Networks, Diffusion and Inequality

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Any process that shapes network formation will have implications for inequality.

DiMaggio and Garip (2011, AJS) argue that:

Homophily (tendency for actors to associate with similar others)

leads to segregated networks, and

to **inter-group inequality** in outcomes for which alters offer a positive influence.

DiMaggio and Garip (2011) ask:

What explains the racial gap in Internet adoption in the United States?

DiMaggio and Garip (2011) consider:

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Homophily: Networks are clustered by education, income, and race

Network externalities: Technology becomes more valuable the more people in one's network adopt it

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Under these conditions by status + homophily + network by status + by status + externalities DiMaggio and Garip (2011) argue:

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social networks lead to surplus inequality

DiMaggio and Garip (2011) use:

an agent-based model

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an agent-based model

with agents sampled from the General Social Survey

Homophily — Network — Diffusion of — Inter-group inequality structure a practice in that practice Homophily —>Network —>Diffusion of _-->Inter-group inequalityConsolidationstructurea practicein that practice

Zhao and Garip

Consolidation: the correlation between characteristics in a population

Blau and Schwartz (1984) Crosscutting Social Circles Blau and Schwartz (1984) argued:

Low homophily and low consolidation ensure cross-cutting social ties and social cohesion

Low homophily and low consolidation linked to higher rates of

- inter-racial marriages in communities Blum 1984
- inter-group interactions in organizations Block & Grund 2014

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Homophily Consolidation



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Homophily _____ Network _____ Social cohesion = _____ Diffusion of a practice

Centola (2015, AJS)

Agent-based model of network formation and diffusion



















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consolidation interact.



Centola (2015, AJS)

HomophilyNetworkSocial cohesion ≡ConsolidationstructureDiffusion of a norm

When the diffusion process is *simple* (i.e., you need 1 adopter in your network to adopt a practice), then **low consolidation and low homophily** lead to successful diffusion.

Centola (2015, AJS)

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When the diffusion process is *simple* (i.e., you need 1 adopter in your network to adopt a practice), then **low consolidation and low homophily** lead to successful diffusion.

When the diffusion process is *complex* (that is, you need \geq 2 adopters in your network to adopt a practice), then **medium consolidation and medium homophily** lead to successful diffusion.













Centola (2015, AJS)

HOMOPHILY

What does this all mean for inequality?










1. Set the level of homophily and consolidation

G individuals in group



Watts, Dodds & Newman (2002)

G individuals in group *L* levels in hierarchy



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1 + number of steps to reach a common root if the trees are superimposed on one another



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- 4. Set the initial seed for diffusion (a random high-status individual and their network)
- 5. Run the model until diffusion reaches equilibrium

Zhao and Garip with status-based adoption threshold



Centola with fixed adoption threshold



Zhao and Garip with varying consolidation





Zhao and Garip with varying consolidation





Zhao and Garip with varying consolidation



Zhao and Garip with varying consolidation



DiMaggio and Garip with fixed consolidation



Inequality **increases** with homophily

Zhao and Garip with high consolidation

DiMaggio and Garip with fixed consolidation





Inequality **increases** with homophily

Zhao and Garip with high consolidation

9

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2

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10

20

Inequality increases

with homophily

Odds Ratio of Adoption



30

Time

40

50

DiMaggio and Garip with fixed consolidation



Inequality increases with homophily

Zhao and Garip with low consolidation



DiMaggio and Garip with fixed consolidation



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What is the underlying intuition?

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Homophily and consolidation can **help diffusion** and as a result can **reduce inequality**





Odds ratios under low consolidation

Can we use these insights in the real world?

Migration is a social diffusion process

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Past migration is a catalyst for future mobility (*aka* cumulative causation of migration)

There is variation ('inequality') in the diffusion of migration

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Example: Migration started in the centralwestern states in Mexico – those connected to the United States via railroads in 1900s. But those states are not the highest-migration states now.



Does the structure of social ties explain the variation in the diffusion of migration?

Network \longrightarrow Diffusion of \longrightarrow Inter-group inequality structure a practice in that practice







Data

Mexican Migration Project 161 communities surveyed between 1982 and 2016 200 randomly-selected households in each community

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Sample

19,708 life histories available from **household heads** and **spouses** >1 million person-years from 1965 to 2016

Induced homophily = homogeneity

complement of mean of all pairwise social distances

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Consolidation

mean pairwise correlation among six dimensions

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Consolidation

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Migration prevalence

Percentage of individuals who have ever migrated in a community-year

Hypotheses

Middling levels of homogeneity and consolidation @ community level

Hypotheses

Middling levels of homogeneity and consolidation @ community level Highest effect of community migration prevalence on individual migration

Models

Logit model of whether an individual makes a U.S. trip in a year

Introduce linear and quadratic terms for homogeneity and consolidation

Include interactions homogeneity x consolidation x prevalence Predicted migration probability under varying degrees of homogeneity and consolidation



Hypotheses

Under high consolidation

Homogeneity **amplifies** between-community variance in migration prevalence







Under low consolidation

Homogeneity **reduces** between-community variance in migration prevalence









Models

Categorize communities into 3 x 3 groups by homogeneity (H) and consolidation (C)

Compute the Gini within each group

Regress the Gini on 9 H x C group and year dummies

Results

Under high consolidation, homogeneity **does not** increase between-community variance.



Results

Under low consolidation, homogeneity **reduces** between-community variance.



Can we use this theory to explain our original puzzle?



Take-away

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Consolidation is key to network formation and diffusion

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Homophily can help diffusion
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These parameters can be measured with socio-demographic data and used as a proxy for network structure