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An Agent-Based Model of Knowledge Transferral: Exploring the Need for Closure & Cognition

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AGENDA

1 Introduction

2 The Agent-Based Model

3 Preliminary Results

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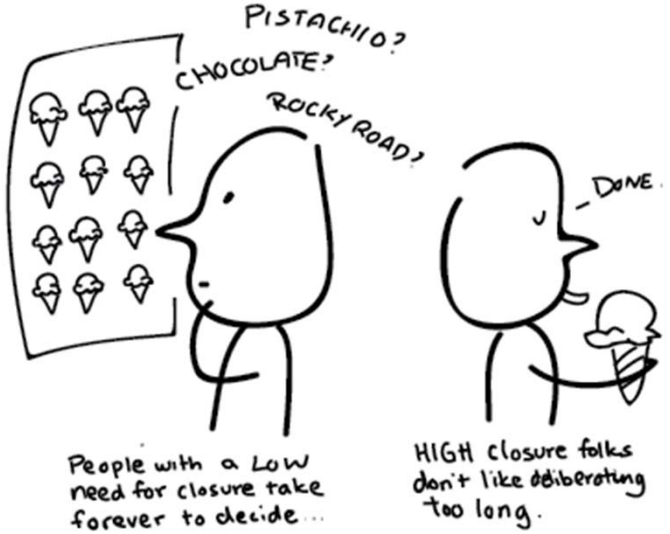
INTRODUCTION

USE OF SIMULATION IN GROUP PROCESS RESEARCH

- Typical approaches to the study of group decision making processes (Poole & Van de Ven 2010):
  - ***variance*** versus ***process*** approaches
- Alternative approach: ***Simulation***
  - bridges gap between variance and process approaches
  - Pros: explicit assumptions/rules; exploration of process dynamics; visualisation and controlled experimentation.
  - Cons: arbitrary/narrow assumptions and rules; low external validity; variabilization.
- We will use simulation to explore the impact the need for cognition (***NFCog***) and need for closure (***NFClos***) on Group Decision Making (GDM).

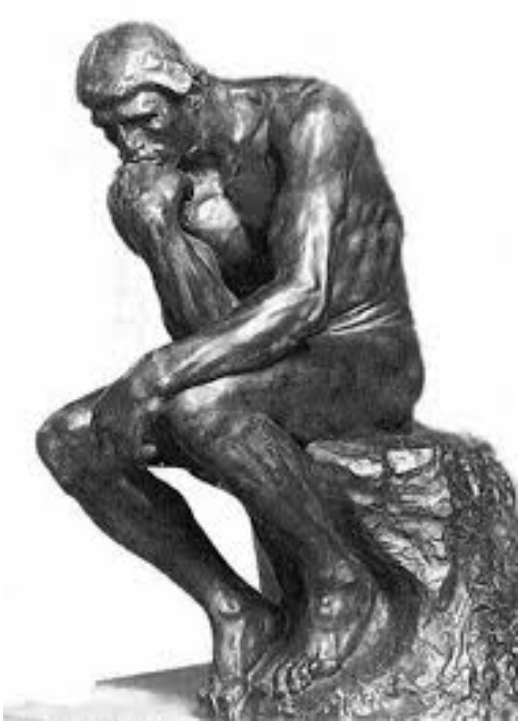
NEED FOR CLOSURE

- A desire for unambiguous information, as opposed to uncertainty or unambiguity. (Webster & Kruglanski 1996)
- Goal oriented.
- High ***NClos*** individuals typically are inclined to (Kruglanski & Fishman 2009):
  - attain closure as quickly as possible, and maintain it for as long as possible;
  - they achieve this by relying on past knowledge and avoiding new information.



NEED FOR COGNITION

- Tendency to engage in and enjoy cognitive efforts (Cacioppo & Petty, 1982).
- Process oriented.
- High ***NFCog*** individuals typically:
  - care about how and why something works, not only that it works;
  - more likely to engage in information seeking, seek more information, evaluate information more thoroughly, etc.



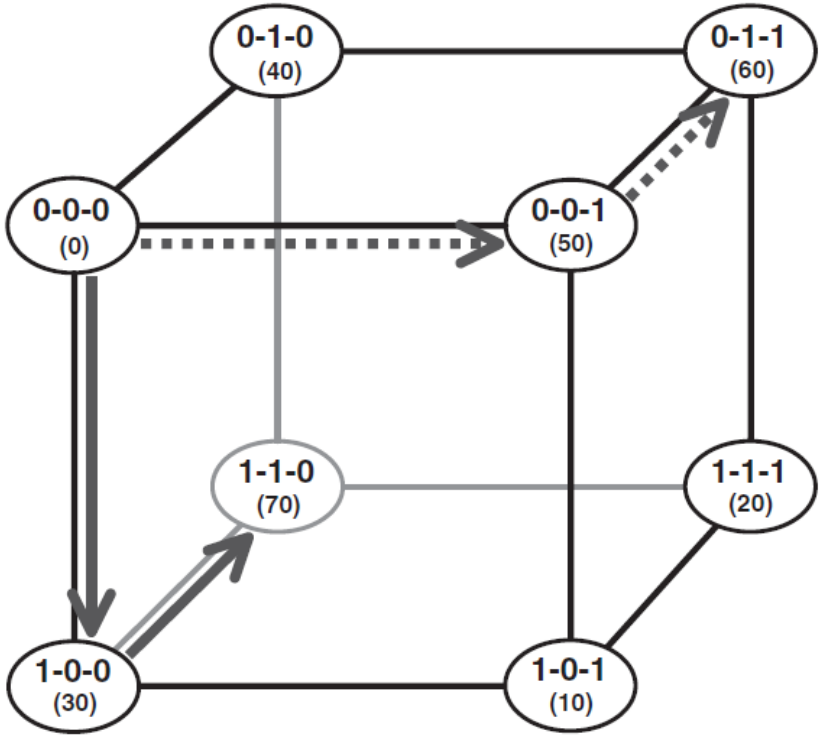
AGENT-BASED MODELS

- Allow ***heterogeneity*** of agents (e.g. participants in a group process), moving on from representative individuals or aggregate measures: the state of each agent can be inspected at any time
- Allow study of the ***interactions*** between agents
- Allow modelling of the temporal: study of the ***dynamics*** of a system rather than just an equilibrium
- '***bottom up***' rather than 'top down' Modelling

PREVIOUS SIMULATION STUDIES OF GROUP PROCESSES

Larson (2007) *N* dimensional problem space (hill climbing algorithm)

- Results: heterogeneous groups (different searching / 'flipset' heuristics) produce better solutions
- Stylized heuristics – limited to ways that a relatively simple solution space is searched
- Little interaction between group members

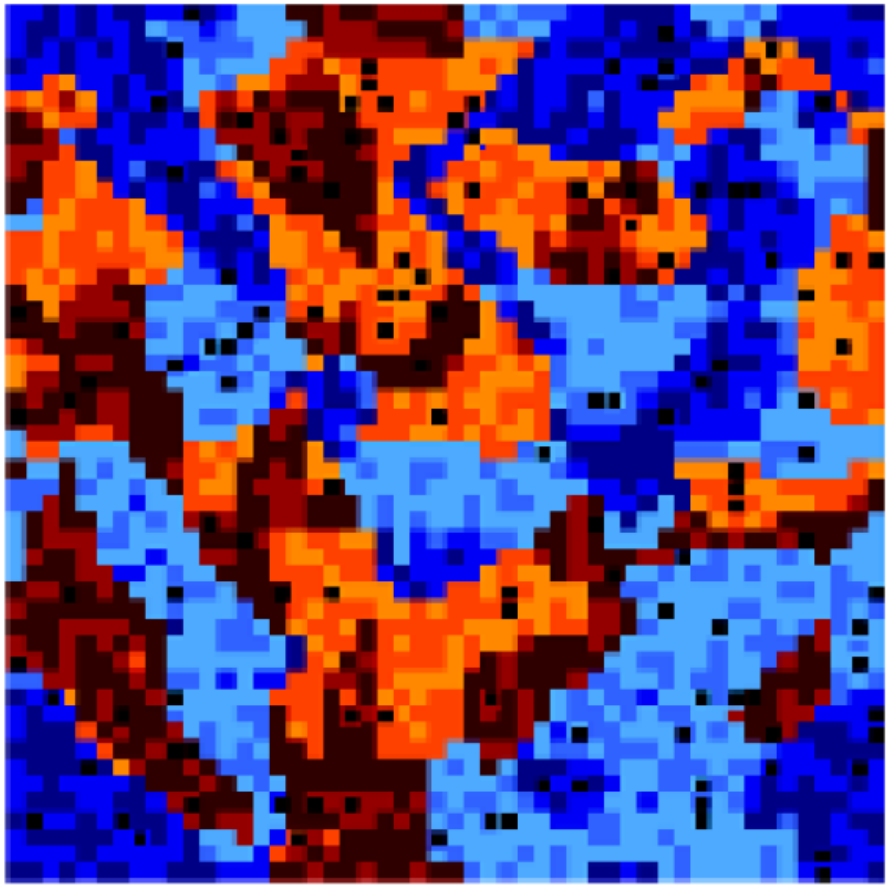


PREVIOUS SIMULATION IN GROUP PROCESSES

Rousseau and van der Veen (2006)

- Model of the emergence of a shared identity

- Limited repertoire of possible outcomes
- Actually a cellular automata model – agents are confined to grid locations

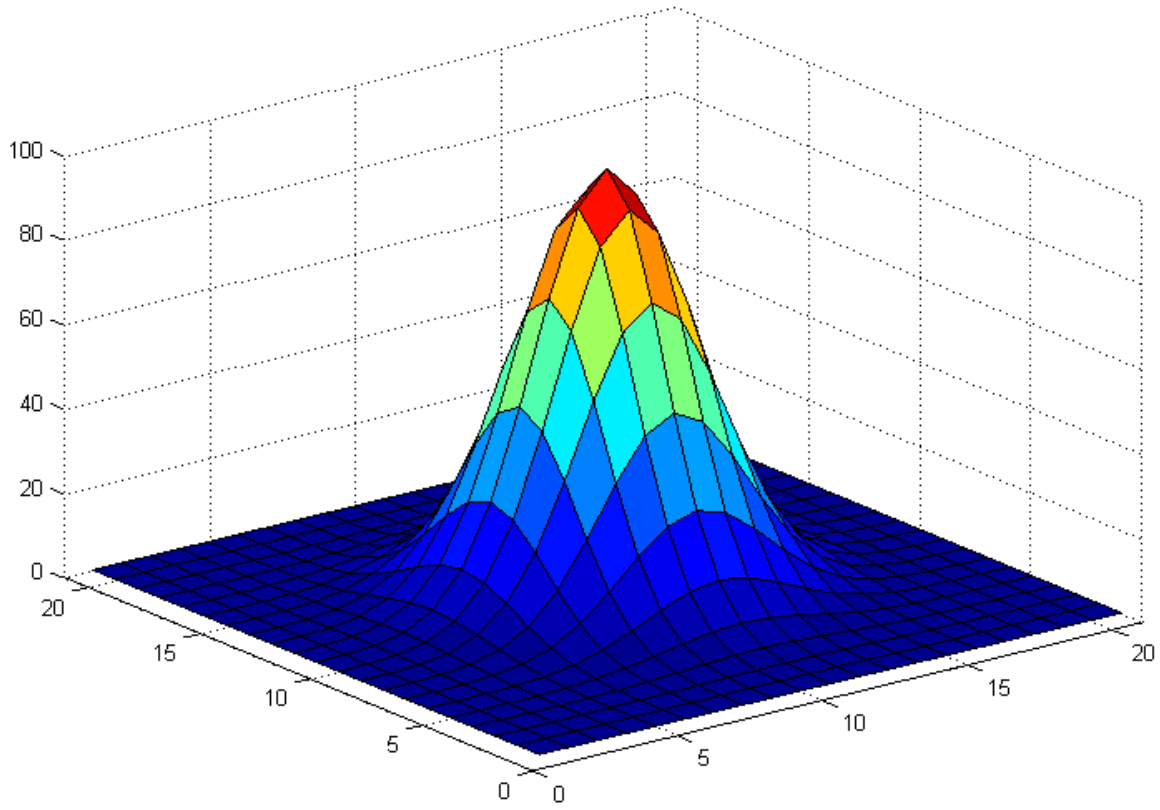


THE AGENT-BASED MODEL

CONSTRUCTION OF THE FITNESS LANDSCAPE

The fitness landscape is created by adding *M* Gaussians at random positions

This is a fitness landscape for *M* = 1 – one central peak, and is the landscape we will use for our experiments



PARTICIPATOR AGENTS

N participants – agents in our agent-based model – are randomly positioned on a fitness landscape.

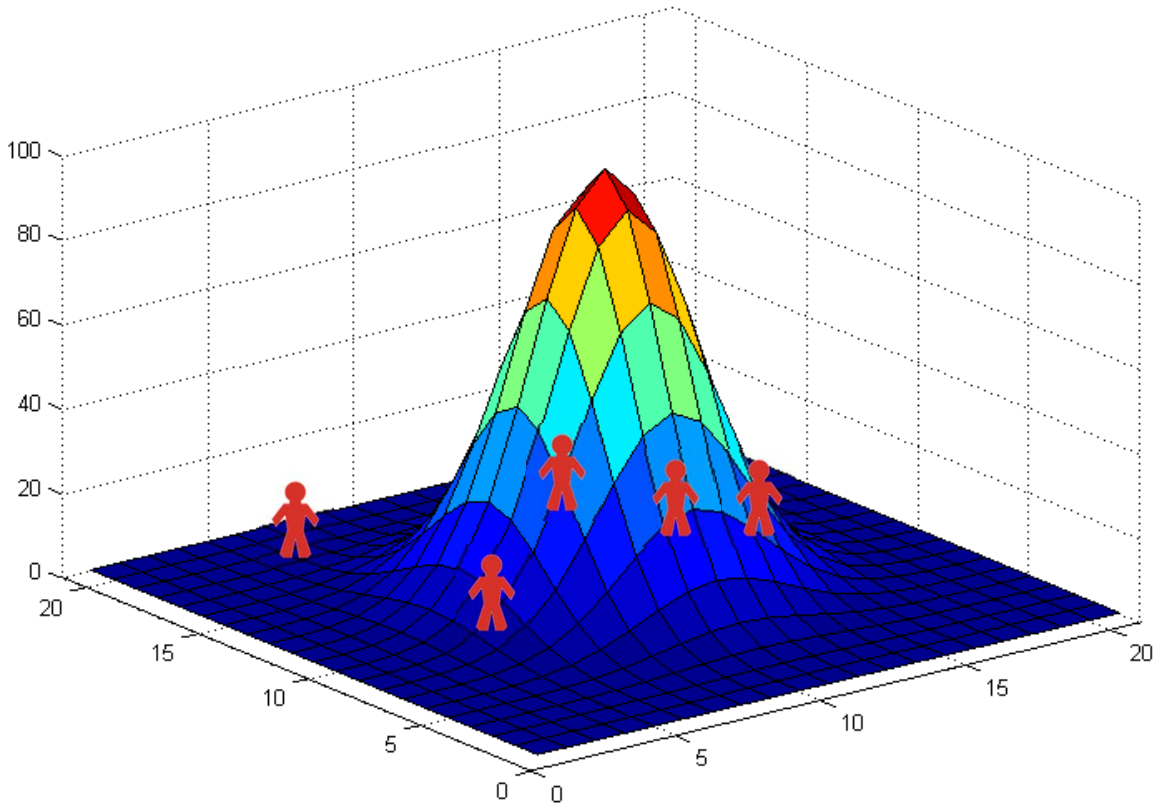
Fitness landscapes (Wright 1932) widely used in the evolutionary biology community. 'Fitness' reduces the output into the 'height' of the landscape.

Widely used in strategic management (Levinthal 1997 and many more recent publications)

CONSTRUCTION OF THE FITNESS LANDSCAPE

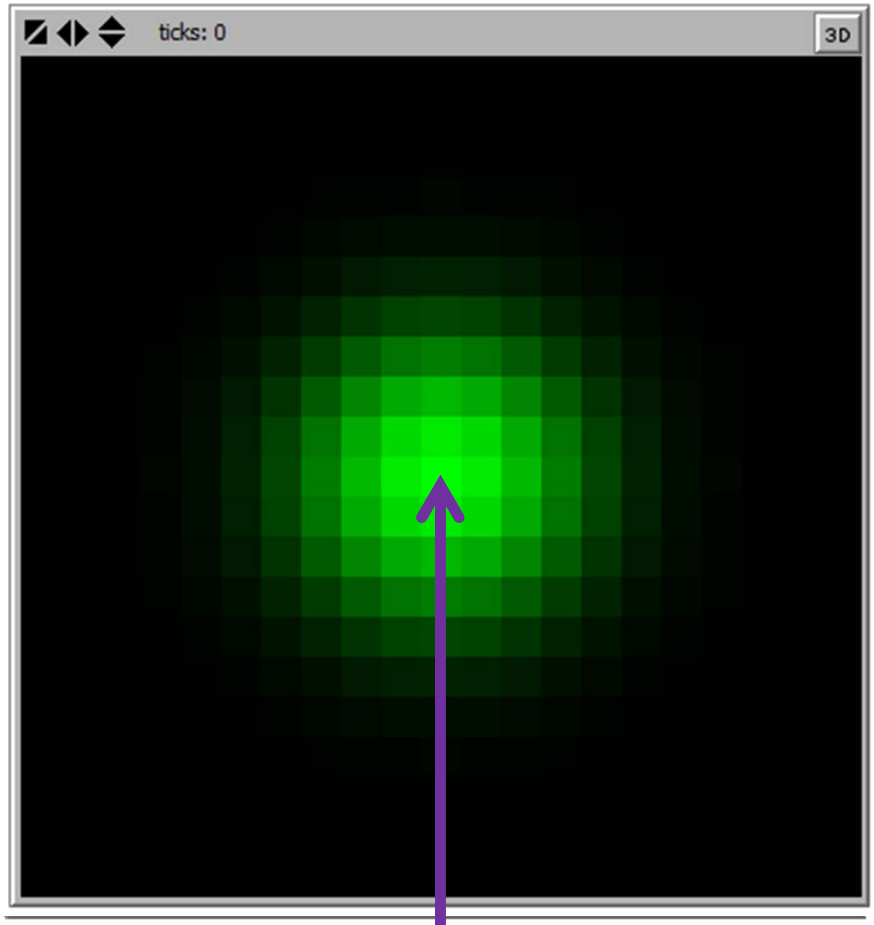
We add *N* agents to the landscape

Participant agents can move around a fitness landscape.



MODEL

The Landscape is Constructed

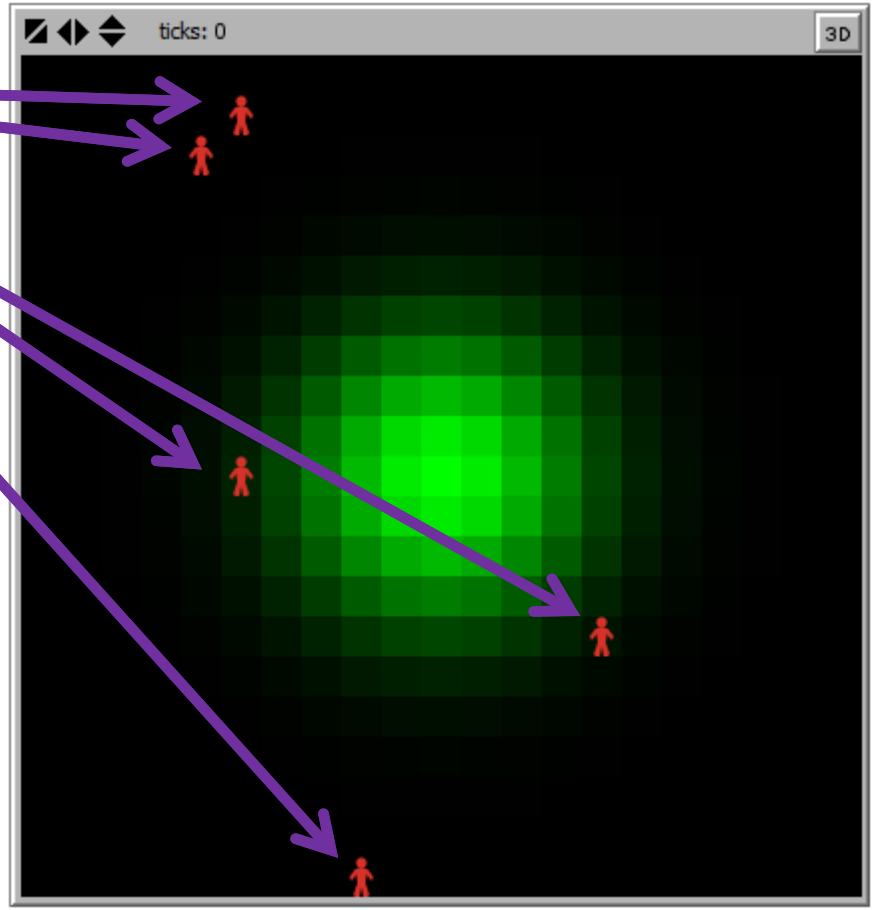


Optimal Solution Point

MODEL

Participants

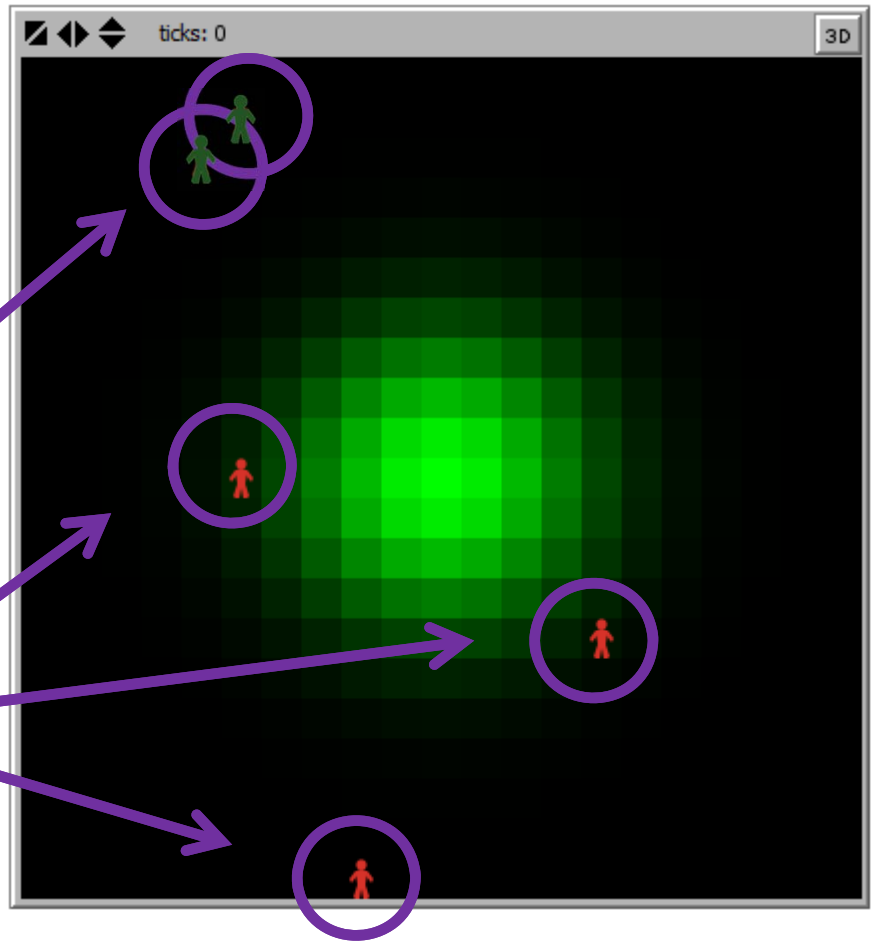
N participants are placed randomly on the fitness landscape



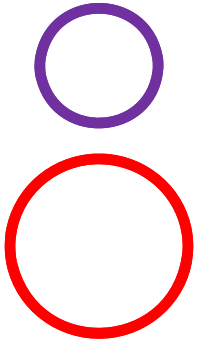
MODEL

Each participant has a ***NFClos*** boundary – if another participant is within this boundary, the participants will not move. So these two participants will stay still (we can colour these green)

And these will keep moving because they have not met another participant within their ***NFClos*** boundary



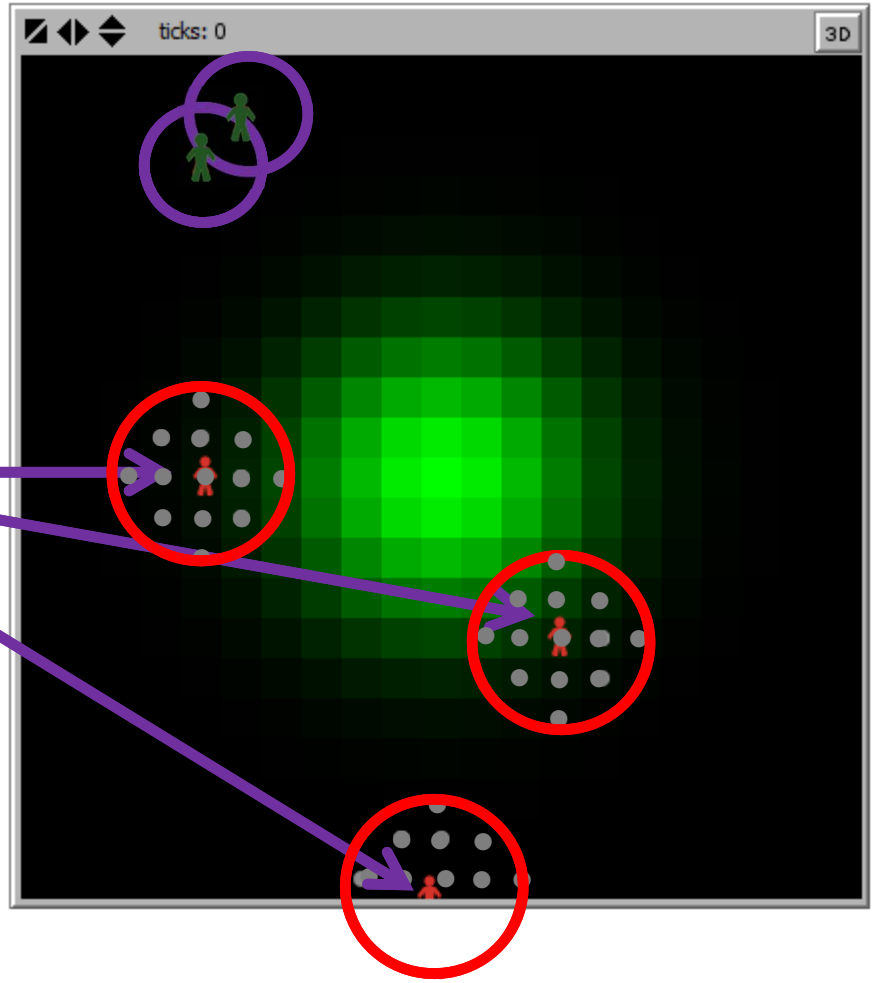
MODEL



NFClos
Need For Closure

NFCog
Need For Cognition

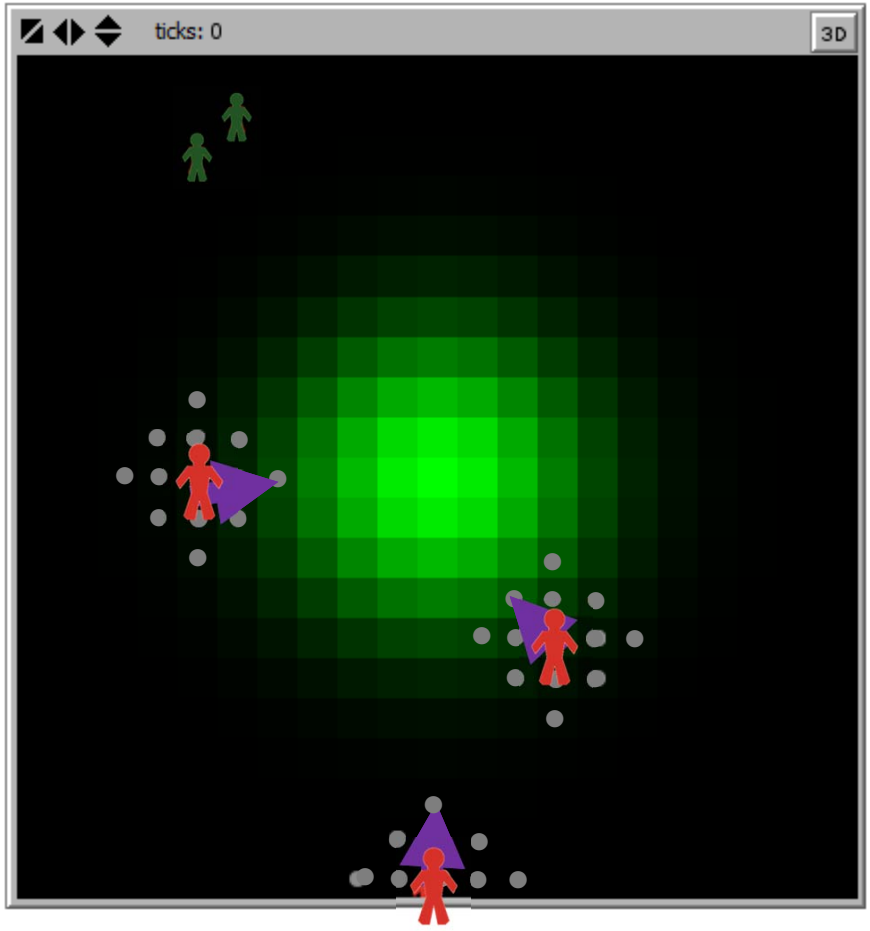
These participants search their local area within their ***NFCog*** radius until they meet another participant within their ***NFClos*** boundary. The gray dots (within their ***NFCog*** radius) show where they have searched



MODEL

If a participant has not found another participant after they have searched their ***NFClos*** boundary, they will move to the position that has the highest position that they have found on the fitness landscape

This repeats until all participants are ‘closed’ or after a certain time period



PRELIMINARY RESULTS

EXPERIMENTS

EXP1 Effect of Need for Closure

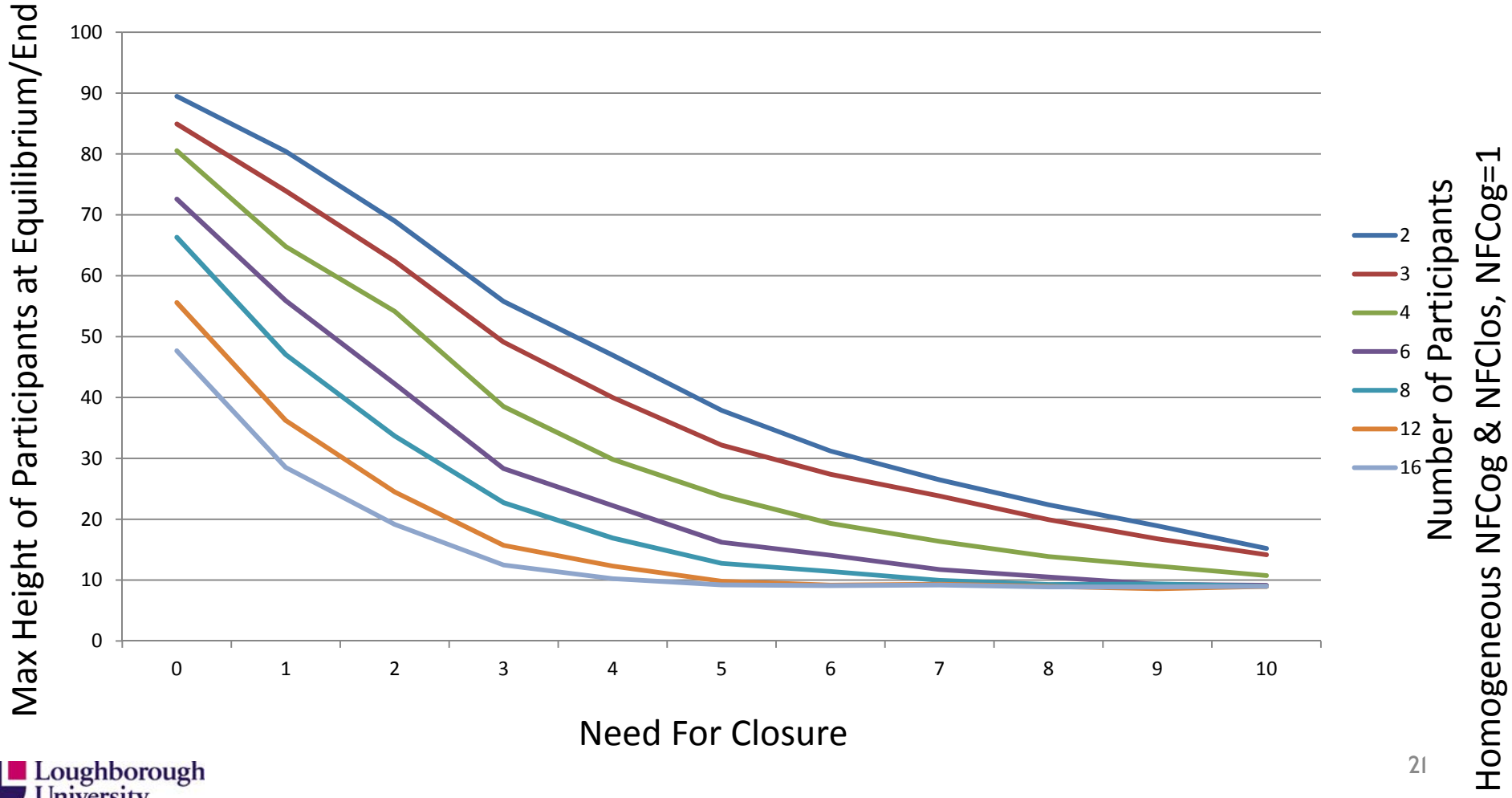
EXP2 Effect of Need for Cognition

EXP3 Interactions: NFCog & NFClos

EFFECT OF NEED FOR CLOSURE

EXPI

Increasing ***NFClos*** level decreases the best solution, more pronounced with more participants



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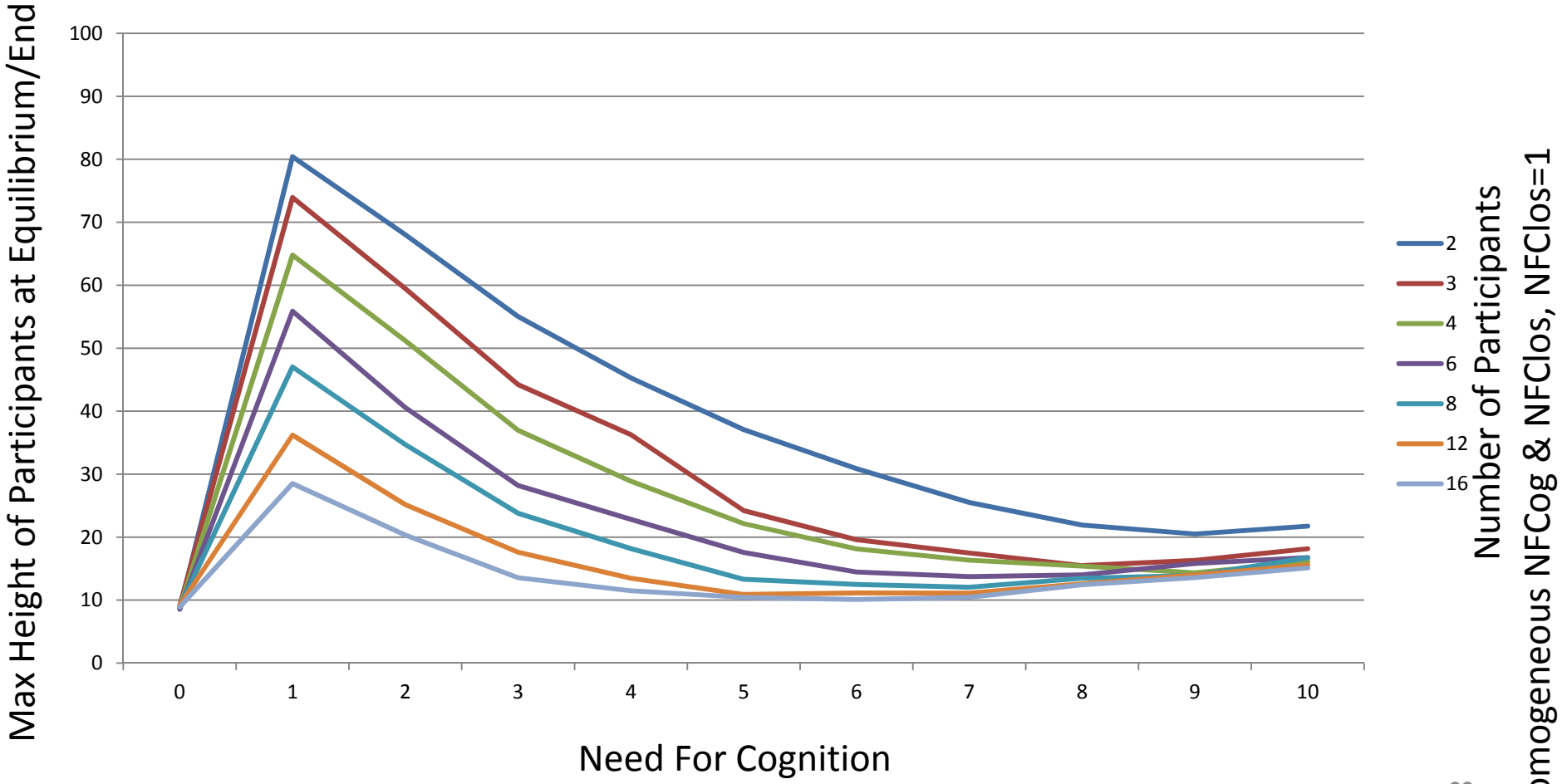
EFFECT OF NEED FOR COGNITION

EXP2

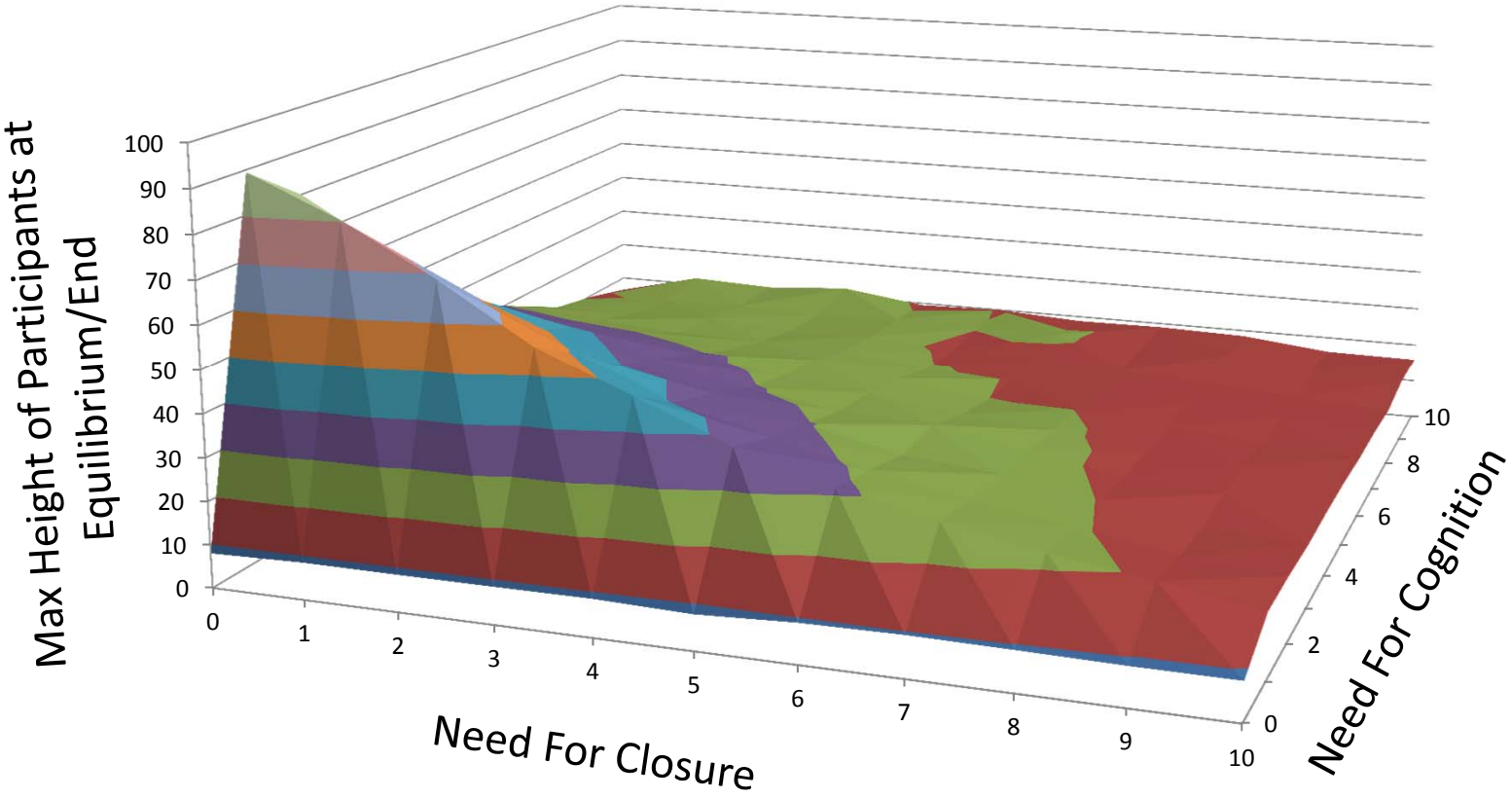
Some ***NFCog*** needed to obtain better solution, then decreases and rises slightly



EFFECT OF NEED FOR COGNITION

EXP3

Average solution decreases with either increased NFCog or NFClos (2 participants)



Homogeneous NFCog & NFClos, *N*=2

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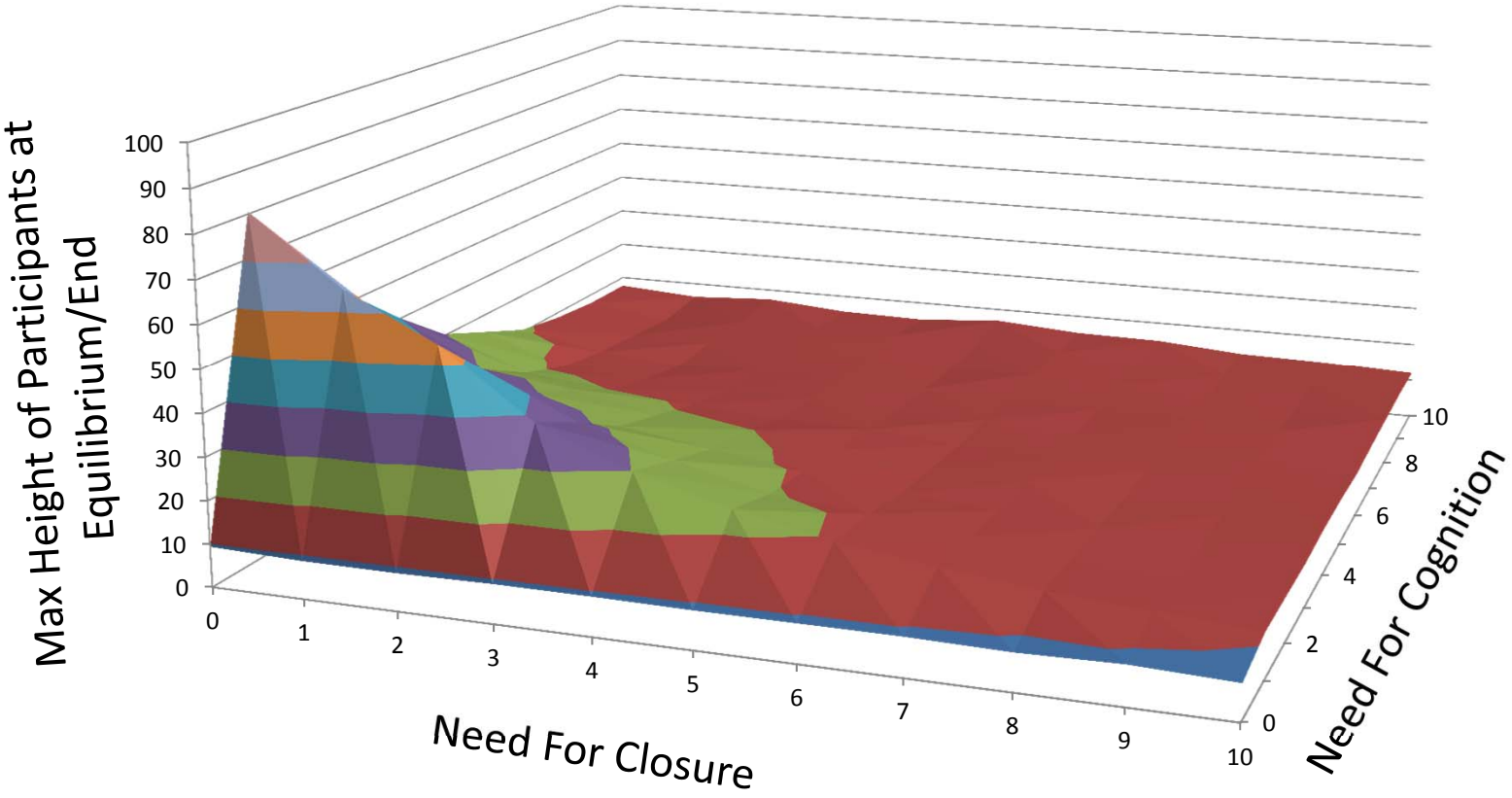
EFFECT OF NEED FOR COGNITION

EXP3

Average solution decreases with either increased NFCog or NFClos
… and this is more pronounced with more partcipants (4 participants)

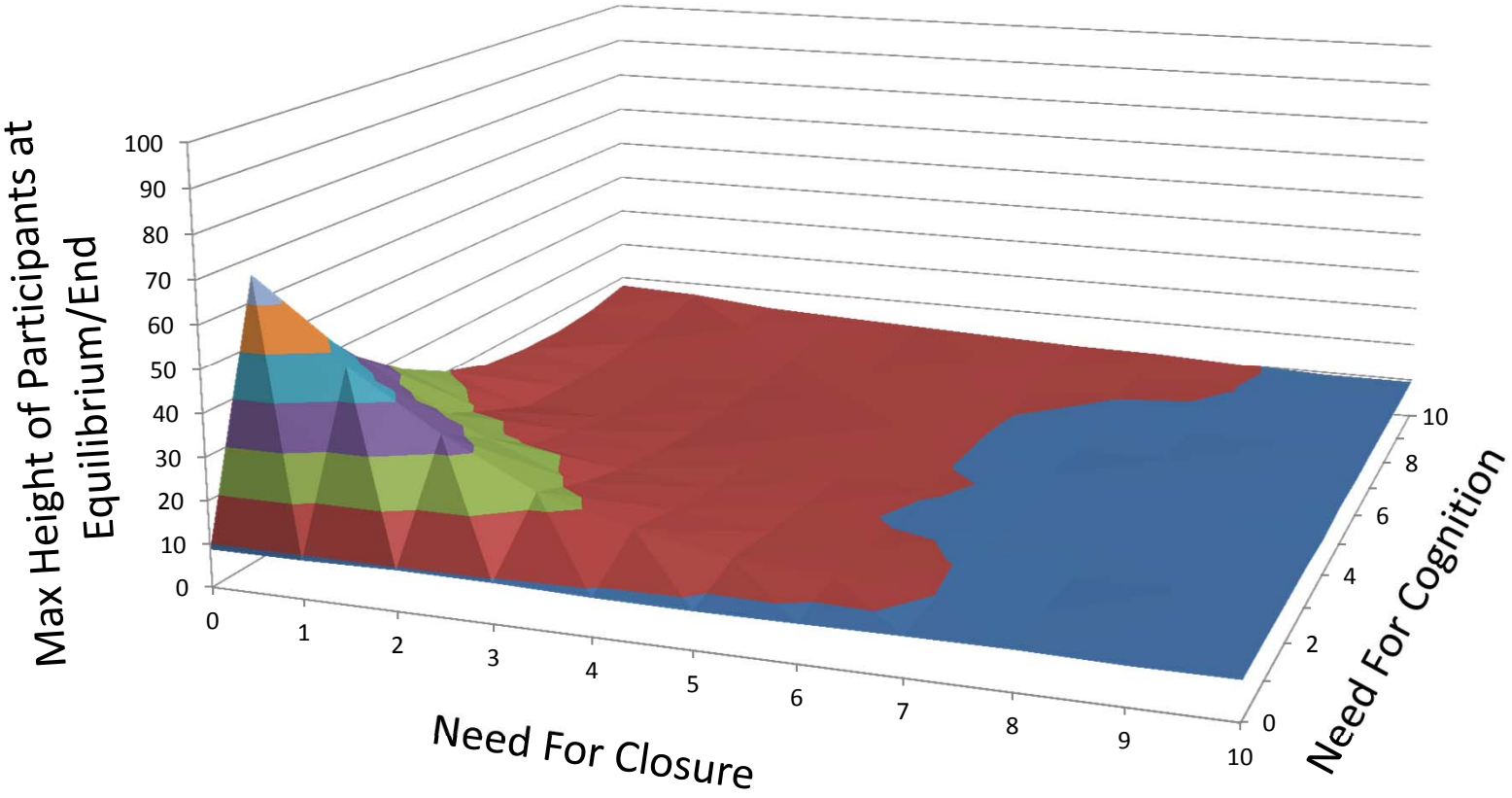


Homogeneous NFCog & NFClos, *N*=4

EFFECT OF NEED FOR COGNITION

EXP3

Average solution decreases with either increased NFCog or NFClos
… and this is more pronounced with more partcipants (8 participants)



Homogeneous NFCog & NFClos, *N*=8

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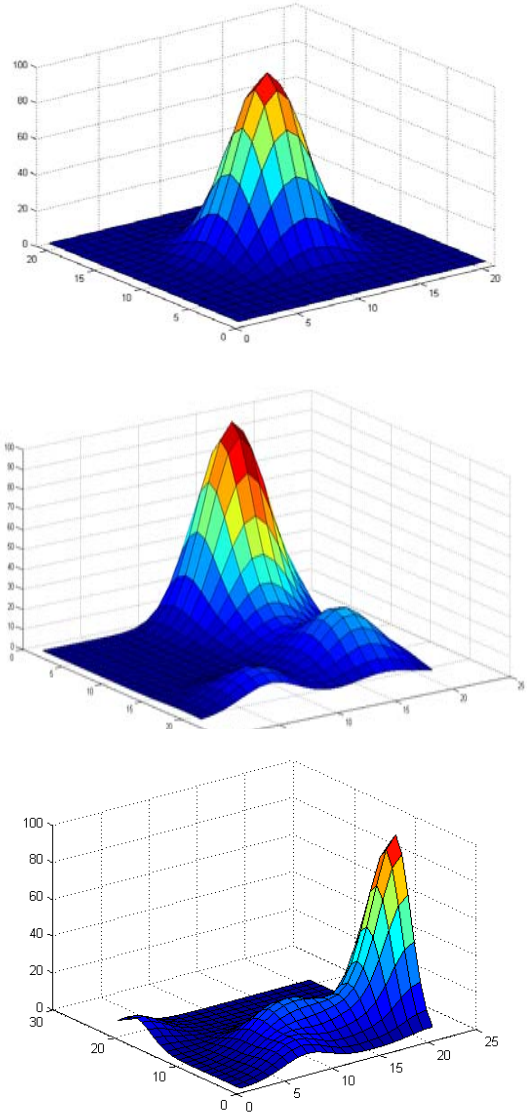
FURTHER WORK

- Role of facilitation
  - i.e. reward/penalty structures for high/low NFClo & NCog
- Complex vs simple group tasks
  - i.e. Different fitness landscape topologies
- Additional traits
- NFCog – only close if higher than delta
- Feedback from participant movement to fitness landscape
  - e.g. endogenous landscape (Robertson 2009)



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