WOW5

Cultural Group Selection and Sustainable Resource Management: Experiments

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Motivation

Core Design Principles

1. Clear boundaries
2. Fairness
3. Collective-choice
4. Monitoring
5. Graduated sanctions
6. Conflict resolution
7. Self determination
8. Nested governance

1. (**CPR**) Ostrom, E. (1990). Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge.
2. (**SES**) Anderies, J. M., Janssen, M. A., & Ostrom, E. (2003). Design Principles for Robustness of Institutions in Social-Ecological Systems. Joining the Northern Commons: Lessons for the World, Lessons from the World, 17–21.
3. (**Any organization**) Wilson, D. S., Ostrom, E., & Cox, M. E. (2013). Generalizing the core design principles for the efficacy of groups. Journal of Economic Behavior & Organization, 90, Supplement, S21–S32.

Sustainability Theory

Cultural Group Selection as Sustainability Theory

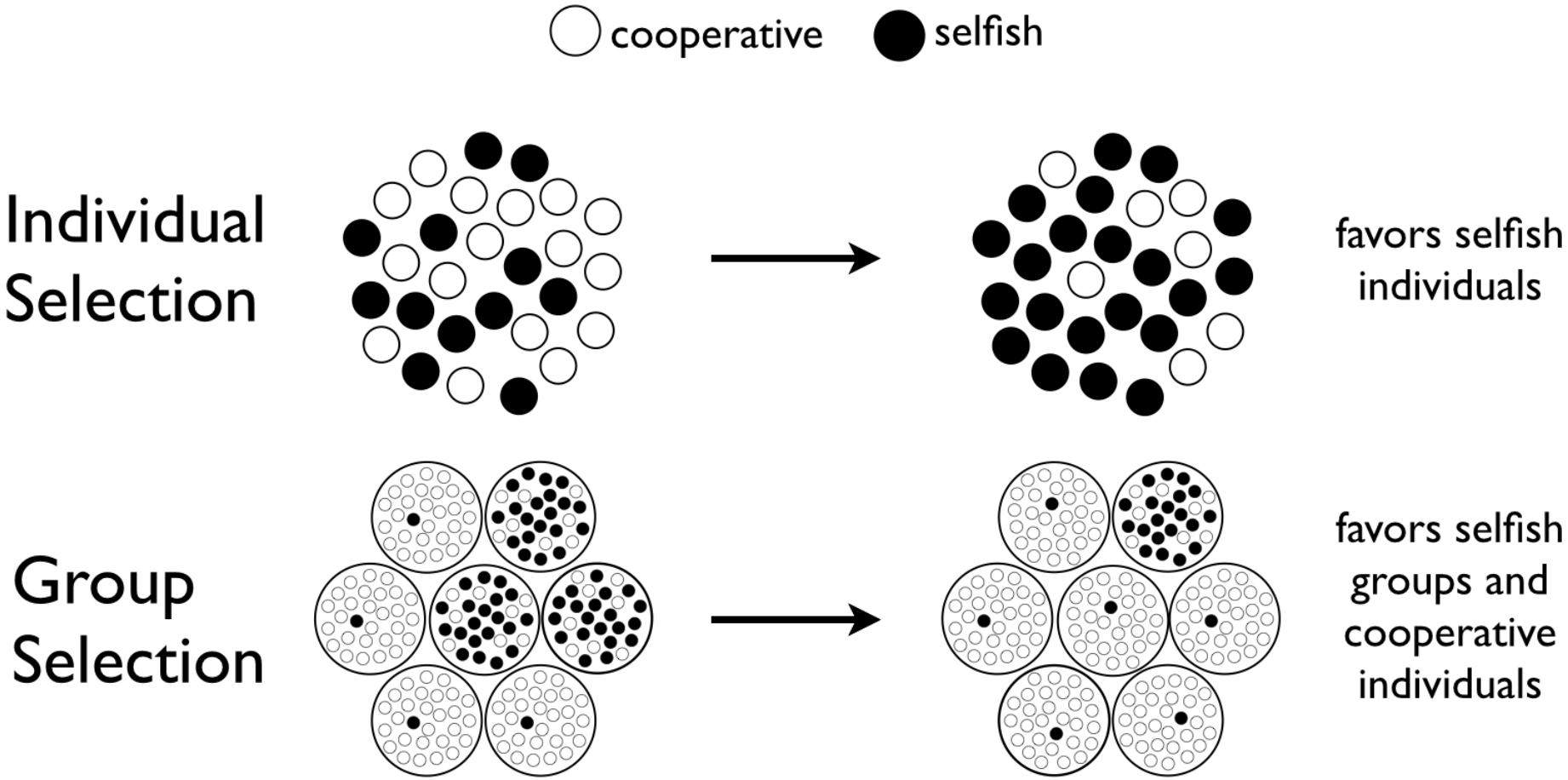
- emergence and persistence of SES states
  - evolutionary game theory
- social domination of SES change
  - cultural vs genetic & environ. change
- cooperation and cultural dynamics
  - cooperation & culture coevolve
- multiple levels of organization
  - Yes!…

Cultural Evolution

Boyd and Richerson, 1985, Culture and the Evolutionary Process, Chicago

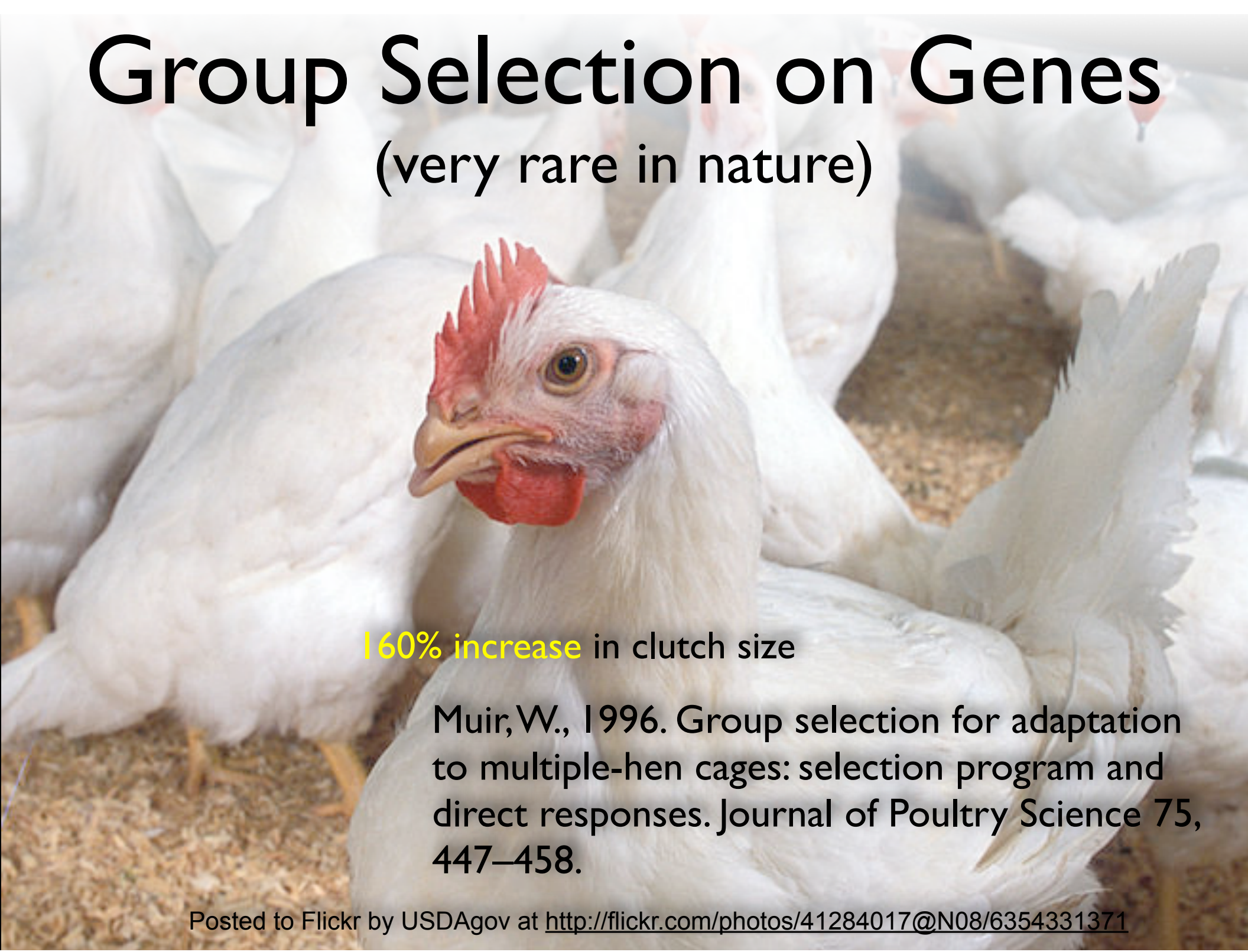
Cavalli-Sforza and Feldman, 1981, Cultural Transmission and Evolution. Princeton

Cultural Group Selection, explained.


cooperative
selfish
Individual Selection
favors selfish individuals
Group Selection
favors selfish groups and cooperative individuals

Group Selection on Genes

(very rare in nature)

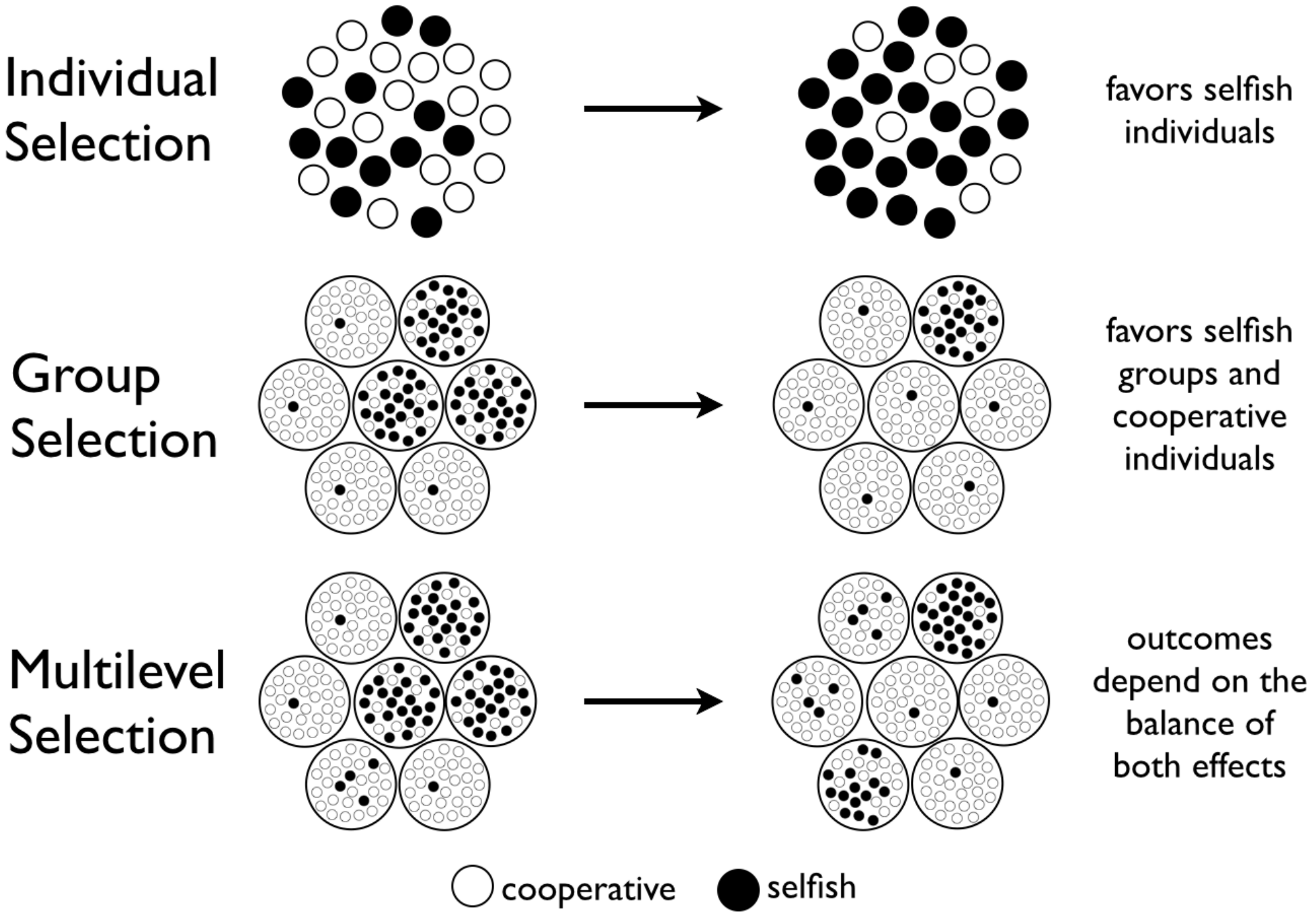


160% increase in clutch size

Muir, W., 1996. Group selection for adaptation to multiple-hen cages: selection program and direct responses. Journal of Poultry Science 75, 447–458.

Molly Hayden, U.S. Army Garrison Grafenwoehr Public Affairs
http://www.army.mil/article/69655/

Multilevel Selection of Sustainable Behavior



Price Equation

$$\overline{w}\Delta\overline{z} = Cov(w_i, z_i) + E(w_i \Delta z_i)$$

The Price equation is a general statement about the statistical requirements for evolution (Frank 1995). expressed as where w is fitness, and z is the trait under selection across individuals i.

$$\overline{w}\Delta\overline{z} = \underbrace{Var(z_g) \cdot \beta(w_g, z_g)}_{\text{group selection}} + \underbrace{E[Var(z_{ig}) \cdot \beta(w_{ig}, z_{ig})]}_{\text{individual selection}}$$

The multi-level extension of the price equation for individuals i and groups g (McElreath & Boyd 2007).

Cultural Group Selection, explained.

Henrich, J. (2004). Cultural group selection, coevolutionary processes and large-scale cooperation. *Journal of Economic Behavior and Organization*, 53(1), 3–35.

1. Differential proliferation & extinction of groups
2. Differential success of groups
3. Selective imitation of between groups
4. Differential migration of individuals between groups

Choi, Bowles, 2007. The coevolution of parochial altruism and war. *Science* 318, 636–640.

The Battle of Agincourt.
http://www.britishbattles.com/100-years-war/agincourt.htm

Group Selection on Genes

Human cooperation is group-centric

Apicella, Marlowe, Fowler & Christakis, (2012) Nature 481, 497–501.

Previous Experiments

Gürerk, Irlenbusch, & Rockenbach (2006) subjects "voted with their feet" and migrated to punishment institution.

Puurtinen and Mappes (2009) groups compete, winning group extracts earnings from losing group. Group competition enhanced cooperation.

Sääksvuori, Mappes, & Puurtinen (2011) punishment produces higher individual and group payoffs during competition, but punishing groups had more equal payoff distribution.

Tan and Bolle (2007) found that cooperation increased due to competition even without incentives to win


Previous Experiments

Implications

- Humans sport self-interested adaptations as well as group-functional adaptations.
  - THEREFORE, We come pre-loaded with adaptations for forming effective cooperative organizations.
- Group-competition accelerates cooperation.
  - THEREFORE, competition can enhance institutional evolution.
- Can these factors be made to drive more sustainable outcomes?

Research Question

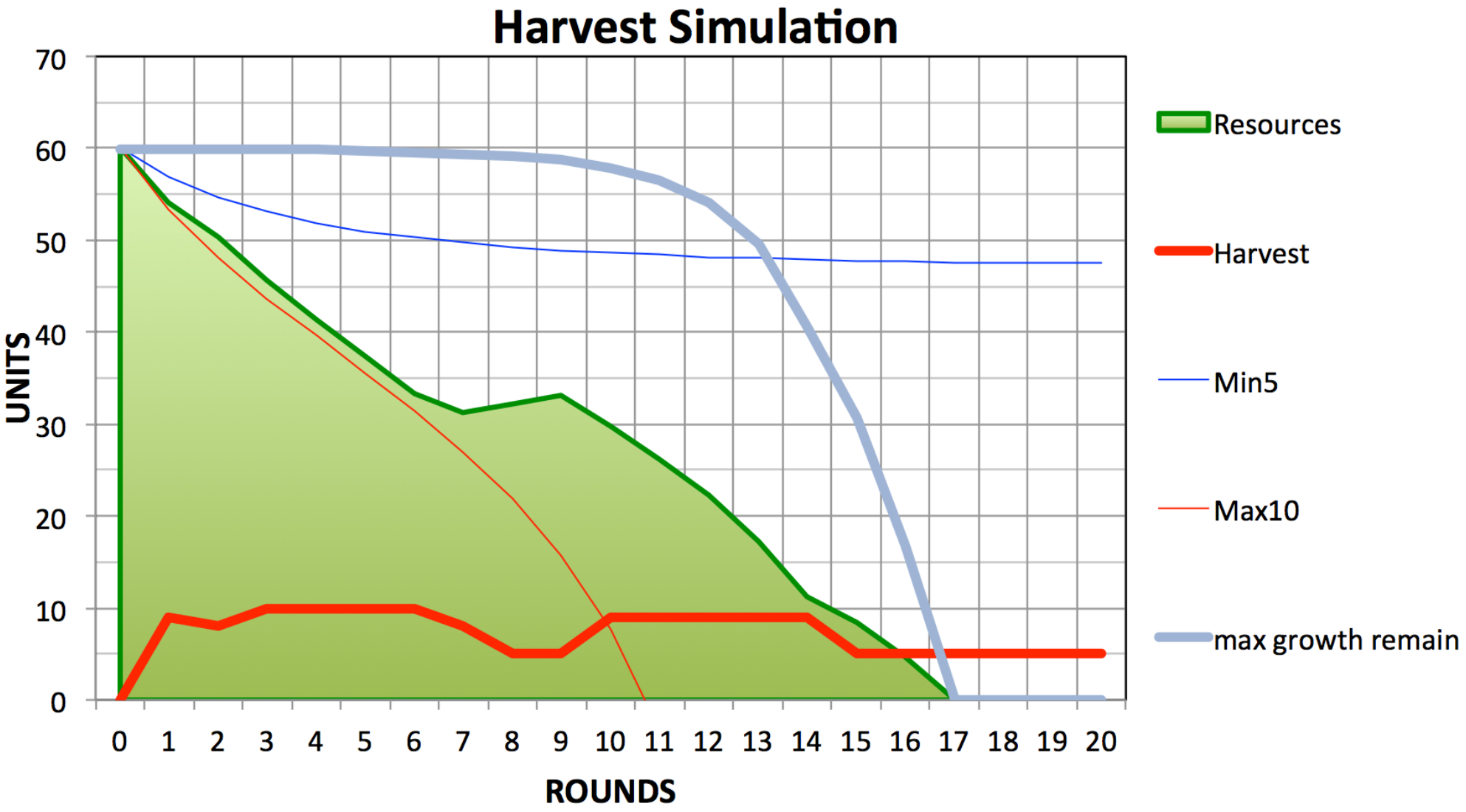
Can the awareness of a peer group cause individuals to alter their resource use?

	Inter-group interaction
Current	Observation
Future	Communication, Exchange

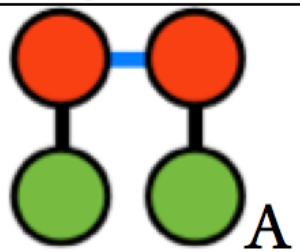
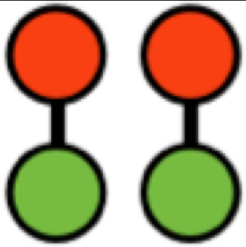
Experimental Design

- **Density dependent, deplete-able, common pool resources**. Participants harvest for survival and profit. Stocks and growth rates are calibrated so that per capita MSY and carrying capacity are constant across treatments.
- **Survival is salient**. Resource stocks and growth rates are also calibrated so that it is possible for players to extinguish the resource. There is no stochasticity or resource fluctuation.
- **Group membership is salient**. Players are randomly assigned to groups of four, allowed to communicate with group members and made aware of the existence, actions and outcomes of a peer group.
- **Two groups play simultaneously**. Experiments contain two sessions. Participants are randomly re-assigned for the second session. This design allows for within-individual measures of treatment effects.

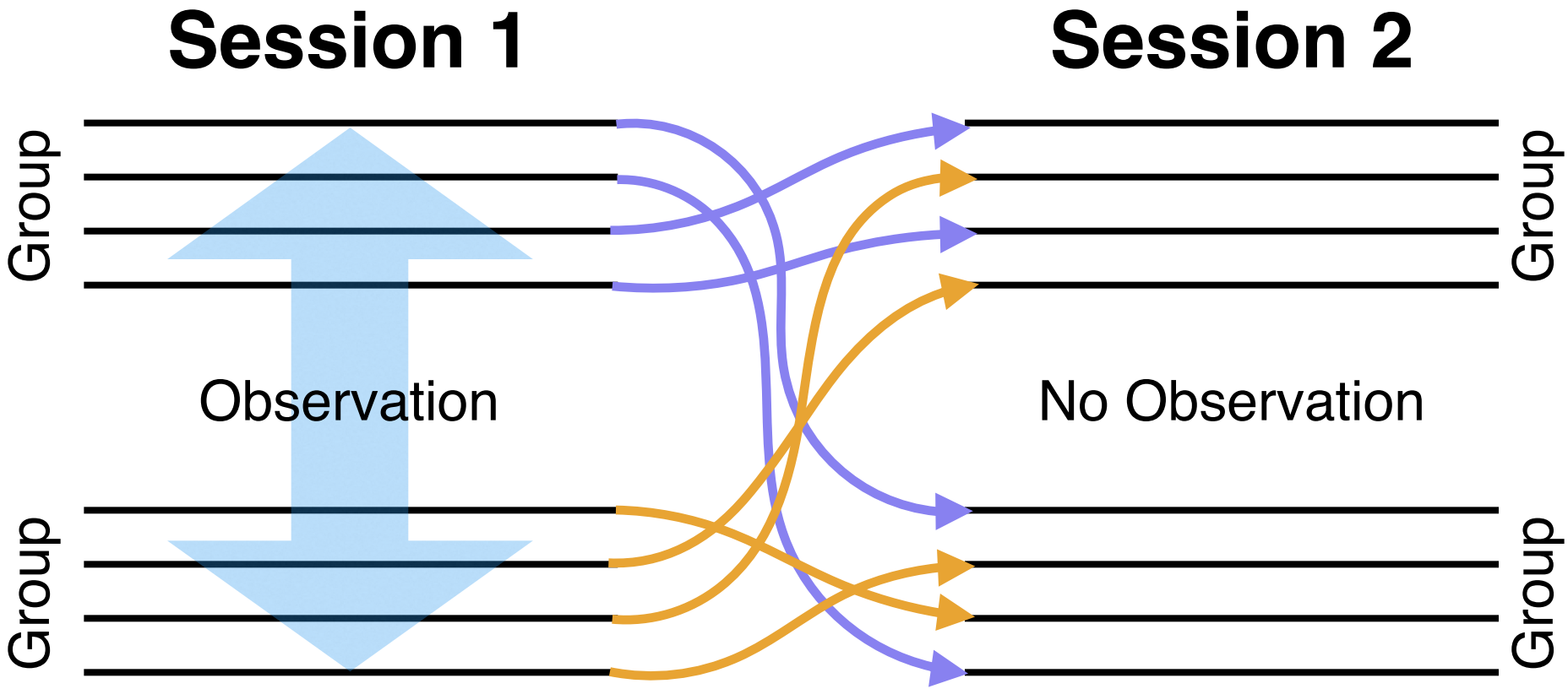
Experimental Design



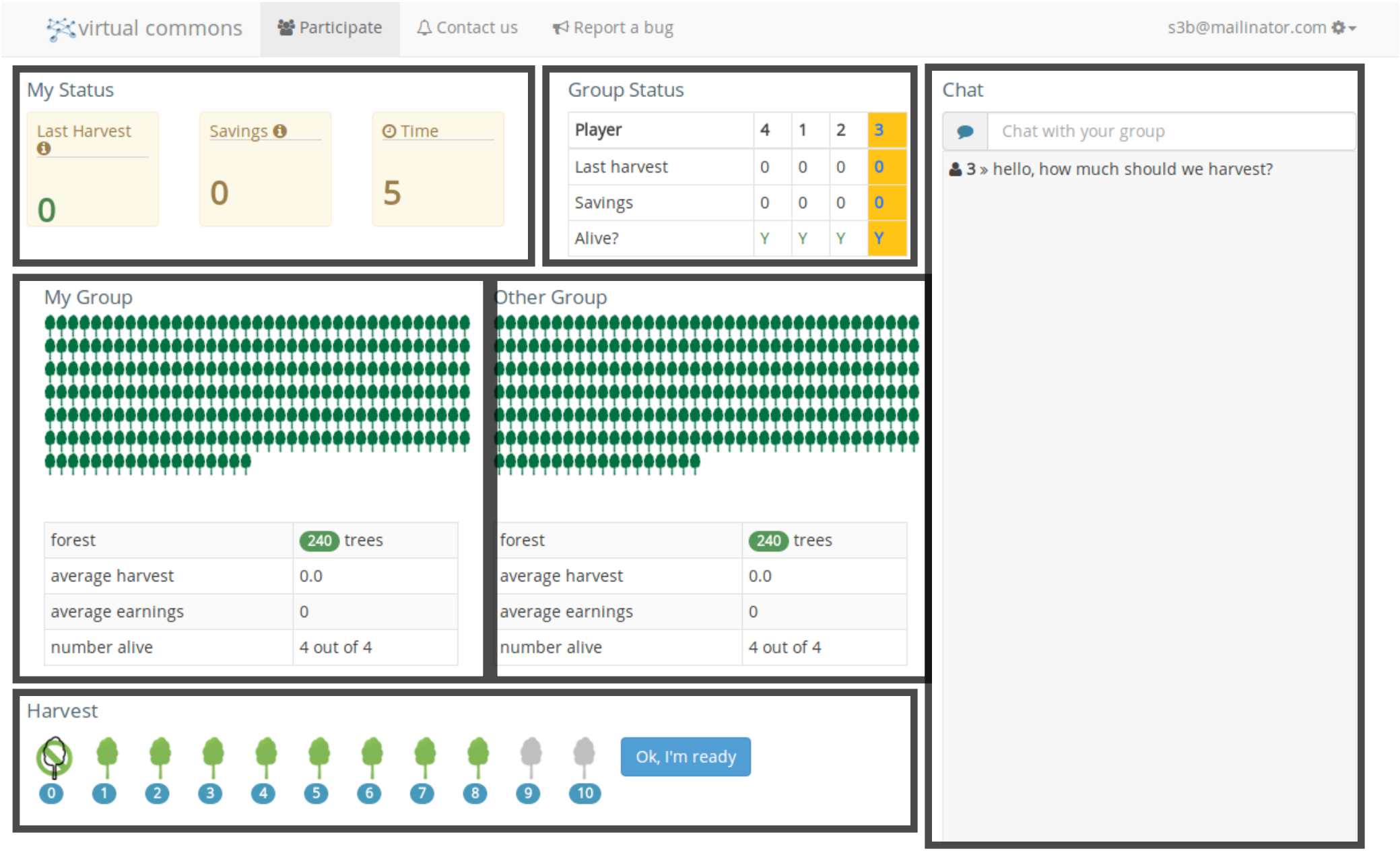
Experimental Design

	Sovereign resources	Shared resources
Peer group observation	 A	 C
No peer group observation	 B	 D

Experimental Design



Experimental Design



No Results Yet!

Open Questions

- How can group structure be optimized to encourage cooperative resource management?
- When do strong group competition and human group-focused adaptations lead to resource destruction?
- How can between-group interactions be organized to facilitate group cohesion and resource conservation while avoiding parochialism and resource-extractive competition?

Open Questions

- What is the operative level of selection?
- How would a change in the level of selection lead to more or less prosocial behavior?

Experimental Frontiers

- Groups within groups - when does the level of selection change?
- Emergent group structure
- Altering the ‘level of selection’

Thank You!

Thoughts?