Ranking people

Joint work with:
F. Karimi, M. Génois, C. Wagner, P. Singer, J. Pfeffer

Markus Strohmaier

University of Mannheim, Chair for Data-Science in the Economic and Social Sciences
GESIS, Scientific Coordinator for Digital Behavioral Data

This talk:

- **Part I: MOTIVATION**
  How is ranking people different from ranking documents?

- **Part II: RANKING OF MINORITIES IN SOCIAL NETWORKS**
  How can inequalities in rankings emerge?

- **Part III: CONCLUSIONS**
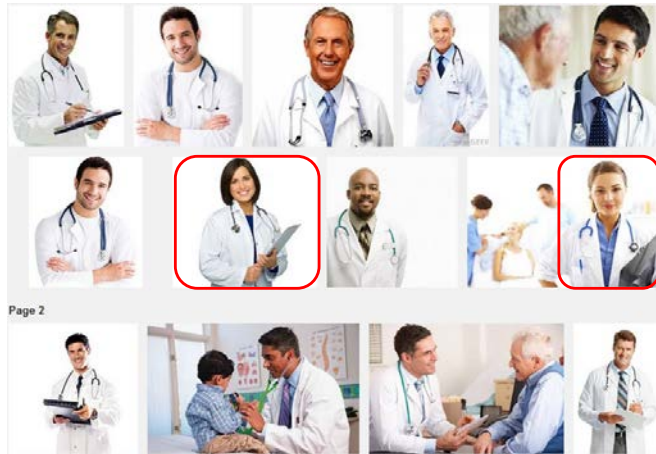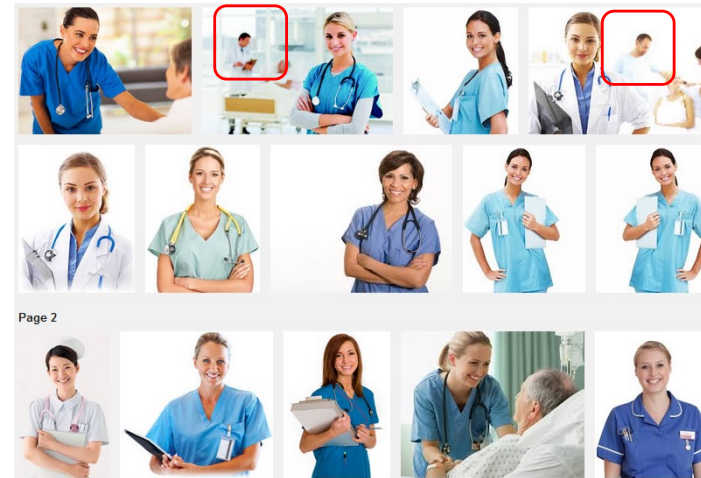 What are implications for information retrieval?

Part I: Motivation

How is ranking people different from ranking documents?

Problem I: Ranking images of people

Google image query: „**Doctor**"   Google image query: „**Nurse**"


*„evidence for **stereotype exaggeration** and systematic **underrepresentation of women**"*

Kay, Matthew, Cynthia Matuszek, and Sean A. Munson. "Unequal Representation and Gender Stereotypes in Image Search Results for Occupations." *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. ACM, 2015.

Problem II: Ranking people

- „observe **significant and consistent group unfairness** against feminine candidates in roughly 1/3 of the job titles we examine."

- „This may be of **particular concern** in technical professions like **Electrical, Mechanical, Network, and Software Engineering** […]."
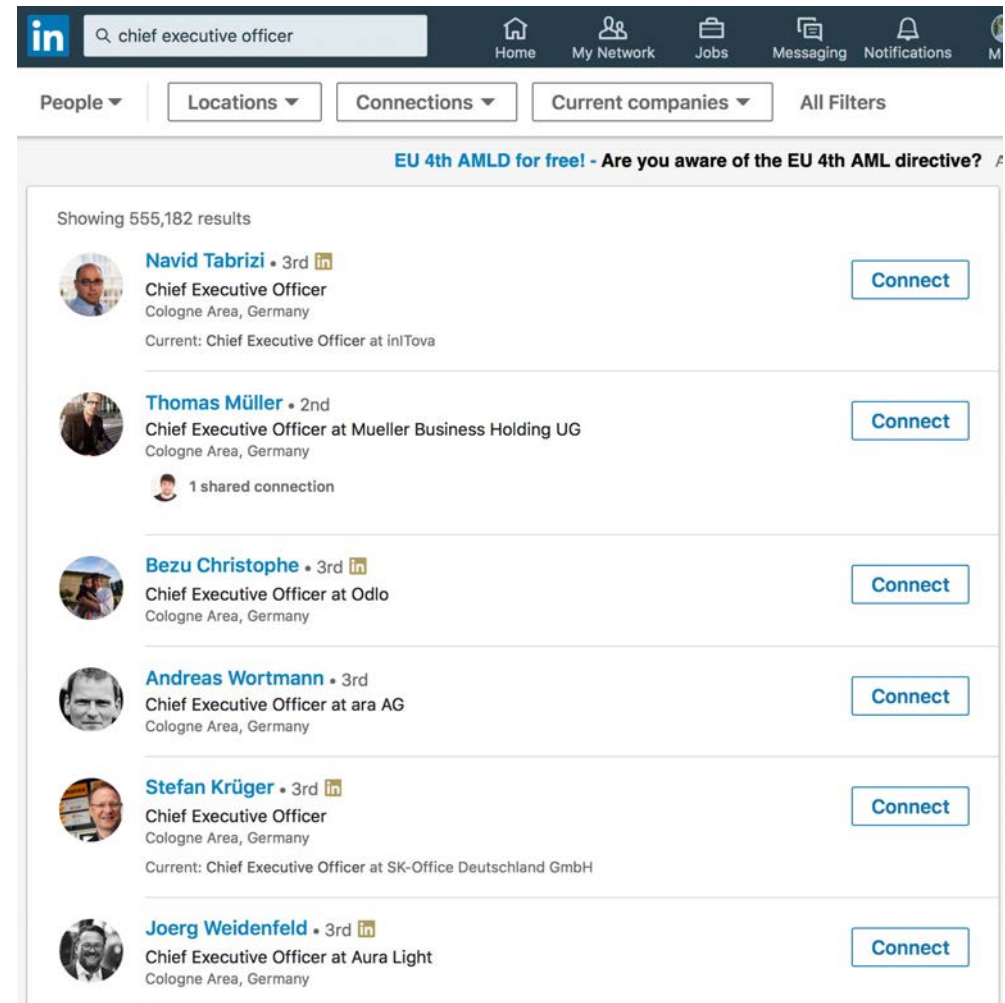
Chen L, Ma R, Hannák A, Wilson C. Investigating the Impact of Gender on Rank in Resume Search Engines. InProceedings of the 2018 CHI Conference on Human Factors in Computing Systems 2018 Apr 21 (p. 651). ACM.
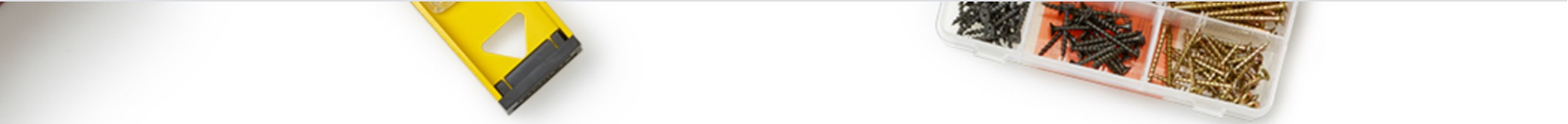
"non-black hosts are able to charge approximately 12% more than black hosts, holding location, rental characteristics, and quality constant."*

€1074
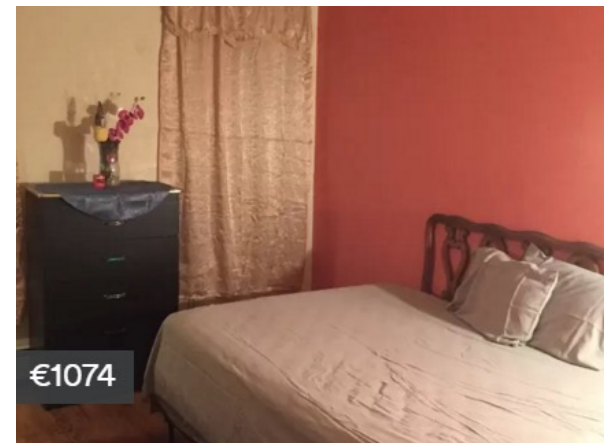
Request to Book

Brooklyn, NY, United States

Edelman, Benjamin G. and Luca, Michael, Digital Discrimination: The Case of Airbnb.com (January 10, 2014). Harvard Business School NOM Unit Working Paper No. 14-054. http://dx.doi.org/10.2139/ssrn.2377353

Services   Log in   **Become a Tasker**

The convenient & fast way
to get things done around the house

Choose from over 60,000 carefully vetted and feedback rated Taskers to get quick help

Mounting & Installation   Moving & Packing   Furniture Assembly

Home Improvement   General Handyman   Heavy Lifting

🔍 Need something different?

Online Freelancing Platforms

Search

Worker Profile

Picture

Name

Experience

Biography

Reviews and ratings

Discrimination

Online freelancing websites

Ranking bias:
Women/black are **ranked lower** in the search results

Rating bias:
Black men receive **worse ratings** than Black workers

Review bias:
White women receive 10% **fewer reviews** than those perceived to be White men

Gender and race **affects how many jobs people get** and how those are evaluated

A. Hannak, C. Wagner, D. Garcia, A. Mislove, M. Strohmaier and C. Wilson. Bias in Online Freelance Marketplaces: Evidence from TaskRabbit and Fiverr. In the 20th ACM Conference on Computer-Supported Cooperative Work and Social Computing (CSCW2017), Portland, OR, ACM, 2017.
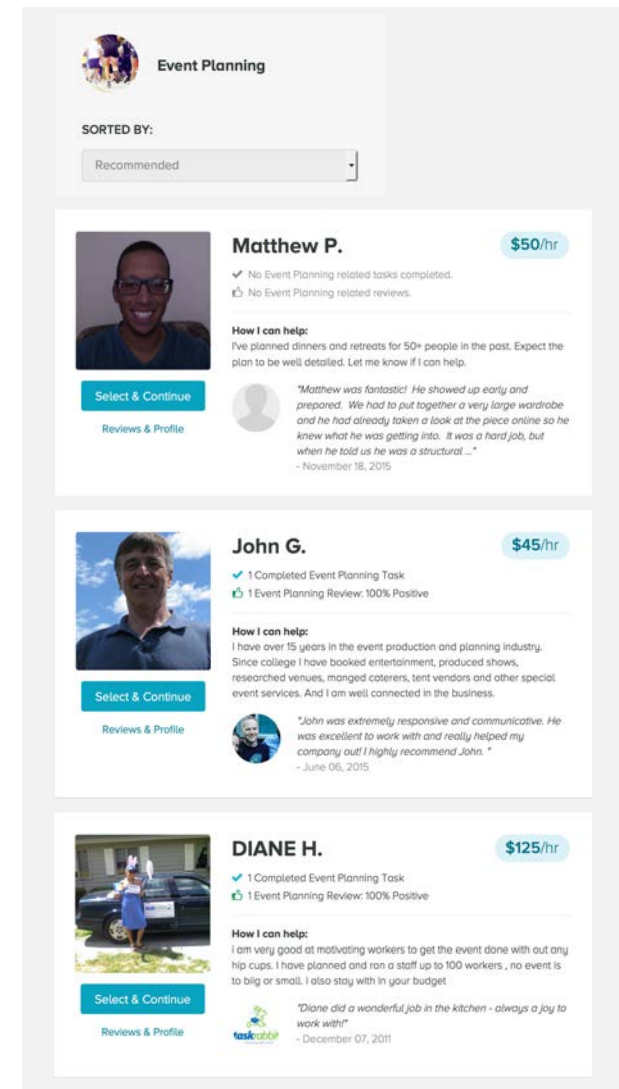
Documents

- Content
- Written artefacts
- Mostly static
- Copyright
- Topical focus
- Passive objects
- Sentiment
- Filtering desirable
- Relevance?

People

- Intent
- Living human beings
- Dynamic and evolving
- Human rights and freedoms
- Stereotypes
- Active subjects
- Opinions
- Discrimination illegal
- Importance?

Many „real world" social phenomena have the potential to spill over to the online world.

- Inequality
- Family
- Radicalization
- Religion
- Morality
- Health
- Culture

- Elections
- Politics
- Polarization
- Discrimination
- Personality
- Hate
- Crime

This talk:

- **Part I: MOTIVATION**
  How is ranking people different from ranking documents?

- **Part II: RANKING OF MINORITIES IN SOCIAL NETWORKS**
  How can inequalities in rankings emerge?

- **Part III: CONCLUSIONS**
  What are implications for information retrieval?

Part II: Ranking of Minorities in Social Networks

What are mechanisms that can explain the emergence of inequalities in rankings?

Karimi, F., Génois, M., Wagner, C., Singer, P. and Strohmaier, M., 2018. **Homophily influences ranking of minorities in social networks**. *Scientific Reports*, *8*.

Example: LinkedIn

Ranking of minorities in online social networks

Rank	Gender
1.	m
2.	m
3.	m
4.	f

¼ (25%) women in the top 4 results
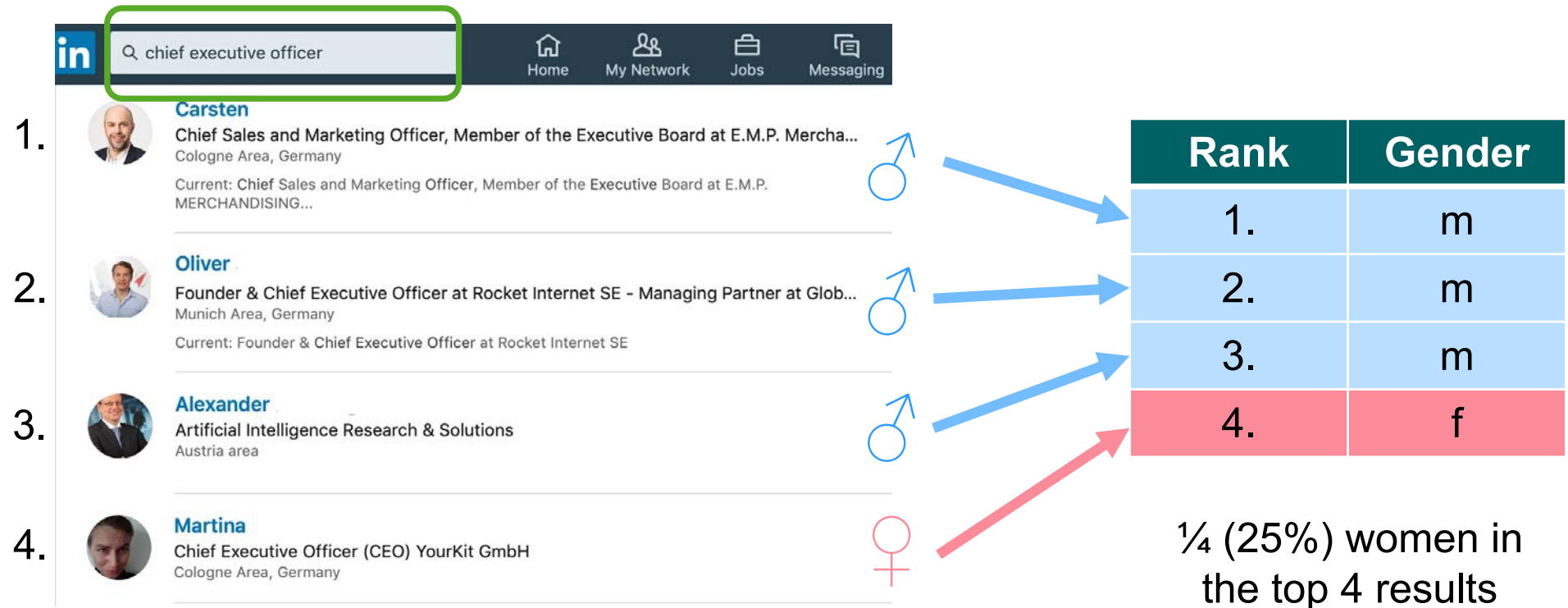
Actual ranking algorithm unknown.
But likely to use the LinkedIn social graph topology.

How visible are minorities in rankings?

Example: rank share of a 25% minority

Expected rank share of a 25% minority

Plot Area
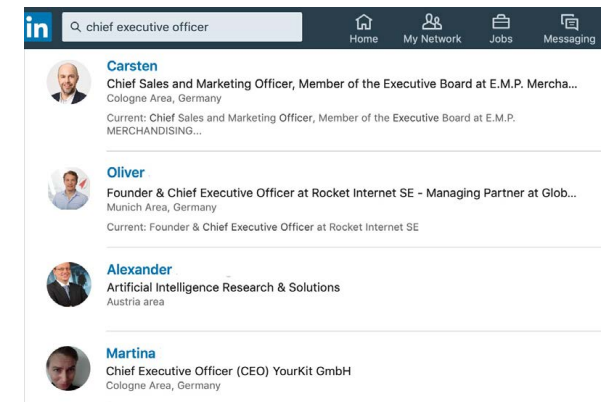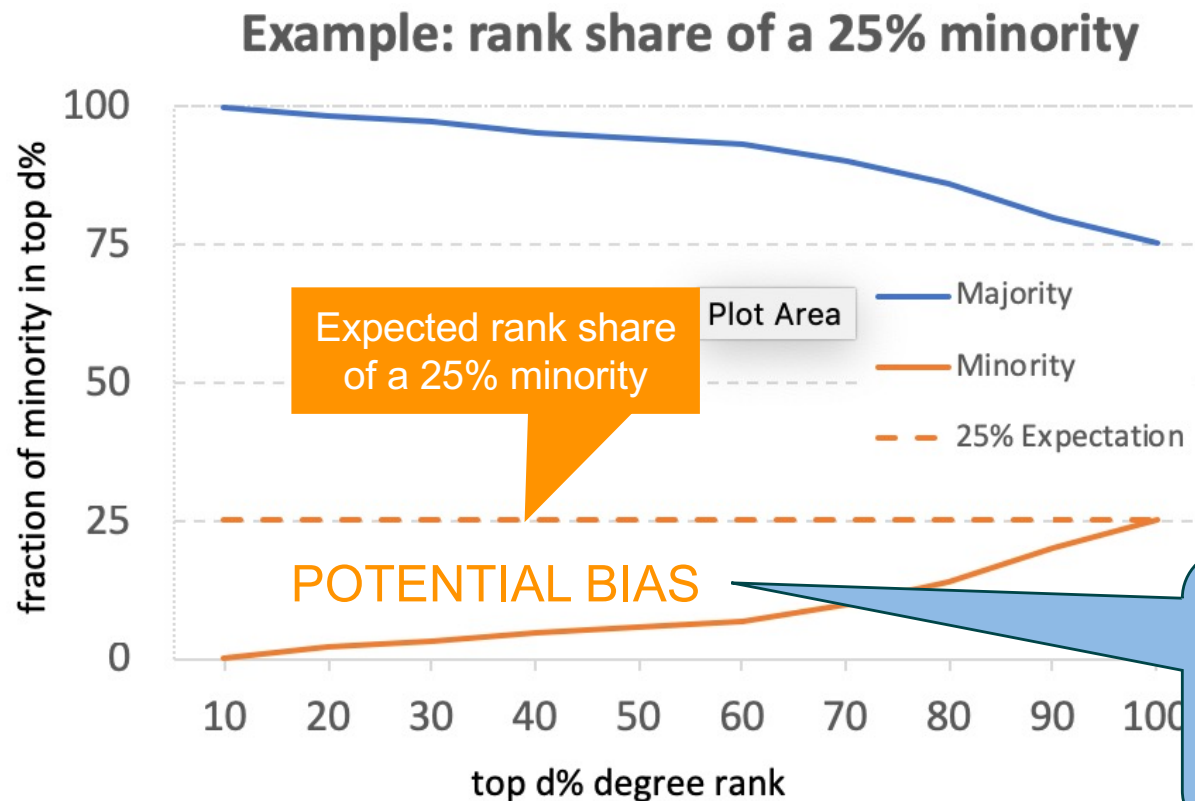
POTENTIAL BIAS

Where does this potential bias come from? Algorithmic or social?

Main Take-Away of this talk

> SOCIAL MECHANISMS LIKE HOMOPHILY ALONE
> can create biases and disadvantages
> when ranking people in social networks

Paul F. Lazarsfeld and Robert K. Merton (1954)
Friendship as Social Process; A Substantive and Methodological Analysis
FREEDOM AND CONTROL IN MODERN SOCIETY

Oddly enough, the English language lacks a word to signify…

Value homophily

Status homophily

"a tendency for friendships
to form between those who are alike
in some designated respect"

*useful, to speak of "degrees of homophily," as measured by indices of
positive correlation between the attributes of friends*

20

friendship networks based on race
(Moody 2001)
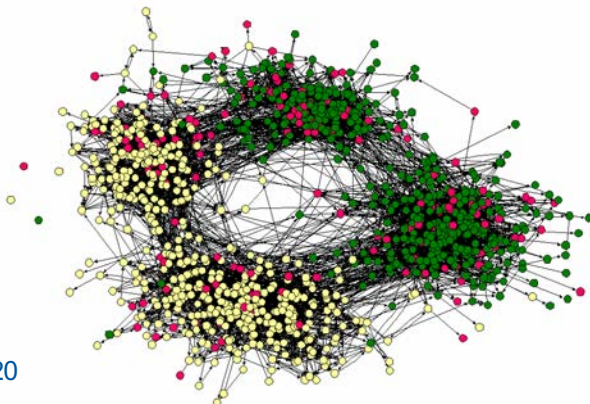
Two „universal" laws found in social networks

1) Homophily
The tendency of similar nodes to attach to each other
→ yielding communities

2) Preferential Attachment
The tendency of nodes to preferentially attach to nodes of high degree
→ yielding scale-free networks
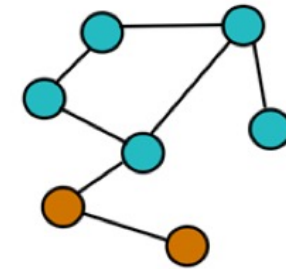
Adapted Barabasi-Albert network generation model

Arrival nodes connect to existing nodes based on

- preferential attachment (k)
- homophily (h)

arrival node
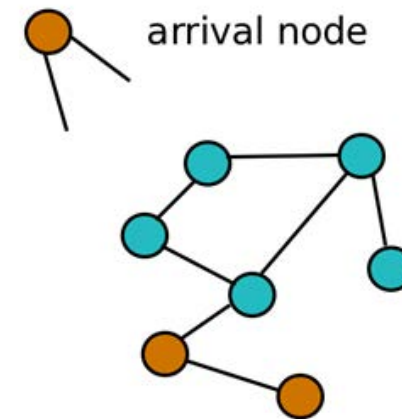
$$p_{connect} \sim h \cdot k$$

$$0 \leq homophily\ (h) \leq 1$$

Visual demo:
https://maxohn.github.io/networkgeneration/

How does homophily influence degree distributions of minorities?

- Barabasi-Albert model with a homophily parameter
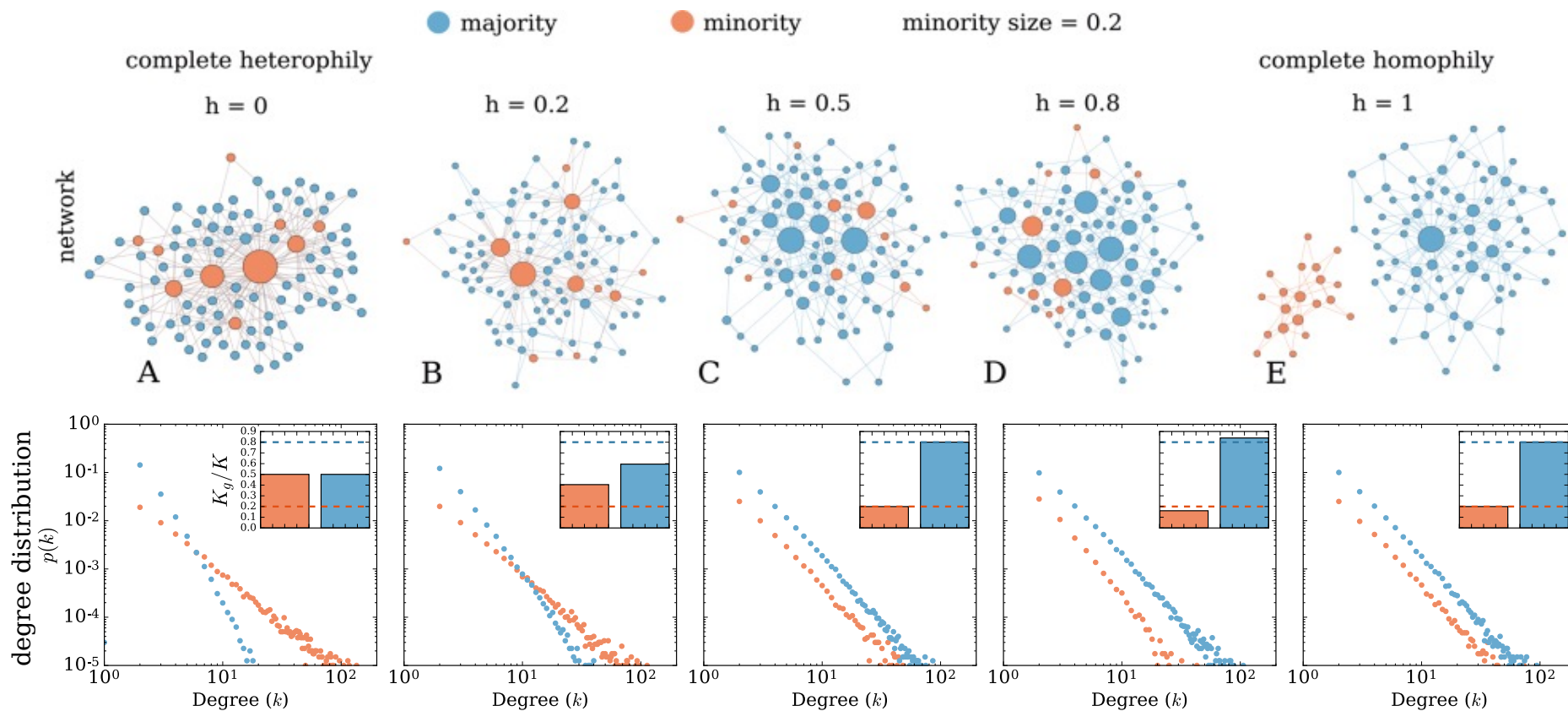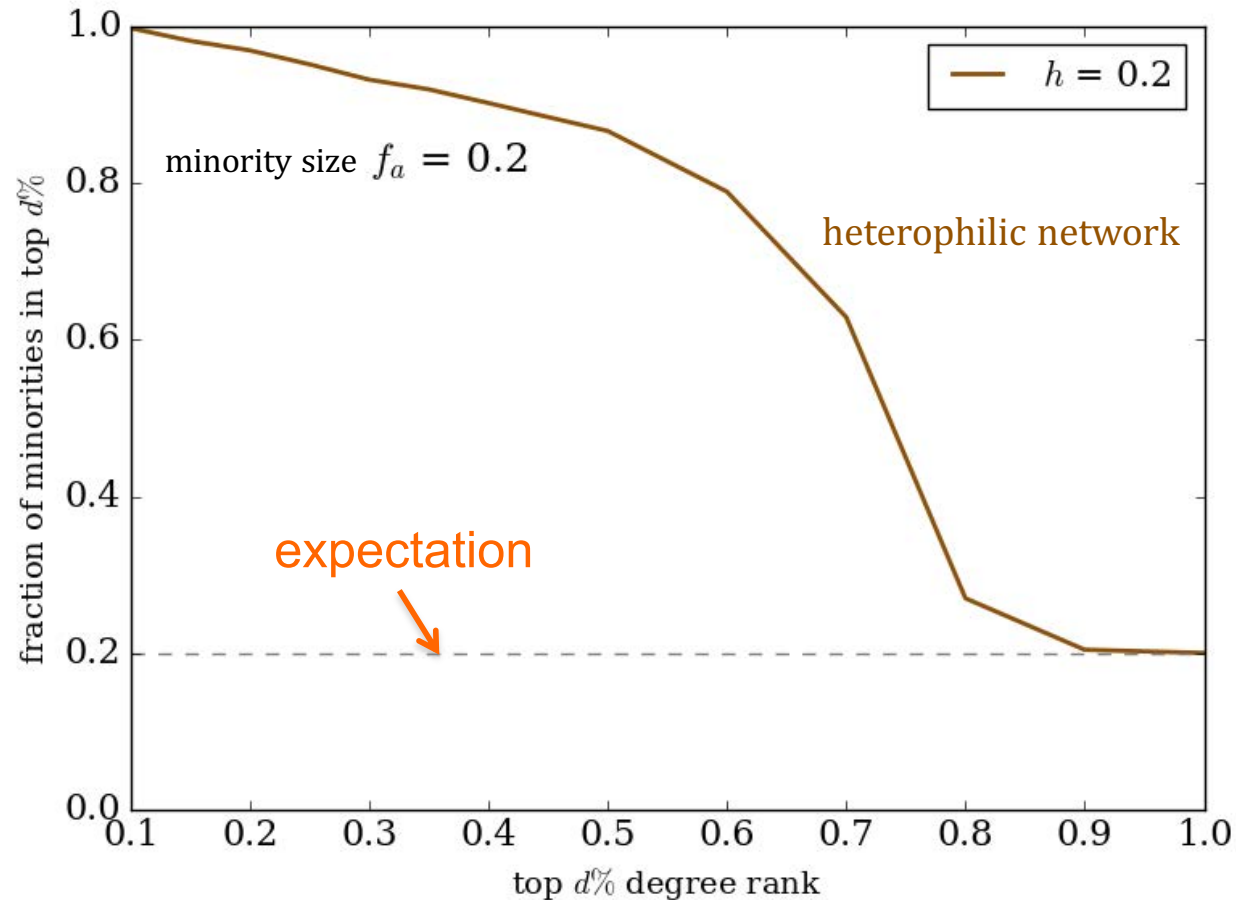
Visibility of minority nodes in top d% (ranked by degree)

Visibility of minority nodes in top d% (ranked by degree)

Ranking of minorities in social networks
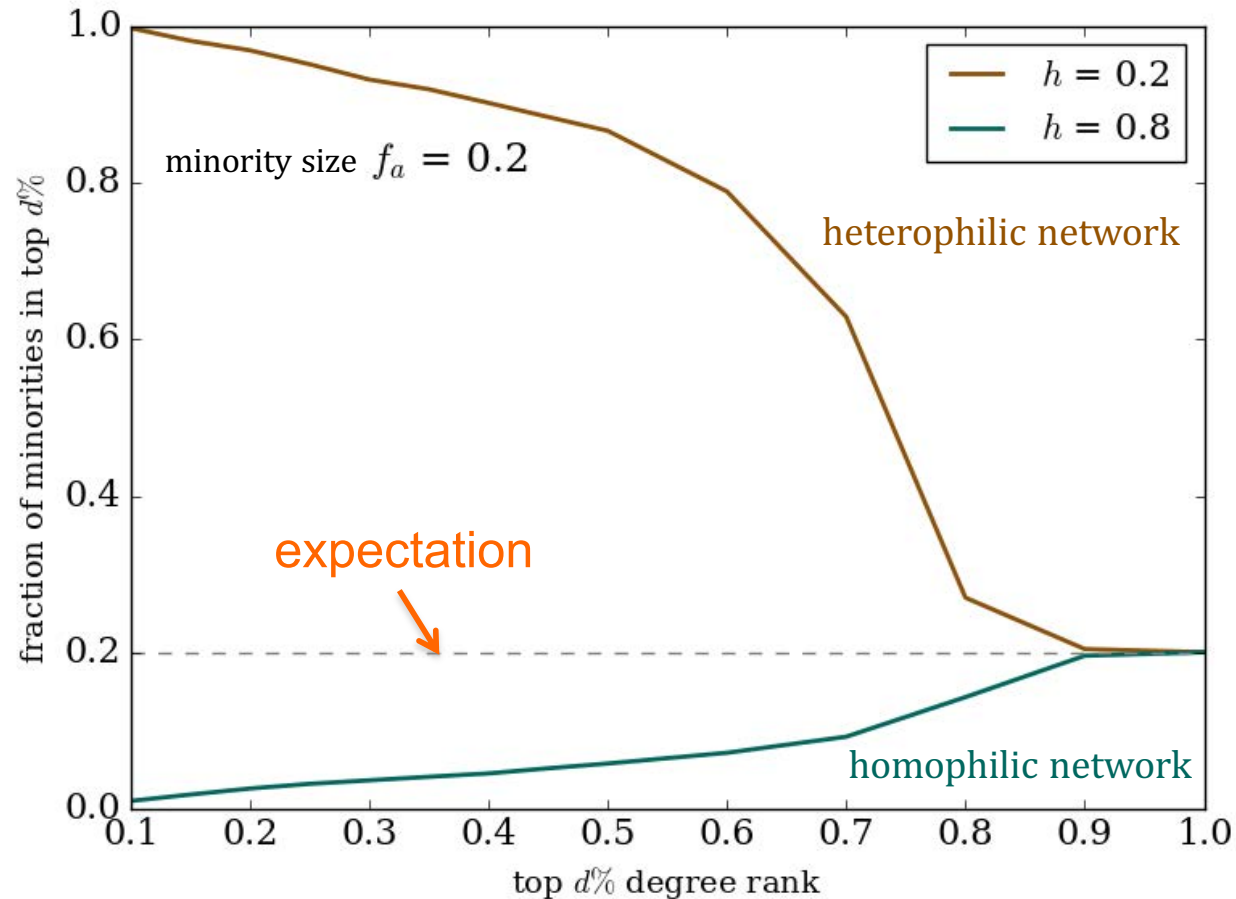
Visibility of minority nodes in top d% (ranked by degree)
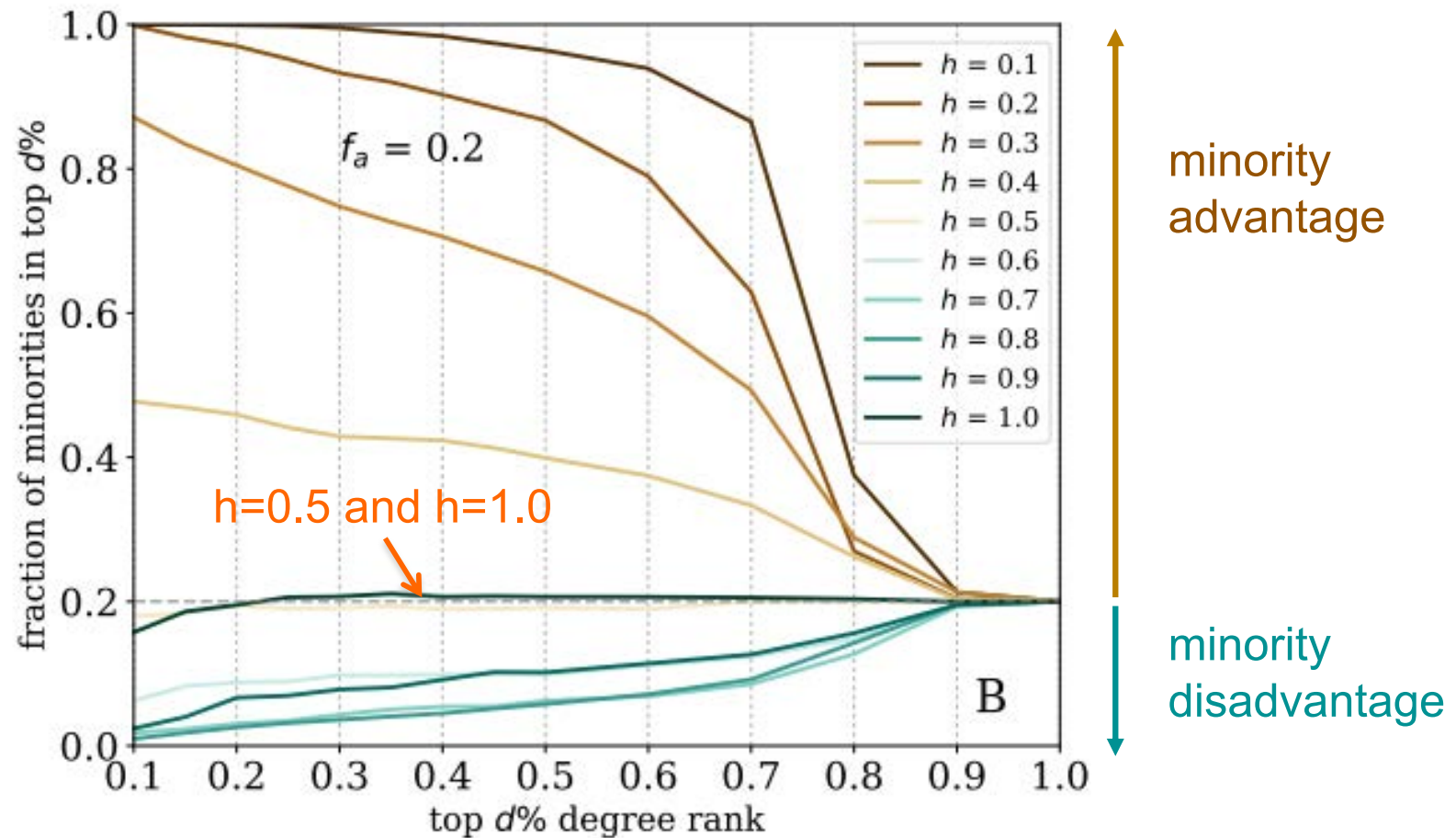
Fraction of minorities total degree vs. homophily
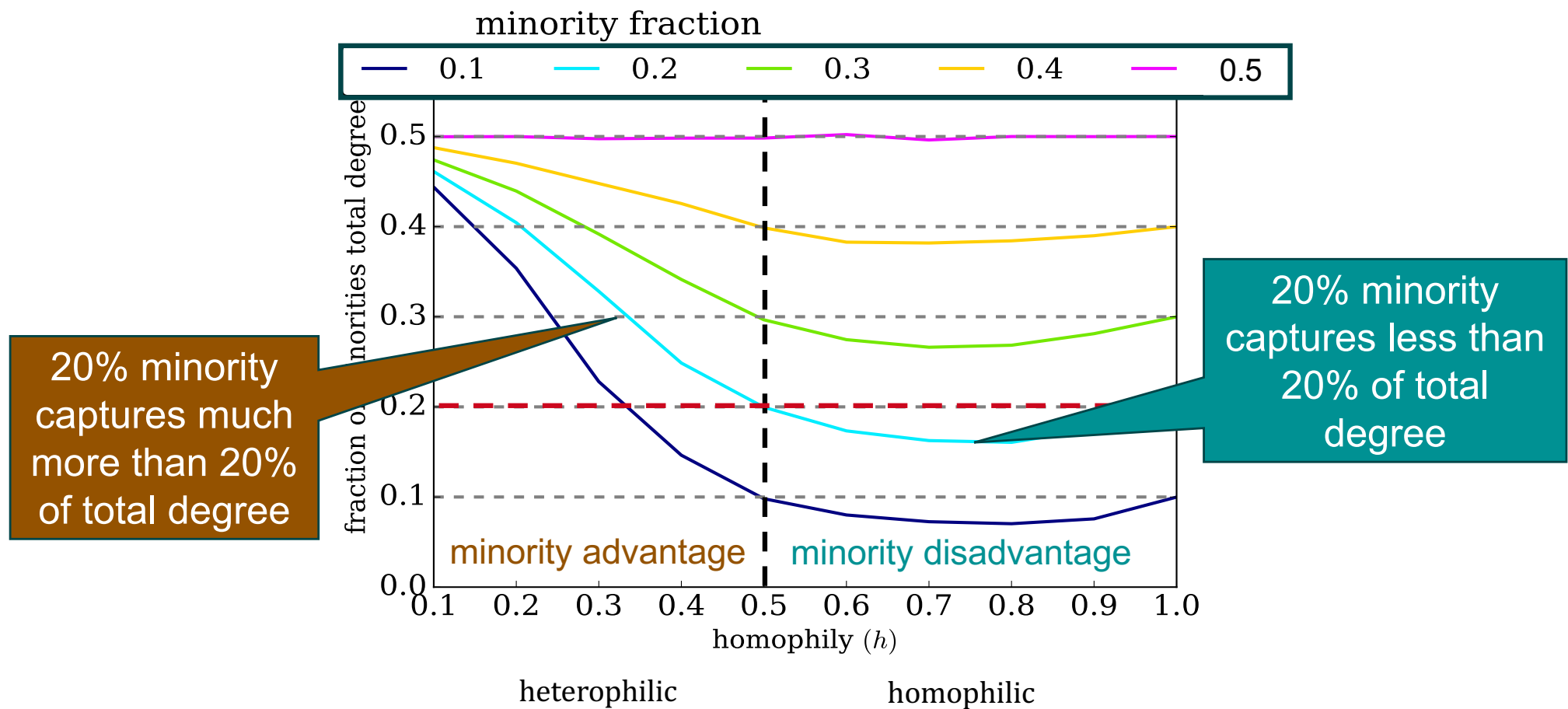
What about empirical datasets?
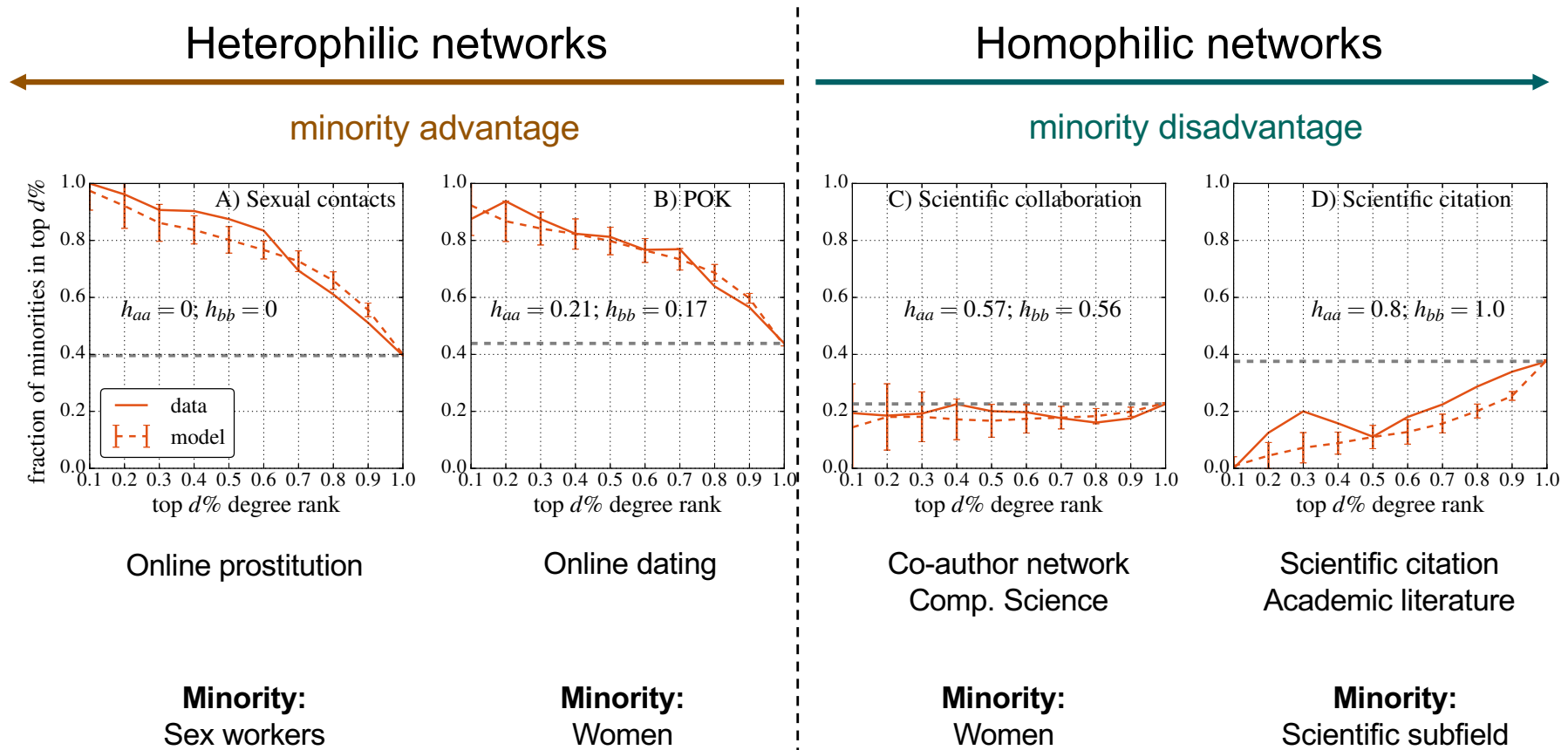
Heterophilic networks ←————— minority advantage

Homophilic networks minority disadvantage —————→

A) Sexual contacts — $h_{aa} = 0; h_{bb} = 0$ — Online prostitution — Minority: Sex workers

B) POK — $h_{aa} = 0.21; h_{bb} = 0.17$ — Online dating — Minority: Women

C) Scientific collaboration — $h_{aa} = 0.57; h_{bb} = 0.56$ — Co-author network Comp. Science — Minority: Women

D) Scientific citation — $h_{aa} = 0.8; h_{bb} = 1.0$ — Scientific citation Academic literature — Minority: Scientific subfield

This talk:

- **Part I: MOTIVATION**
  How is ranking people different from ranking documents?

- **Part II: RANKING OF MINORITIES IN SOCIAL NETWORKS**
  How can inequalities in rankings emerge?

- **Part III: CONCLUSIONS**
  What are implications for information retrieval?

Part III: Conclusions

What are implications for information retrieval?

Karimi, F., Génois, M., Wagner, C., Singer, P. and Strohmaier, M., 2018. **Homophily influences ranking of minorities in social networks**. *Scientific Reports*, *8*.

Main Take-Away of this talk

SOCIAL MECHANISMS LIKE
HOMOPHILY ALONE
can create biases and disadvantages
when ranking people in social networks

Ranking People – Implications for Information Retrieval

1.) Human social behavior alone can cause inequalities
  designers of people ranking systems need to be mindful when designing algorithms

2.) IR evaluation must expand to evaluate sociological issues
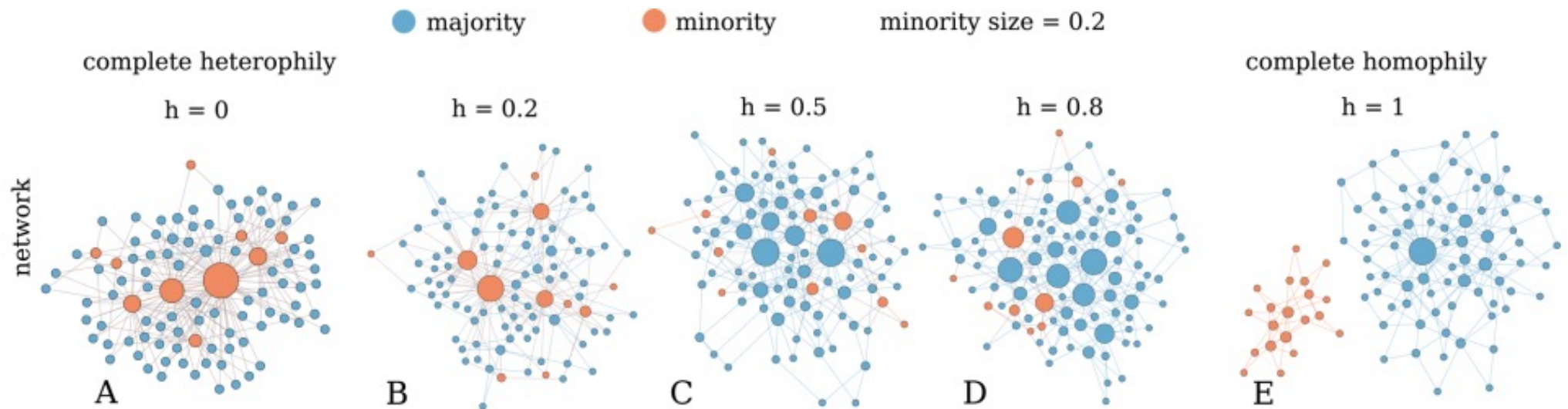 must include new techniques for bias, discrimination, fairness, inequality, polarization, etc detection.

3.) People ranking != document ranking algorithms applied to people
  it is a new field of research requiring a whole new *interdisciplinary* approach to design

4.) Let us stop calling them „users", let us call them „people"
  Computer scientists like abstraction, but „users" exist only in relation to systems. „People" is a much richer and more useful representation of reality.

majority   minority   minority size = 0.2

complete heterophily
h = 0

h = 0.2

h = 0.5

h = 0.8

complete homophily
h = 1

network

A   B   C   D   E

Thank you!

Markus Strohmaier

References:
Karimi, F., Génois, M., Wagner, C., Singer, P. and Strohmaier, M., 2018. **Homophily influences ranking of minorities in social networks**. *Scientific Reports, 8*.

Wagner, C., Singer, P., Karimi, F., Pfeffer, J. and Strohmaier, M., 2017, April. **Sampling from Social Networks with Attributes**. In *Proceedings of the 26th International Conference on World Wide Web* (pp. 1181-1190).

Lee, E., Karimi, F., Jo, H.H., Strohmaier, M. and Wagner, C., 2017. **Homophily explains perception biases in social networks**. *arXiv preprint arXiv:1710.08601*.