

Network Deliberation:

The role of network structure in large-scale,
internet-enabled, participatory decision-making

Edward L. Platt

Dissertation Committee

Daniel M. Romero (chair)

Ceren Budak

Tawanna Dillahunt

Scott E. Page



Photo: Creative Commons, Flickr user ericmerrill



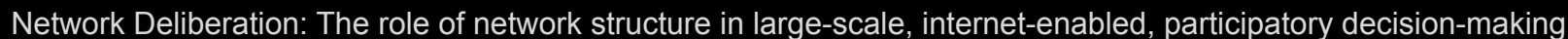
Photo: Creative Commons, David Shankbone



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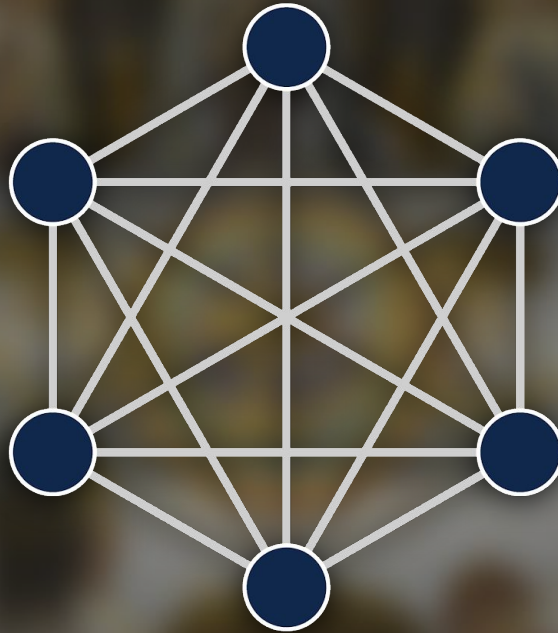
Wikipedia (/ˈwɪkɪˈpiːdiə/ (listen)), /ˈwɪkiˈpiːdiə/ (listen) ***WIK-ih-PEE-dee-ə***) is a multilingual, web-based, free-content **encyclopedia** that is based on a model of openly editable content. It is the largest and most-popular general reference work on the Internet,^{[3][4][5]} and is named as one of the most popular websites.^[6] It is owned and supported by the **Wikimedia Foundation**, a **non-profit organization** which operates on whatever money it receives from its annual fund drives.^{[7][8][9]}

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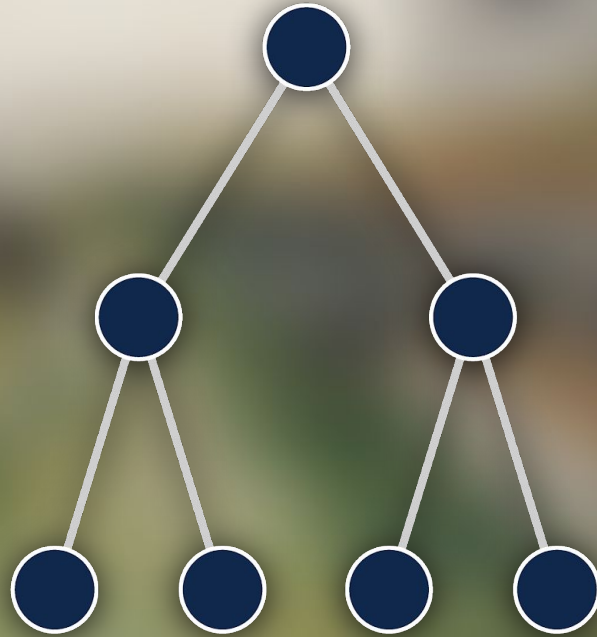


The Knights and Kings of the Round Table – Évrard d'Espinques

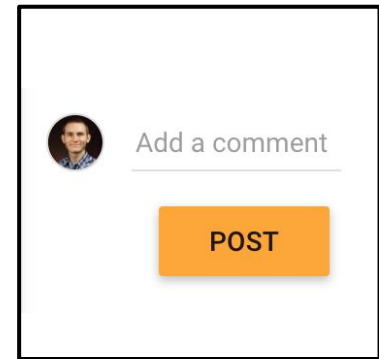
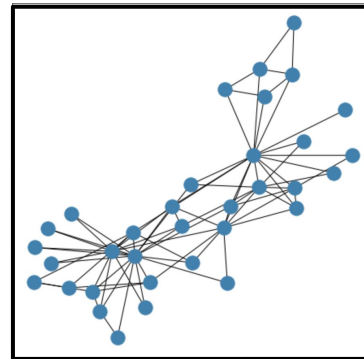
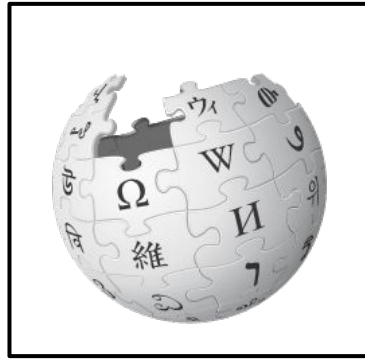




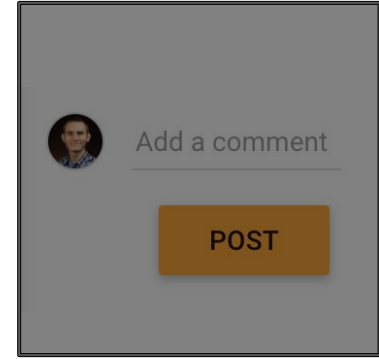
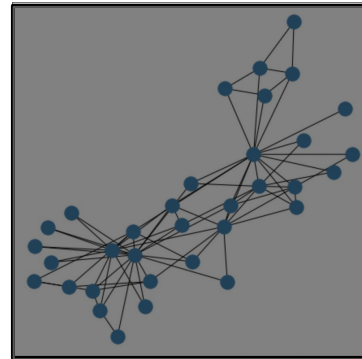
Attack of the Prussian Infantry – Carl Röchling

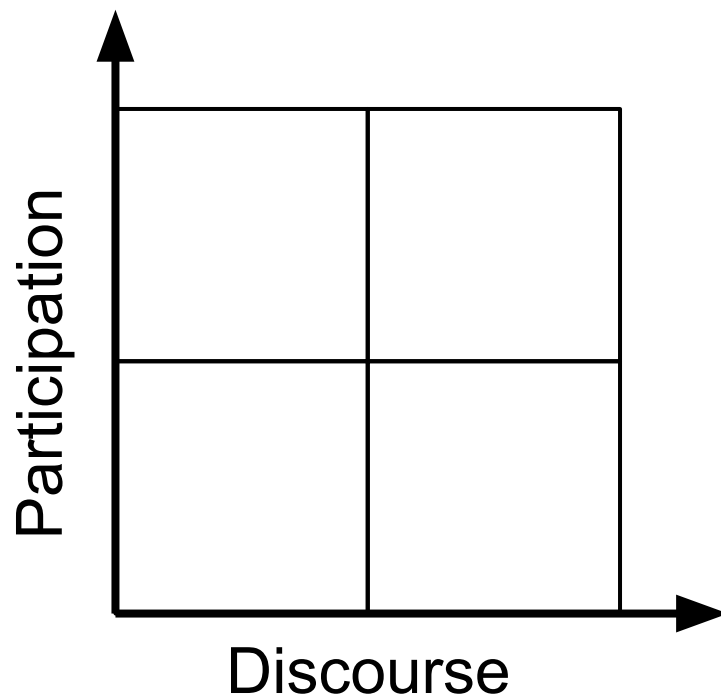


Network Deliberation

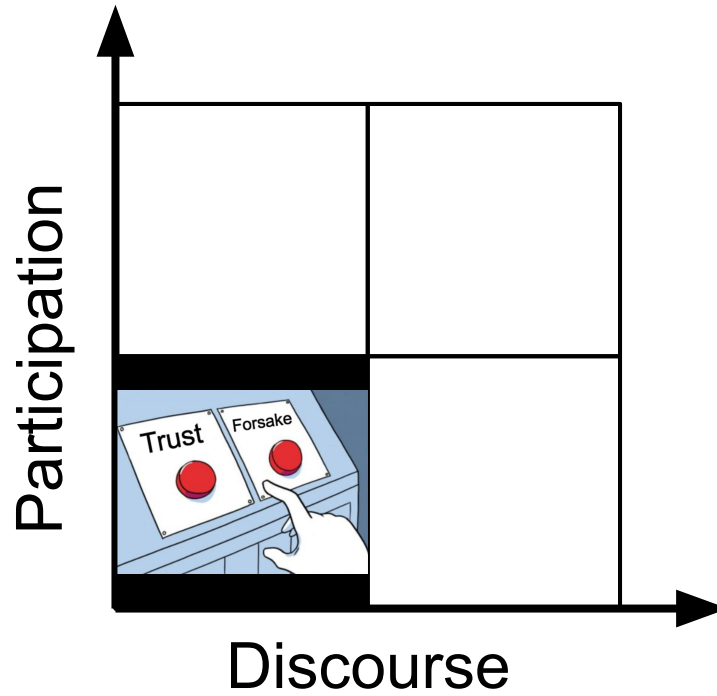


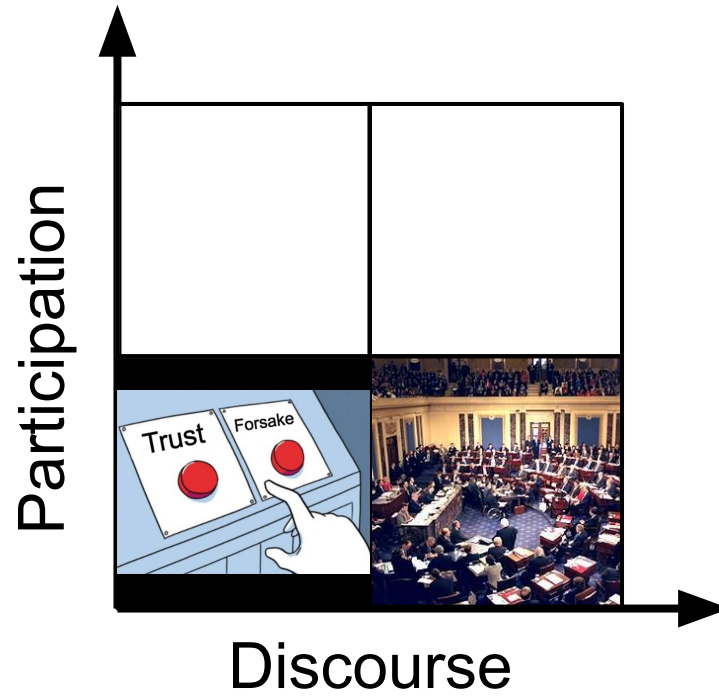
Collective Decision-Making

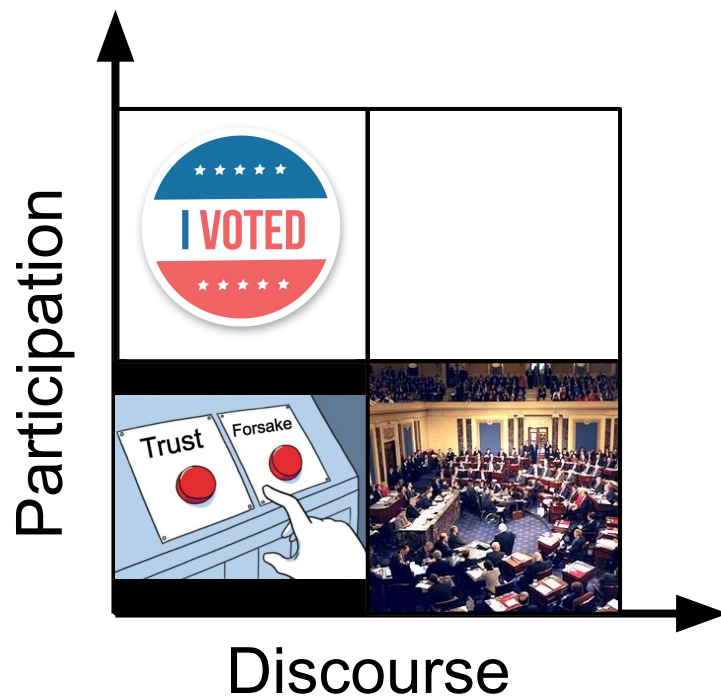




Adapted from Ackerman & Fishkin, 2002



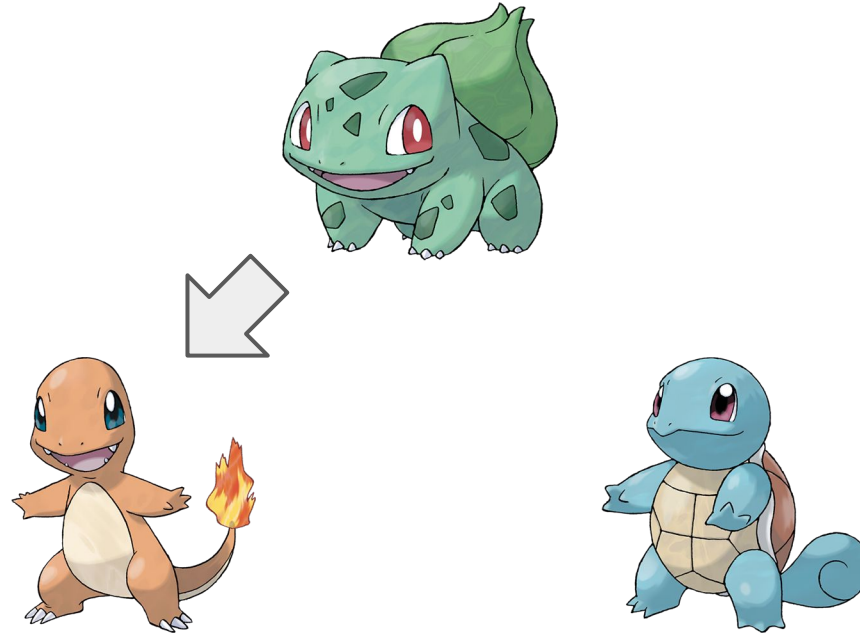




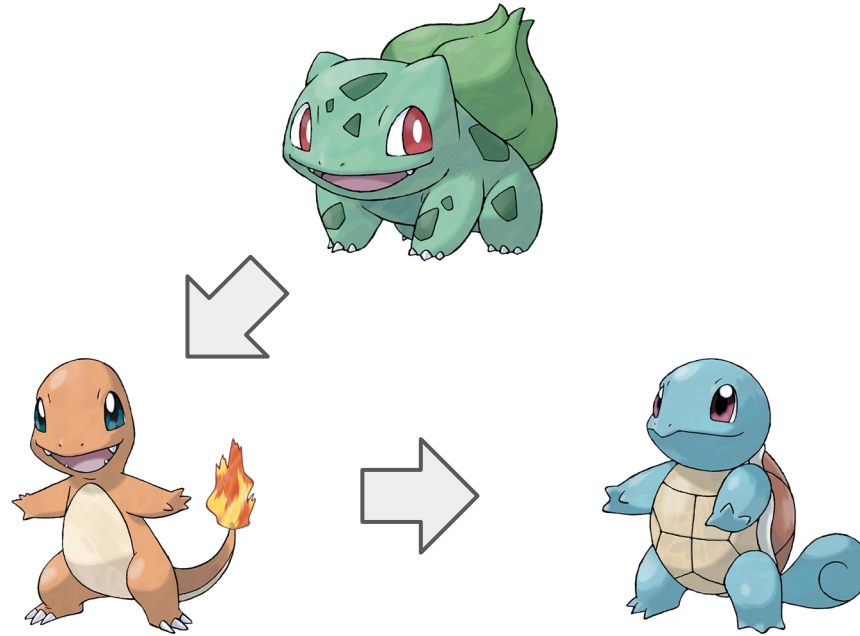
Condorcet Paradox



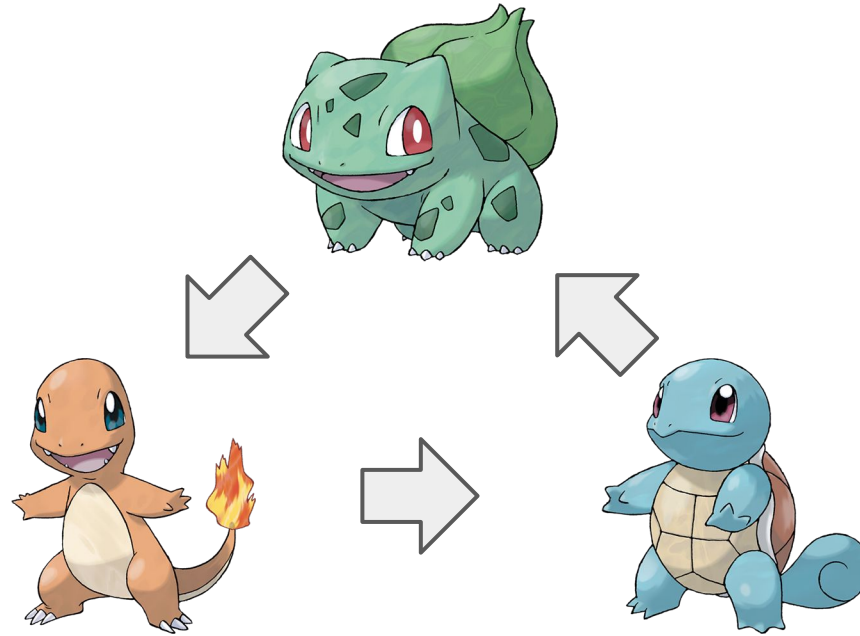
Condorcet Paradox



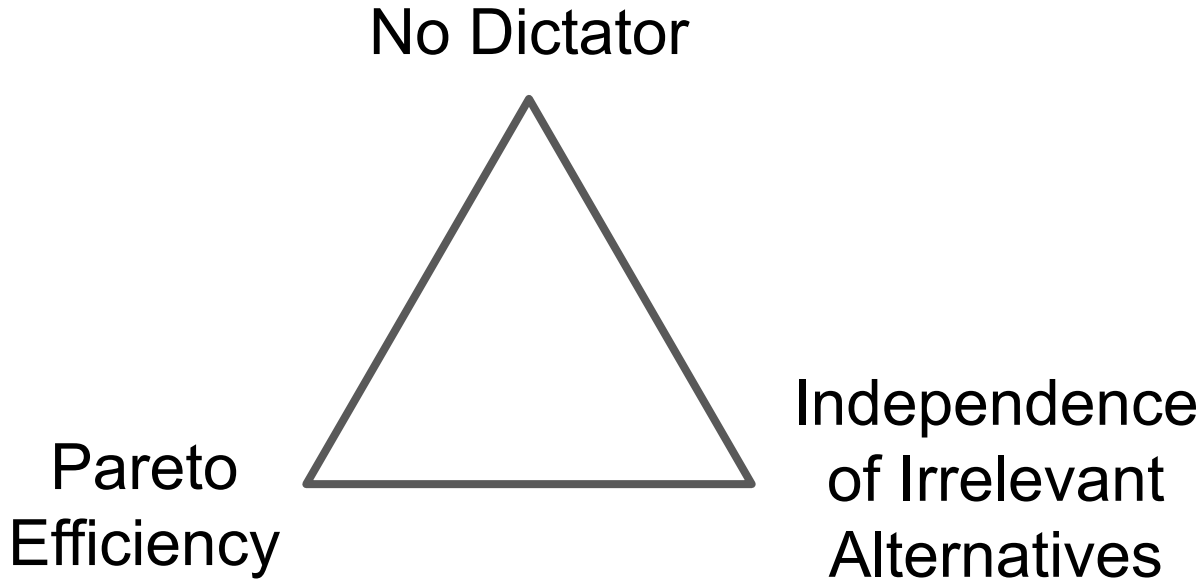
Condorcet Paradox

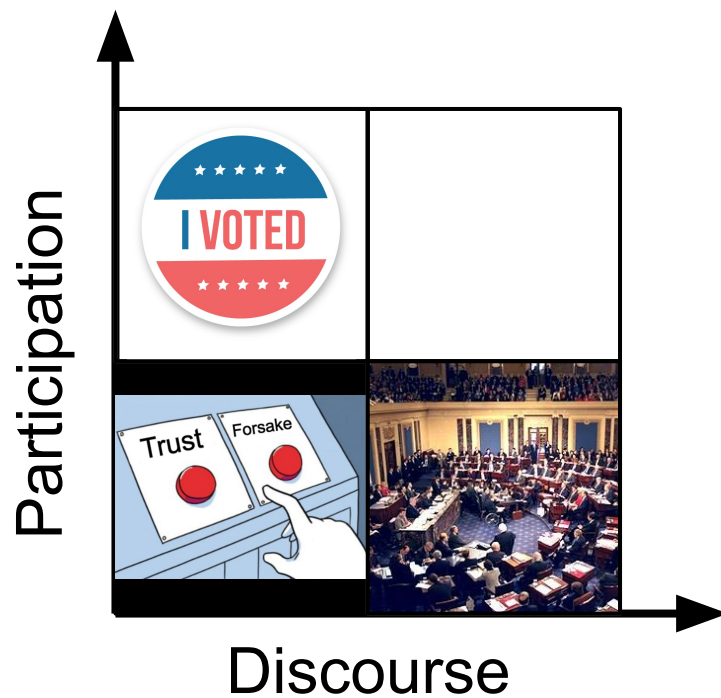


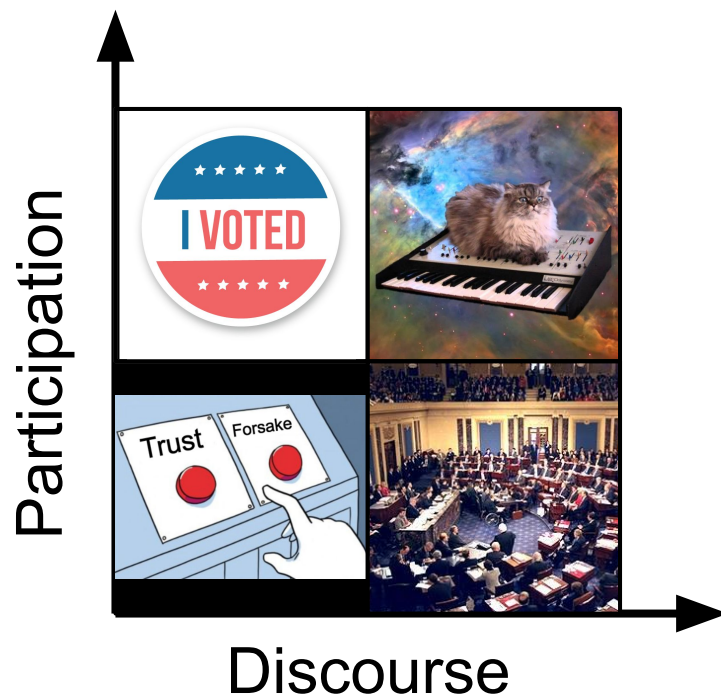
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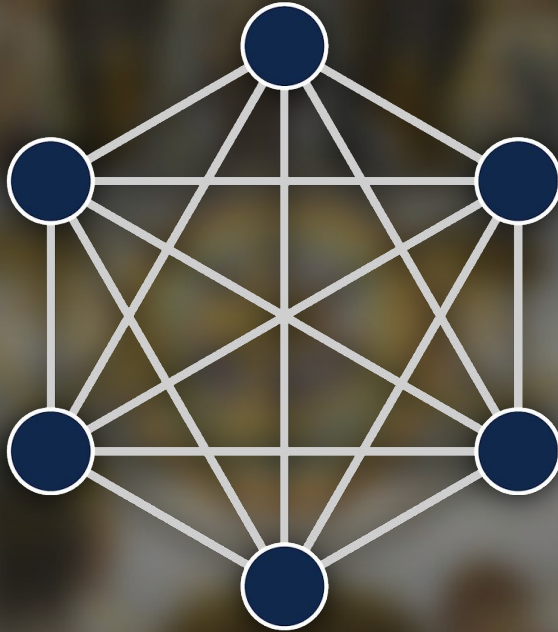


Arrow's Impossibility Theorem





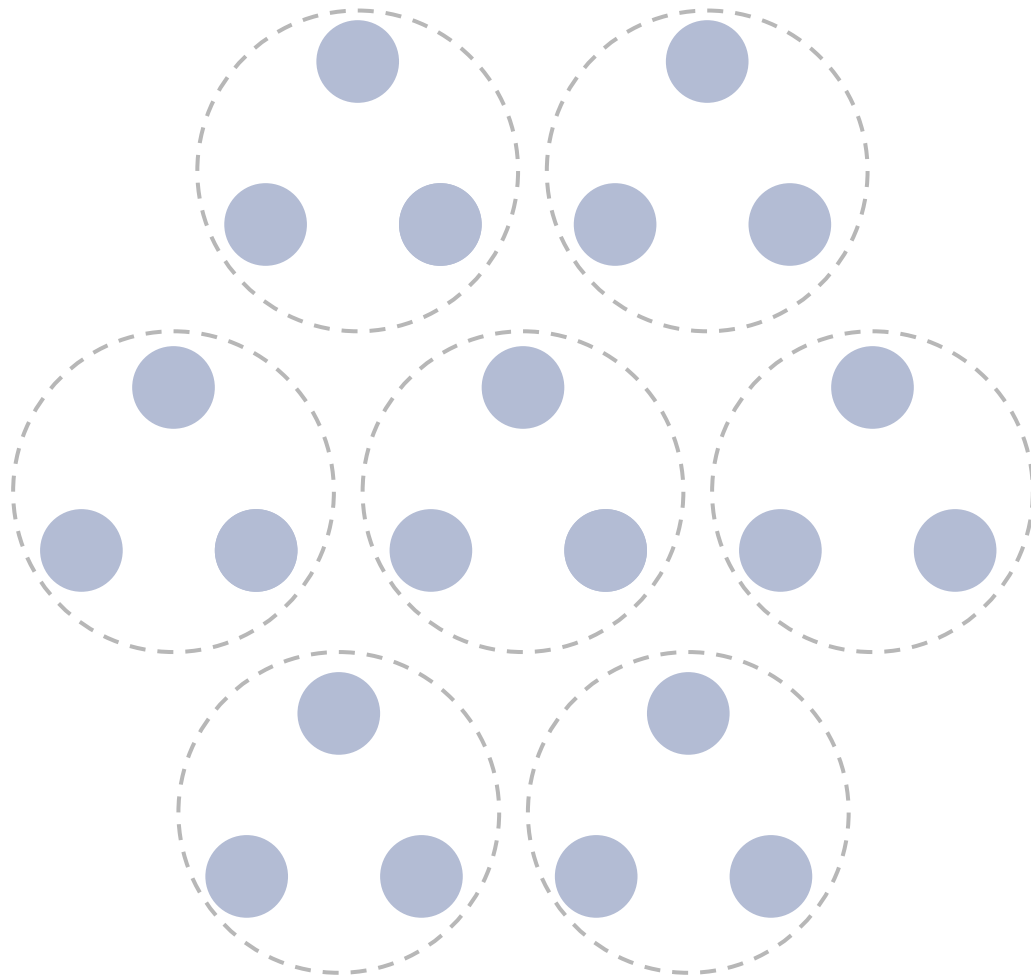


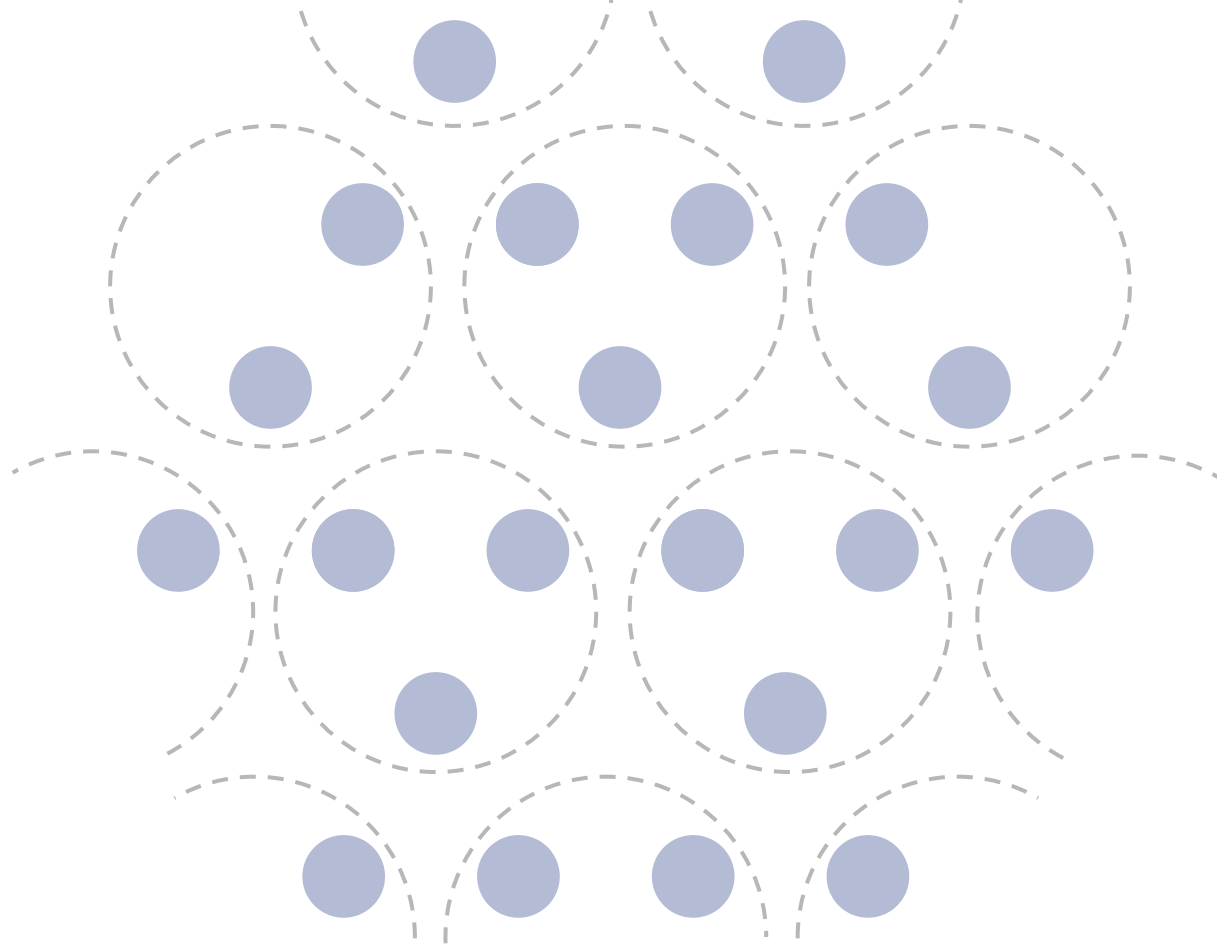


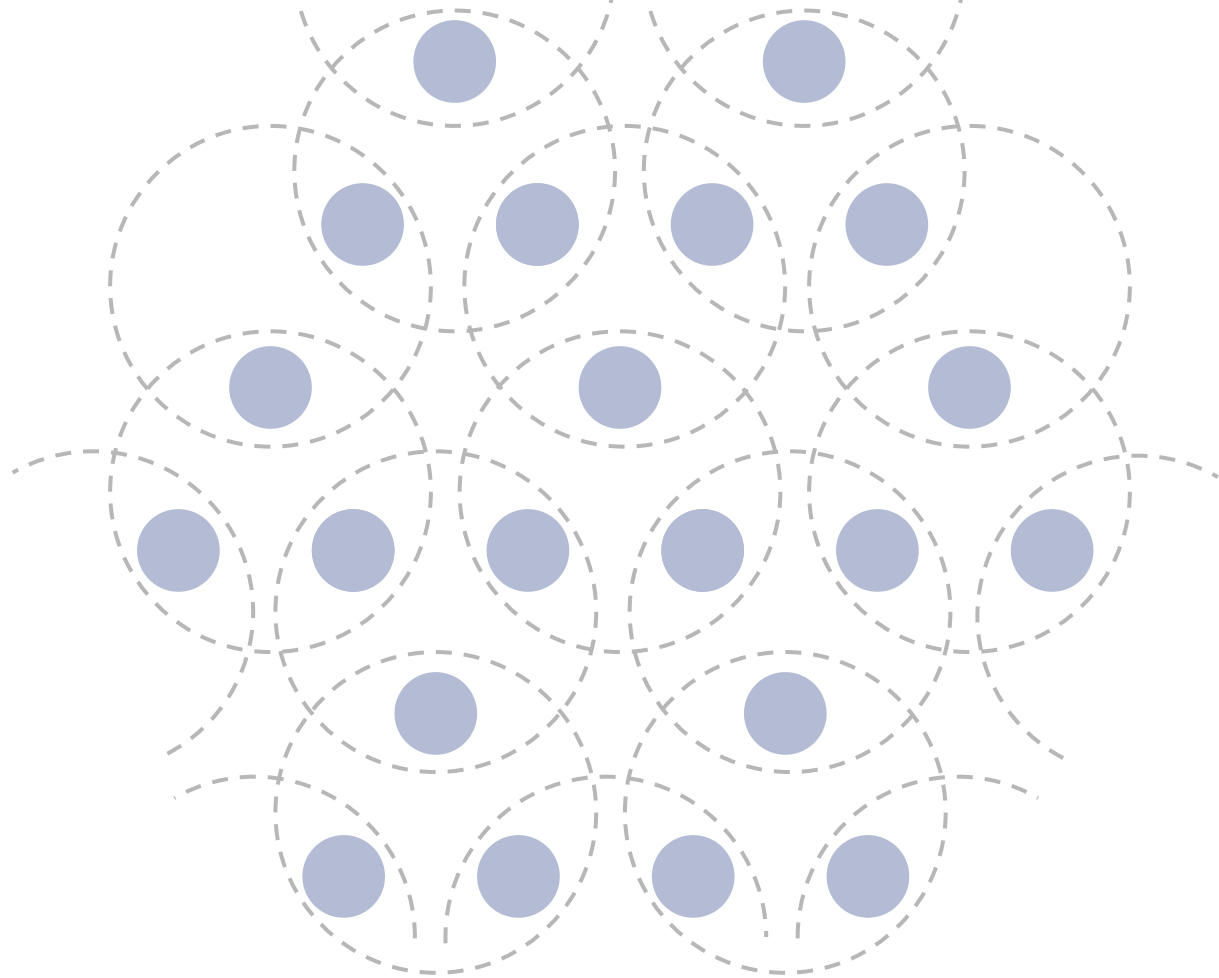
Network Deliberation



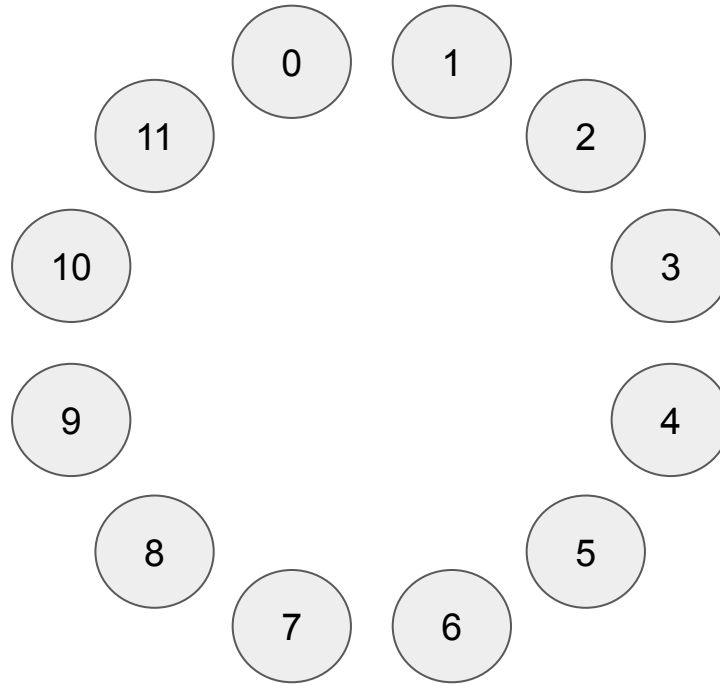
Photo: Creative Commons, Flickr user togawanderings



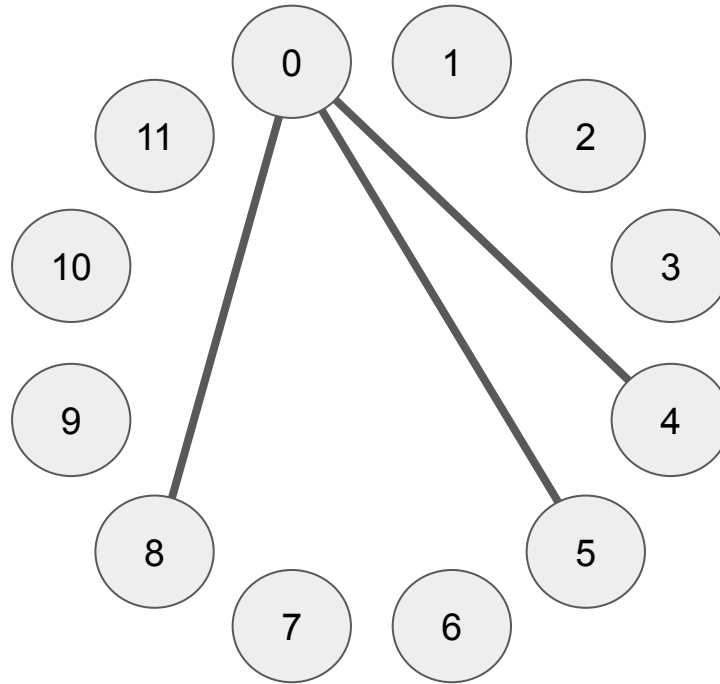




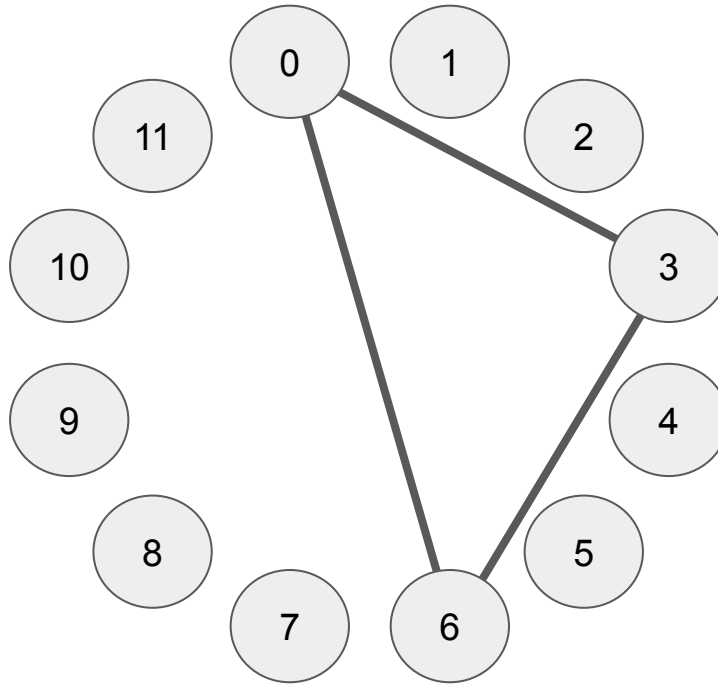
Network Structure



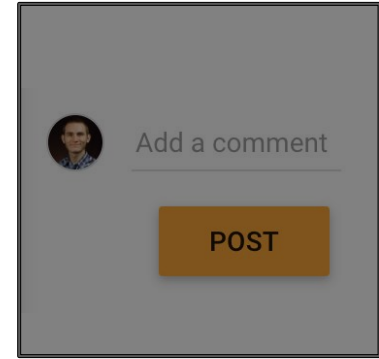
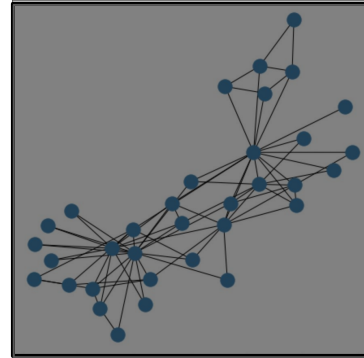
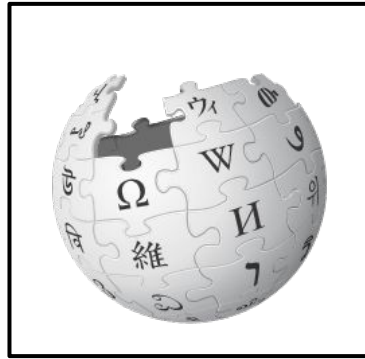
Degree



Geodesic Path Length



Observation: WikiProjects

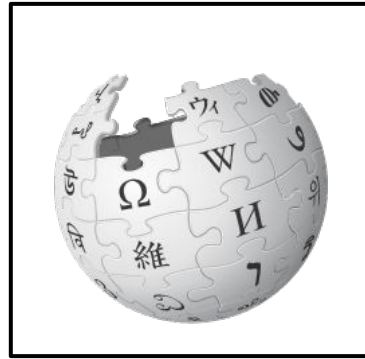


With: Daniel M. Romero



Photo CC-BY-SA: Flickr user Olaf_Janssen

WikiProjects





Talk:Knitting

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Knitting is a former [featured article candidate](#). Please view the links under Article milestones below to see why the nomination failed. For older candidates, please check the [archive](#).

Article milestones

| Date | Process | Result |
|-----------------------------------|--|--------------|
| December 16, 2006 | Featured article candidate | Not promoted |
| March 26, 2007 | Peer review | Reviewed |
| April 7, 2007 | Good article nominee | Not listed |

Current status: **Former featured article candidate**



Knitting has been listed as a [level-4 vital article](#) in Technology. If you can improve it, [please do](#). This article has been rated as [B-Class](#).



This article is within the scope of [WikiProject Textile Arts](#), a collaborative effort to improve the coverage of [textile arts](#) on Wikipedia. If you would like to participate, please visit the project page, where you can join the [discussion](#) and see a list of open tasks.



[Textile arts portal](#)

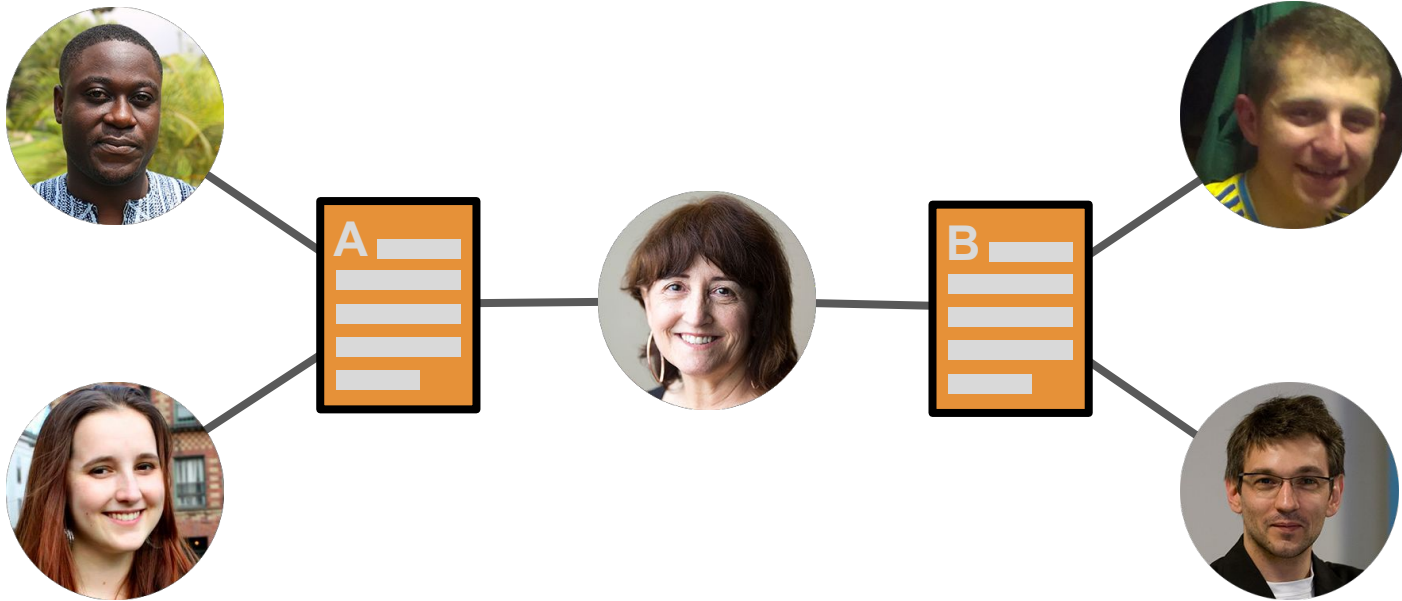
B

This article has been rated as **B-Class** on the [quality scale](#).

Top

This article has been rated as **Top-importance** on the [importance scale](#).

Coeditor Networks



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Coeditor Networks





Wikipedia:WikiProject Textile Arts

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About us [\[edit \]](#)

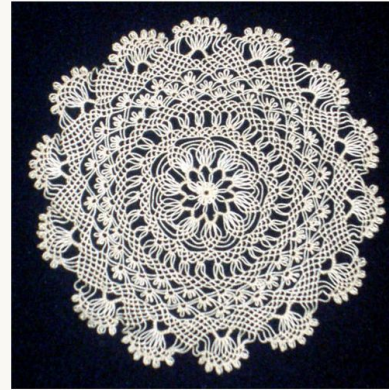
This [project](#) aims to better organize information in articles related to [Textile arts](#) on Wikipedia. A major problem is organizing the vast amount of information that has been and continues to be collected. A primary goal of this project is to collect and organize this information and make it accessible to everyone, regardless of their skill level.

If you would like to help, feel free to add yourself to the [list of participants](#), or just look over the [How you can help](#) section below. Also of interest is the [Textile Arts Portal](#) associated with this project.

Concrete goals [\[edit \]](#)

- Create and perfect articles on the [fundamental topics](#) in textile arts, with a particular focus on subjects that are most commonly taught. The perfect article is complete, but accessible to a [secondary school](#) student.

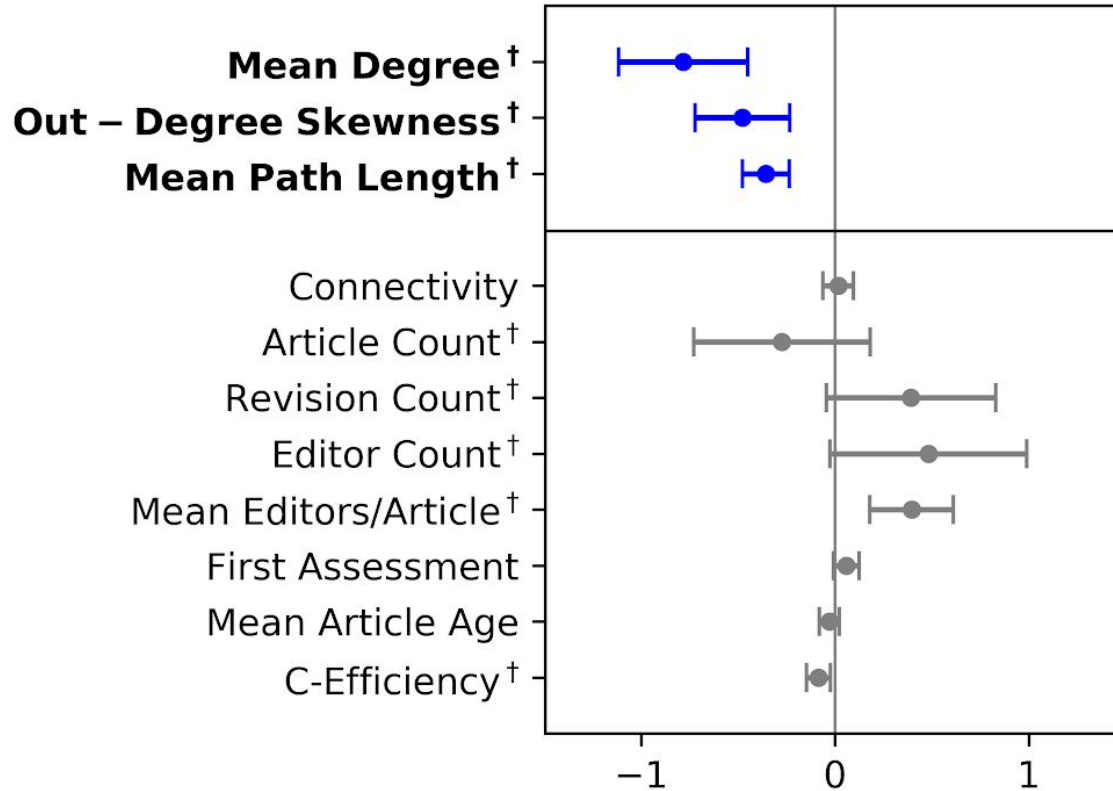
WikiProject Textile Arts



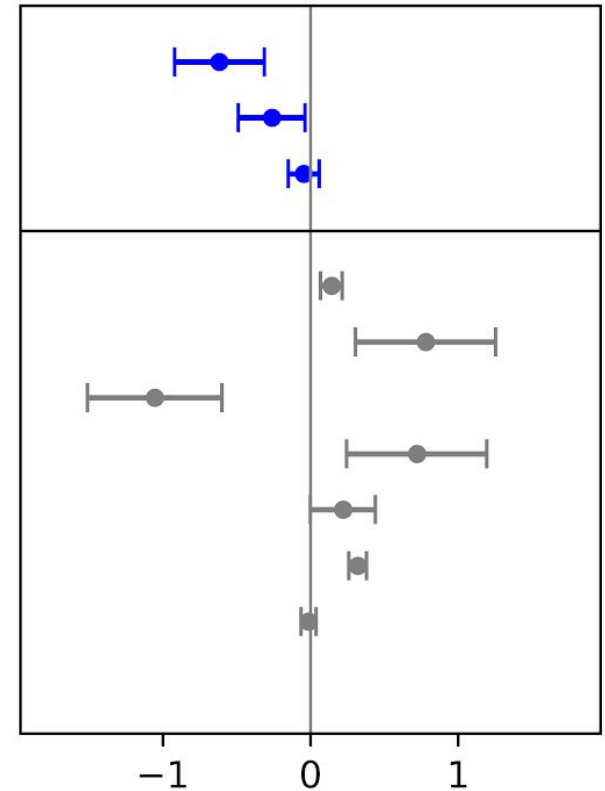
Project standards

| | |
|--|---|
| <i>Portal:</i> |  Textile Arts Portal |
| <i>Shortcuts:</i> | WP:TA , WP:WPTA |
| <i>Project template:</i> | {{WikiProject Textile Arts}} |
| <i>Collaboration of the Month:</i> | Current TA COTM |
| <i>Member userbox:</i> | {{User Textile Arts}} |

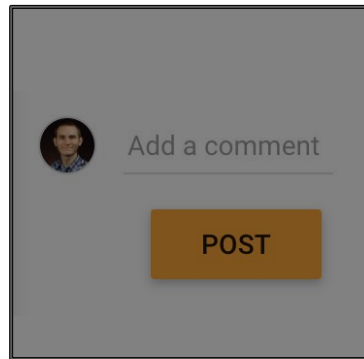
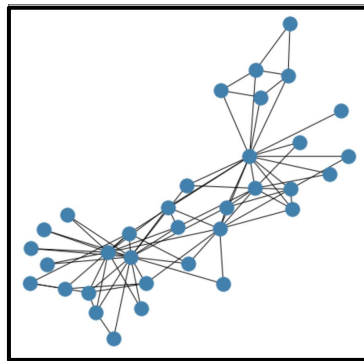
Performance



Productivity

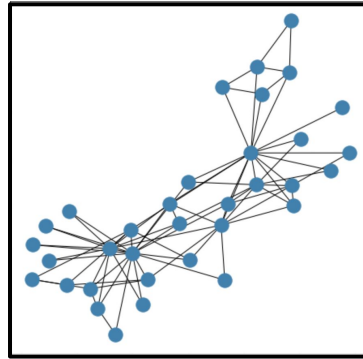


Agent-Based Simulation



With: Herminio Bodon, Daniel M. Romero

Simulating Complex Tasks

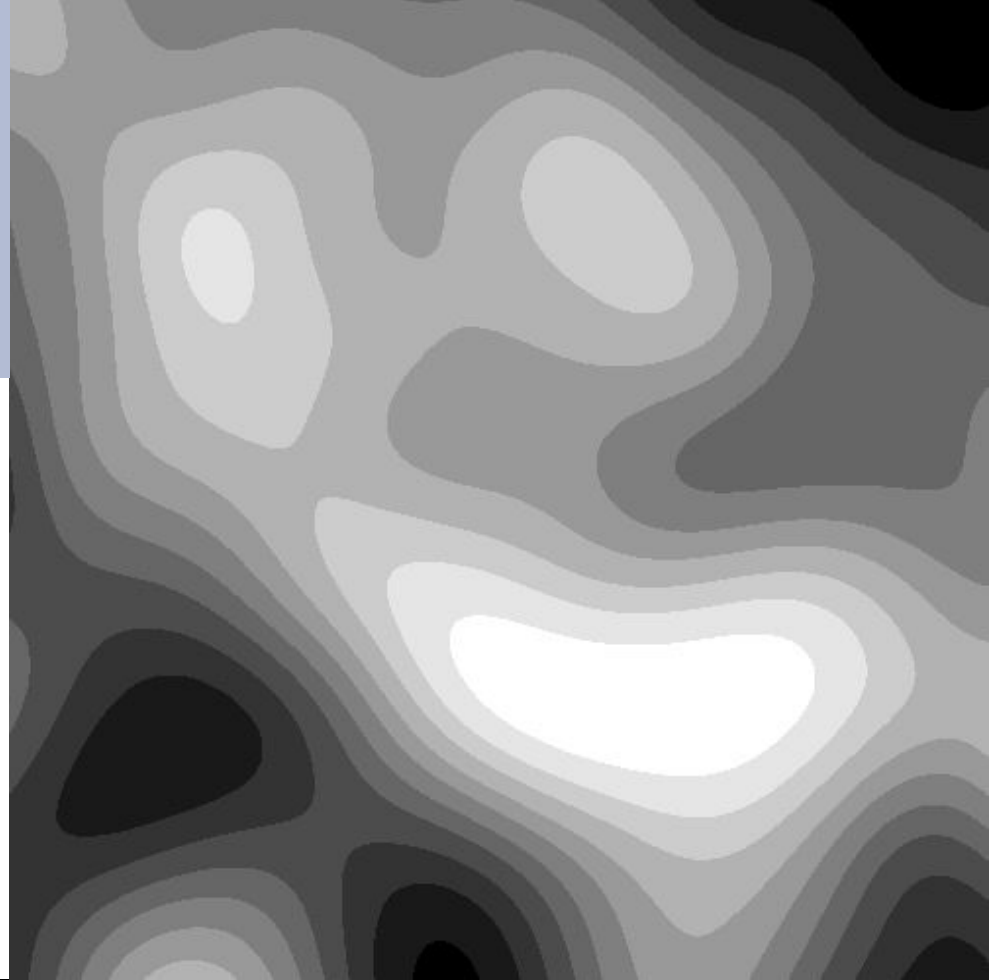


Simulating Complex Tasks

Objective Function $Q(x)$

Rugged Landscapes

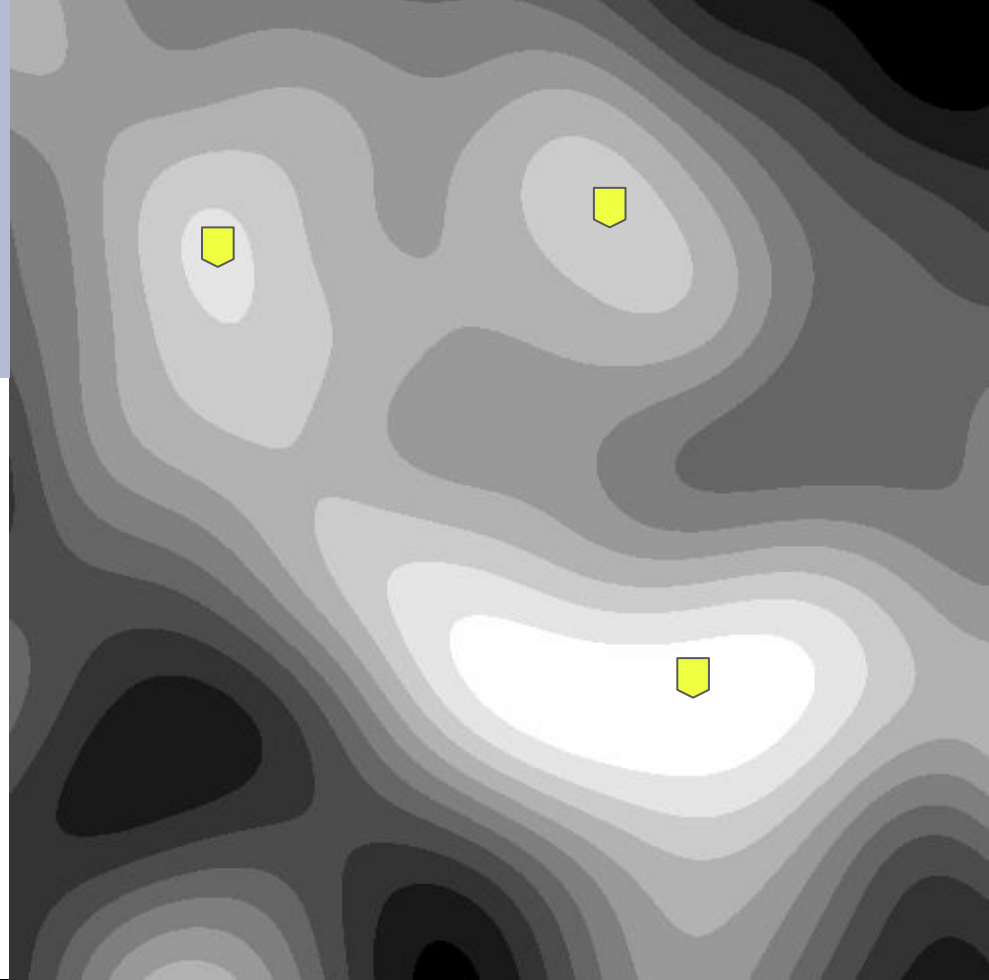
Objective Function $Q(x)$



Rugged Landscapes

Objective Function $Q(x)$

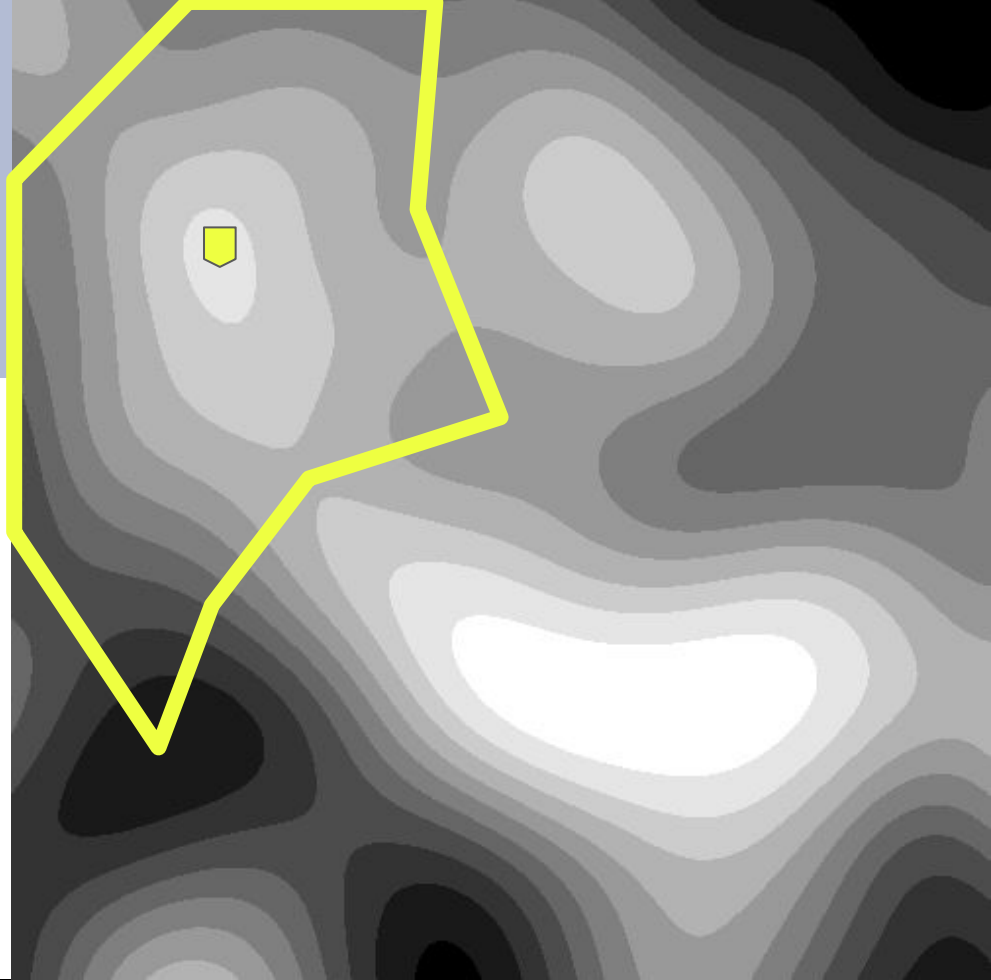
1. Local Maxima



Rugged Landscapes

Objective Function $Q(x)$

1. Local Maxima
2. Basins of Attraction



NK Model

(Kauffman & Levin, 1987)

- “Tunably rugged”

NK Model

(Kauffman & Levin, 1987)

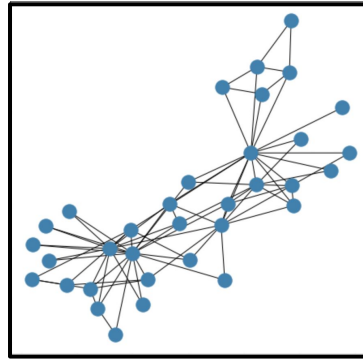
- “Tunably rugged”
- State x is a length- N binary string

NK Model

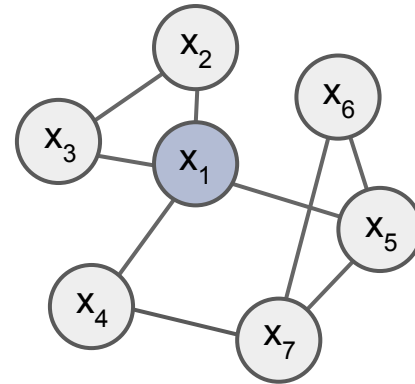
(Kauffman & Levin, 1987)

- “Tunably rugged”
- State x is a length- N binary string
- Sum of terms involving $K+1$ elements of x

Simulating Deliberation

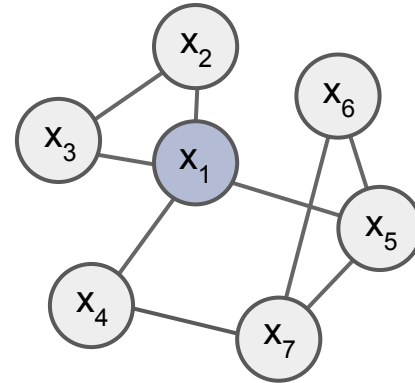


Learning Strategies



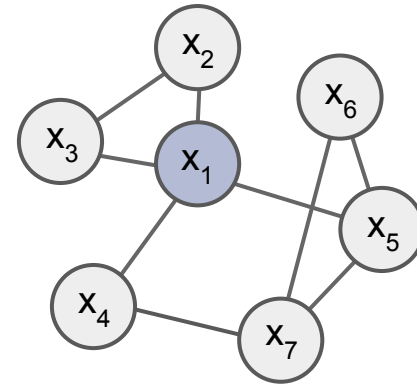
Learning Strategies

| | | | | | |
|-------|---|---|---|---|---|
| x_1 | 0 | 1 | 1 | 0 | 1 |
| x_2 | 1 | 0 | 1 | 1 | 0 |
| x_3 | 1 | 0 | 1 | 1 | 0 |
| x_4 | 0 | 1 | 0 | 0 | 1 |
| x_5 | 1 | 1 | 0 | 1 | 1 |



Learning Strategies

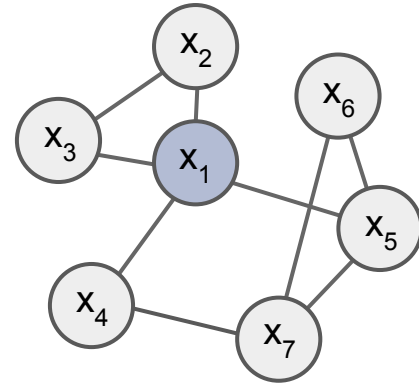
| | | | | | | |
|-------|---|---|---|---|---|-------|
| x_1 | 0 | 1 | 1 | 0 | 1 | $Q=3$ |
| x_2 | 1 | 0 | 1 | 1 | 0 | $Q=3$ |
| x_3 | 1 | 0 | 1 | 1 | 0 | $Q=3$ |
| x_4 | 0 | 1 | 0 | 0 | 1 | $Q=2$ |
| x_5 | 1 | 1 | 0 | 1 | 1 | $Q=4$ |



Best-Neighbor

(Lazer & Friedman, 2007; Barkoczi & Galesic, 2016)

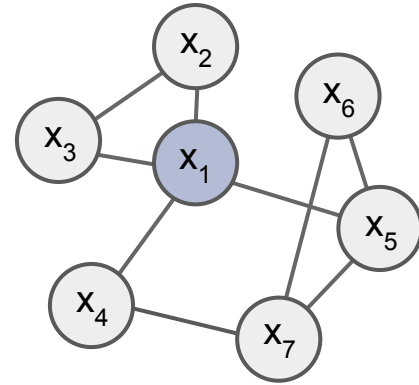
| | | | | | | |
|-------|---|---|---|---|---|-------|
| x_1 | 0 | 1 | 1 | 0 | 1 | $Q=3$ |
| x_2 | 1 | 0 | 1 | 1 | 0 | $Q=3$ |
| x_3 | 1 | 0 | 1 | 1 | 0 | $Q=3$ |
| x_4 | 0 | 1 | 0 | 0 | 1 | $Q=2$ |
| x_5 | 1 | 1 | 0 | 1 | 1 | $Q=4$ |



Best-Neighbor

(Lazer & Friedman, 2007; Barkoczi & Galesic, 2016)

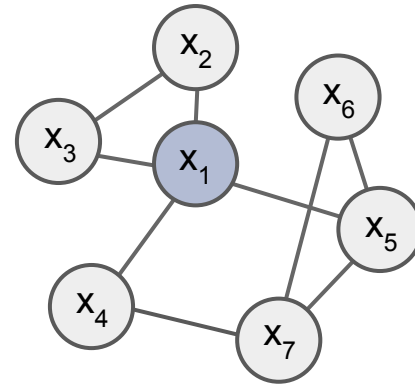
| | | | | | | |
|-------|---|---|---|---|---|-----|
| x_1 | 0 | 1 | 1 | 0 | 1 | Q=3 |
| x_2 | 1 | 0 | 1 | 1 | 0 | Q=3 |
| x_3 | 1 | 0 | 1 | 1 | 0 | Q=3 |
| x_4 | 0 | 1 | 0 | 0 | 1 | Q=2 |
| x_5 | 1 | 1 | 0 | 1 | 1 | Q=4 |



Conform

(Mason & Watts, 2012; Barkoczi & Galesic, 2016)

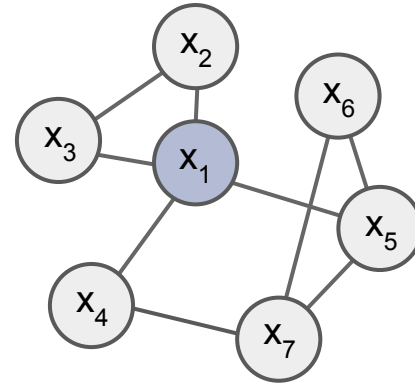
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|-------|---|---|---|---|---|
| x_1 | 0 | 1 | 1 | 0 | 1 |
| x_2 | 1 | 0 | 1 | 1 | 0 |
| x_3 | 1 | 0 | 1 | 1 | 0 |
| x_4 | 0 | 1 | 0 | 0 | 1 |
| x_5 | 1 | 1 | 0 | 1 | 1 |



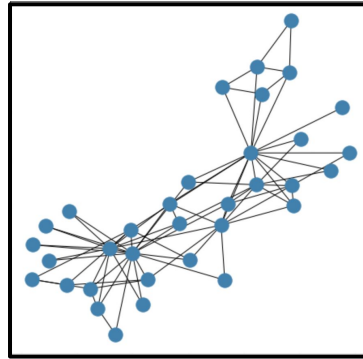
Conform

(Mason & Watts, 2012; Barkoczi & Galesic, 2016)

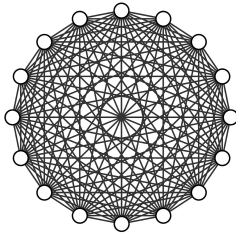
| | | | | | |
|-------|---|---|---|---|---|
| x_1 | 0 | 1 | 1 | 0 | 1 |
| x_2 | 1 | 0 | 1 | 1 | 0 |
| x_3 | 1 | 0 | 1 | 1 | 0 |
| x_4 | 0 | 1 | 0 | 0 | 1 |
| x_5 | 1 | 1 | 0 | 1 | 1 |



Simulating Relationships

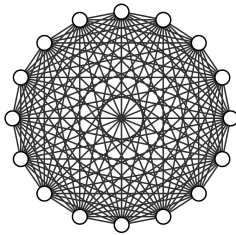


Conventional Large Groups

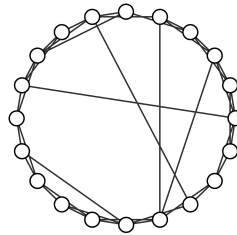


Complete

Conventional Large Groups

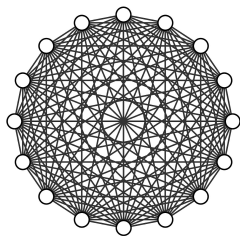


Complete

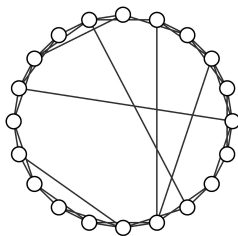


Small-World
(Watts &
Strogatz, 1998)

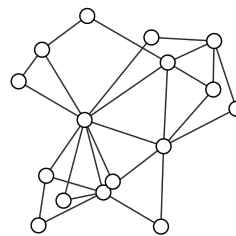
Conventional Large Groups



Complete

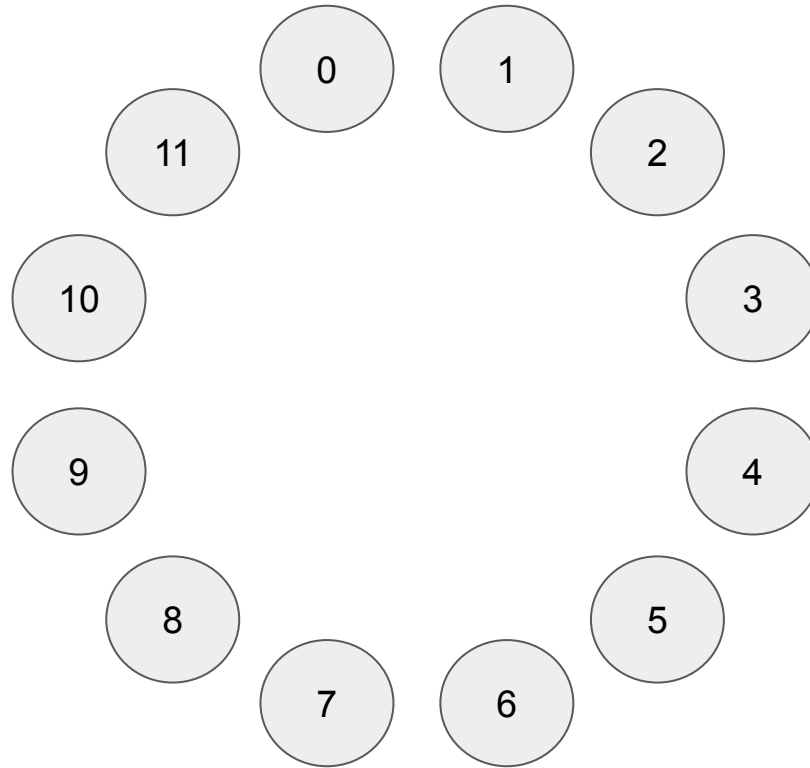


Small-World
(Watts &
Strogatz, 1998)

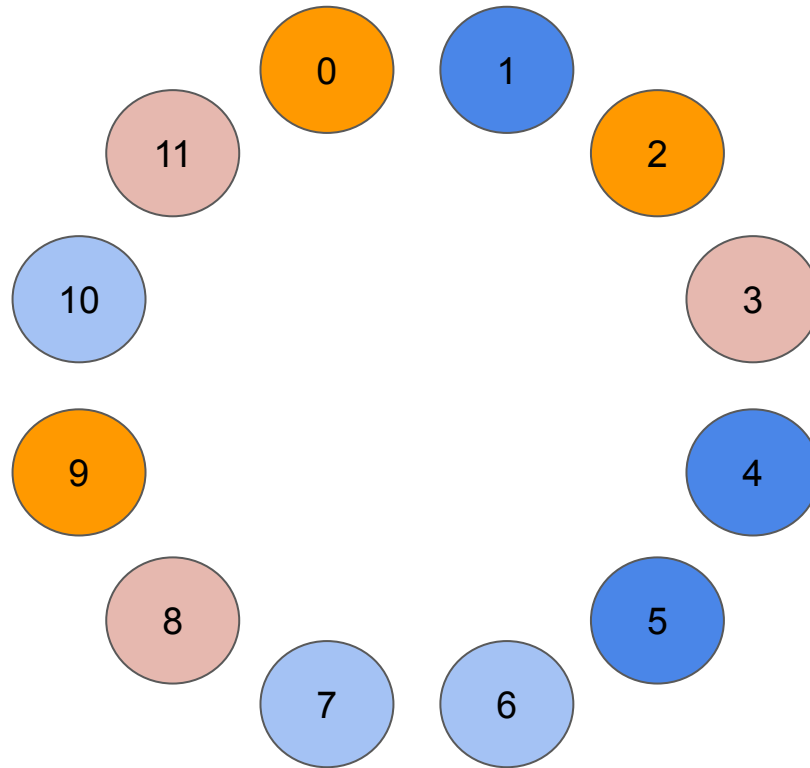


Preferential
Attachment
(Barabási &
Albert, 1999)

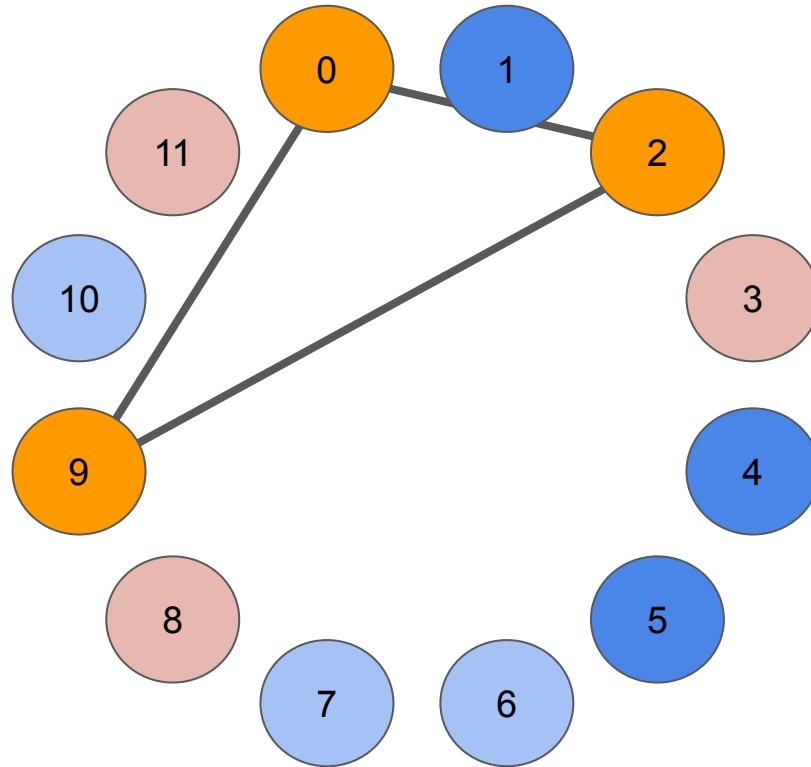
Network Deliberation



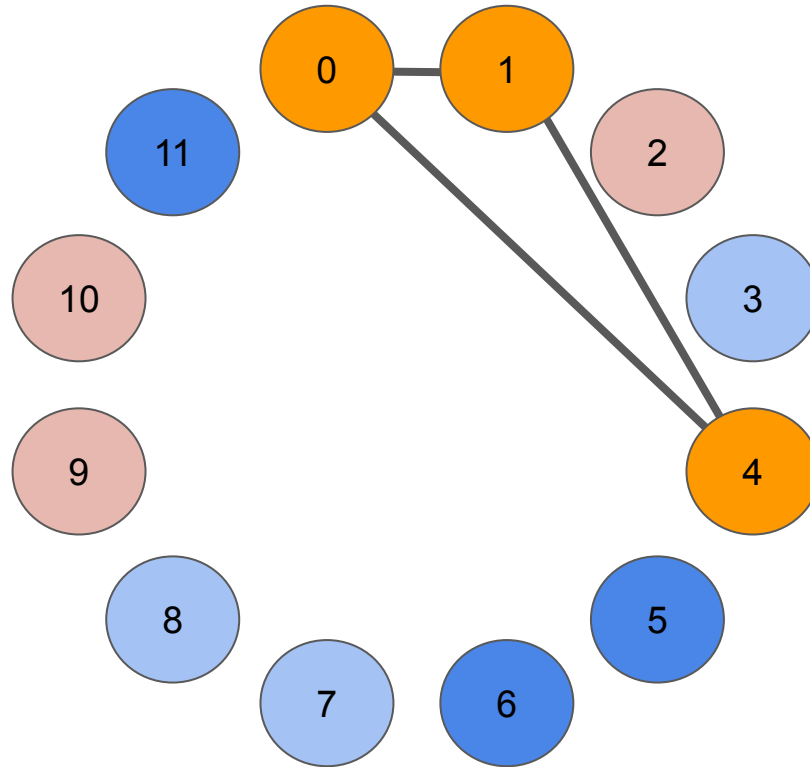
Random Pod



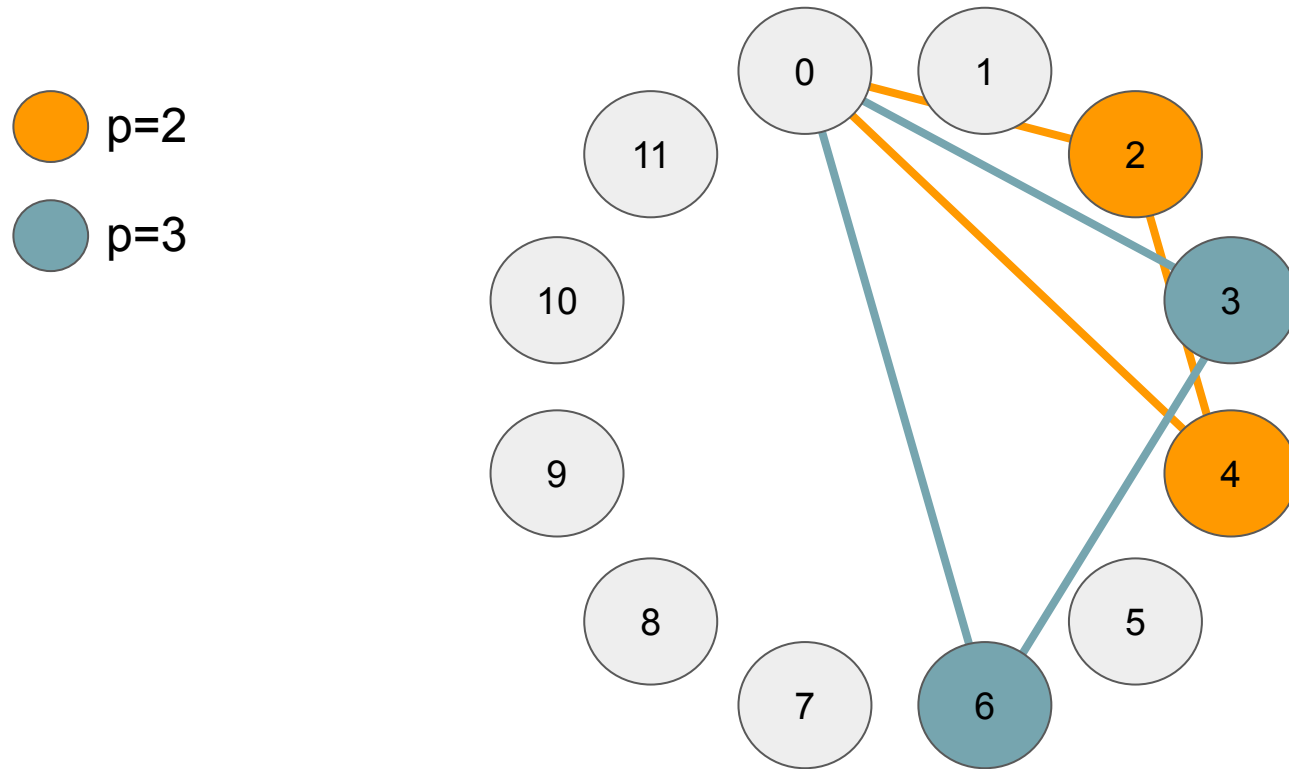
Random Pod



Random Pod

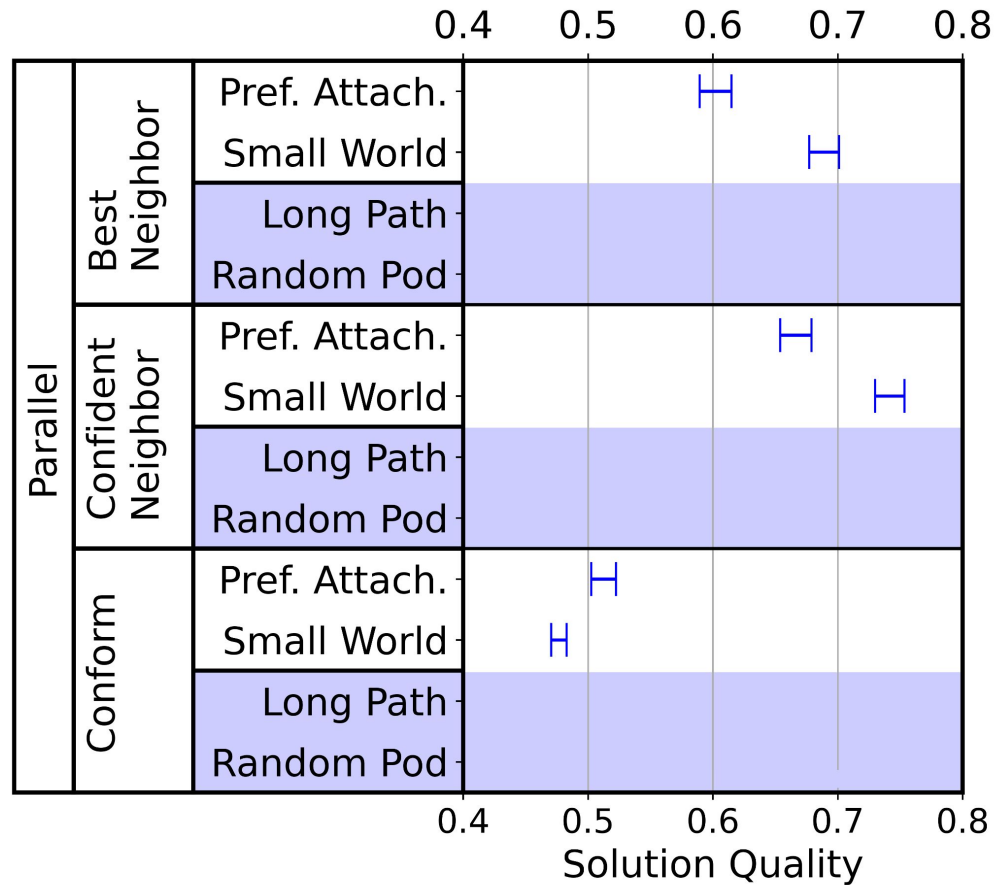


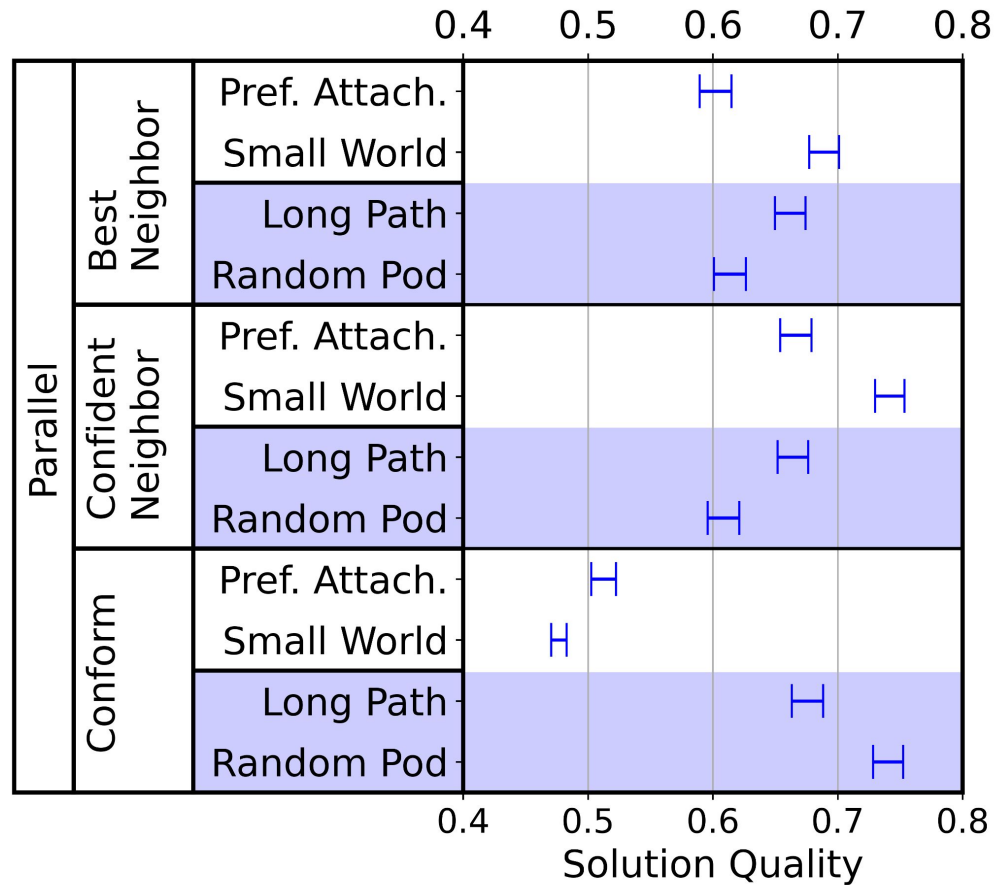
Long-Path



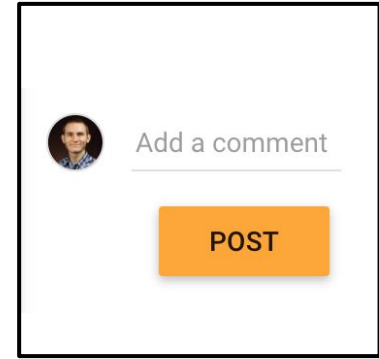
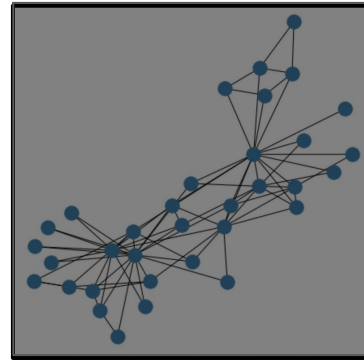
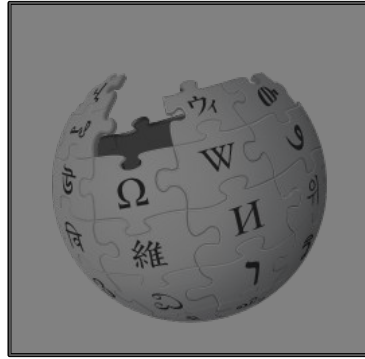
Simulation Procedure

1. Place agents on a network.
2. Assign each agent a random initial solution.
3. For each agent:
 - a. Use social learning to find new solution.
 - b. Use individual learning to find new solution.
 - c. Adopt one of the above.
4. (ND only) Reassign pods.
5. Repeat from step 2 until solutions are stable.





Online Experiment



With: Jane Im, Daniel M. Romero

Hypothesis / Research Questions

H1: Network deliberation results in higher agreement among participants than single large-group deliberation.

Hypothesis / Research Questions

H1: Network deliberation results in higher agreement among participants than single large-group deliberation.

RQ1: How do preferences evolve throughout network deliberation?

Hypothesis / Research Questions

H1: Network deliberation results in higher agreement among participants than single large-group deliberation.

RQ1: How do preferences evolve throughout network deliberation?

RQ2: How effective is network deliberation at identifying and resolving conflict?

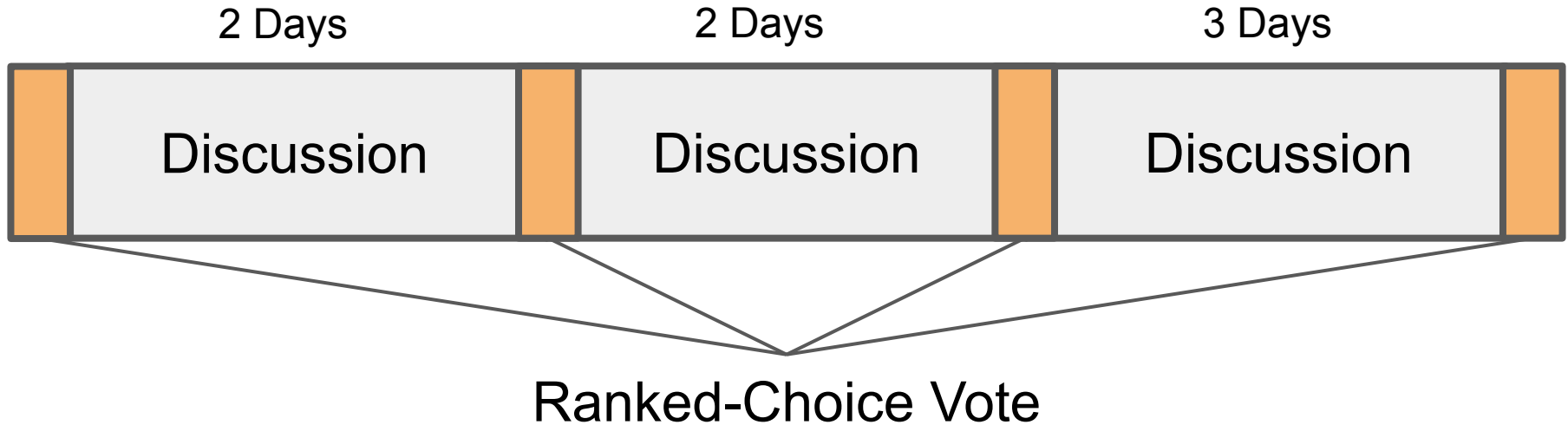
Deliberation Topic

The 2021 SI 301 final exam will include a section worth up to 10% based on content covered during the first part of the semester. Which of the following options should be chosen for the topic and format of that section of the exam?

Deliberation Topic

1. Open-ended with partial credit (2 questions, 5 points each) - Ch. 1-2
2. Open-ended with partial credit (2 questions, 5 points each) - Ch. 3
3. Multiple choice with no partial credit (5 questions, 2 points each) - Ch. 4
4. Multiple choice with no partial credit (5 questions, 2 points each) - Ch. 5
5. True/false with no partial credit (10 questions, 1 point each) - Ch. 6
6. True/false with no partial credit (10 questions, 1 point each) - Ch. 9

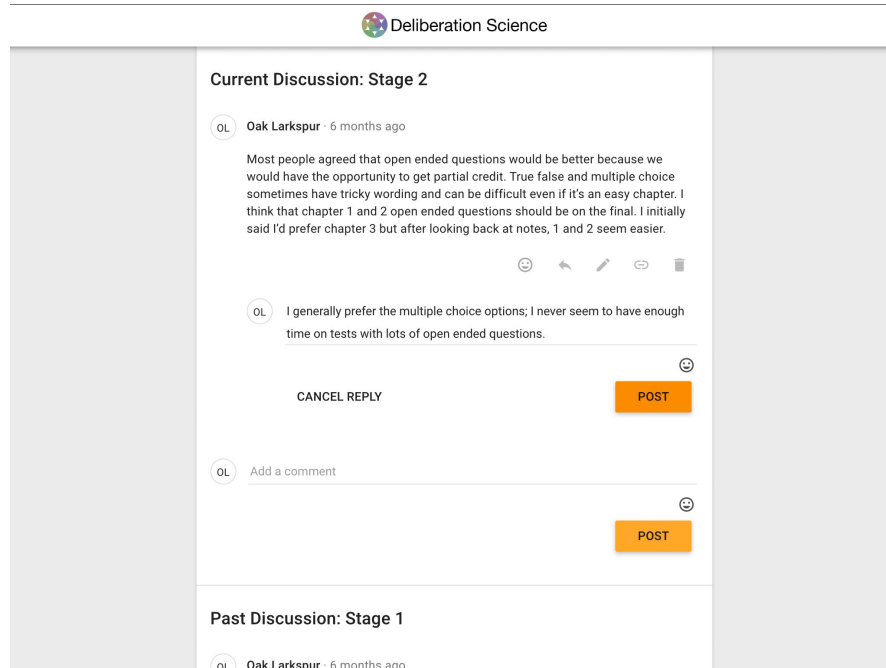
Deliberation Structure




Treatments

1. Control: Conventional deliberation (N = 33)
2. Network deliberation: random-pod (pod size ≤ 5 , N=33)

Online Platform



Online Platform

 Deliberation Science

What should the topic and format be for a section of the SI 301 final exam? - Stage 3

The 2021 SI 301 final exam will include a section worth up to 10% based on the content covered during the first part of the semester. Which of the following options should be chosen for the topic and format of that section of the exam?

Drag the options below to arrange them according to your preference. Order them from most preferred (top) to least preferred (bottom).

Your response

Drag and drop options in order of preference (1 being your most preferred option).

- 1

Open-ended with partial credit (2 questions, 5 points each) - Ch. 1-2:

Intro to networks.
- 2

Open-ended with partial credit (2 questions, 5 points each) - Ch. 3:

Bridges, clustering, triadic closure, strong and weak ties, and the Strong Triadic Closure Property.
- 3

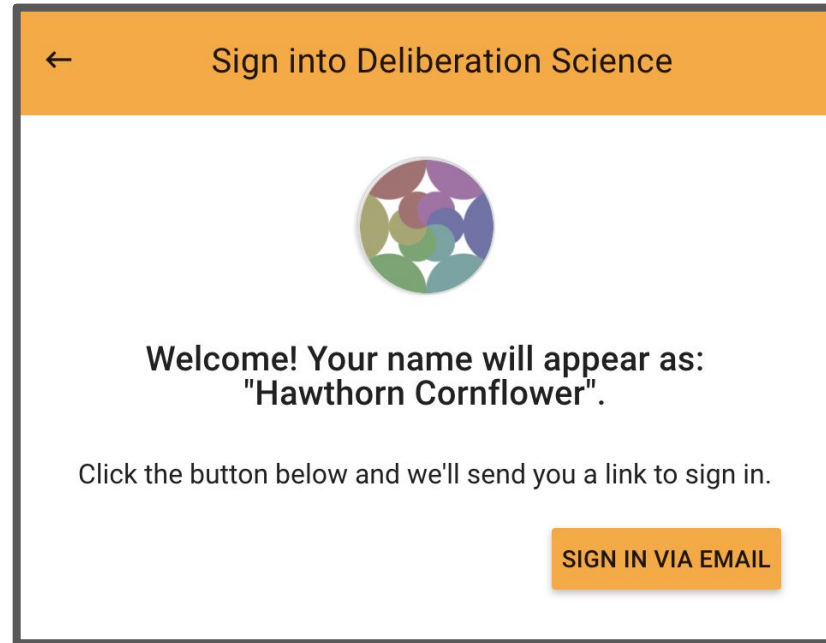
True/false with no partial credit (10 questions, 1 point each) - Ch. 9:

Auctions.
- 4

True/false with no partial credit (10 questions, 1 point each) - Ch. 6:

Game theory, best responses, and Dominant Strategies, Nash

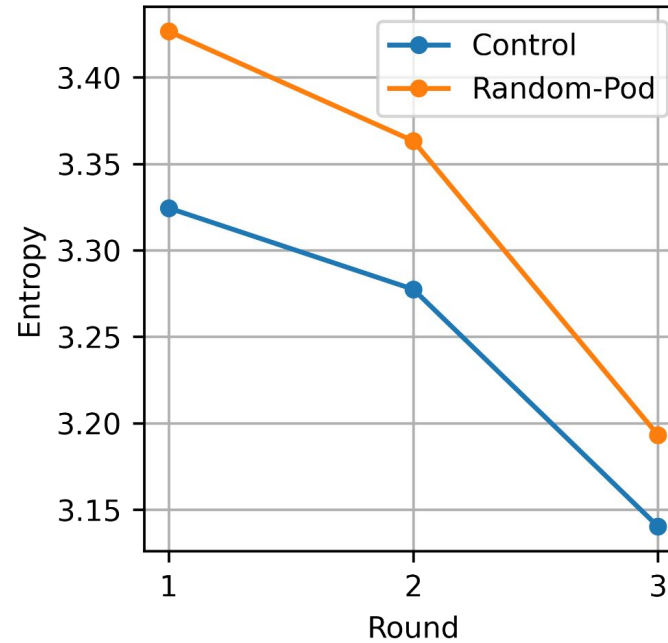
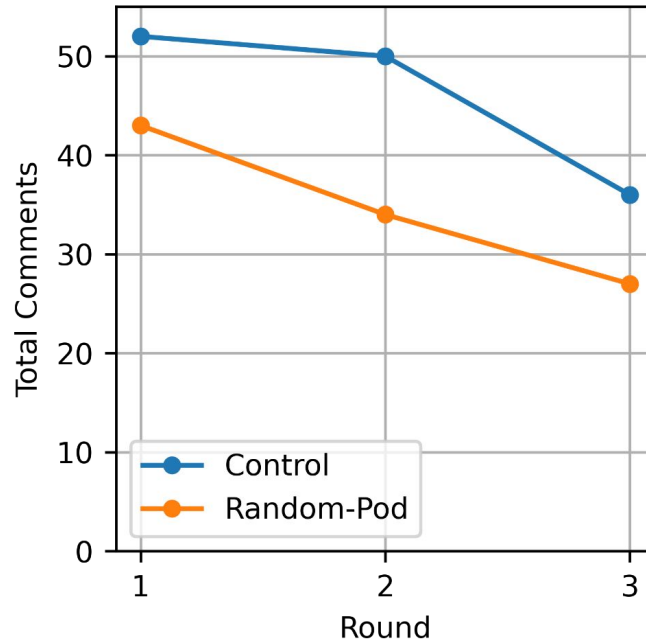
Pseudonymous Deliberation



Deliberation Excerpt

P09: Opened ended questions allow for partial credit while multiple choice and true false has no partial credit. I feel comfortable with chapters 1, 2, and 3 as they are the easiest. I am least comfortable with auctions.

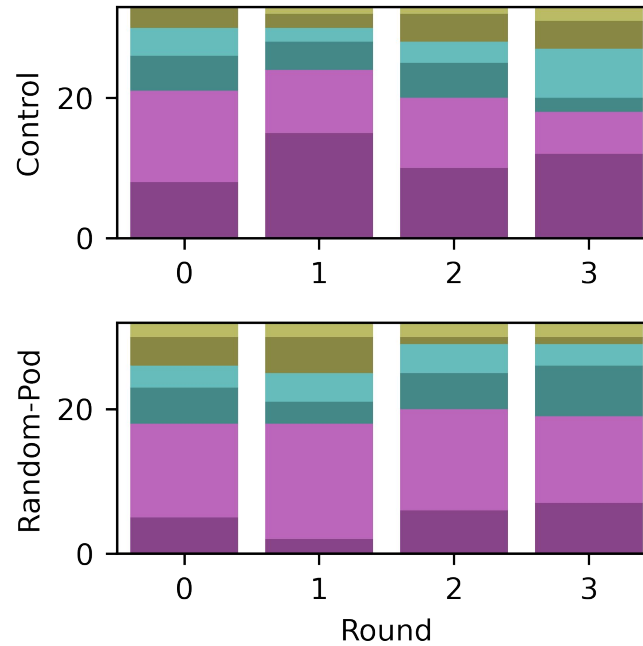
Comment Activity



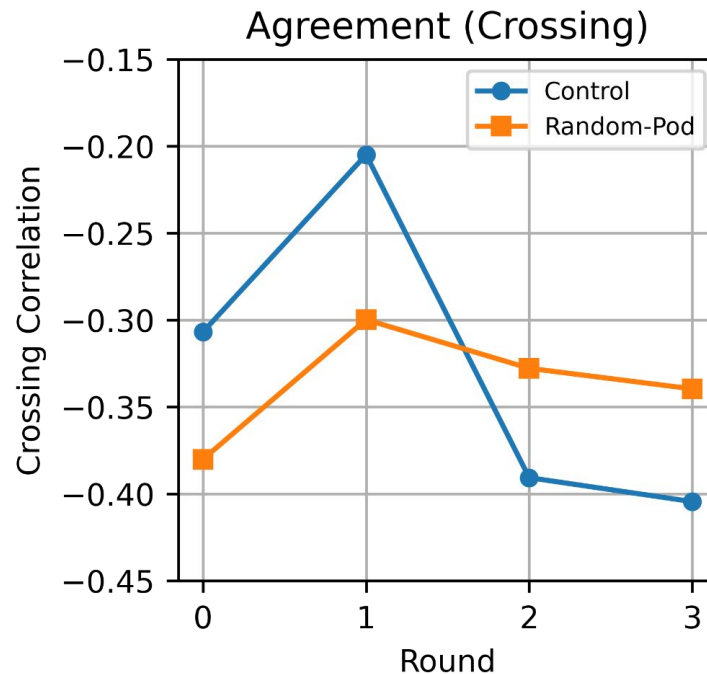
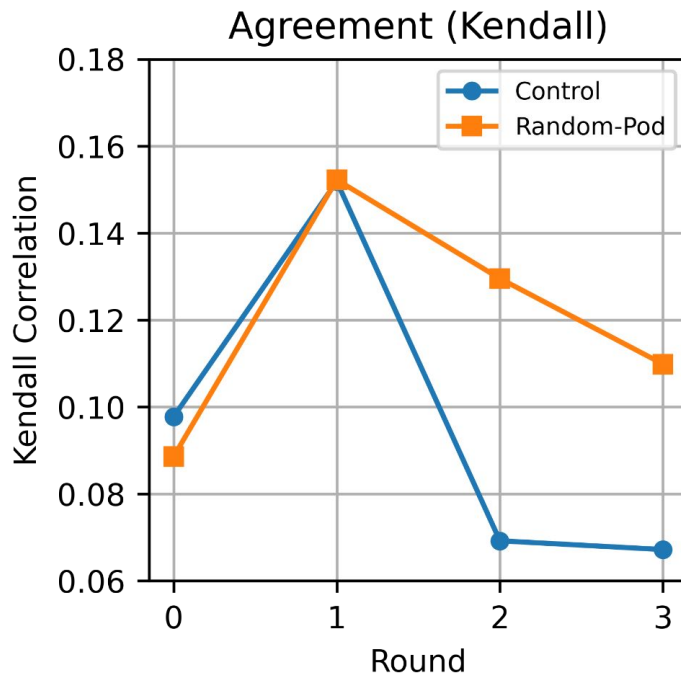
Voting Results

| | <u>Control</u> | | | <u>ND</u> | | |
|-------|----------------|-------------|-------|-----------|-----------|-------|
| Round | Condorcet | Plurality | Borda | Condorcet | Plurality | Borda |
| 0 | prop2 | prop2 | prop1 | prop2 | prop2 | prop2 |
| 1 | prop1 | prop1 | prop1 | prop2 | prop2 | prop2 |
| 2 | prop1 | prop1/prop2 | prop1 | prop2 | prop2 | prop2 |
| 3 | prop1 | prop1 | prop1 | prop2 | prop2 | prop2 |

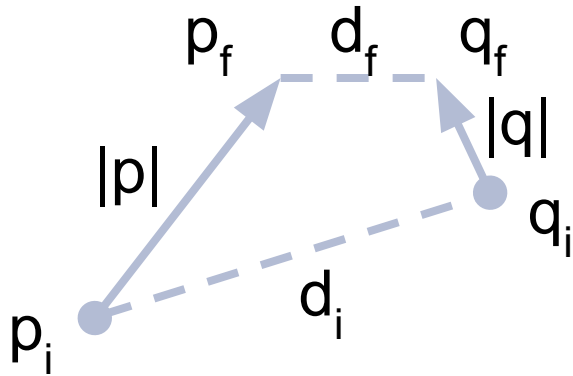
First-Choice Distributions



Agreement

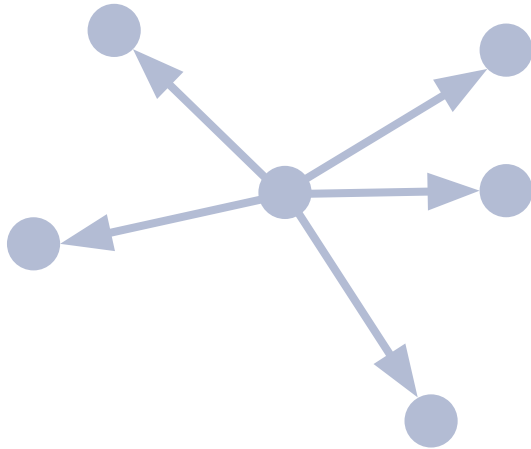


Social Influence



$$c(p, q) = -(d_f - d_i) \frac{|p|}{|p| + |q|}$$

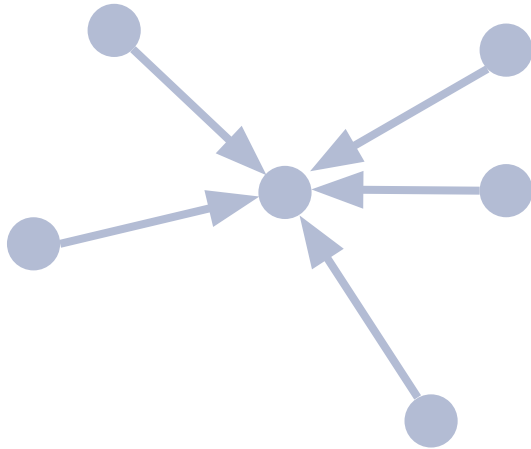
Social Influence



Conformity

$$C(p) = \sum_q c(p, q)$$

Social Influence



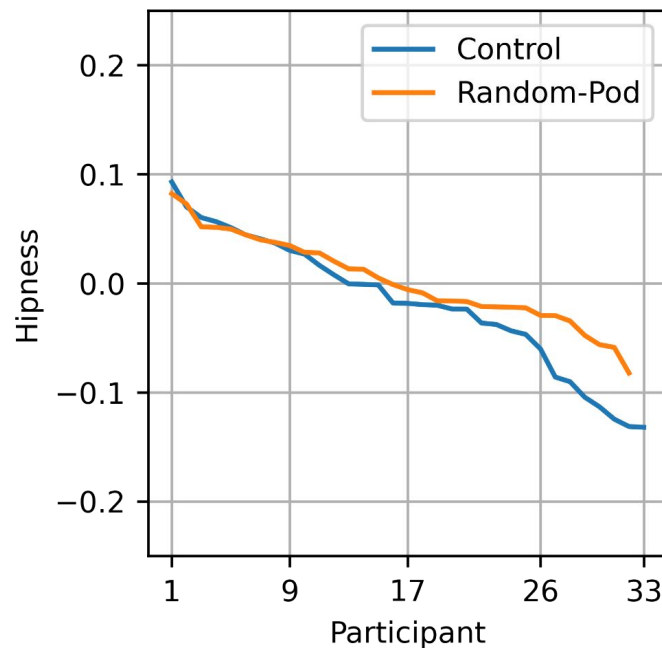
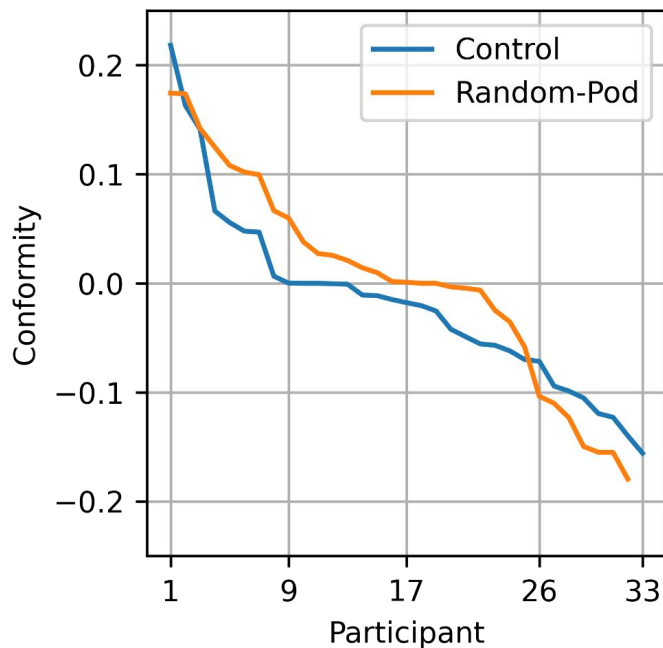
Conformity

$$C(p) = \sum_q c(p, q)$$

Hipness

$$H(p) = \sum_q c(q, p)$$

Social Influence



Social Influence

Control

| | Prop 1 | Prop 2 |
|---------|--------|--------|
| Poll 0 | 8 | 13 |
| Round 1 | 7 | 2 |
| Poll 1 | 15 | 9 |

Random-Pod

| | Prop 1 | Prop 2 |
|---------|--------|--------|
| Poll 0 | 5 | 13 |
| Round 1 | 2 | 9 |
| Poll 1 | 2 | 16 |

First-choice Votes / Supportive Comments

Discussion

Discussion

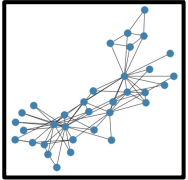


1. Evidence supporting tight-knit equal participation.

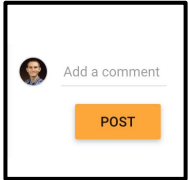
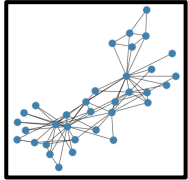
Discussion



1. Evidence supporting tight-knit equal participation.
2. Improvements under strong social influence.



Discussion



1. Evidence supporting tight-knit equal participation.
2. Improvements under strong social influence.
3. Support for H1 that Network Deliberation improves agreement in real deliberation.
4. Evidence of information cascade and protective effects of Network Deliberation.

Discussion



1. Design of platforms and protocols.
2. Design of organizational structures and procedures.

Network Deliberation:

The role of network structure in large-scale,
internet-enabled, participatory decision-making

Edward L. Platt

Dissertation Committee

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Tawanna Dillahunt

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