

# Ideas worth spreading:

How does network position influence  
the spread of research topics?

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How do research ideas spread within a discipline?

How does network position affect the spread of new ideas?

# Prestige and Publication

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Inputs, Outputs, and the Prestige of  
University Science Departments\*

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Warren O. Hagstrom  
*University of Wisconsin*

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*Sociology of Education*, 375-397 (1971)

## **Professional Standing and the Reception of Scientific Discoveries<sup>1</sup>**

Stephen Cole

*State University of New York at Stony Brook, and Bureau  
of Applied Social Research, Columbia University*

*American Journal of Sociology* 76(2), 286-306 (1970)

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## **DEPARTMENTAL EFFECTS ON SCIENTIFIC PRODUCTIVITY\***

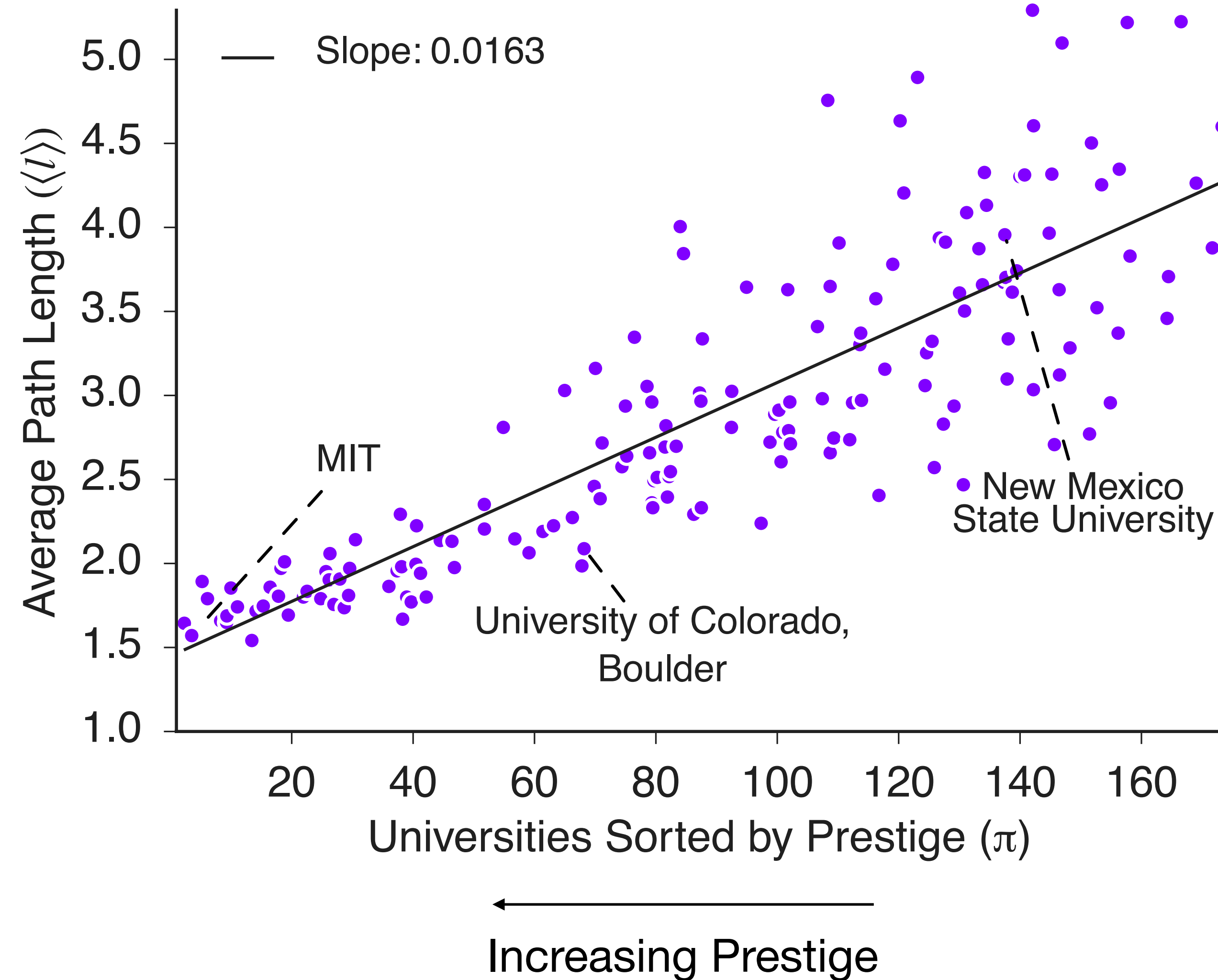
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PAUL D. ALLISON  
*University of Pennsylvania*

J. SCOTT LONG  
*Indiana University*

*Am. Soc. Rev.* 55, 469-478 (1990)

# Prestigious universities are better connected



# Methods

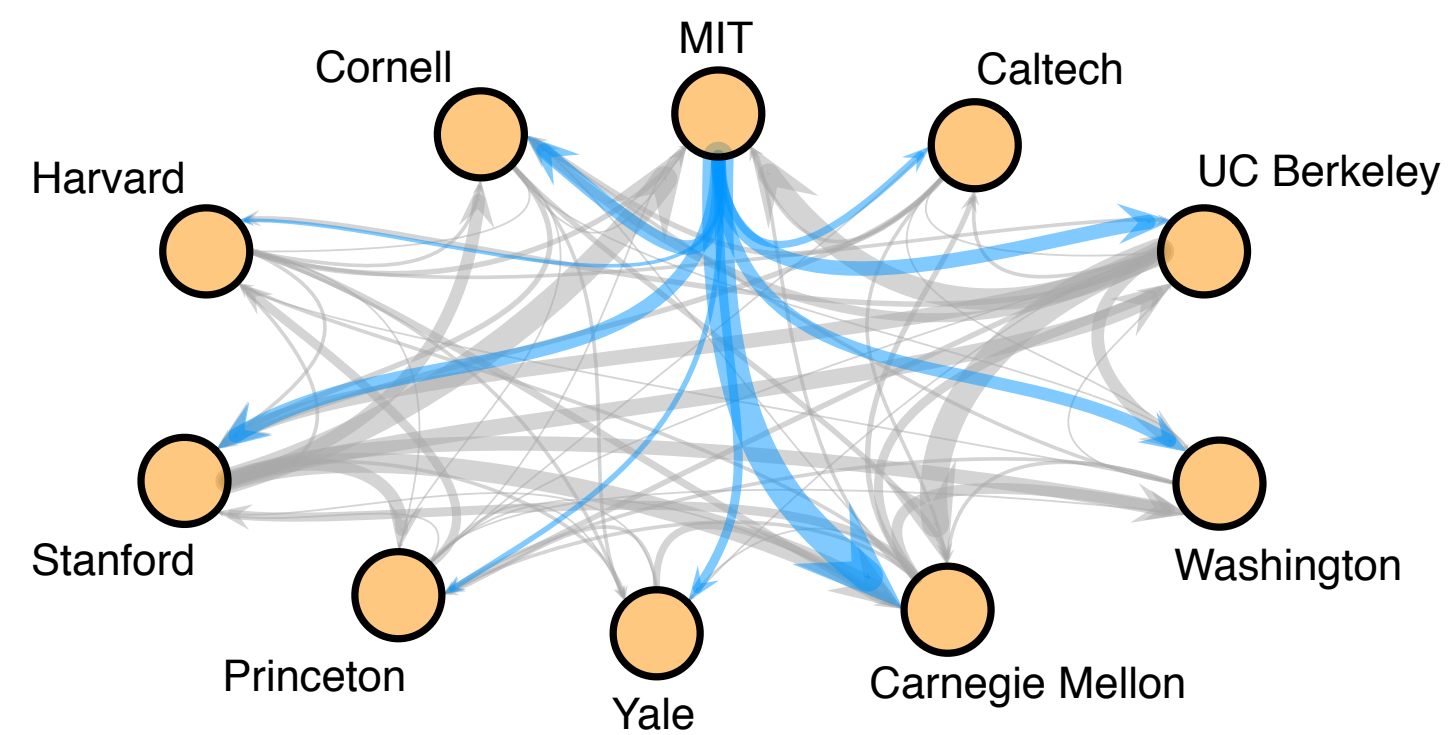
How much does an idea's origination location matter for how far it spreads?

First, we need to know how ideas spread.

Then, we can use simulation to measure the consequences of prestige.

# Data

## Faculty hiring network



*Science Advances* 1(1), e1400005, 2015.

## Publication records



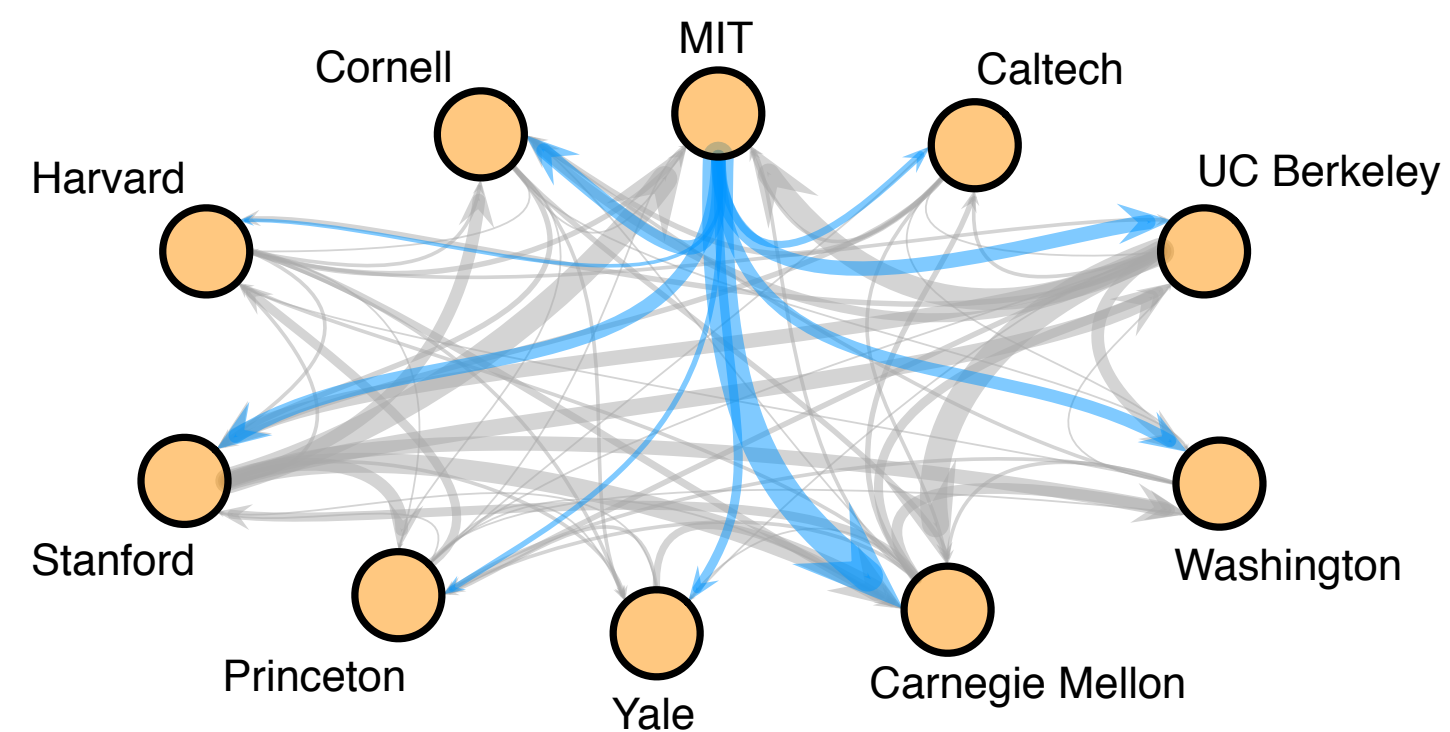
computer science bibliography

- [c6] Leto Peel, Aaron Clauset: **Detecting Change Points in the Large-Scale Structure of Evolving Networks.** AAAI 2015: 2914-2920
- [19] Leto Peel, Aaron Clauset: **Predicting Sports Scoring Dynamics with Restoration and Anti-Persistence.** ICDM 2015: 339-348
- [19] Abigail Z. Jacobs, Samuel F. Way, Johan Ugander, Aaron Clauset: **Assembling thefacebook: Using heterogeneity to understand online social network assembly.** CoRR abs/1503.06772 (2015)
- [18] Leto Peel, Aaron Clauset: **Predicting sports scoring dynamics with restoration and anti-persistence.** CoRR abs/1504.05872 (2015)
- [17] Amir Ghasemian, Pan Zhang, Aaron Clauset, Cristopher Moore, Leto Peel: **Detectability thresholds and optimal algorithms for community structure in dynamic networks.** CoRR abs/1504.06179 (2015)

*Proc. 25th Int'l World Wide Web Conf. (WWW)*, (2016)

# Data

## Faculty hiring network



*Science Advances* 1(1), e1400005 (2015)

Publication records.  
Education and employment  
history for faculty at 205 U.S.  
and Canadian CS depts.

Node  $u$  represents an  
institution with unique prestige.

Edge  $(u, v)$  represents a PhD  
candidate from  $u$  who got an  
assistant faculty position at  $v$ .

# Data

Publication records for 2659  
tenure-track faculty.

Includes title, author list, venue,  
and date for each pub.

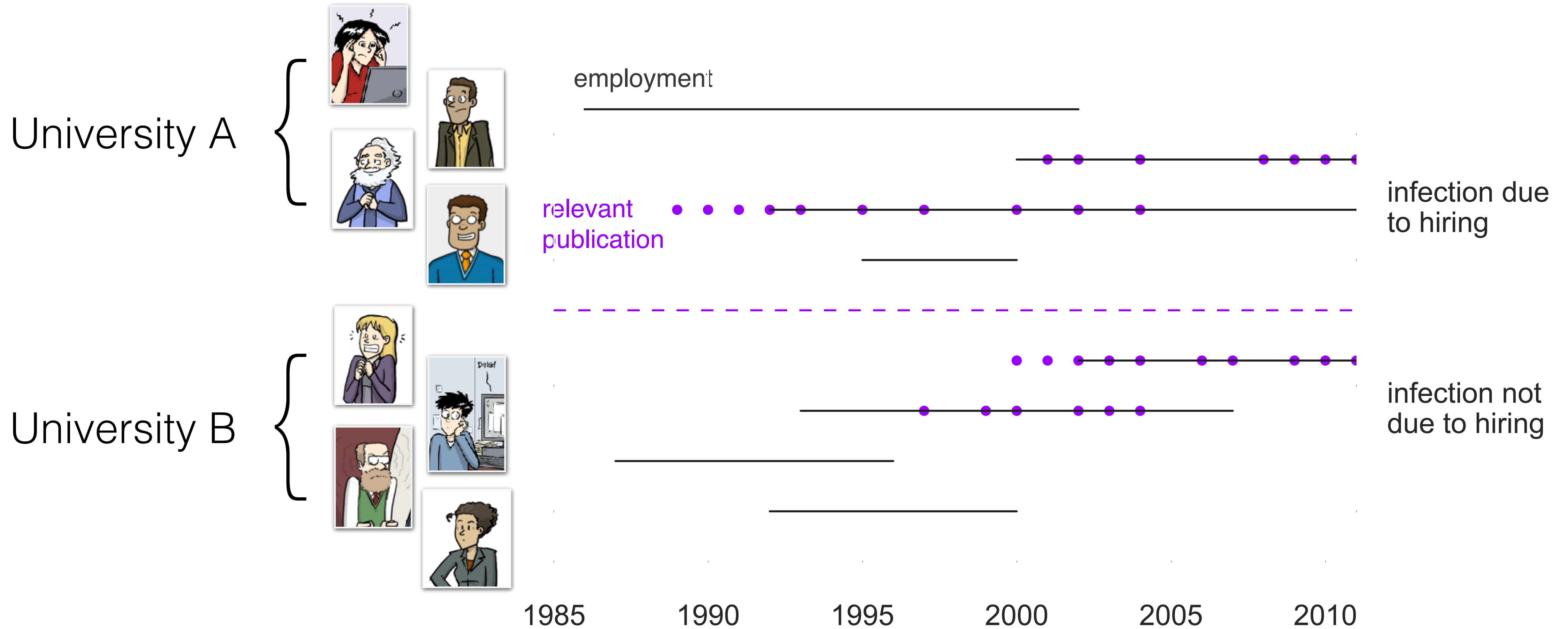
Use first assistant  
professorship start dates to  
identify faculty who started a  
research area at their university.

## Publication records



*Proc. 25th Int'l World Wide Web Conf. (WWW), (2016)*

# Do faculty bring research with them?



# Research ideas spread across hiring

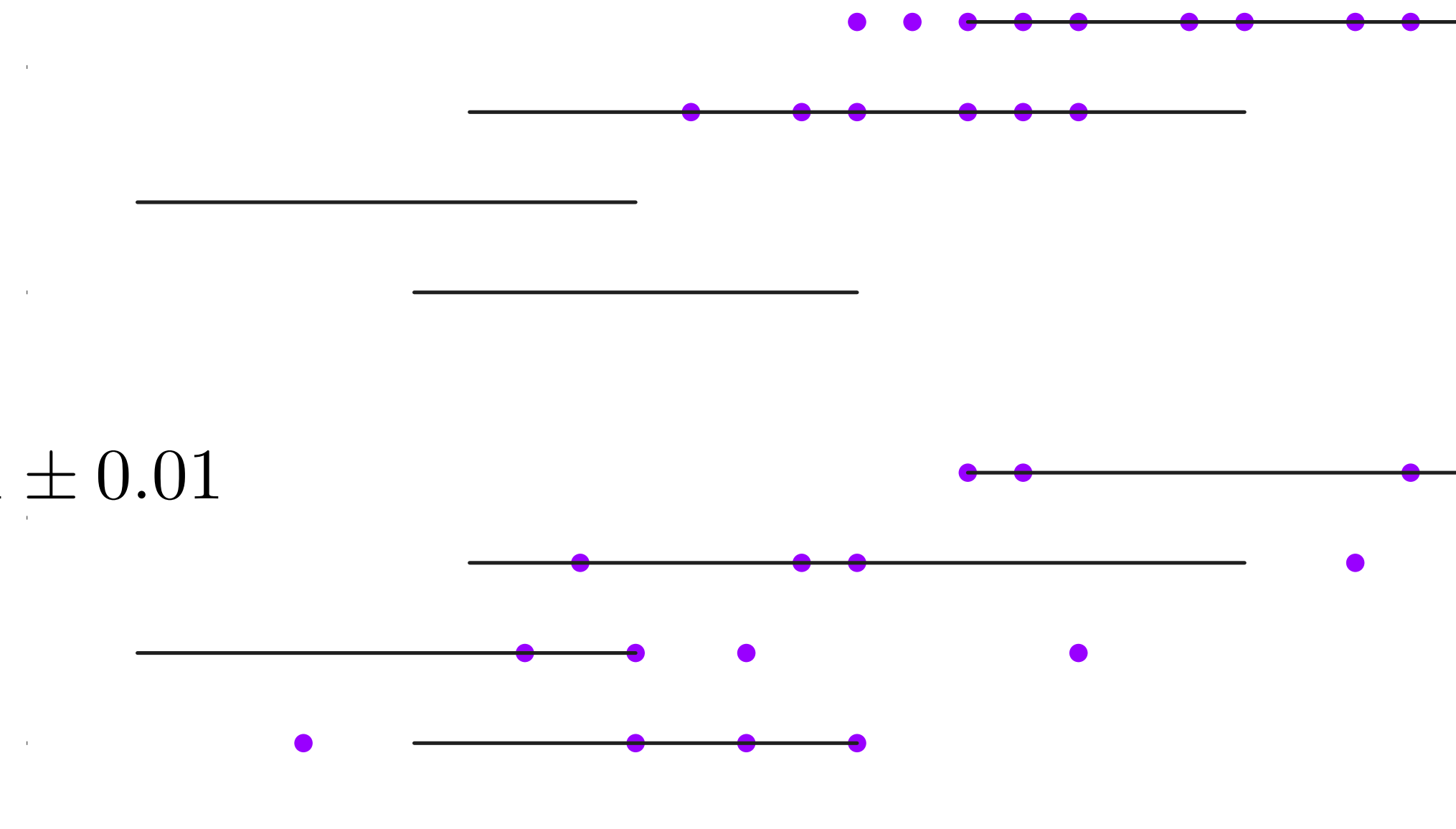
Compare real hiring infection rate to a null model where faculty randomly choose research topics.

**“topic modeling”**:  $p = 0.01 \pm 0.01$

**“incremental computing”**:  $p = 0.01 \pm 0.01$

**“deep learning”**:  $p = 0.2 \pm 0.01$

Faculty hiring network shapes spread of ideas.

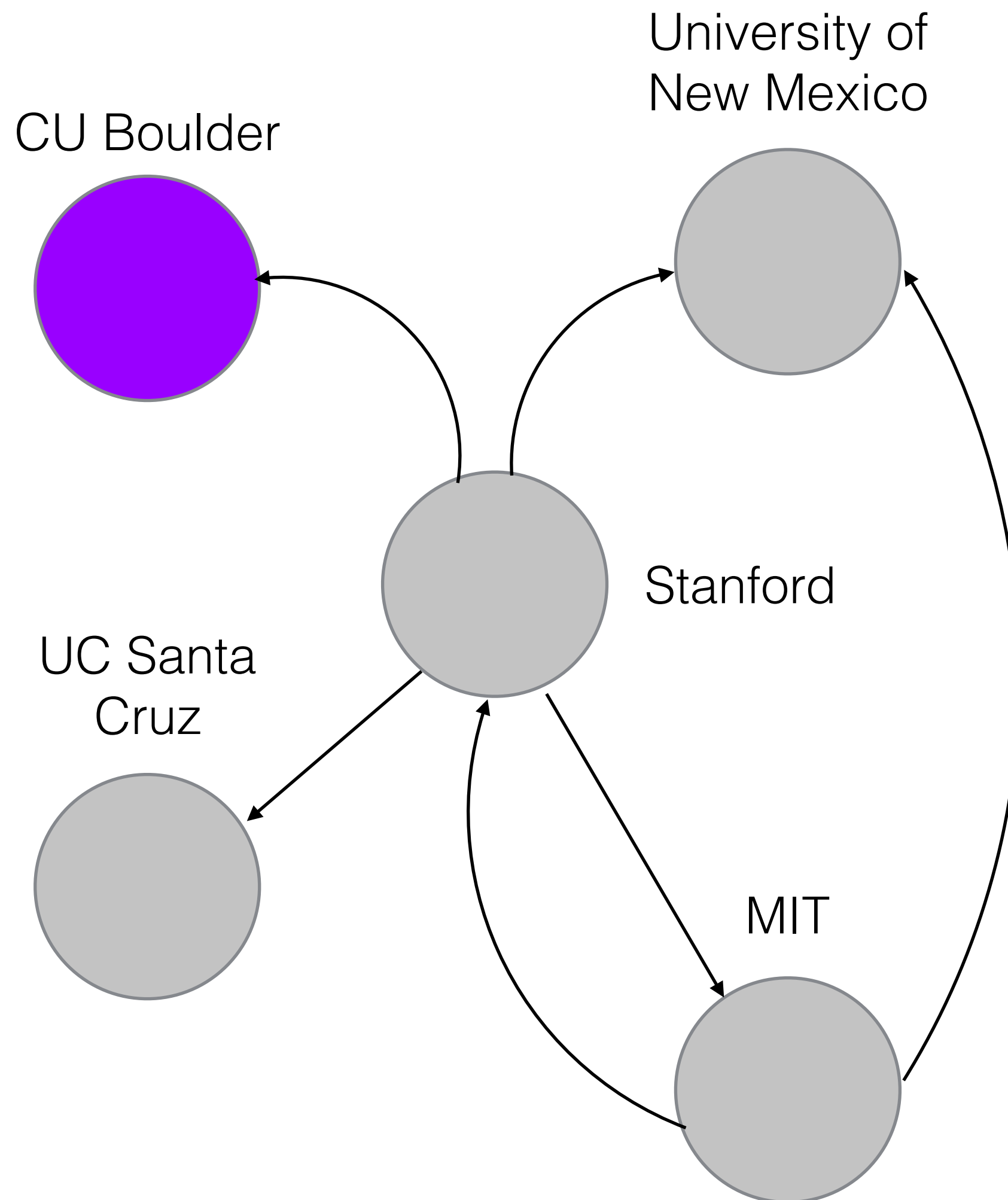
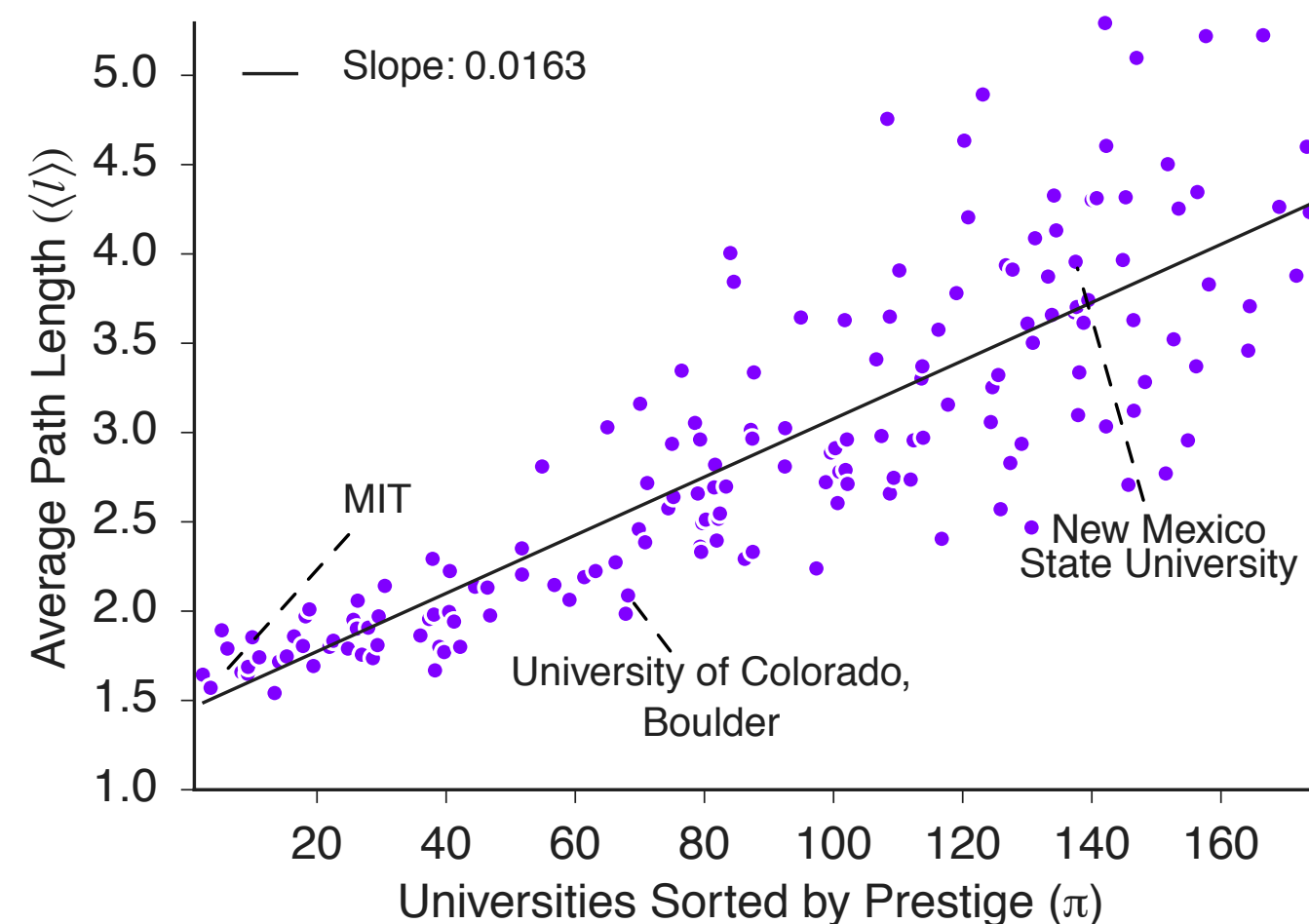


# What role might prestige play in the spread of new ideas?

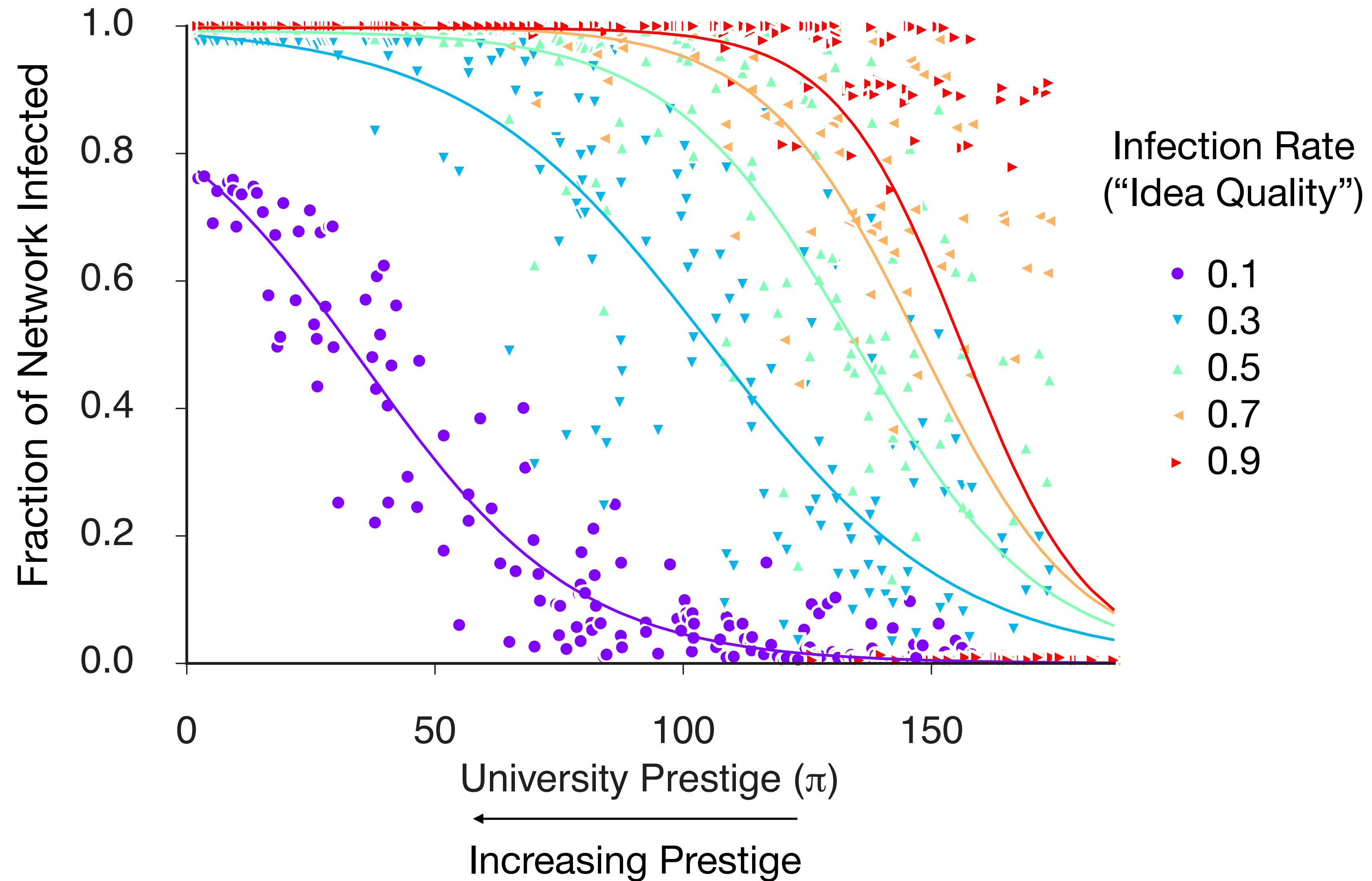
Seed an epidemic at a single university with unique prestige.

Simulate an SI epidemic on the network.

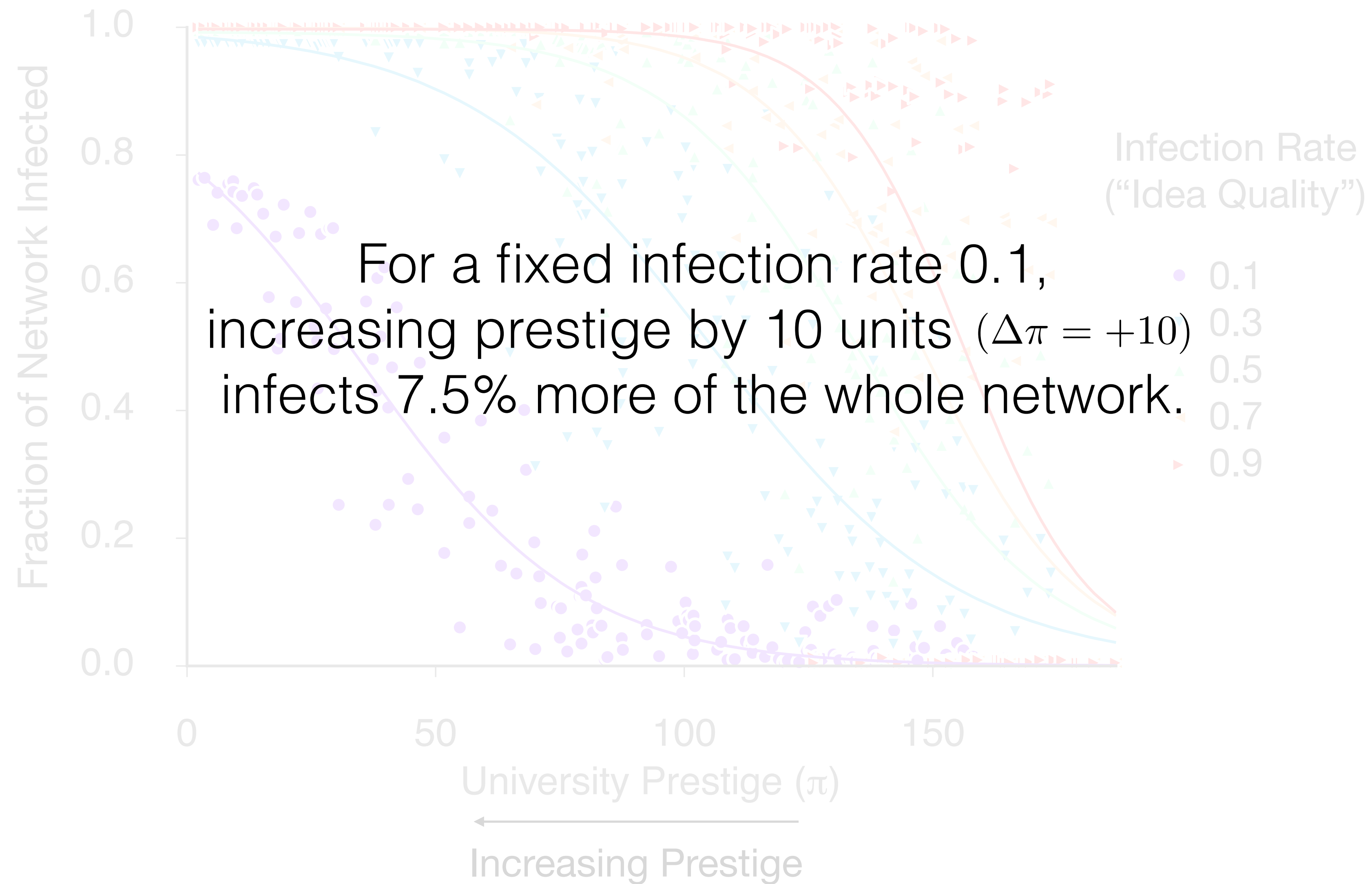
Examine resulting epidemic size as a function of prestige (network location) and quality of idea.



# Network position affects epidemic size



# Network position affects epidemic size



# Conclusions

Researchers appear to carry some research ideas from PhD to first assistant professorship.

Under a model where ideas entirely spread via hiring, higher prestige universities have large influence.

# Future Work

Better approximate the spread of research by obtaining full text of publications.

Explore more sophisticated models of idea-spreading.

# Thanks!

Collaborators: Dimitrios Economou,  
Samuel Way, Aaron Clauset

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