Where Do Best Ideas Come From? Unpacking Idea Trajectories on Small World Networks

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Where do the best ideas come from?

Theoretical starting point: organizational theory

People search on their own

"...we noticed that many of IDEO's designs contained innovative features that engineers had seen in previous products."
(Hargadon and Sutton, 1997: 723)

People transfer, copy, synthesize, refine ideas by talking to their contacts

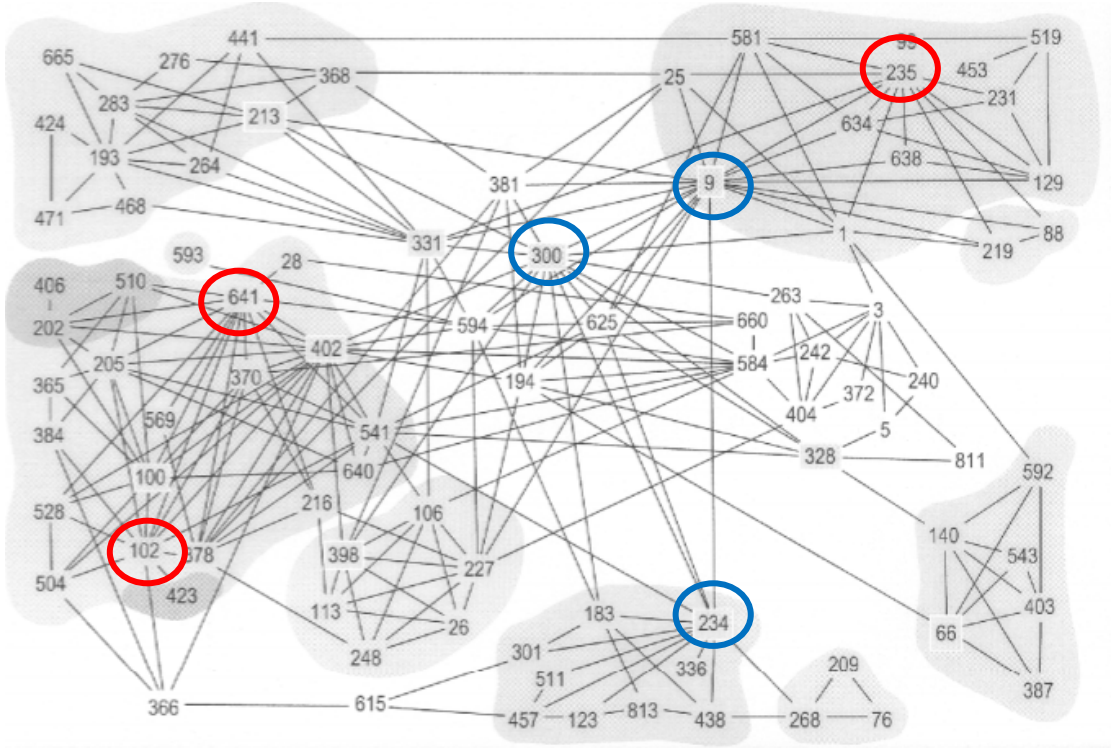
(e.g., Burt, 2004; Fleming et al., 2007; Hargadon and Sutton, 1997; Reagans and McEvily, 2003; Uzzi and Spiro, 2005)

Interactions occur on "small world network"

- Knowledge and information are sticky and more homogenous within network communities
- The transfer and recombination of ideas between network communities is essential to producing good ideas

  "New ideas are created as combinations of old ones." (Collins, 1987: 67)

  "*People familiar with activities in two groups are more likely to see new beliefs or behaviors that combine elements from both groups*." (Burt, 2004: 355).



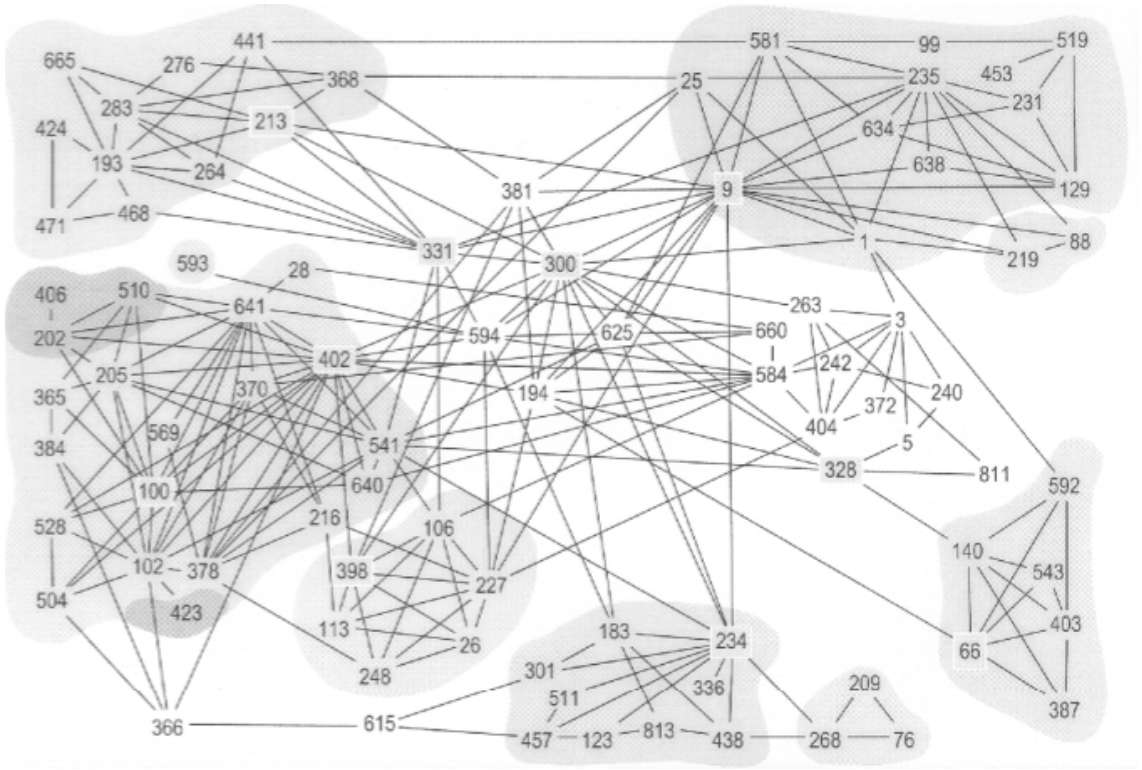
Source: Burt, R. S. (2004). Structural holes and good ideas. *American Journal of Sociology*: 366.

Individual Actions, Social Structure, and Best Ideas

Current literature is emphasizes *good* ideas, not necessarily *best* ideas. But reasonable to infer the following propositions …

Proposition 1: Between network community recombinations lead to best ideas.

Proposition 2: Although high levels of copying between actors can reduce the overall diversity of knowledge in an organization, between network community transfers can lead to best ideas by exposing actors to diverse knowledge that exists within the organization



Shortcomings of Current Theory and Evidence

- What explains variation in quality of ideas?
  - only *"some fraction of the brokerage-spawned new ideas are good"* (Burt, 2005: 59)
  - brokers go through numerous *"novel combinations of existing practice or opinion [that] are worthless"* (Burt, 2010: 5)
  - role of non-brokers

- The processes of transfer and recombination that assumed to underlie the advantage of social structures are frequently theorized, but are rarely observed and hence are only weakly understood.
  - Creativity and entrepreneurship research suggests that solutions to particularly complex problems are hard and are likely to require multiple steps (refinements, recombinations) (Amabile, 1996; Berg, 2014)

Idea → Best idea

?

Our Approach

Use agent-based modeling as a tool to build and refine current theory

Emphasis on how the social structure of interpersonal relationships and the underlying activities on that network intertwine

Make visible (typically) unobserved processes and outcomes

- best possible idea for the collective
- idea evolution and trajectories

Desired System Characteristics for Model

Ideas and Idea Performance

Ideas are characterized by multiple features that work together to determine the value of the idea to the organization.

Ideas continuously move through social space in the process of discussion and imitation, being morphed, changed, and synthesized along the way.

Social Structure

Social networks in organizations are described by small-world structures that included tightly interconnected network communities that are sparsely connected across.

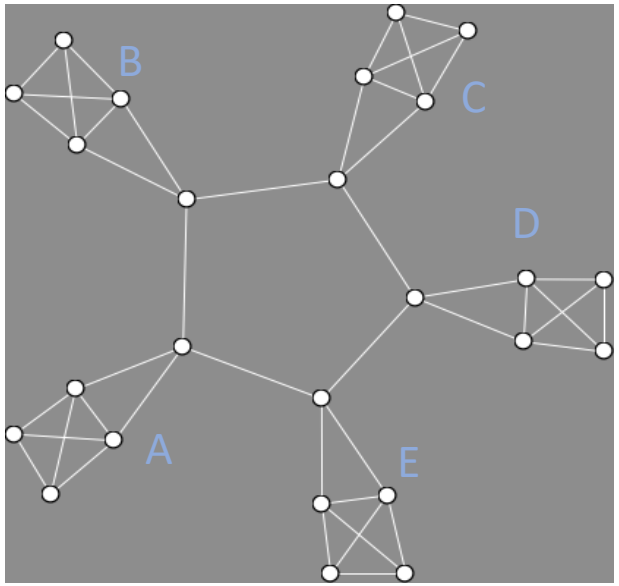
Knowledge and information are sticky and more homogenous within network communities and, conversely, more heterogeneous across network communities.

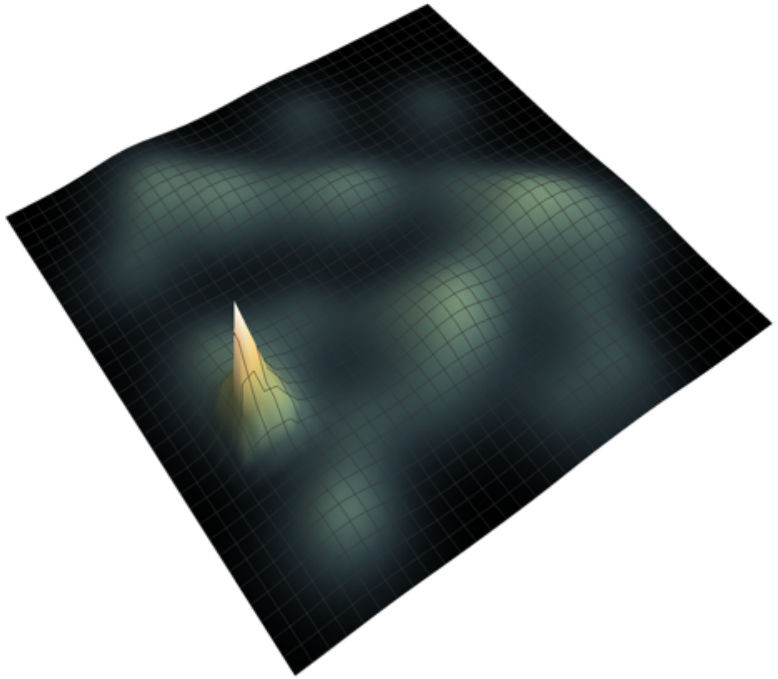
Idea Exchange and Improvement

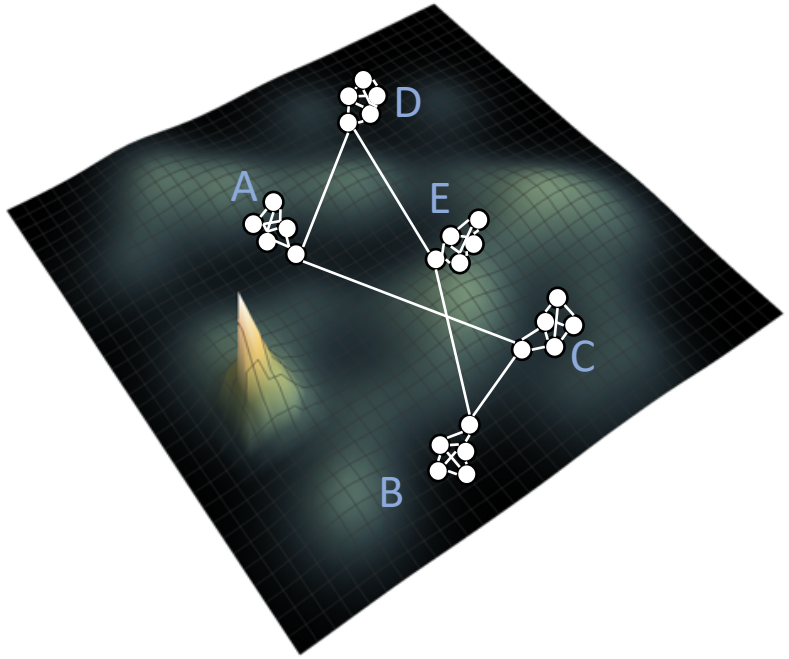
Actors are boundedly rational. They attempt to improve ideas, but they can only evaluate and improve a limited number of ideas at any given point in time.

Actors can upgrade ideas by borrowing ideas from others in the organization, synthesizing elements of their own idea with those from others, or by searching for ideas independently

Model Description: Key Elements







Social structure of the group

- 25 actors; 5 network communities
- Network connections determine who can interact with whom

Idea performance landscape

- Features of an idea corresponds to a particular location on a 32x32 grid
- Decisions about x and y interact with each other, leading to rugged performance landscape
- Clear global peak (best idea)

Actor beliefs (ideas)

- Each person holds a set of beliefs (an idea regarding a solution to the problem)
- Each of those beliefs have an associated performance value (quality)
- Beliefs are much more similar within- than between-network communities

Model Description: Idea Exchange and Improvement

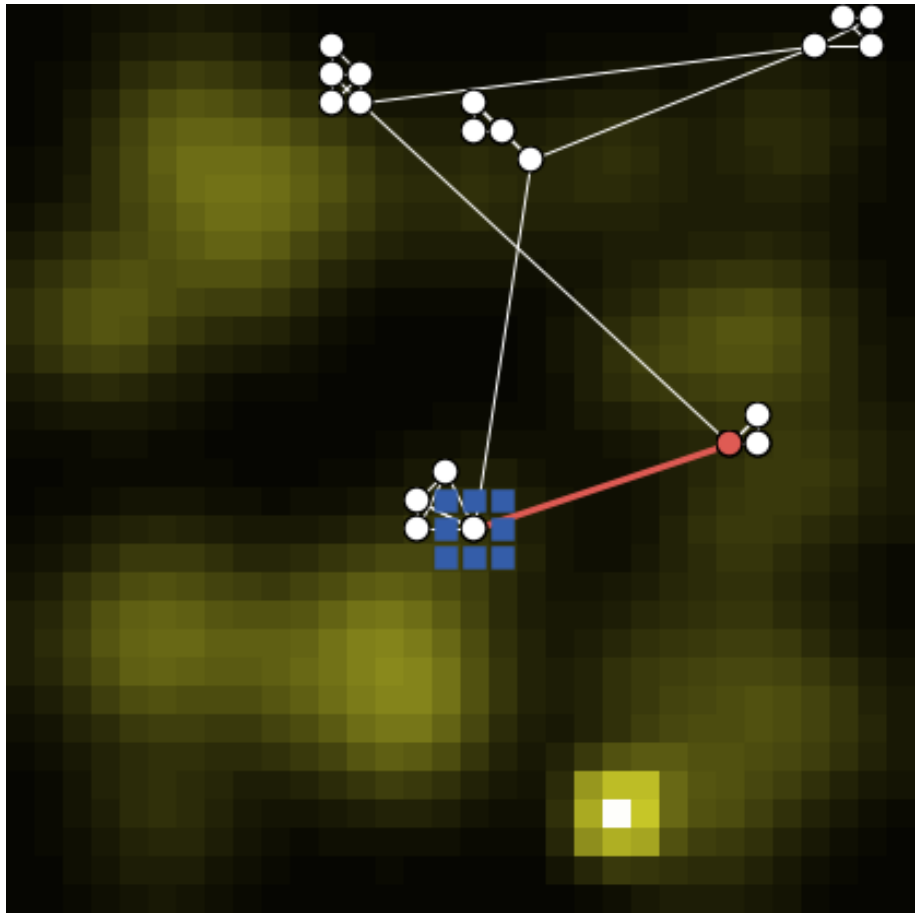
Choice #1: **Self Search vs. Collaboration**

- ***Self-Search:*** Ego can independently search for a higher-performing idea within a limited local vision (e.g., read, google, listen to a podcast).
- ***Collaboration:*** Ego can initiate interaction with a network contact.

If Choice #1 is Collaboration,

Choice #2: **Copying vs. Recombination**

- ***Copying:*** Ego or alter can attempt to copy a higher performing idea from each other.
- ***Recombination:*** Ego and alter can attempt to identify novel recombinations of their currently held beliefs.
  - Crossover of underlying traits (bit string representations of location)

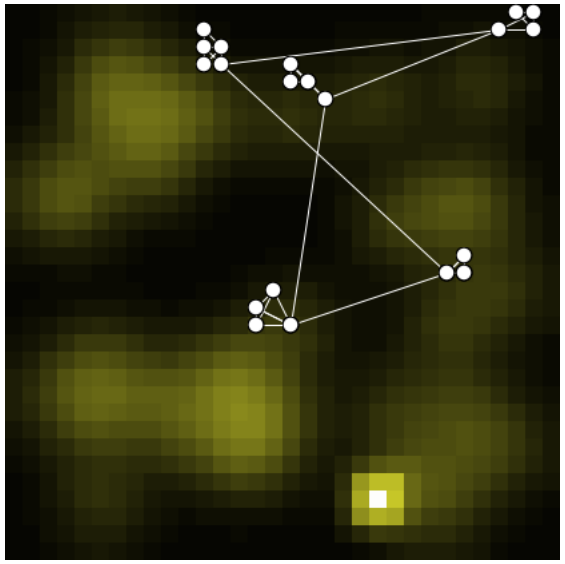


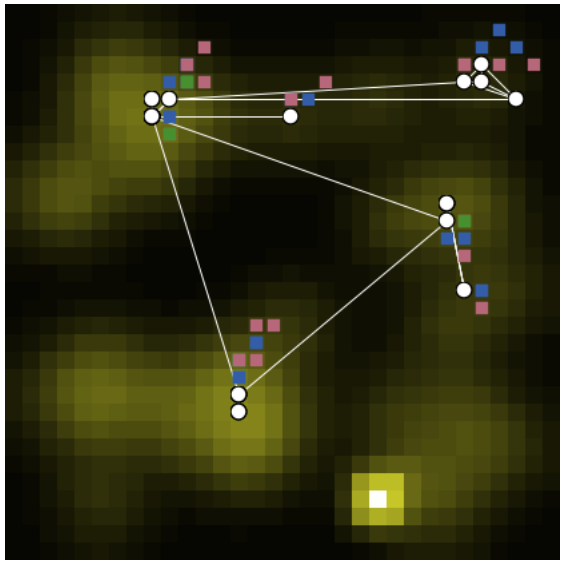
One Time Period of the Model

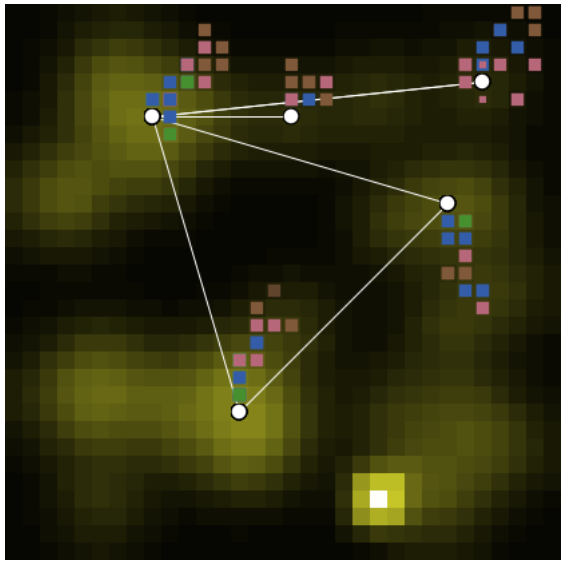
1. One actor (ego) is randomly selected to act.
2. Ego chooses whether to search on her own (self-search) or by interacting with others (collaboration)*
3. If ego engages in self-search, she evaluates the performance of nearby locations in the feature space she can "see"
4. If ego decides to collaborate, she selects one randomly selected network contact (alter) with whom to interaction.
   - Ego can propose either a recombination or copy interaction*
   - Ego will not consider choosing an alter with whom a previous attempt at interaction did not yield a change in either actor's , unless either ego or alter have updated their beliefs since the previous interaction
5. If alter chooses to participate, a recombination or copy interaction ensues
6. Ego and/or alter update beliefs to highest-performing idea found

* Propensities for collaboration and recombination are exogenously determined

People

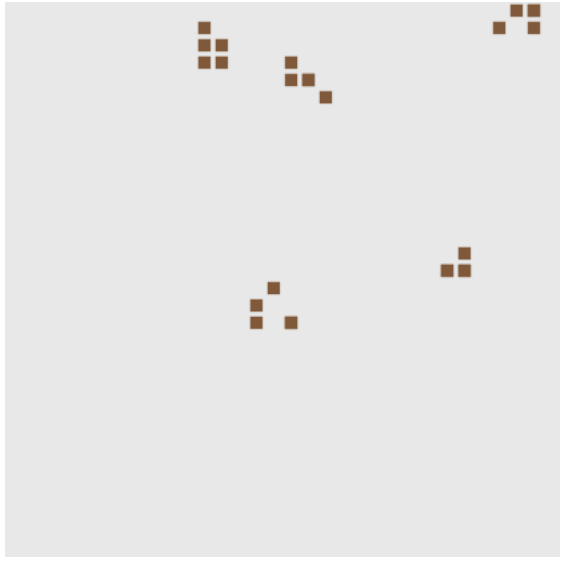




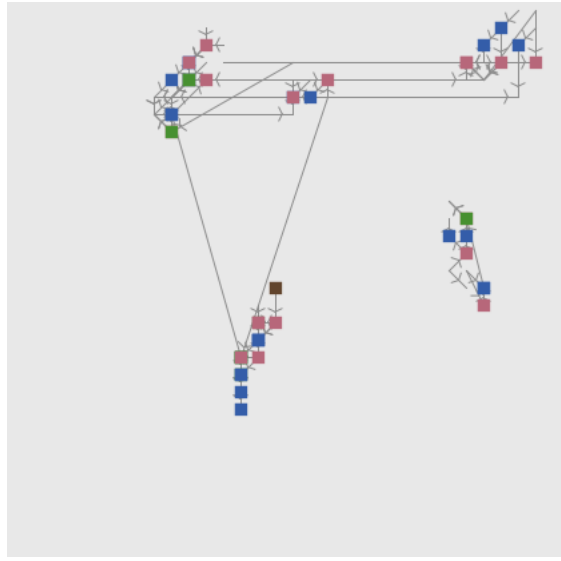


Ideas

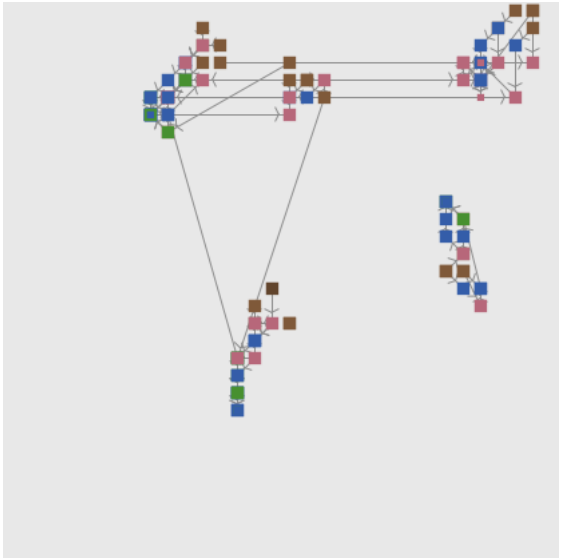
t = 0



t = 300



t = 5000



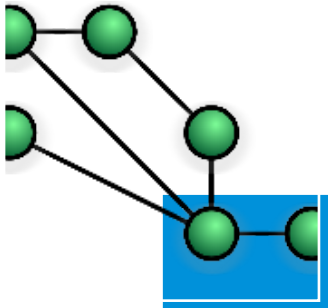
Starting idea

Self-search

Copying

Recombination

Model Analysis



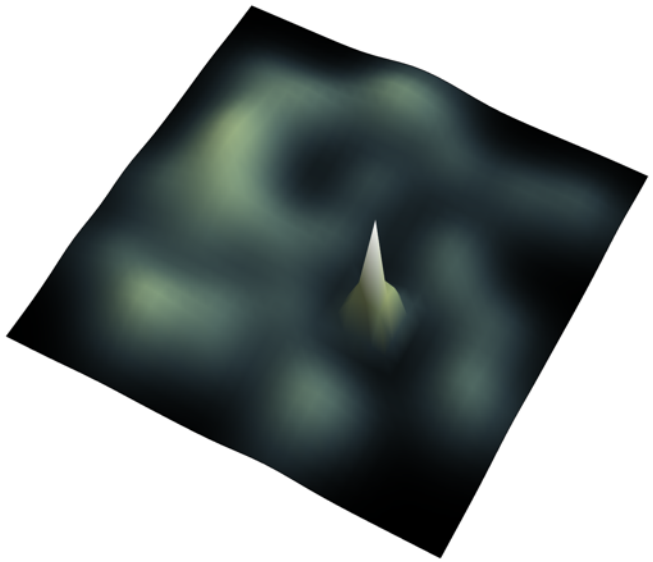
Stage 1

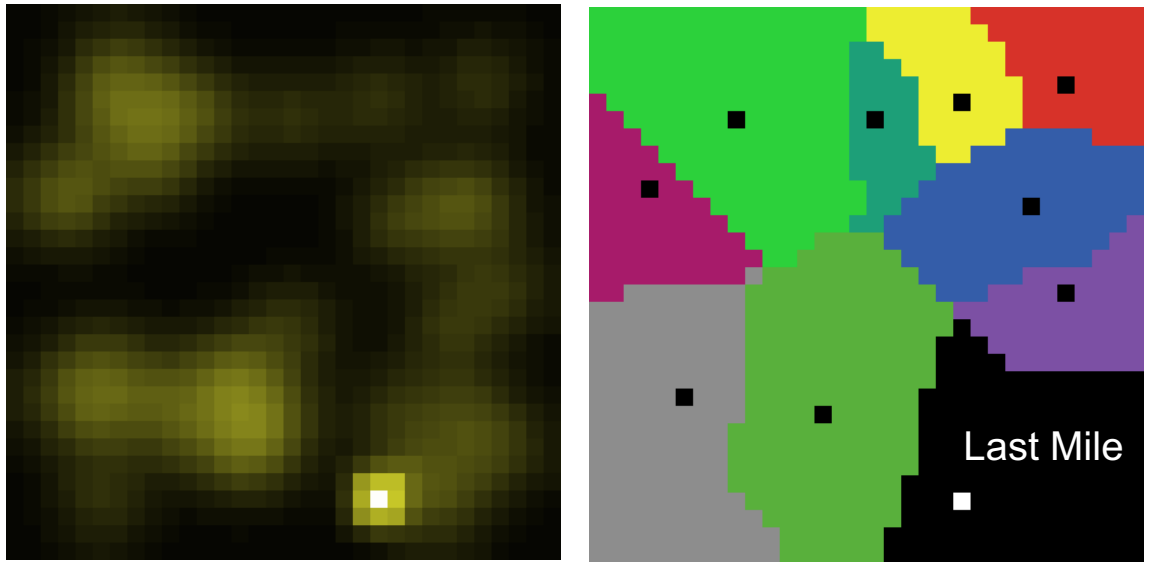
- Qualitatively examine the trajectory of many, many initial ideas

Stage 2

- Test the logical implications of our process-oriented, inductive learnings by analyzing data generated by running computational experiments.

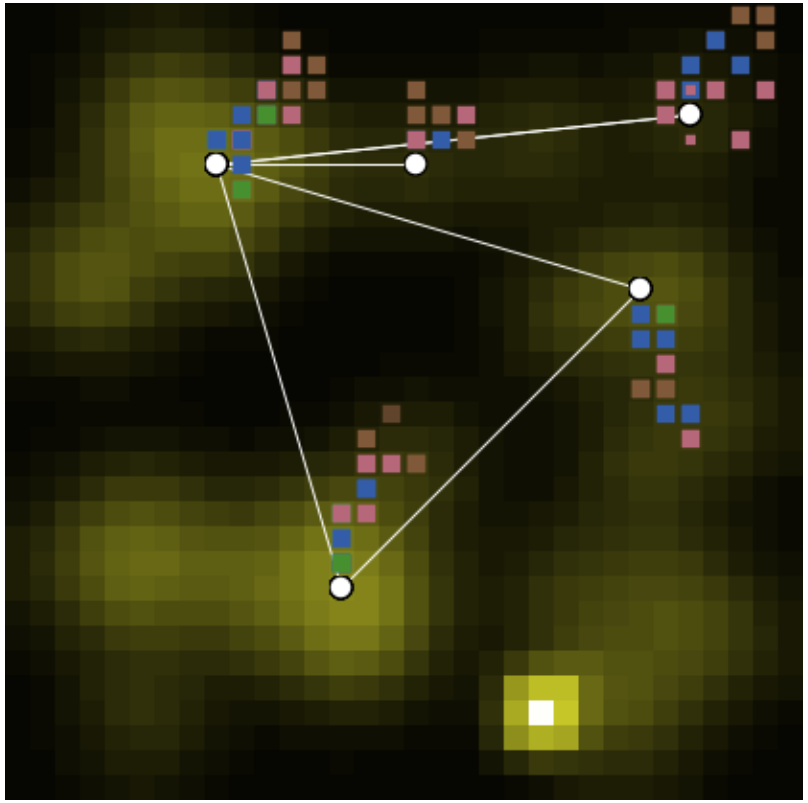
Modeling Insights: Idea Chain Development Stages



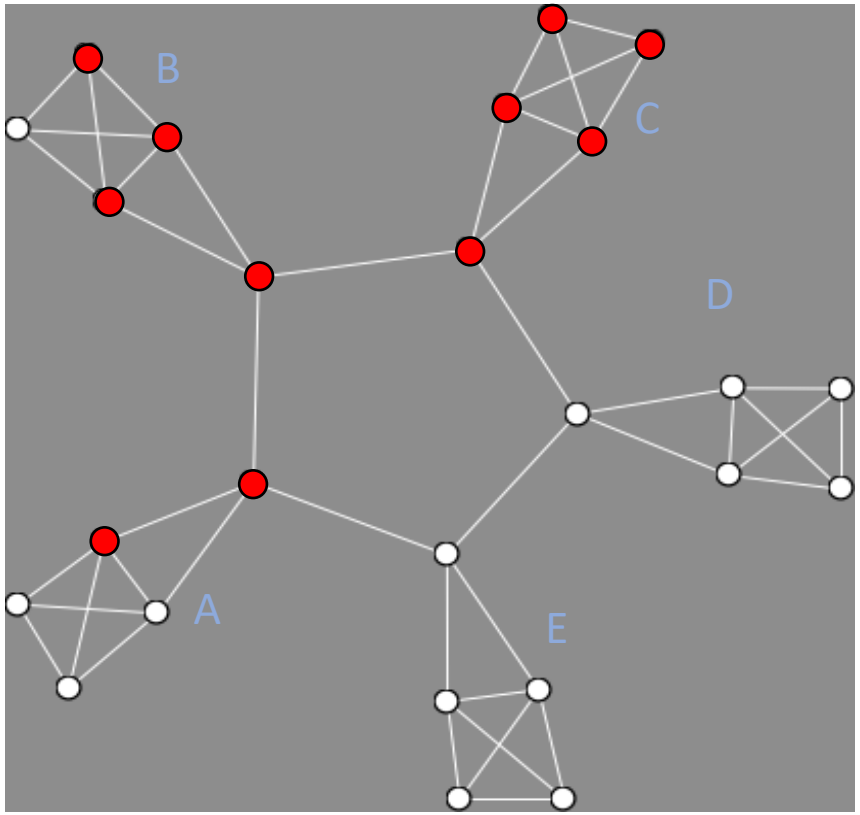


- Performance basins/valleys around local peaks
- Self-search alone leads to local peak of basin
- Basin of global peak is the “last mile”

Modeling Insights: Two key, emergent processes

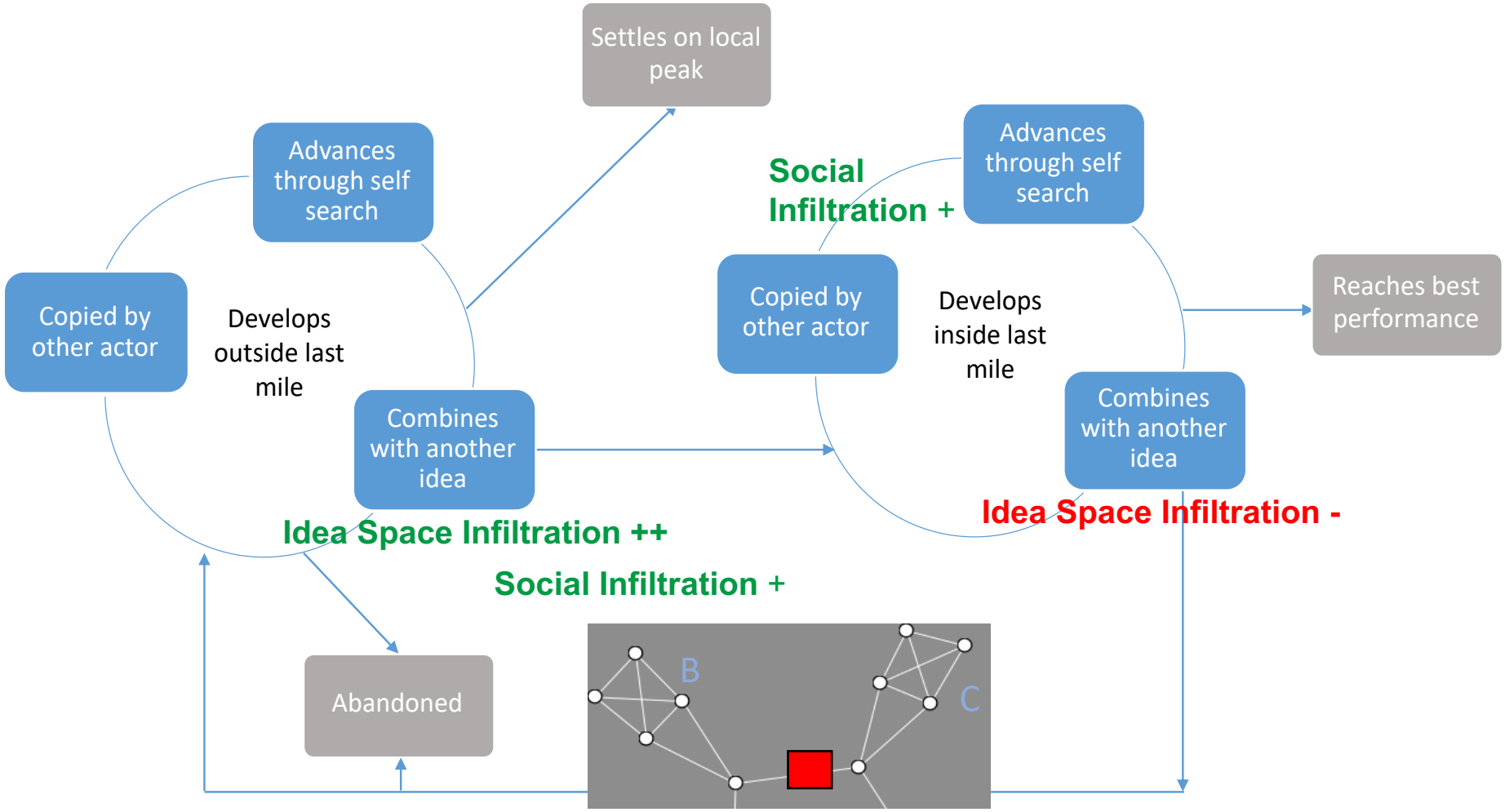


Idea Space Infiltration



Social Infiltration

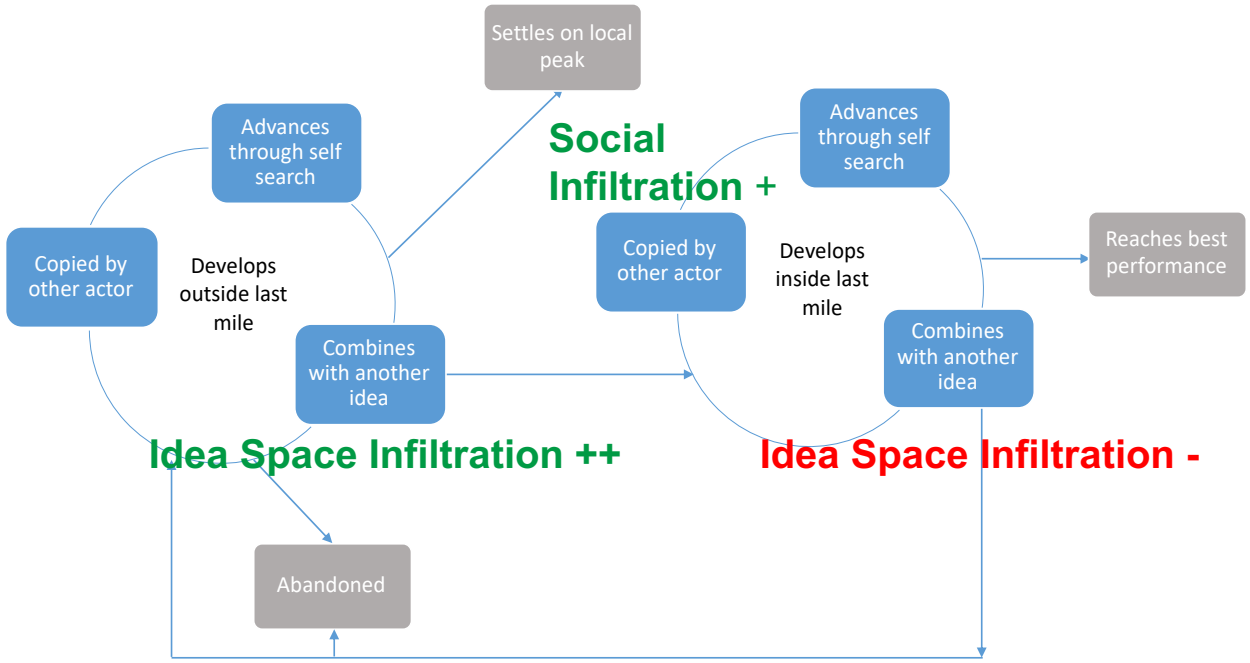
The Life (and Death) of Ideas



Computational Experiments

Experiment 1

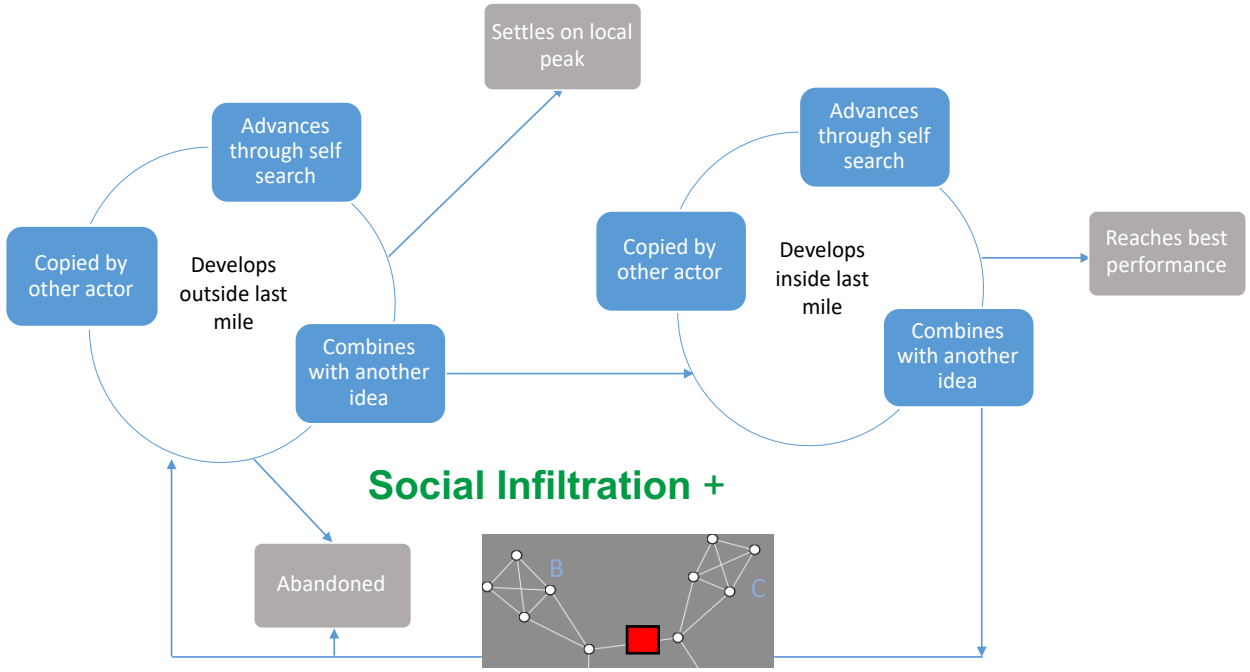
- Purpose: Examine impact of change activities inside and outside of last mile
- Fix actors to high levels of collaboration and recombination
- Identify and create a focal idea
- Collect trajectories of all focal ideas
- 25,000 runs



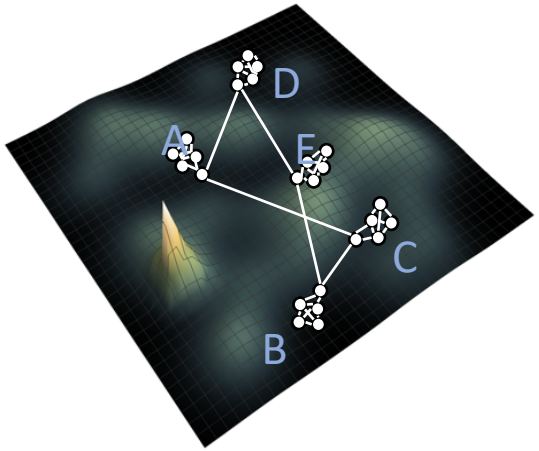
Computational Experiments

Experiment 2

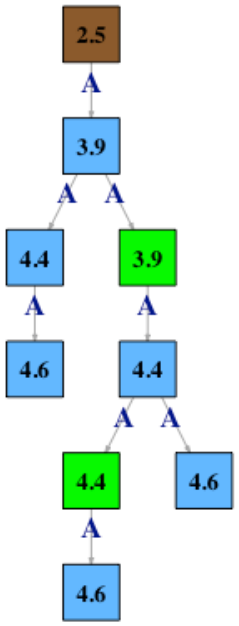
- Purpose: Examine impact of having both actors adopt an idea resulting from a recombination
- Fix actors to high levels of collaboration and recombination
- Identify and create a focal idea
- Make random whether one or both partners adopt a recombination
- Collect trajectories of all focal ideas
- 5,000 runs



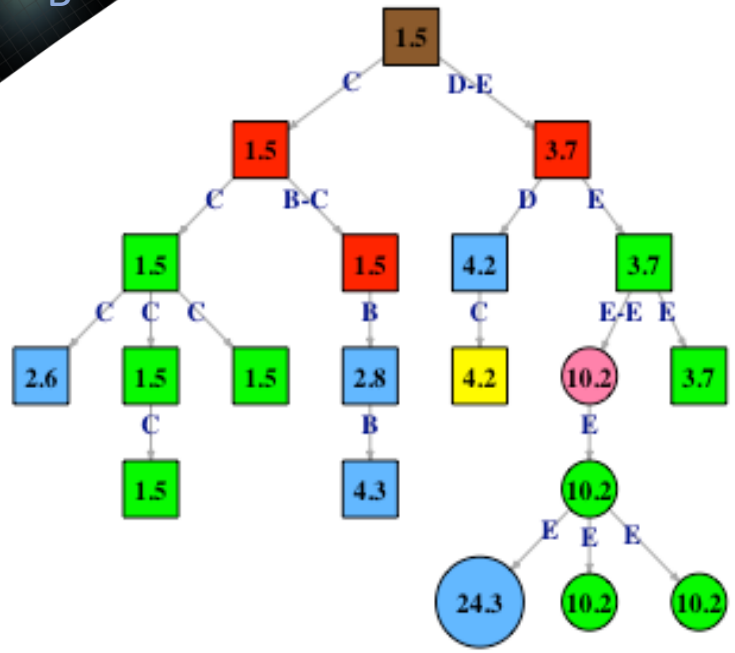
Fundamental Unit of Analysis: Idea Chains



Idea Chain 1



Idea Chain 2

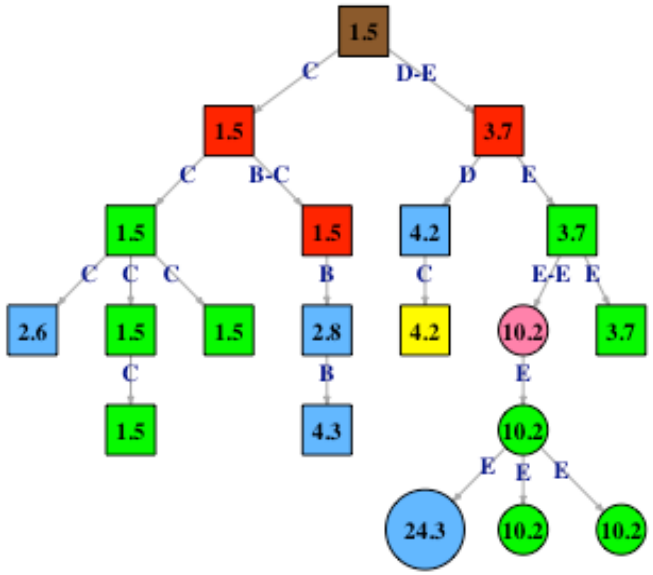


	Last Mile	Activity Type
	outside	within-network recombination
	outside	between-network recombination
	outside	within-network copy
	outside	between-network copy
	outside	self search
	inside	within-network recombination
	inside	between-network recombination
	inside	within-network copy
	inside	between-network copy
	inside	self search

Activity Impact Depends on Idea Development Stage

Data: Focal idea chains from runs in Experiment 1

Analysis: Logit models predicting the likelihood of success as a function of the number of each activity type on the chain



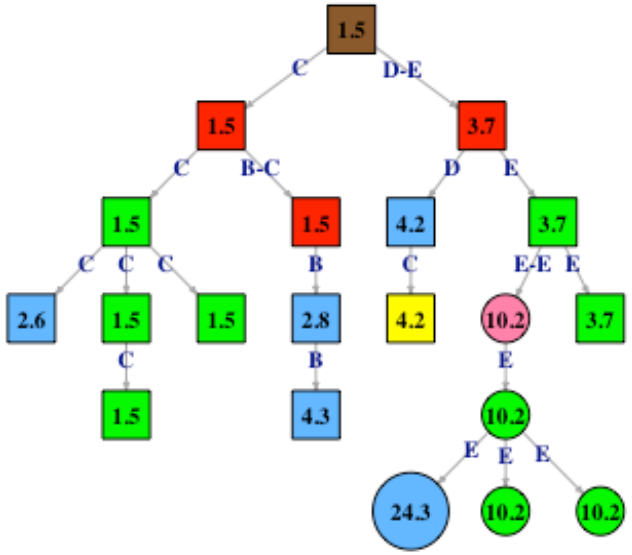
Expected percentage point change in the probability of reaching and completing the last mile corresponding to one additional change activity

Idea Chain Activity	Reached last mile (n=21572)	Reached best idea after entering last mile (n=6141)
Within-network community recombination	1.3	-10.9
Between-network-community recombination	3.7	-5.8
Within-network-community copying	-0.31	9.2
Between-network community copying	0.91	19.8
Self-search	-0.88	22.9

Network Community Infiltration Amplifies Recombination Impact

Data: Focal idea chains from runs in Experiment 2

Analysis: Logit models predicting the likelihood of success as a function of the number of each activity type on the chain, *incorporating whether one or both actors adopted a recombination*



Expected percentage point change in the probability of reaching the last mile corresponding to one additional change activity, by number of partners adopting

Idea change activity	One adopts	Both adopt
Within-network community recombination	A **1.0**	A--A **2.5**
Between-network-community recombination	B **1.6**	A--B **5.2**

Summary of Findings

Extant Theory	Refined Understanding
Proposition 1: Between network community recombinations lead to best ideas.	**Proposition 1a:** The impact of both between- and within-network community recombination activity is contingent on the stage of idea development. • Outside the last mile stage, recombination activities contribute to best idea development by increasing the infiltration of the idea space • Inside the last mile stage, where the infiltration of social space is of greater importance, recombination activities risk impeding development **Proposition 1b:** Recombination activities are more likely to contribute to best ideas when both interaction partners adopt the new idea that emerges from their joint activity, as having multiple partners adopt increases the infiltration of social space in addition to producing a novel idea

Summary of Findings

Extant Theory	Refined Understanding
Proposition 2: Although high levels of copying between actors can reduce the overall diversity of knowledge in an organization, between network community transfers can lead to best ideas by exposing actors to diverse knowledge that exists within the organization	**Proposition 2a:** Between network community copying enables an idea to infiltrate multiple network communities, thereby reducing the risk of the idea being abandoned and increasing its chances of being further developed. • Inside the last mile stage, the impact of this benefit on the likelihood of becoming the best idea is strong and positive. • Outside the last mile stage, the impact is modest, and on average lower than the impact of between network community recombination activities.