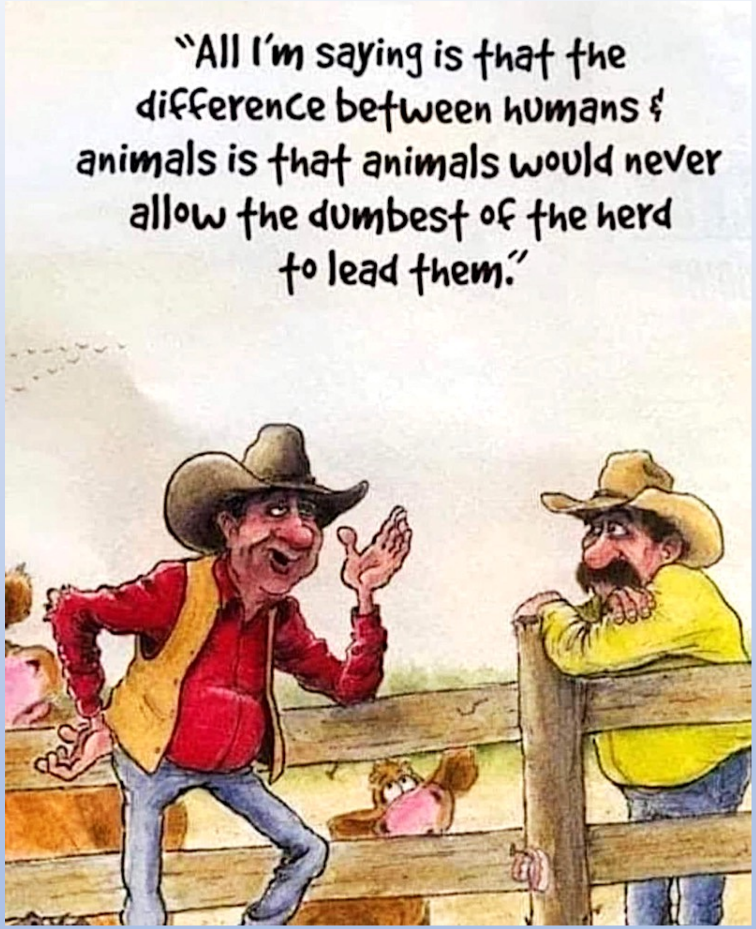
Observations on Modeling Social Identity (SI): Suggestions to address the challenges of SI

Norman L. Johnson

Referentia Systems, Honolulu Hawaii, Santa Fe New Mexico

norman@SantaFe.edu

http://CollectiveScience.com



Is the reason for this that we (humans) are behaviorally different?

Or, is it that our society is different, and triggers maladapted but evolved social behaviors?

(Animals don't have social media! Cities, mixed cultures, …)

The perspective that follows is that some of the human social behavior is similar to other social organisms, but is expressed differently because adaptability has created a social society that is very different than where we evolved. For example, 10,000 years ago we knew everyone in our community, but now most people are strangers. This has consequences on how our social identity is expressed.

The second perspective is that fundamental changes in societies are resisted from the top down, yet change occurs from the bottom up. ➔ Coordination in and across identity groups is key to solving the grand challenges of society.

Introduction: Vegetarian Chicken Ham

Complex social organisms (humans) have individuals with multiple, distinct social identities

Mixing causes cognitive identity dissonance and stress, which results in maladapted behavioral changes

Most of the talk focuses on

1. How (emergent) group performance is uncorrelated with individual performance in certain types of problems. Models where group fitness is derived from individual fitness may miss important societal features
2. Why Social Identity (SI) is maybe missing in many SSC talks when it's obviously relevant

See my paper for details on

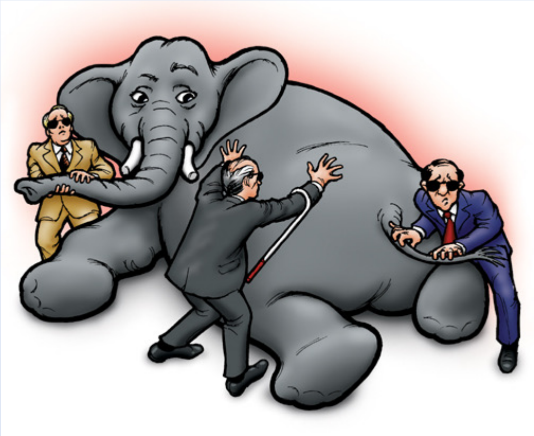
- The modeling consequences when SI can form from trivial features
- Need for habitual SI and triggers and thresholds of SI behavior in models
- Is there a universal SI model for all social organisms? And what are the benefits of such a model?
- We really need a validated community model for SI, motivated by the success of an analog in computational epidemiology

(Email me for the SSC2022 paper or available online at my LinkedIn and academia.edu)

The next slide captures how there has been a bias against theories of group processes (such as group selection) in the last 60 years. And, how that bias may still be active and impact the acceptance of the application of social identity in many models and theories when it would seem to be obvious.

Why isn't SI more common at SSC2022? There is a history of the repression of research on collective performance

"Current sociobiology is in theoretical disarray, with a diversity of frameworks that are poorly related to each other. Part of the problem is a reluctance to revisit the pivotal events that took place during the 1960s, including the rejection of group selection and the development of alternative theoretical frameworks to explain the evolution of cooperative and altruistic behaviors... **Multilevel selection theory** (including group selection) provides an elegant theoretical foundation for sociobiology in the future, once its turbulent past is appropriately understood." – E. O. Wilson and David Sloan Wilson 2007



Evolutionary origins of cooperation has been poorly studied, largely not capturing the emergent origins of cooperation (Hemelrijk 1997), continuting to this day. Relevant to group selection and group fitness in SI models.

The bias towards the research of the higher performance of diverse groups over experts: "*I don't see what is wrong, but it can't be right*" a Reviewer's comment of pre-pub from Johnson 1998

There was a bias against collective performance for over 50 years. Yes, recent acceptance of multilevel selection and the popularization of "collective intelligence," resulted in improvements, but there still remains some blind-spots in the acceptance of SI, particularly how SI modifies social networks and affects group performance.

The next slides capture the ”low hanging fruits” of desirable additions to SI models and simulations:

- The modeling consequences when SI can form from trivial features
- Need for habitual SI and triggers and thresholds of SI behavior in models
- The need for a validated and accepted community model of SI dynamics, based on how an analogous community model for epidemics changed the modeling approach in epidemiology and led to realistic, large-scale resources

Two examples from recent publications illustrate the need for the first two additions.

Behavior-influencing SI from trivial differences

Observations

- *"… competition is not necessary for group identification, and even the most minimal group assignment can affect behavior. 'Groups' form by nothing more than random assignment of subjects to labels… Subjects are more likely to give rewards to those with the same label than to those with other labels, even when choices are anonymous and have no impact on [their] own payoffs."* Akerlof and Kranton 2000
- Social behavior (SI?) in lower social organisms (wasps) is not determined by genetic kin but by ecological, physiological, and demographic factors Gadagkar 2001
- **SI theories, models, and simulations seem to omit the possibility of SI formation without some fitness payoff, even though Tajfel's initial SI work was based on these early experiments** Hornsey 2008

Recommendations

- **Treat SI as an innate need** at the bottom of Maslow's pyramid in all social organisms, but where the expression is determined by social sophistication and environment
- **SI is an "innate attractor"** in the individual, requiring minimal stimulus, even random, to cause SI expression
- **Why overlooked?** Experimental designs specifically trigger mature expressions of SI, consciously or unconsciously
- **How important is this recommendation?**

  The inclusion of random generation of individual SI may improve (emergent) group performance and robustness (Johnson 1998)

Triggers, thresholds, and habitual behavior in SI dynamics: the overlooked simulation options

Questions

- **What are circumstances in which a new SI is induced or a pre-existing SI expression is triggered?**
- **Is the formation or expression of SI a gradual or abrupt process? Is there a threshold transition?**
- **Can the expression of a SI be a habitual state, not requiring an active choice?**
- **What triggers the expression of one of many multiple SIs in an individual?**
- Do lower social organisms have multiple SIs?

Observations

- CONSUMAT (Jager et al. 2000) used three core behavioral models
  - **Habitual** as a rest state
  - **Rational choice** <= triggered by historical need dissatisfaction
  - **Social copying <= triggered by stress or uncertainty**
  - Thresholds on triggers were essential for realistic dynamical results
- A 2017 framework (Schluter et al.) for comparing behavioral theories of social-ecological systems does not explicitly include SI, triggers, and thresholds as essential features. But Social norms are included.

Recommendation: a realistic SI model must include a rest state of habitual behavior, with triggers for activated behavioral states and thresholds for transitions (these thresholds could be path-dependent)

SI model development and testing needs a validated community like this:

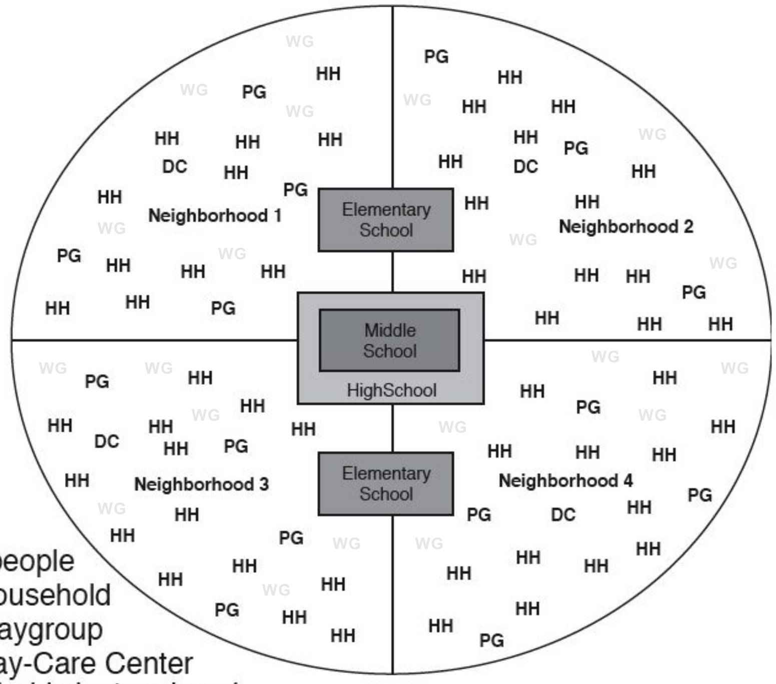
Person-to-person tranmission in a 2000-person Community Model for Smallpox

Science 298, 1428 (15 Nov 2002)

Containing Bioterrorist Smallpox

M. Elizabeth Halloran,* Ira M. Longini Jr., Azhar Nizam, Yang Yang

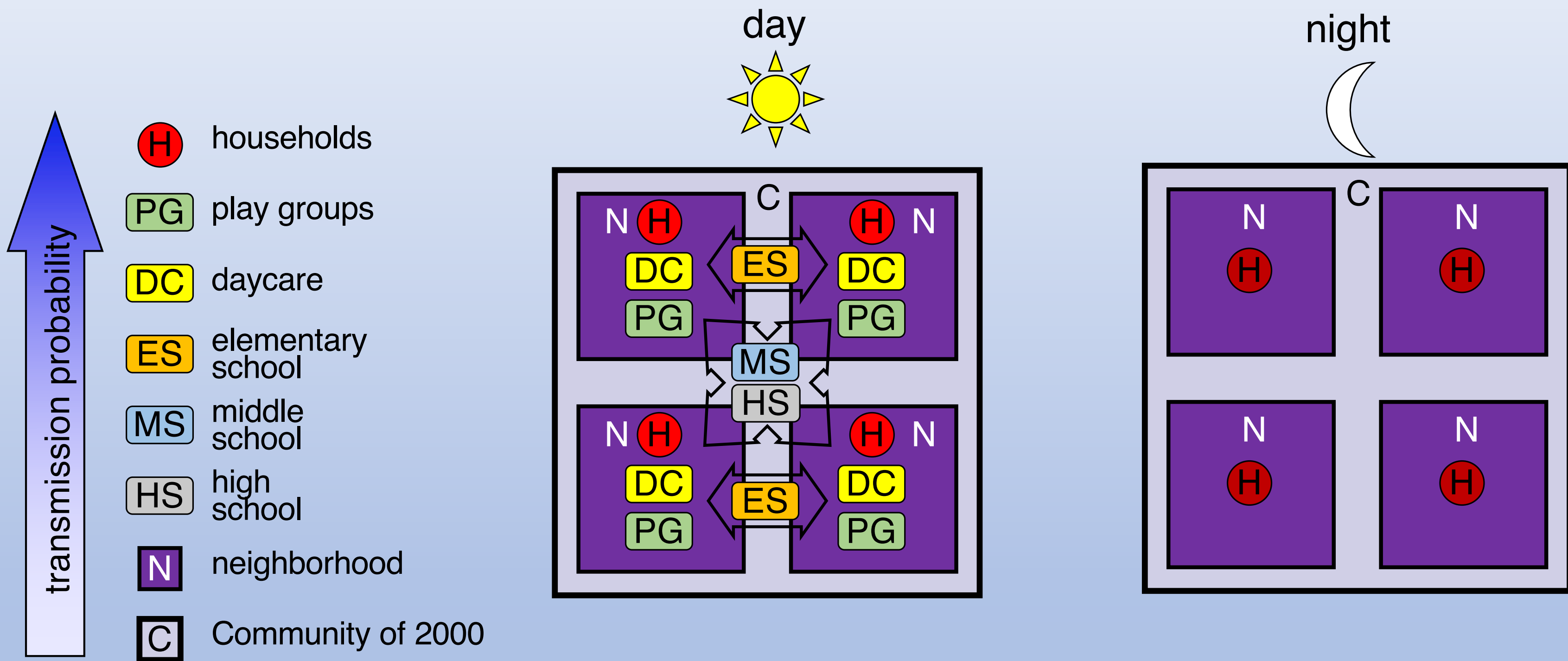
The need for a planned response to a deliberate introduction of smallpox has recently become urgent. We constructed a stochastic simulator of the spread of smallpox in structured communities to compare the effectiveness of mass vaccination versus targeted vaccination of close contacts of cases. Mass vaccination before smallpox introduction or immediately after the first cases was more effective than targeted vaccination in preventing and containing epidemics if there was no prior herd immunity (that is, no prior immunologic protection within the population). The effectiveness of postrelease targeted and mass vaccinations increased if we assumed that there was residual immunity in adults vaccinated before 1972, but the effectiveness of targeted vaccination increased more than that of mass vaccination. Under all scenarios, targeted vaccination prevented more cases per dose of vaccine than did mass vaccination. Although further research with larger-scale structured models is needed, our results suggest that increasing herd immunity, perhaps with a combination of preemptive voluntary vaccination and vaccination of first responders, could enhance the effectiveness of postattack intervention. It could also help targeted vaccination be more competitive with mass vaccination at both preventing and containing a deliberate introduction of smallpox.



2000 people
HH: Household
PG: Playgroup
DC: Day-Care Center
Household cluster size: 4

This epi-community model became a standard tool in the development of models and applications in epidemiology and was replicated to capture populations of millions of people in EpiCast, which became used worldwide (Germann et al., *Mitigation strategies for pandemic influenza in the United States*, PNAS **103**, 5935-5940, 2006). Similar possibilities are possible for SI modeling. A recent publication uses a similar community model: Agrawal, R. et al., "*Socially Intelligent Genetic Agents for the Emergence of Explicit Norms*" ArXiv abs/2208.03789 (2022).

The Halloran epi-community model even included Day/night separation of work/home transmission as an important feature of disease spread.
What are the important features of a social identity community model?



I developed a framework for a SI community model, including social media, to be used in a decision simulation resource for the deployment of messaging in regions with polarized populations: Johnson, N.L.: *Final report of SAGE: Situational Awareness for the Get-The-Word-Out (GTWO) Environment project*, 98 pages (September 23, 2009). Request CDRL A001AC, N00014-09-M-0190 from the Office of Naval Research.

Example: ABM Implementation of a comprehensive Social Identity Theory (SIT + SCT) (Upal & Gibbon 2015)

Description

- **"How SI ABM simulations can be a valuable tool for theory refinement" using a rational choice theory**
  - Intergroup behavior is based on Tajfel's SIT and later Self-Categorization Theory (SCT)
  - Includes a comprehensive spectrum of socio-structural beliefs, individual and collective strategies, intergroup permeability, personal and group costs…
- **Simulations of 100 agents**, examined 12,000 simulation groups with 500 rounds per group with random distributions of individual resources, agent perceptions of permeability, legitimacy, stability, and individual esteem.
- **Analysis of the simulations** examined correlations between the input parameters and outcomes of multiple SI management strategies ➔ two "emergent" (unexpected) results: 1) the positive correlation between average group resources and all SI actions and 2) the negative correlation between outgroup resources and SI actions.

Comments

- Implementations of the SIT were linear in all relationships and deterministic.
  - No triggers or thresholds in SIT were used
  - No habitual behavior used
  - No random formation of SI from trivial or random features
- **The linear nature of the dynamical model results in smooth relationships in the dependent variables with the independent parameters ➔** Correlations become sampling from normal distributions with few interesting features, possibly or likely hiding all but the strongest dependencies.
- **The inclusion of habitual behavior, triggers, and thresholds would result in nonlinearities that might (probably?) yield more realistic dynamic**s, although with greater model complexity and analysis.
- Confusion when using "emergent" instead of "unexpected" results

ABM study of how different types of diversity affect trust, conformity, and group SI utility (Fazelpour & Steel 2022)

Description

- **Studied the important topic of the positive and negative effects of different types of diversity on SI performance with respect to trust and conformity.**
- **The challenge problem**: two-armed bandit
- Payoff preferences are shared based on a predetermined and fixed social network
- **➔ Different types of diversity "can, in certain circumstances, benefit collective performance by counteracting two types of conformity that can arise in homogeneous groups: those relating to group-based trust and those connected to normative expectations toward in-groups"**
- Duplicates the discoveries from the 1990s research into the positive correlation between group diversity and group performance (Johnson 1998, Hong 2004)
- But argues that demographic diversity (including SI) trumps cognitive or experiential diversity

Comments

- **The use of a fixed social network is a problem**
  - Although the study claims the variable weights of social network connections capture intergroup dynamics, details are missing to make an assessment
  - This is a common problem in many SI studies!!
- **No modeling information is provided if triggers and thresholds were included** in the implementation of behavior models, communications, or strategies
- **Habitual behavior is not mentioned**, but the model does include reinforcement learning
- **Because the ABM simulations duplicate prior conclusions about group performance and diversity, this makes it a useful model for testing SI theories and the tension between diversity and conformity**
- But model details are insufficient to assess the conclusions about demographic and cognitive diversity.

The following slides discuss the possibility of a universal SI model.

Followed by a longer discussion on how including emergent group fitness may affect SI models.

Levels of social and individual complexity in social organisms

slime molds	"low" social insects	"high" social insects	social mammals	"low" apes	"high" apes	humans

Social identity, diverse, decentralized, collective survival and problem solving, collectively adaptable, self-organizing, emergent properties

Collective memory, Collective Intelligence, Deception

Individual intelligence & emotions

Individual sentient, consciousness & complex

My slide from a workshop on "The Evolution of Social Behavior" which covered experiments of a wide range of social organisms

Observation: All social organisms when stressed copy peer behavior – not of others, but group self

Social Identity (SI) is a property of all Social Organisms

Observations

- **A revelation:** At a Social Behavior Workshop, observed that all social organisms express social copying when stressed or uncertain (last slide)
- **Recent advancements of modeling in the "hard sciences"** (My professional identity) – which have the advantage of general governing equations (accepted by all) plus application-specific constitutive equations (models of reality).
- **Major advances due to massive computing power:** epidemiology, solid mechanics, & turbulence using simple models with high spatial resolution, replacing complex models with low resolution. Now ABM sims capture some of these advantages.

Questions?

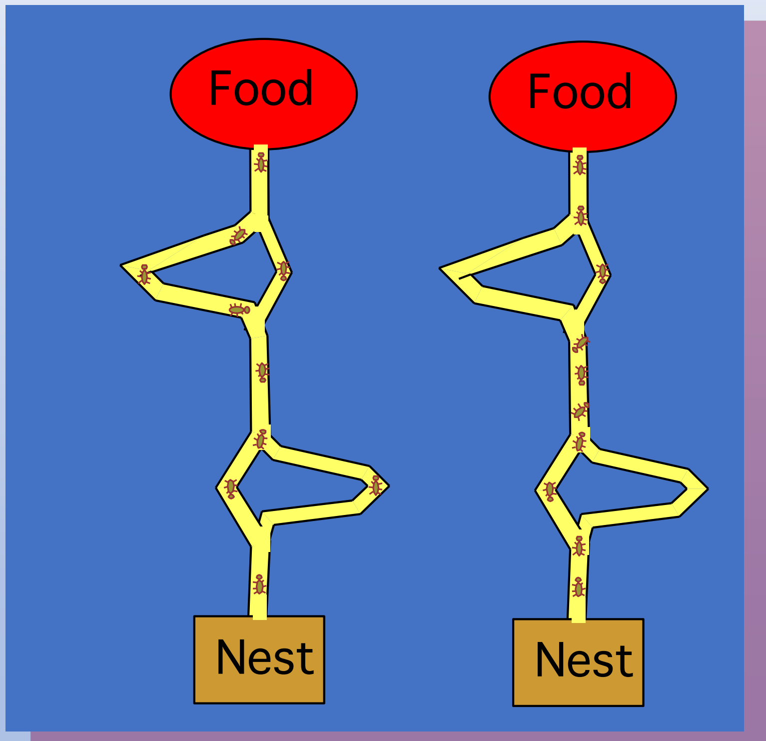
- For SI modeling, what SI foundation is accepted by all?
- For example
  - SI behavioral changes from uncertainty and mild stress, maybe fear or anxiety
  - Habitual SI behavior (later)
  - Allowing SI to be triggered by trivial features (next)
- **Can more realistic SI behavior be captured from a universal SI model, combined with realistic & dynamic social networks, which are changed by the SI model?**

My working definitions of SI: When SI is triggered: 1) the messenger is more important than the message and 2) When something is done to a member of your SI group – good or bad, you feel like it was done to you.

Ant Foraging Solving "HARD" NP-complete problems

To illustrate why SI models should capture emergent group fitness

The ant colony finds the shortest path in complex environments



While probably the most studied example of self-organization where local simple rules yield a global solution (shortest path) or behavior (flocking).

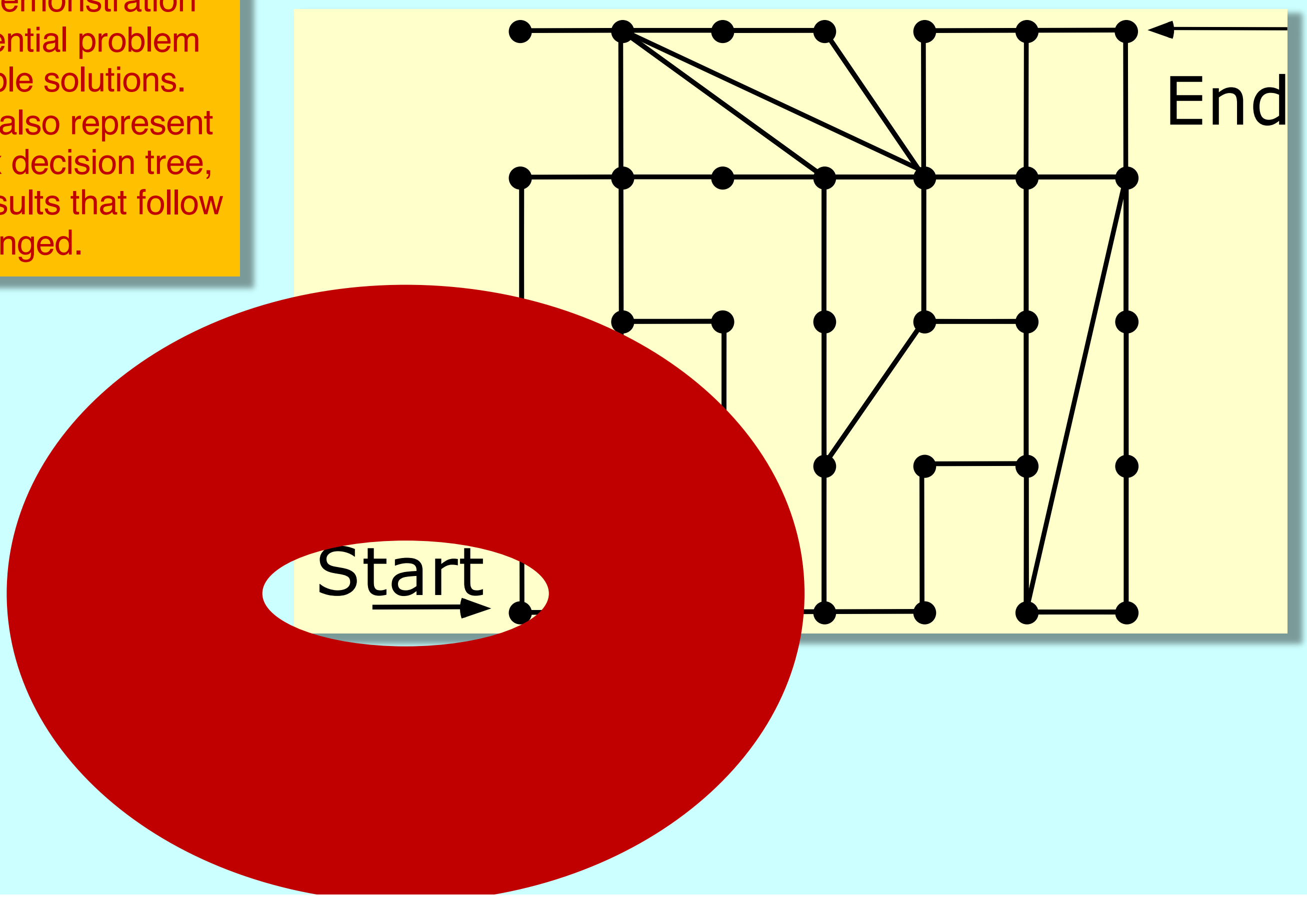
The dominant view: over time the pheromone trails are strongest on the shortest path and one ant can be found that exploits this shortest path, and soon the entire collective.

In the following I'll show a similar model problem from Johnson 1998 that shows how the aggregate individual performance is lower than a "collective" individual following the global (emergent) pheromon path using the same rules. But only for a certain range of complexity of the problem.

How you think it works may not be correct

A Model for Solving *Hard* Problems from Johnson 1998

Why a maze? It is the simplest demonstration of a sequential problem with multiple solutions. But could also represent a complex decision tree, but the results that follow are unchanged.



How can groups

> solve hard problems
> without coordination
> without cooperation
> without selection?

Use a Maze with many solutions

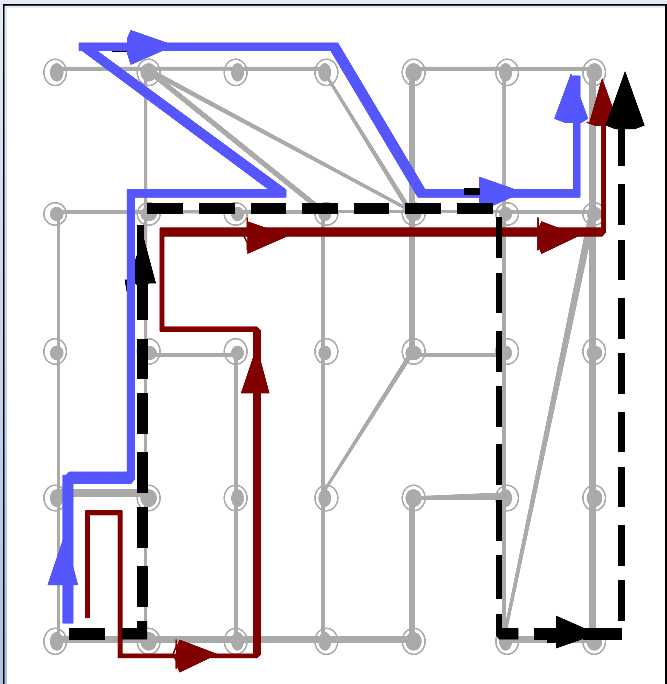
> non-optimal and optimal.

Individuals

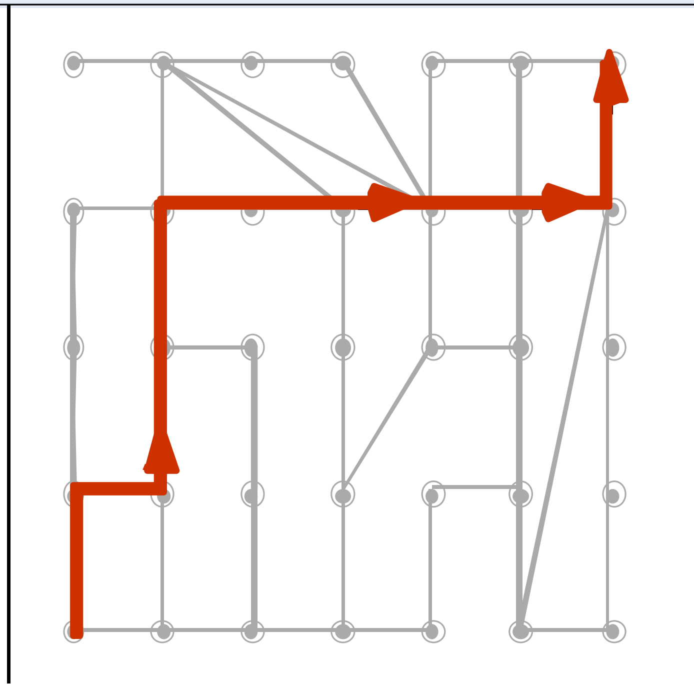
> Solve a maze, no global perception
> Independently
➢ Same capability
➔ produce experience

Group solutions uses different aggregates of the individual experiences USING the same rules (capabilities) as the individual.

How group information results in the Shortest path



Paths of three ants



Collective path

On the left, paths of three individuals are shown – independently found. None of them the optimal path, because they have loops that are not closed.

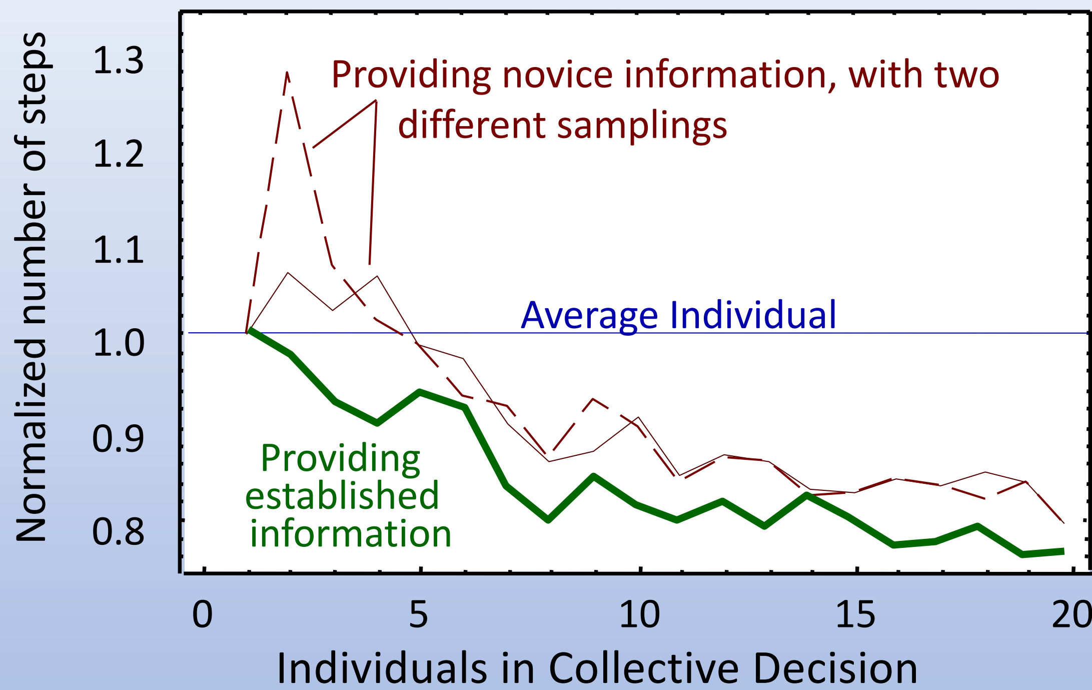
On the right is the path taking the strongest "pheromones" or individual preferences, yielding a group preference path that is the shortest path.

This is the state before any of the ants use the emergent pheromone path, so there is no one ant using the optimal path – contrary to popular beliefs.

Hence, if the group fitness is based on the aggregate individual fitness, it will miss the emergent group fitness.

For example, If natural selection is applied, no individual has the optimal fittest. This is why emergent group selection is important.

Group Performance beats the average individual…



This graph shows how the steps of the group path for the maze in the previous slide, as based on the aggregate individual information of larger and larger sized groups, normalized by the average individual steps (11.8).

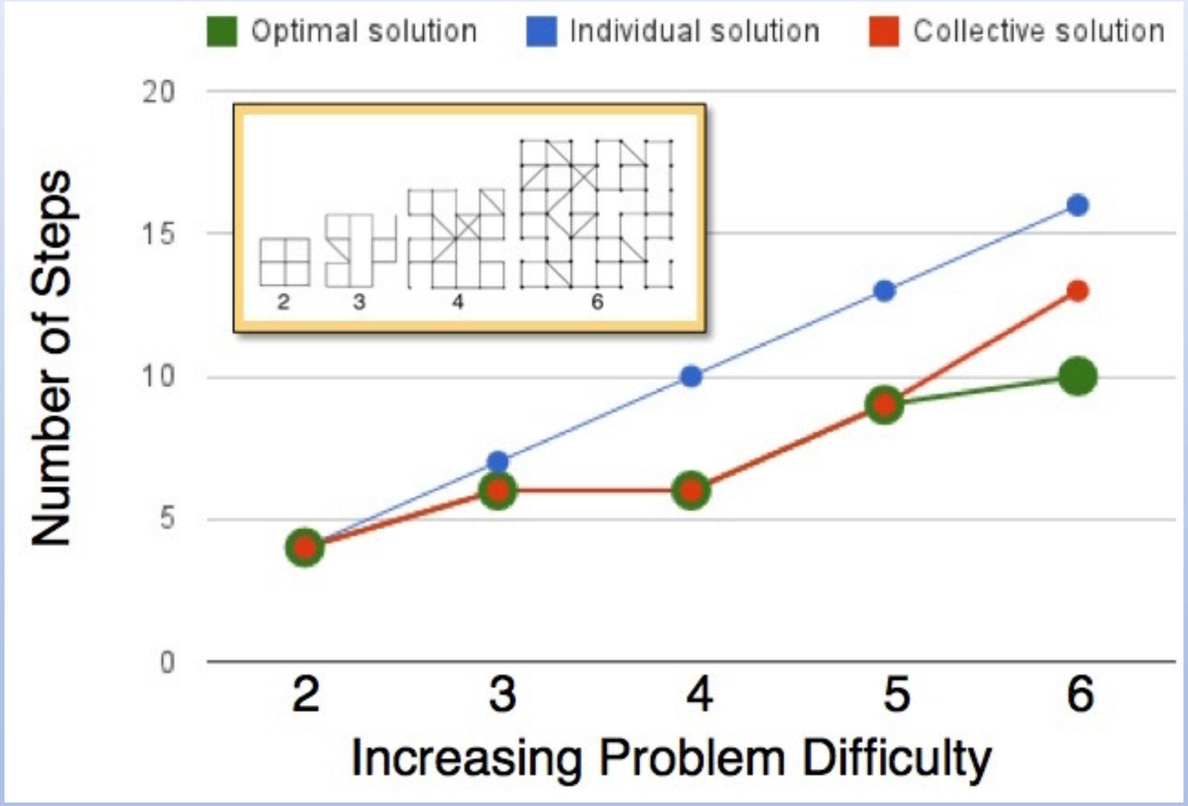
The upper red curves show two different groupings of individuals – showing how randomness is highest for smaller group information aggregates.

The lower green curve uses individual preferences that exclude the extraneous loops, which would be dropped.

An analysis shows that the convergence to the optimal solution correlates with the unique diversity of the individuals in the group.

Conclusion: the collective solution converges to one of the shortest paths without requiring cooperation or selection.

How problem complexity affects group performance

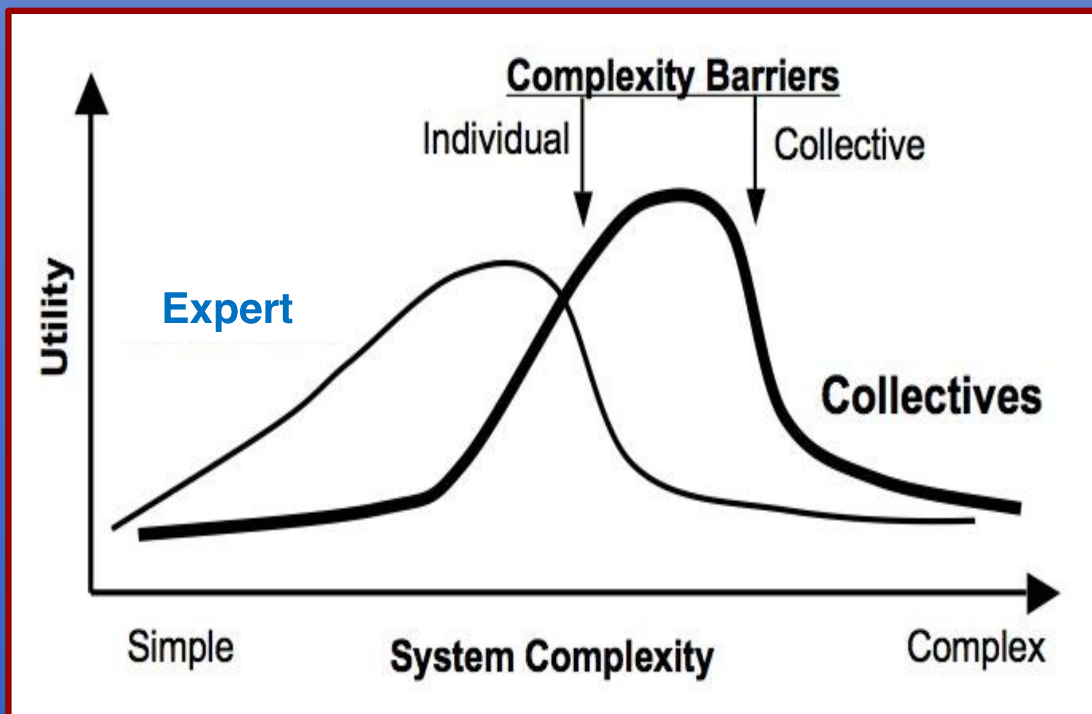


This graph shows the performance of the collective for large groups (converged). Three results are shown for each maze size: the optimal solution (green), the individual performance (blue), and the collective performance (red).

Observe how the individual and collective performance are the same for low and high (for larger mazes) problem difficulty. For low difficulty, all the individuals can optimally solve the maze, so the collective solution has no advantage. At the hghest difficulty, the individual's solution, using the same rules, appears to be a random walk, showing no capability. Hence, the collective solution has no individual weak signals to amplify in the aggregation.

Hence, **the emergent collective solution shows a benefit only for a range of complexity.** The lesson is that SI simulations that evaluate group SI fitness must allow for the emergent collective performance, but only for a range of difficulty.

Utility of Performance vs. Problem Complexity



System complexity:
Number of rules, randomness, interdependence, tipping points …
Even diversity of social identity – interenally and externally

This figure is a cartoon showing the last results in terms of how the utility of the expert and collective changes with system complexity.

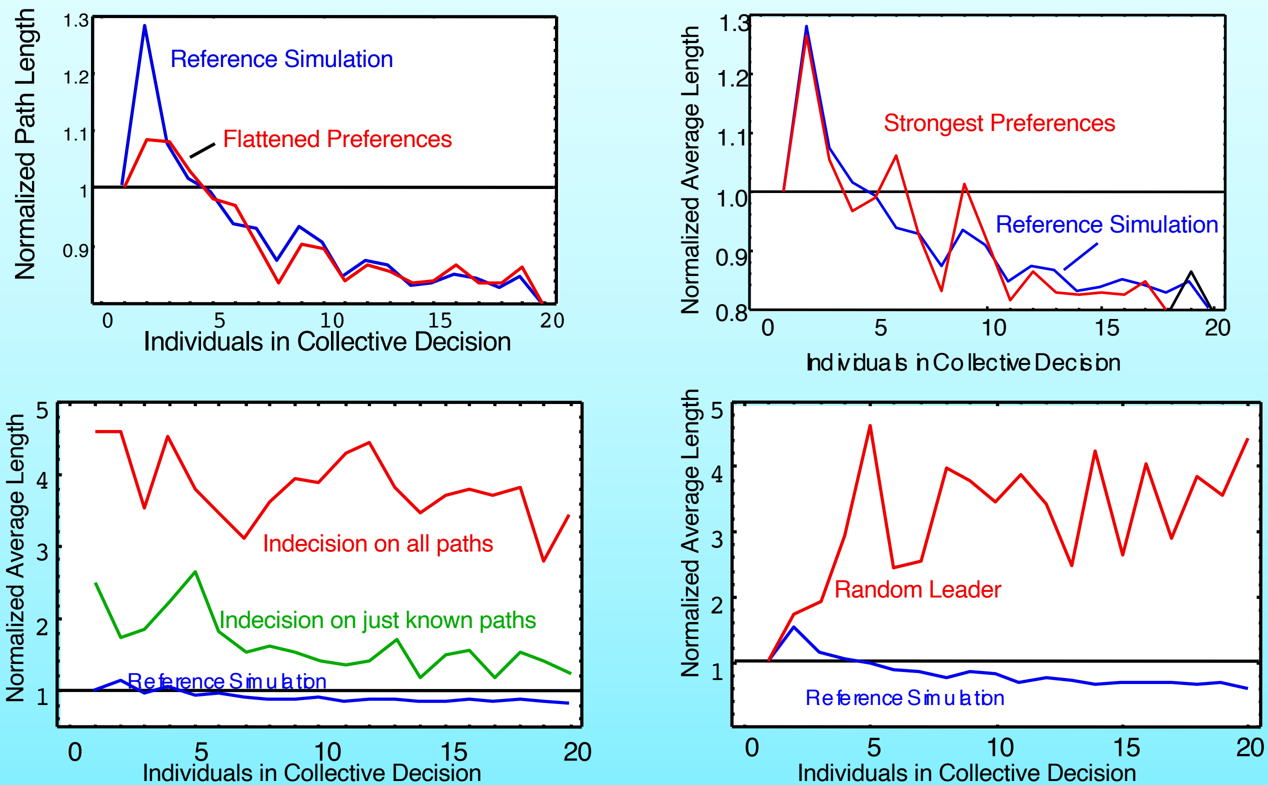
The individual and collective utility experience a complexity barrier at a certain levels of complexity.

The shift from individual to collective utility is why social identity and group selection have evolved.

In ant foraging, ants have evolved communication strategies to solve harder problems than an individual can solve. Humans have done the same but also suffer from maladaptation of their SI traits.

Effect of Loss of Individual Contributions?

Social identity can modify the contribution of the individual.



These four figures capture how the collective performance changes as the contribution of the individual is modified (see Johnson 1998 for details).

These are common considerations on how SI may modify individual contributions.

For example, conformity may make the individual share their flattened or optimal preference in order not to stand out. But the consequences to the collective performance are not significant.

But, contributions that are indecisive (one preference at each node is given, but not necessarily the best for the individual) or the selection of a random leader at each node, results in no convergence in the collective path.

Summary of results of emergent group fitness

(red text shows other results from the same study not presented earlier in this talk)

What the ABM sims say (Johnson 1998)

- **Emergent group utility can be uncorrelated with aggregate individual utility**
  - may alter conclusions about the SI utility
- **Emergent group performance is extremely robust to noise** (70% of information can be replaced)
  - The expert or individual is strongly affected
- **Group performance is robust to individuals having different goals**
- **The emergent group performance is robust to uncorrelated bias in the individual contributions**
  ➔ SI groups may show higher emergent performance in experiments in the presence of miscommunication or misinformation.

What is required for the best solution

- **Requires a shared worldview**: agreement on options at decision points, agreement on meanings of information, but not necessarily the same goals
- **Lower group performance results when group participation is based on individual performance!**
- **Required of the individual expression for an optimal emergent solution**
  - The individual must have some level of performance (can't be random across all agents)
  - When the individual can communicate their full or partial experience to the group solution,
  - Fails when multiple individuals defer to a leader

Including emergent properties in multi-level SI simulations can result in more robust and realistic models, change the conclusions of non-emergent studies, and contribute to a new understanding of SI in group performance.

Summary and New Social Identity frontiers

Recommendations

- **Model emergent (generative) group fitness for robustness, adaptability, and evolutionary insight, considering the sweet spot of problem complexity**
- Don't get discouraged about your SI conclusions, the reviewer may have a collective fitness bias
- **SI Models must always include habitual behavior with SI triggers and thresholds**
- **Consider a universal SI model for all social organisms** (response to stress, uncertainty, fear)
- **Group and individual SI utility can be maladapted.**
- **Consider the formation of SI from trivial features ➔ SI is an innate attractor in all social organisms, but SI behavior is an expression of the individual internal states and environment**
- **Develop and use a validated SI community model**

Evolutionary view across all systems

- **Observe: One function of SI that has evolved in all social organisms is the expression of an innate immune response to others – a primitive brain/behavior feature.**
- **BODY immunity**: the body's adaptive immune system has an *awareness of the biological self* to protect from outsiders while not attacking the high diversity within
- **BRAIN immunity**: Consciousness or sentience evolved from the need for the awareness of the self to protect the thinking self from dangerous or distracting external ideas while managing the diversity of internal ideas (unpublished work)
- **Emergent SI immunity**: Can human SI functionality be viewed or modeled as an emergent self-awareness or consciousness of the SI group, providing the group-self immunity from others in the ideation space, while managing the high internal individual diversity?
- Why do we elect dumb leaders? It's an autoimmune disease!
  Gabor Maté: "The Myth of Normal: Trauma, Illness, and Healing in a Toxic Culture" 2022

The following slides are more material on using emergent modeling instead of traditional methods

One extreme: Direct or Traditional Modeling

Centralized, premeditative, analytical, scientific

- **Process**
  - Experiment -> analyze & understand -> model & predict -> control & test. Repeat.
- **Applicable systems**
  - Small systems of high complexity or large systems of low complexity
- **Typical goal**
  - What is the most simple model that will describe the system?
- **Advantages**
  - Optimal performance and use of resources
  - Predictive within application space (interpolative model)
- **Disadvantages**
  - Interpolation only: Limited prediction outside the application range
  - Limited capability to explain origins of capabilities or properties
  - Limited by modeler's understanding
- **Failure mode**
  - Extension outside of range of applicability, extrapolation fails
  - No adaptability, resilience, redundancy, robustness.

Other extreme: Emergent* Modeling

Decentralized, intuitive, hierarchical, computational

- **Process**
  - Create components as in the Direct Model, define relationships
  - A "Solution" arises from the dynamics from a diversity of potential solutions
- **Applicable systems**
  - Large systems of high *global* complexity
  - Engineering simulations
- **Typical goal**
  - Modeling a system that cannot be understood or treated as an aggregate
- **Advantages**
  - Dynamics lead to emergent properties and new features
  - Prediction outside application of components (true extrapolation)
  - Capability to explain origins of capabilities or properties
  - *Robust, resilient, adaptable, fault-tolerant, scalable*
- **Disadvantages**
  - No theory
  - No recipes for their creation
- **Failure mode**
  - Over-specification of the components blocks emergent properties

Josh Epstein might call this “generative”

Challenges with Emergent Properties

- An emergent property is dependent on what you define as the system, its internal parts and its surroundings
- A model with emergent properties emphasizes "dynamics between parts," instead of "states of the system"
- The predictive burden is on the model, rather than the modeler
- **Theory of emergent properties in more complex "Complex Systems" is missing and likely not to be achieved soon**

Advantages of Emergent Properties

- Models with emergent properties are generally as descriptive as “direct” models, but are more simple.
- Emergent properties do not have the bias of the modeler (note that emergent properties may not be beneficial)
- When global performance is directly tied to individual traits (e.g., cooperation), the origin of the performance is often an emergent property
- **Emergent properties are all about diversity in some form - traits, potential solutions, histories, demographics, etc.**
- Remember the social ameba and social insects