience/Perception & Housing in | Experience Perception | What's the medium? | Swarm system to build structure<br>AB-quality of light<br>Smoke Machines<br>Programs | <a href="#">Swarm</a> system to build structure<br>AB-quality of light<br>Smoke Machines<br>Programs | What makes this only possible through Swarm? | Generating a physical form that would otherwise be unattainable<br>Generating light patterns that have unique properties exclusive to Swarm | 1. Using Swarm to generate many stars with different size and <a href="#">order</a><br>2. Using Swarm to simulate fireworks view | How | Generate a swarm<br>Contain the Vectors Within an Ellipse<br>Java Names of Swarm<br>Point Names as ID | 1. Generate a swarm<br>Contain the Vectors Within an Ellipse<br>Java Names of Swarm<br>Point Names as ID<br>2. Generate a swarm<br>Programs to simulate the movement of star<br>3. Generate a swarm<br>Programs to simulate fireworks view | <p><a href="http://www.journal.cs-design.it/design/exhibition-en-lieu-lumineuses-et-sculptures-dedicas-pour-une-771148">http://www.journal.cs-design.it/design/exhibition-en-lieu-lumineuses-et-sculptures-dedicas-pour-une-771148</a></p> <p>Glass mirrors moving through</p> <p><a href="https://www.youtube.com/watch?v=flBq2H-ASY">https://www.youtube.com/watch?v=flBq2H-ASY</a></p> <p><b>Research/references by AM:</b></p> <ul style="list-style-type: none"> <li>• <a href="#">Nan Dong Cosmic Dance – Gravity</a>, 2015 (breathing surface, floating cube, light, mirror)<br/><a href="https://www.studiogong.com/cosmic-dance">https://www.studiogong.com/cosmic-dance</a><br/><a href="https://vimeo.com/118517485">https://vimeo.com/118517485</a></li> <li>• <a href="#">Anthony McCall You and I</a> (2005) (paper shapes through smoke machines in dark room)<br/><a href="https://www.youtube.com/watch?v=qKgzbQ2w1kw">https://www.youtube.com/watch?v=qKgzbQ2w1kw</a><br/><a href="http://www.anthonymccall.com/web/tours.html">http://www.anthonymccall.com/web/tours.html</a><br/><a href="https://www.mca-mc.org/collection/exhibition/705/light-show">https://www.mca-mc.org/collection/exhibition/705/light-show</a></li> <li>• <a href="#">Graffiti Universe</a> (The Weather Project, 2003) (the sun at Tate)<br/><a href="http://www.tate.org.uk/critics/comment/articles/the-weather-project">http://www.tate.org.uk/critics/comment/articles/the-weather-project</a></li> <li>• General <a href="#">Universe</a> (Slow Art Inside a Cube IV, 2009) (moving robotic arm with light inside cut out cube)<br/><a href="https://www.youtube.com/watch?v=jvsa-A_EK6AA">https://www.youtube.com/watch?v=jvsa-A_EK6AA</a><br/><a href="https://www.mca-mc.org/collection/exhibition/116/light-show">https://www.mca-mc.org/collection/exhibition/116/light-show</a></li> <li>• <a href="#">James Gotschall</a> - all his work, or more specifically <a href="#">Swarm</a><br/><a href="http://jamesgotschall.com/works/type/gotschall/">http://jamesgotschall.com/works/type/gotschall/</a><br/><a href="https://nqa.gov.au/conturme/">https://nqa.gov.au/conturme/</a></li> <li>• <a href="#">Felix Göttsche</a> (Torus United (Galaxy)) (1999) (golden bead curtain that people walk through)<br/><a href="http://www.guggenheim.org/artworks/72101">http://www.guggenheim.org/artworks/72101</a></li> </ul> | <p><b>Swarm</b> flowers and People – Gold, 2015 (currently on display at the Art Gallery of NSW – interactive work)<br/> <a href="https://www.artgallery.nsw.gov.au/exhibition/alpha-light-jason/">https://www.artgallery.nsw.gov.au/exhibition/alpha-light-jason/</a><br/> <a href="https://www.youtube.com/watch?v=hrv_50t_Ekg">https://www.youtube.com/watch?v=hrv_50t_Ekg</a></p> <p>Nervous System generating light<br/> <a href="https://nervous.cc/2014/03/light-search_tags.php?search=lighting">https://nervous.cc/2014/03/light-search_tags.php?search=lighting</a></p> <p>Traffic Cloud, London, Heathrow airport<br/> <a href="https://www.youtube.com/watch?v=tPjTowr_w">https://www.youtube.com/watch?v=tPjTowr_w</a></p> <p>How do <a href="#">Swarm</a> work <a href="https://www.youtube.com/watch?v=qQfUPMXQZQY">https://www.youtube.com/watch?v=qQfUPMXQZQY</a></p> <p>4.4: Combining Steering Behaviors: Hacking - <a href="#">The Nature of Code</a><br/> <a href="https://www.youtube.com/watch?v=qkTf2XWfHfI">https://www.youtube.com/watch?v=qkTf2XWfHfI</a></p> <p>John <a href="#">Anderson</a> (Throwing a ball in the air to get a straight line (best of Thirty-Six Attempts) (1973) (book, random movements, seemingly <a href="#">random</a>, post, beautiful artwork)<br/> <a href="http://www.mca-mc.org/sites/default/files/images/reviews/122/anderson.pdf">http://www.mca-mc.org/sites/default/files/images/reviews/122/anderson.pdf</a></p> <p>Force <a href="#">align</a> them in Centrally<br/>   A Vector Position in the Center<br/>   Align/carene/avoid/magnet behavior (rotated quality of Light)<br/>   Agents grow with time</p> <p>Bee Installation <a href="https://www.youtube.com/watch?v=ilicygzb9lo">https://www.youtube.com/watch?v=ilicygzb9lo</a></p> <p>SVG reference: <a href="http://taggit.com/manu/grading/#positioning">http://taggit.com/manu/grading/#positioning</a></p> <p><b>Research work by <a href="#">Jieming Hu</a>:</b><br/> <a href="#">Code part</a>.</p> | <p>1. <a href="http://alpha.editor.p5js.org/Jieming/sketches/Elengg02a">http://alpha.editor.p5js.org/Jieming/sketches/Elengg02a</a><br/>   Swarm project: Original work by Henry Fritz<br/>   Adapted by <a href="#">Jieming Hu</a></p> <p>2. <a href="http://alpha.editor.p5js.org/Jieming/sketches/blym+020e">http://alpha.editor.p5js.org/Jieming/sketches/blym+020e</a><br/>   Swarm project: Original work by Henry Fritz<br/>   Adapted by <a href="#">Jieming Hu</a> (add comments)</p> <p><b>visual art :</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://www.youtube.com/watch?v=UWk4Tg1gkhs&amp;t=5s">https://www.youtube.com/watch?v=UWk4Tg1gkhs&amp;t=5s</a></li> <li>2. <a href="https://www.youtube.com/watch?v=qKgzbQ2w1kw">https://www.youtube.com/watch?v=qKgzbQ2w1kw</a></li> <li>3. <a href="https://www.youtube.com/watch?v=qWm02trv0s">https://www.youtube.com/watch?v=qWm02trv0s</a></li> <li>4. <a href="https://www.youtube.com/watch?v=qNfWNg8qf7M">https://www.youtube.com/watch?v=qNfWNg8qf7M</a></li> <li>5. <a href="https://www.youtube.com/watch?v=qkTf2XWfHfI">https://www.youtube.com/watch?v=qkTf2XWfHfI</a></li> <li>6. <a href="https://www.youtube.com/watch?v=qDw733Cw6B3tPlkzN2AGyCNtmt9PhgRSD_p0XKcefG_A/index2">https://www.youtube.com/watch?v=qDw733Cw6B3tPlkzN2AGyCNtmt9PhgRSD_p0XKcefG_A/index2</a></li> <li>7. <a href="https://www.youtube.com/watch?v=qDw733Cw6B3tPlkzN2AGyCNtmt9PhgRSD_p0XKcefG_A/index3">https://www.youtube.com/watch?v=qDw733Cw6B3tPlkzN2AGyCNtmt9PhgRSD_p0XKcefG_A/index3</a></li> <li>8. <a href="https://www.youtube.com/watch?v=qNfWNg8qf7M">https://www.youtube.com/watch?v=qNfWNg8qf7M</a></li> <li>9. <a href="https://www.youtube.com/watch?v=qDw733Cw6B3tPlkzN2AGyCNtmt9PhgRSD_p0XKcefG_A/index5">https://www.youtube.com/watch?v=qDw733Cw6B3tPlkzN2AGyCNtmt9PhgRSD_p0XKcefG_A/index5</a></li> <li>10. <a href="https://www.youtube.com/watch?v=qV23crTpQkw&amp;index=1&amp;list=PLkzN2AGyCNtmt9PhgRSD_p0XKcefG_A">https://www.youtube.com/watch?v=qV23crTpQkw&amp;index=1&amp;list=PLkzN2AGyCNtmt9PhgRSD_p0XKcefG_A</a></li> </ol> <p><b>Reference:</b></p> <ol style="list-style-type: none"> <li>1. "Amazing Art Video", YouTube, N.p., 2017, Web, 10 May 2017.</li> <li>2. N.p., 2017, Web, 10 May 2017.</li> <li>3. "Relax Music - The Most Amazing Space Nebula - 2 Hours - Sleep Meditation - 1080P HD", YouTube, N.p., 2017, Web, 10 May 2017.</li> <li>4. "Myself Drawing - How to Draw a Star", YouTube, N.p., 2017, Web, 10 May 2017.</li> <li>5. "Relax Music - The Most Amazing Space Nebula - 2 Hours - Sleep Meditation - 1080P HD", YouTube, N.p., 2017, Web, 10 May 2017.</li> <li>6. "The Splendor Of Color Kaleidoscope Video V2.1 1080P", YouTube, N.p., 2017, Web, 10 May 2017.</li> <li>7. "Undercroft Live Visual Show, Starbatter Graz, 16.9.16", YouTube, N.p., 2017, Web, 10 May 2017.</li> </ol> |
|---|---|---|---|--------------------------------------|-----------------------|--|---|--|---|-------------------|------------------------------------|-----------------------|--------------------|--|--|--|---|--|-----|---|--|---|---|---|
| What's the Aim?   | Thoughts  | Thought by <a href="#">Jieming Hu</a>   |   |                                      |                       |  |   |  |   |                   |                                    |                       |                    |  |  |  |   |  |     |   |  |   |   |   |
| Installation art, functions of light  | <a href="#">Swarm</a>   |   |   |                                      |                       |  |   |  |   |                   |                                    |                       |                    |  |  |  |   |  |     |   |  |   |   |   |
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| What's the Point?   | Experience/Perception & Housing in  | Experience Perception   |   |                                      |                       |  |   |  |   |                   |                                    |                       |                    |  |  |  |   |  |     |   |  |   |   |   |
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| <p>Finished the draft sketch <a href="#">[Jieming]</a><br/>   Code processing: <a href="http://alpha.editor.p5js.org/Jieming/sketches/BjeBd7w12">http://alpha.editor.p5js.org/Jieming/sketches/BjeBd7w12</a></p>    | <p><b>ideal work</b></p>  <p>MDF: 9mm board = 2400 x 1200 sheet<br/>   300 x 300mm circle x 9mm depth (model)</p> | <p>Analyse swarm: dots<br/> <a href="http://alpha.editor.p5js.org/Jieming/sketches/Elengg02a">http://alpha.editor.p5js.org/Jieming/sketches/Elengg02a</a></p>    | <p>Pats Rendition of the Swarm: Magnets + Repulsion Systems</p>  |                                      |                       |  |   |  |   |                   |                                    |                       |                    |  |  |  |   |  |     |   |  |   |   |   |

A large, glowing, organic light sculpture titled "Together". The sculpture is composed of numerous thin, curved, glowing lines that converge towards the center, creating a bright, central point of light. The lines are illuminated from within, casting a warm glow on the surrounding environment. The overall shape is organic and fluid, resembling a cluster of leaves or a complex network.

## *Together, 2017*

---

A swarm system  
based installation  
artwork

Patrick Rose, u6435655  
Jimeing Hu, u5841919  
Andy Mullens u4844953

---

Foundations of Creative Code  
DESN6002  
2017

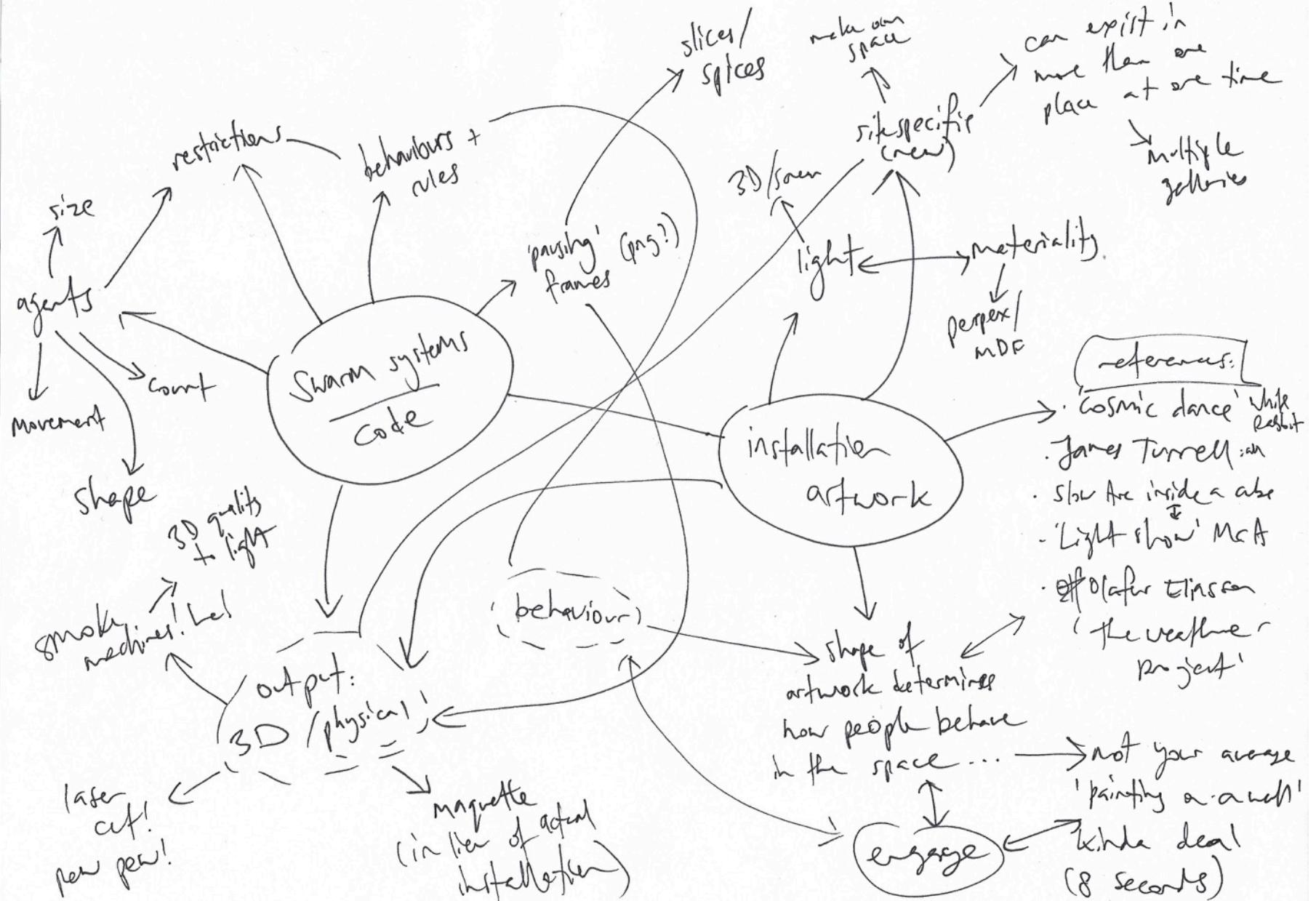
# Why // What

## Cultural context

- Installation artwork
- Moves beyond static viewing of 2D art on wall in white cube
- Immersive
- Shape of the artwork (light and shadow) changes with the presence of an audience

## Use of swarm

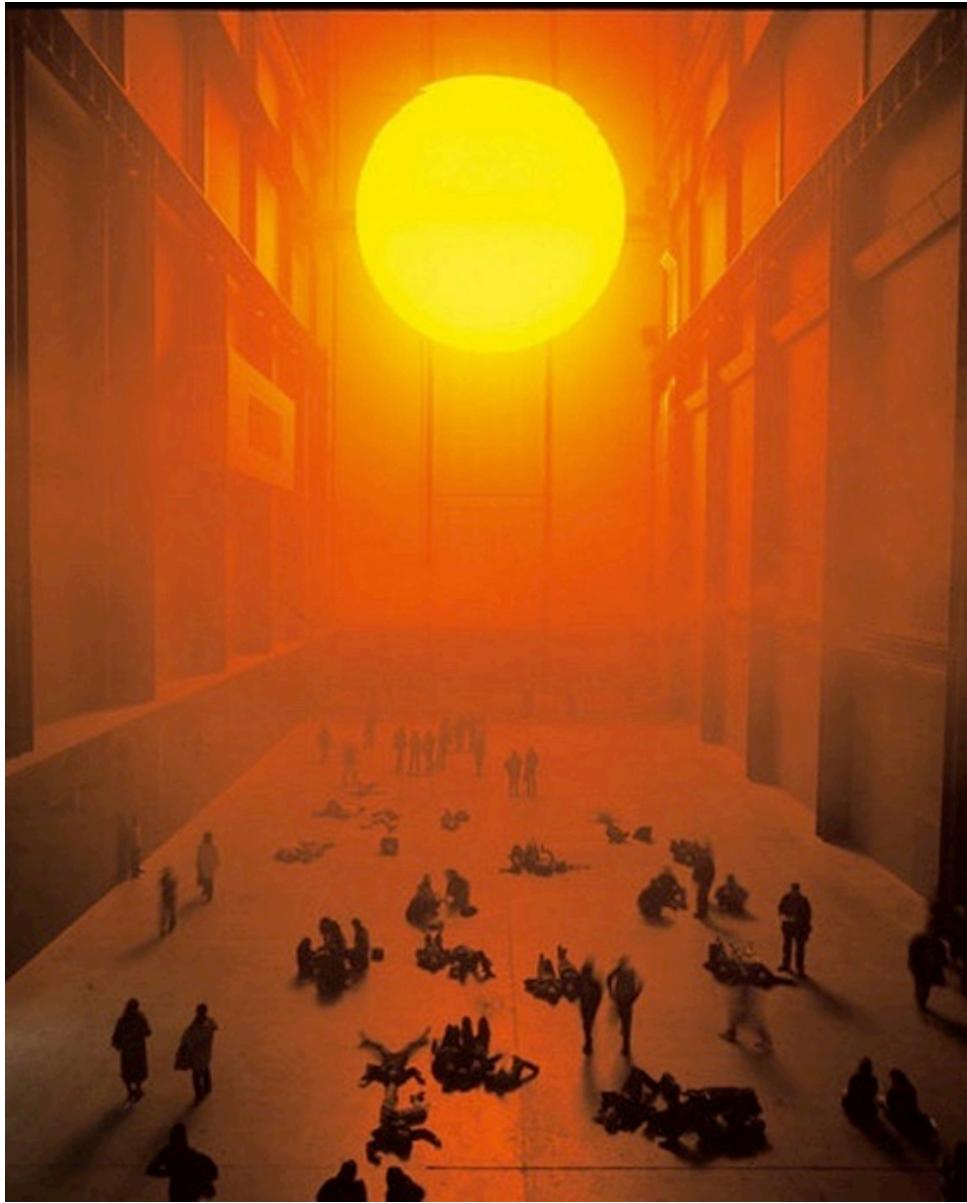
- Behaviour of agents
- Contain to a circular form
- Generative, always different



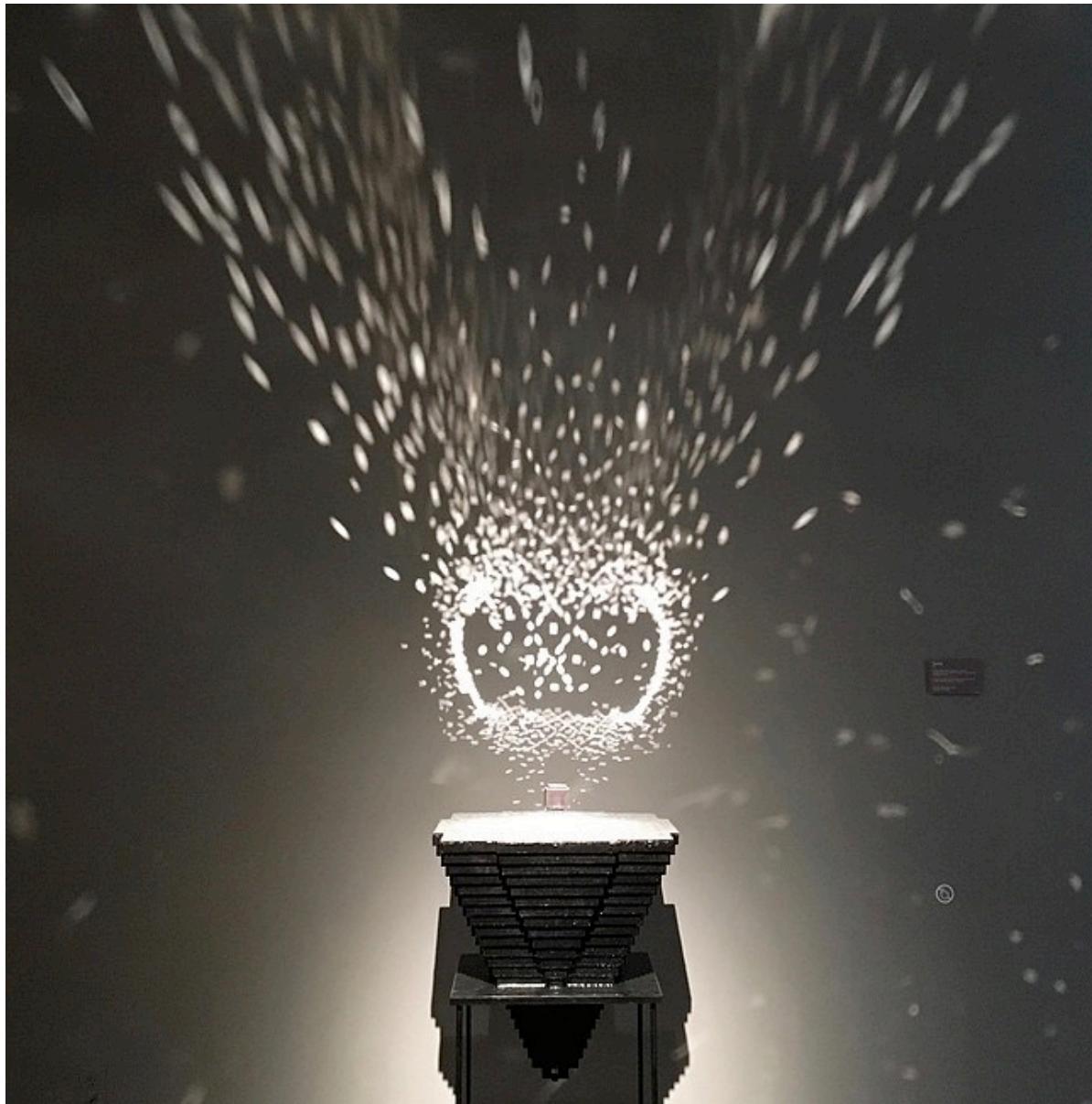
Initial mind map: swarm, context, media



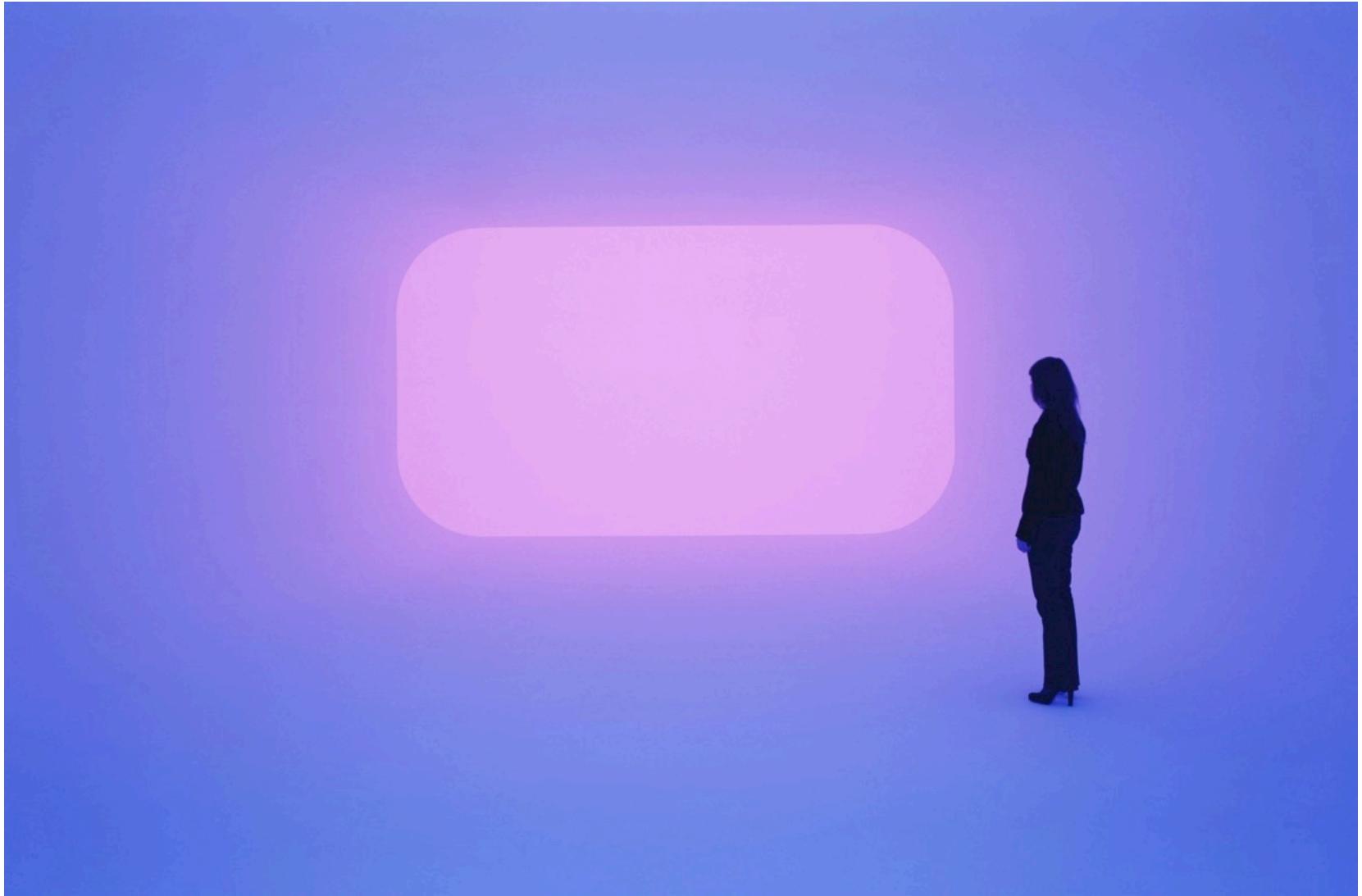
Conrad Shawcross *Slow Arc Inside a Cube IV*, 2009



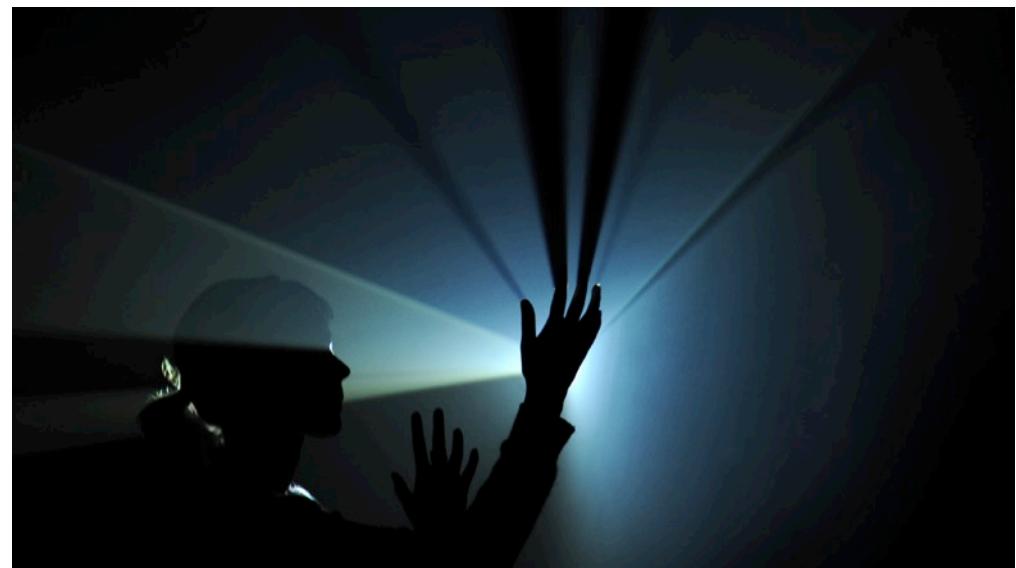
Olafur Eliasson *The Weather Project*, 2003



Nick Dong *Cosmic Dance – Gravity*, 2015



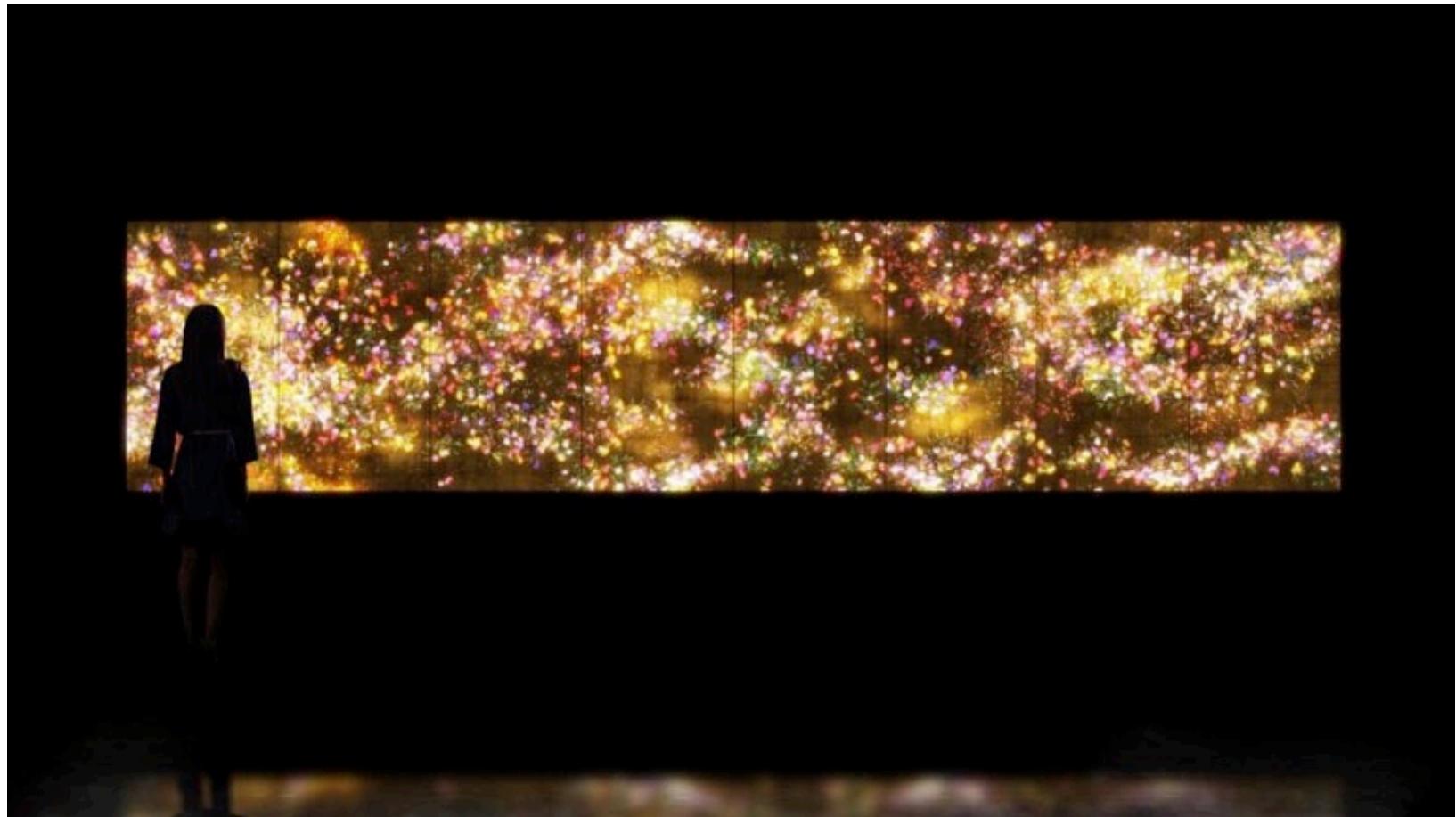
James Turrell *Ganzfeld*



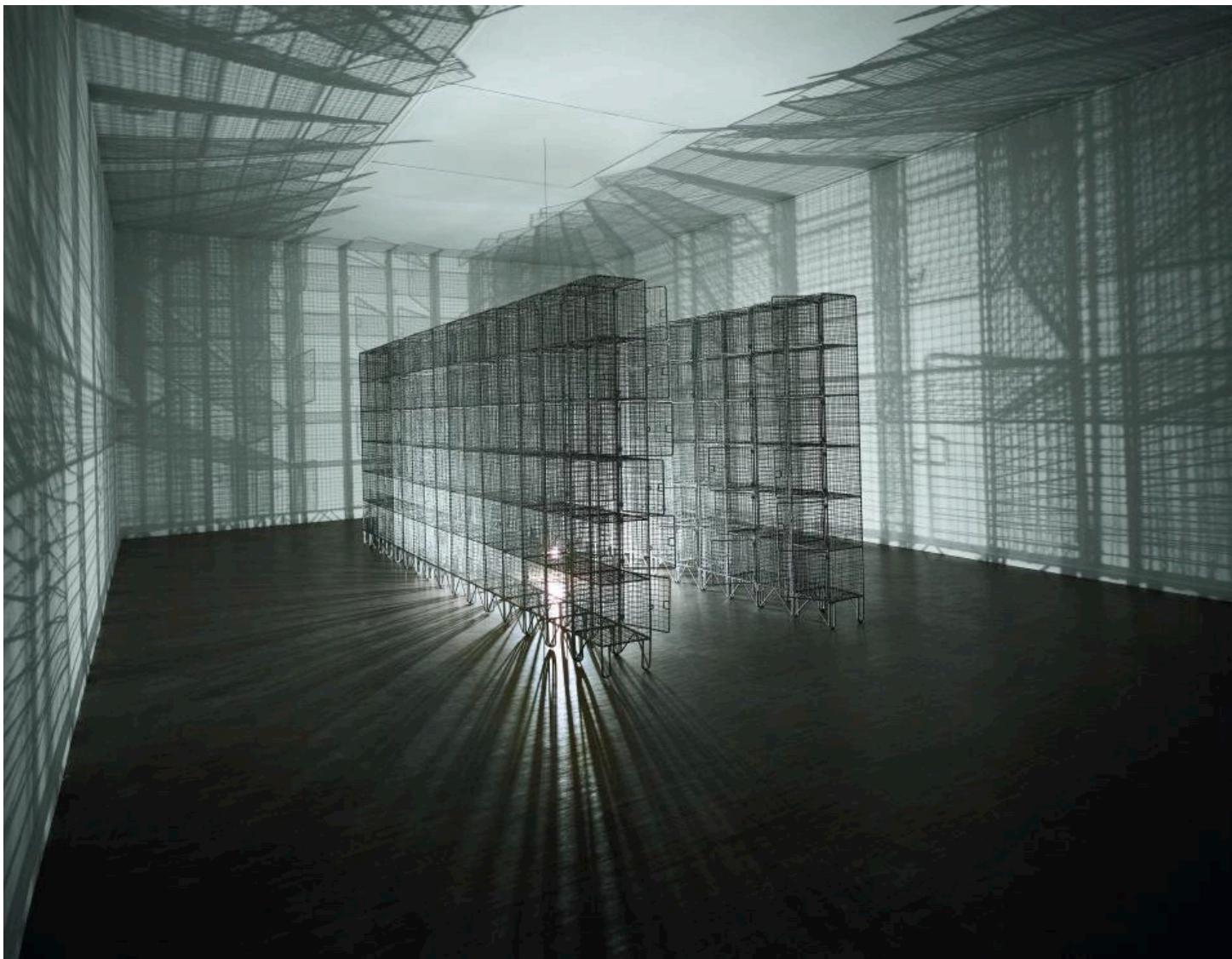
Anthony McCall *You and I Horizontal*, 2005



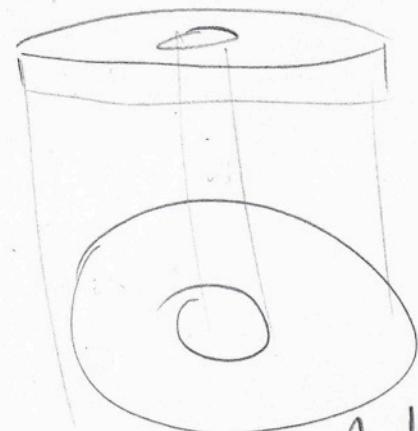
Felix Gonzalez-Torres *Untitled (Golden)* 1995



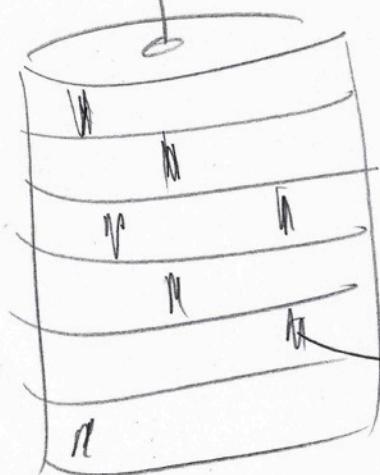
teamLab *Flowers and People – Gold*, 2015



Mona Hatoum *Light Sentence* 1992



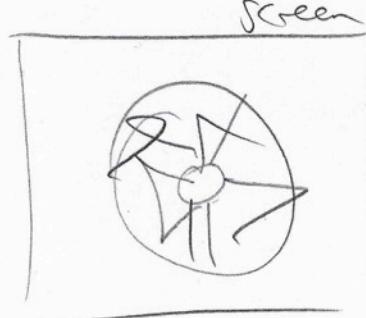
light in centre



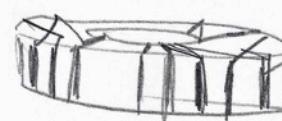
cylinder

stacks  
of  
discs/  
donuts

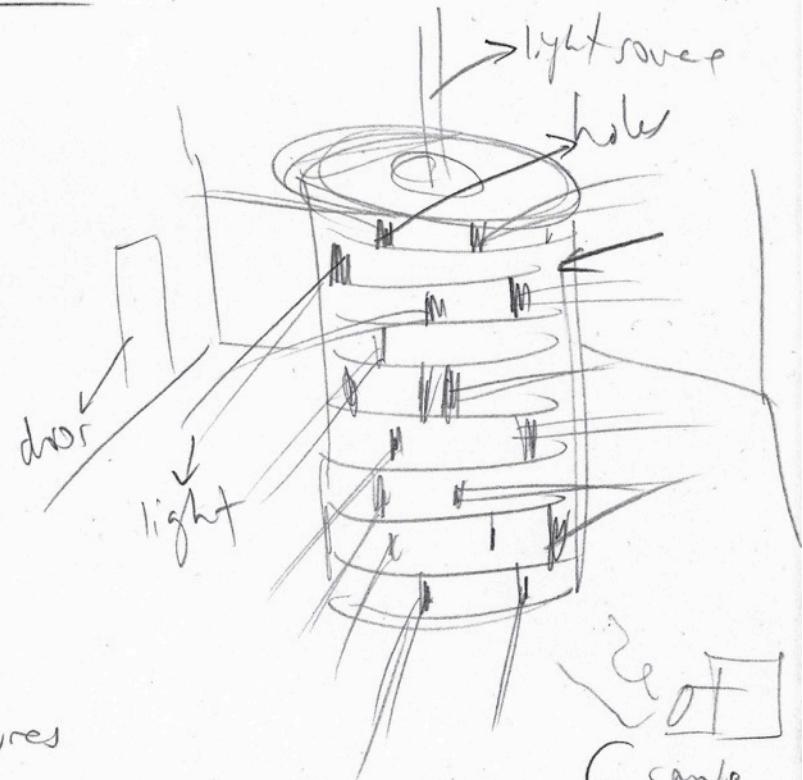
sherm  
punctures



screen



gaps  
where  
the light  
comes through



Initial sketches



Auto-refresh donut test ↗ by andy.mullens

THIS IS A PREVIEW VERSION OF THE EDITOR, THAT HAS NOT  
YET BEEN OFFICIALLY RELEASED. IT IS IN DEVELOPMENT, YOU  
CAN REPORT BUGS HERE. PLEASE USE WITH CAUTION.



project-folder

sketch.js  
index.html  
style.css  
agent.js

```

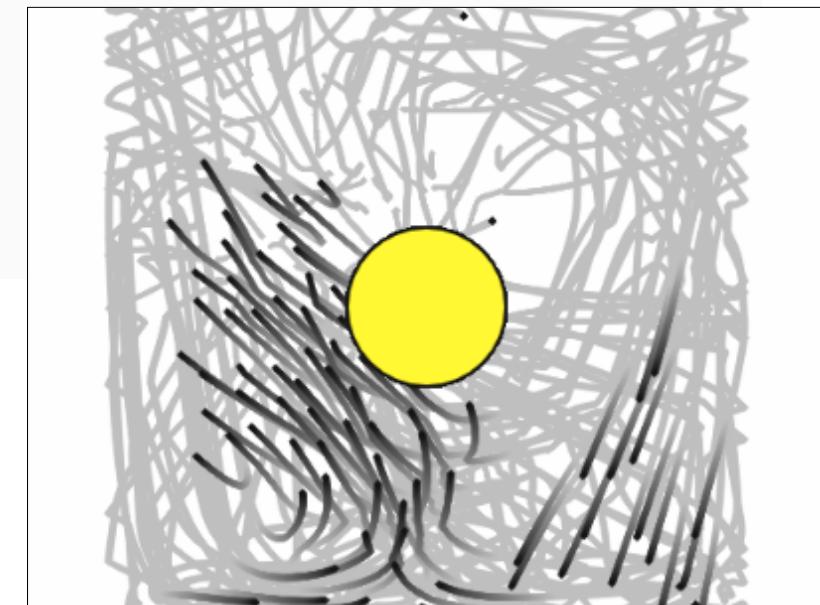
1 var swarm = [];
2 var friction = 0.98;
3 var swarmCount = 10;
4
5 var avoidRadius = 15;
6 var avoidStrength = 0.15;
7
8 var cohereRadius = 30;
9 var cohereStrength = 0.05;
10
11 var alignRadius = 40;
12 var alignStrength = 0.01;
13
14 function setup() {
15   createCanvas(400, 400);
16
17   for (var i=0; i<swarmCount; i++){
18     var newA = new Agent(random(100,300),random(100,300),random(-1,1), random(-1,1));
19     swarm.push(newA);
20   }
21 }
22
23 function draw() {
24   //background(255,20);
25   noFill();
26   ellipse (width/2, height/2, width/1.5, height/1.5)
27   ellipse (width/2, height/2, width/4, height/4)
28
29   for (agent of swarm){
30     agent.draw();
31     agent.cohere();
32     agent.avoid();
33     agent.align();
34     agent.move();
35

```

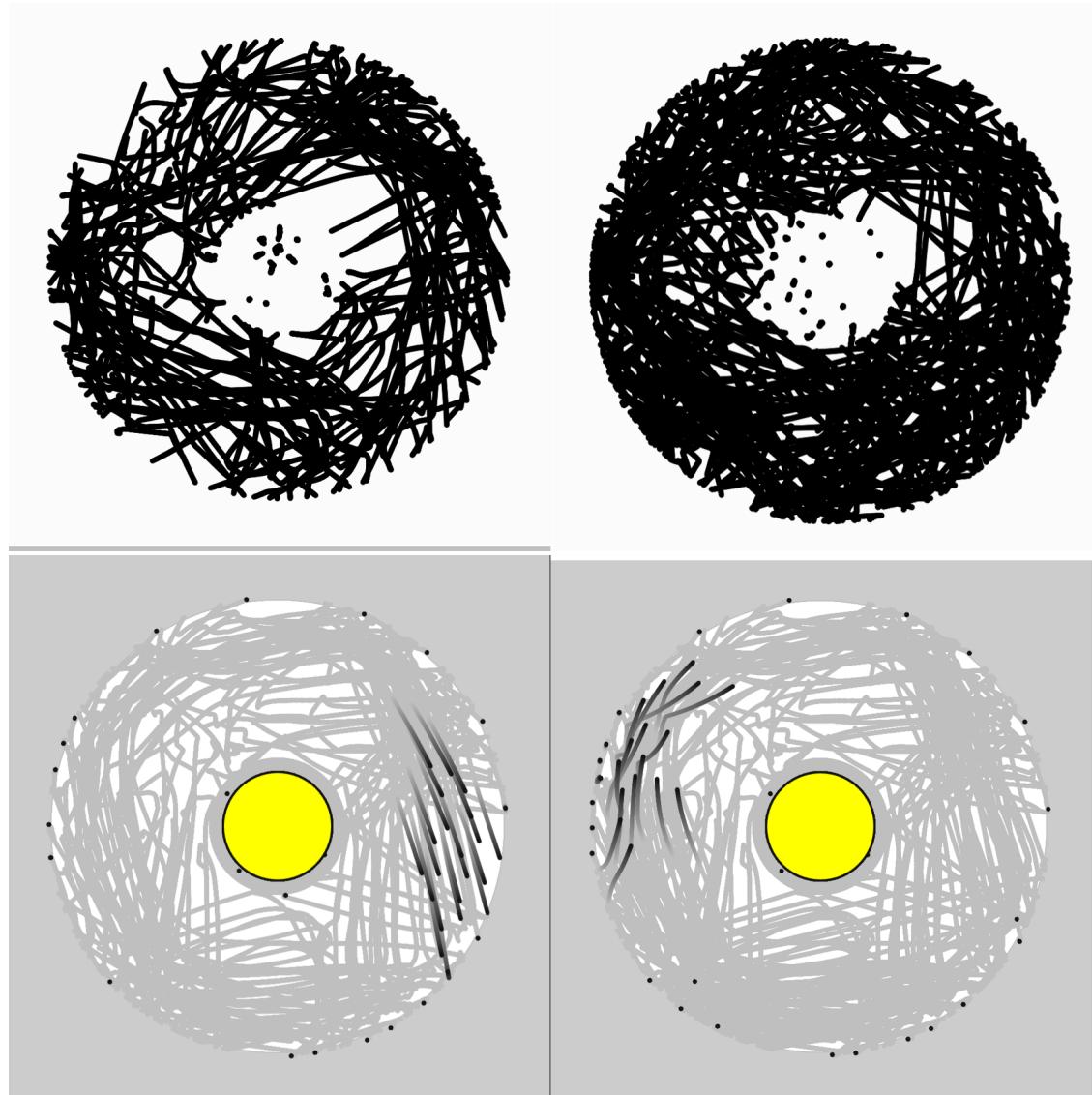
Console

Saved: 25 minutes ago

Preview



Early versions of sketch



Early versions of swarm sketch

Duplicate Download Share Open Examples Reference About

Auto-refresh  HTTPS by andy.mullens

agent.js

```

for (var neighbour of swarm){
  var nd = this.pos.dist(neighbour.pos); // neighbour distance
  if (nd < avoidRadius && nd > 0){// ignore neighbours that are far away
    var pushVec = p5.Vector.sub(this.pos,neighbour.pos); // repulsive push away from
    pushVec.normalize();
    avoidVec.add(pushVec);
  }
  avoidVec.normalize(); //scale to 1.0
  avoidVec.mult(avoidStrength); // multiply by the strength variable
  this.vel.add(avoidVec); // add to velocity
}

this.align = function(){ // alignment - move in a similar direction to your neighbours
  var averageVelocity = createVector(); // vector to store average velocity
  for (var neighbour of swarm){ // run through the swarm
    var nd = this.pos.dist(neighbour.pos); // neighbour distance
    if (nd < alignRadius && nd > 0){ // ignore neighbours that are far away
      averageVelocity.add(neighbour.vel); // add my neighbour's velocity
    }
  }
  averageVelocity.normalize();
  averageVelocity.mult(alignStrength);
  this.vel.add(averageVelocity); // add to velocity
}

this.magnet = function(){ // head towards the magnet
  toMagnet = p5.Vector.sub(bigMagnet,this.pos);
  toMagnet.normalize();
  toMagnet.mult(0.05);
  this.vel.add(toMagnet);
}

```

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Auto-refresh  HTTPS by andy.mullens

project-folder

- sketch.js
- index.html
- style.css
- agent.js

sketch.js

```

6 var swarmCount = 8;
7
8 var avoidRadius = 50;
9 var avoidStrength = 0.25;
10
11 var cohereRadius = 50;
12 var cohereStrength = 0.05;
13
14 var alignRadius = 40;
15 var alignStrength = 0.01;
16
17 // var swarm = [];
18 // var friction = 0.99;
19 // var swarmCount = 20;
20
21 // var alignDistance = 60;
22 // var alignStrength = 0.01;
23
24 // var avoidDistance = 20;
25 // var avoidStrength = 0.1;
26
27 // var cohereStrength = 0.1;
28 // var cohereDistance = 50;
29 var bigMagnet;
30
31 function setup() {
32   createCanvas(400, 400);
33   svg = SVG('svgtest').size(400, 400);
34   background (0);
35
36   fill(255);
37   stroke (50);
38   ellipse1 = ellipse (width/2, height/2, width/1.2, height/1.2);
39   fill(0);
40   ellipse2 = ellipse(width/2, height/2, width/4, height/4);
41

```

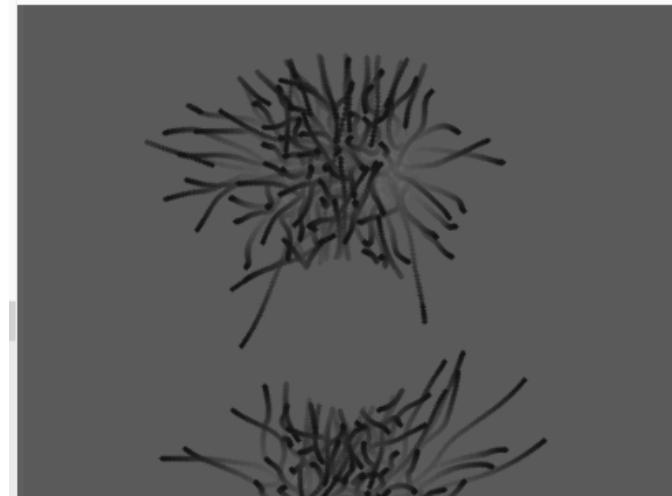
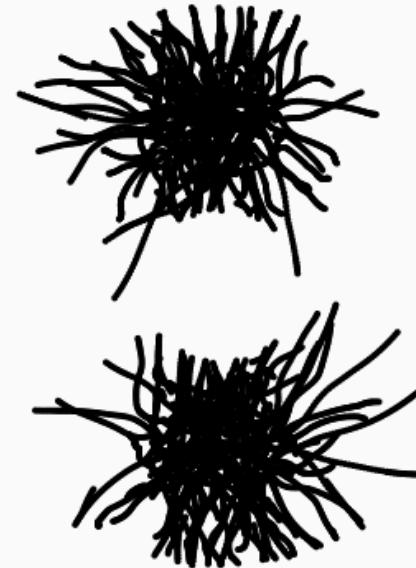
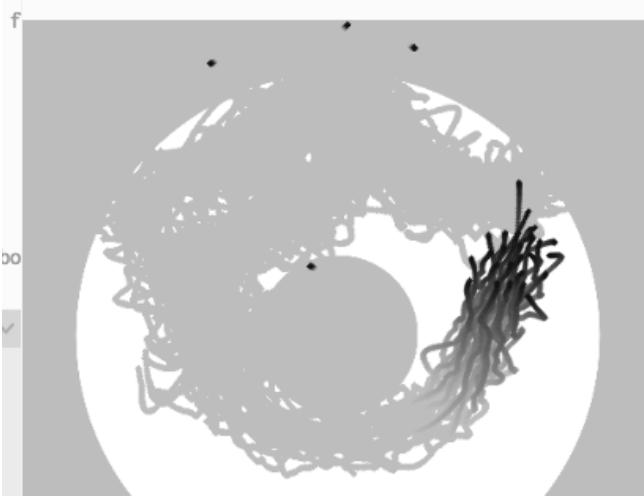
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Hello, andy.mullens!

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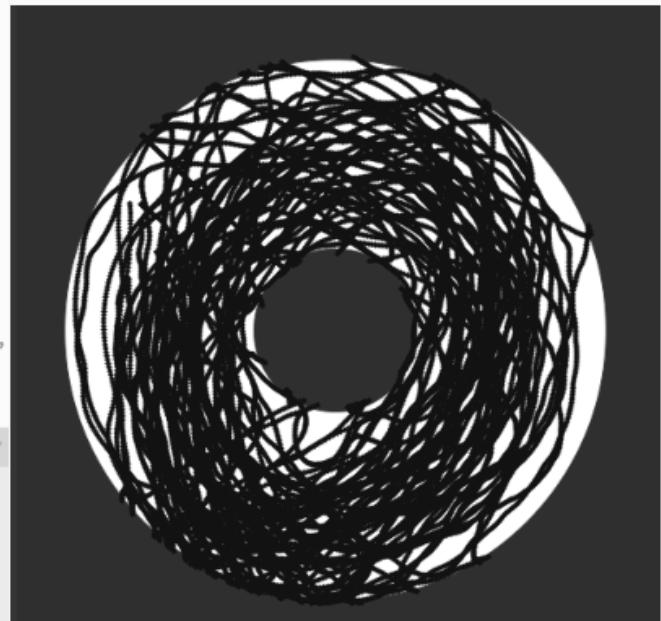
Early versions of swarm sketch

Preview



Early versions of swarm sketch

```
53
54 function draw() {
55
56     //Iteration to call functions
57     for (agent of swarm){
58         agent.draw();
59
60         agent.move();
61         agent.avoid();
62         agent.cohere();
63         agent.align();
64         agent.repulsion();
65         agent.magnet(); // run the magnet function for this agent
66         agent.antimagnet();
67
68     }
69     if (frameCount%300 == 0) svgd.clear();
70
71 }
72 // define saveSVG();
73 function saveSVG(){
74     svgraw = document.getElementById("svgttest").innerHTML;
75     console.log(svgraw);
76     svgaray = [svgraw];
77     save(svgaray, "donut_frame_"+frameCount+".svg");
78 }
79 // press S to call saveSVG();
80 function keyPressed(){
81     if (key == 'S') saveSVG();
82 }
83
84
85 function saveImages(){
86
87
88     if (frameCount%300 == 0) saveFrames("donut frame", "png", 1, 1); //save the canvas,
89 }
90
91
```



Later version of swarm sketch



Auto-refresh

HTTPS

Swarm Jimmy + Pagnet + A by andy.mullens

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project-folder

sketch.js

index.html

style.css

agent.js

```

1 var swarm = [];
2 var friction = 0.96;
3 var swarmCount = 10;
4
5 var avoidRadius = 30;
6 var avoidStrength = 0.15;
7
8 var cohereRadius = 150;
9 var cohereStrength = 0.05;
10
11 var alignRadius = 40;
12 var alignStrength = 0.1;
13
14     var bigMagnet;
15     var antiMagnet;
16
17
18 function setup() {
19
20     createCanvas(500, 500);
21     svgd = SVG('svgtest').size(500, 500);
22     background (50);
23
24     fill(255);
25     //draw two circles
26     stroke (50)
27     ellipse1 = ellipse (width/2, height/2, width/1.2, height/1.2);
28     fill(50);
29     ellipse2 = ellipse(width/2, height/2, width/4, height/4);
30     fill(255);
31     ellipse3 = ellipse(width/2, height/2, width/6, height/6);
32     // rect1=rect(245,175,9,9);
33     // rect2=rect(185,285,9,9);
34     // rect3=rect(304,288,9,9);
35
36     //frameRate (20);

```

Console

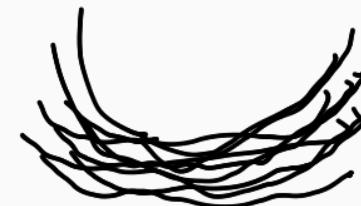
```

cx="152.16073912928903" cy="164.54250000791995"></circle><circle id="SvgsCircle6988" r="2.5" cx="465.5621038001047" cy="252.5932822330567">
</circle><circle id="SvgsCircle6989" r="2.5" cx="105.37810820589489" cy="264.474216036202"></circle><circle id="SvgsCircle6990" r="2.5"
cx="87.22044501083383" cy="300.5495077012152"></circle><circle id="SvgsCircle6991" r="2.5" cx="108.26545632906621" cy="322.88272102791456">
</circle><circle id="SvgsCircle6992" r="2.5" cx="139.37127685927598" cy="318.3049534891974"></circle><circle id="SvgsCircle6993" r="2.5"
cx="121.19644052887739" cy="203.659688691363034"></circle><circle id="SvgsCircle6994" r="2.5" cx="156.16597134786056" cy="288.2631928188021">
</circle><circle id="SvgsCircle6995" r="2.5" cx="133.91959656402028" cy="265.4179500640143"></circle><circle id="SvgsCircle6996" r="2.5"
cx="122.15350303989104" cy="292.1652434579836"></circle><circle id="SvgsCircle6997" r="2.5" cx="152.04240364405885" cy="165.86767918604494">
</circle></svg>

```

Saved: 17 hours ago

Preview



donut\_frame\_599.svg.txt

donut\_frame\_299.svg.txt

donut\_frame\_299.svg (1).txt

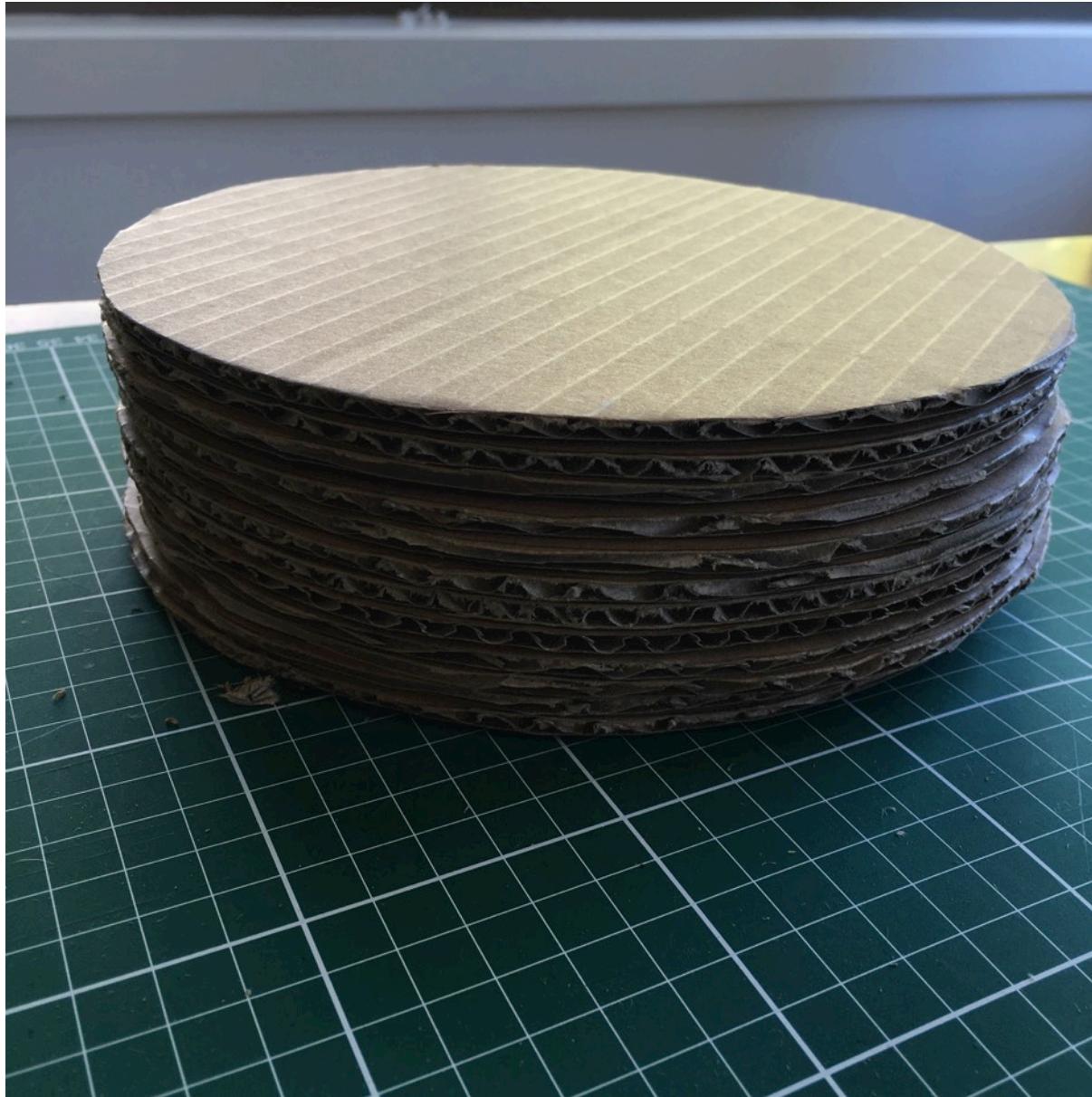
donut\_frame\_899.svg.txt

donut\_frame\_599.svg.txt

donut\_frame\_299.svg.txt

Show All X

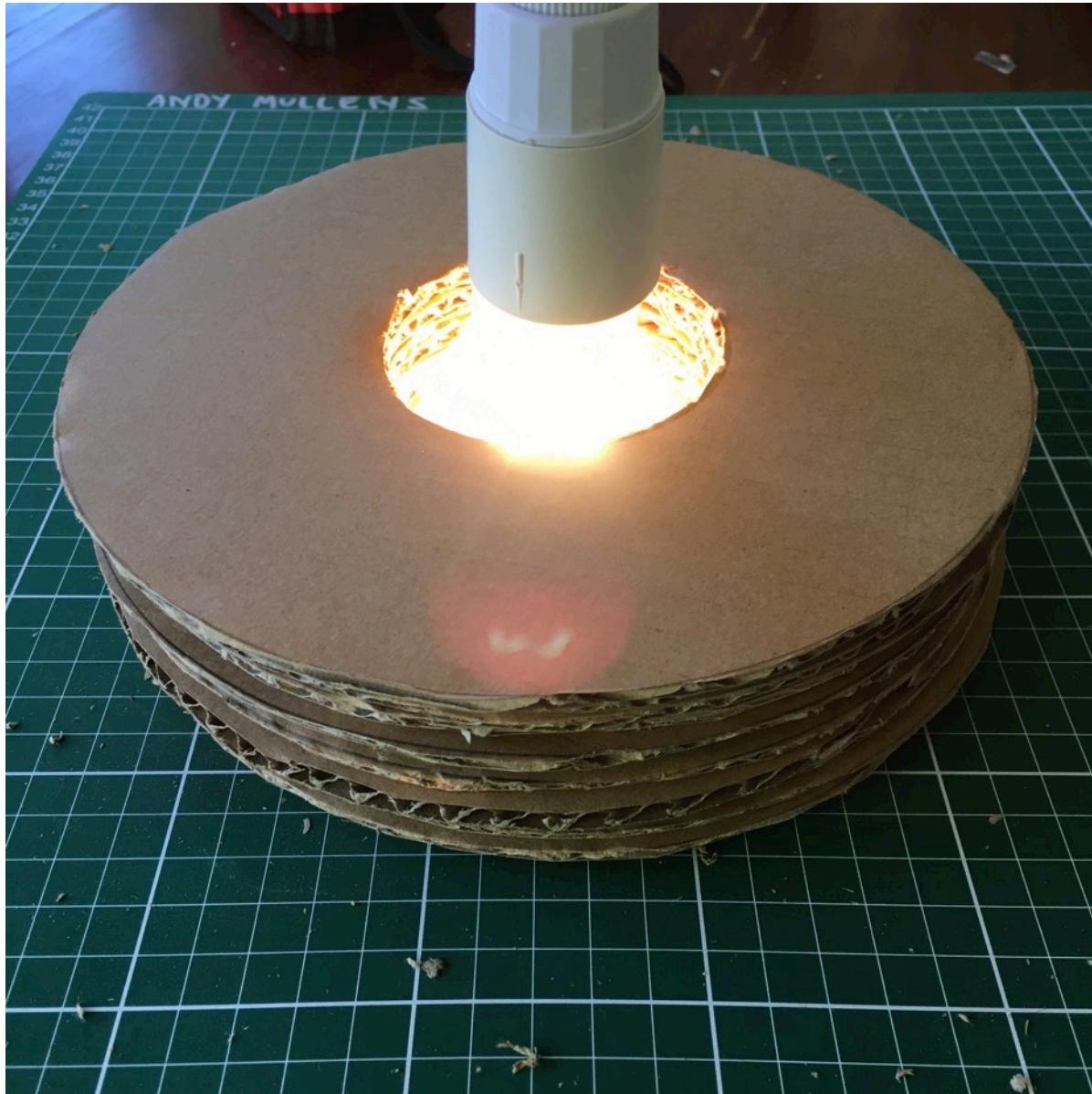
Final swarm sketch used



Rough physical “sketch” of our swarm project



Rough model, mapping out layers and light

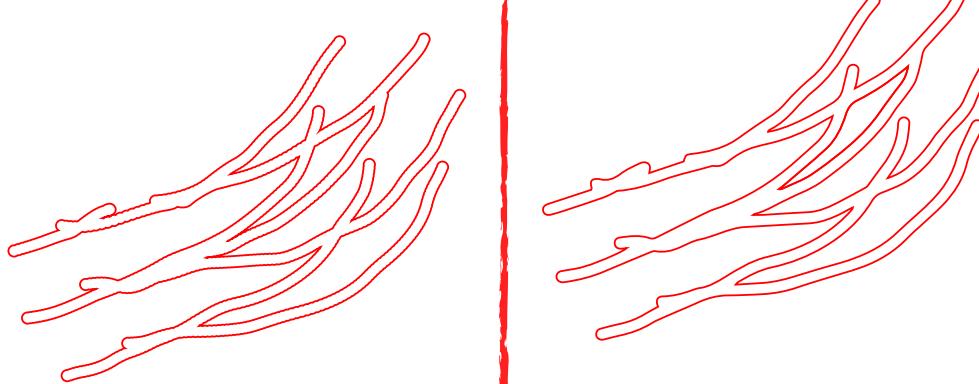


Physically mapping out what our fabricated swarm project would look like



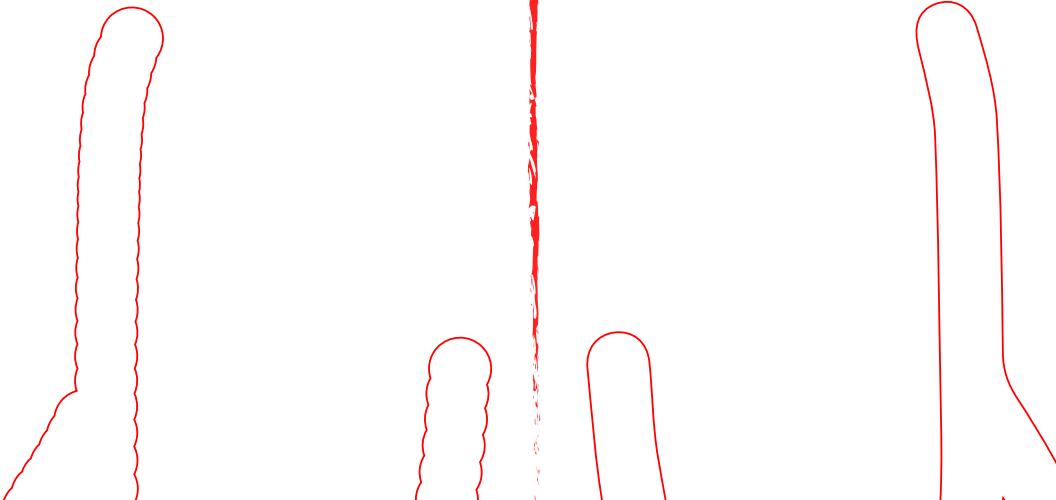
Light through the corrugated cardboard

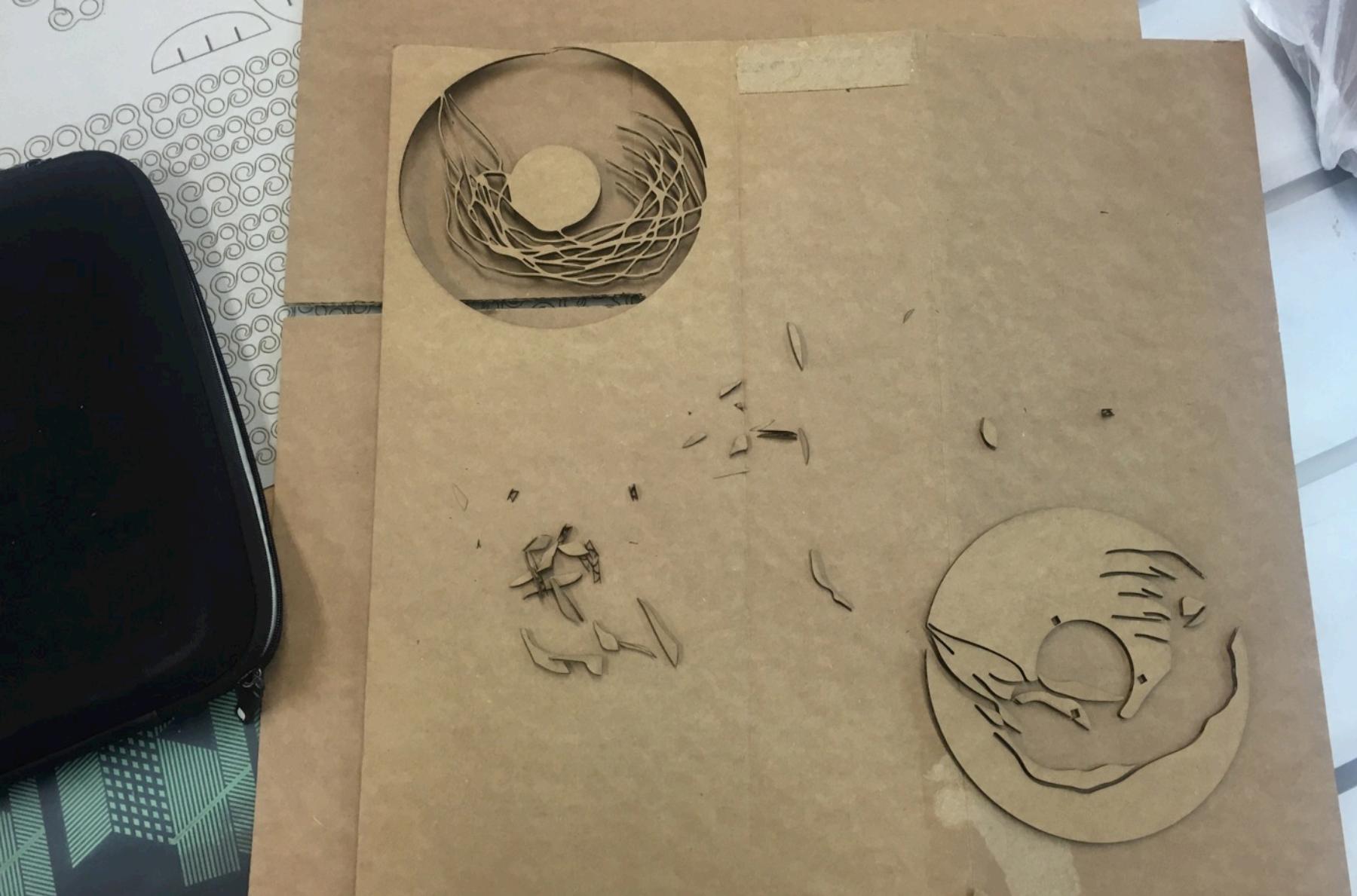
# SVG Path Smoothing Vs Image Trace and Simplification of a PNG File



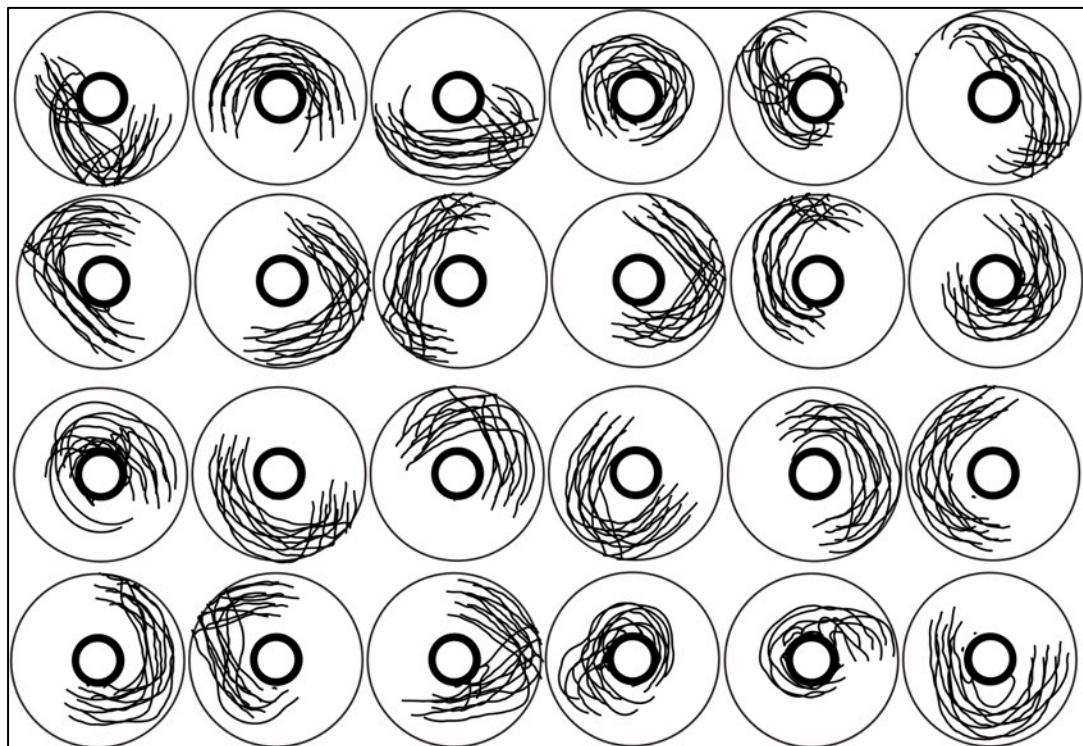
More Accurate  
Exact Representation of Form

Cheaper to Cut  
Smoother Path  
More Simple Form

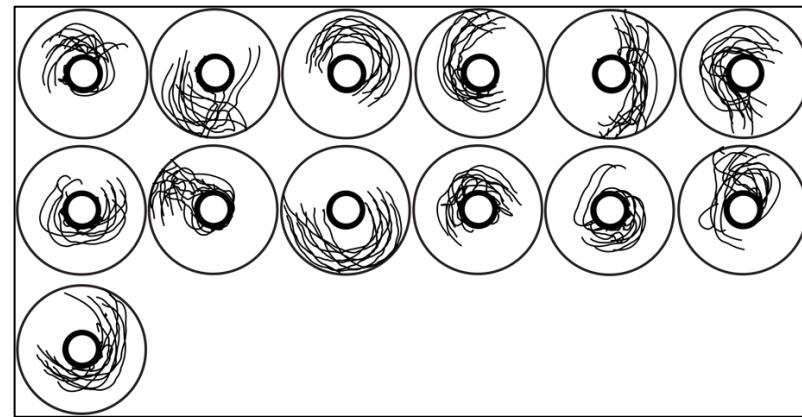




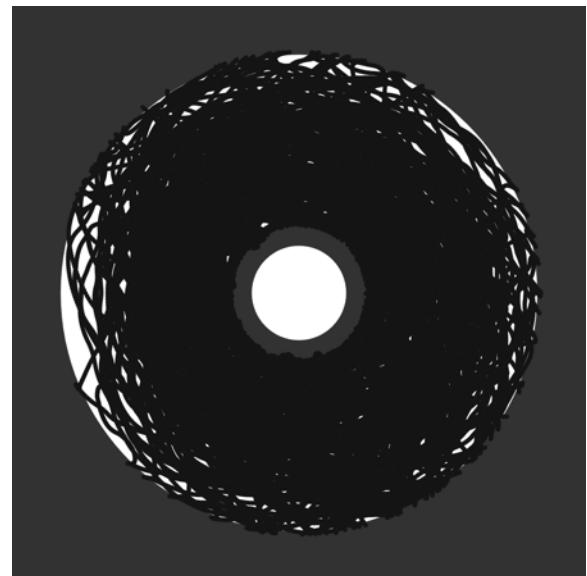
Test on laser cutter // change in direction // inner form more interesting

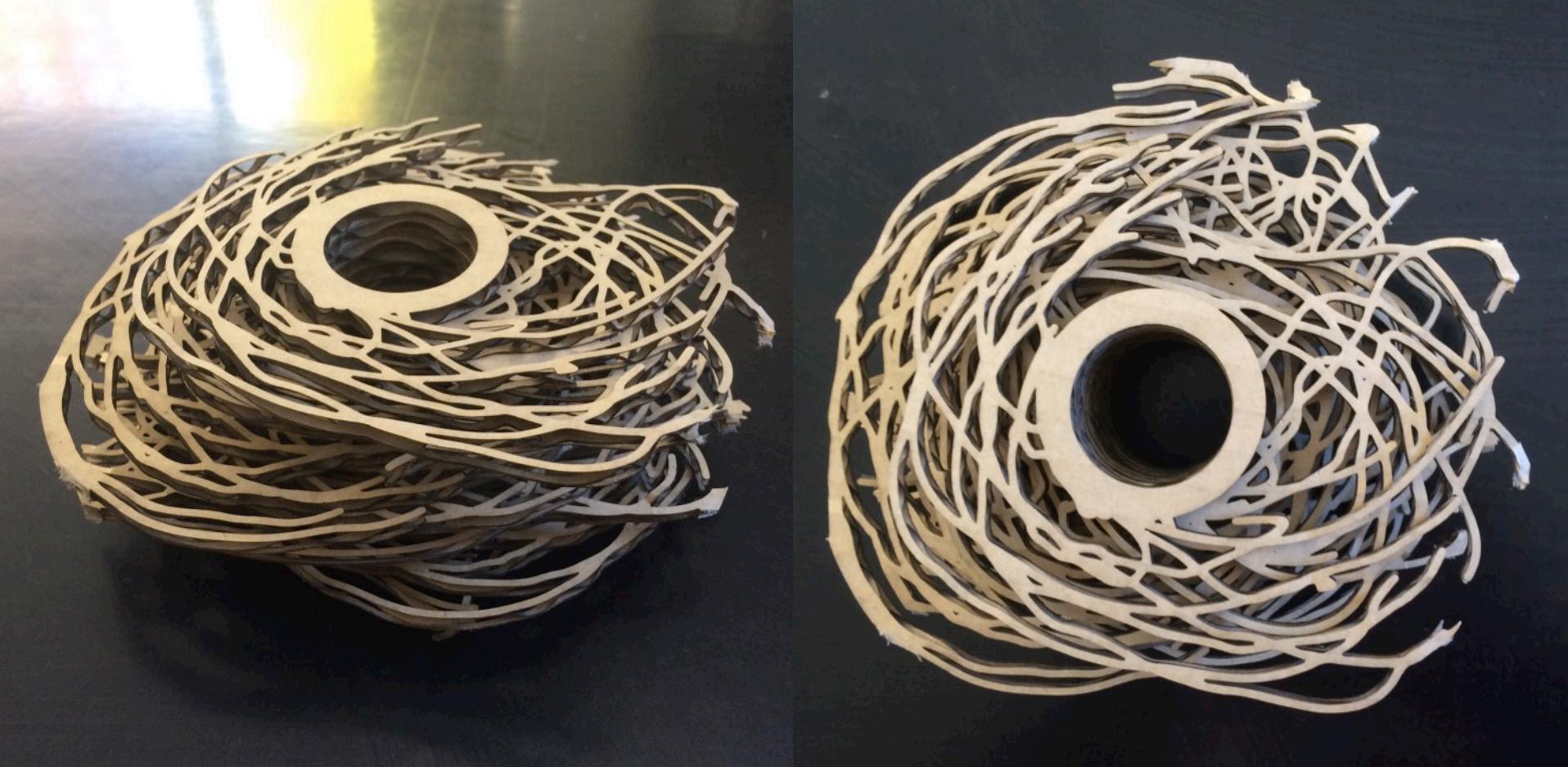


Final swarm frames used for laser-cut



First frame VS last  
frame (all layers)





Final fabricated laser cut form, layered





















