AS
Lecture 9

Week 10 - Self organising Systems

Self organisation is Bottom up — rather than top down

Entrophy

thermodynamics:
- in an isolated/closed sys, energy is conserved (First law)
- Entrophy/disorder can only increase or same (Sec law)
  E = Max = therm equilib
  ↳ at this point a system can do no work
  living systems must avoid thermo Dyn equilib

A sys in thermo equilib is in mechanical, thermal & chemical equilib
↳ Balanced system

Mechanical = Forces

having some kind of gradient or differential is essential for a system to work
↳ Ability to change/move??

in a coupled system & Env (external)
- the system is always moving toward more entropy
- External factors from the env are imported to reduce entrophy (human, External = Food & Drink)

high entrophy = high probable state

importing low entropy
export

Self Organisation

"Appearance of structure without an external agent imposing it"

Everything being of self organisation

e.g. ice crystals
- organises when you take energy out of it
- thermal energy ↓ = entropy ↓ & then crystals form

~~as a sys moves towards~~ in closed sys entropy goes up as we reach thermodynamic eq
↳ freeze is not close sys

Normally you need to inject energy for a sys to reach a new state
- ice is unique as looses energy

Phase transition = change of sys state
- ASbys step function is an example

flocks of birds are self-organising
boids (Reynolds 1987)
flocking simulation

Emergance

systems which self-organise tend to have emergant properties

Patterns / Flocks of birds
- low level rules dont say make a ~~Flock~~ FLOCK

two flavours of self-org:
- emergent
- internally re-organising → hebbian

Superorganisms

coined by William Morton Wheeler (1928)

to denote insect societies that possess features of organization analgous to the physiological processes of individual organisms

- Ant colonies
- Ant attacks

Social homeostasis:

Honey bees temp regularization 33-35 °C
- flanning w/ wings to drive air flow
- Shiver to warm up

learnt through positive feedback to create self organisation

Bayes Bots - Ebert et al.

kilobot = walking bot

take a random walk

100 bot react to B/W lights above

light sensor on top

task = Determining lights = more black or more w

i.e. a global property ...

hard when ratio is not too extreme

Bots can communicate locally within 3 body lengths about estimates

uses Bayesian algo to update their posterior

this is self-organised but not emergent

- why not emerg? 1 Robot w/ enough time = same result