

神經與行為模型建構 (Neural & Behavioral Modeling)

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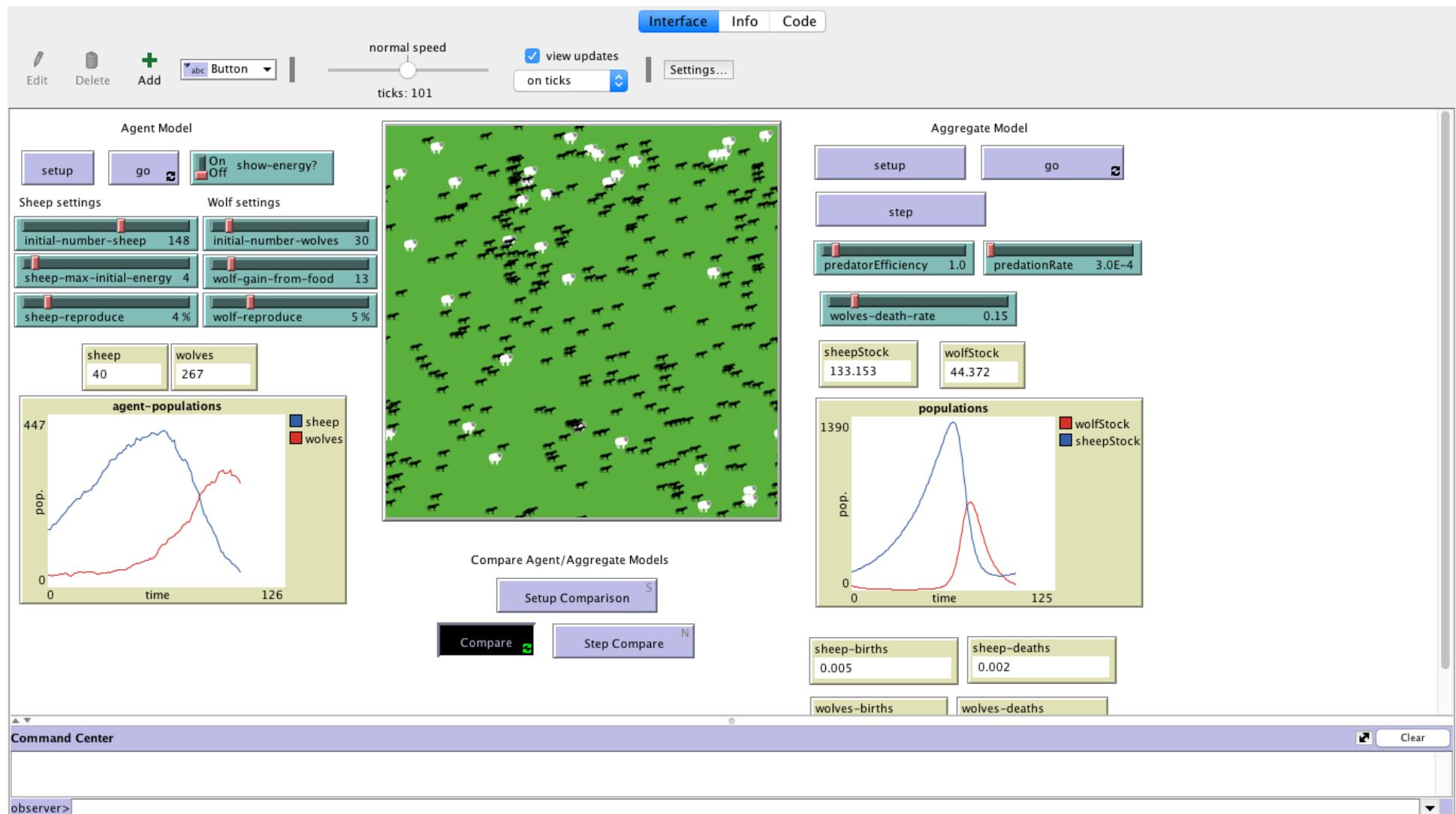




今天模型要往下降一個尺度
!

Predator-Prey Model

NetLogo: Models Library→System
Dynamics→Wolf Sheep Predation (Hybrid)



Overview Cellular Automata Models Agent-Based Models

社會科學模型建構：特色

單位是處在一個格點環境的人

具有某些基本的特質（性別、記憶容量、容忍度）

互動的對象或有的資訊是臨近的人 / 環境 (locality)

變異與隨機性

人常有個體差異

環境可有一些隨機元素



互動 / 演化規則

簡單規則能衍生出相當複雜的穩定態

社會科學模型建構：實做

物件導向程式設計 (OOP)

單一類別（如男女）下面可有不同的物件（個人）
物件有其性質（變數）與特定動作（函數）

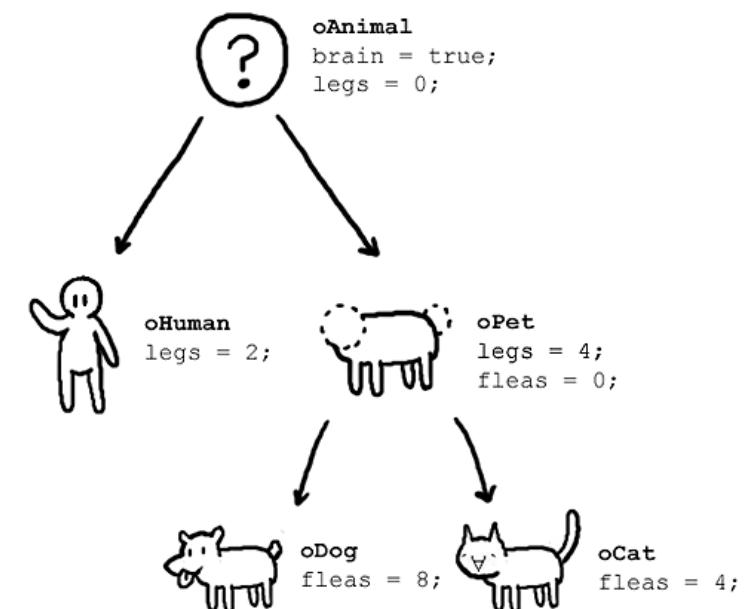
實作語言

什麼語言都可以 (C, C++, Python, Matlab, etc.)
常用開源軟體 NetLogo

模型分類

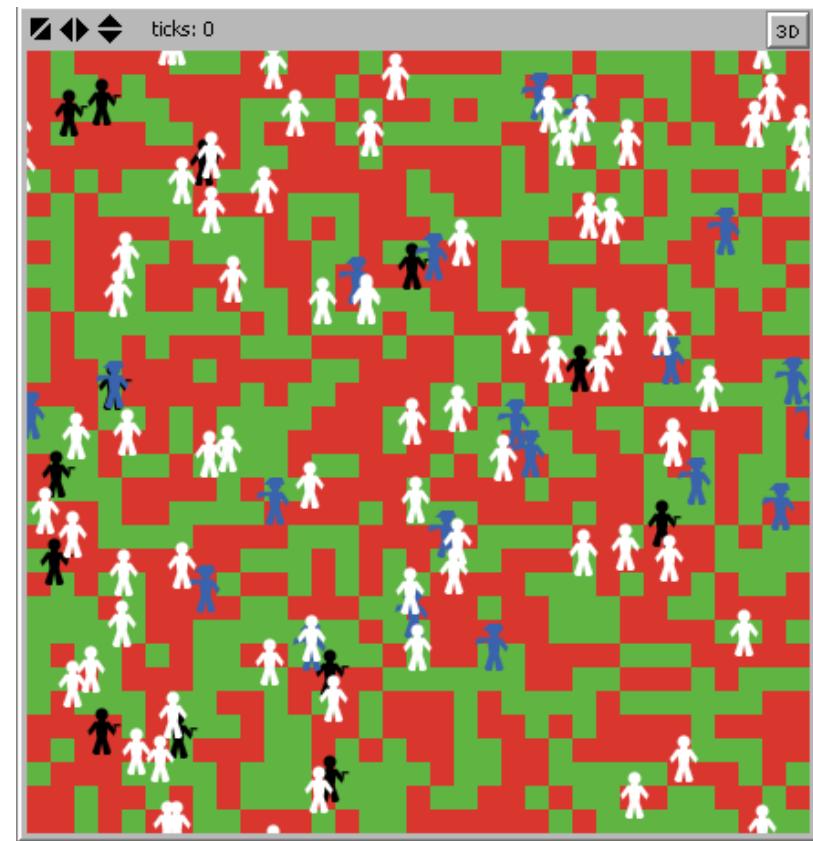
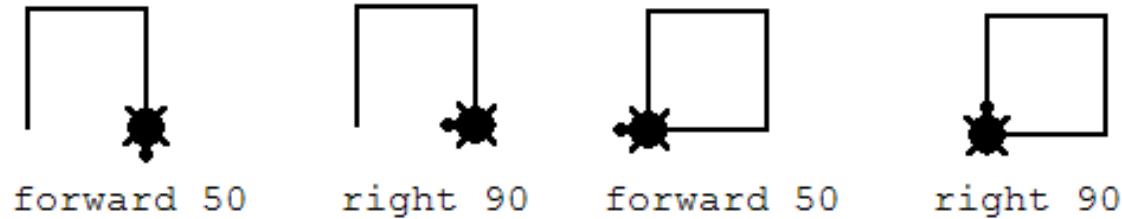
自動機（人 = 格點）

代理人（人 ≠ 格點）



社會科學模型建構：NetLogo (1/2)

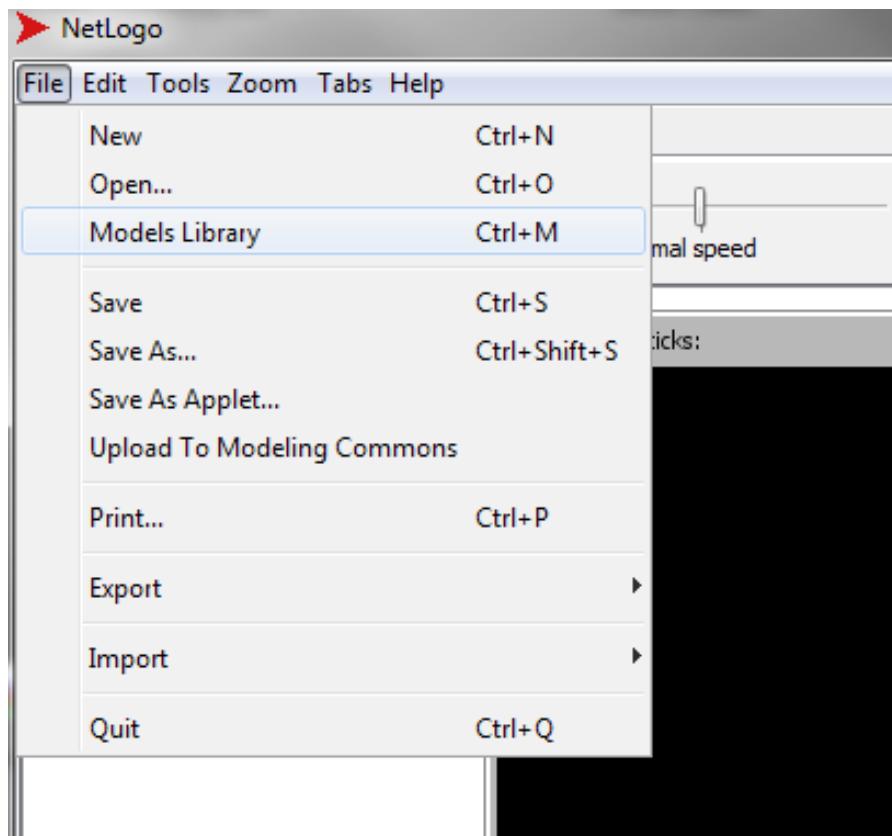
從小朋友畫畫用的語言 Logo 發展而來



人 =turtle; 格點 =patch; 你 =observer

社會科學模型建構：NetLogo (2/2)

最好的入門方式是官網三個 tutorials



Explore The Modeling Commons

- Search
Suggestion: Search for 'predation'
- List all 1,000+ models
- List recently changed models
- Jump to a random model
- View projects (model collections)
- Help!

最好的進階學習是內建與官網上的 models library



Overview Cellular Automata Models Agent-Based Models

Conway's Game of Life

NetLogo: Models Library→Computer
Science→Cellular Automata→Life



Python 的版本也很簡單

其他用 CAM 的社會科學模擬

- Axelrod's Tribute Model
- Bremer-Mihalka's & Cusack-Stoll's Realpolitik Models
- Hegselman's Opinion Dynamics Model
- Parisi's Model of the Neo-Assyrian Empire
- Sakoda's Group Attitudinal Model
- Schelling's Urban Racial Segregation Model

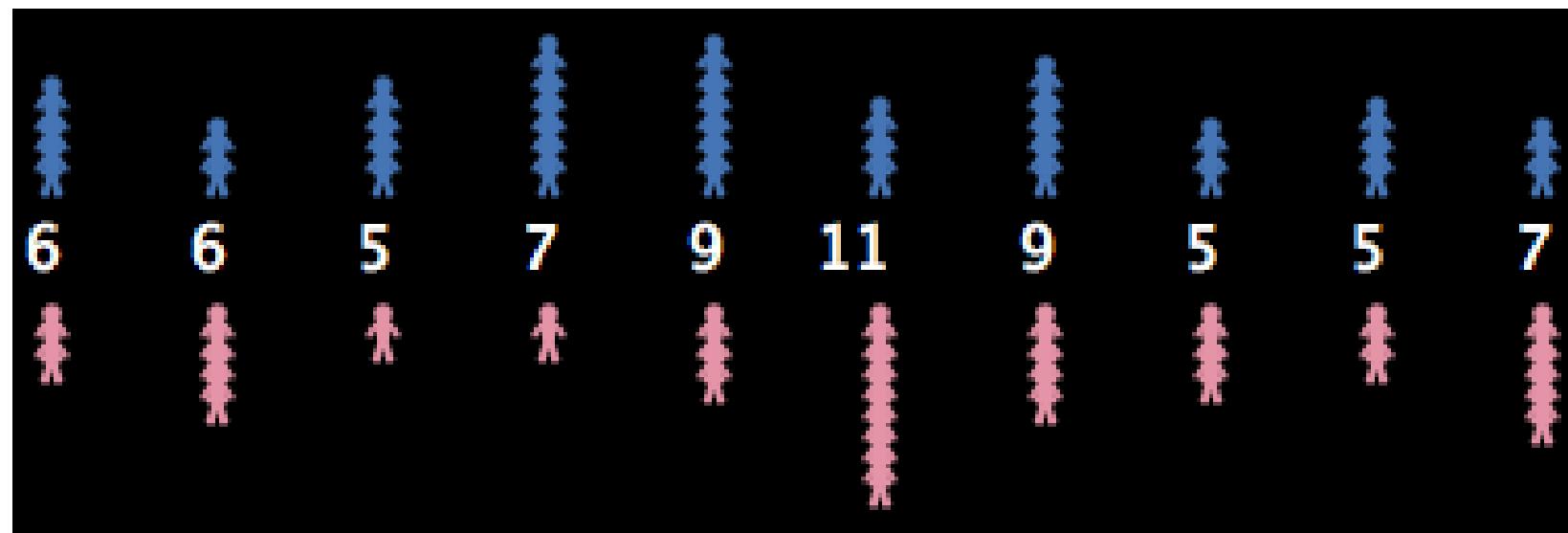


Overview Cellular Automata Models Agent-Based Models

Party Dynamics

NetLogo: Models Library→Social Science→Party

對異性比例的容忍度如何影響最後群聚的穩定態？



或許也可解釋意識形態族群 / 政黨的形成

MIT Matching Game

傳聞為 MIT 經濟學家 Dan Ariely 所做之實驗

想象你到达晚会会场，刚一进门，主人就在你的前额上写了点什么。他告诉你不要照镜子或者问别人。你在会场转了转，发现会场的男男女女前额上都标着从1到10的数字。主人对你说你的任务就是尽量找到数值最高，而且愿意和你交谈的人组成一对。你自然朝数字为10的人走去，但是他（她）看了你一眼就走开了。接下来，你又去找数字是9或8的人，以此类推，直到后来一个数字是4的人向你伸出手，你们一起交谈。



後來被打臉說根本沒這個實驗

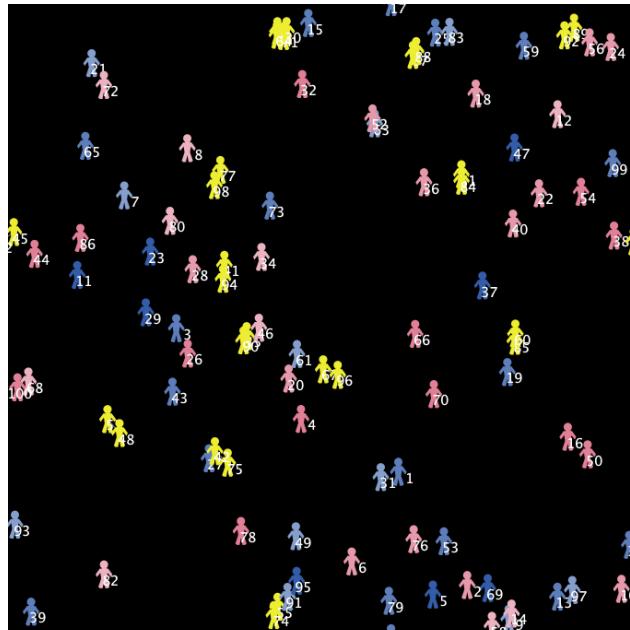
Matching Simulations (1/2)

其實早在 1986 年就有了

INTERPERSONAL RELATIONS AND GROUP
PROCESSES

The Matching Hypothesis Reexamined

S. Michael Kalick and Thomas E. Hamilton III
University of Massachusetts, Boston



Matching Simulations (2/2)

Cumulative Couple Formation and Intracouple Attractiveness
Correlations in Simulations Using Different Mate-Preferences

Date	Simulation 1 (Attractiveness)		Simulation 2 (Matching)		Simulation 3 (Combined)	
	% in couples	r	% in couples	r	% in couples	r
1	5.6	.05	26.7	.85**	13.4	.74**
2	12.2	-.06	48.6	.84	26.4	.74
3	16.5	-.09	61.6	.84	36.5	.72
4	21.8	-.02	71.8	.85	44.5	.73
5	24.9	-.01	79.0	.85	51.7	.72
6	28.3	-.02	84.3	.84	59.1	.73
7	31.3	-.03	88.9	.84	64.2	.73
8	34.1	-.02	91.3	.84	69.0	.73
9	36.1	-.03	94.0	.85	73.0	.72
10	38.7	-.01	95.3	.85	77.3	.71
11	40.2	.02	96.1	.85	80.5	.71
12	42.2	.05	97.3	.85	83.5	.70
13	43.9	.06	98.3	.85	86.2	.71
14	45.3	.07	98.8	.85	88.7	.71
15	46.2	.07	99.2	.85	91.6	.71
16	47.7	.07	99.4	.84	93.7	.72
17	49.0	.07	99.6	.84	94.8	.72
18	50.7	.08			95.8	.71
19	53.1	.09*			96.2	.71
20	54.8	.11			97.2	.71
21	56.8	.12	99.7	.84	97.7	.71
22	57.5	.12			98.3	.71
23	58.7	.13			98.5	.71
24	59.8	.14			98.8	.71
25	61.2	.15			99.2	.71
26	63.4	.17			99.3	.71
27	64.5	.19			99.4	.70
28	65.2	.20			99.6	.70
29	66.8	.22			99.8	.70
30	68.3	.23				
31	70.2	.26				
32	71.8	.27			99.9	.70
33	73.2	.29				
34	74.8	.30	99.8	.84	100	.70
35	76.6	.32				
36	78.4	.35				
37	79.9	.37				
38	81.8	.39				
39	84.4	.41				
40	86.7	.43				
41	87.4	.44				
42	89.6	.46				
43	91.8	.48	99.9	.83		
44	94.5	.50				
45	95.7	.51				
46	97.1	.53				
47	98.3	.53	100	.83		
48	99.1	.54				
49	99.7	.55				
50	100	.55				

找條件最好 vs. 找跟自己差不多

- 後者會導致伴侶條件正相關過高
- 前者也會導致伴侶條件有正相關



鳥的社群行為

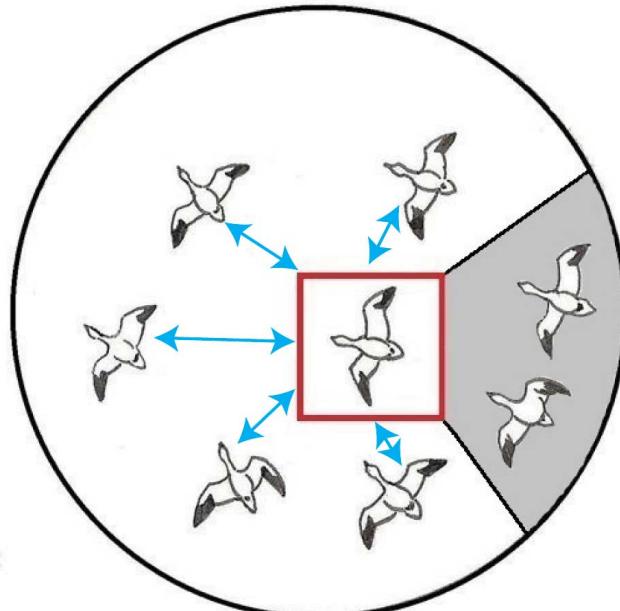
個體如何得知群體接下來飛行的方向？



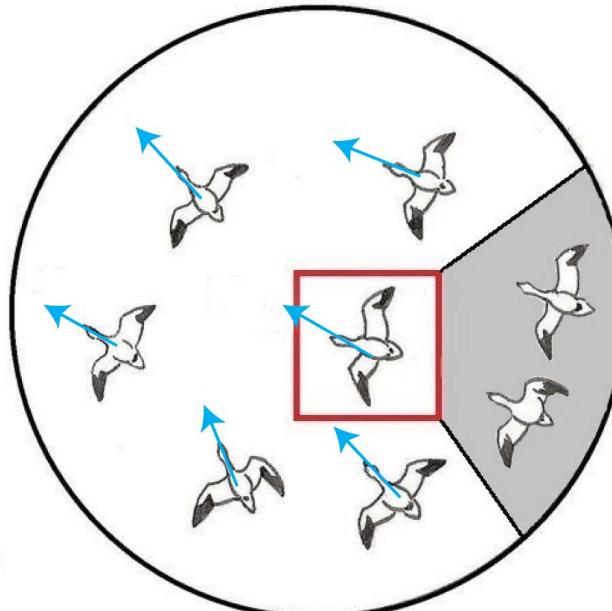
Boid Model

NetLogo: Models Library→Biology→Flocking

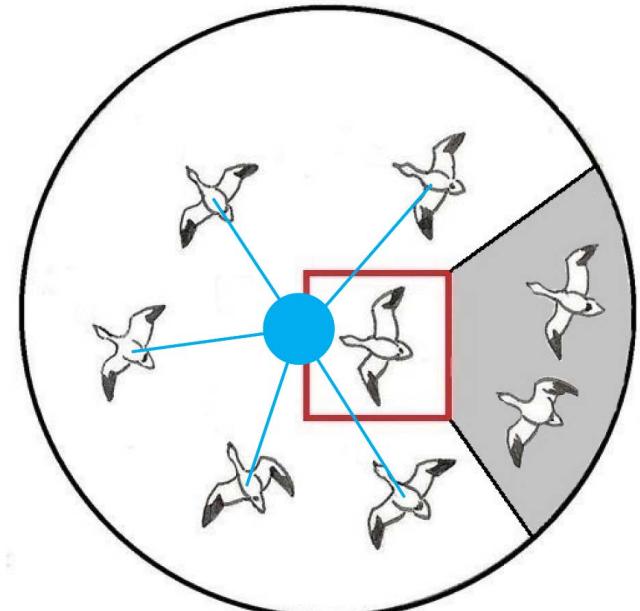
Separation



Alignment



Cohesion



Python 的版本其實也不難 (?)

其他用 ABM 的社會科學模擬

Model name	Referent system and research questions	Empirical calibration	Source code	Bibliographic reference
RiftLand model	East African coupled socio-techno-natural system; hazards and disaster scenarios	High	MASON	Cioffi-Revilla et al. (2012)
Anasazi	Long House Valley, Arizona; population dynamics and carrying capacity	High	Ascape, NetLogo	Dean et al. (1999), Axtell et al. (2002)
Sugarscape	Theoretical system of agents; social consequences of agent rules	Medium	Ascape, NetLogo	Epstein and Axtell (1996)
RebeLand	Political stability in a country; insurgency and state-failure dynamics	Medium	MASON	Cioffi and Rouleau (2010)
GeoSim	Balance of power system; territorial change	Medium	Repast	Cederman (2003)
FEARLUS	Land-use and cover change; farming dynamics	Medium	Swarm	Gotts and Polhill (2010)
SIMPOP	Urban systems; growth dynamics	Medium	C++	Sanders et al. (1997)
Heatbugs	Abstract social system; agent happiness and social proximity	Low	Swarm	C.G. Langton, Swarm Development Group
Wetlands	Hunter-gatherers affected by weather; social effects of memory	Low	MASON	Cioffi et al. (2004)

用 ABM 來研究（社會 / 文化）心理學

優點在實驗有高度的控制性且可大規模地檢視不同機制

Special Issue Article

Agent-Based Modeling: A Guide for Social Psychologists

Social Psychological and
Personality Science
2017, Vol. 8(4) 387-395
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DOI: 10.1177/1948550617691100
journals.sagepub.com/home/spp



**Joshua Conrad Jackson¹, David Rand^{2,3,4}, Kevin Lewis⁵,
Michael I. Norton⁶, and Kurt Gray¹**

Table I. Comparing Agent-Based Modeling to Other Methods.

Research Aspect	Field Studies	Lab Experiment	Archival Studies	ABMs
Control and realism	Low control; high realism	Medium control; medium realism	Low control; medium realism	High control; low realism
Scale	Medium to high scale	Low to medium scale	High scale	High scale
Nonlinear dynamics	Medium visibility	Low visibility	Medium visibility	High visibility
Mechanism	Medium clarity	High clarity	Low clarity	High clarity

Note. ABMs = agent-based models.

做 ABM 的七個步驟

主要是定義 agents 如何在環境中互動

1. What are your world's dimensions?
2. How do agents meet?
3. How do agents behave?
4. What is the payoff?
5. How do agents change?
6. How long does your world last?
7. What do you want to learn from your world?

範例 1：個體經濟學→總體經濟學 (1/3)

Prisoner's Dilemma → Emerging economies

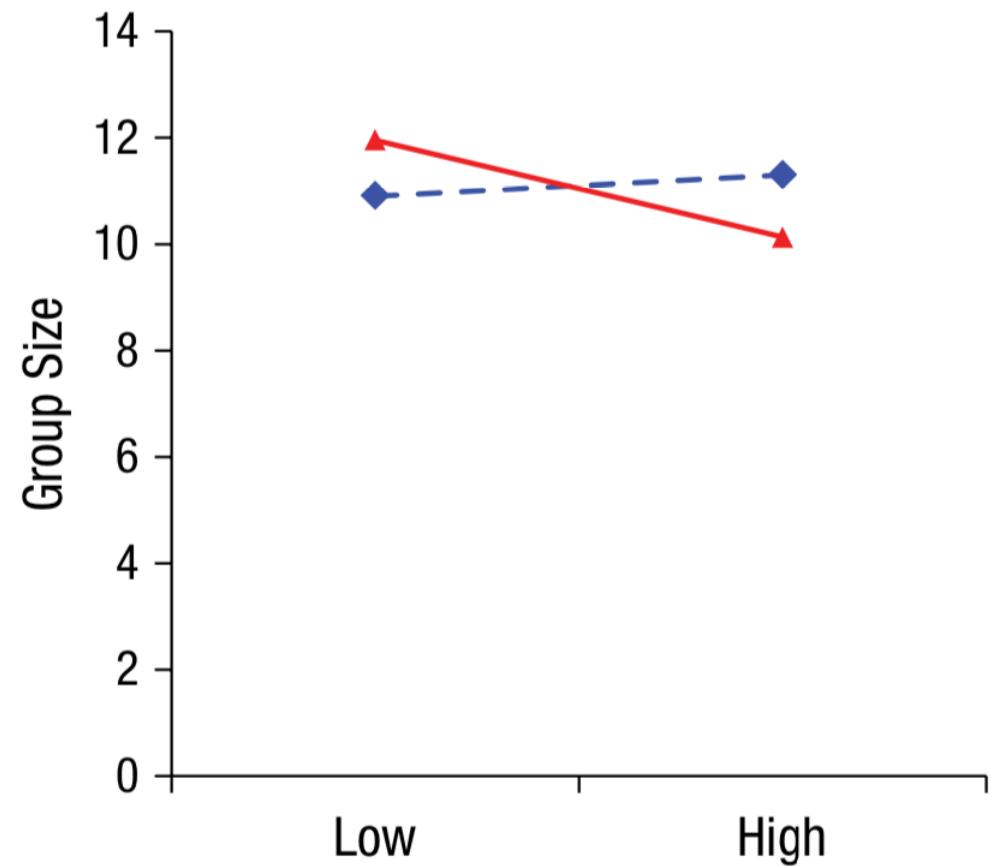
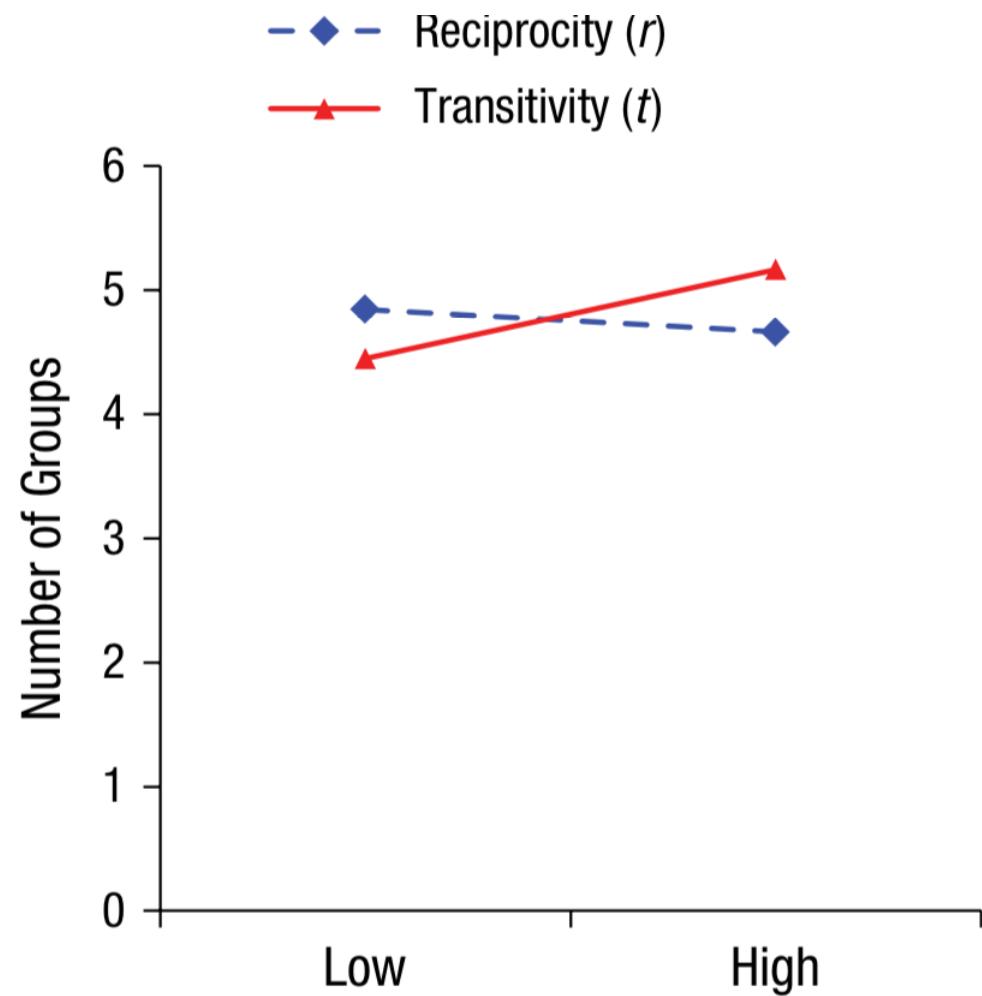
Research Article

The Emergence of “Us and Them” in 80 Lines of Code: Modeling Group Genesis in Homogeneous Populations

		Player 2	
		Cooperates	Defects
		Cooperates	1/1 -3/3
Player 1	Cooperates	3/-3	-1/-1
	Defects		
Payoff: Player 1/Player 2			

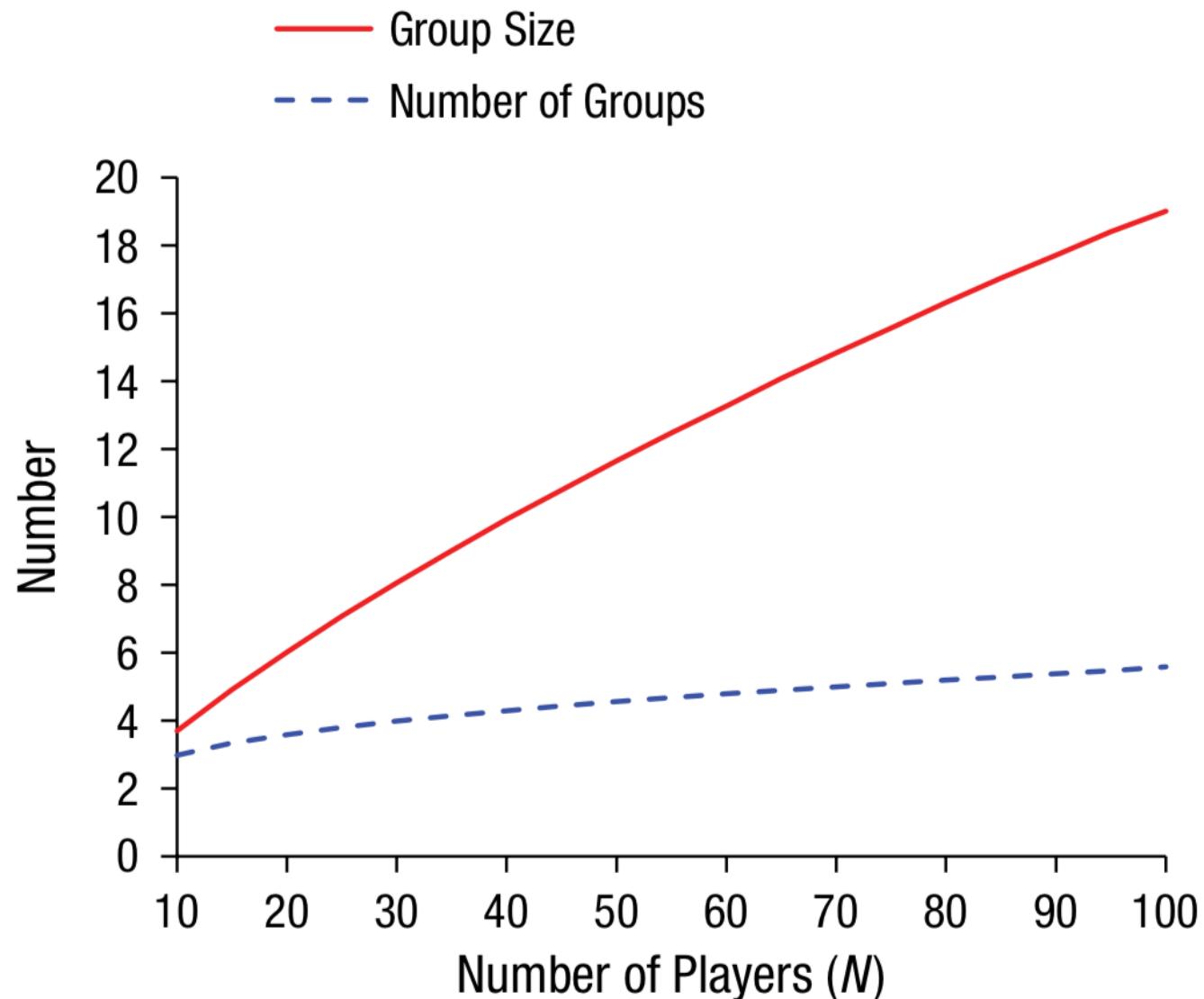
範例 1：個體經濟學→總體經濟學 (2/3)

有 Reciprocity & Transitivity 兩互動特性就會分群



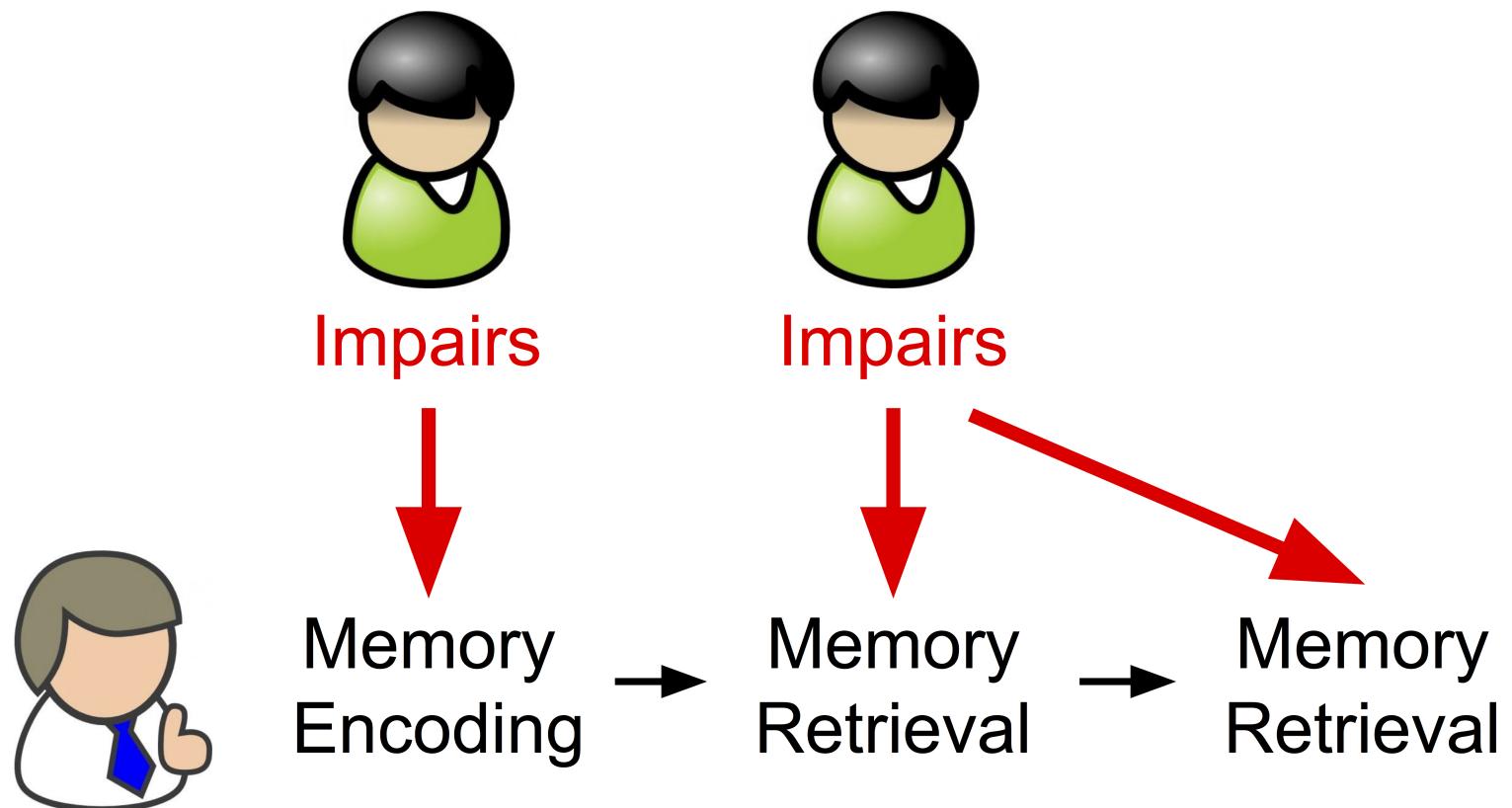
範例 1：個體經濟學→總體經濟學 (3/3)

人數主要影響的是 group size 而非 # of groups



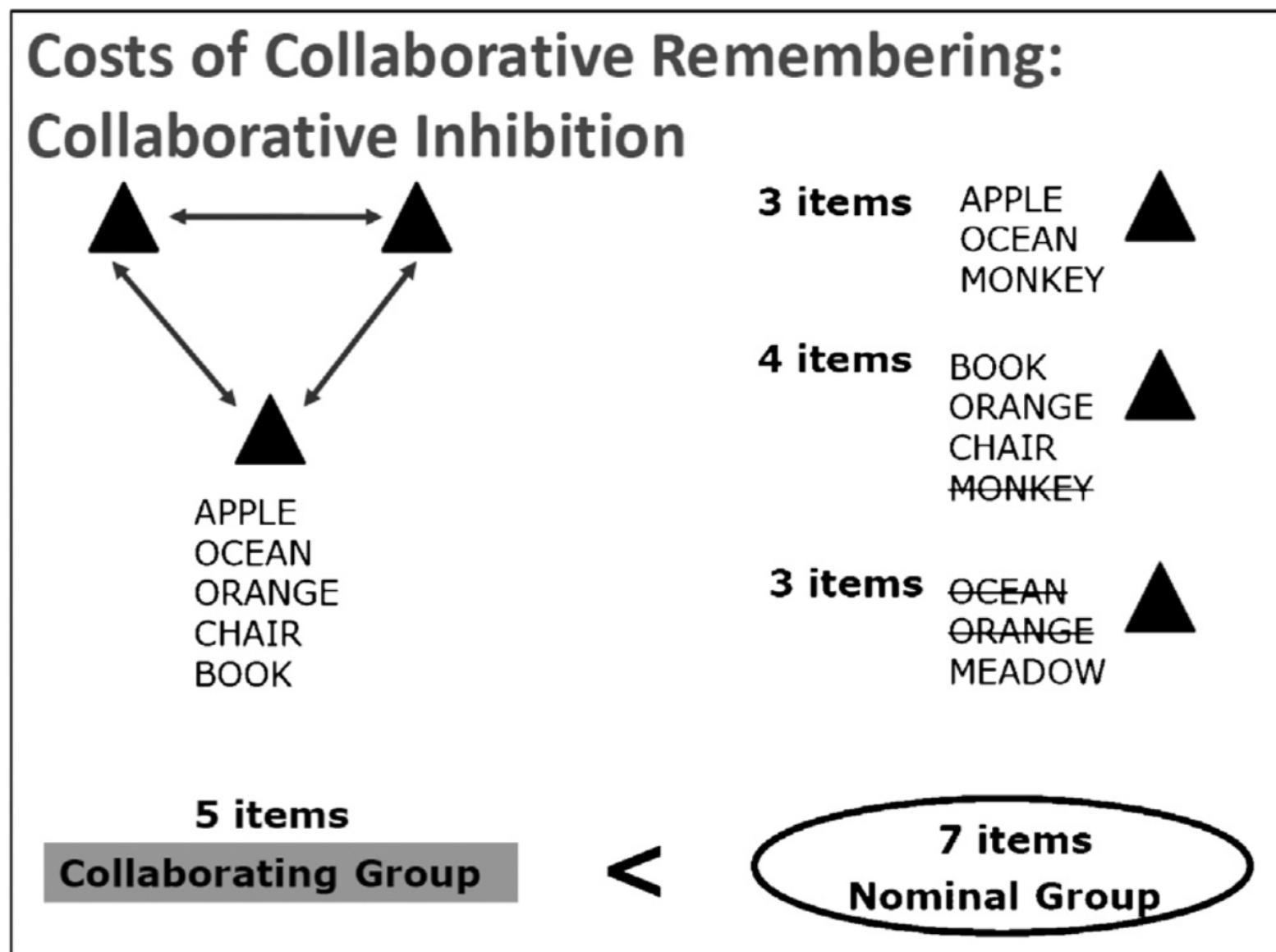
範例 2: 認知心理→社會認知心理 (1/5)

第三種現象 : Retrieval-induced Forgetting
→ Socially-shared Retrieval-induced Forgetting



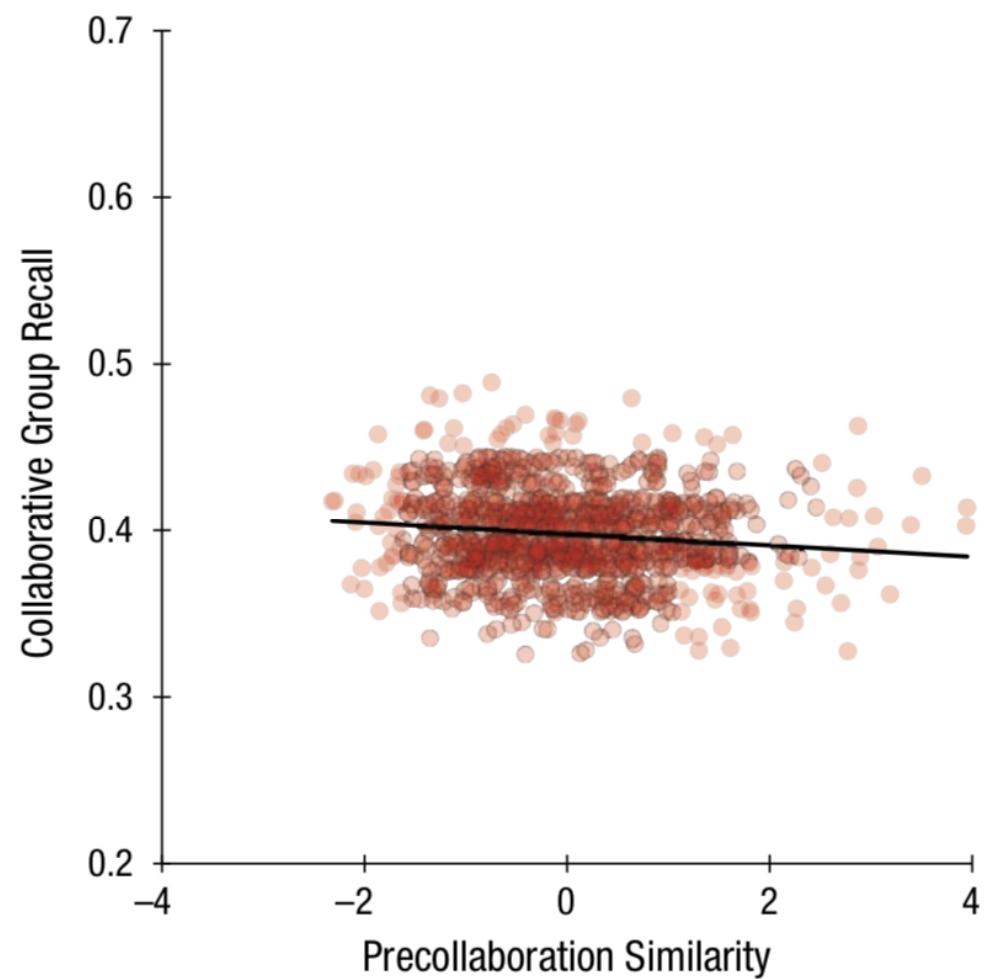
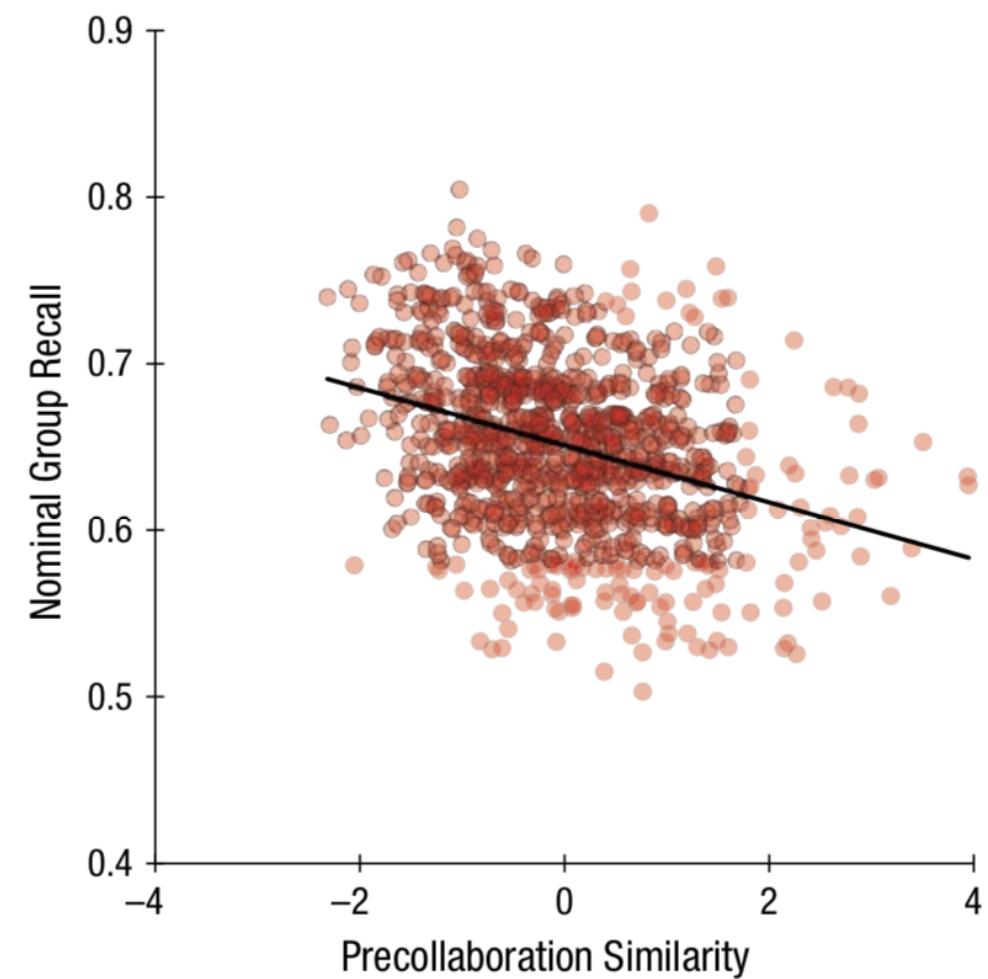
範例 2：認知心理→社會認知心理 (2/5)

今天來探討第二種現象：Collaborative Inhibition



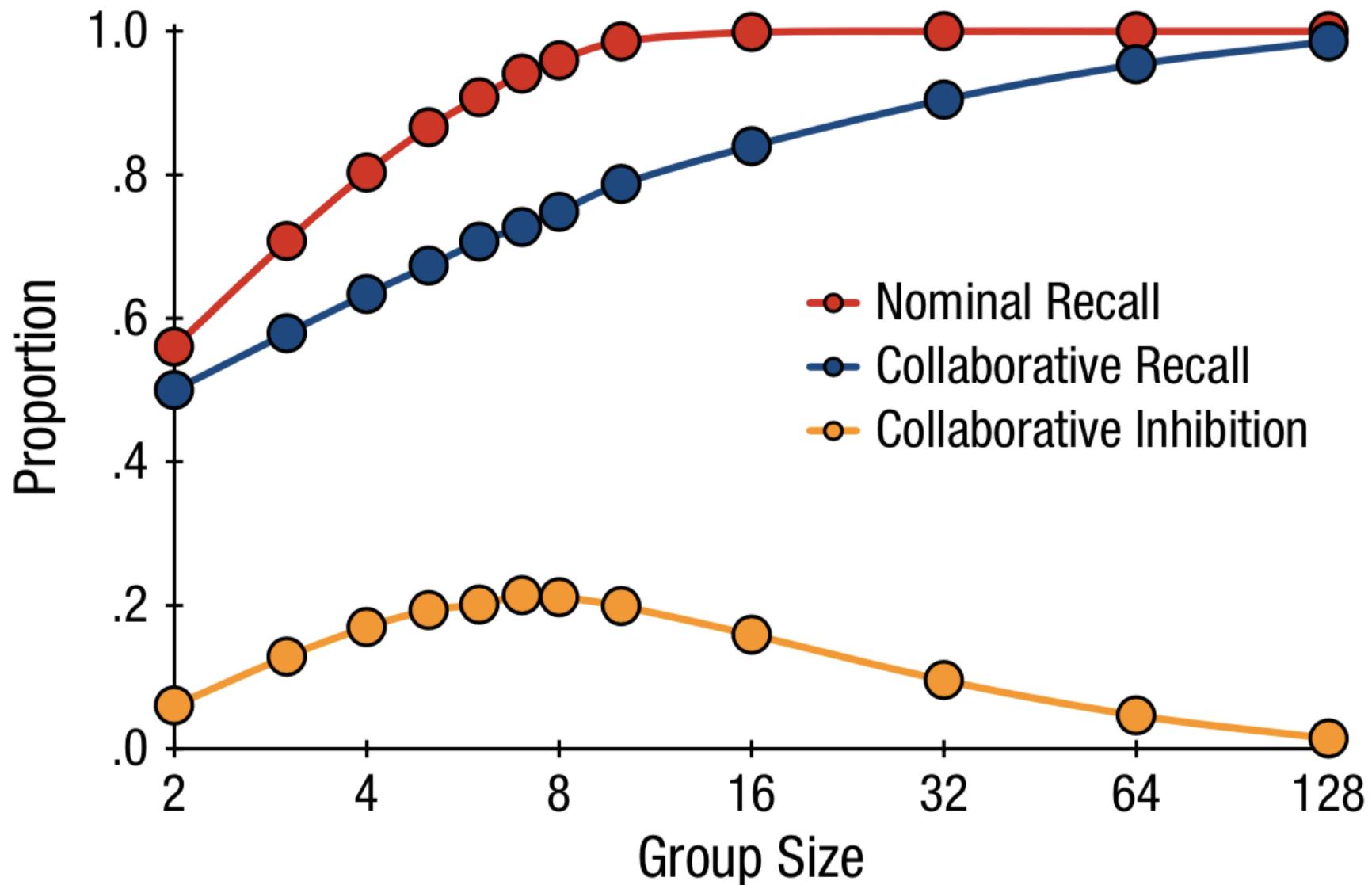
範例 2：認知心理→社會認知心理 (3/5)

為何會有 Collaborative Inhibition 的現象？



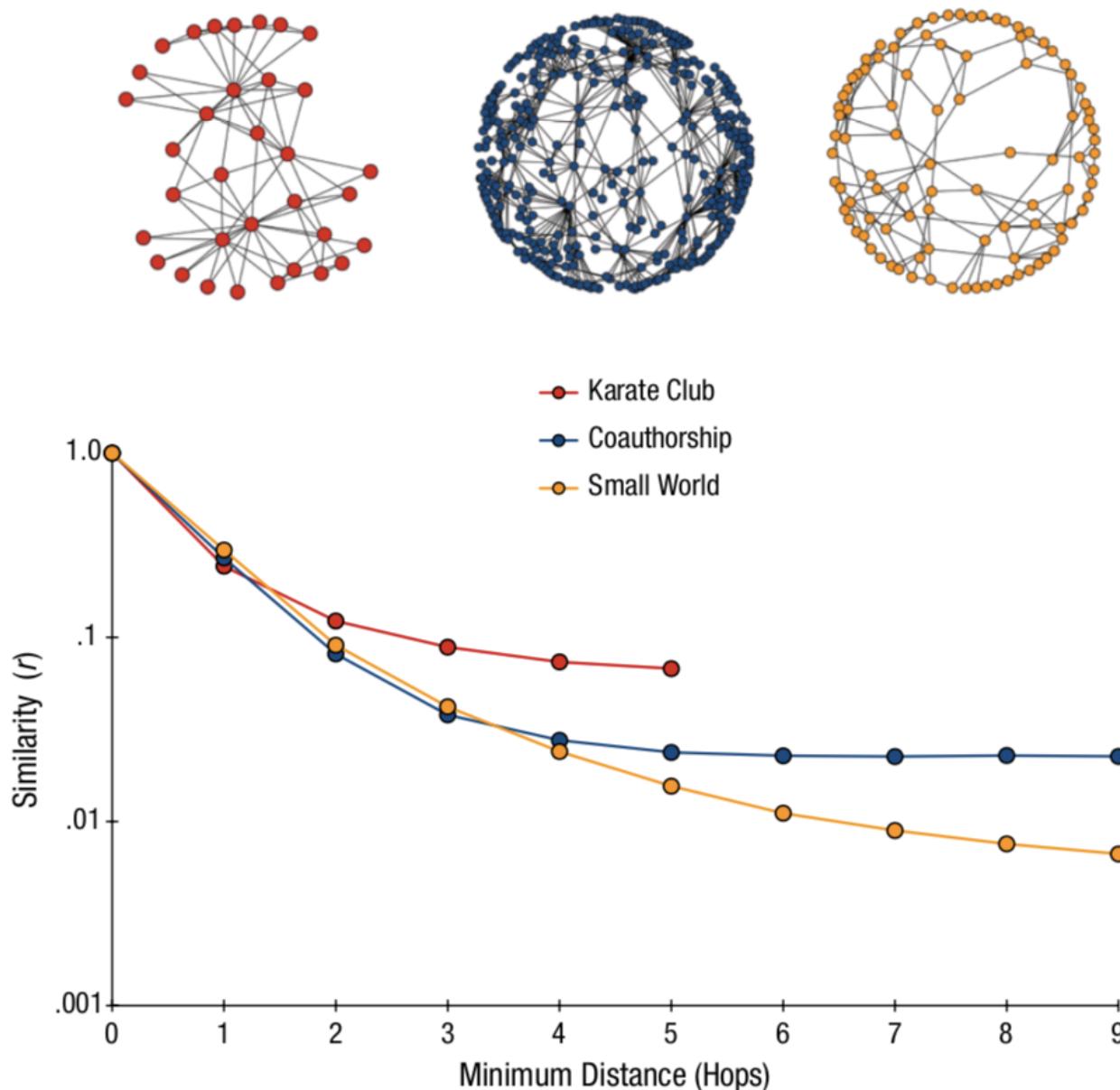
範例 2：認知心理→社會認知心理 (4/5)

不是 group size 愈大 CI effect 就愈大



範例 2：認知心理→社會認知心理 (5/5)

CI effect 可以透過 social nets 傳遞



Game Over

