Exploring team science dynamics through social network analysis

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The Odor2Action Network

NeuroNex
ODOR2ACTION

Background

The Odor2Action Network (O2A) coordinates efforts that lead to an end-to-end understanding of how brains organize and process information from odors in the environment to guide adaptive behaviors.

O2A embraces a **team science approach.**

Effective team science requires consideration of and attention to:[1-3]
- *Contextual factors around collaboration*
  Researchers' readiness, tendency to collaborate
  Previous collaboration among team members
  Spatial distance
- *Organizational behavior and infrastructure*
  Institutional supports and constraints
  Cyber-infrastructure
- *Team psychology and interpersonal context*
  Trust, shared vision, and cohesion
  Propensity to endorse multidisciplinary values, behaviors

The Science of Team Science (SciTS) empirically examine[s] the processes by which large and small scientific teams, research centers, and institutes organize, communicate, and conduct research.[3]

As one method of examining our network interactions over time, we have committed to conducting an annual **Social Network Analysis (SNA).**

Network Goals

Goal 1: Produce impactful research results

Goal 2: Build an integrated research network around team science that is broadly connected to the neuroscience community

Goal 3: Develop trainees for contribution to the field

Goal 4: Conduct outreach to disseminate results beyond academic settings.

Goal 5: Develop a next generation system for broadly sharing data and compute resources with the scientific community

Methods

- Participants – Odor2Action members (N=54)
- Instruments – Network Survey
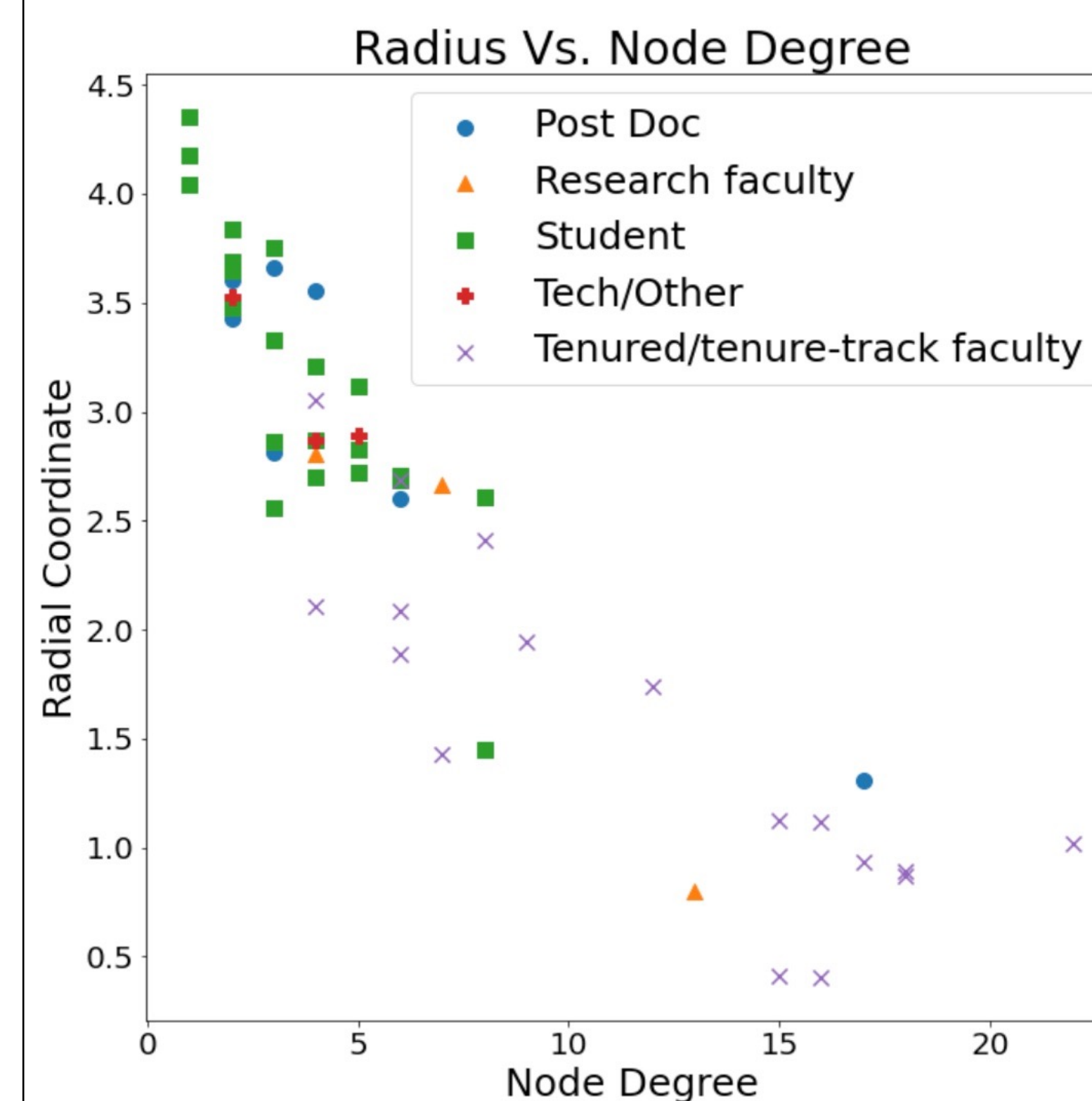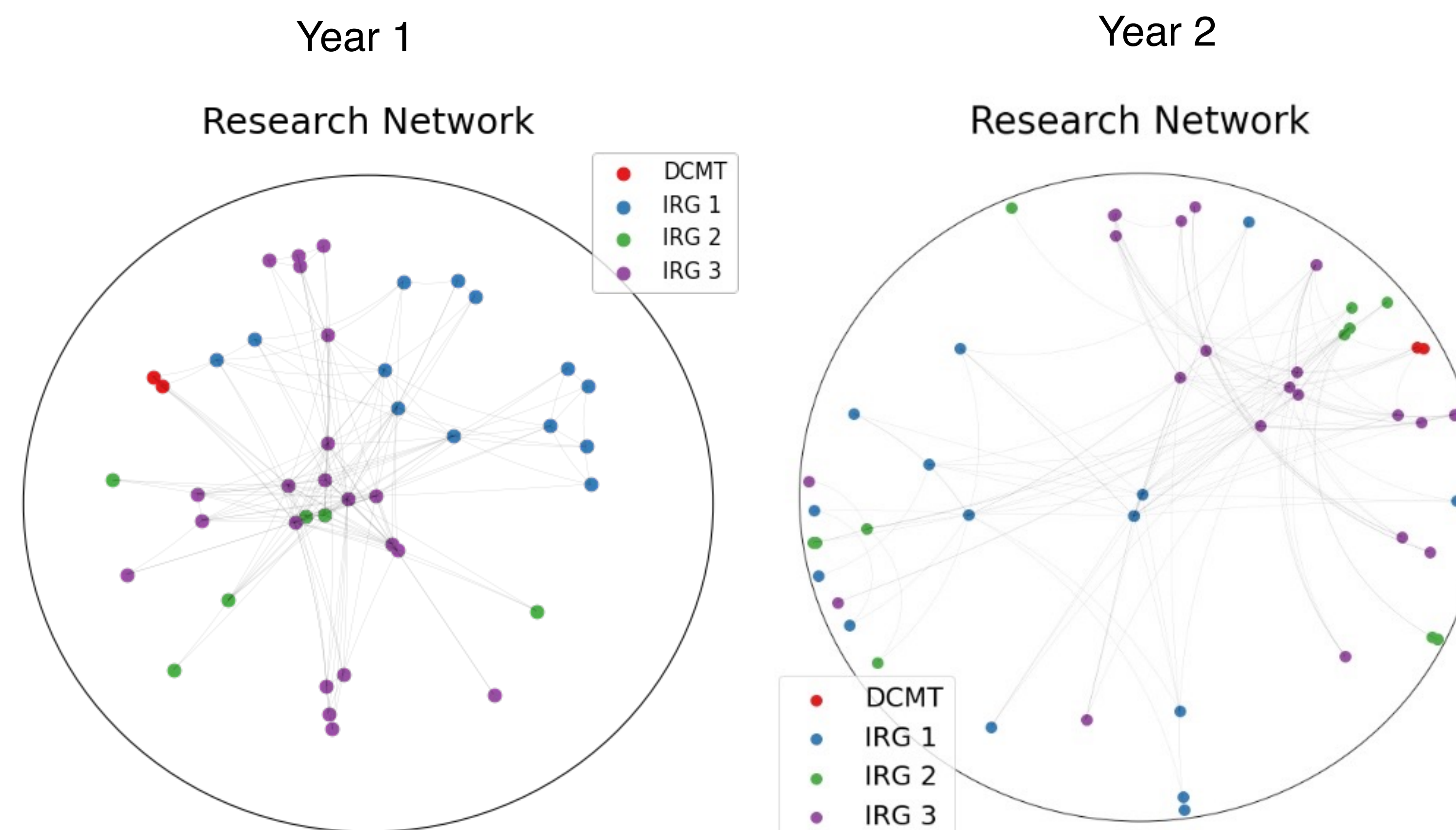- Response Rate – 83% (Year 2) vs 82% (Year 1)

SNA questions and scales
- I discuss, develop or otherwise collaborate on RESEARCH with this person: (1-5 scale, 5 = Much or all the Time)

- For each person, please select the choice that best reflects your relationship. (1-5 scale, 5 = I actively share information, and we plan and work together towards shared goals)

Social Network Analysis

Social Network Analysis: used to examine the structure of relationships ("ties") between individuals ("nodes") in social systems, rather than the individuals themselves.[2]

Year 1
Research Network

Year 2
Research Network

Legend: DCMT, IRG 1, IRG 2, IRG 3

Radius Vs. Node Degree

Legend: Post Doc, Research faculty, Student, Tech/Other, Tenured/tenure-track faculty

- **Node degree:** number of nodes a given node is connected to

- "Hubs" have higher degree

- Reflects structure of traditional research group

  e.g. science done by students and postdocs, communicated through entire network by PI

Changes in clustering between project year 1 and 2:
- overall clustering across the network *decreased*
- however IRGs themselves look *more* clustered
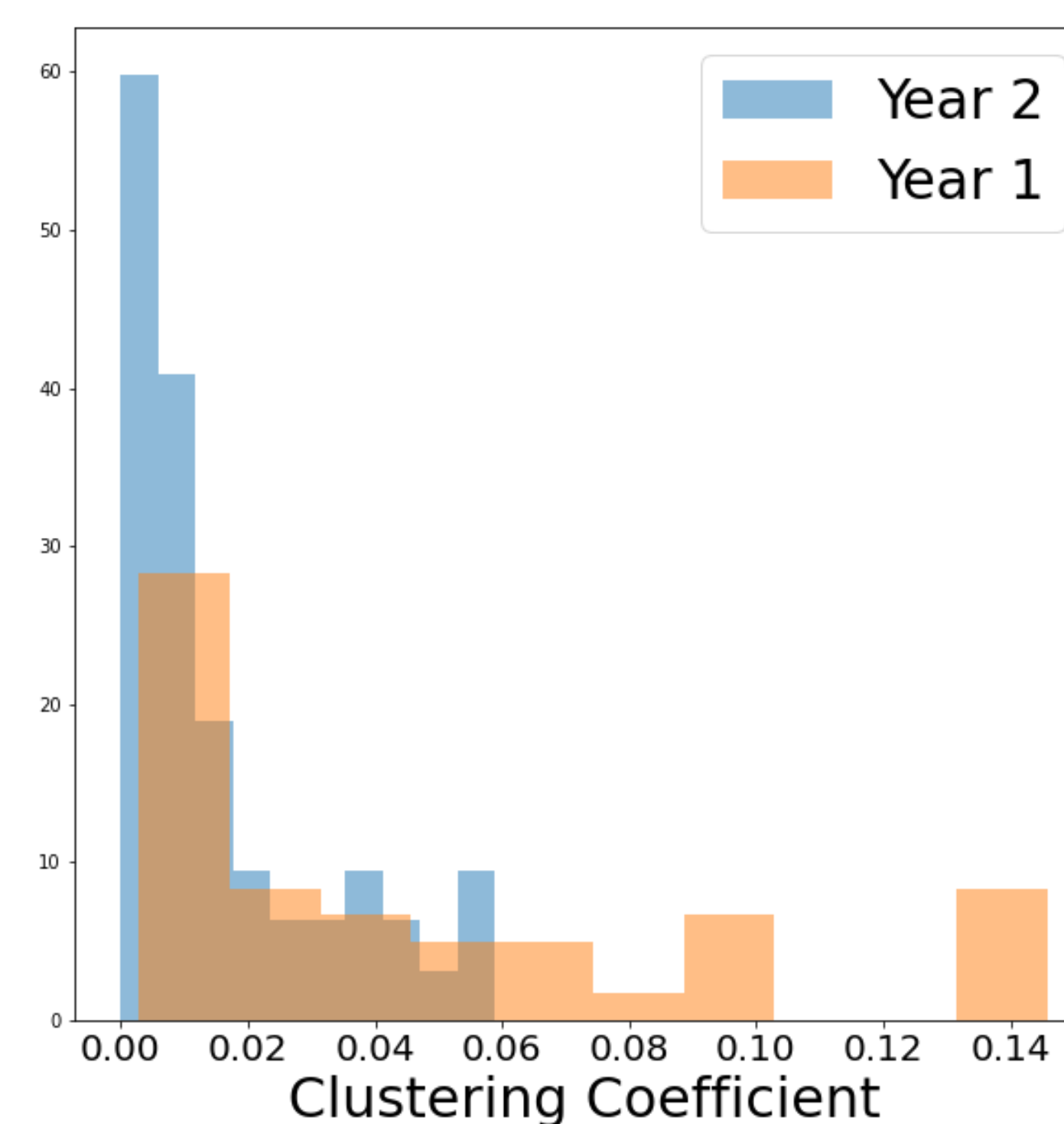
Avg # of collaborators w/in the same IRG

	IRG 1	IRG 2	IRG 3
Year 2	4.4	3.3	6.7
Year 1	4.7	2.5	7.3

Avg # of collaborators from a different IRG

	IRG 1	IRG 2	IRG 3
Year 2	1.9	1.6	1.9
Year 1	4.1	5.8	3.3

Findings

On average people are at least "aware" of the work being done by **26%** of people in the network.

Central hubs in the research do the most "active sharing" of information
- Tenured faculty on average "actively share" info with 12.7 other people
- All others on average "actively share" info with 4.4 other people

Active sharing implies research collaboration

Conclusions

1. Still see a lot of hierarchical structure
Suggestions: where possible, move to reduce hierarchies. Amplify mentees and support their growth (e.g. delegate giving talks or leading project meetings, participate in exchanges)

2. Have become less clustered *overall,* but more clustered by IRGs
Suggestions: eventually increasing engagement with colleagues across IRGs to diversify perspectives

3. Team science progresses along a continuum:
awareness > communication > cooperation > collaboration
O2A is generally at "awareness" and "communication" stages
Suggestions: movement towards "cooperation" (complementary research) and "collaboration" (shared goals)

4. Network members rated us generally high in domain of diversity (7 out of 10), but have suggestions to improve
Suggestions: offering O2A summer fellowship for URM undergrads, inviting guest speakers who represent diverse backgrounds, preparing newsletters/conducting more outreach

References

1. Bennett, L. M., & Gadlin, H. (2012). Collaboration and team science: from theory to practice. *Journal of Investigative Medicine, 60*(5), 768-775.
2. Falk-Krzesinski, H. J., Contractor, N., Fiore, S. M., Hall, K. L., Kane, C., Keyton, J., ... & Trochim, W. (2011). Mapping a research agenda for the science of team science. *Research Evaluation, 20*(2), 145-158.
3. Stokols, D., Hall, K. L., Taylor, B. K., & Moser, R. P. (2008). The science of team science: Overview of the field and introduction to the supplement. *American Journal of Preventive Medicine, 35*(2), S77–S89.
4. Marin, A, Wellman, B (2011) Social network analysis: An introduction. In: J. Scott & P. J. Carrington (Eds.) *Handbook of Social Network Analysis* (pp. 11-25). SAGE.