Proposal for a Final Group Project titled: ANTiAction

Executive Summary

ANTiAction 

Assignment Objective: Using *Processing*, create a visually appealing and intellectually compelling demonstration of artificial life with one or more of the following properties: self replication, flocking/swarming, genetics, kinetic life, cellular automation.

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ANTiAction is a computer simulated Uncle Milton's style Ant Farm. It follows the creation and daily life of a new ant colony. The action starts slowly with a solitary queen ant shortly after her nuptial flight, but will quickly show signs of new life that grows and escalates to a teeming frenzy.

The Queen has burrowed herself into a chamber and begins laying eggs. These fertilized eggs hatch and grow at an accelerated pace to become the worker female ants that will serve the fledgling colony. They will build and widen tunnels that will become the highways of commerce. They will carve out rooms for specific purposes such as for food storage, a brood or "nursery" and garbage. All of this excavated earth will be carried to the surface and dumped, creating a hill around the entrance to the colony. Food from the outside will be gathered and brought home to feed the colony. Chemical messages alert others from the colony of a food source to be harvested or of a member's death and possible attack on the colony. As the populations increase, the Queen will seek a deeper and safer chamber to lay more eggs and increase the power of the colony and start the cycle all over again.

ANTiAction is a hypnotic terrarium of movement, industry, communication, and struggle. It is a saga of life and death that mesmerizes, a source of fascination for all.

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Story – ANTiAction's opening screen shows a cross-section of soil with the earth's surface near the top of the window; a few sprigs of greener here and there. In the center is a short tunnel going straight down to a chamber where a large Queen Ant is about to begin her brood. She has just returned to Earth from her nuptial flight with enough sperm to last her 25-year life span. She has broken off her wings and burrowed down to create this chamber where she will begin continuously laying small fertilized eggs. They will morph quickly into maggot-like pulsating larvae and then larger pupae. We will watch as one by one, they transform into full-grown adult worker ants that will serve the fledgling colony.

These Worker ants are sterile females and will be taught by the queen to care for the young. They will venture to the surface in search of food. When a food source is found, a chemical pheromone is emitted leaving a trail on the ground as chunks of the food are carried back to the colony. Pheromones are a way of communication between the colony members. Other Workers will recognize this scent and its meaning and will join in harvesting the food by following the trail to the source. As more of the food is brought home, they will again reinforce the path by emitting more of the pheromones. Once the food source is exhausted the pheromones will no longer be put down and the scent will dissipate.

Other Worker ants will dig more tunnels and chambers, and widen the connecting tunnels. Rooms with specific purposes will be carved out and the excavated earth will be carried out to the surface and dumped creating a hill around the entrance. The Queen will seek deeper and safer chambers to continually lay her eggs.

As the colony increases in numbers, more food will need to be found. Soldier ants which are larger and older Workers will begin exploring further away for new food sources. They will happen upon ants from other colonies that would be considered a threat their own colony. Fights will ensue and a damaged Soldier will emit an alert chemical pheromone. This causes nearby Workers to go into an attack frenzy and Workers further away to quickly investigate.

This is the continuing daily struggle that an ant colony endures to survive and thrive.

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Art Style – This is a 2D virtual representation of a black ant colony, crawling around a flat window much like the child's toy, Uncle Milton's Ant Farm. Earth Particles will be represented by brown or sandy colored shapes. Red colored Fire Ants will pose as threatening predators, maybe from a nearby fire ant colony that explored too close. They are differentiated by their red color.

Code creating Sprites images would include:

- Ant Development frames:
  - Egg development frames (egg to pulsating larvae to pupae to adult)
  - Walking frames
  - Pause frames (a stutter step used for when an ant is delayed on its journey)
  - Pulling frames (for Fighting and Clearing Debris)
- Earth Particles with differing shapes
- Food Sources with differing shapes and groupings

Mechanics – The ants will have set characteristics that serve the colony as a whole, yet allow them to function independently and autonomously, working on their present task at hand.

The Processing Sketch must accomplish these things to simulate the workings of the colony:

- **Ant Class Types**: Queen, Egg, Larvae, Worker, Soldier (older larger Workers)

- **Ant Traits**: Colony, Age, default Job, present Task, Speed, assigned Post, next Destination, Clamped
  - **Age:** Used to keep track of development stages and assigned default Job
  - **Colony:** Own or Predator
  - **Job**: Queen, Forager, Digger, Attend Queen, Guard and care for Young
    - **Queen** – there can be only one, although in nature that is not always true.
    - **Foragers** wander on the surface looking for food to bring back home as well as sounding the alarm for predators. These older ants have the most dangerous job. They will be larger in size to better fight off predators.

        - **Diggers** will create the tunnels and rooms, moving the earth to the outside surface.
        - **Attendants** are young adults that are Posted by the Queen's side. They will guard and bring food to the Queen wherever she goes usually staying in the deeper chambers of the colony. The Queen and Attendants will evacuate to the deepest chamber when an Alert pheromone is detected for a last stand.
        - **Nannys** are young adults that feed and guard the eggs and larvae until they are fully developed. They will not venture far from their assigned Post.
    - **Task**: Forage, Dig, Gather Food, Defend Colony, Attend Queen, Guard Young
    - **Automated Movements**: This includes the specifics of *Speed*, next *Destination*, circling a Post, but also the more generalized movements of Walking on surfaces, Collision Avoidance, Deciding where to dig and where to not, Carrying earth out, Carrying food in, Moving debris and Fighting. All of these last functions require that the ant's jaws or mandibles would be clamped onto something.
    - **Sensing**: There would also be a need for continuously running automated sensing functions for finding Food, Predators, Pheromones, Debris. Diggers will need to sense a Room's Size, detecting a Thin Wall and discerning whether what is on the other is a "Highway" tunnel or a chamber.

- **Earth Particles**: Size, Location, how close together they can be Packed, Color, pheromone Endurance
    - **Pheromones Trials**: There are two types of pheromones that will be represented, Food pheromones and Alert pheromones. Both will dissipate over a short time and rather than taking up the open traversable tunnel space, their presence will be represented by changing the color of an Earth "particle" where it was emitted. Therefore pheromones will be part of the Earth array or class.

        - **Food** (green) – Ants would put down this food pheromone periodically as they are carrying food to the colony's storeroom, leaving a trail back to the

source. Other ants without a Post would then assist in gathering this food source. Once it is consumed into the colony, this pheromone will no longer be put down and the pheromone particles will return to an earth particle.

- **Alert** (red) – This pheromone is put out by an injured ant, which would incite an immediate attack response to any Workers close by. Other ants that sense it but are further away and without a Post would quickly go to assess the situation. Any fallen ants become debris and would be moved to the outside or into a garbage room.

- **Food Characteristics**: Size, Location, and Color. Food sources will randomly appear on the surface and might include broad leaf plant clippings, a strawberry from a nearby plant or an apple dropped from a tree.

- **Predator Characteristics**: This is the same as a Foraging Worker Ant but would be from a different ant colony.