



# **Creation, Evolution, and Dissolution Of Social Groups**

Presented By:  
Christos KREATSOULAS

# Outline

- Background
- Utility Model
- NetSense data
- Results
- Discussion
- Questions



The background features a central word 'Background' in a bold, black, sans-serif font. Surrounding the text are several light gray circles of varying sizes and opacities. Some circles are solid, while others are semi-transparent. Dashed gray lines connect some of the circles, creating a network-like structure. The overall aesthetic is clean and modern.

**Background**

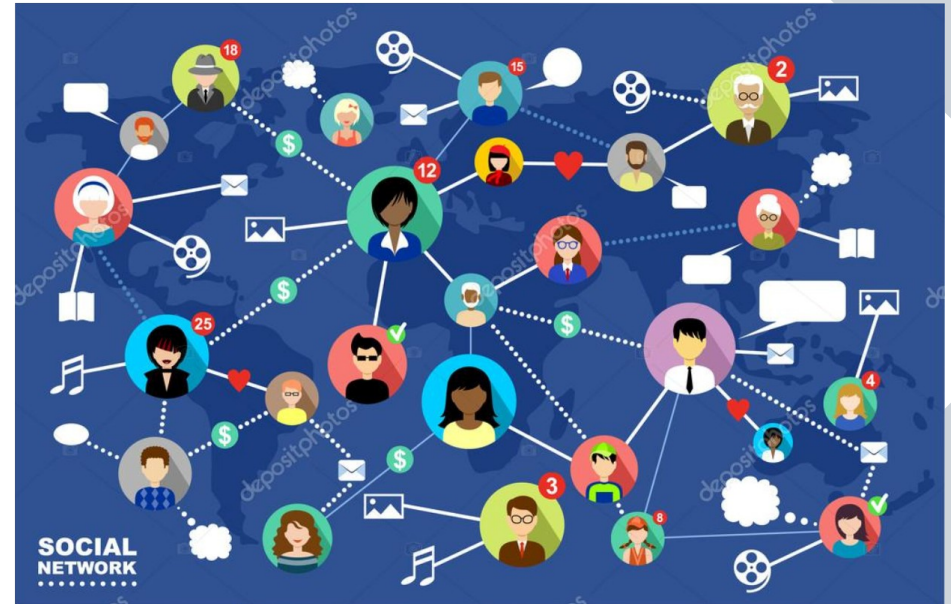
# Motivation

- Central Question in Social Science
- Few empirical studies relating to impact of opinions/values
- Key part of the human experience



# Goals / Purpose

- Model the evolving dynamics of social groups and values
- Account for two trends: increase in opinion homogeneity and fickleness of individuals with unpopular opinions




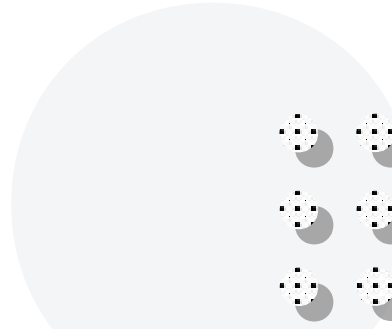
The image features a central text element 'Utility Model' surrounded by six light gray circles of varying sizes. The circles are arranged in a roughly circular pattern around the text. Dashed black lines connect some of the circles, forming a network of relationships. Specifically, a dashed line connects the top-left circle to the top-center circle, another connects the top-center circle to the top-right circle, a third connects the top-right circle to the middle-right circle, and a fourth connects the middle-right circle to the bottom-right circle. The bottom-left circle is also connected to the middle-left circle by a dashed line. The text 'Utility Model' is centered in a large, bold, black sans-serif font.

# Utility Model



# Utility + Homophily



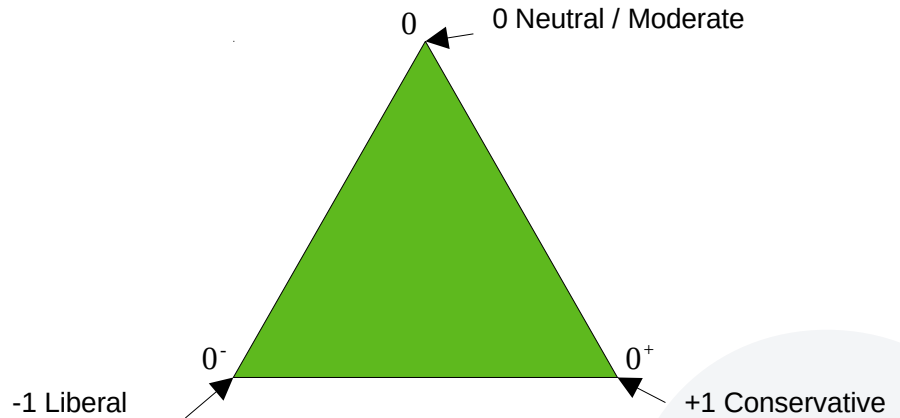
- Previous works:
    - Homophily as primary benefit of group membership
      - Both sociol-demographic characteristics and values
    - Ruling parties equally negative toward non-ruling
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# Subjective Utility Model

- Gain utility from interacting with like-minded members
- Lose utility from interacting with other members
- Individuals primarily make group changes for their own benefit
- May also act altruistically
  - Strongly: Benefit of entire group
  - Weakly: Benefit of members with same values

$$W_{g,a}^s = \sum_{m \in g \cap s_{m,a}=s} w_{m,g}$$

$$u_{v,g,a} = w_{v,g} (2W_{g,a}^{s_{v,a}} - W_{g,a}^{s_{v,a}^+} - W_{g,a}^{s_{v,a}^-})$$



$$f_v^u = x f^g(v) + \sum_{g \in G_v} \sum_{a \in A} u_{v,g,a}$$

$$f^g(c) = W_v (2\bar{W} - W_v)$$

$$W_v = \sum_{g | v \in G} w_{v,g}$$



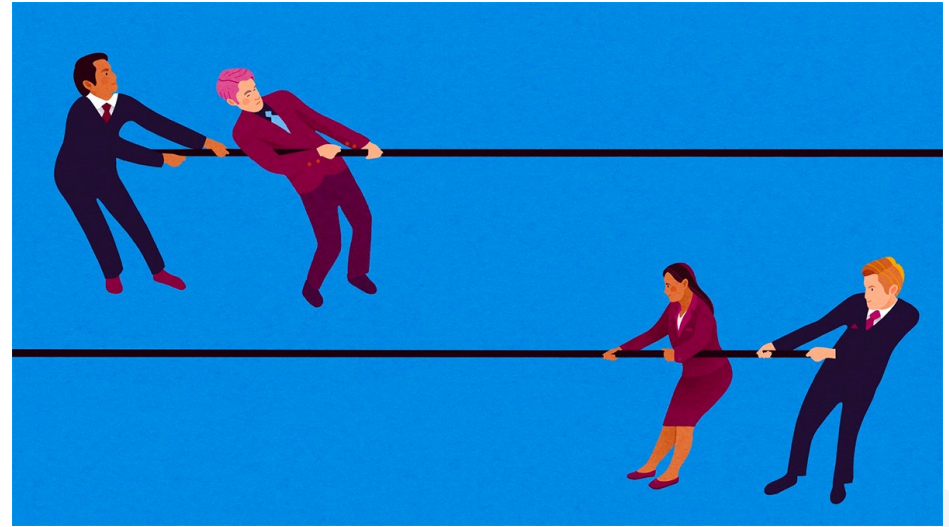
# Calculating Polarization

- Measure variance of each stance,  $s$ , across each issue,  $a$ .

$$W_{g,a} = \sum_{s=-1}^1 W_{g,a}^s$$

$$G_{g,a}^s = w_{g,a} \frac{\sum_g W_{g,a}^s}{\sum_g W_{g,a}}$$

$$P_{g,a} = \sum_{s=-1}^1 (w_{g,a} G_{g,a}^s - W_{g,a}^s)^2$$



The image features a central text element 'NetSense Data' in a bold, black, sans-serif font. This text is surrounded by several light gray circles of varying sizes. Some of these circles are connected to each other by dashed gray lines, creating a network-like structure. The overall composition is minimalist and modern, set against a plain white background.

**NetSense Data**

# Collection Methods

- Follows 196 students in the incoming 2011 class of Freshman at Notre Dame
- Two components
  - Survey results on variety of topics collected during each semester
  - Continuously collected Bluetooth information from phones of participants
    - Interaction detected by physical proximity

Properties of group structure	Semester			
	1	2	3	4
Number of people in all groups	189	185	171	153
Number of groups	256	269	149	100
Number of meetings per group	177.9	224.5	205.1	132.8
Average number of group members	4.1	3.9	3.9	4.0
Average fraction of attended meetings	0.89	0.91	0.90	0.91

# Data

Semester	Percentage of changes that are			Group polarization	
Boundary	Egocentric	Altruistic		Percentage	Absolute
		Weakly	Strongly	Increase	Difference
1-2	90.6	80.4	76.6	64.0	2.64
2-3	92.4	84.0	81.4	49.1	1.96
3-4	95.3	89.2	86.2	37.4	1.80

Fractions of:	All individuals with		High utility individuals with	
	Majority stance	Minority stance	Majority stance	Minority stance
Politics	0.55	0.16	0.74	0.10
<b>Legalization of</b>				
Marijuana	0.54	0.14	0.75	0.03
Abortion	0.49	0.13	0.63	0.13
Gay marriage	0.54	0.20	0.68	0.12

# Data

Measure	Group joining	Group leaving	Stance change
Precision	88% (0.28%)	26% (2.8%)	58% (21%)
Recall	84% (0.23%)	93% (2.8%)	50% (27%)
F1	86% (0.24%)	41% (2.7%)	54% (22%)

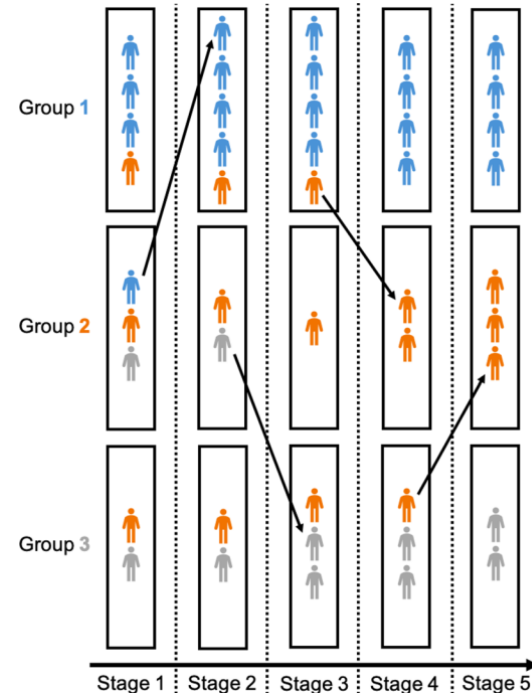
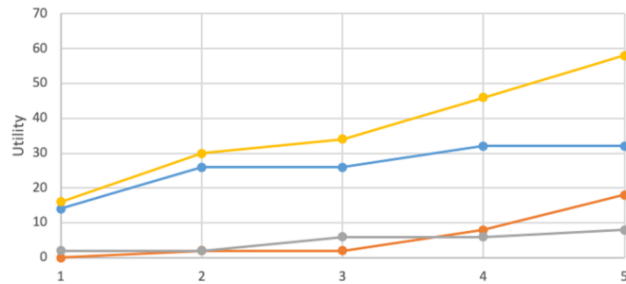
- Test data vs Random Network (parenthesized)

A decorative graphic featuring several light gray circles of varying sizes and dashed lines. The circles are arranged in a scattered pattern around the central text. Dashed lines connect some of the circles, creating a network-like structure. The overall style is clean and modern.

# Results

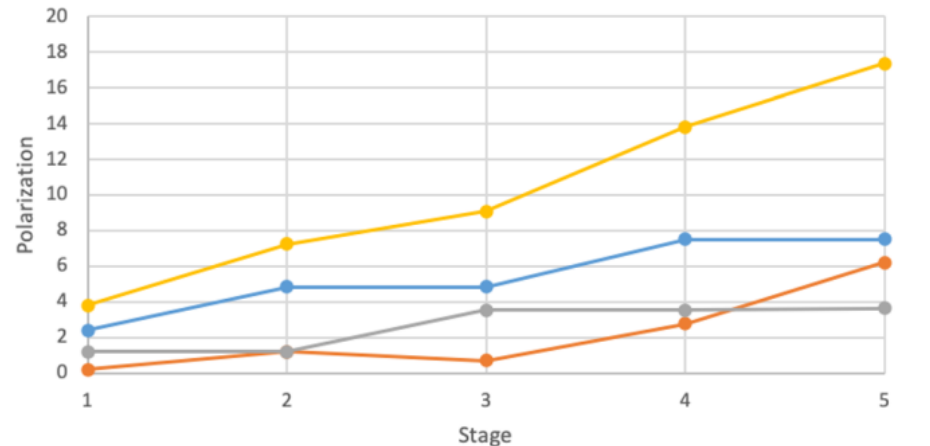
# Utility Drives Group Dynamics

- Increases in utility account for 93% of the changes made
- Those with low utility make frequent changes



# Predicting Changes in Membership And Opinions

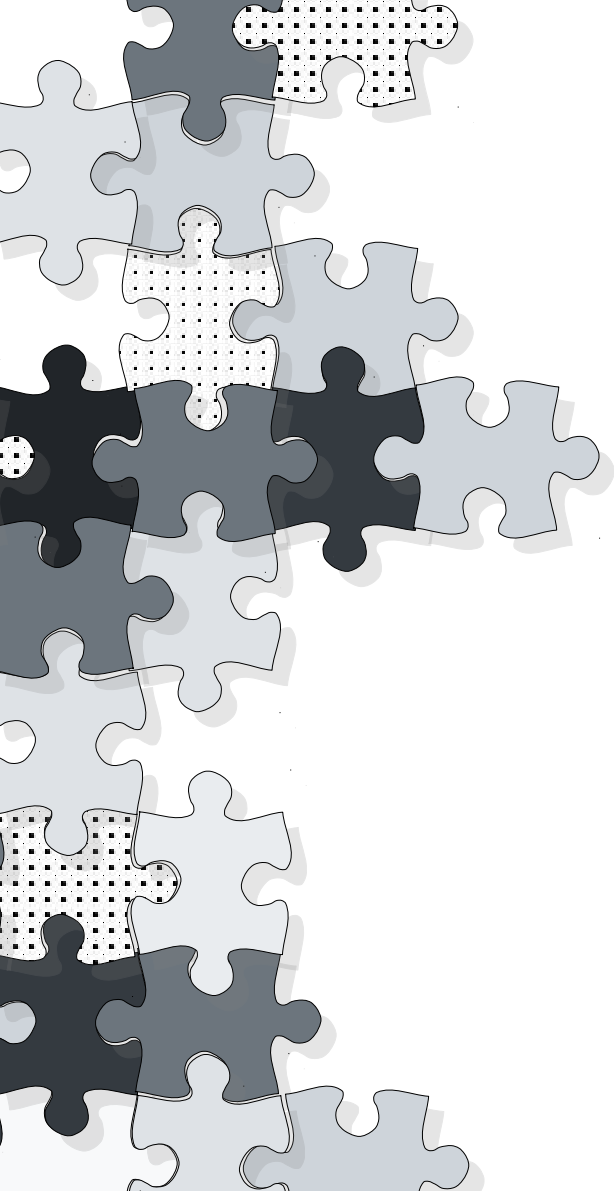
- Model best predicts group joining
  - Some capacity to predict group leaving
  - Some capacity to predict stance changes







# Discussion



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- Social group preferences are strongly egocentric
  - Able to predict group joining behavior well
  - More empirical analysis needed in the area

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# References



- Flamino, J., Szymanski, B.K., Bahulkar, A. et al. Creation, evolution, and dissolution of social groups. Sci Rep 11, 17470 (2021). <https://doi.org/10.1038/s41598-021-96805-7>



Questions?