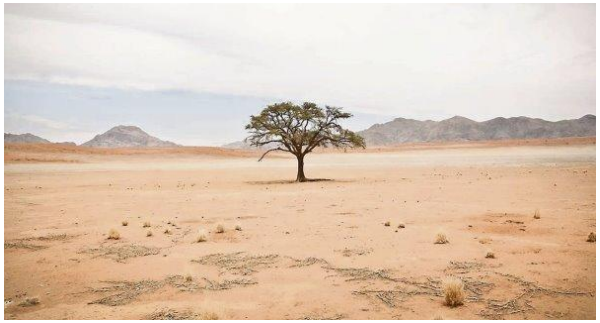
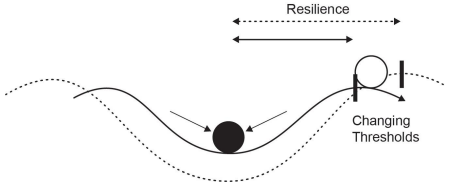
Survival and resilience varying the correlation of shocks





Campenni', M[1], Cronk, L[2], and, Aktipis, CA[1]

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2 Department of Anthropology, Rutgers University

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The Human
Generosity Project

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The Human Generosity Project

Outline

- Introduction: Maasai and resource transfers
- Methods (the model)
- Research questions: correlation of shocks, survival and resilience
- Results
- Conclusions and future works

Risk management

- Risk management as an adaptive problem for human beings
- Resource transfers to manage risks

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Resource transfers

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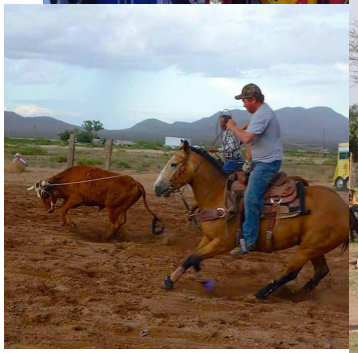
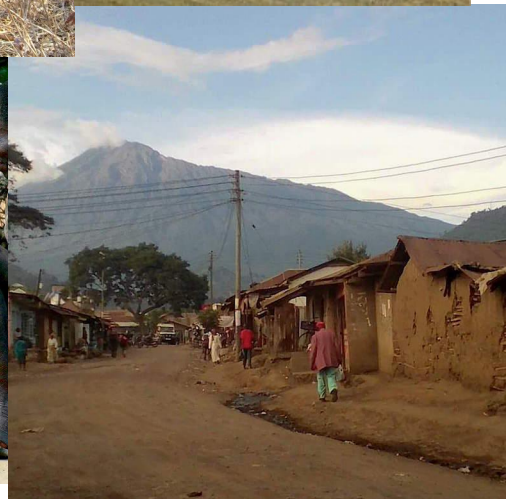
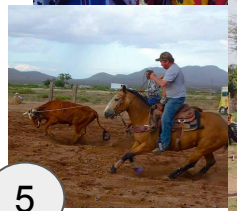
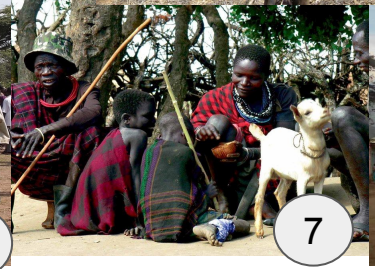


Generosity across societies

The Human Generosity Project seeks to understand the nature of generosity by looking across societies at norms and cultural practices underlying sharing. This work began through studying the osotua norm of the Maasai of Kenya and has since expanded to encompass many other societies.





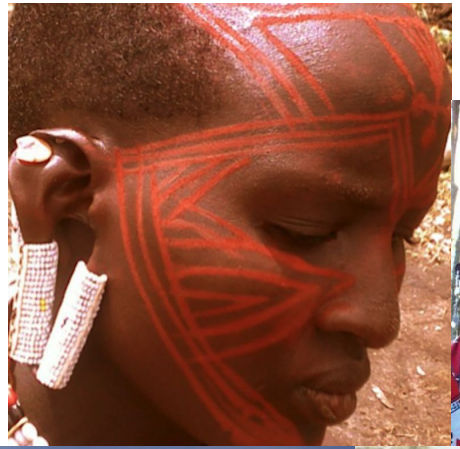
The Human Generosity Project

The Human Generosity Project is the first large-scale **transdisciplinary** research project to investigate the interrelationship between **biological and cultural influences on human generosity**. We use multiple methodologies to understand the nature and evolution of human generosity including i) **fieldwork**, ii) **laboratory experiments** and iii) **computational modeling**.

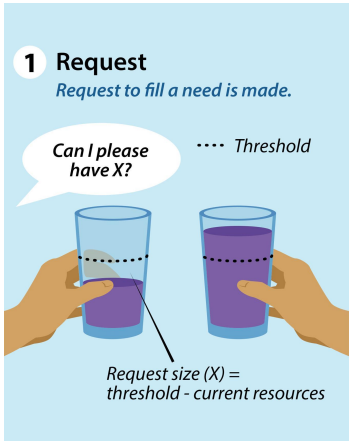
http://www.humangenerosity.org/

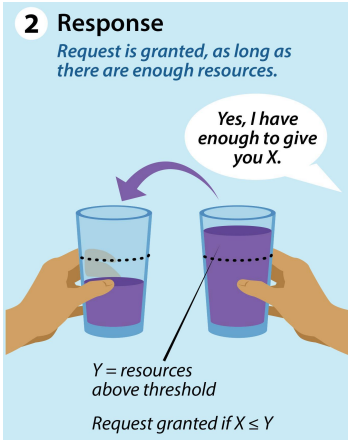
Maasai

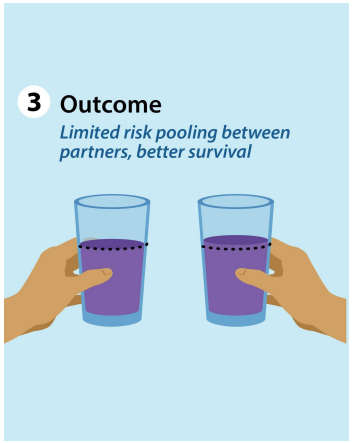
- Pastoral society
- Resource transfer and sharing
- *“osotua”* and *”sile”*
- Transferring cattle



Need-Based Transfers (NBT)







Need-Based Transfers Algorithm

- Ask when in need
- Give if able

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Account-Keeping (AK)

Account-Keeping Algorithm

- Ask when in need
- Give if no debt

Accounting system with memory for
- Size of debt/credit
- Time incurred

Specified parameters for:
- Maximum tolerated delay
- Probability of repayment (given sufficient resources)

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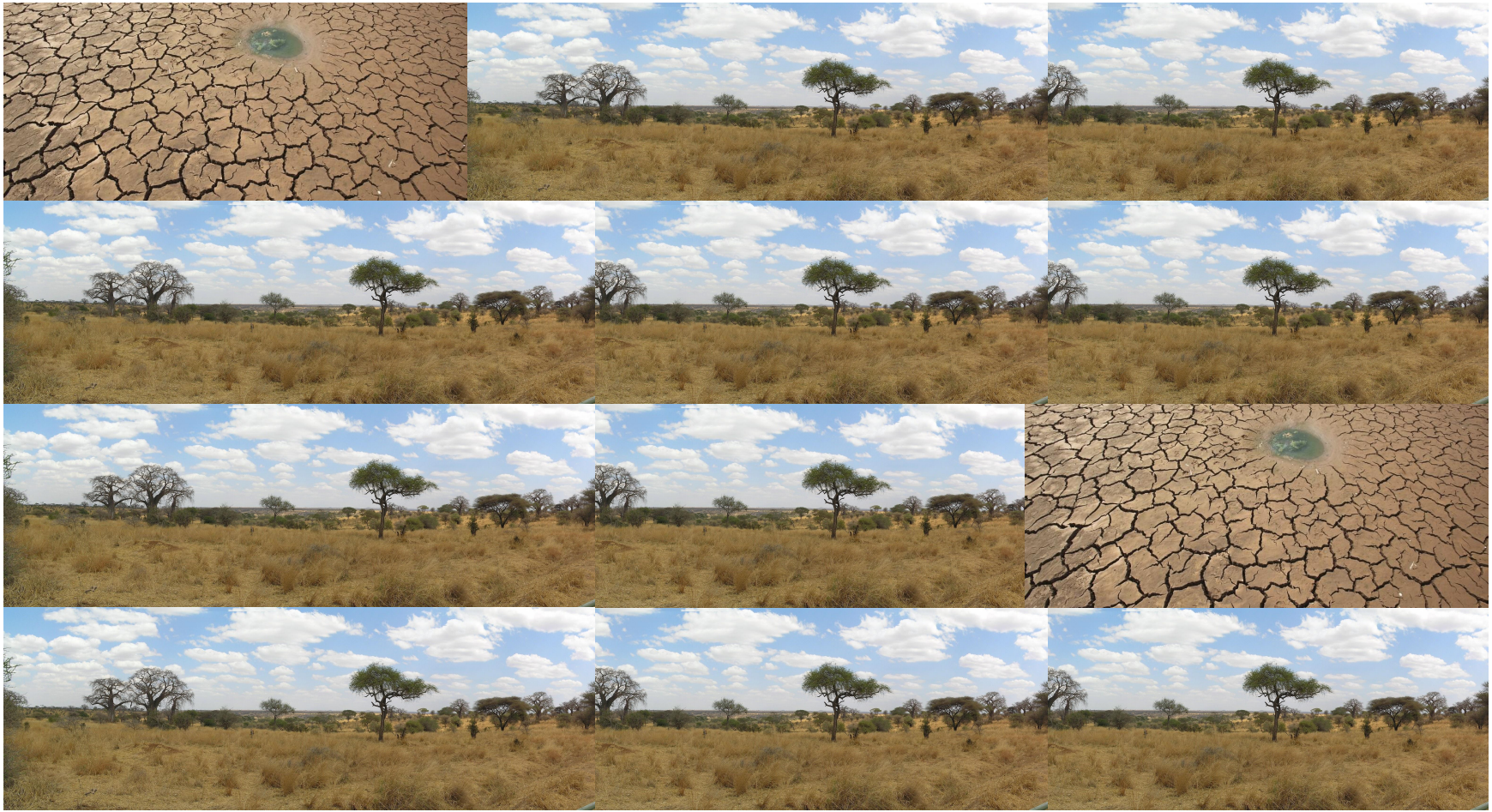
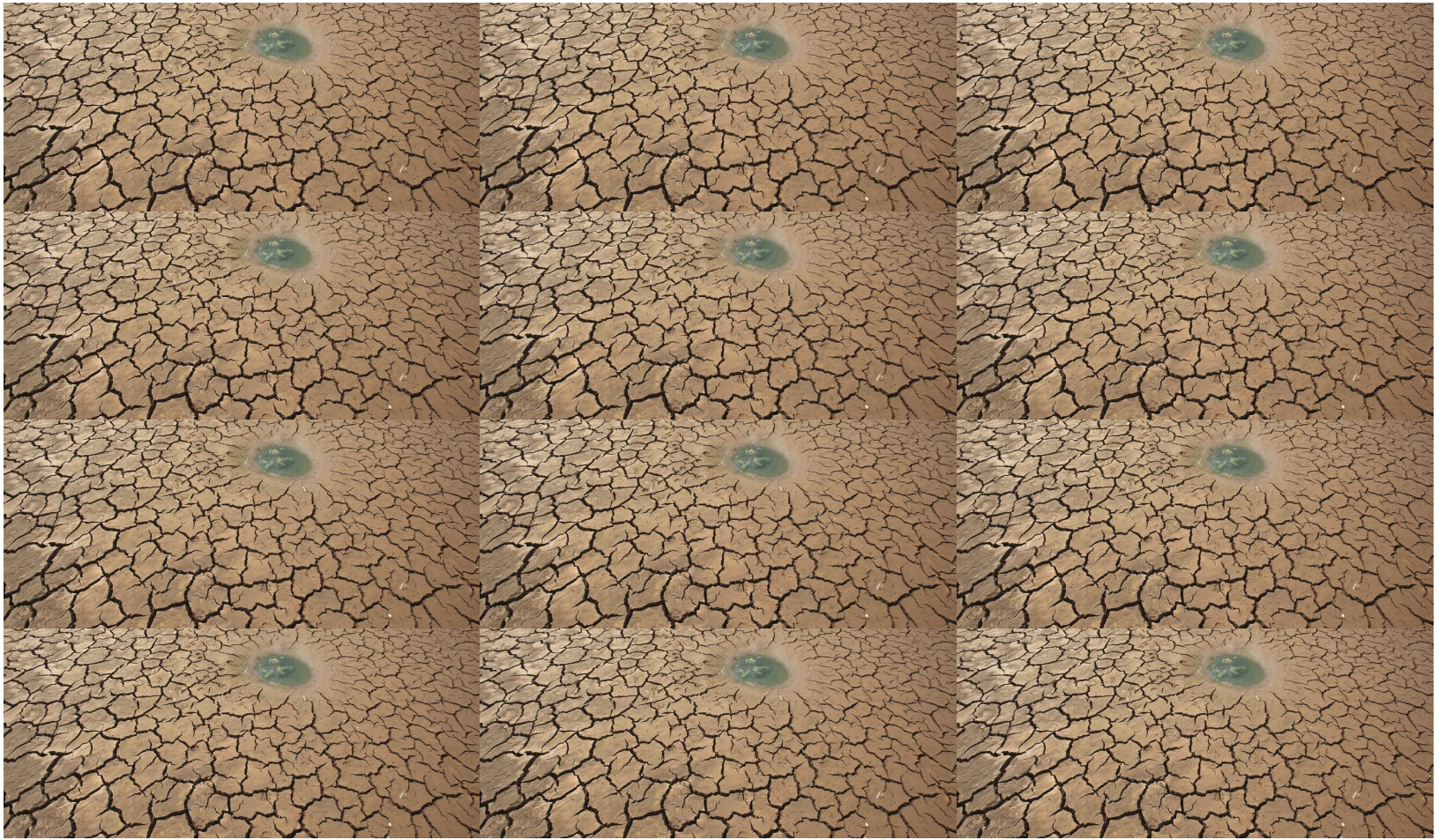
Correlation of shocks





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The Model

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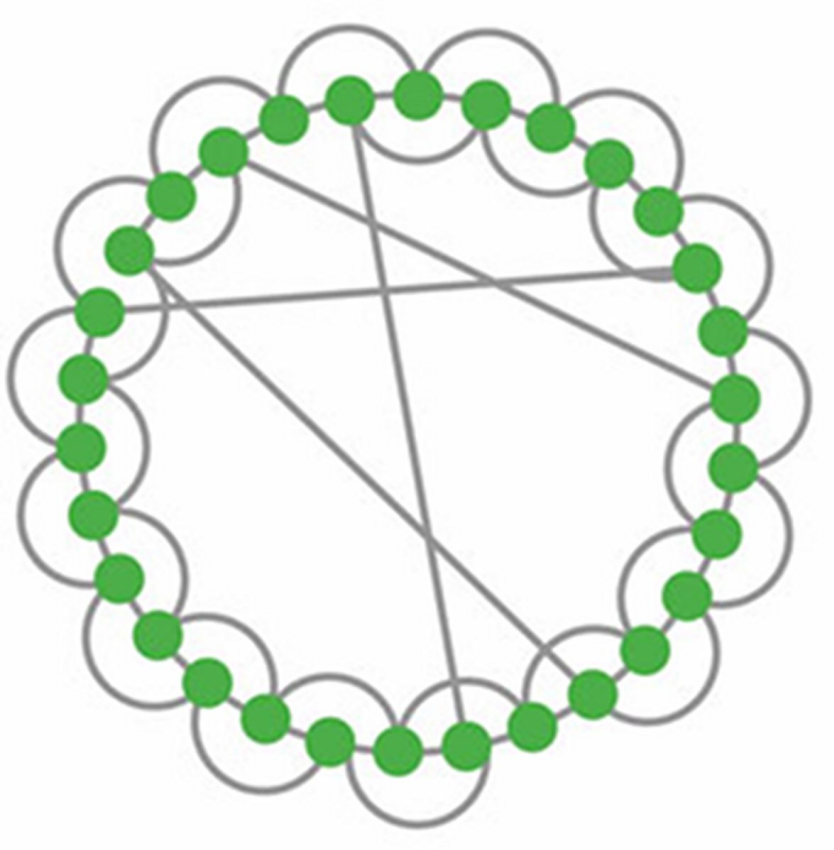
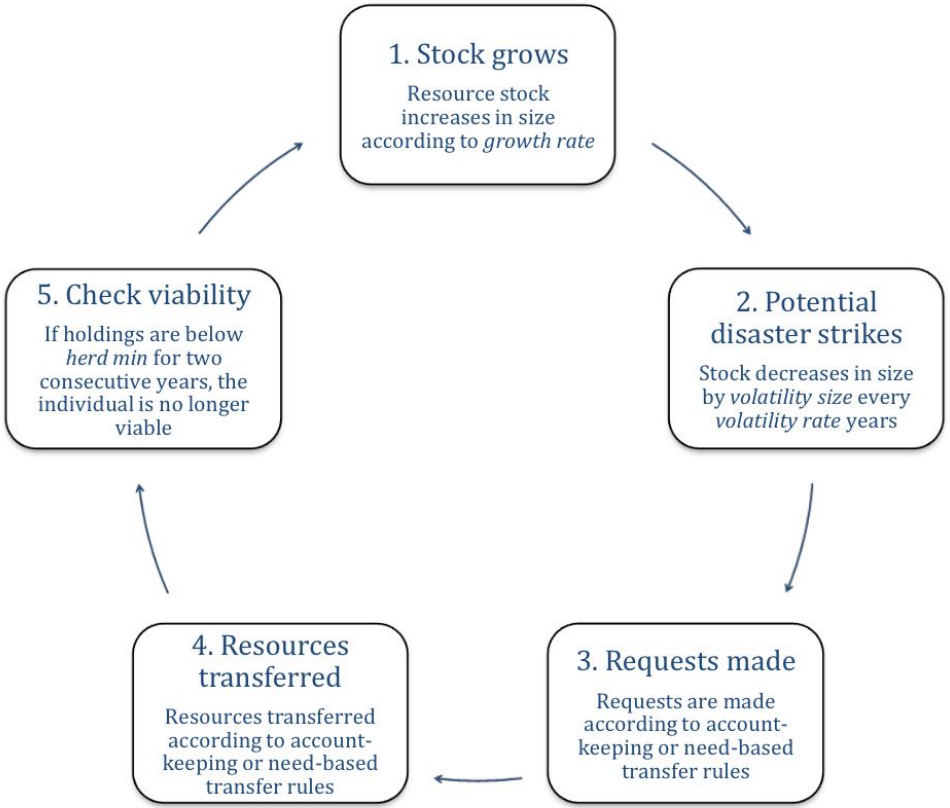


The Model

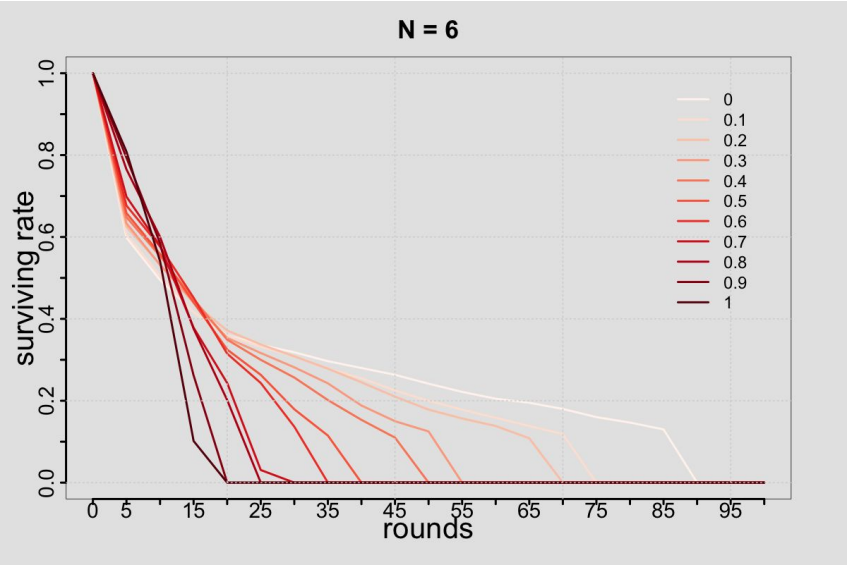

1. Stock grows
Resource stock increases in size according to *growth rate*
2. Potential disaster strikes
Stock decreases in size by *volatility size* every *volatility rate* years
3. Requests made
Requests are made according to account-keeping or need-based transfer rules
4. Resources transferred
Resources transferred according to account-keeping or need-based transfer rules
5. Check viability
If holdings are below *herd min* for two consecutive years, the individual is no longer viable

Research Questions

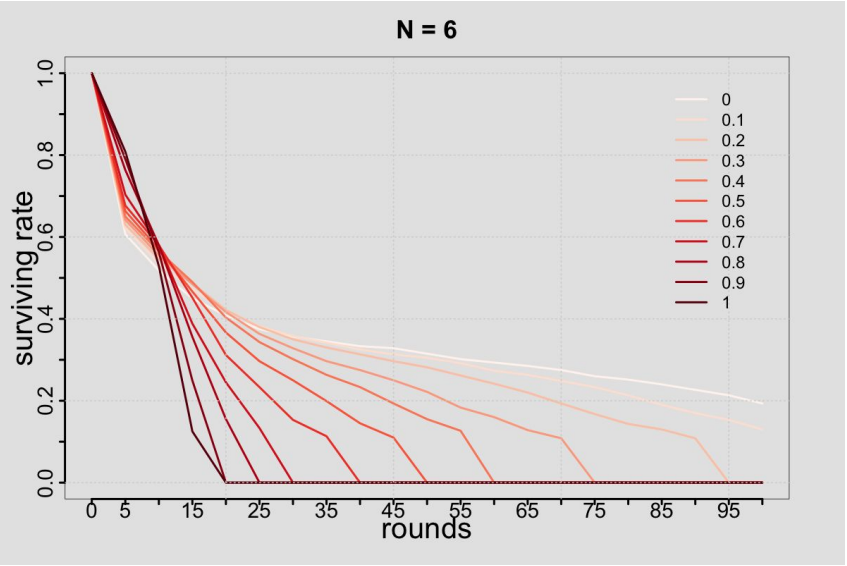
- Is survival lower when shocks are correlated rather than uncorrelated?
- Do need-based transfers lead to greater resilience to correlated shocks than account-keeping?
- Does group size affect resilience to correlated shocks?
- Does network structure affect resilience to correlated shocks?

Results 1

AK



NBT



Research Questions

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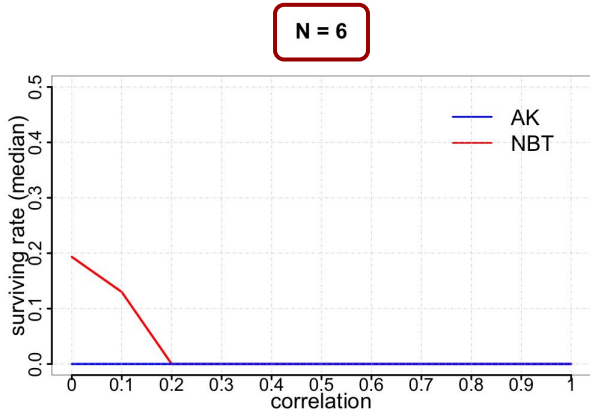
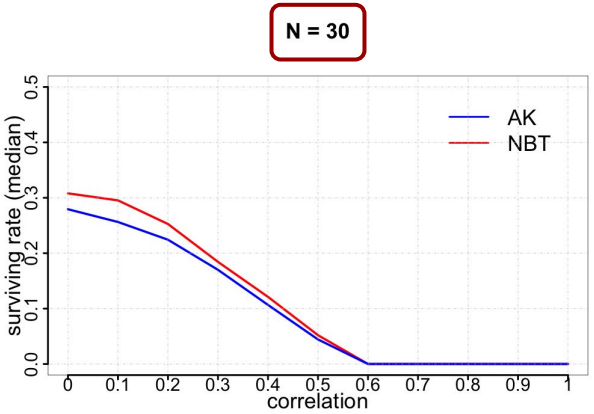
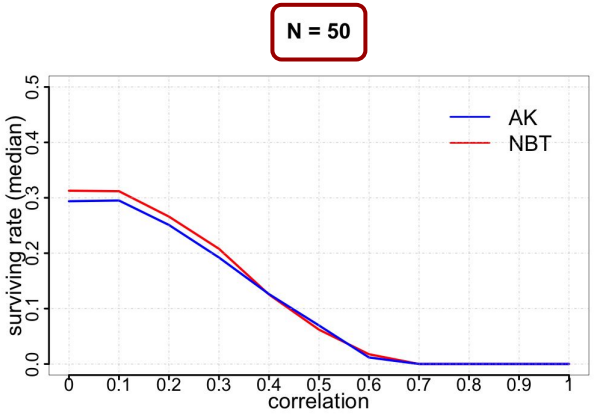
Results 2


N = 6
surviving rate (median)
0.0
0.1
0.2
0.3
0.4
0.5
AK
NBT
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
correlation


N = 30
surviving rate (median)
0.0
0.1
0.2
0.3
0.4
0.5
AK
NBT
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
correlation


N = 50
surviving rate (median)
0.0
0.1
0.2
0.3
0.4
0.5
AK
NBT
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
correlation

Research Questions

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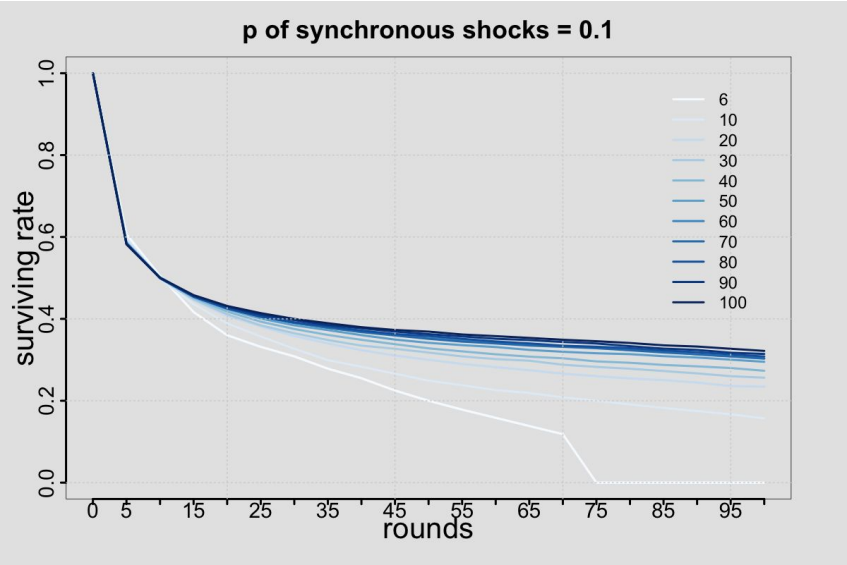
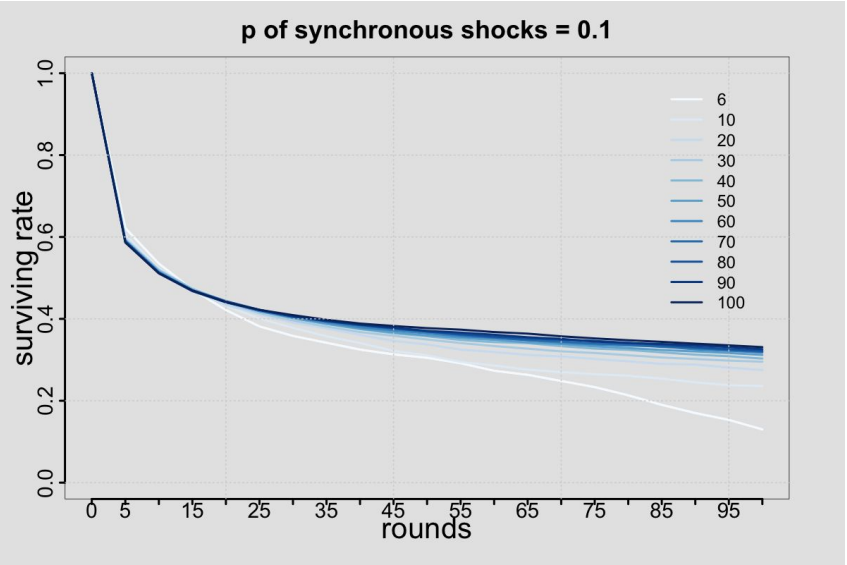
Results 3

AK



NBT



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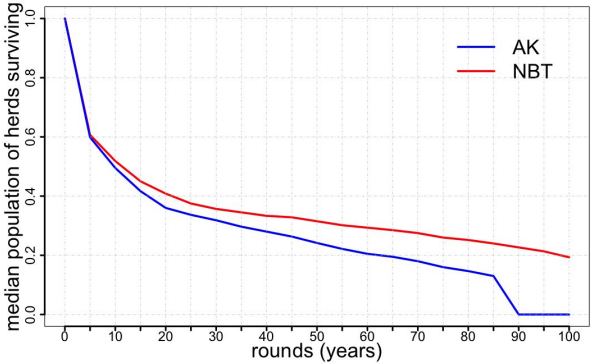
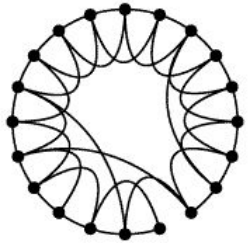
Results 4

N = 6

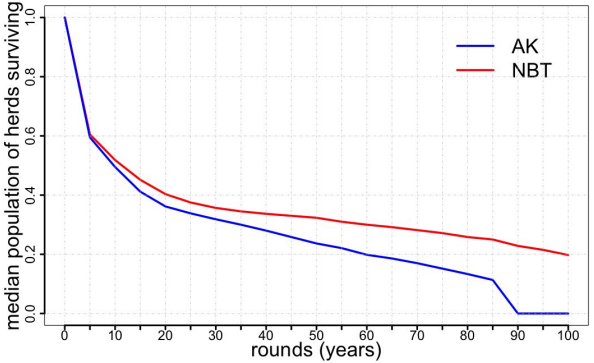


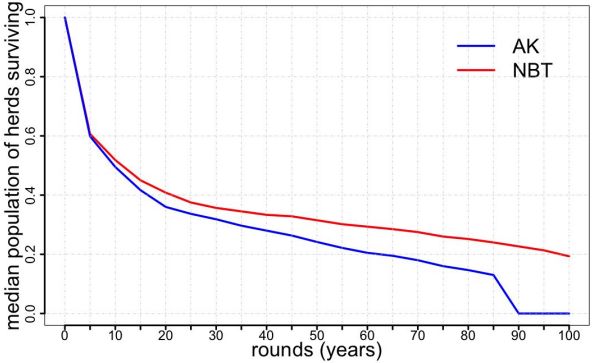
Small-world



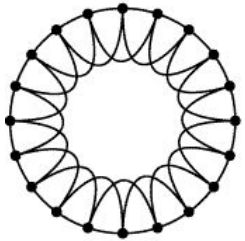
Results 4

N = 6

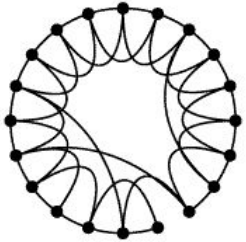




Regular



Small-world



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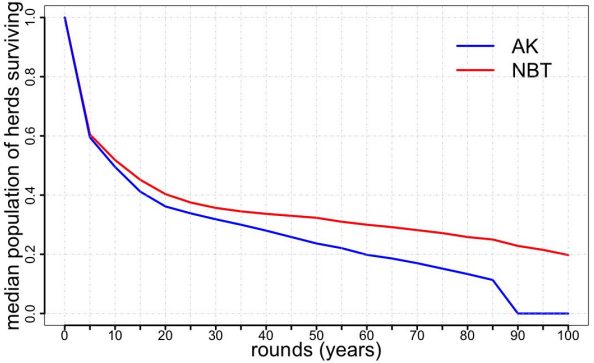

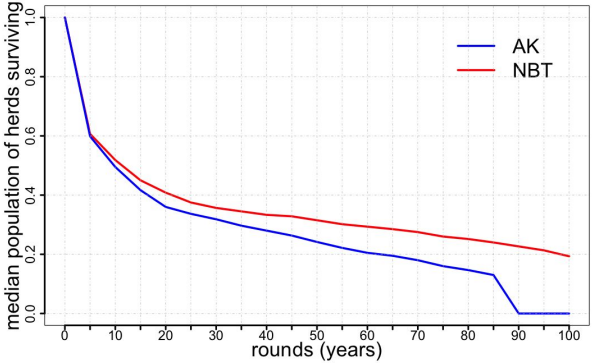

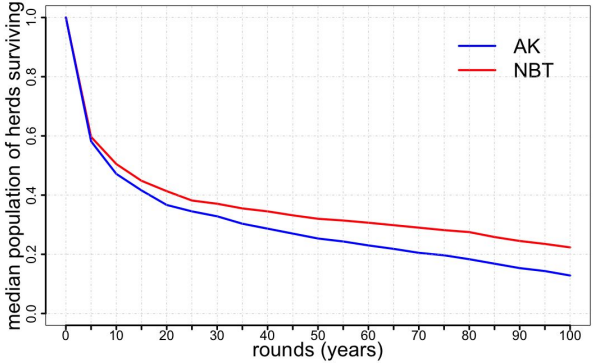

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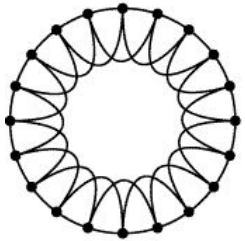
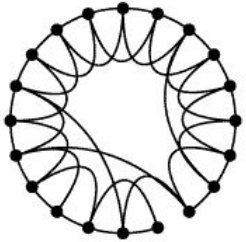


Small-world



Preferential-attachment

Conclusions

- Is survival lower when shocks are correlated rather than uncorrelated?
  - Yes! The higher is the correlation of shocks, the lower is the survival of the system
- Do need-based transfers lead to greater resilience to correlated shocks than account-keeping?
  - Yes! Systems adopting NBT strategy show greater resilience to correlated shocks
- Does group size affect resilience to correlated shocks?
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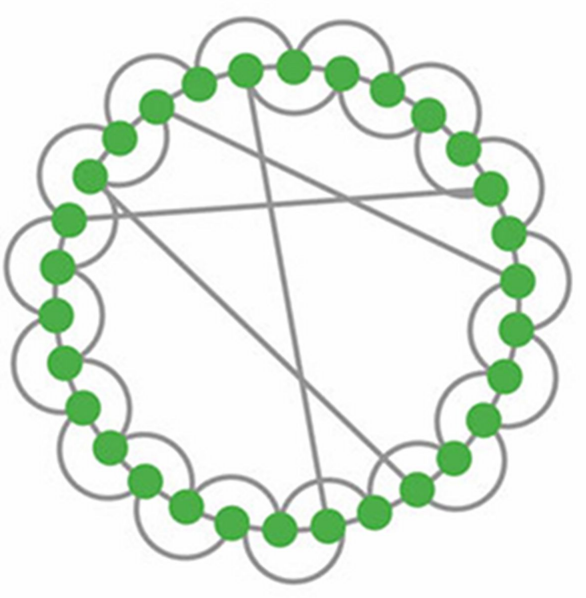
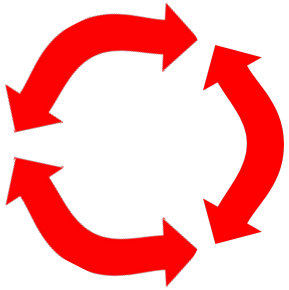
Future Directions

- Resource sharing in a **spatial explicit foraging model**
  - How group's survival rate in a foraging task is affected by
    - different resource sharing rules (e.g., NBT vs. AK)
    - different spatial distributions of food patches (e.g., uniform vs. patchy)
    - different food patches regrow rate (e.g., seasonality)
- **Cheating**
  - Detecting cheaters
  - Counter strategies against cheater behavior
- **Evolutionary dynamics**
  - Mixed population of both NBTs and AKs
  - Evolution of foraging strategies

Agent-Based Modeling within HGP





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Padmini Iyer
Brighid McCarthy
Dennis Sonkoi
Cathryn Townsend

University of Roehampton
Colette Berbesque

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Thank you!