Agents of Spatial Influence:
Form Reflection

RAY LC

THESIS FORM

The mechanical gestures that machines make are meaningful to us in-so-far as it is able to respond to our attempts to communicate. Mechanical devices, however, are not flesh and blood, and are missing the millions of years of evolution that led us to our current distinctly human forms. In order to make human-machine communication possible in the realm of explicit gestures, the machine ought to be able to interpret our most basic emotions and expressions garnered through collective evolution of the species, and respond back to us in a biologically relevant form.

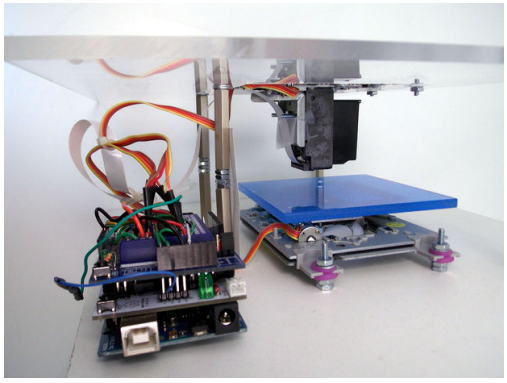

Figure 1: A hypothetical bioprinter that accepts G Code commands line-by-line and extrudes edible material interactively, controlled via computer and Arduino.

Expressive mechanical gestures of devices arranged in space influences human perception and behavior. I propose to show this idea using a 2D bioprinter that builds interactive edible constructions by reaction to human expressions and emotions. The emotional responses like joy, sadness, anger, and surprise modifies the distances and speed of the extrusion by the printer, while expressions like eyebrow up, eye closure, and nose pokes will determine the particular movement of the printer. The resulting edible item is a biological expression of both the player's facial gesture interactions and her current mental state.

I'd like to show this emotionally responsive machine as an exhibition piece on a platform for artworks. Players can also see their own reactions on a screen placed nearby.

FUTURE STEPS

Questions that have come up include the following.

1. How do you make the printing process interactive moment by moment?

A: I will execute G Code that goes to the bioprinter (currently worked at by Leah Willemin) line-by-line. The actual code is determined by the expression and emotion read at that time.

2. How will you design the gestures of the machine?

A: The expressive control of the machine will be based on natural human gestures. For example, a cringing nose could correspond to a movement back-and-forth of the spindle head, while a raised eyebrow can make the head move upwards for a sustained period. The gesture set will be designed to make the interactions as natural as possible.

3. If emotions info are coming in moment-by-moment, how will you sample the right reading for interaction?

A: I will consider the machine "locked-out" when performing an action, so that it won't be responding to new input until it's stationary. Staying put is a universal signal for the next human expression to be read and interpreted.

4. Will you have time to build this in time for thesis?

A: I hope to work with Leah Willemin in the implementation of the firmware for the bioprinter. In case the extrusion isn't ready, I'll resort to using a pen blotter.

I will first make a digital prototype that convert emotions and expressions to movements on a machine intended to eventually mimic the bioprinter. I hope to do this in Unity using the Affdex package to read emotions and facial gestures and convert them to G Code (for the CNC aspect of the bioprinter). I may also simply draw these intended movements before getting too deeply into G Code programming. The result would be an interactive game that draws on a 2D surface based on player emotional responses.

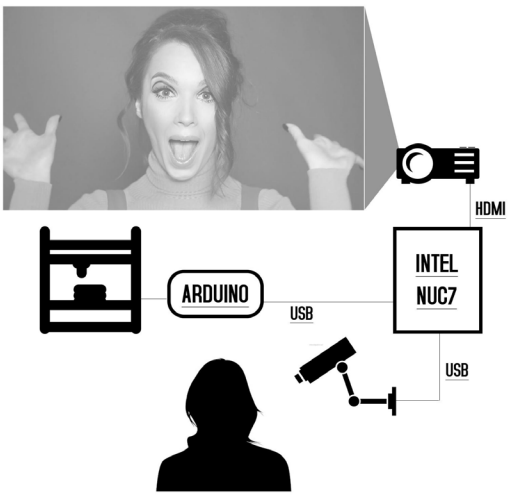

Figure 2: Exhibit plan using a webcam to capture human face, detect emotions and expressions in Unity on the NUC7 computer, and use that to control motors in the bioprinter. Expressions can also be viewed for feedback on projection.