### Flocking structures

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# Flocking models

The modelling of flocks has been an active area of applied mathematics for the past thirty years.

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- Reynolds: *boids* model
- Vicsek: self-propelled particle models
- Kennedy and Eberhart: optimisation models

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# Simple rules



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# Simple rules



- track your neighbours
- don't crash

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# Simple rules



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seek a target

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# Simple rules

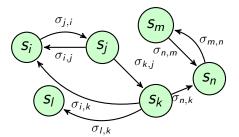


- track your neighbours
- don't crash

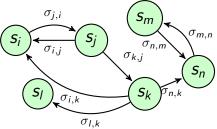
- seek a target
- prioritize neighbours

Image: A math a math

### Dynamic networks

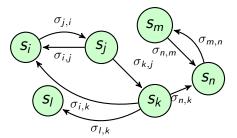


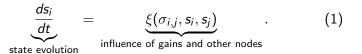
### Dynamic networks





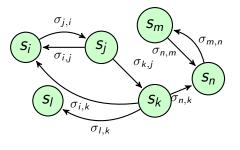
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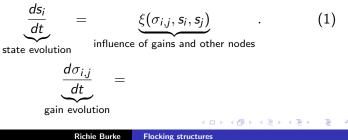




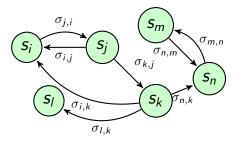
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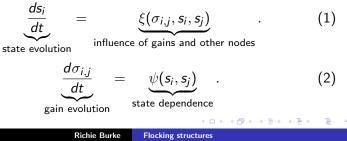
### Dynamic networks





### Dynamic networks





# Metrics

We can apply graph theoretic metrics to investigate the spacial structure of the ensemble at various resolutions.

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• larger flock (graph diameter)

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We can apply graph theoretic metrics to investigate the spacial structure of the ensemble at various resolutions.

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- micro level (clusters)

Important parameters:

- number of agents
- number of neighbours
- ICs (spacial and communicative)



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#### Finish thesis

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