A Situated Cognition Approach to Social Modeling of Teams in Complex Systems

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Common Assumptions in Modeling Complex Engineered Systems

Perfect or bounded rationality

Lossless or near lossless information transfer

Little or no learning

Little or no cognitive behavior

Little or no social behavior

Primarily third person knowledge

SITUATED COGNITION

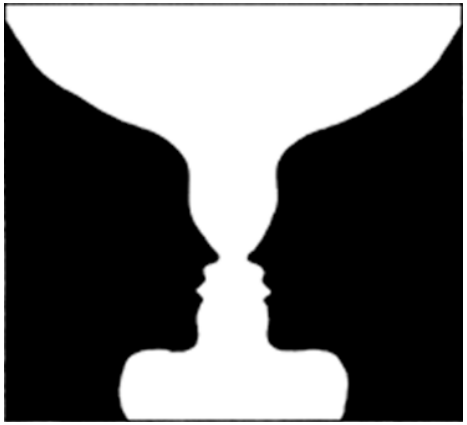
Third-Person Knowledge

- Knowledge from physical sciences
- Knowledge from engineering science
- Knowledge from computer science
- Knowledge from organizational science

First-Person Knowledge

- Knowledge from doing
- Knowledge from interacting in the world

Where you are when, matters

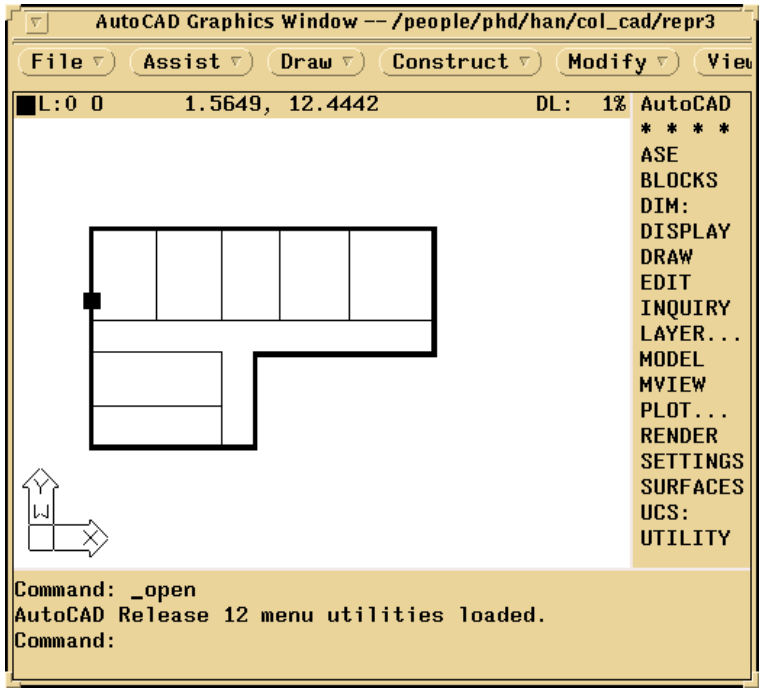


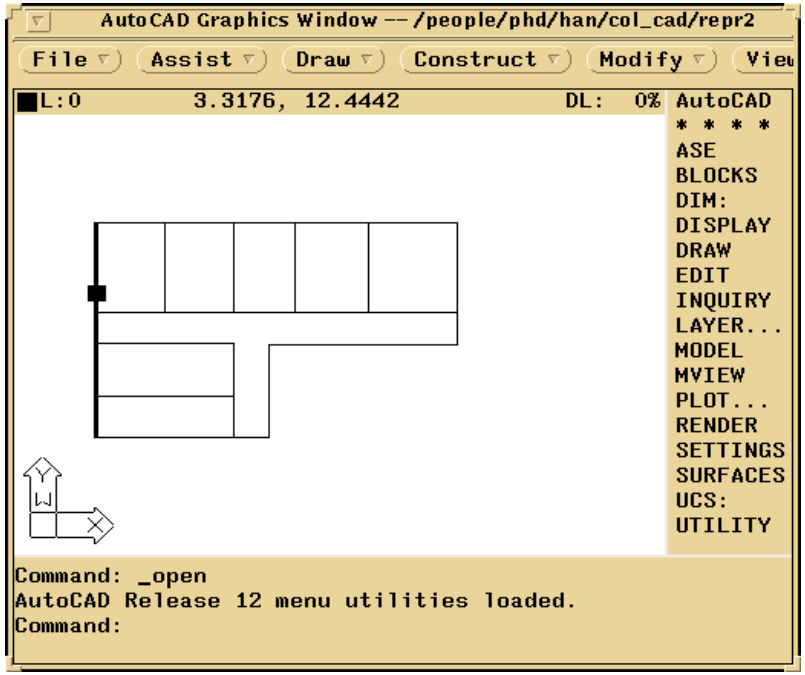
What you are looking for affects what you see

I cdnuolt blveiee taht I cluod aulaclty uesdnatnrd waht I was rdanieg. Aoccdrnig to rscheearch at Cmabrigde Uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoatnt tihng for esay rdeinag is taht the frist and lsat ltteer be in the rghit pclae. The rset can be a taotl mses and you can sitll raed it wouthit a porbelm. Amz3nig huh? Yaeh, and I awlyas thought slpeling was ipmorantt.

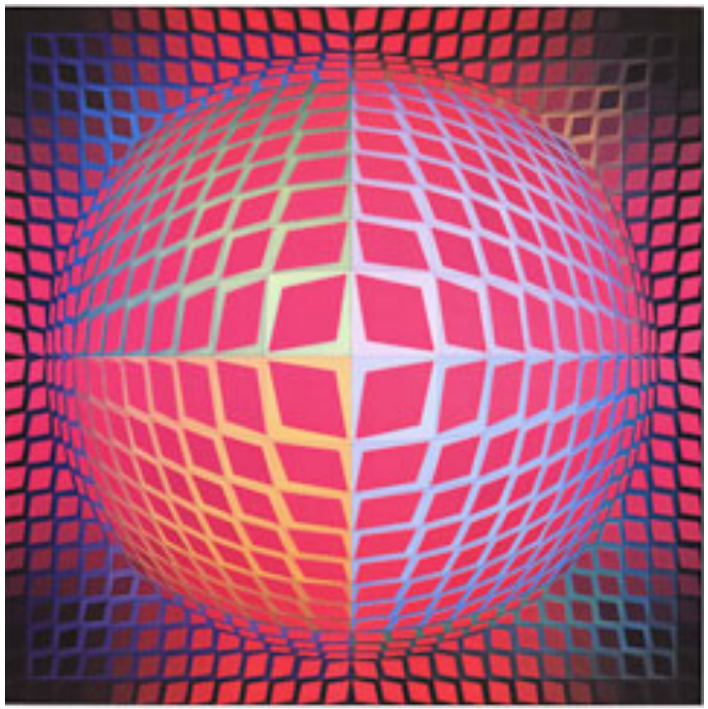
No unique representation of world: depends partly on your expectations

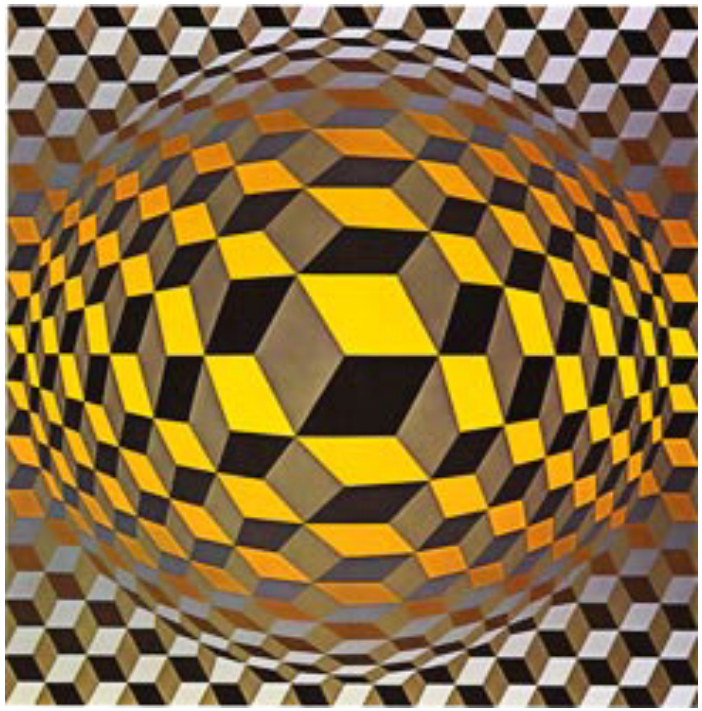
What you see is not necessarily what you get





What you see is not necessarily what is there





Vasarely

Memory and remembering

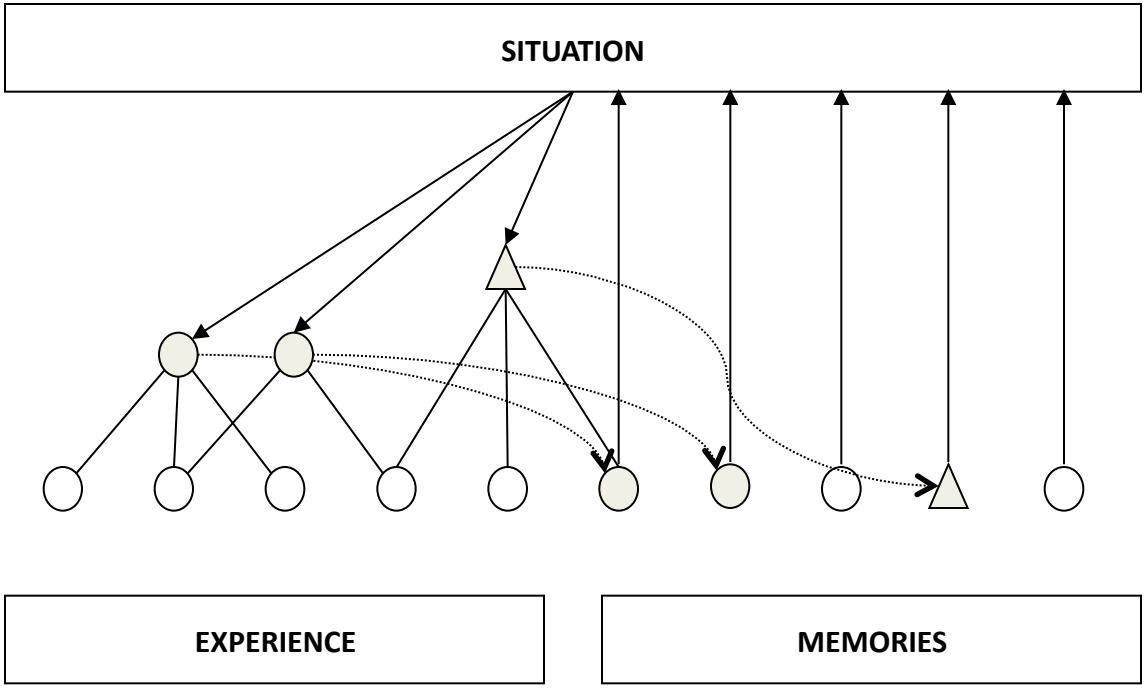
"Remembering is not the re-excitation of innumerable fixed, lifeless and fragmentary traces. It is a … reconstruction, or construction, built out of the relation of our *attitude* towards a whole active mass of organised past reactions or experience, and to a little outstanding detail which commonly appears in image or in language form."
Bartlett (1932)

Constructive memory

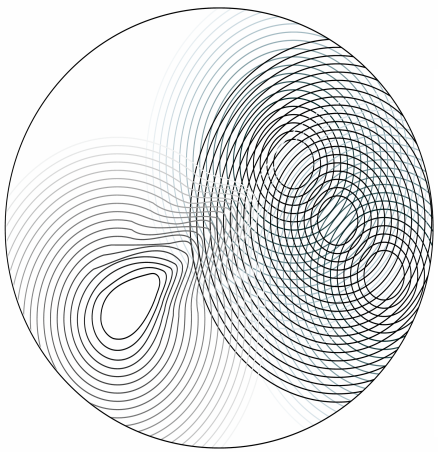
- memory is reasoning process
- index need not be explicit
- index changed by its use
- content changed by its use
- memory structure changed by its use

- memories constructed through need to have memory
- memories function of past *interactions* and *interactions* at time and place of need to have memory

Constructive Memory



Constructive memory



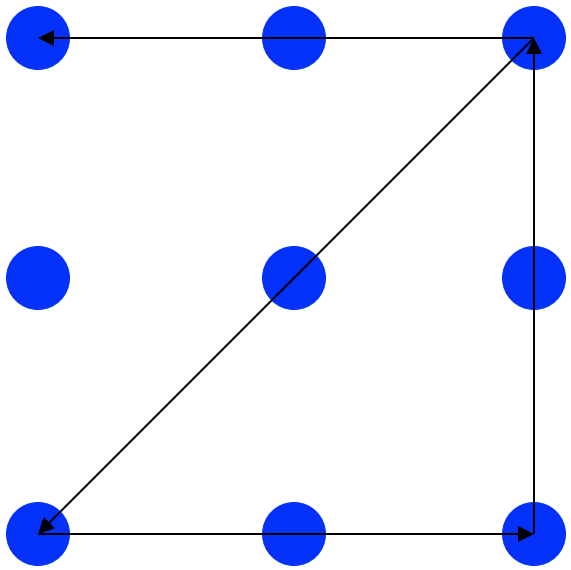
Experiences

“subsequent experiences structure and hence give meaning to what was experienced before.” Dewey (1896) via Clancey (1997)

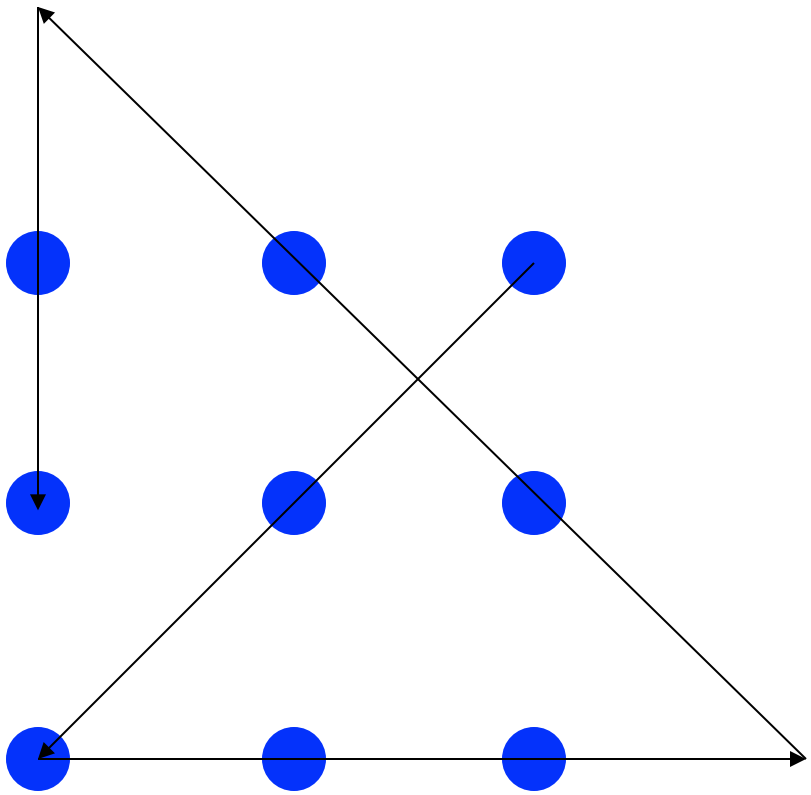
Situatedness:

Situations ≅ World View ≅ Meanings, Values, Expectations

Situation 1



Situation 2



Situations give meanings

Example of unsafe demolition practices

Situated Cognition

Basic Ideas

Knowledge from interaction not just encoding

Memory by construction not just recall

Situations give meanings and expectations

Cognitive Situatedness Principles

Principles for Engineered Teams

Principle of Effect
What you do matters

Principle of Ordered Temporality
When you do what you do matters

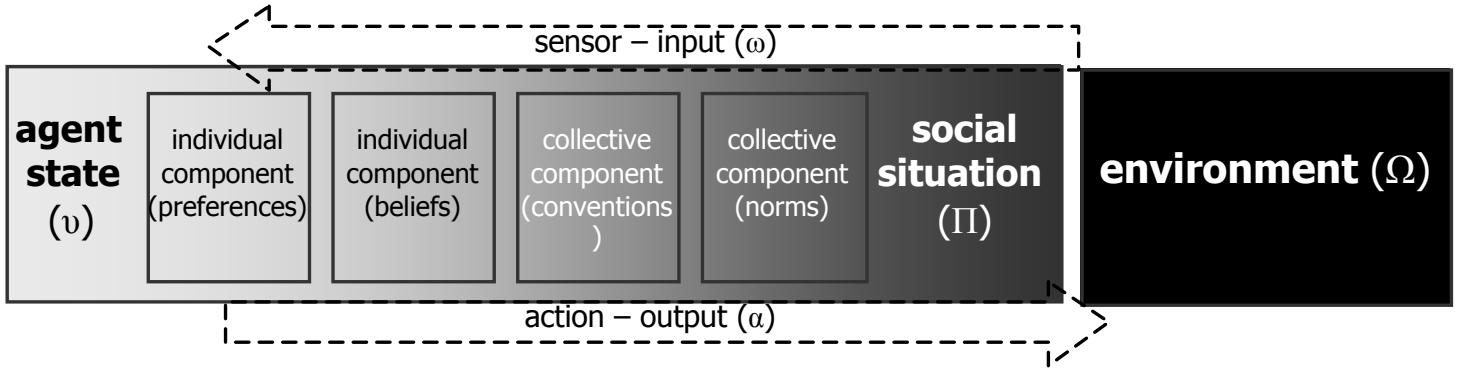
Lemma of Experience
What you did before affects what you do now

Principle of Locality
Where you are when you do what you do matters

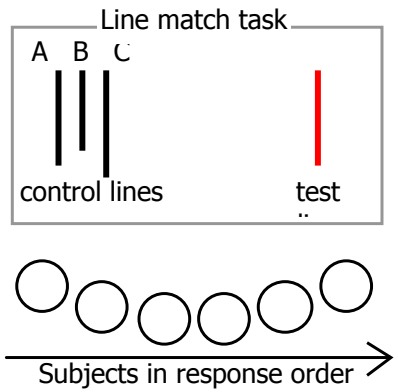
Principle of Interaction
Who and what you interact with matters

Principle of Ontology
What you think the world is about affects what it is about for you

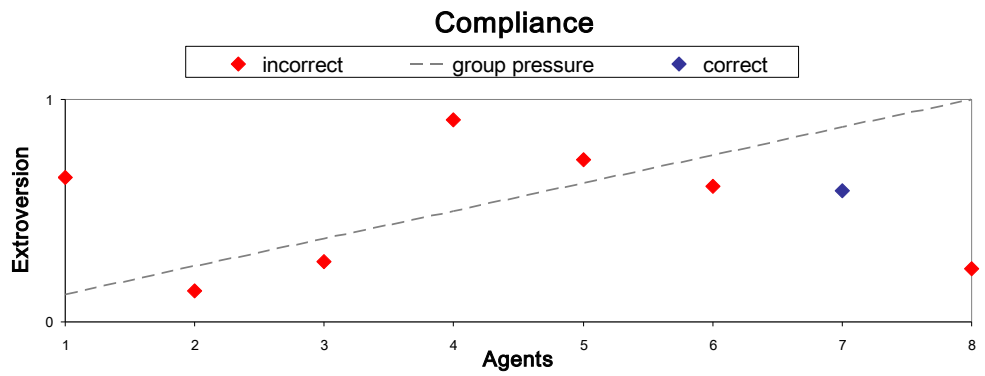
Situated Social Agents



Asch's 1951 Social Pressure Experiment



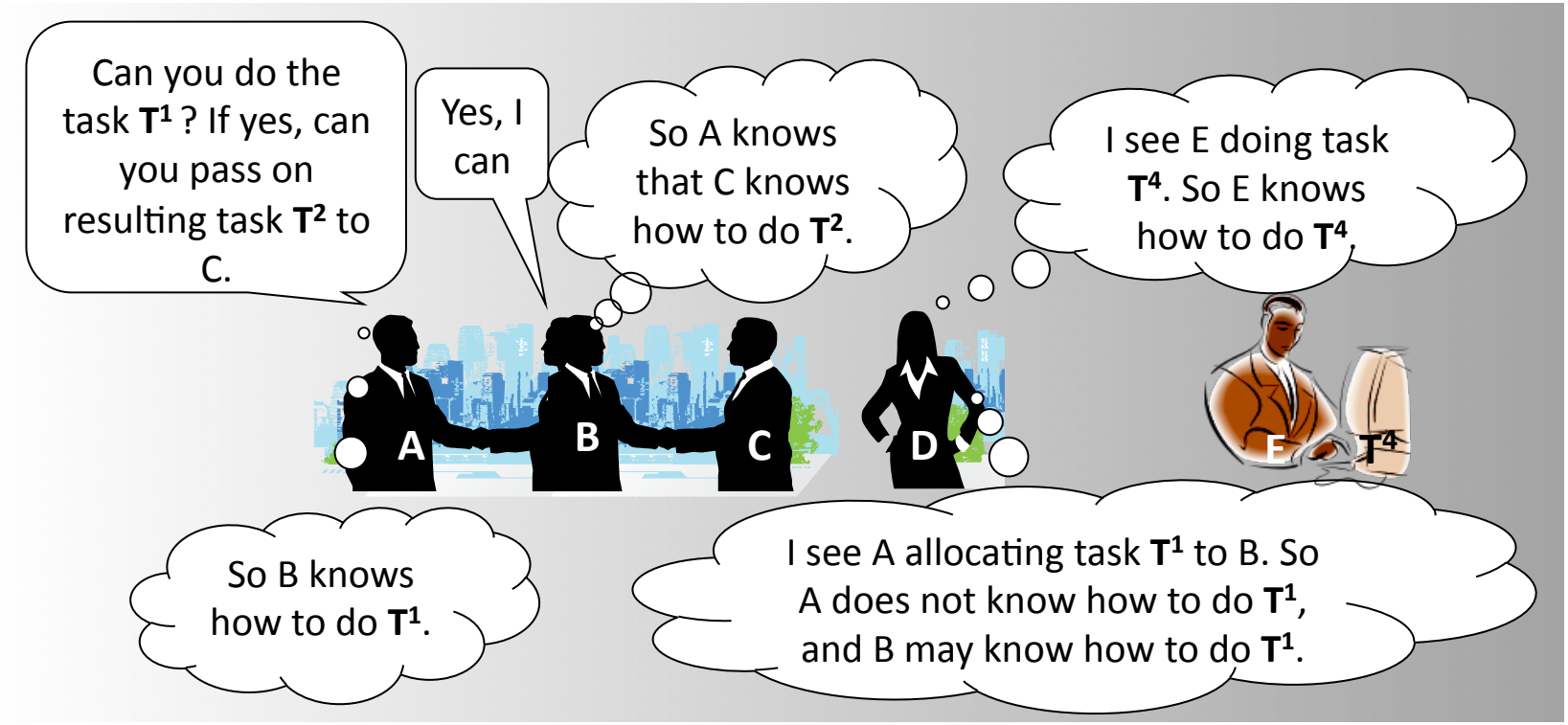
Social Agent Model Results for Asch Experiment



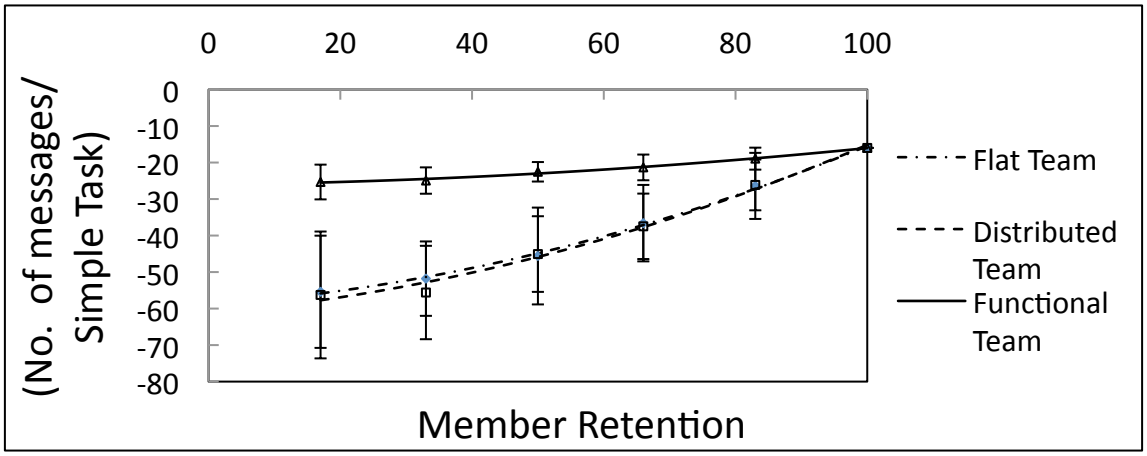
Agent	v_a	v_e	α'	Comply
ag1	0.91	0.65	α'_i	false
ag2	0.96	0.14	α'_i	false
ag3	0.93	0.27	α'_i	false
ag4	0.89	0.91	α'_i	false
ag5	0.94	0.73	α'_i	false
ag6	0.95	0.61	α'_i	false
ag7	0.99	0.59	α'_c	true
ag8	0.94	0.24	α'_i	false

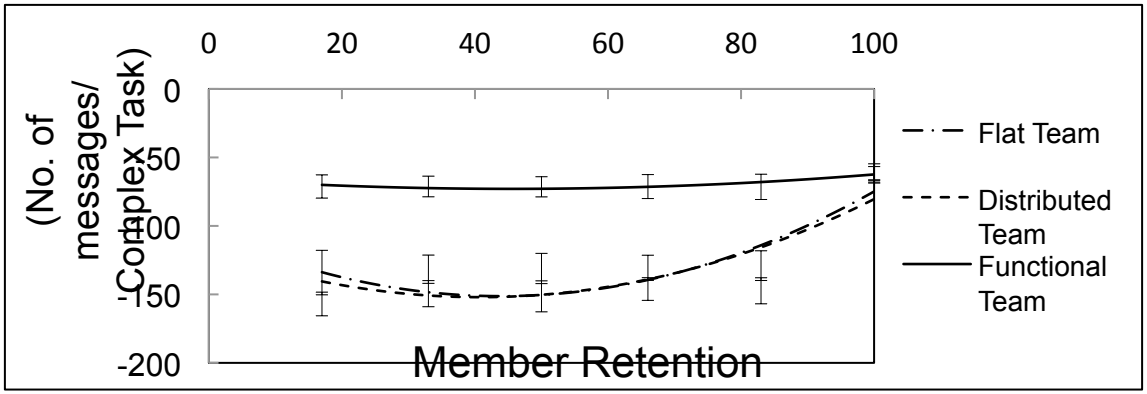
Computational Modeling: Social Cognitive Agents

Social Learning in Teams

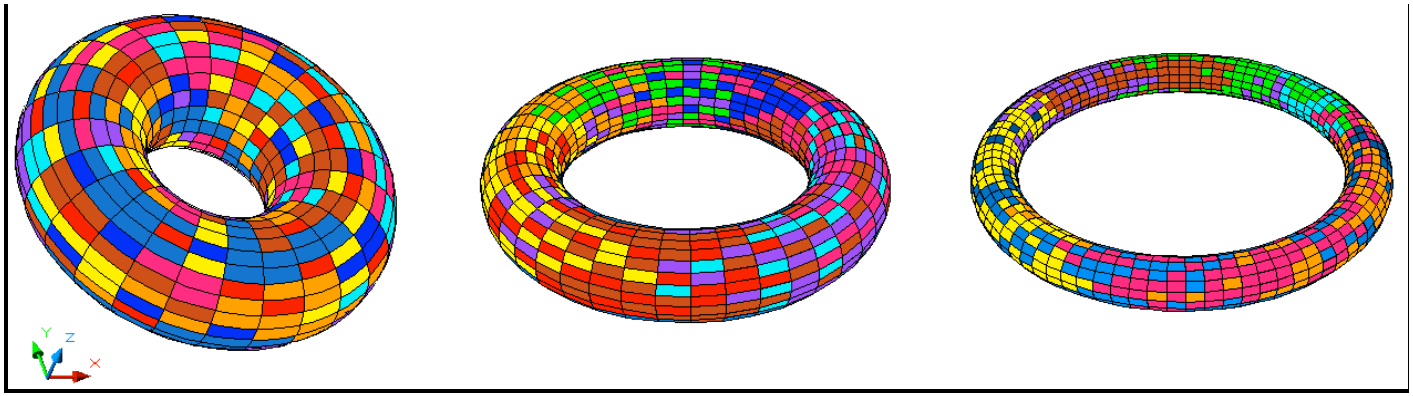


Effect of Team Member Retention on Communication

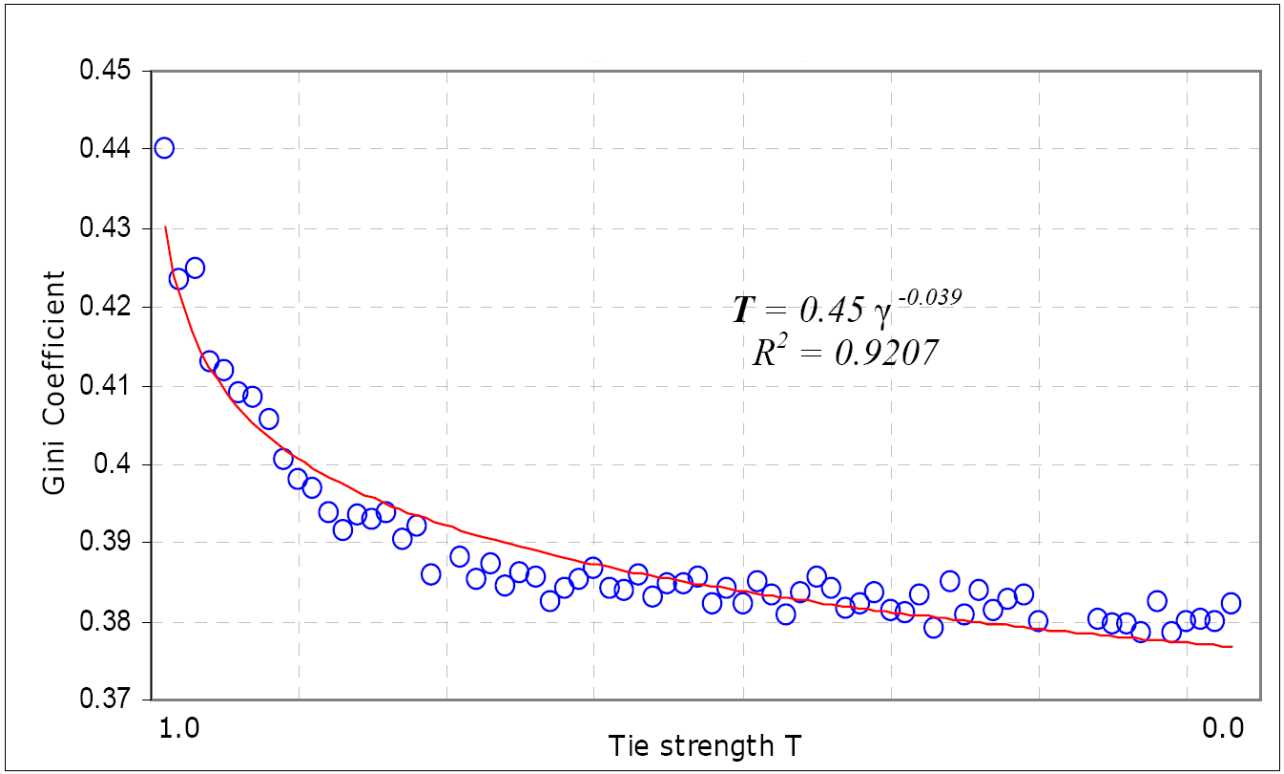




Social Structure Modeling Using Cellular Automata



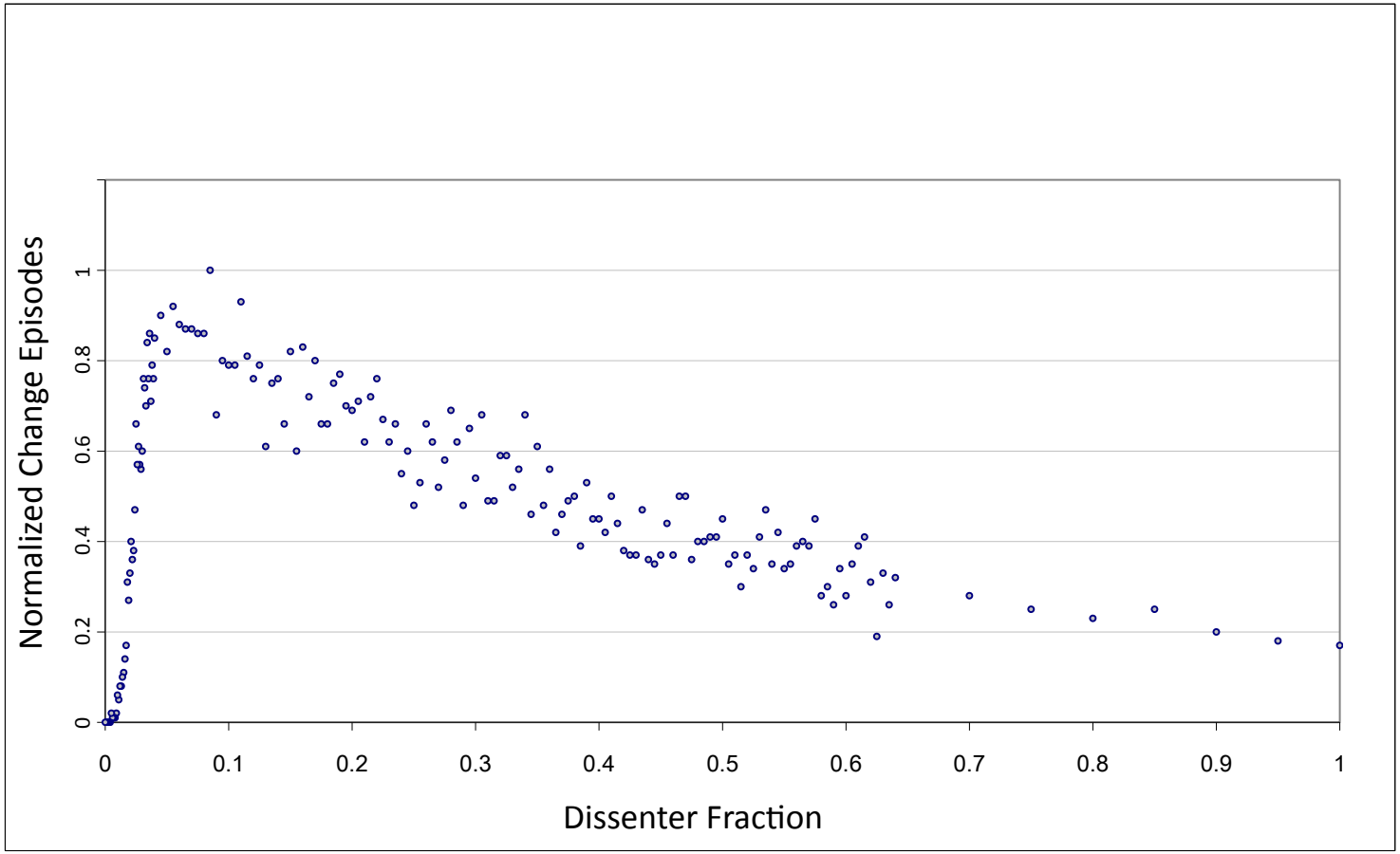
Influence of Social Ties in Teams



As **T** increases, exchange of opinions decreases and influence concentrates (Gini coefficient increases), increase hierarchies

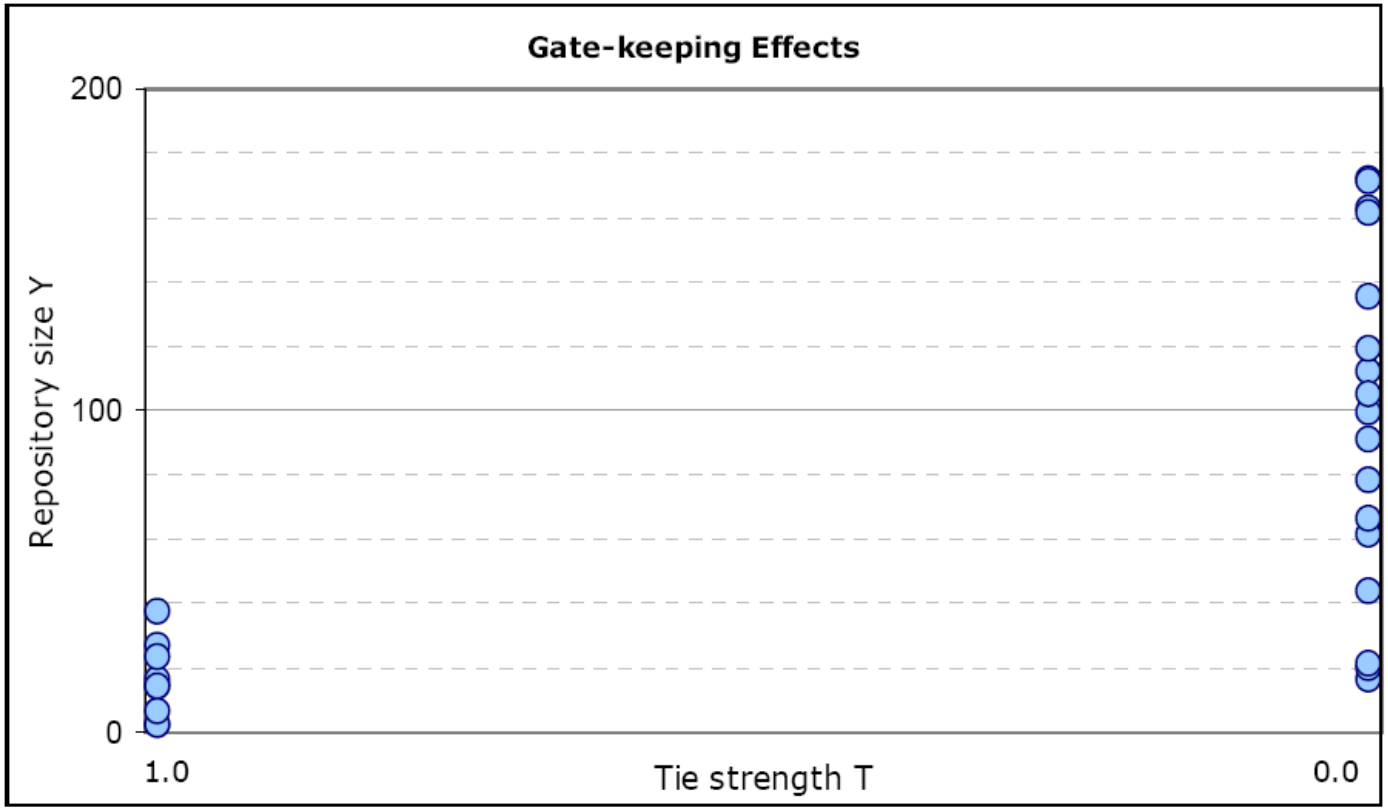
As **T** decreases, exchange of opinions increases and influence structures of dominance are more distributed (Gini coefficient decreases), flatter hierarchies

Dissenters in Teams

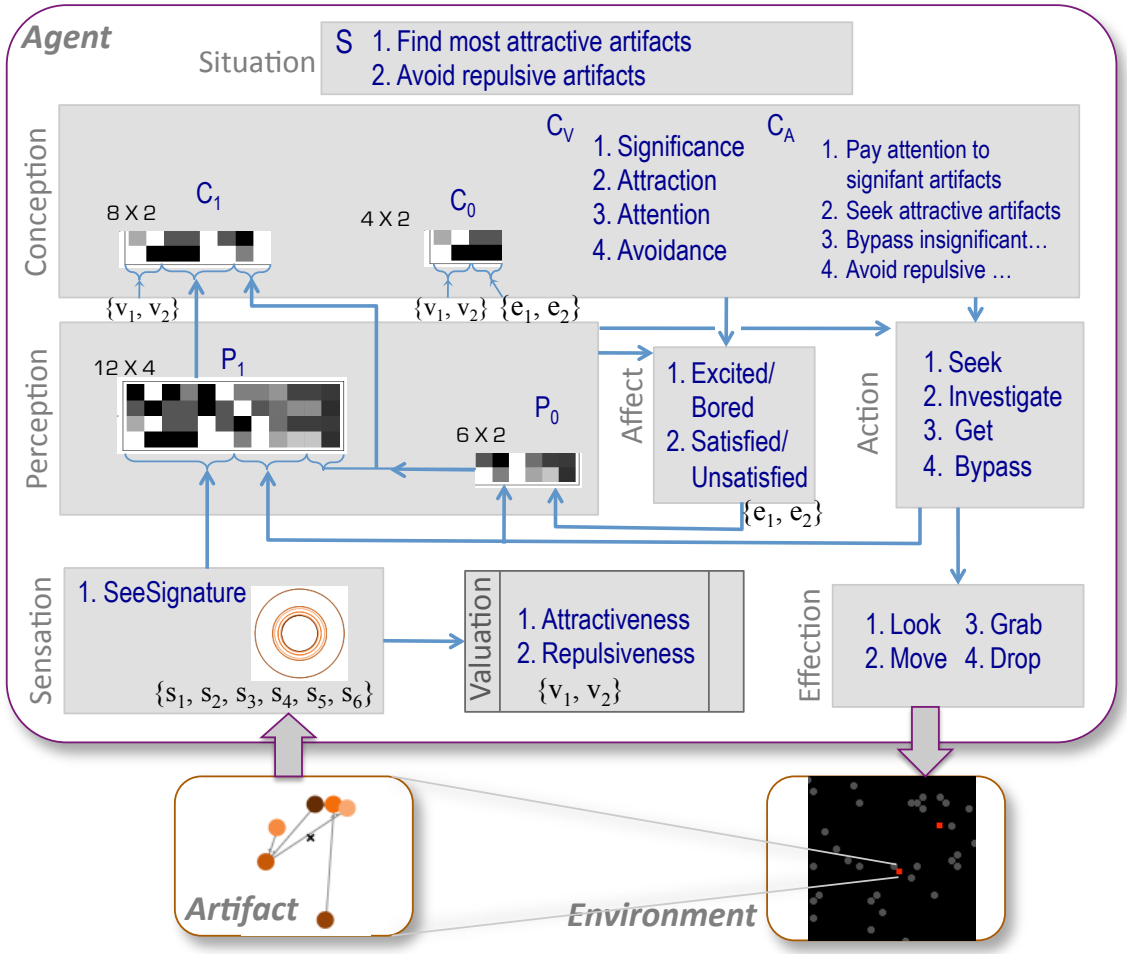


Gatekeeping Effects

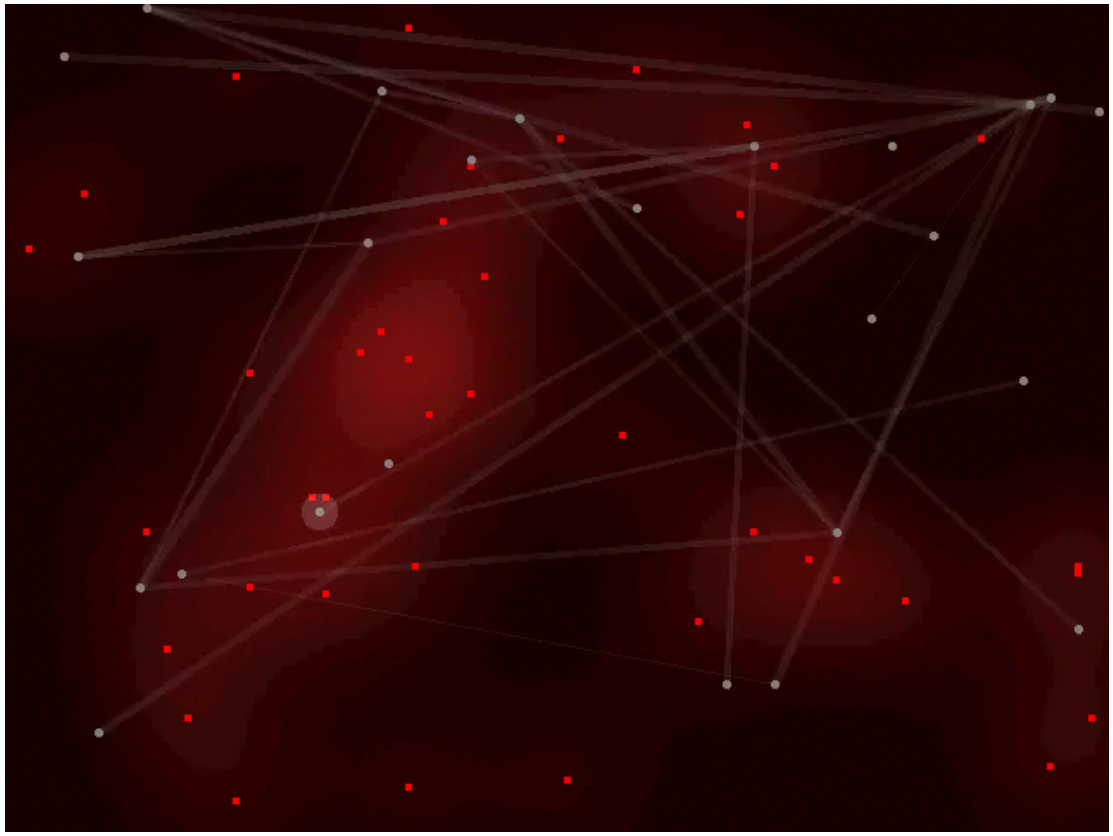
Boundary values T = 0 and T = 1 only



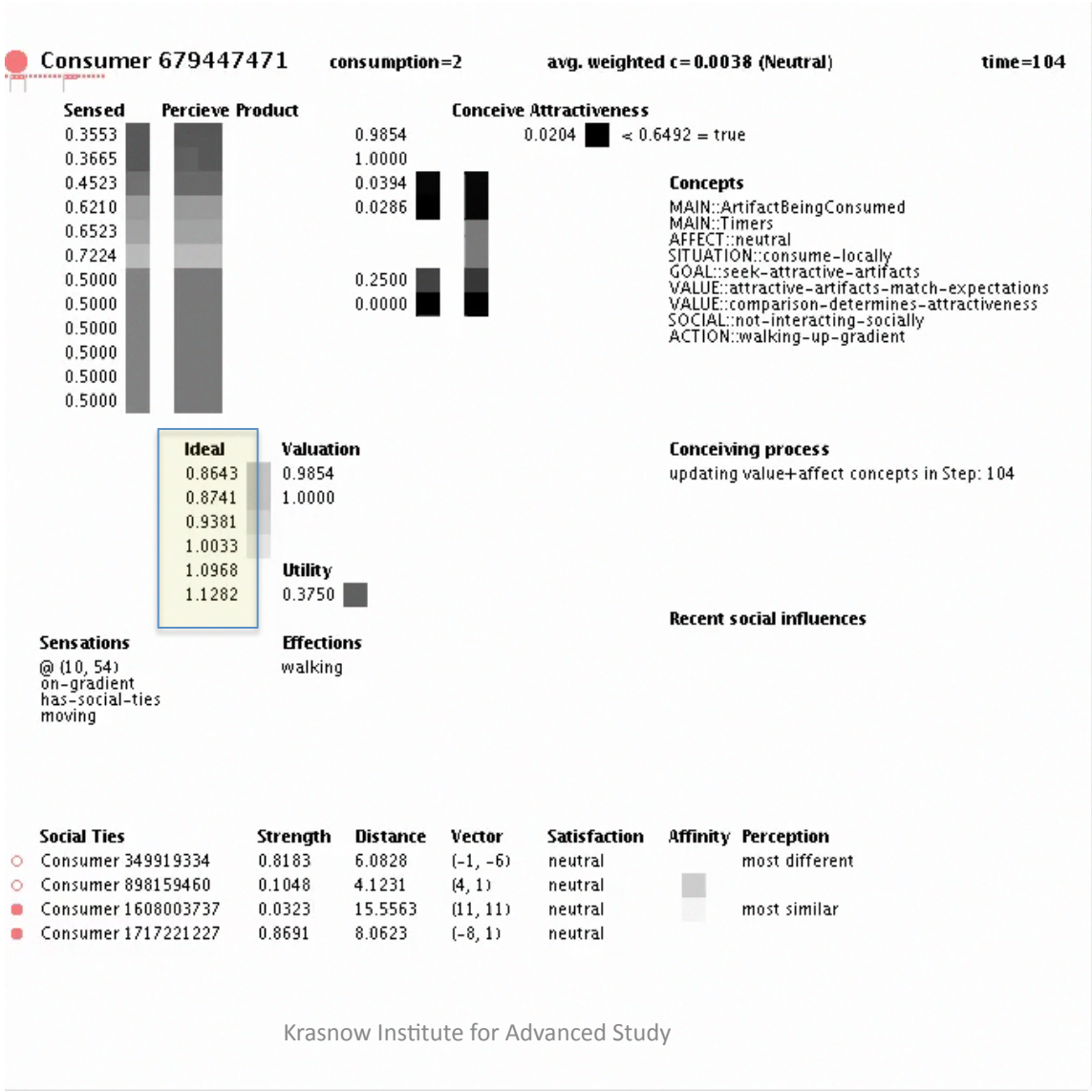
Cognitively Rich Agents



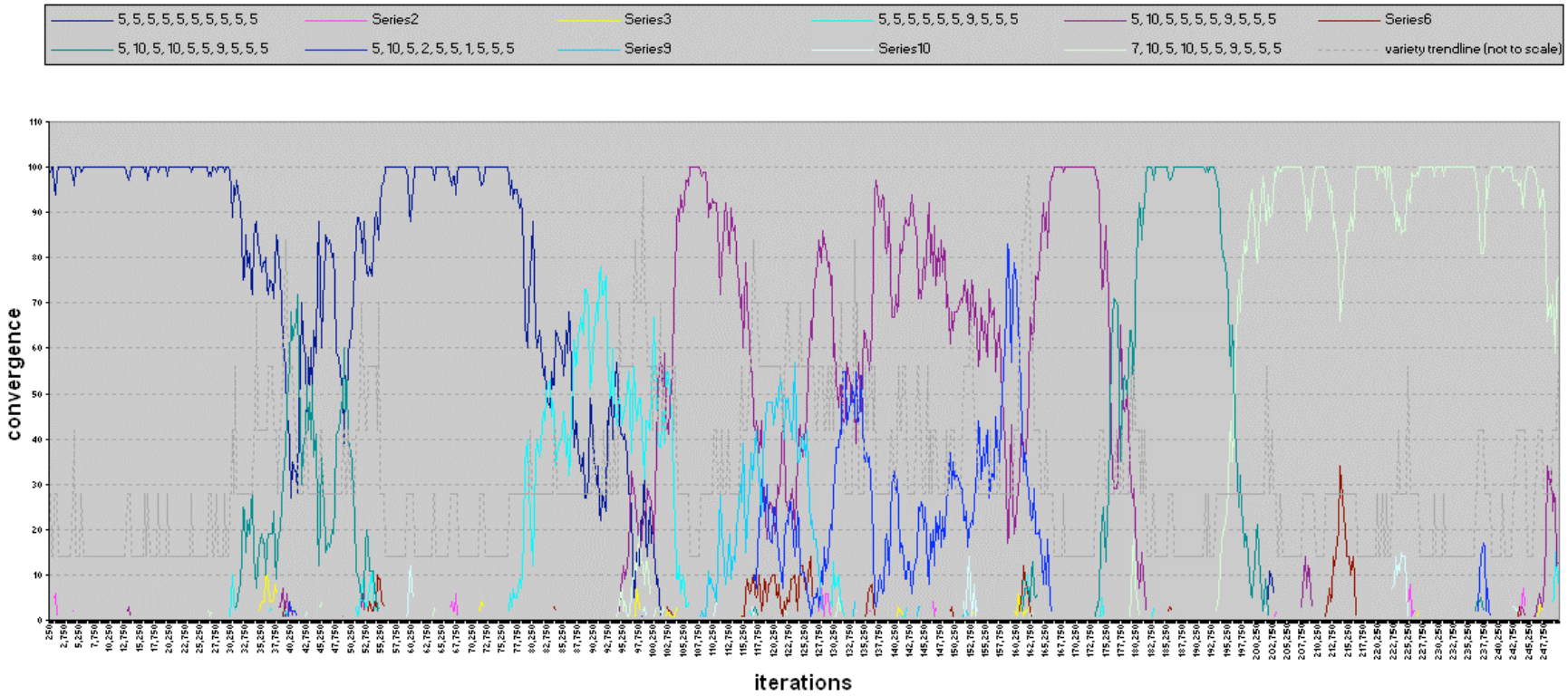
Changing Value of Ideas



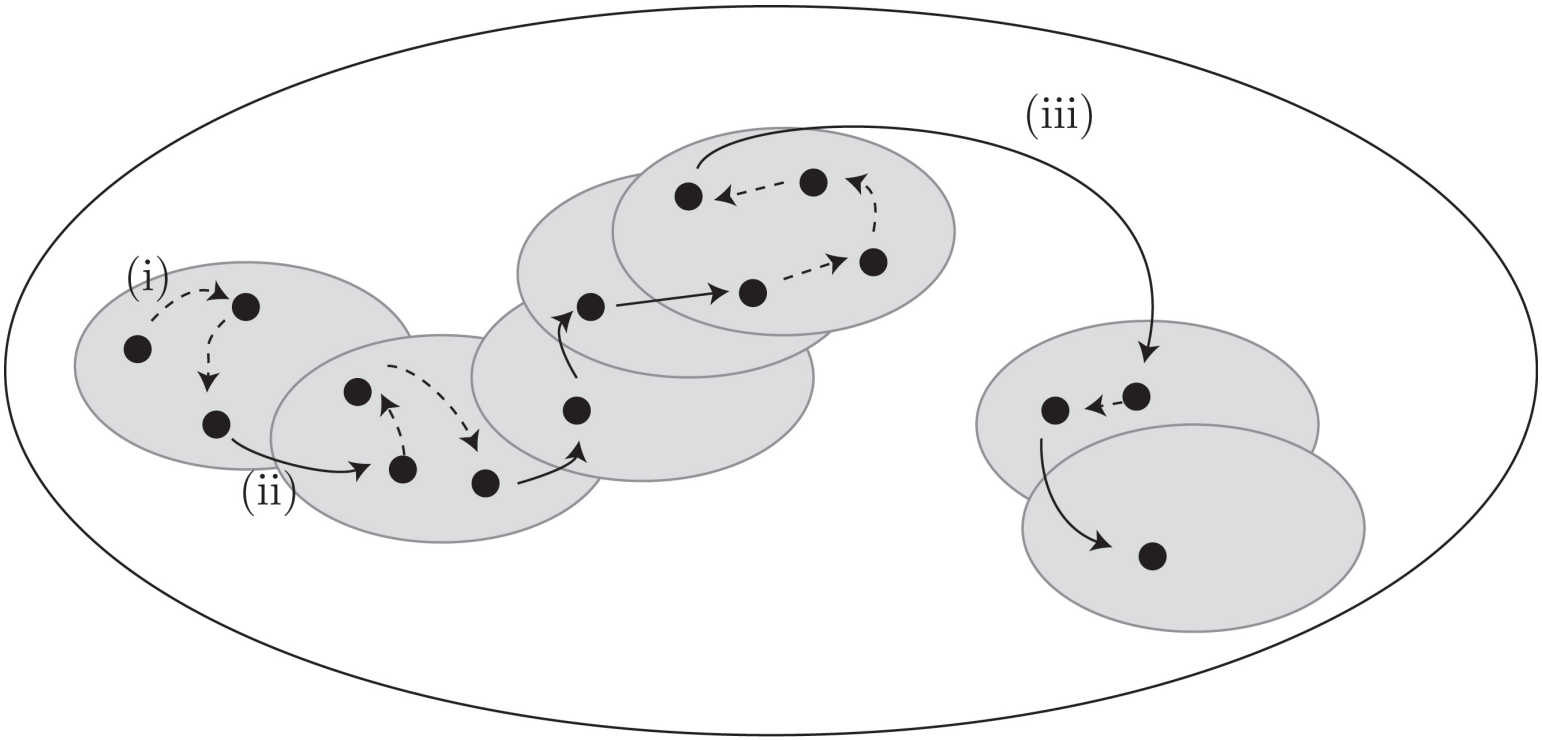
Changing Values Through Interaction



Valuation of Ideas



Situated Social Behavior of Complex System of Teams



Acknowledgements

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