Analysing Organisations using Simple Computational Models

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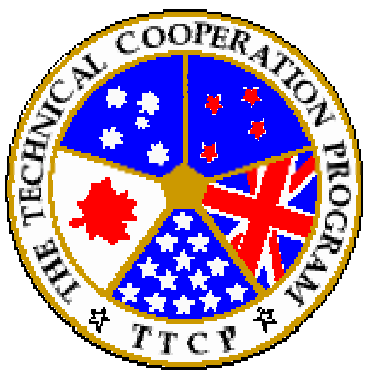
TTCP Defence Human Systems Symposium 2010



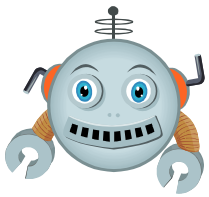
Australian Government

Department of Defence

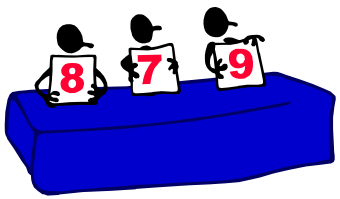
Defence Science and Technology Organisation

Overview of this talk

Motivation

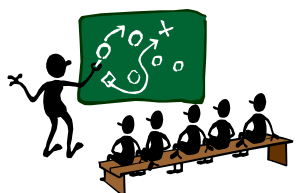


Organisational modelling



Empirical human data

Agent-based simulation experiments



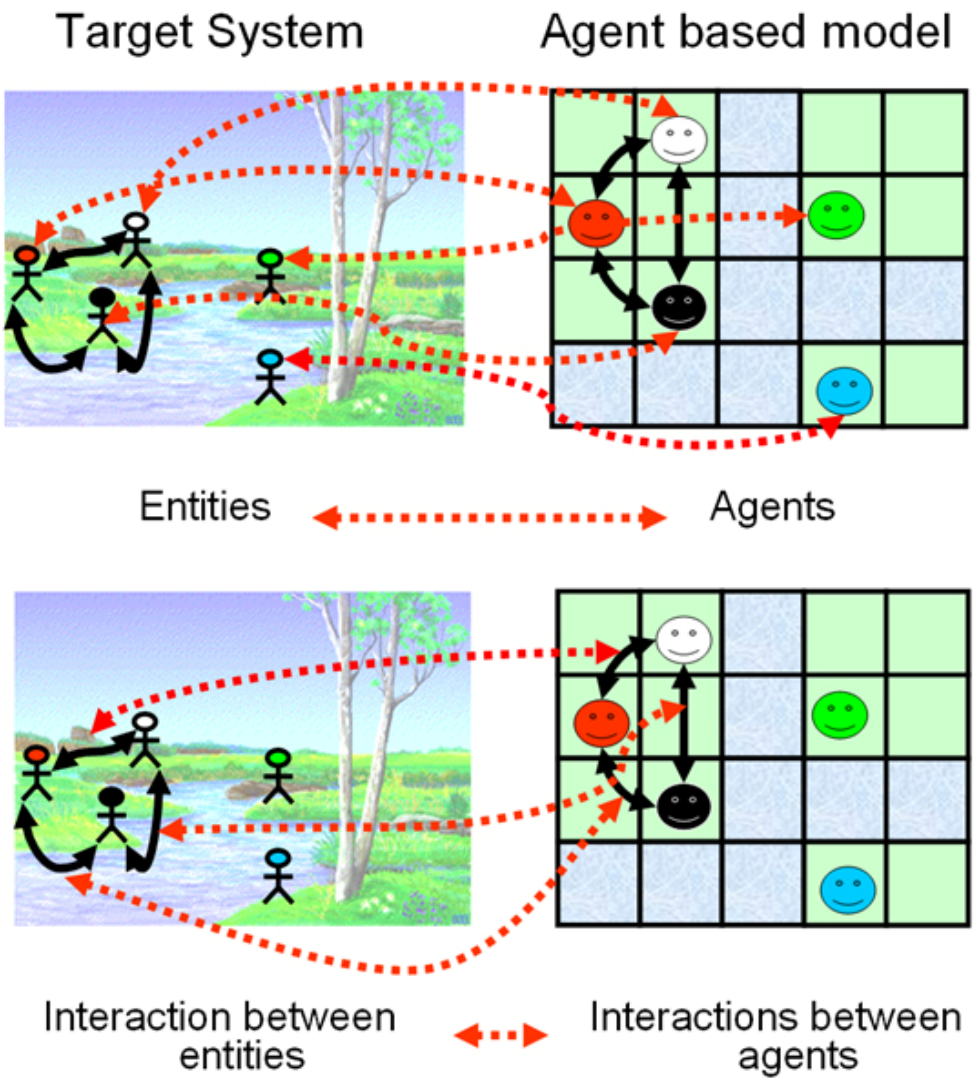
Implications

***Motivation**: Teams, especially HQ teams*

"It is not technology, systems or platforms that generate the real capabilities for our Defence Force, it is the strength of our ***people****."* — Australian Department of Defence, ***Force 2020***

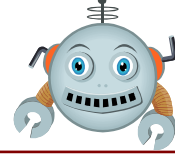
"How teams work is a subject that has received some attention, but little of it has been focused in military domains with the pressures inherent in these situations. … ***We need to know far more than we currently do about this behavior***" — David Alberts, ***Information Age Transformation: Getting to a 21st Century Military***

Modelling



José Manuel Galán *et al*. (2009), "Errors and Artefacts in Agent-Based Modelling," *Journal of Artificial Societies and Social Simulation* jasss.soc.surrey.ac.uk/12/1/1.html

Modelling

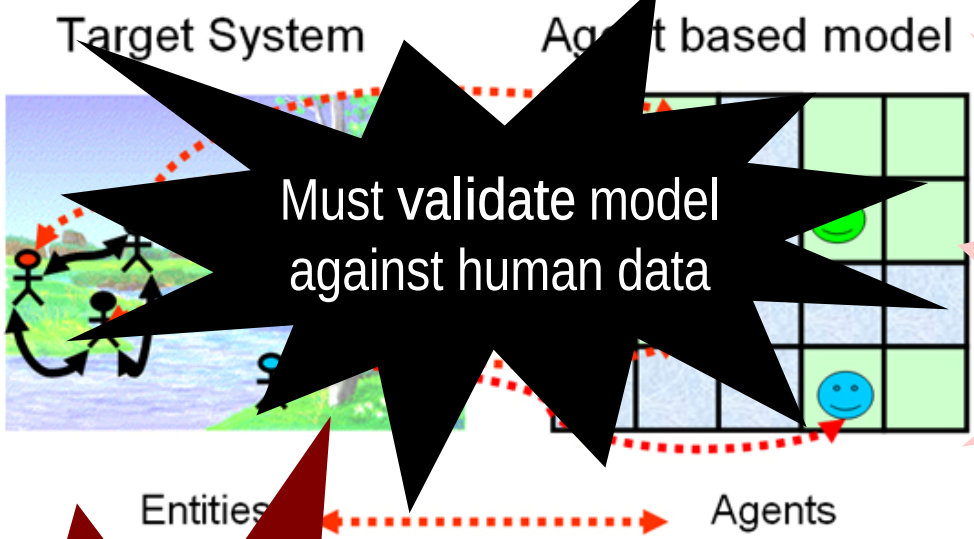


The most important thing … when going from research to model are the **human concepts that make the biggest difference** in explaining what happens in the population.

Then make sure the **computer versions of the concepts interact like the human concepts** …

Michael Agar (2003), "My Kingdom for a Function: Modeling Misadventures of the Innumerate," *Journal of Artificial Societies and Social Simulation*, 6(3), jasss.soc.surrey.ac.uk/6/3/8.html

"Scaling down" agent activities



Must validate model against human data

Agents have much simpler "brains" than real people

Select the tasks so that the agents can solve them together but not alone

So give agents simpler tasks (e.g. factorisation) to preserve interaction patterns

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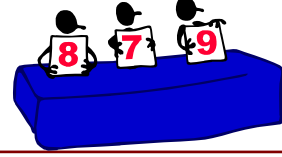
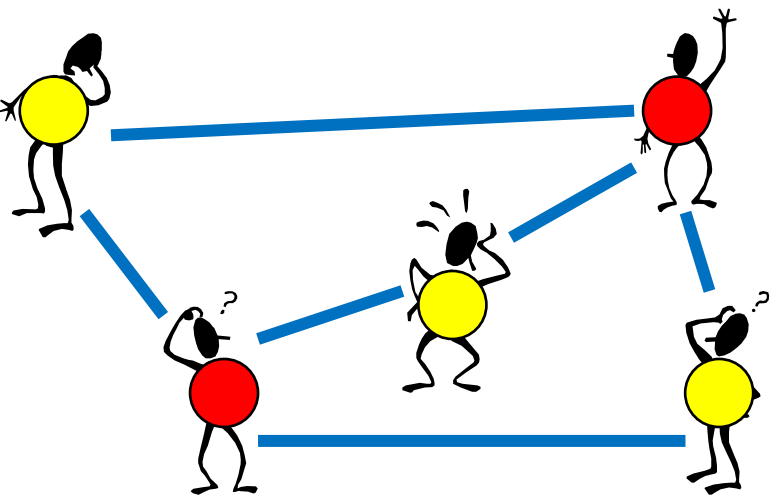
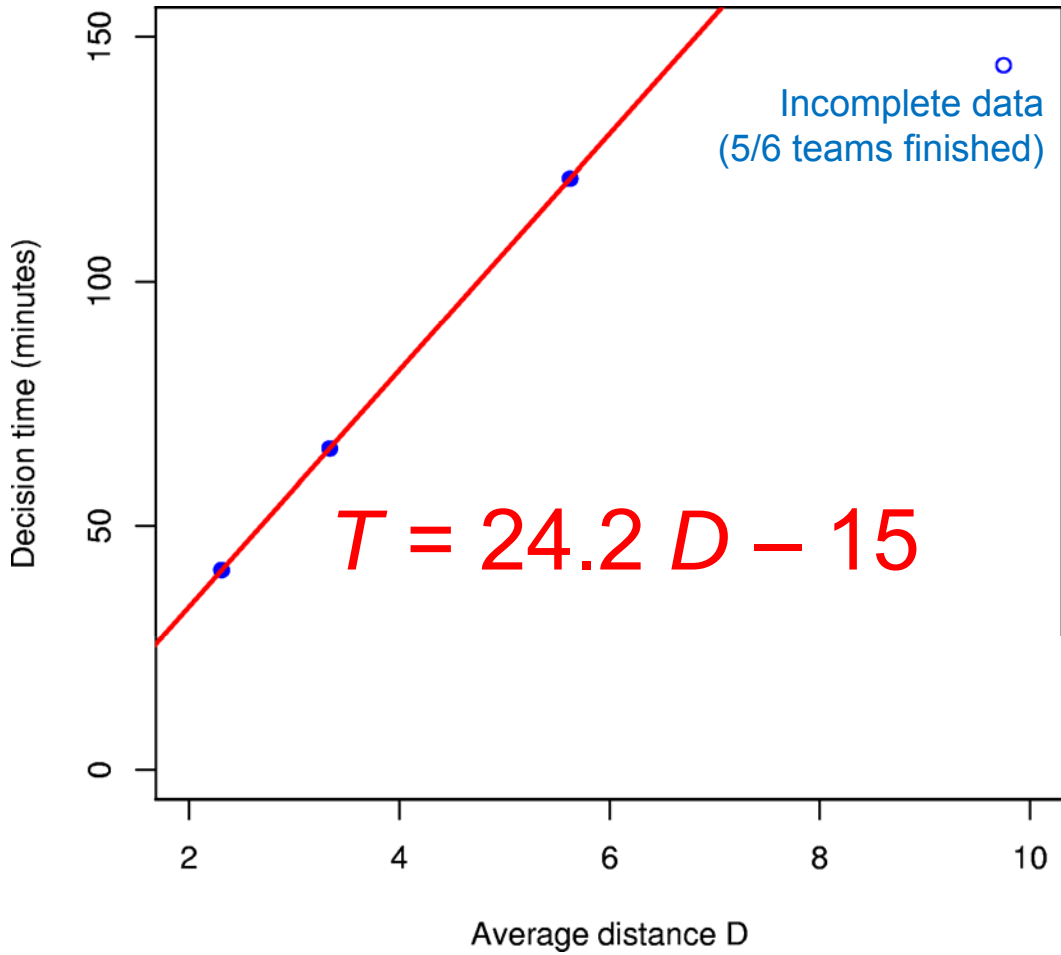
Human data: *Kearns' network colouring*



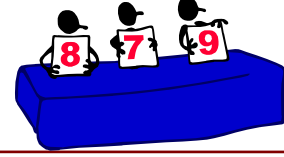


Average distance D = 1.4

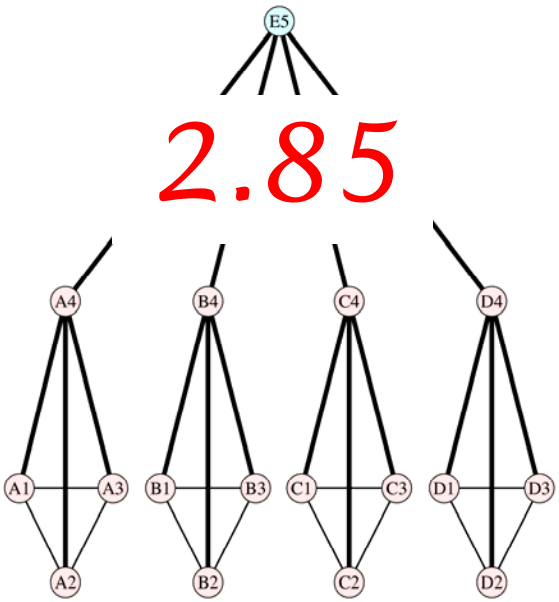


See www.cis.upenn.edu/~mkearns/ and Kearns, M., Suri, S., & Montfort, N. (2006) "An Experimental Study of the Coloring Problem on Human Subject Networks," *Science*, Vol. 313, 11 August, pp 824–827

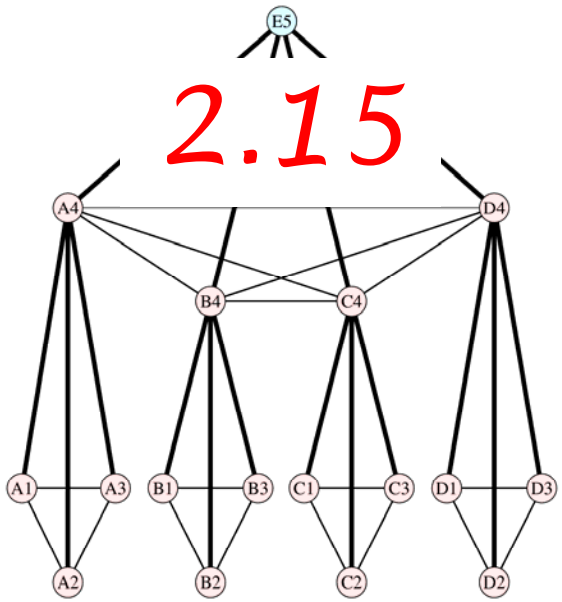
Thunholm et al: ELICIT game data



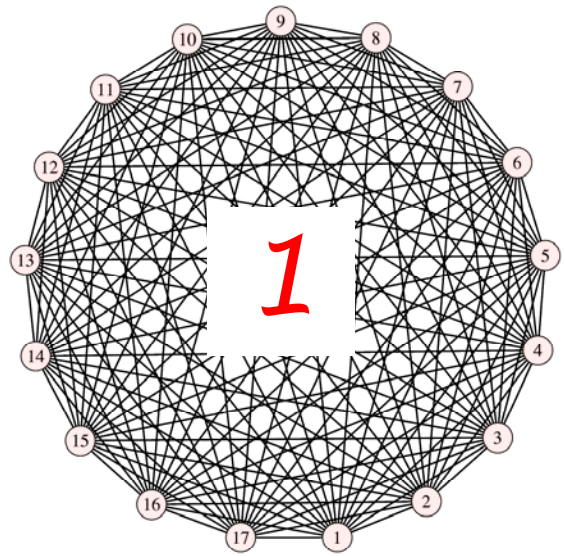
Team decision-making using different organisational structures



(a) Traditional Hierarchy



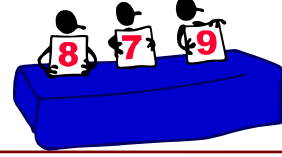
(b) Hybrid Organization

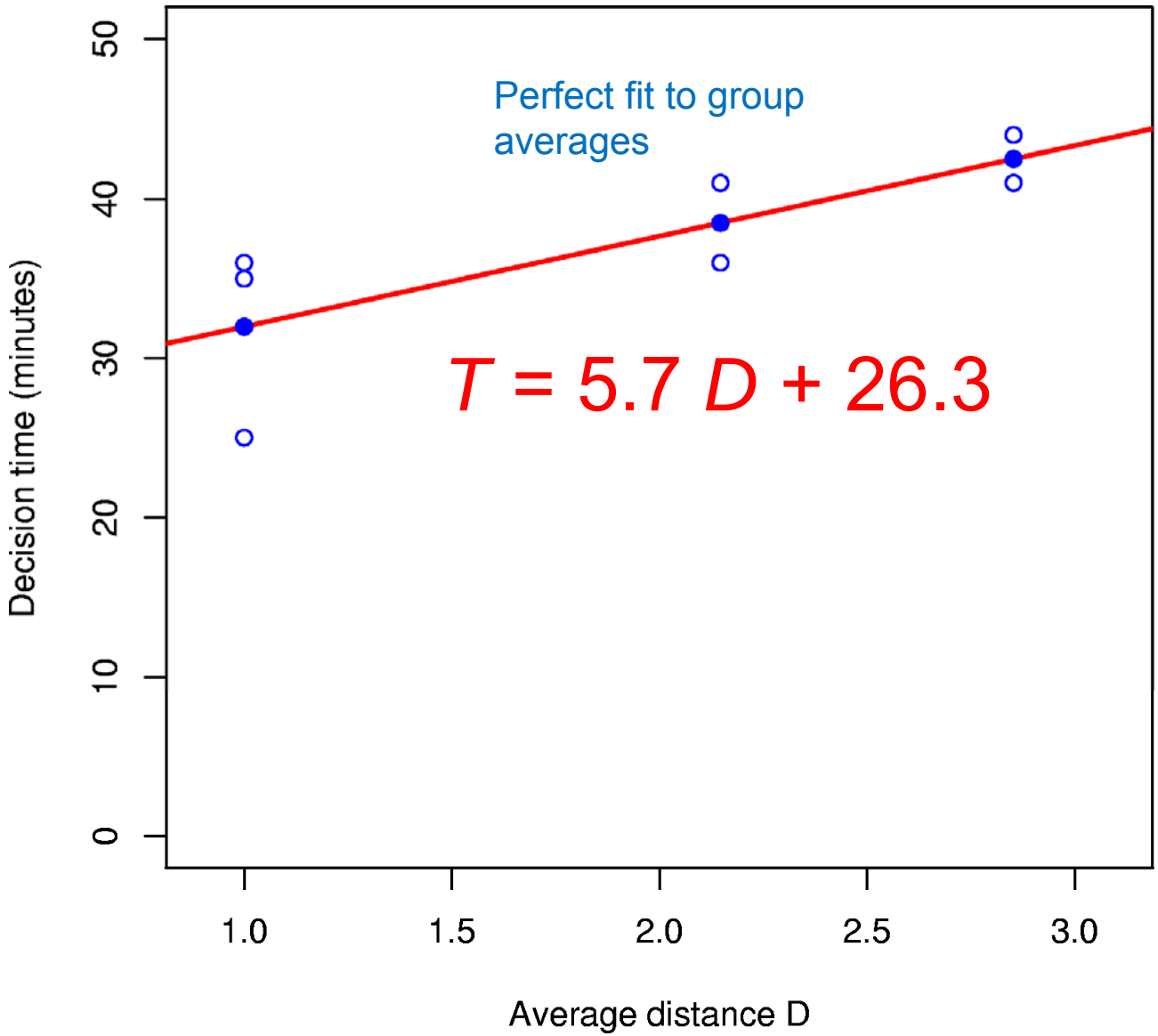


(c) Edge Organization

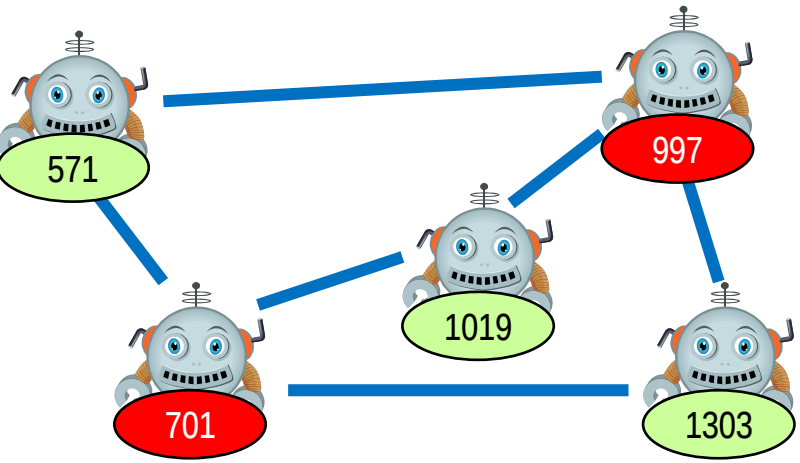
P. Thunholm, E.-C. Ng, M. Cheah, K.-Y. Tan, N. Chua, and C.-L. Chua, "Exploring Alternative Edge versus Hierarchy C2 Organizations using the ELICIT Platform with Configurable Chat System." *International C2 Journal*. 3(2), 2009, www.dodccrp.org/files/IC2J_v3n2_04_Thunholm.pdf

Human data: *Thunholm et al. (ELICIT)*

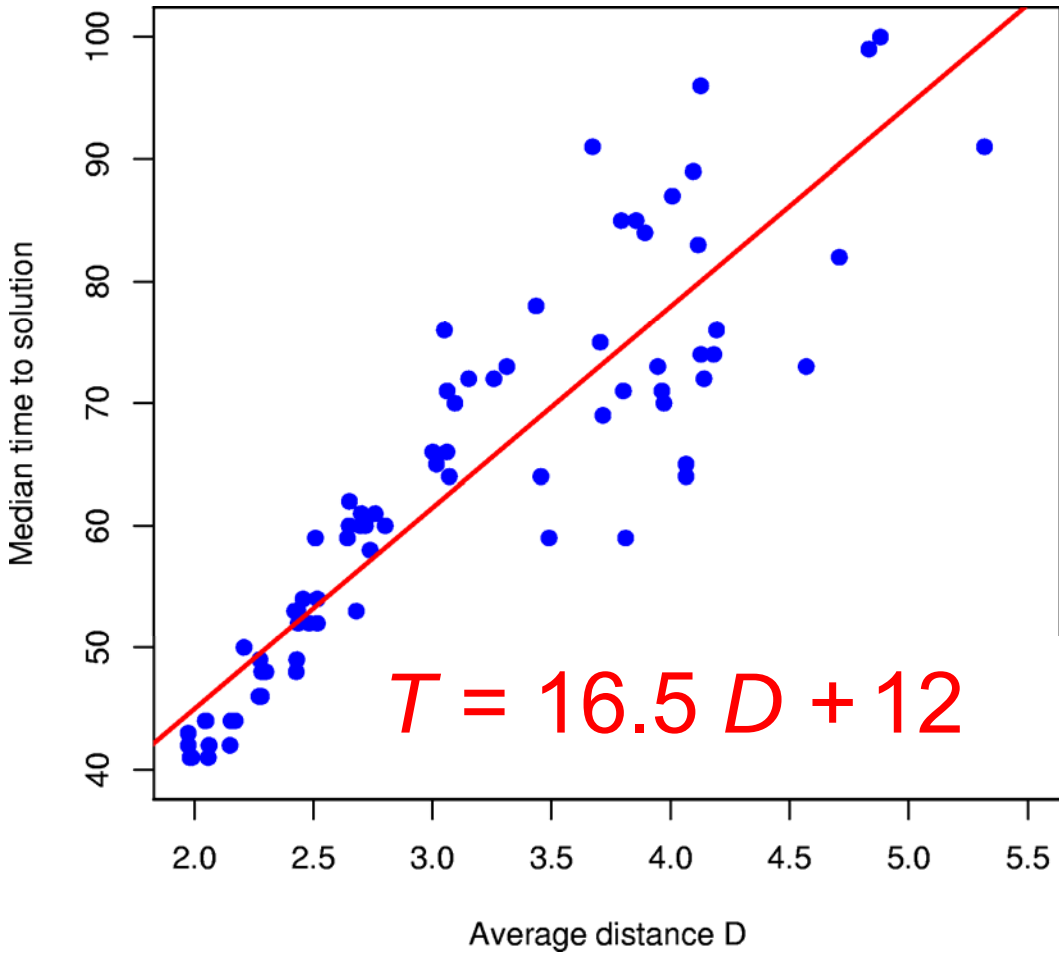




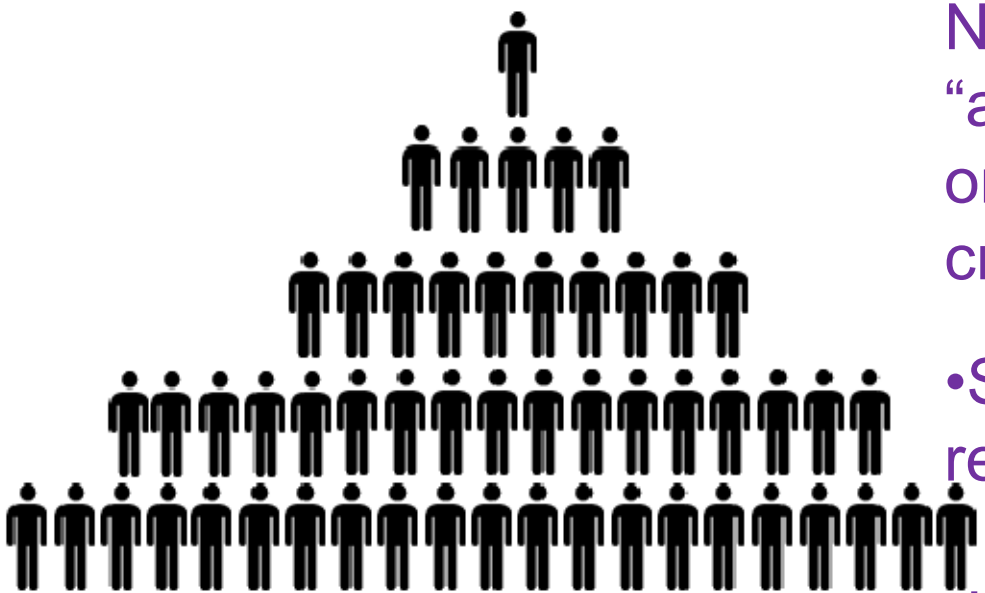
***Simulation data**: factoring problem*



- 6,598,886,315,082,427
  = 571 × 1,019 × 1,303
  × 2,371 × 3,671 etc.
- Agents exchange messages about factorisation attempts
- Finish when all agents have the complete answer



Implications



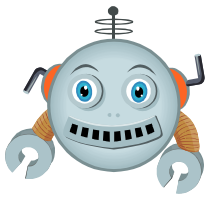
Need mechanisms to reduce "average distance" in organisations and teams, by cross-linking the "bottom levels"

- Shared information repositories
- Liaison officers
- Staff in similar roles meeting
- Performance improvement seems to continue as *D* drops

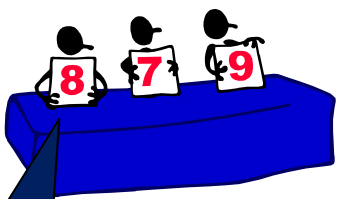
→ "Edge Organization"

Overview of this talk

Our goal has been to study network effects in teams



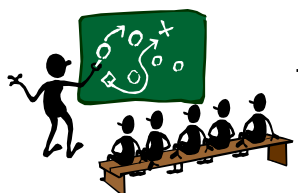
We have used agent-based modelling



Empirical human data suggests $T = a + b\,D$

Any questions?

So do simulation experiments …



→ implications for teams