

## The Complex Systems Summer School

The Santa Fe Institute's Complex Systems Summer School is the premier complex systems workshop where diverse participants work together on self-directed research projects



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INSTITUTE

Lacking curricular, resource, and research constraints, the summer school is in many ways an ideal environment for academic collaboration

Does the program fulfill its goal of encouraging collaboration among varied people on interdisciplinary research?


## Data

Manually extracted and coded from the summer school's Wiki (2005-2019)

### Participant Profile

Dakota Murray **1**

From Santa Fe Institute Events Wiki



**2**

Dakota Murray **3** **4**

Indiana University Bloomington - USA

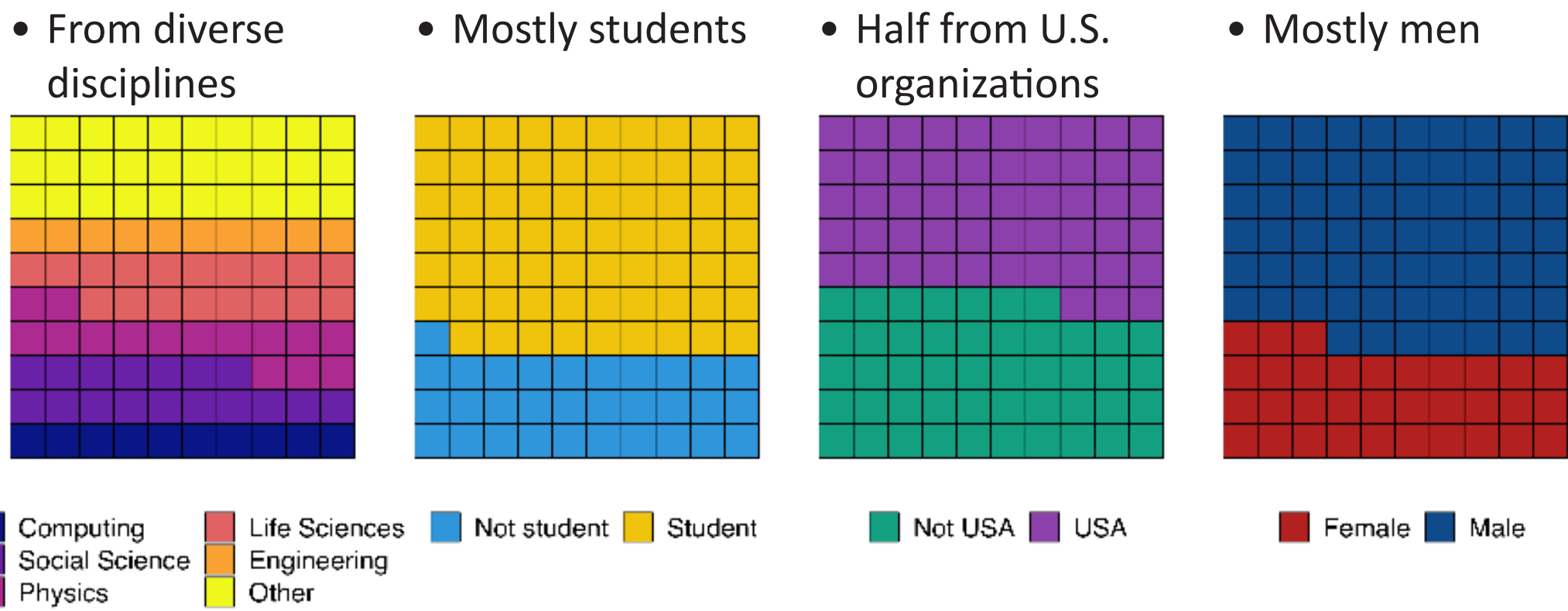
**5** **6**

I am a 3rd year doctoral student in the Computing, Culture, and Society track in the Department of Informatics at Indiana University Bloomington. Drawing on my technical background and theory from Science and Technology Studies, I investigate the ways in which social factors shape the scientific process, and how science goes on to shape culture and society.

1. Name
2. Perceived gender
3. Organizational affiliation. If University, also prestige with Shanghai Rankings
4. Country of study/work
5. Discipline, coded from self-reported description into UNESCO classifications
6. Professional position (i.e., student)

### Participant characteristics

After parsing and cleaning the data, we find that participants are



### Project abstract

A Breeding Pool of Ideas: Analyzing Interdisciplinary Collaborations at the Complex Systems Summer School **7**

Jacqueline Brown<sup>1</sup>, Dakota Murray<sup>2</sup>, Kyle Furlong<sup>3</sup>, Emily Coco<sup>4</sup>, Fabian Dablander<sup>5</sup>

November 1, 2019 **8**

Interdisciplinary research is increasingly viewed as necessary to break down disciplinary silos and advance knowledge in areas that span multiple fields of study. Consequently, it is important to understand the factors that facilitate cross-disciplinary collaboration. In this research, we examine the formation of self-organized project groups and the structure of collaboration networks at the Santa Fe Institute's Complex Systems Summer School for graduate students and professionals from around the world. Our study includes all offerings of the summer school from 2005-2019, a dataset comprising 822 participants and 322 projects. We used several methods to evaluate the factors influencing group formation. One analysis of group homophily by participant discipline suggests that no one discipline is more prone to interdisciplinary collaboration than others. Furthermore, most people tend to work with people from disciplines that are different from their own, indicating a willingness to engage in interdisciplinary collaboration among participants of all backgrounds. We also used a series of null models to examine how country of study, gender, position, institutional prestige, and discipline of participants influenced group formation. Our results for the latter four were consistent with random mixing; however, country of study provided evidence for higher than expected rates of collaboration between U.S. and non-U.S. participants. In examining the proportion of projects in each discipline in comparison to the number of participants from that discipline, we found that social and behavioral sciences projects were significantly overrepresented. In contrast, physical sciences, engineering, and mathematics and statistics projects were significantly underrepresented. This could be due to several factors, such as higher level of baseline interest in or knowledge of social and behavioral sciences or the common application of methods from physical sciences, engineering, and mathematics to study topics in other disciplines. Finally, we conducted a survey that returned 167 responses from alumni of the Complex Systems Summer School, the results of which illustrate the program's profound impact on participants. On the whole, our study suggests that programs such as the Complex Systems Summer School can successfully foster interdisciplinary collaboration by selecting participants from a wide variety of backgrounds and creating space and time for self-organized research.

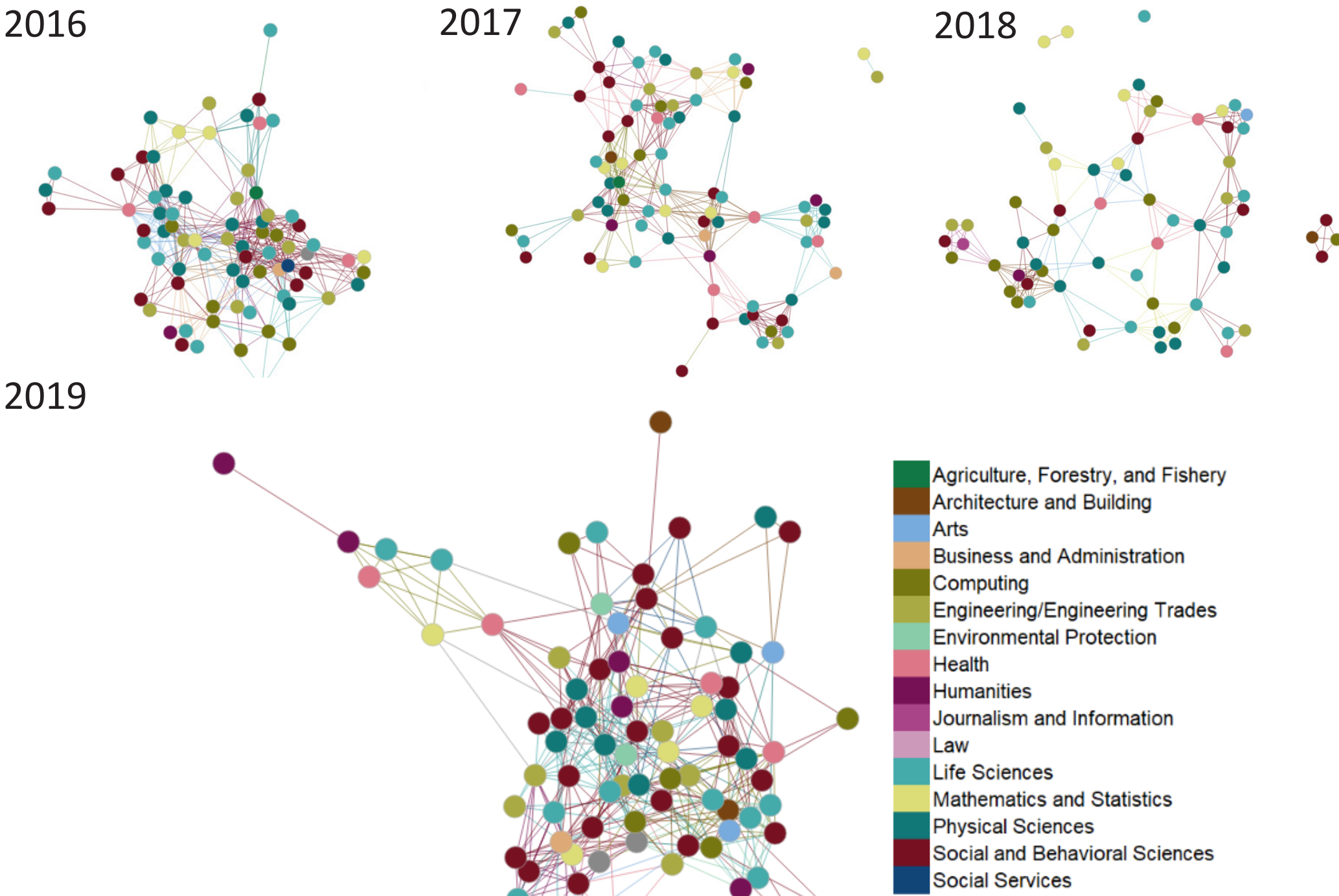
Santa Fe 2018



■ Agriculture, Forestry, and Fishery  
■ Architecture and Building  
■ Arts  
■ Business and Administration  
■ Computing  
■ Engineering/Engineering Trades  
■ Environmental Protection  
■ Health  
■ Humanities  
■ Journalism and Information  
■ Law  
■ Life Sciences  
■ Mathematics and Statistics  
■ Physical Sciences  
■ Social and Behavioral Sciences  
■ Social Services

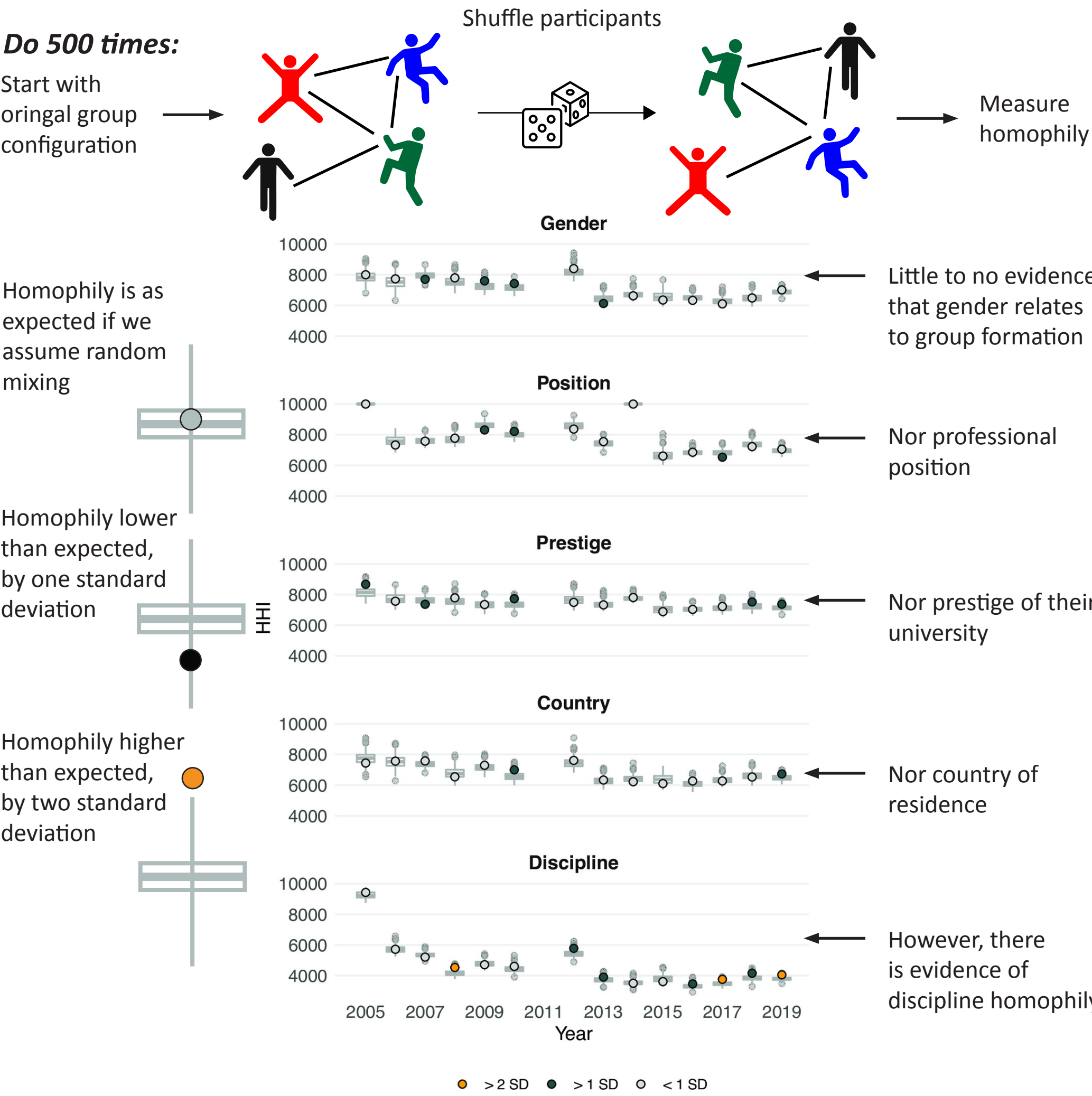
7. Title
8. Participants involved
9. Project discipline, coded from title and abstract into UNESCO classifications

## Collaboration networks at the summer school



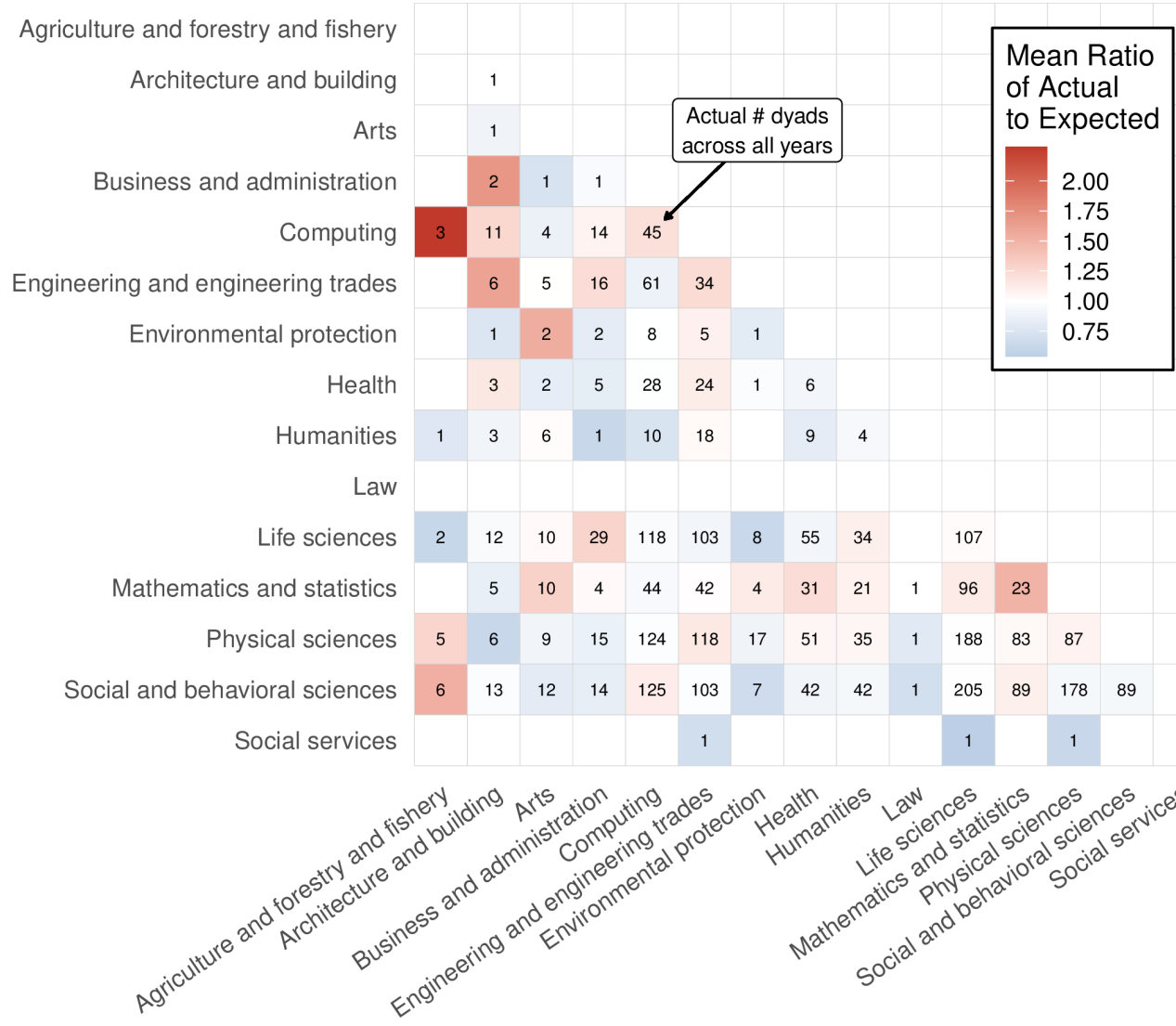
## Do demographics relate to who works together?

Compare actual homophily (using Herfindahl-Hirschman Index) to a null model that assumes random mixing



## Which disciplines work together?

Actual vs. expected collaborative pairs across all years



Collaborative pairs formed for every pair of participants in a group

Homophily in

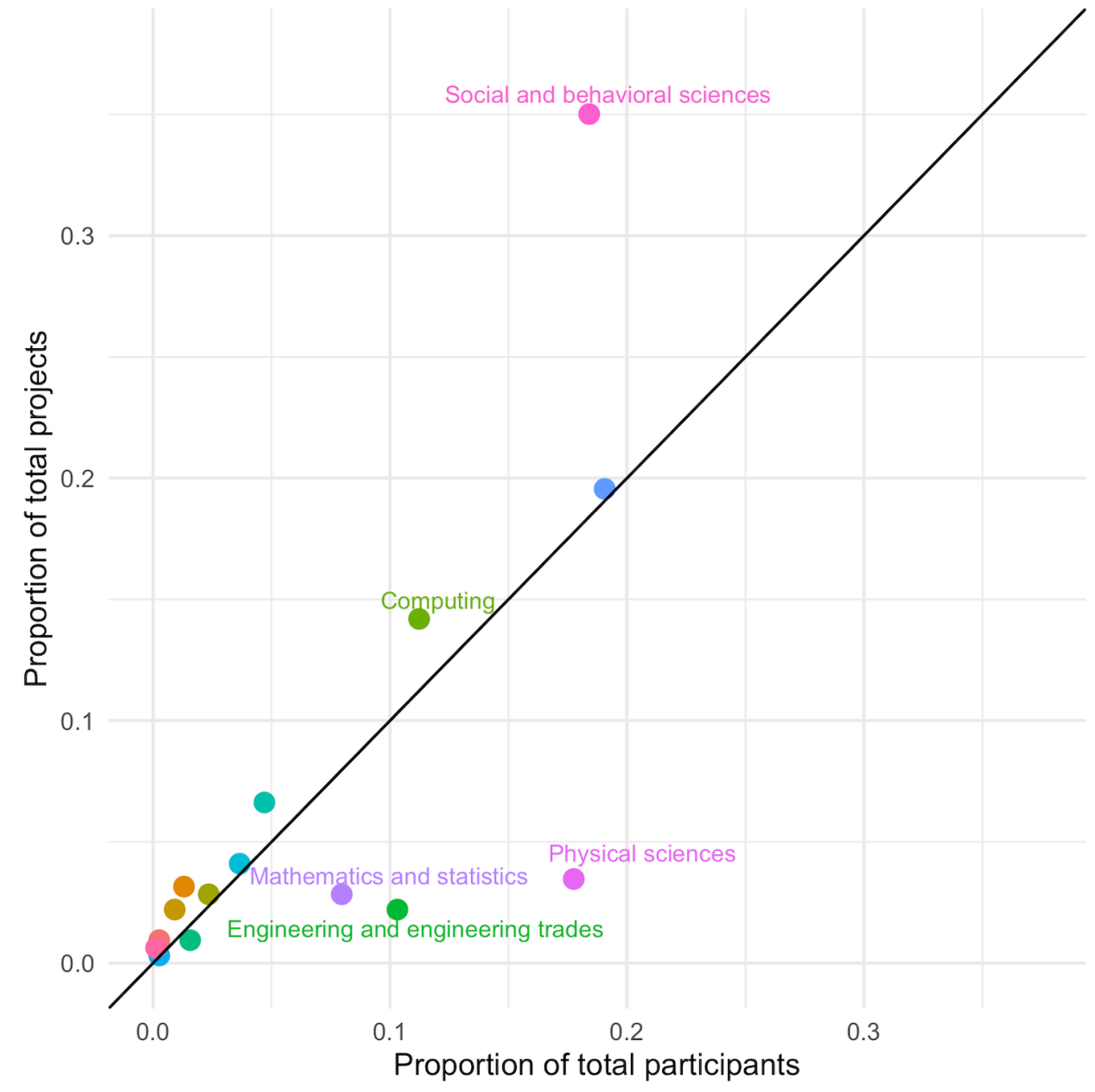
- Computing
- Engineering
- Physics
- Math & Statistics

Collaboration in

- Physics with Engineering
- Health with Math & Statistics
- Computing with Social Science

## What kinds of projects do they work on?

Proportion of participants in each discipline by proportion of project disciplines



A greater proportion of groups collaborated on Social Science projects than there were individuals who had a Social Science background

There was a low proportion of Physics, Engineering, and Math & Statistics projects than there were participants

When participants collaborate, they tend to do so on social science projects

## In summary

- Group formation at the Complex Systems Summer School is mostly consistent with random mixing, except in terms of discipline
- Participants in the "hard sciences" tend to work together, and some disciplines have affinities for collaboration
- When people work together, they tend to work on Social Science projects

We thank the Santa Fe Institute for providing facilities and guidance. We also thank our fellow participants in the 2019 Complex Systems Summer School.

For more information,

- **Tweet at:** @dakotasmurray; @jackiebrownTO
- **Email at:** dakmurra@iu.edu; jackie.ilana.brown@gmail.com
- **Preprint at:** <https://osf.io/preprints/socarxiv/e3z4v>

