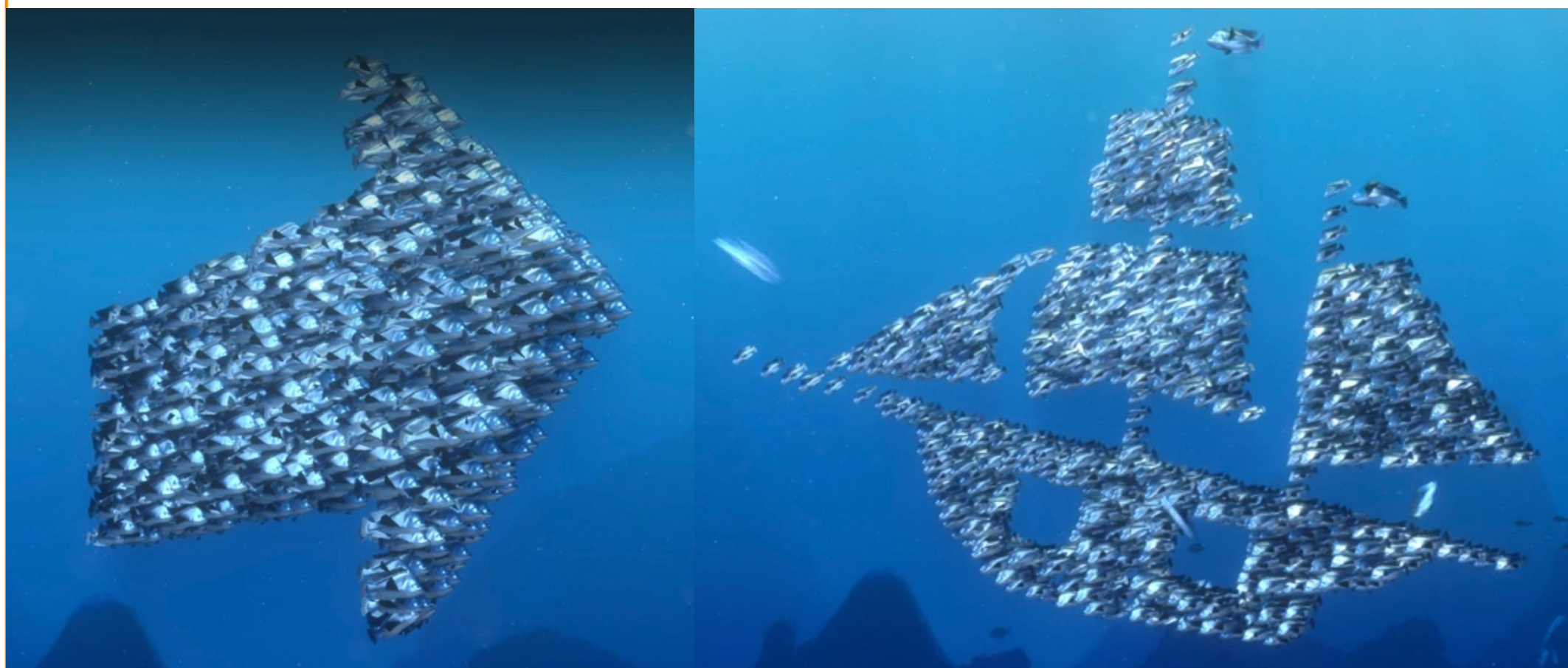# Shape Reconstruction using Particle Swarm Optimization

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Introduction/Motivation

- **Question:**
  Is the fish behavior and ability to organize into shapes in *Finding Nemo* possible?
- **Goals:**
  1. Produce a particle swarm model that can recreate shapes based purely on agent communication and incentivization.
  2. Create a customizable user experience to visualize and showcase the particle swarm.

Methods/Approach

Beginning with simple particles that have mass and velocity, we then implemented the PSO algorithm.
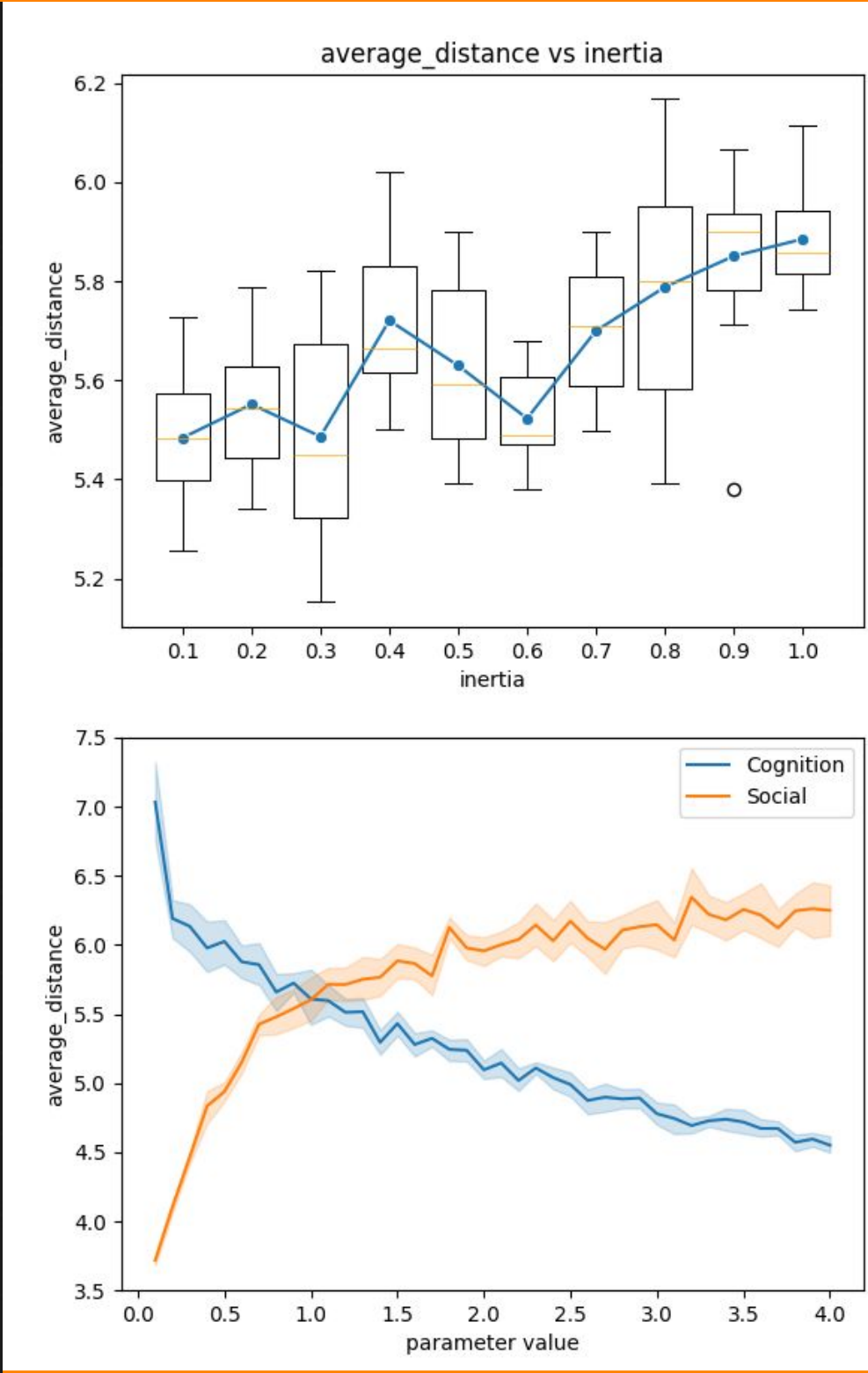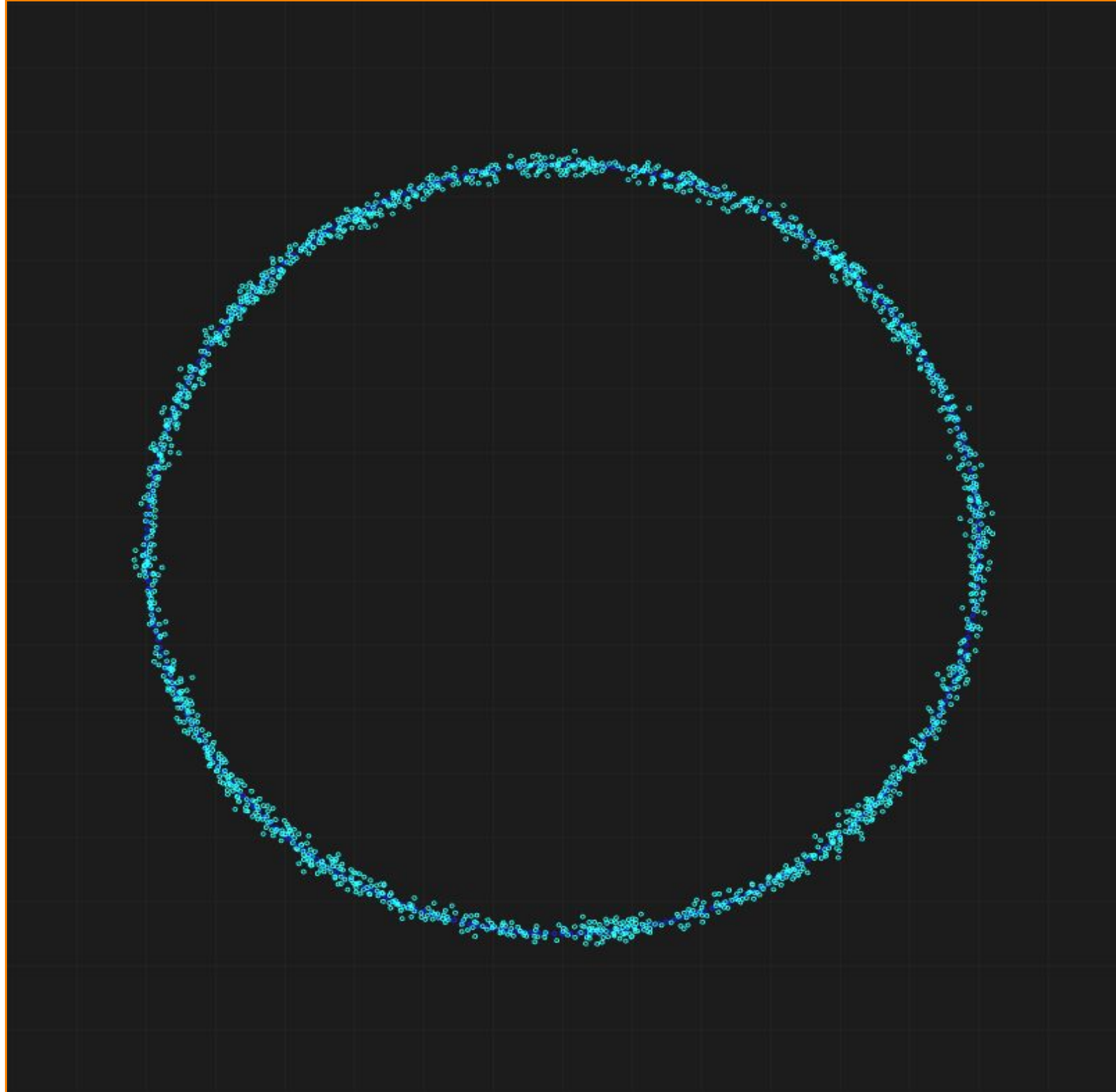
Overview:

- *Food Particles* (blue) - stationary, in the desired shape, agents are attracted to their "scent".
- *Agents* (cyan) - Move aimlessly until food is introduced, can communicate with other agents sharing their personal best scent.

Changes to agent scent, social, and inertia parameters result in varying results.
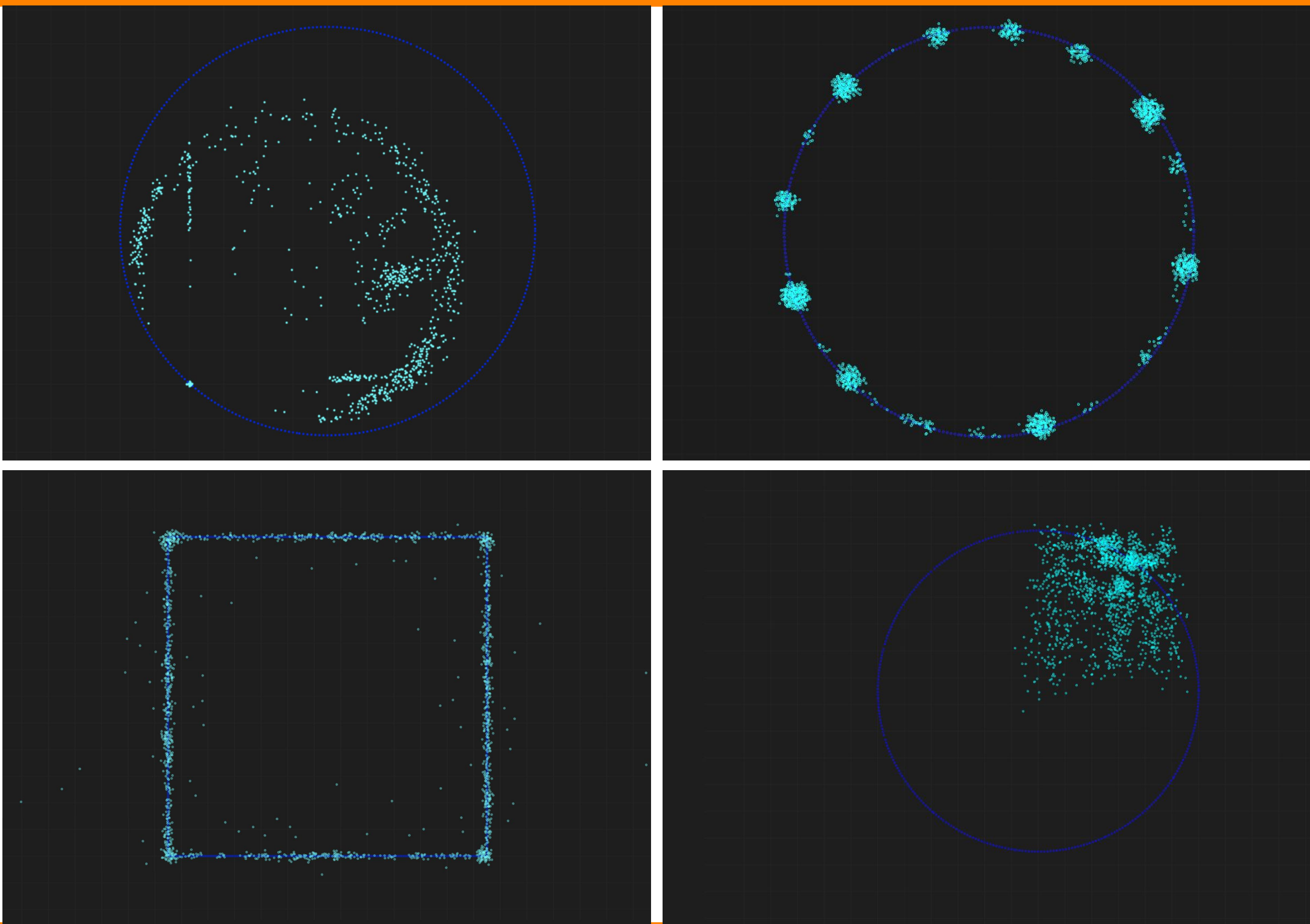
Results

1. Cognition and social are directly related to shape quality and are almost inversely proportional.
2. Higher social values produce lanes when converging and result in clusters of agents around the shape.
3. Inertia does not have a significant impact on accuracy.
4. Varying the scent parameter only changes how quickly the agents converge (will converge either way).

Conclusion

- To produce an accurate shape, the social parameter must be practically non-existent.
- It is theoretically possible for independent agents to form the shapes seen in *Finding Nemo* from only controlling individual behavior and with the proper incentive.

Future Work

- Continue optimizing parameters to get a more evenly filled shape
- Add more shape presets and shape drawing feature
- Rework and optimize canvas behavior to stop performance lose when changing settings

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