

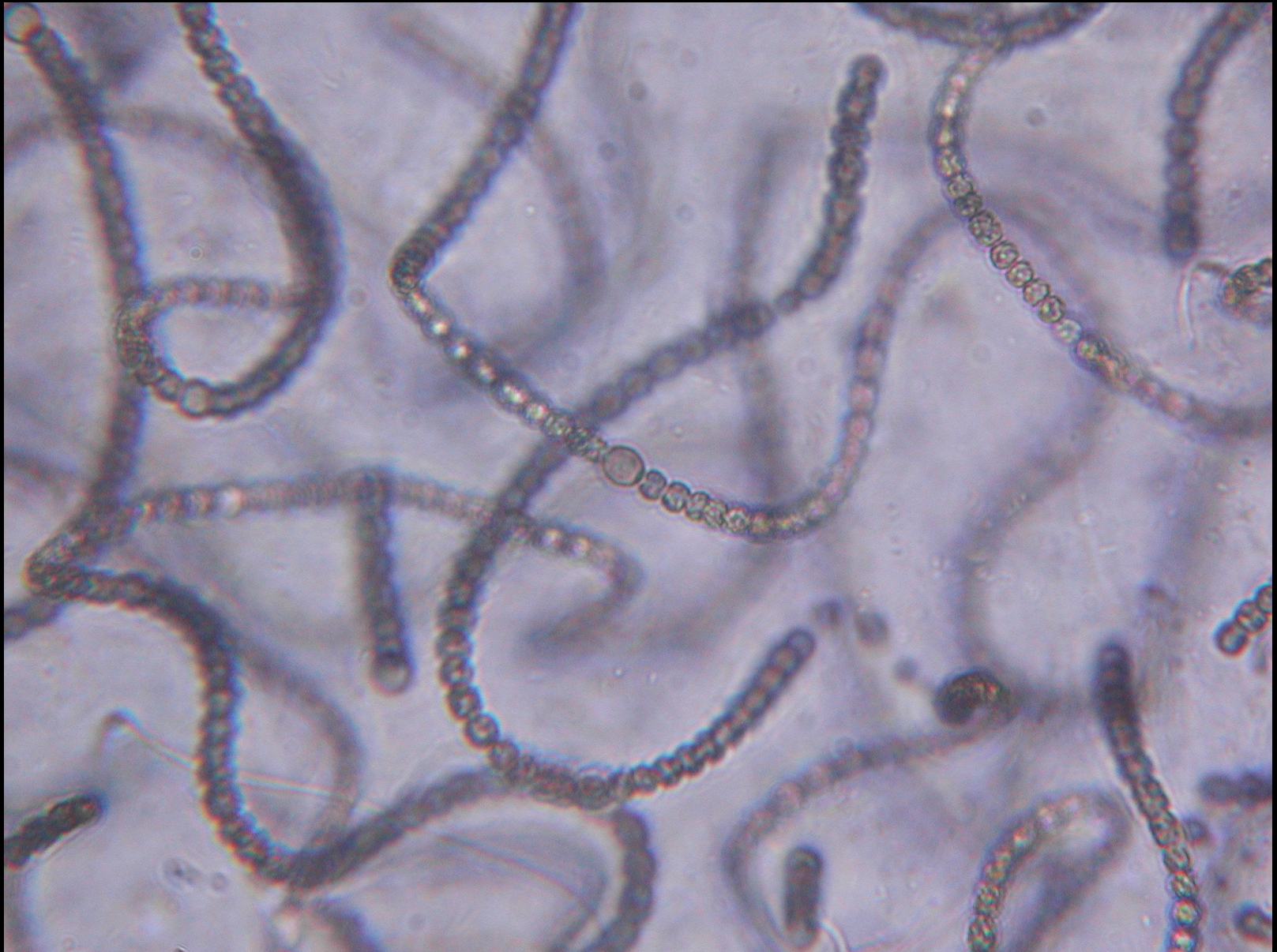


Good and Evil

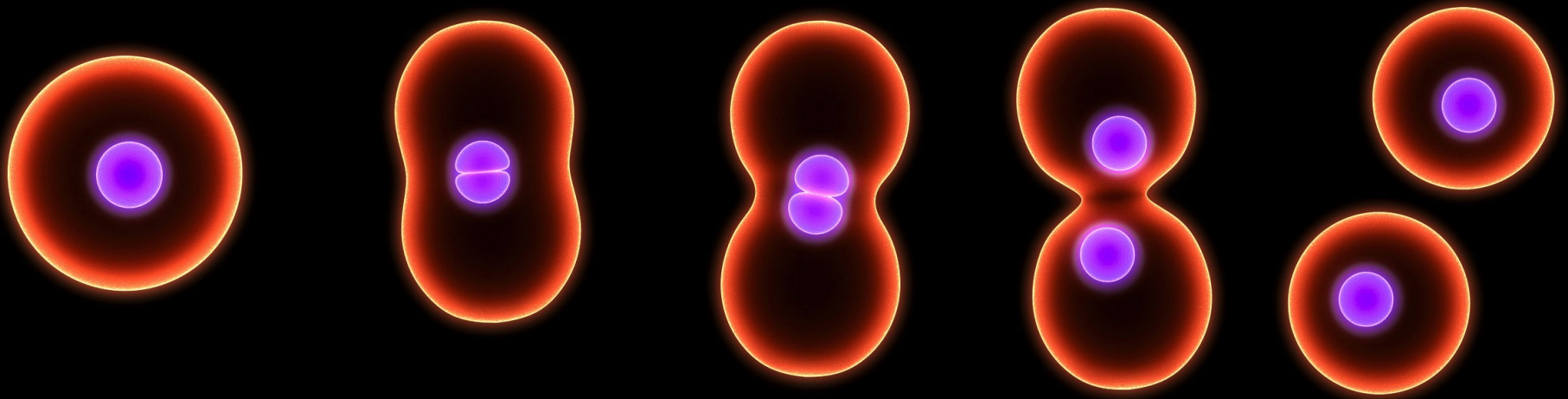




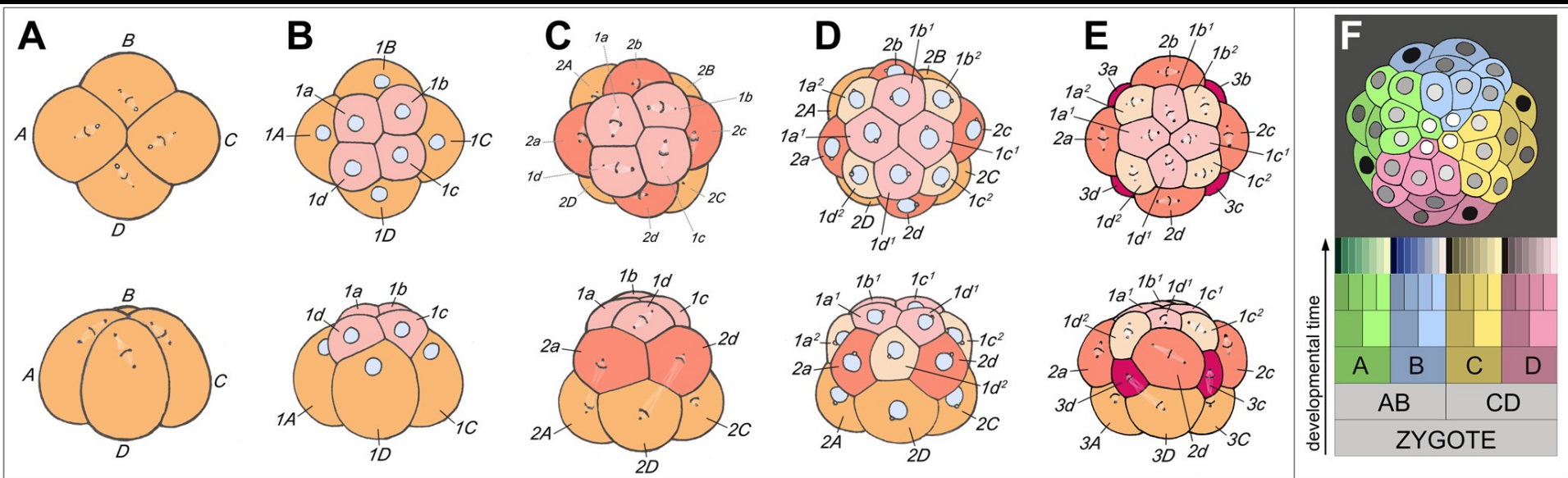
Corals cooperate repairing damaged bits



Some cyanobacteria sacrifice themselves for the their neighbours



Cell division unicellular



Labour division through multicellularity



Labour division leaf-cutter ant



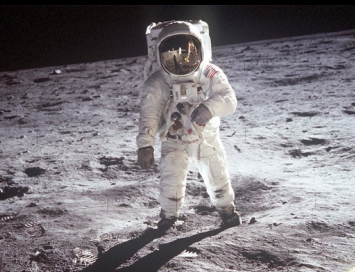
Labour division leaf-cutter ant



John Maynard Smith



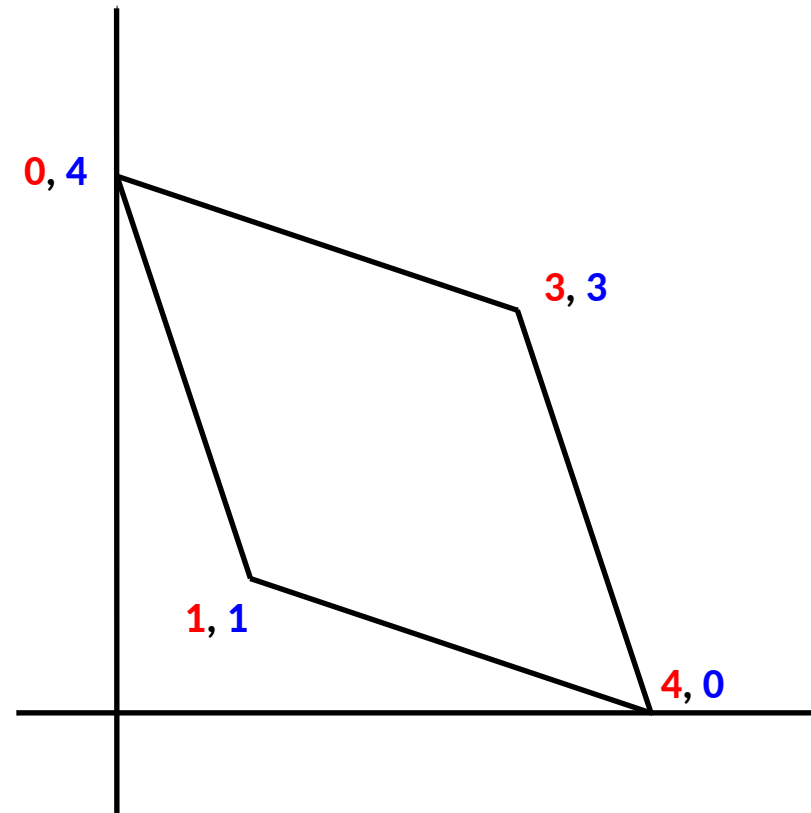
Eörs Szathmáry



Fruits of labour division in humans

Prisoners' dilemma

	Cooperate	Defect
Cooperate	3, 3	0, 4
Defect	4, 0	1, 1





Felix Warneken



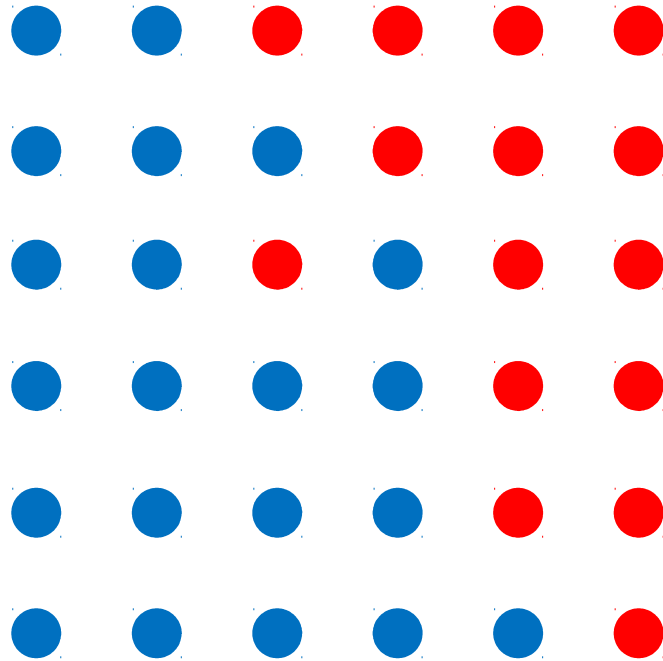
© Warneken & Tomasello

Kinderen helpen al op heel jonge leeftijd

1. *Population structure*
2. *Repetition*
3. *Signaling / Partner choice*

1. *Population structure*

Population structure





J. B. S. Haldane

I would jump into a river to save two brothers, but not one, or to save eight cousins, but not seven.

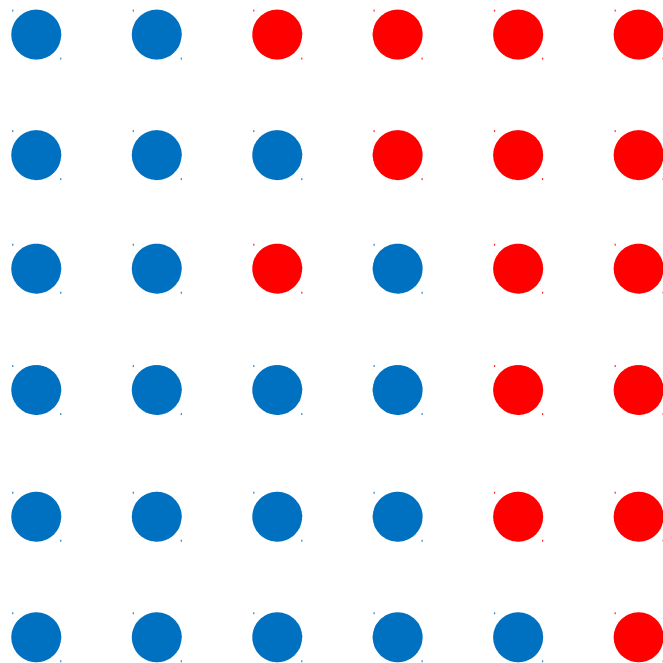


William D Hamilton

$$rb > c$$

Wilson, Pollock, Dugatkin, 1992.

Cancellation effect



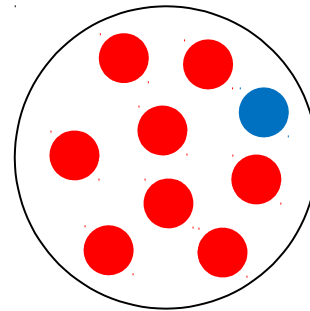
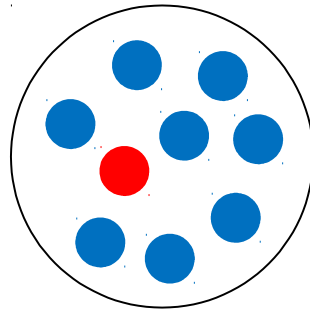
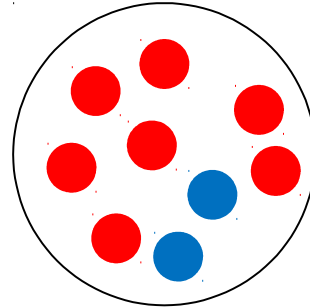
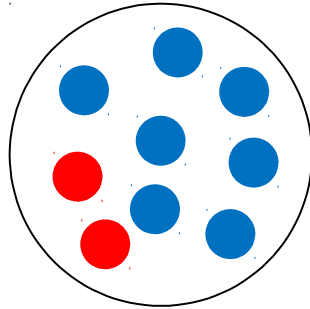
Selfishness beats altruism within groups.

Altruistic groups beat selfish groups.

Everything else is commentary.

D. S. Wilson & E. O Wilson

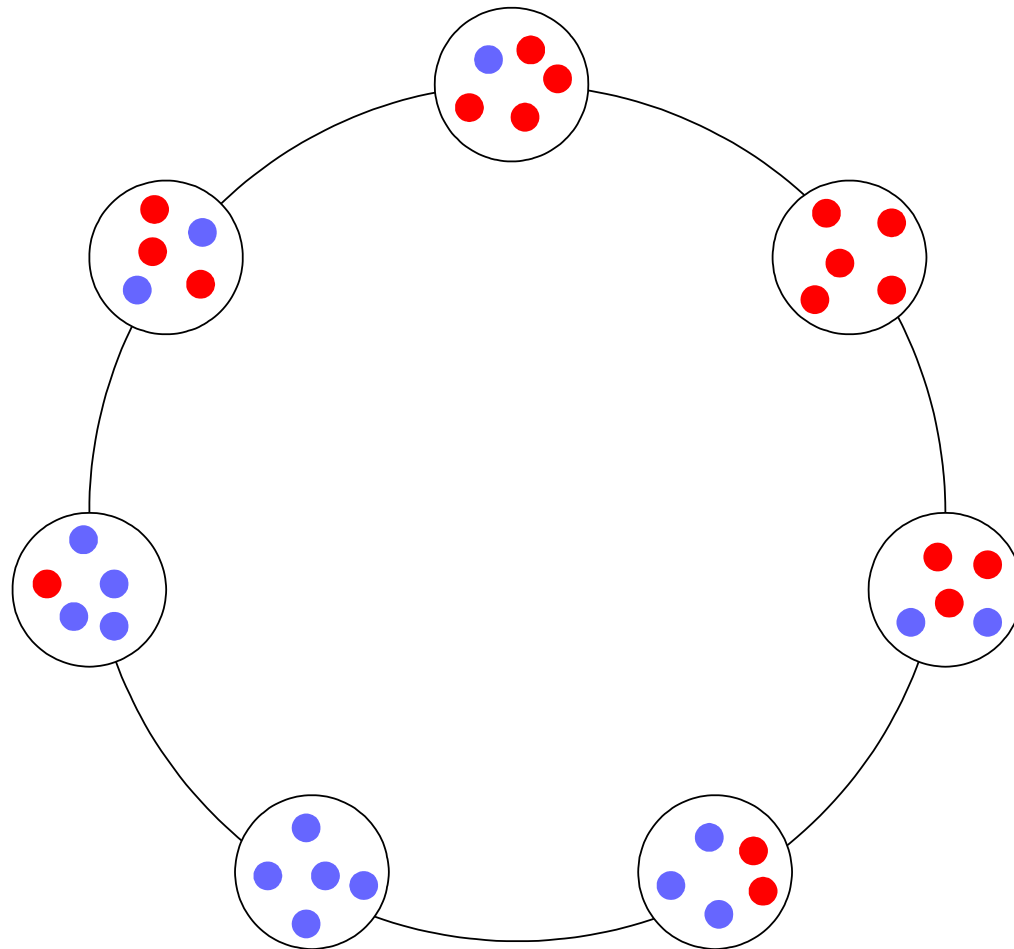
Group selection






suusvandenakker

Cancellation effect at the group level



Aslı Akdeniz



2. *Repetition*

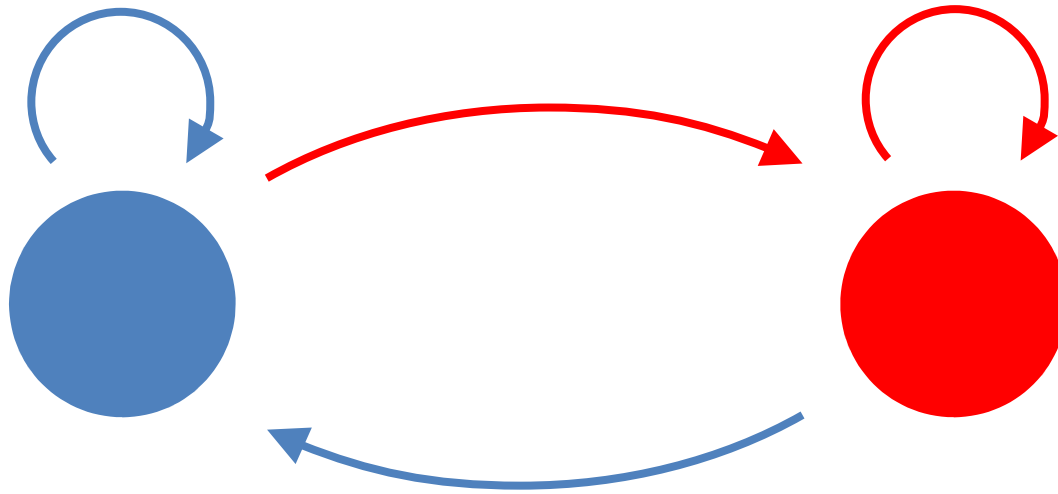


The shadow of the future

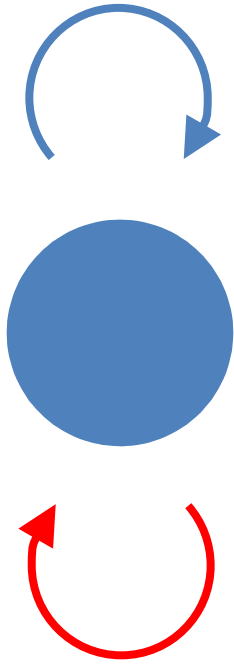


The shadow of the future

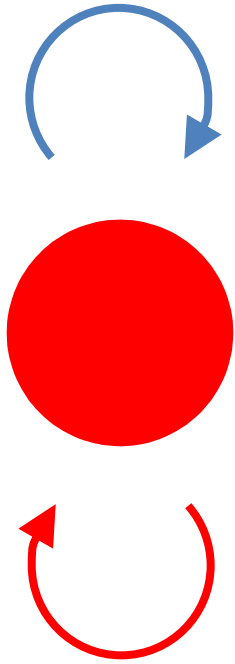
Tit-for-Tat



All C

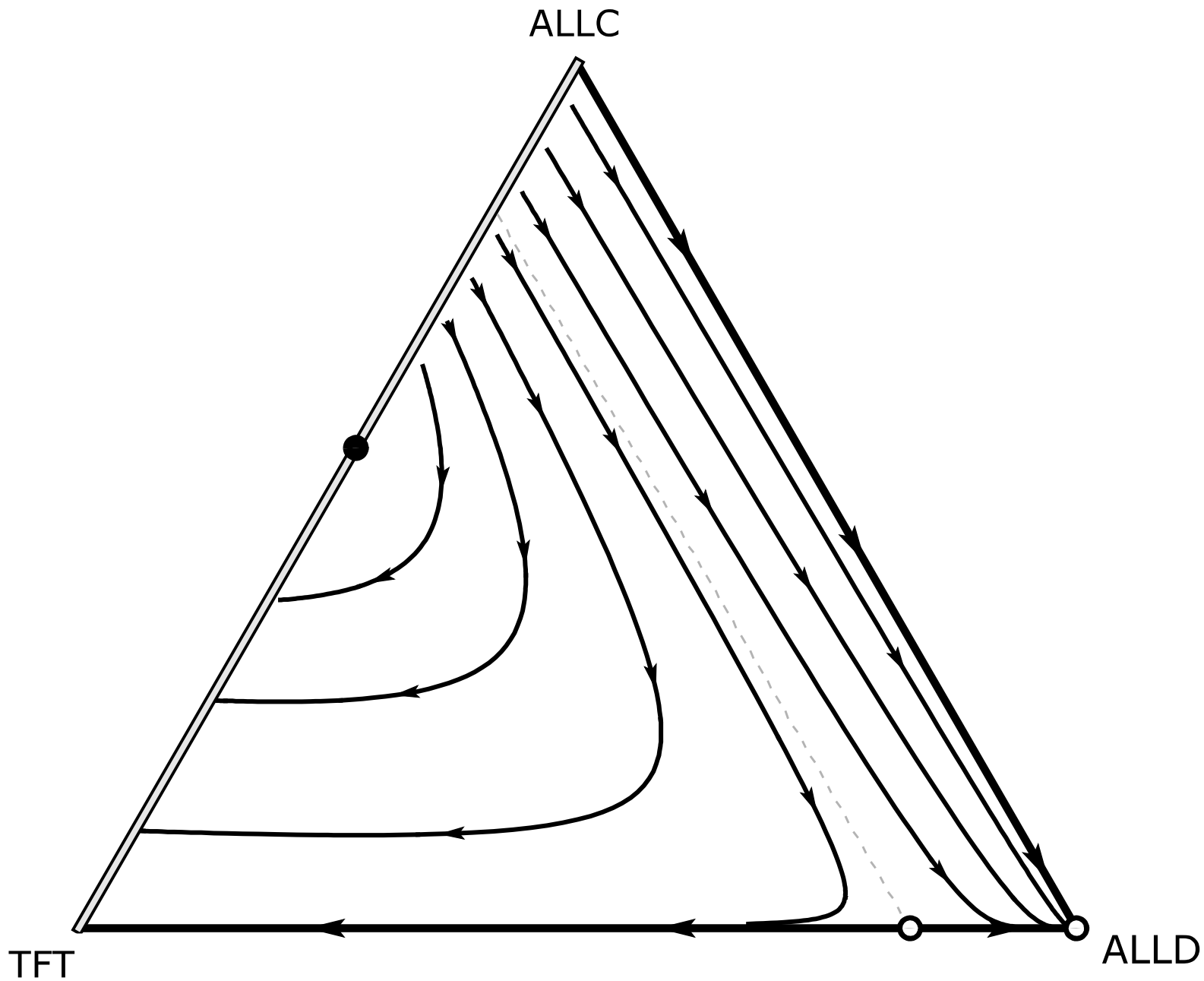


All D



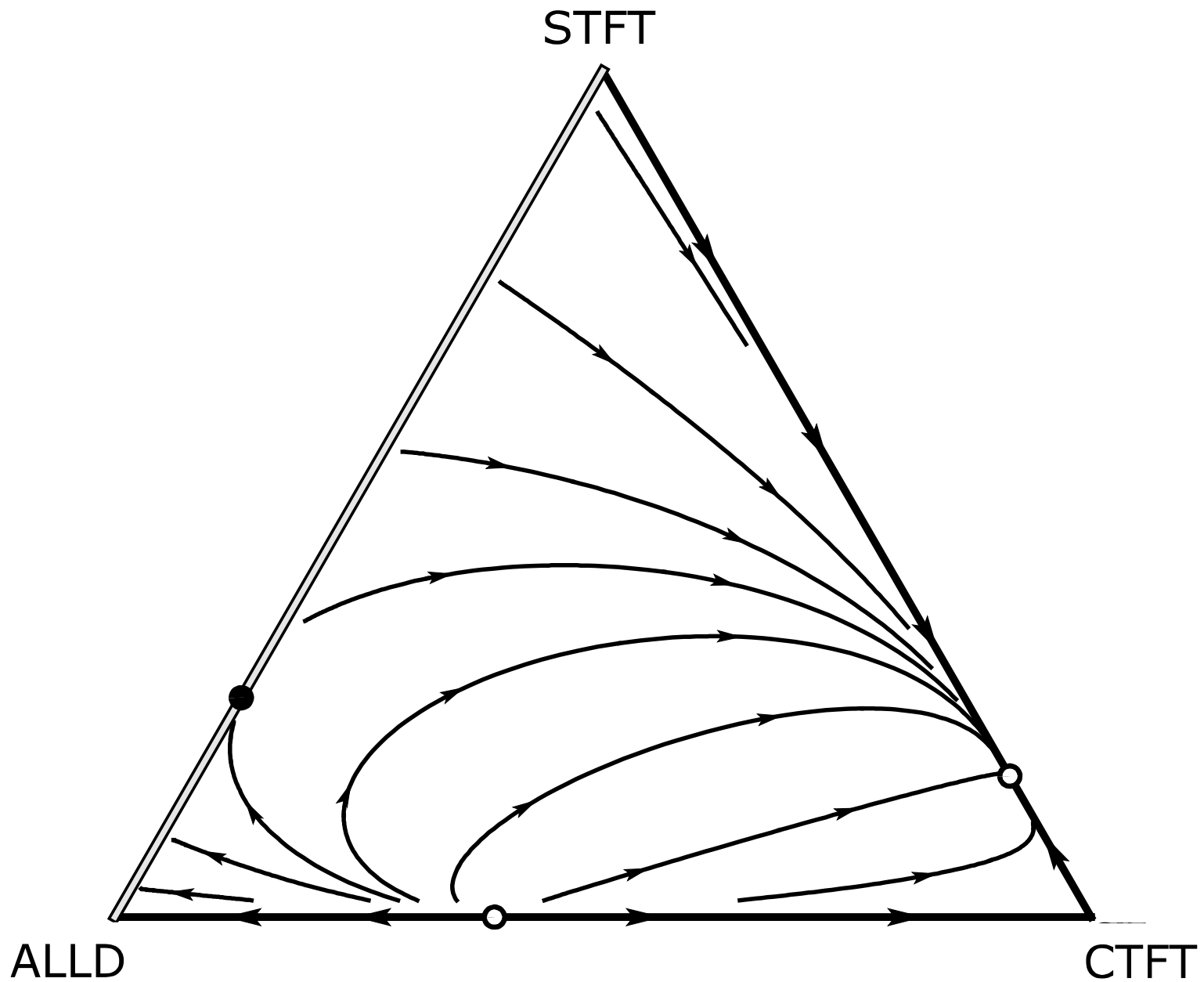
	TFT	All D
TFT	3	δ
All D	4 - 3δ	1

	TFT	All C	All D
TFT	3	3	δ
All C	3	3	0
All D	$4 - 3\delta$	4	1



Mutual cooperation is unstable

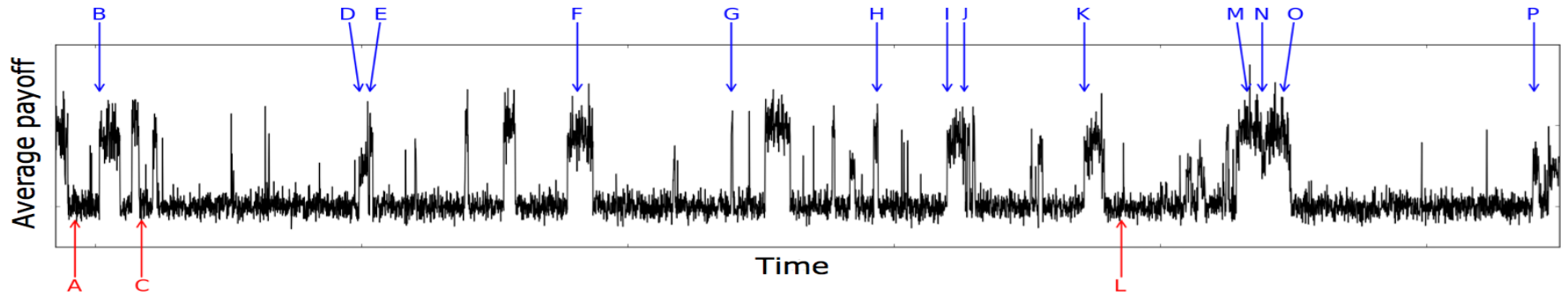
(any positive level of cooperation can be undermined by an indirect invasion)

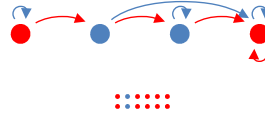
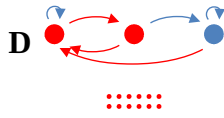
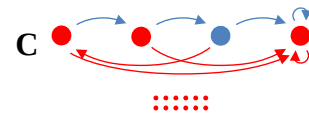
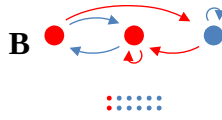
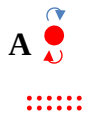


Mutual defection is also unstable

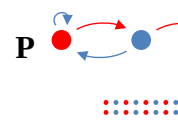
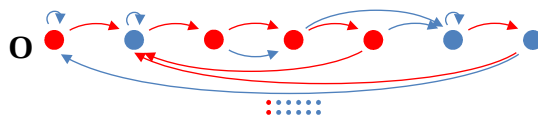
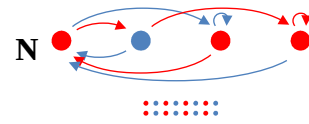
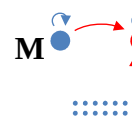
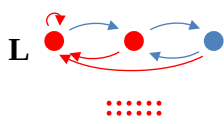
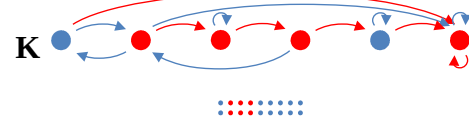
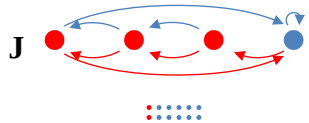
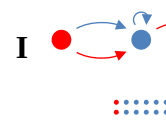
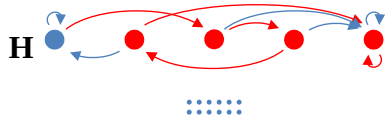
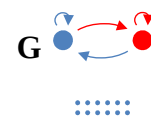
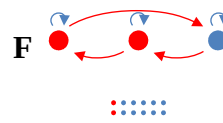
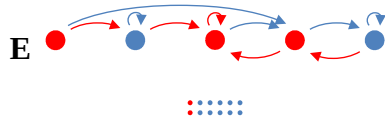
(any *lack* of cooperation can be also undermined by an indirect invasion, if δ is high enough)

Repetition





against each other:



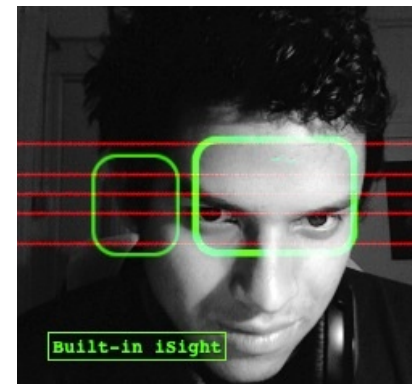
Everything changes,
nothing remains the same

Buddha

Everything changes,
nothing remains the same

Buddha

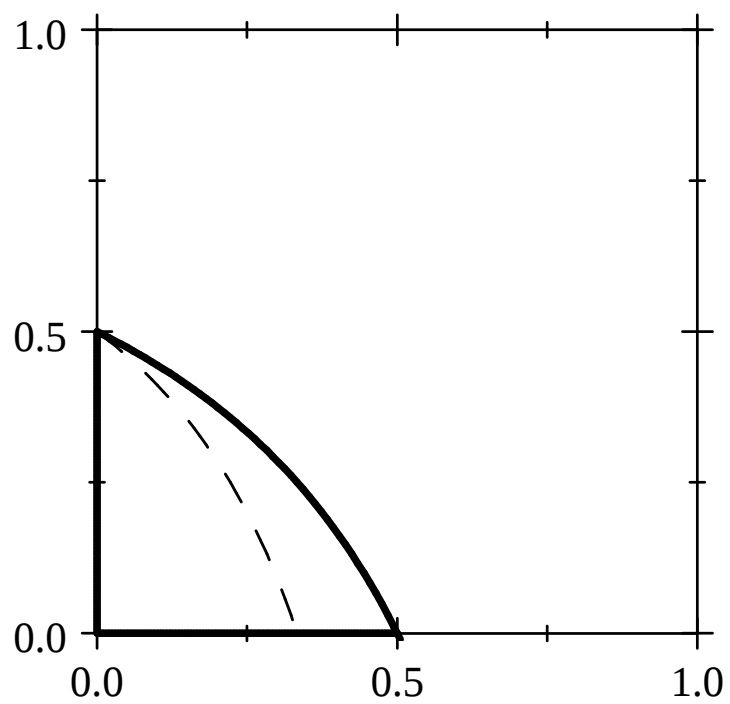
Julián García



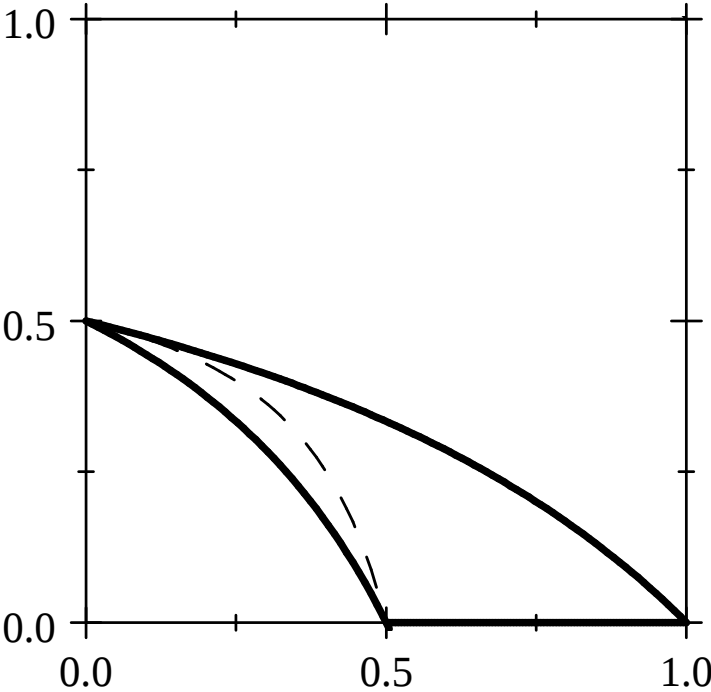
1. *Population structure*

2. *Repetition*

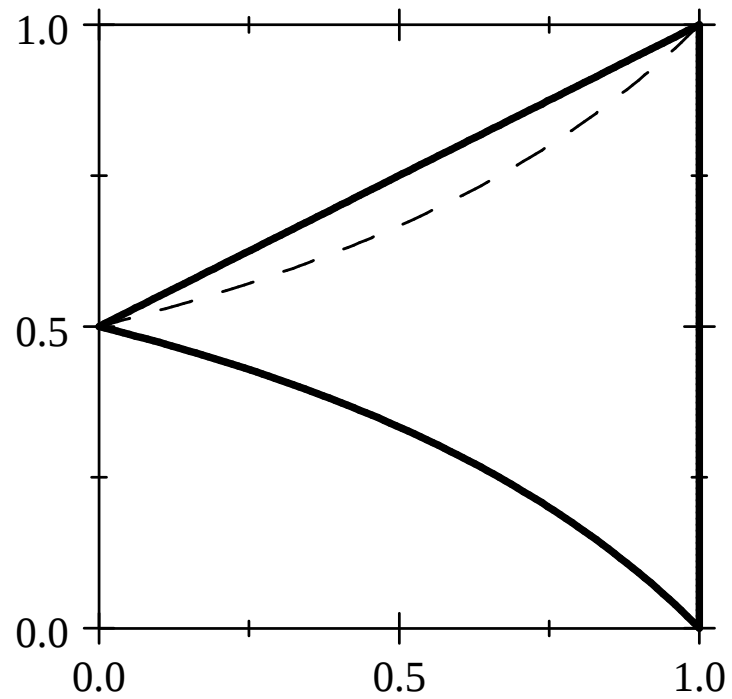
no cooperation



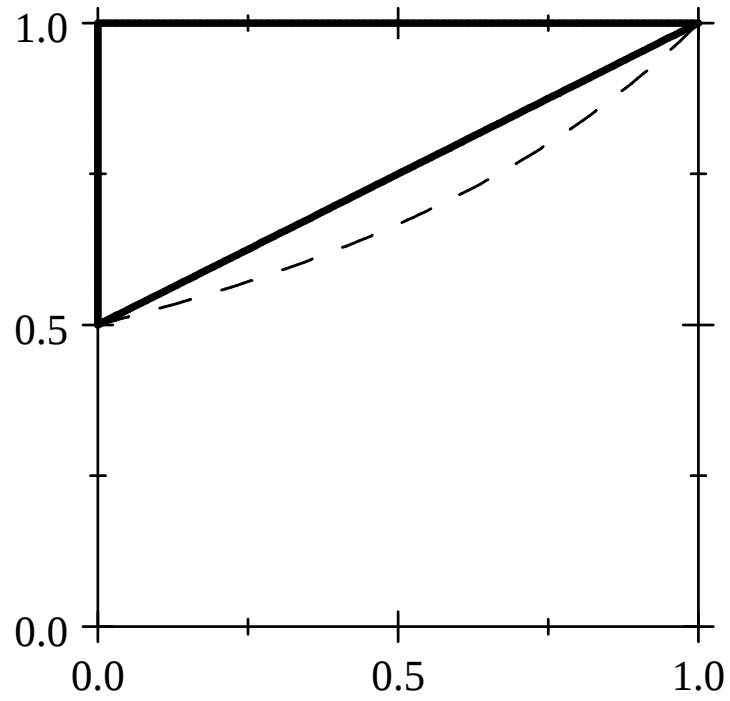
multiple equilibria



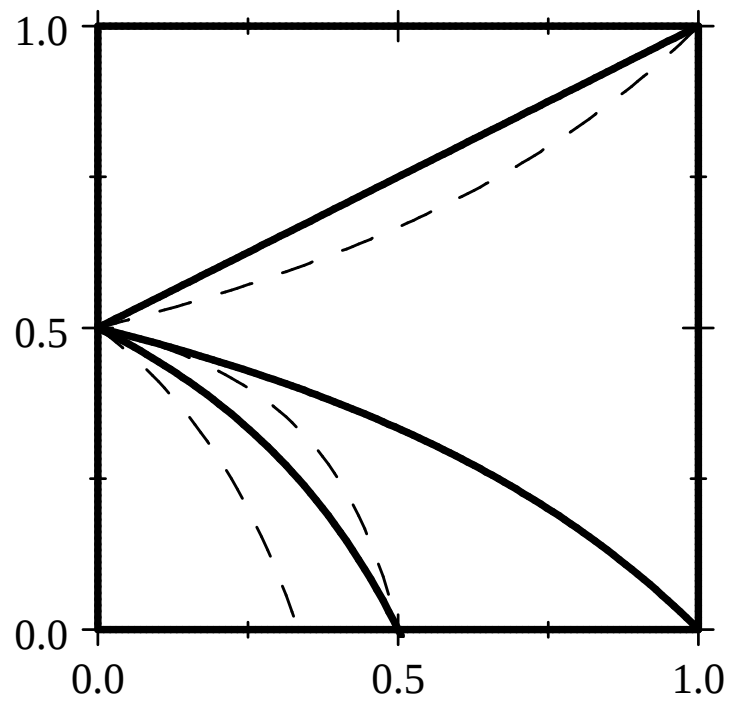
multiple equilibria, but none
without any cooperation

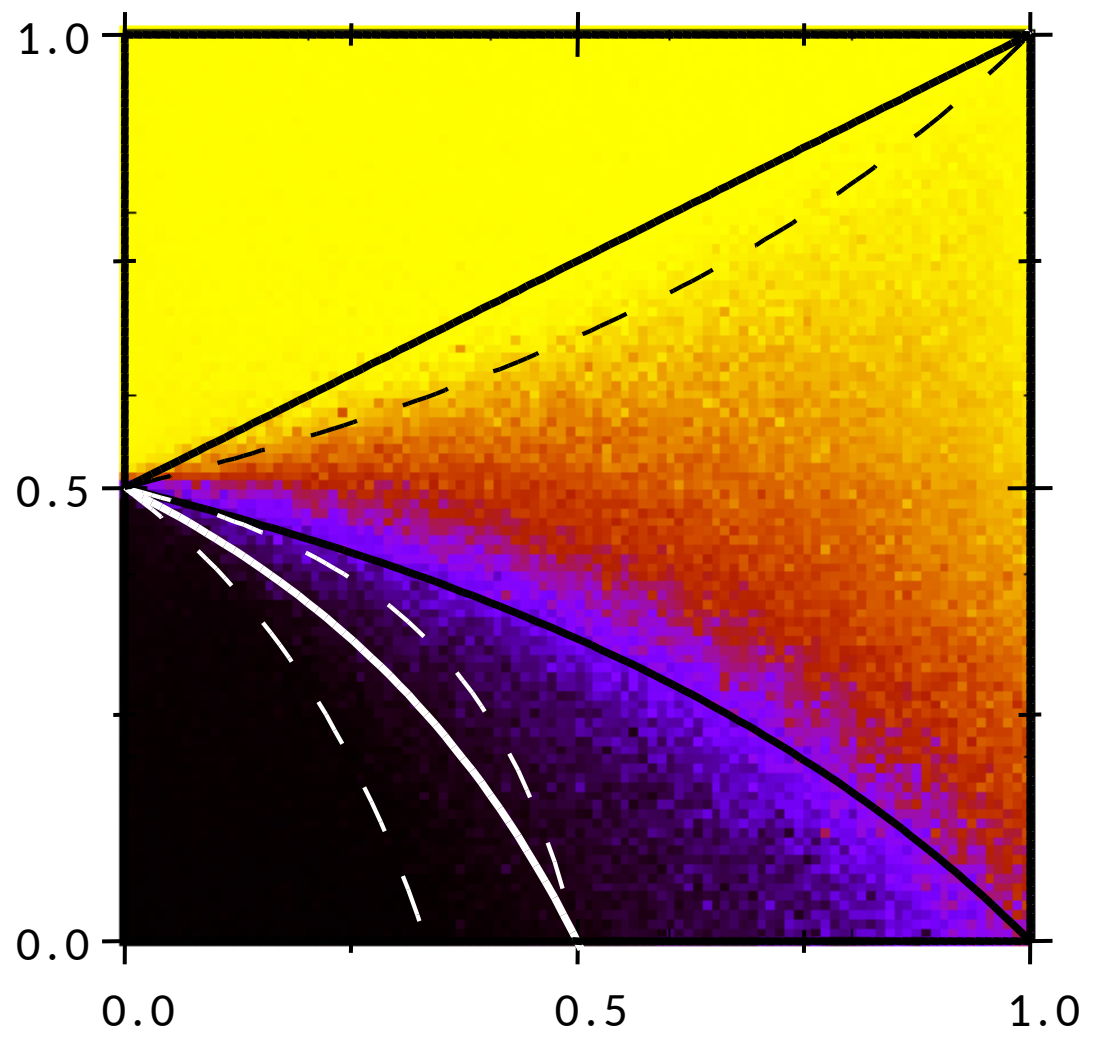


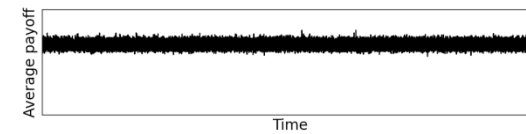
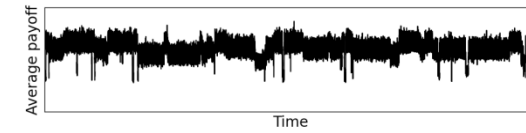
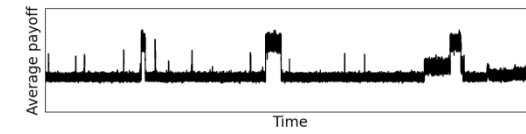
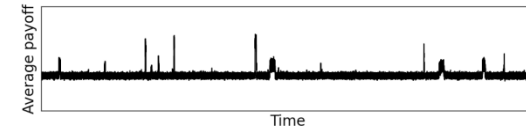
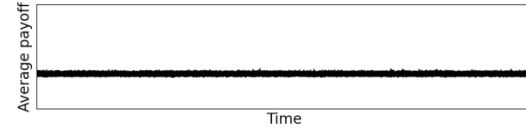
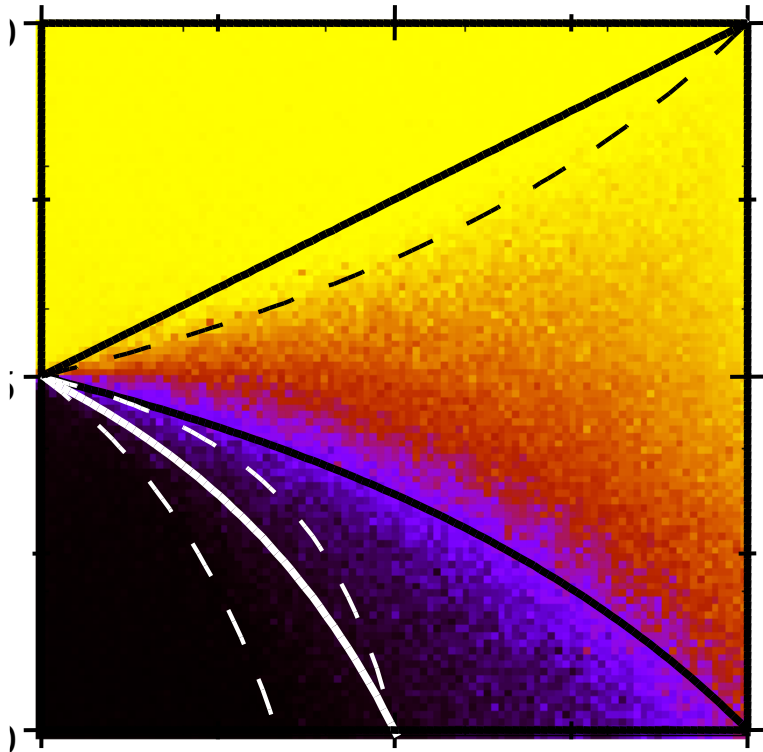
full cooperation



repetition + population structure

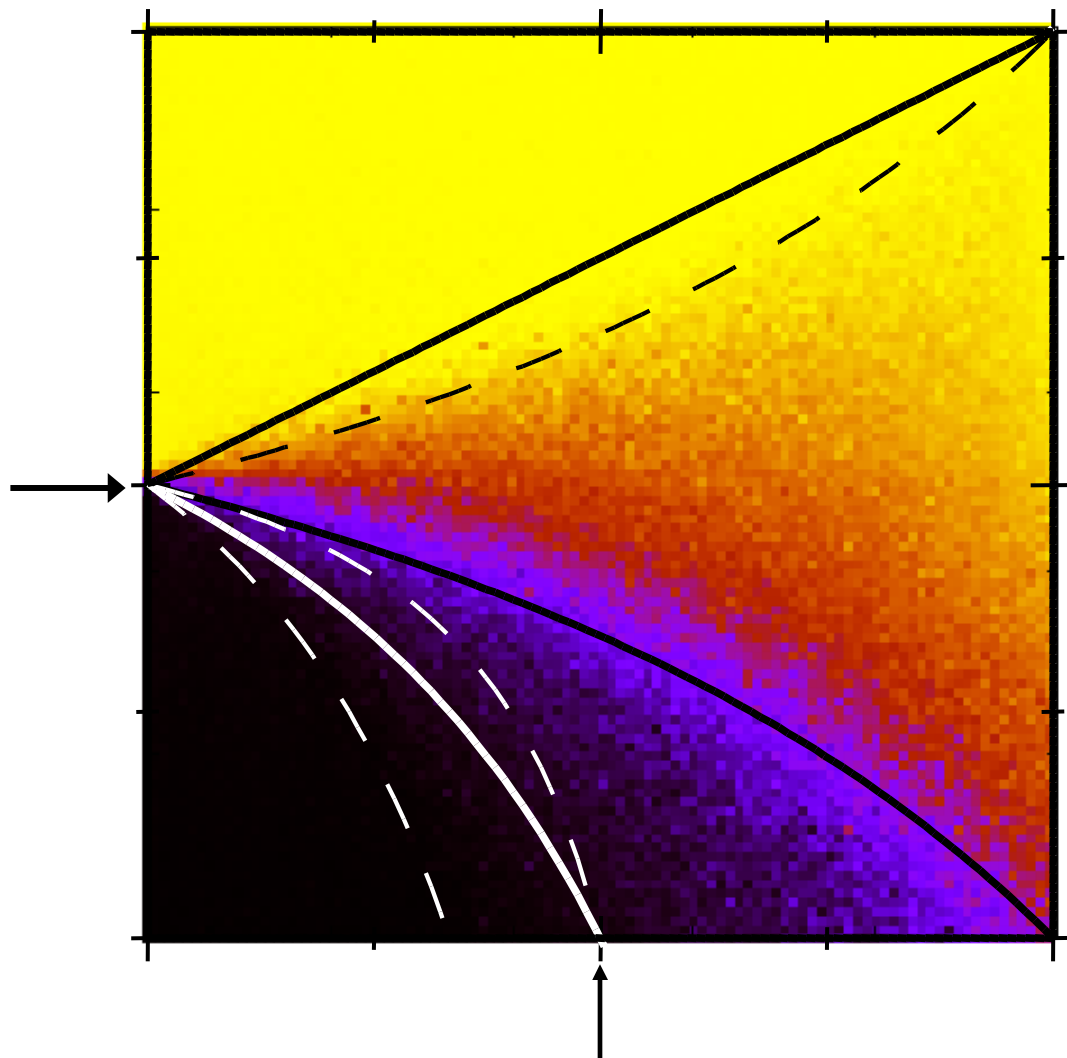






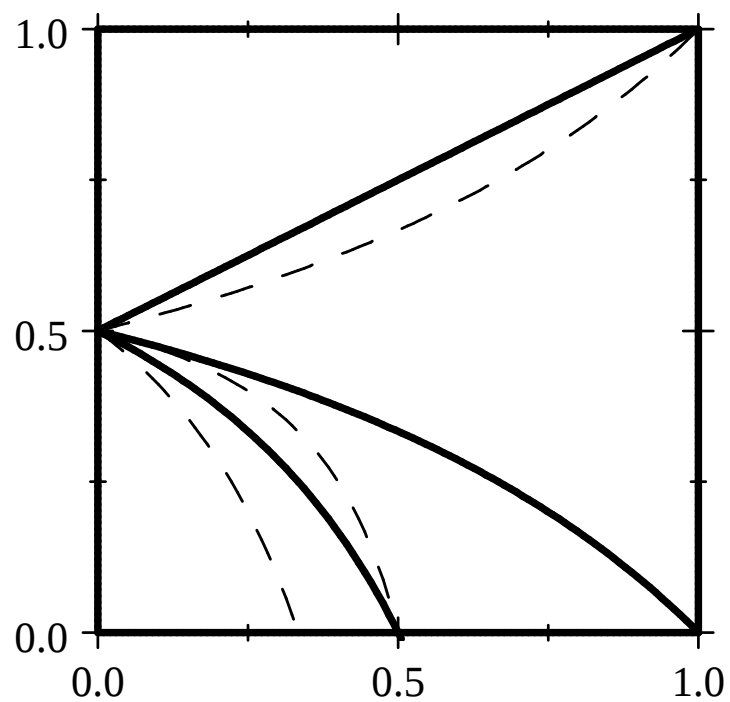
Van Veelen et al., PNAS, 2012

Hamilton's rule
(biology)

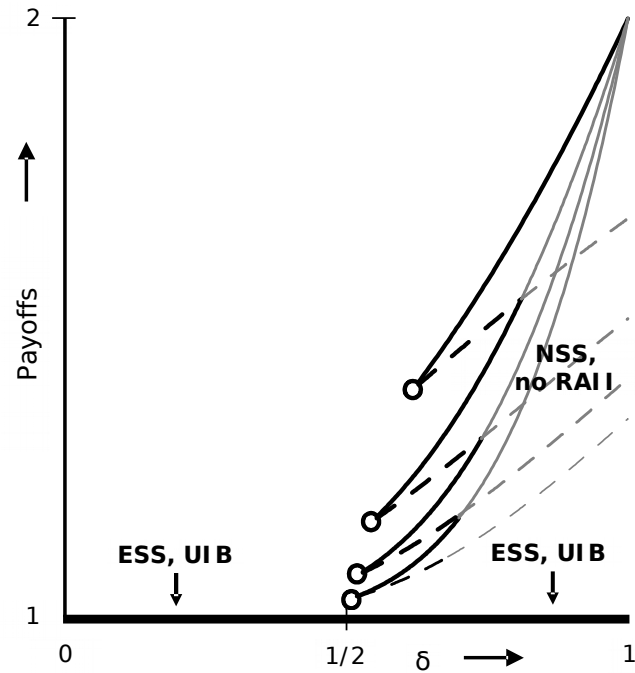


Folk theorem
(economics)

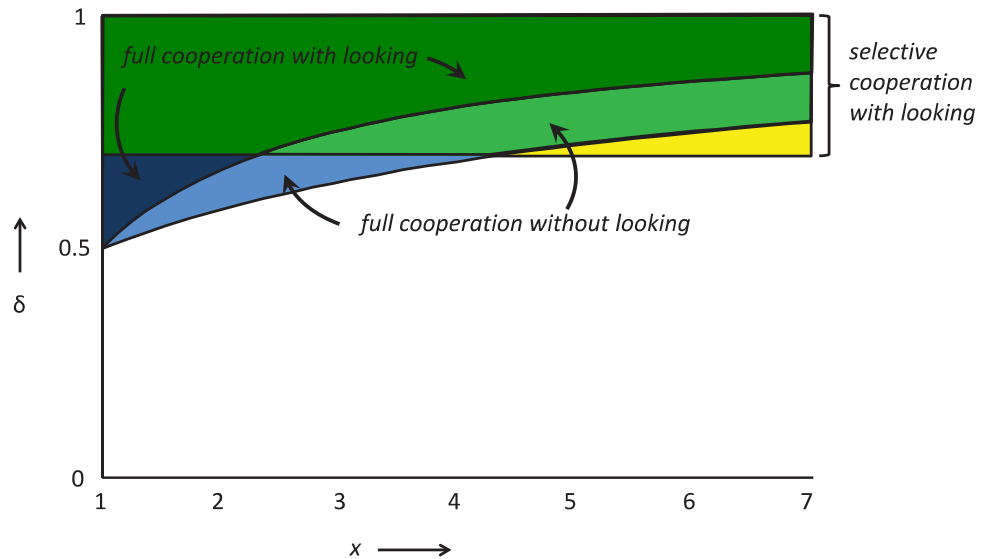
Repetition + population structure



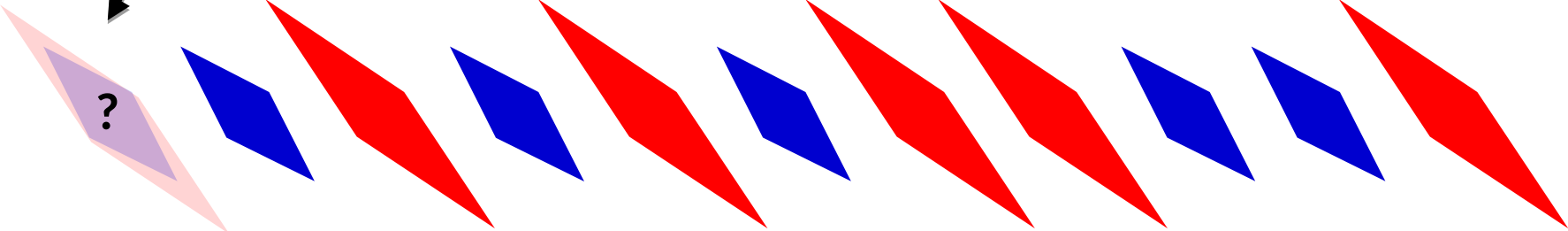
Repetition + complexity costs



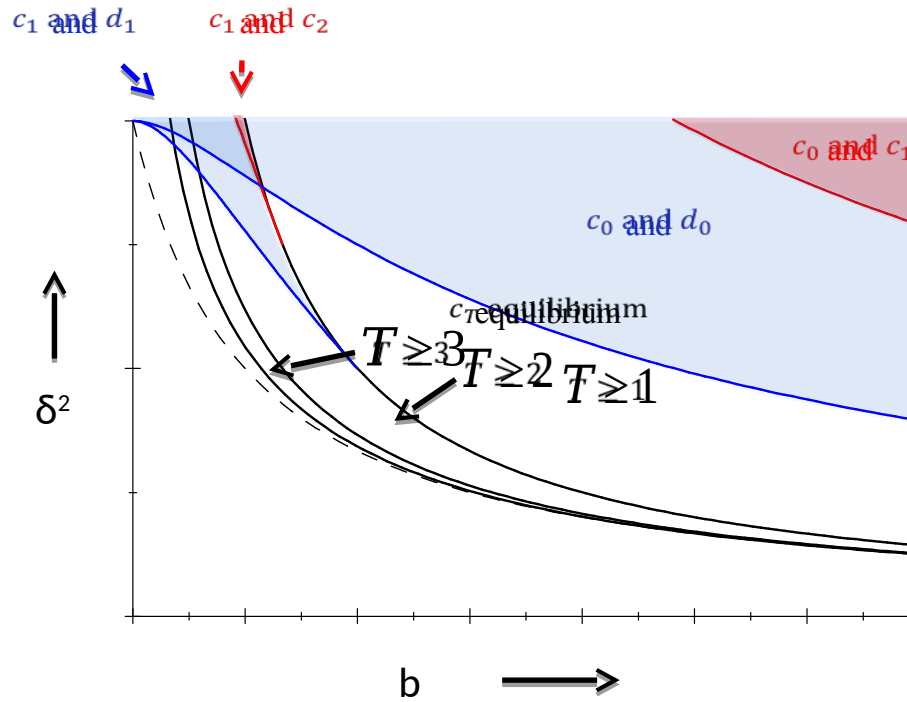
Repetition + endogenous information

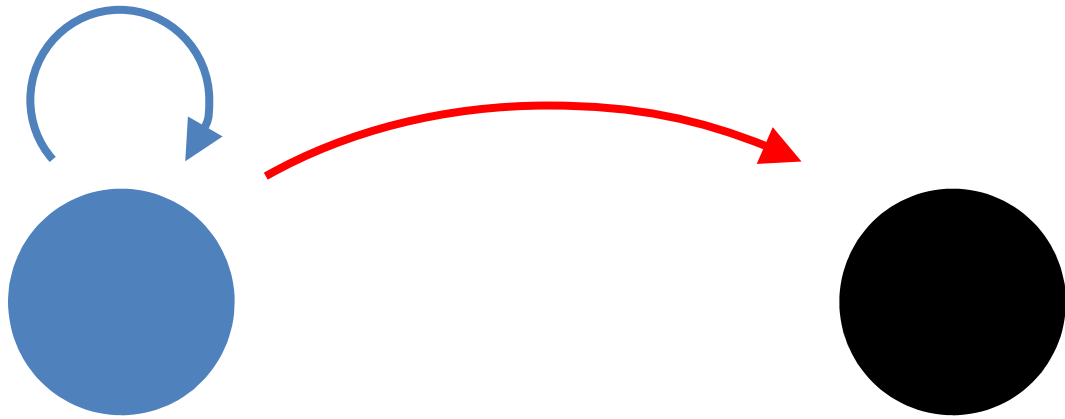


Future gains worth the costs



Repetition + partner choice

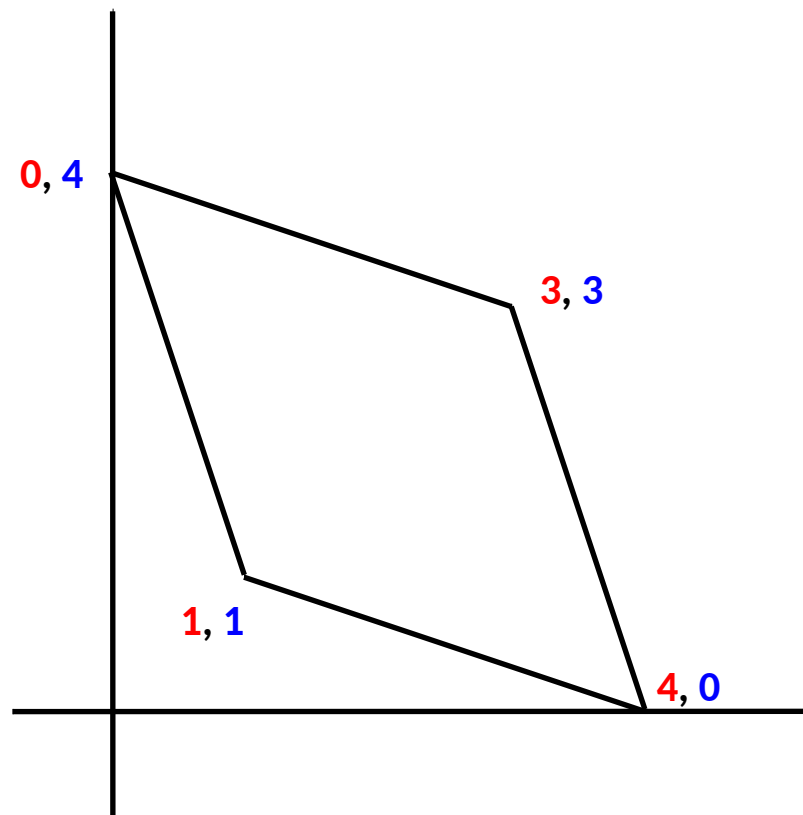




3. *Signalling / Partner choice*

Prisoners' dilemma

	Cooperate	Defect
Cooperate	3, 3	0, 4
Defect	4, 0	1, 1



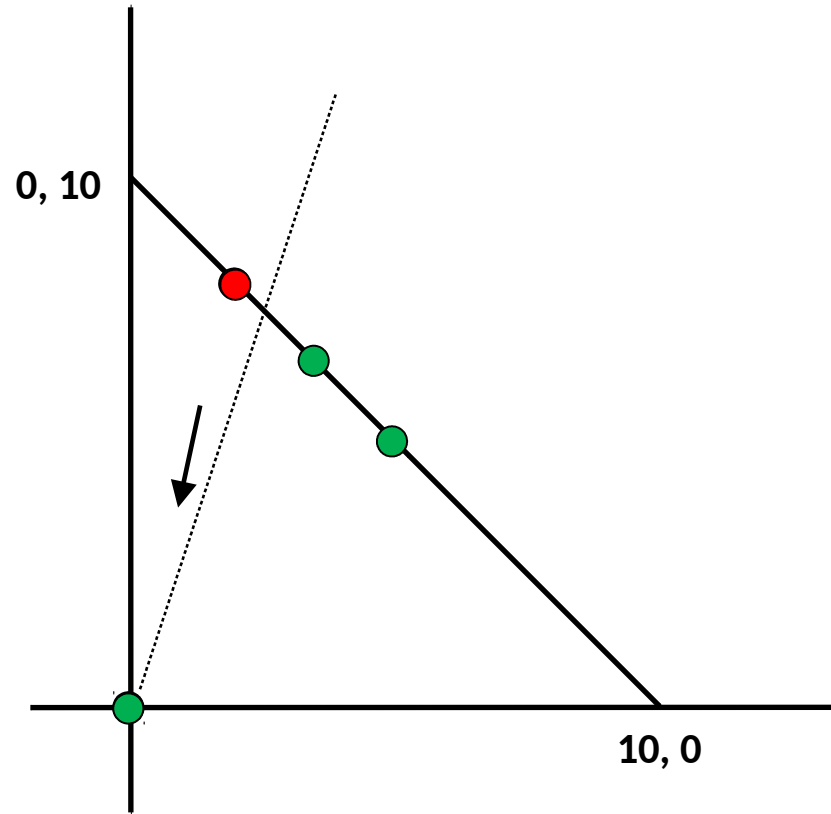
Ultimatum game

Player 1

propose division

Player 2

accept or reject





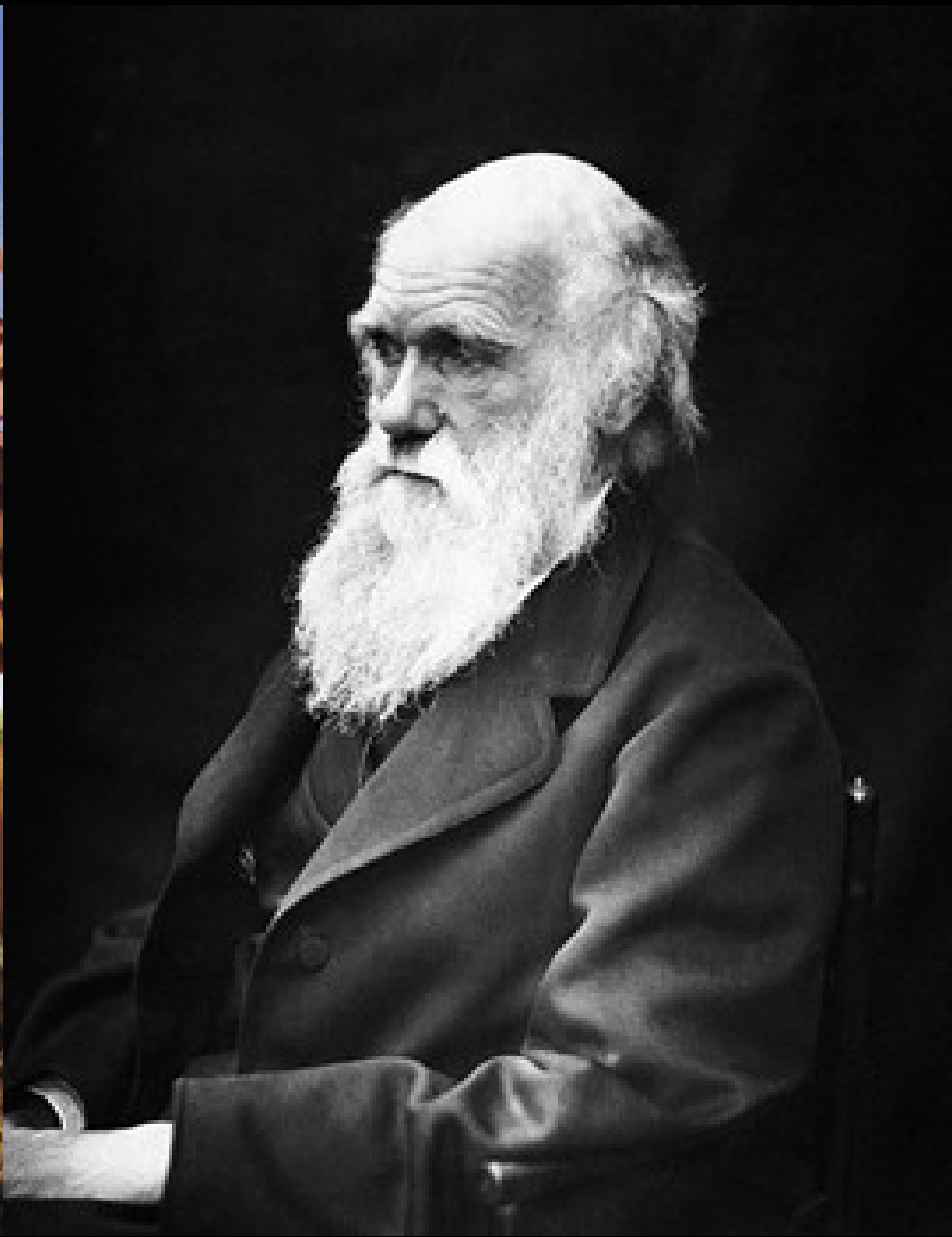
**PASSIONS
WITHIN
REASON**

*The Strategic Role
of the Emotions*

ROBERT H. FRANK



Anger management and commitment issues

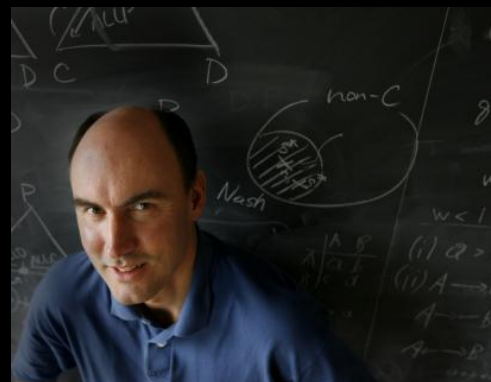




Ben Allen



Moshe Hoffman



Martin Nowak



Dave Rand



Carl Veller



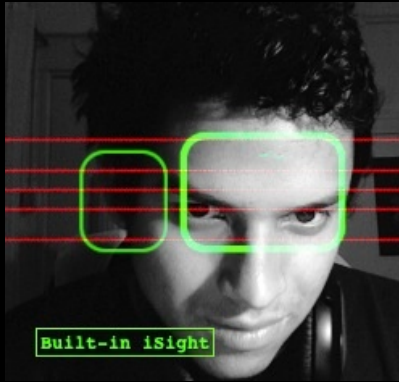
Burt Simon



Shishi Luo



Arne Traulsen



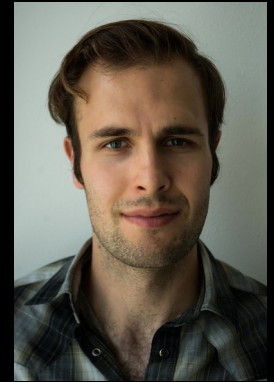
Julián García



Martijn Egas



Maus Sabelis



Stephan
Jagau



Boris van
Leeuwen



Charles
Noussair



Theo
Offerman



Sigrid
Suetens



Jeroen van de
Ven



Luis Izquierdo



Segis Izquierdo



Aslı Akdeniz

A photograph of a field of yellow flowers, possibly rapeseed, with a power line tower in the background. The scene is bathed in a warm, golden light, suggesting a sunset or sunrise. The text "LOVE PEACE UNDERSTANDING" is overlaid on the image in white, bold, sans-serif capital letters, slanted upwards from left to right.

LOVE PEACE UNDERSTANDING