

Abstract

Project XENOLALIA is an art-science installation that intersects an artificial intelligence neural network and colonies of a single-celled freshwater photosynthetic algae *Euglenas gracilis*. This project focuses on bridging art, biology, and engineering to communicate fundamental principles of science to the public. The goal for me this summer is to determine the optimal growth conditions for *E. gracilis* to be used in this installation. Once it is determined, an image derived from a neural network will be projected onto a petri dish full of *E. gracilis*. They will then respond by mimicking that image; which will then again be fed into the neural network, to project a new image. This creates an infinitely iterative process, which can be perturbed by introduction of environmental variables. We intend to take advantage of this installation to educate the public about how living systems may respond to environmental change.

Project Description

This particular project not only fits with my major but perfectly fits with my interests. Through this project we are creating an interactive image that is dependent on a neural network and a live organism. As we change the conditions that *E. gracilis* are kept in, this interactive image will respond depending on the feedback from *E. gracilis* and the neural network. This, while may be the beginning of an alien language, it also allows for us to teach how living organisms may respond in unprecedented ways to environmental change, such as climate change. This is what got me interested in this project.

In my opinion, educating the public on environmental topics is of utmost importance since the health of earth concerns everyone living on it. It is my goal to become a science communicator and use opportunities such as project XENOLALIA that intersects arts, biology, engineering to educate the public about fundamental principles of science.

Secondly, since this project also focuses on engineering based off biology it goes into the realm of biomimicry, one of my personal favorite types of science. Lastly, if this project goes well, we can create kits that can be used for demonstrations in schools and/or art exhibits. This type of public education outreach is what inspires me to do research. Especially research that bridges the gap between the general public and science! I have high hopes that this project will allow a smooth transition into a discussion on climate change. A topic that is very controversial but also extremely important in today's environment!

The methods I plan on using to obtain data from the organism begin with using a spectrophotometer to measure the absorbance of my sample of *Euglenas gracilis* to get a relative idea of the

concentration of *E. gracilis* I have. After figuring out the relative concentrations, I will test to see if one concentration of *E. gracilis* will give me better results than another. This will be done by placing the different concentrations of *E. gracilis* under the same shape; this shape will be provided by a projector. After waiting for set intervals of time (eg. 5min, 10min etc.) I will look at the progress made by *E. gracilis*, take a picture for each time I check them, and then compare the different concentration level and their overall progress in forming the shape they are placed under (eg. star, circle, equal sign). This will also be done under different wavelengths of light instead of the typical white light the projector will provide to see if *E. gracilis* is more inclined to go into a specific color light.

So what's being tested is what if anything can increase the concentration of *E. gracilis* in the area under the light and decrease the amount of time they take to react/get there.

The second part being tested is whether we can automate the process by iteratively changing the projected image as one generated by a neural network. One way to do this about this is that the artificial neural network will come to "imagine" an image that will be projected on the Euglenas, which in return will assemble (possibly imperfectly) around the projected light, reproducing the image. The image formed by the Euglenas is then sent back to the neural network, which will "imagine" a new image based on it. This feedback process will be repeated infinitely (or until *E. gracilis* stops moving, which is more likely). The audience should be able to see, at the macroscopic level, the formation of the image on the petri dish. If successful, we will enlarge the installation using large glass dishes.

If this could be compacted into a manageable kit it could be used in an interactive art exhibit that would allow the guests to choose from a variety of images they want *E. gracilis* to be. This kit could also be implemented in school classrooms as a demonstration or a lab. This type of public outreach is exactly what is needed in today's society with the growing need for public involvement in science and the world around them. This is also a great way to help expand involvement that the university has with its surrounding community.

In the movie *Arrival*, Louise Banks uses interactive images to communicate with extraterrestrial visitors to save life on planet earth; using the results of project XENOLALIA, the processes to creating a methods of communication with extraterrestrial life could begin!

I plan on spending twelve weeks working in Dr. Jayasundara's lab. I will spend six weeks working on this project.

Budget Justification

Total Budget Requested: \$3,000

Budget: Stipend Amount: \$1,800

Budget: Materials and Supplies: \$800

Budget: Travel: \$400

Budget: MISC: 0

Budget Justification: Eighteen-hundred dollars for a stipend since I plan on working for six weeks with three-hundred dollars a week. Eight-hundred would go towards materials and supplies that being: large transparent dish 24 inches in diameter, projector, consumables, beakers, gloves, and pipettes. The last four-hundred dollars will be used for public outreach with visits to schools in the Bangor and Orono area and/or local conferences.