Universiteit Utrecht

Self-organisation in complex systems

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Self organisation:

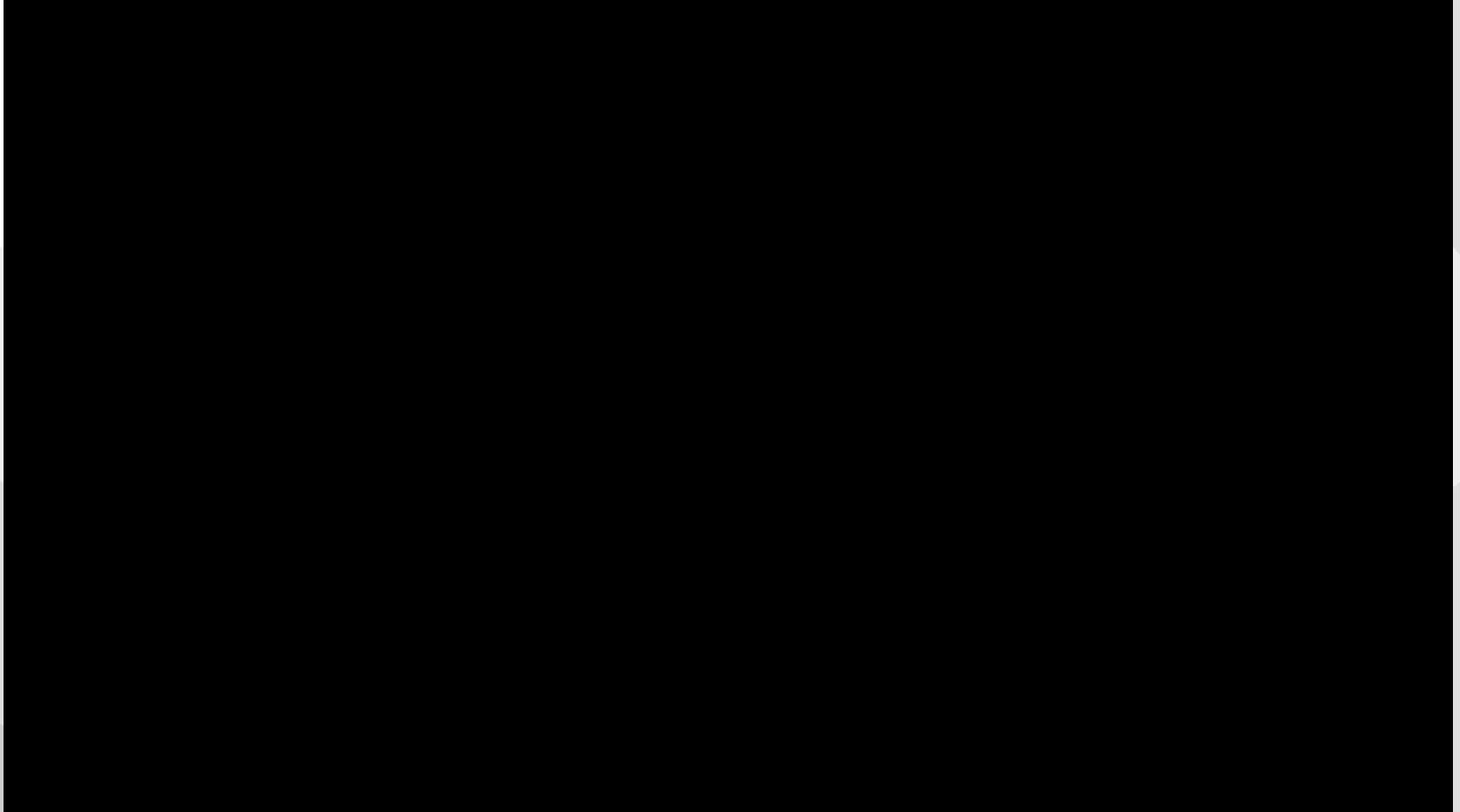**Understanding seemingly coordinated or synchronised global level behavior**

Global coordination as the product of local interactions
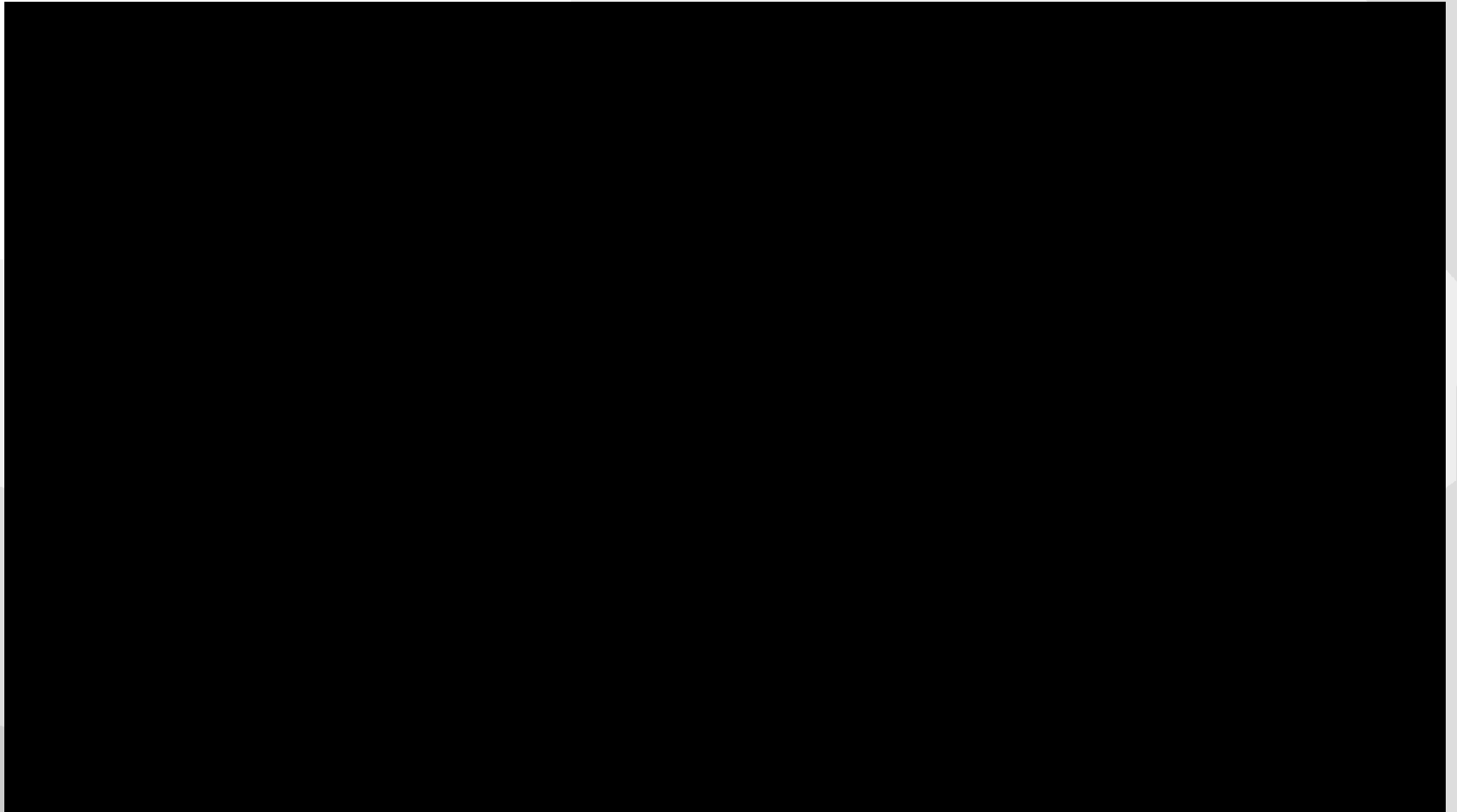
Understanding group (macro) behavior....

... by modeling individual (micro) processes...

Self organisation:

The 'emergence' of order arises bottom up

Interactions of many 'agents' that are not controlled by central authority

Agents do not intent to create the emergent structure

Emergence

Process whereby larger entities, patterns, and regularities arise through interactions among smaller or simpler entities that do not exhibit such properties

Whole is greater than the sum of its parts

The emergent phenomena cannot be trashed back to components on their own
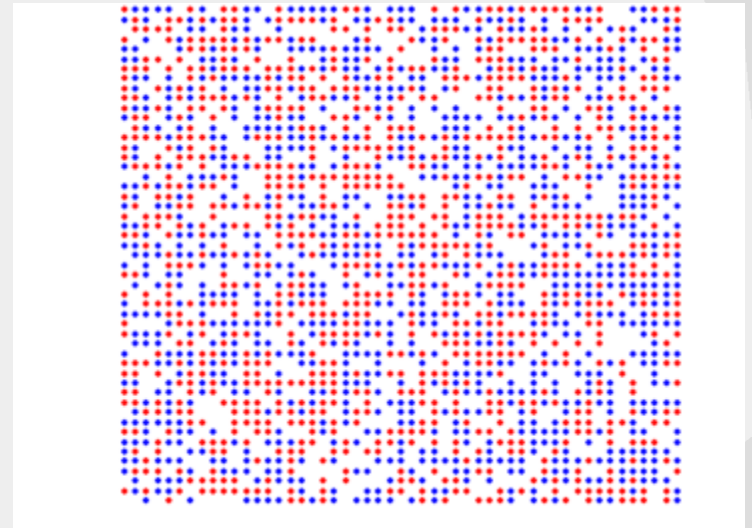
Example: Shelling's segregation model

System: A town

Agents: Humans

Humans have preferences to live among at least 30% of their own kind

Interaction: If preference is not met they move

Emergence: Segregation
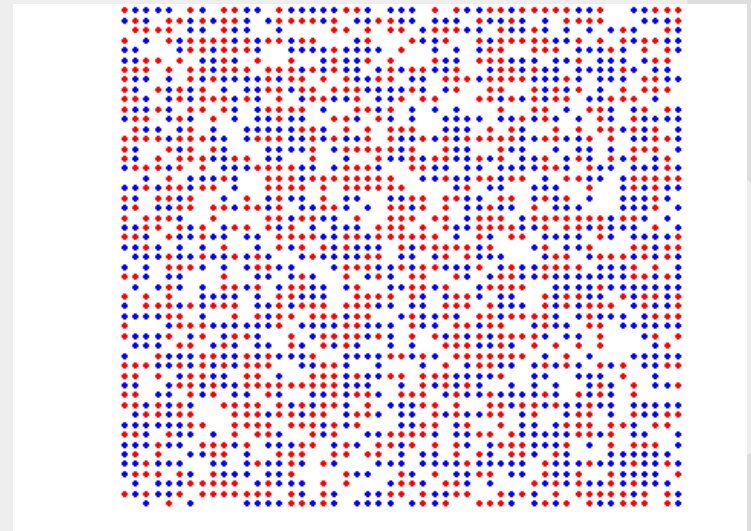
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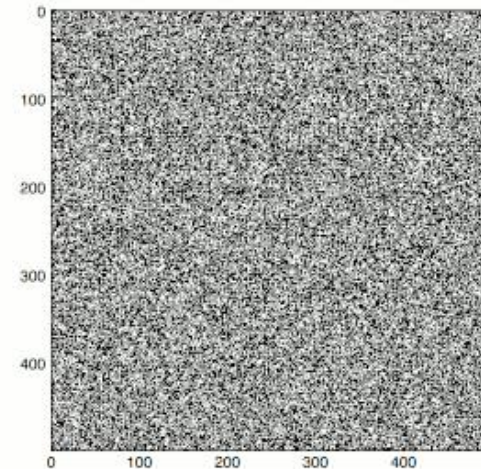
Emergence: Segregation

Example: Ising model

System: Ferromagnetic system

Agents: atomic spins

Interaction: Two spin states (-1 or +1) interacting with neighbors

Emergence: Phase transition

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Summary

Self-organisation: Studying global level (emergent) phenomena by modelling local interactions