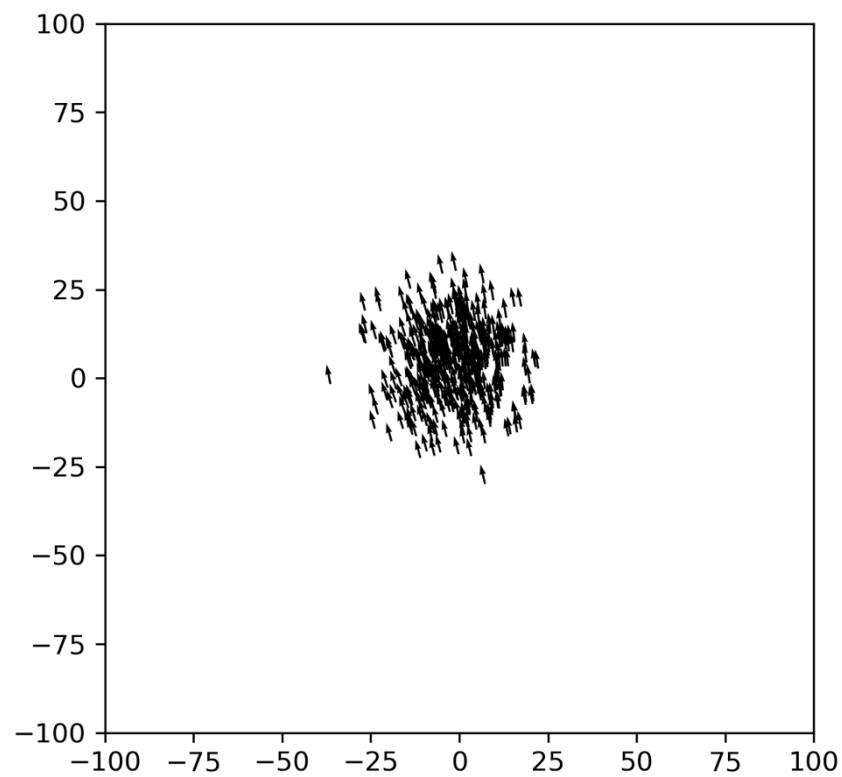
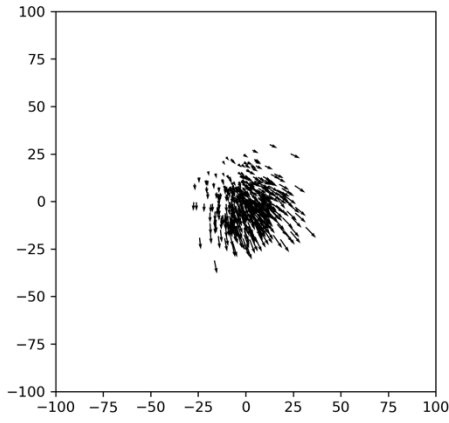
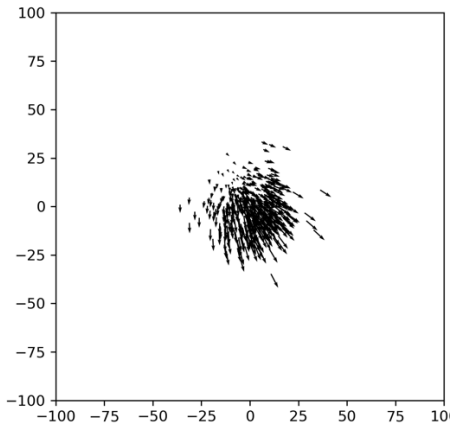
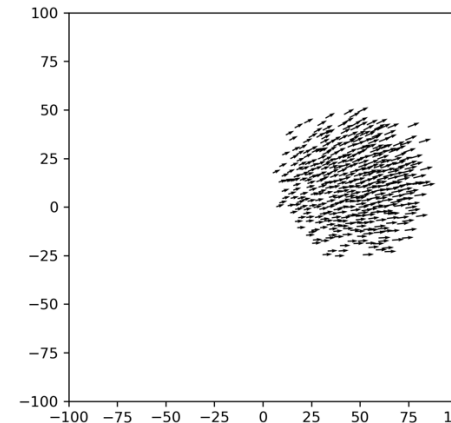
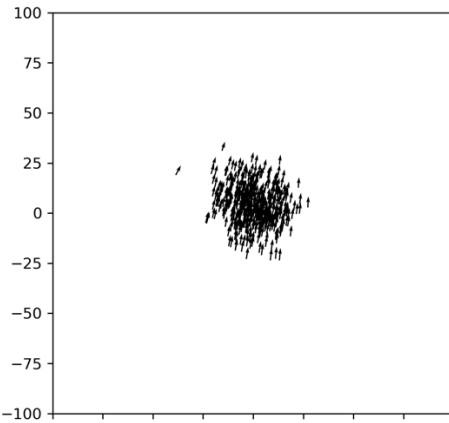
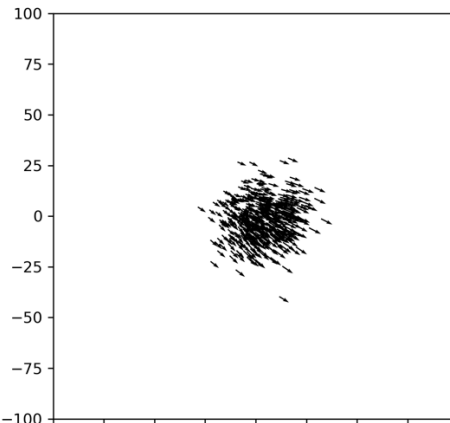


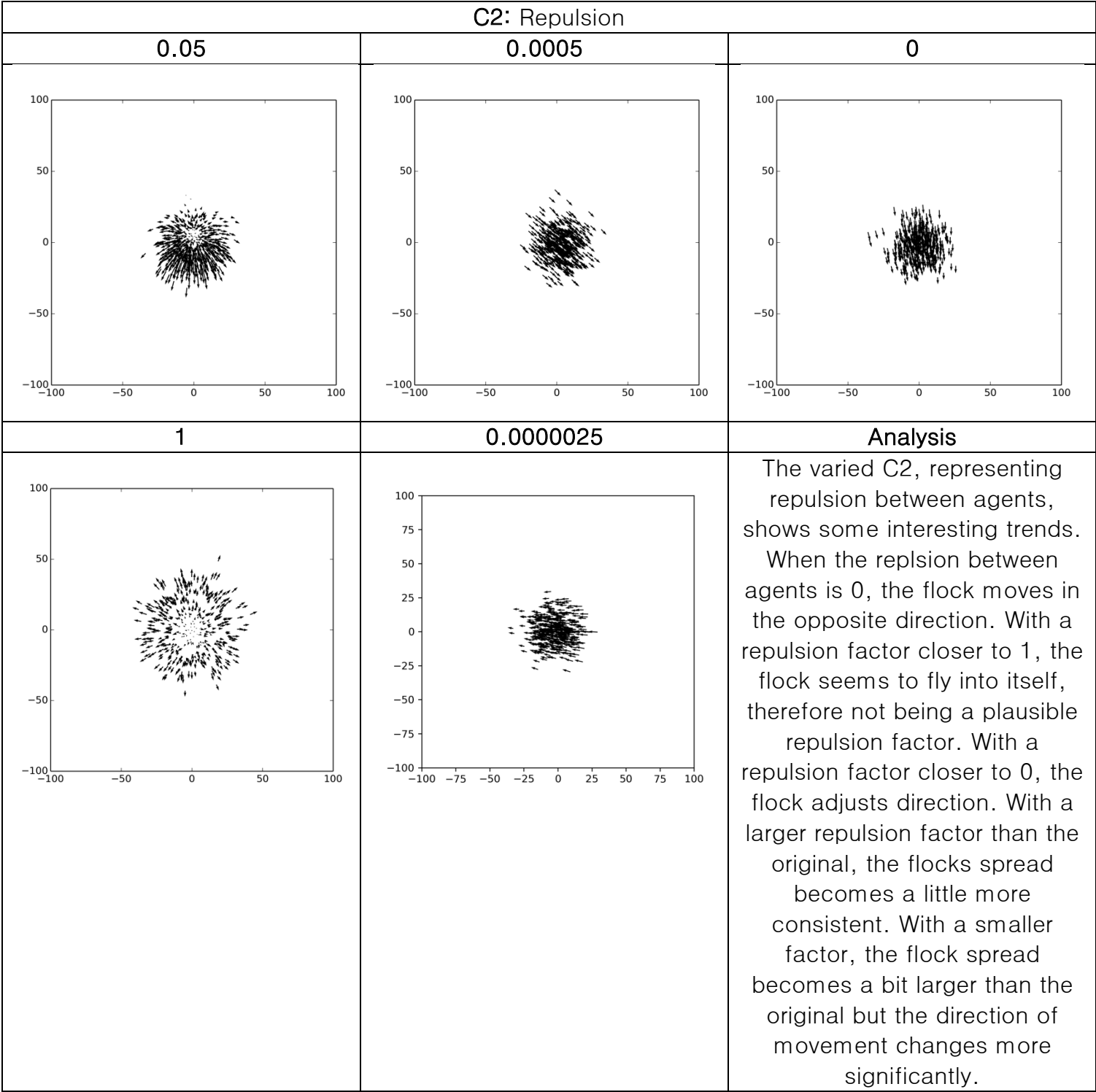
CSCI 4314: Dynamic Models In Biology
Homework Set 3
Purna Sengupta

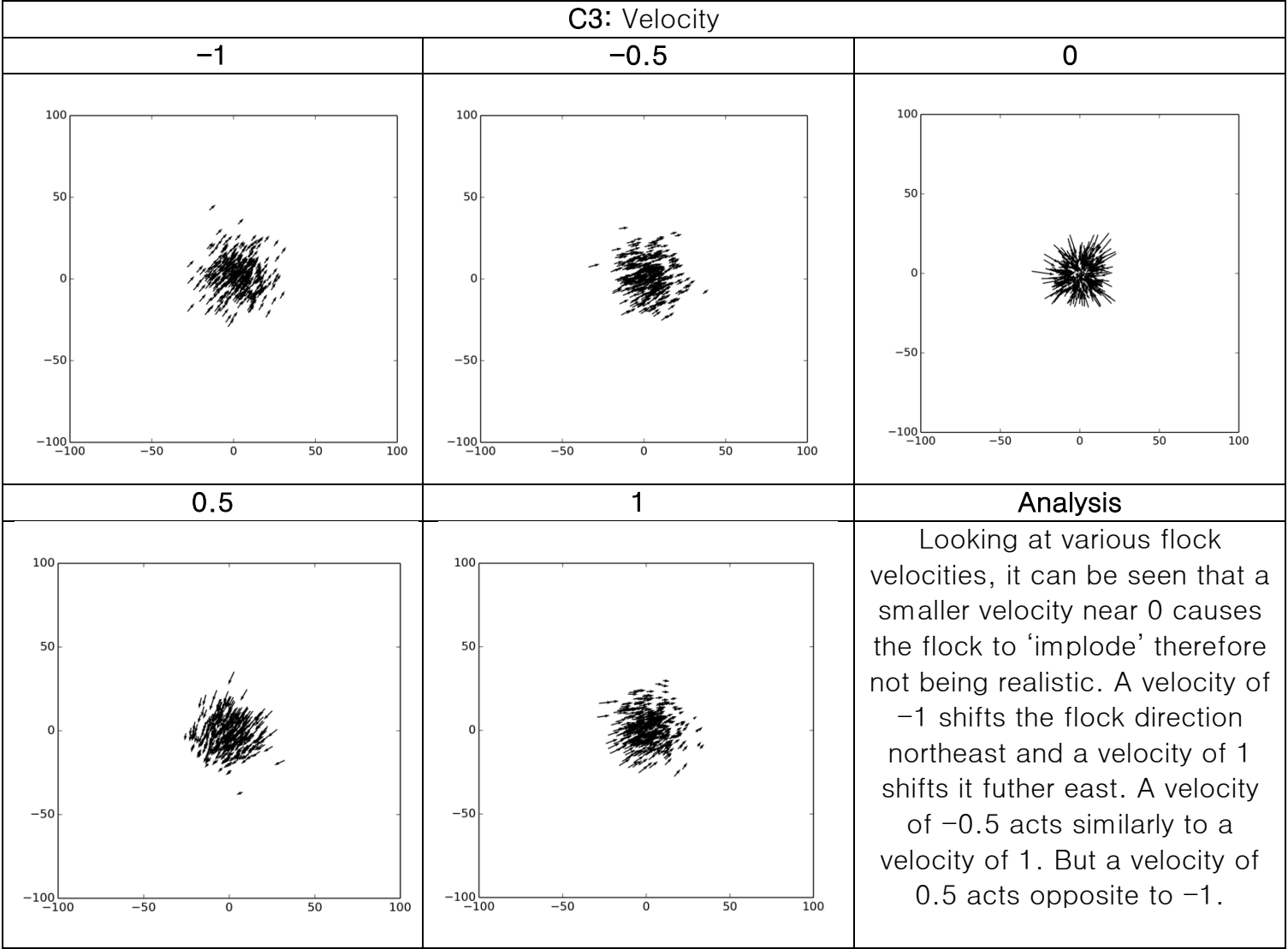
Simulation of Flocks

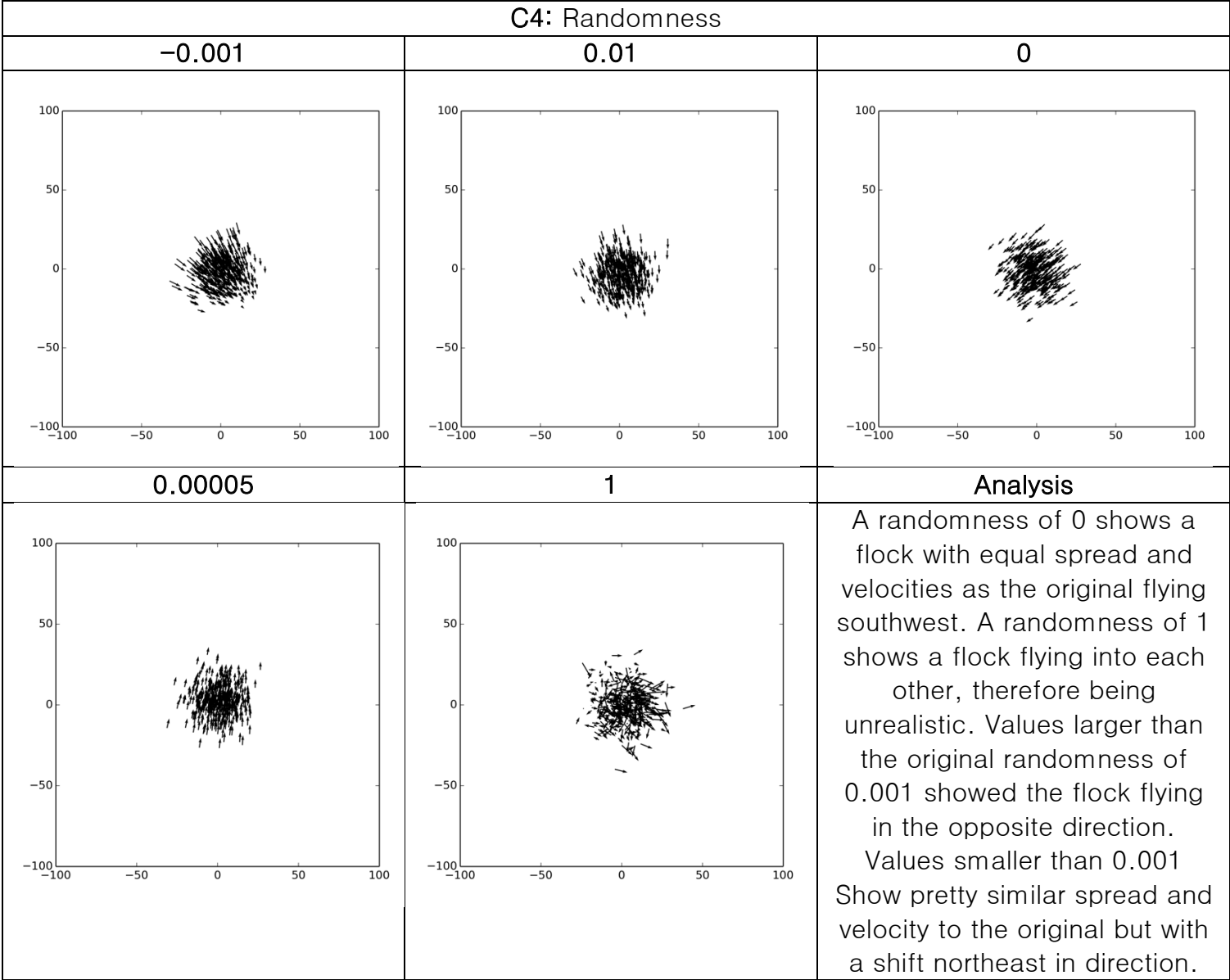
Original Conditions: $c1: 0.00001$ $c2: 0.00001$ $c3: 1$ $c4: 0.001$



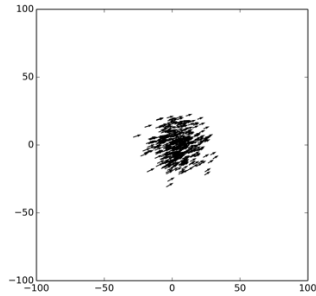
C1: Attraction		
-0.00001	-0.000005	0
		
0.000025	0.000005	Analysis
		<p>From the varied C1 values of attraction amongst to flock, it can be seen that 0 attraction amongst the agents places them evenly within the flock spread. The attraction of the flock also influences the direction of the flock and velocity of each individual agent. With negative attraction values, the flock fly's in the opposite direction. An increase attraction from the original value brings them closer together. A smaller attraction adjusts the direction and spreads the flock out.</p>







C5 = 0.001



Paper Review

(a) Main Contribution

Strömbom mentions that most research relating to shepherding and herding follows a theoretical approach. This past research effectively models the interactions of agents based on factors such as attraction, repulsion and alignment. Strömbom aims to contribute to research in this field with a more realistic and real-life approach that can benefit in applications outside of herding. Strömbom finds that sheepdogs can herd groups double the size of a normal large group of sheep. Using an emergent method of switching between driving and collecting sheep, the dogs show an effective method of herding sheep. By collecting the sheep into one large group, and then directing them to their destination, the sheepdog can focus on keeping the herd cohesive and on route. With these findings, Strömbom hopes to use sheep-dog interactions to design robots that can aid in influence movement of other agents.

(b) Essential Principle

The essential principle that Strömbom focuses on is the use of shepherding dogs herding autonomous interacting agents, sheep, towards a target destination. Based on the adaptive switching shown in the research and data analysis, a side-to-side motion of the shepherd emerges that shows improved efficiency in herding. This follows the two principles, (i) to reduce the probability of the herd splitting and (ii) to keep the herd moving towards their destination. Strömbom focuses on this emergent trend in herding strategies and finds it to be useful in understanding group movement.

(c) Major Strength

Strömbom heavily discusses the plausibility of the data used in their research. The data analysis is defended with real world examples of similar trends and phenomena. Sheep-dog interactions repeatedly show similar emergent movement in herding dogs that aid in efficiently moving a flock to their destination.

(d) Weakness

The paper lacks discussion of future work and applications outside of shepherding flocks. Though there is slight mention of possible applications, including citations to other sources, there is no discussion of how the conducted research and analysis can also be applied further. There is not discussion of how past data or research can or has been applied to outside applications, and therefore, the paper begs for a discussion of how their data and research goes further to prove outside application.

(e) Future Work

There is clear evidence that research in sheep-dog interaction and behaviors has applications in crowd control. In current society, it is common for riot or other quickly forming crowds to need quick, non-violent crowd control or dispersal. This is commonly the responsibility of police officers and other officials. Using the methods found from the research and data analysis in this paper and others similar to it could

greatly help these officials in non-violent crowd control. Herding research has great applications even further at large scale concert venues or weekend long events. Overall, the paper failed to really dive into the many uses of their research, and did not fully support why it has great value.

Strömbom D, Mann RP, Wilson AM, Hailes S, Morton AJ, Sumpter DJT, King AJ. 2014 Solving the herding problem: heuristics for herding autonomous, interacting agents. *J. R. Soc. Interface* 11: 2014 0719 <http://dx.doi.org/10.1098/rsif.2014.0719>