

Problem solving in complex systems:
collective chain formation and
distance resolution in the weaver ant
Oecophylla smaragdina

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Social insects:

- alternative solutions to solving complex problems, via minimal individual skill sets
- indiv behaviour/perception + collective/emergence = 'sensible'
- models for network/traffic flow, search algorithms, construction sets



Bonabeau & Theraulaz

F. schaufussi group size matches the task required
during cooperative prey retrieval

Traniello & Beshers (1991), Robson & Traniello (1998)

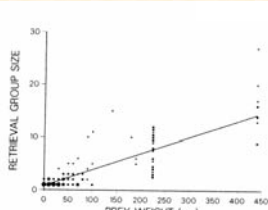


Fig. 1. The relationship between retrieval group size and prey weight. Dashed line represents the density of plotted points. 1, 2-5, 6-10, 11-20, and >20 points

But no individual is 'aware' of prey mass
Indiv. forager behaviour + colony response to retrieval = sensible collective action

Oecophylla nest construction as a model for problem solving



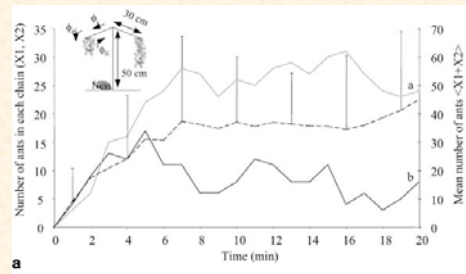
Can groups solve 'the shortest gap' problem

Groups sometimes act like drops of liquid . . .



Bonabeau et al. (1998) Dripping faucet with ants. Phys Rev E. 57

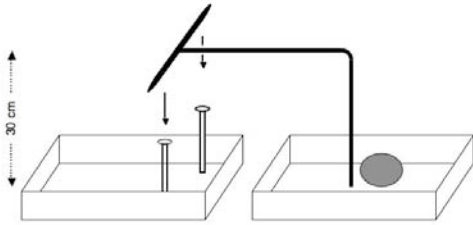
The system 'chooses' when offered a binary choice . . .



A link between colony size, prob. leave & prob. joining

Lioni & Deneubourg (2004)

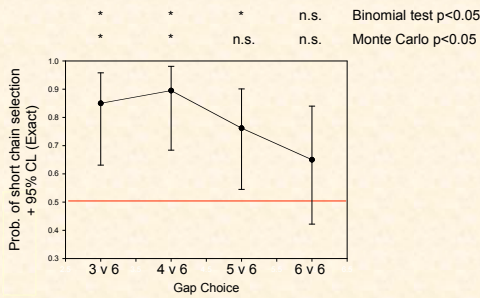
Experimental design: can *Oecophylla* chains select the shortest gap?



- 5 nests, 4 pairs of targets (3 v 6, 4 v 6, 5 v 6 & 6 v 6 cm),
- Randomise order and placement
- Enclose in white background, HD video

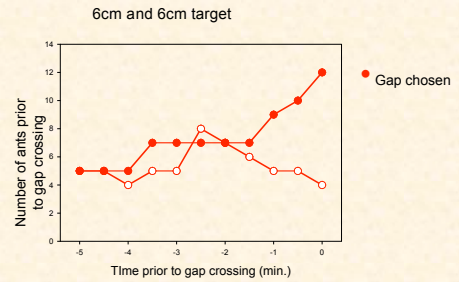


Oecophylla chains select the shortest gaps

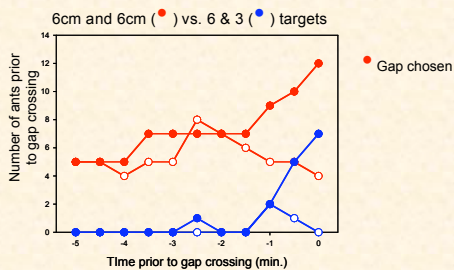


... Discrimination related to relative distance

Dynamics appear typical for a bifurcating system



'Time to chose' & 'worker allocation' related to relative gap distance



Prob. joining chains changes with relative gaps

Where to from here?

- ARC: Robson, Crozier & Deneubourg: Chain formation in weaver ants: a new approach for understanding the decision-making and problem-solving capabilities of complex biological systems.
 - sensory ecology, genetic subgroups & simulations
- chains, mounds, gravity and global toolkits
- Aust. Evolution Society/Aust. IUSSI: Townsville 2011



