The following network of Olympic athletes
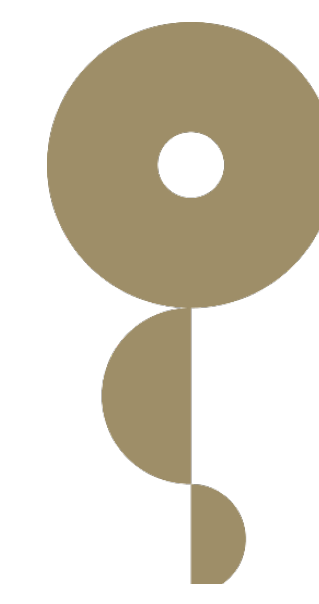
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Olympic medalists: who follows whom?

- We built the network between Olympic medalists in Tokyo 2020, extracting the following links in Twitter on January 2023
- Our database included the accounts of 1052 athletes. 964 of them appear at least in a link, with a total of 7326 directed links
- Metadata included the success (number of gold, silver and bronze medals), sex, country and sport of each individual

The Olympic directed network

- 964 athletes, 956 of them are in the largest connected component, 827 in the largest strongly connected component
- Top 10 athletes with most followers (largest k_{in}):

| Rank	Athlete (country, sport)	k_{in}	Medal(s)
1	Kevin Durant (USA, basketball)	69	1
2	Allyson Felix (USA, athletics)	56	1 3
3	Teddy Riner (France, judo)	54	1 3
4	Alex Morgan (USA, football)	52	3
5	Simone Biles (USA, gymnastics)	50	2 3
6	Megan Rapinoe (USA, football)	48	3
7	Adam Peaty (GB, swimming)	46	1 1 2
8	Nikola Karabatic (France, handball)	43	1
9	Noah Lyles (USA, athletics)	40	3
10	Tom Daley (GB, diving)	40	1 3
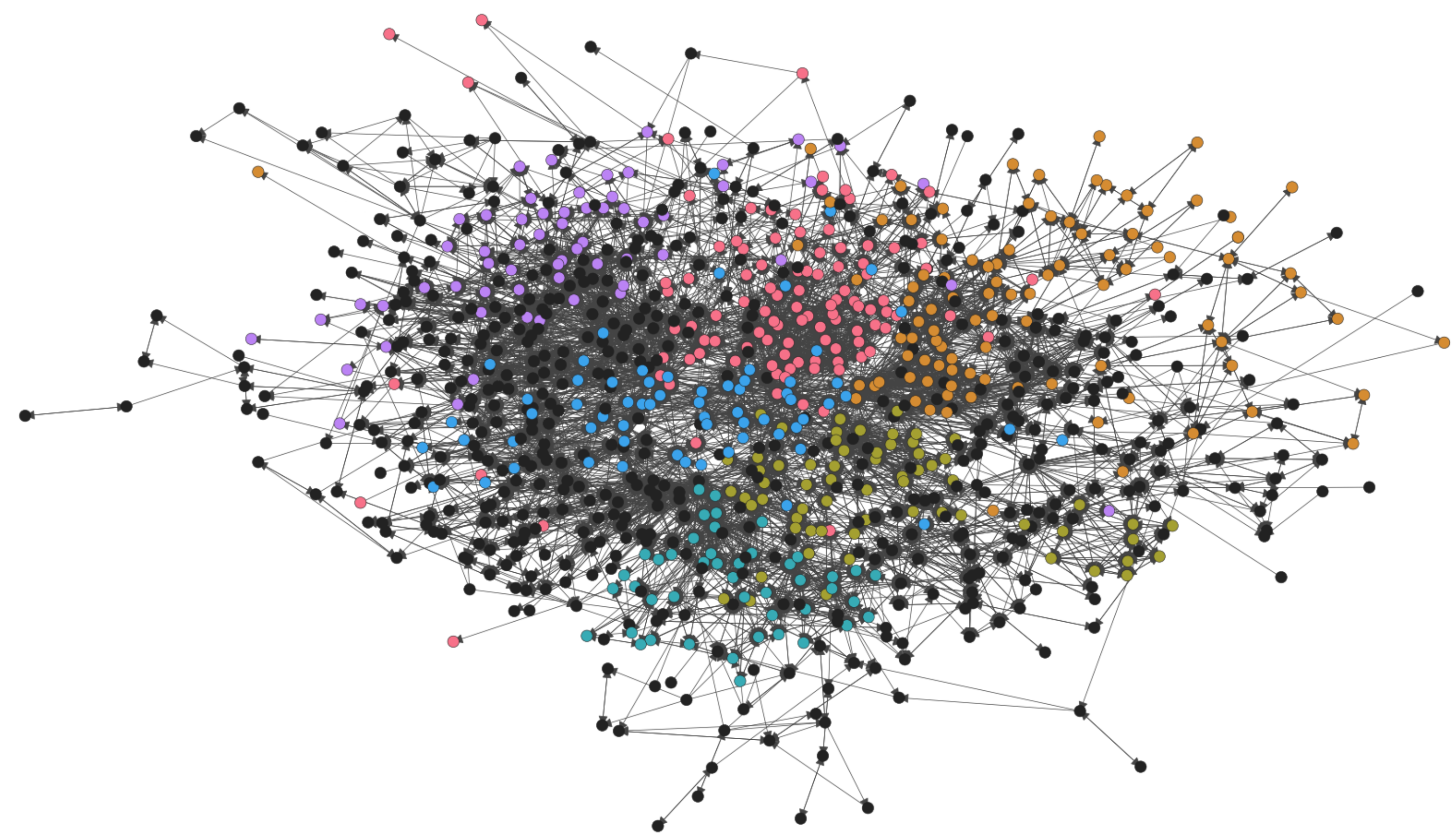
Athletics
Basketball
Cycling
Handball
Football
Swimming

Assortativity: likelihood to link to people with similar features

Sex assortativity

- Following patterns according to sex (Male/Female)
- $k_{in}^M/k_{out}^M = 1.05$, $k_{in}^F/k_{out}^F = 0.96$
- Two null models:
  - Rewiring of the edges (keeping k_{in}, k_{out} and node properties)
  - Random directed network keeping number of edges, number of nodes and group size (node properties)
- Rewiring and random network: opposite behavior in diagonal. $k_{in}^F k_{out}^F$ 60% higher than $k_{in}^M k_{out}^M$
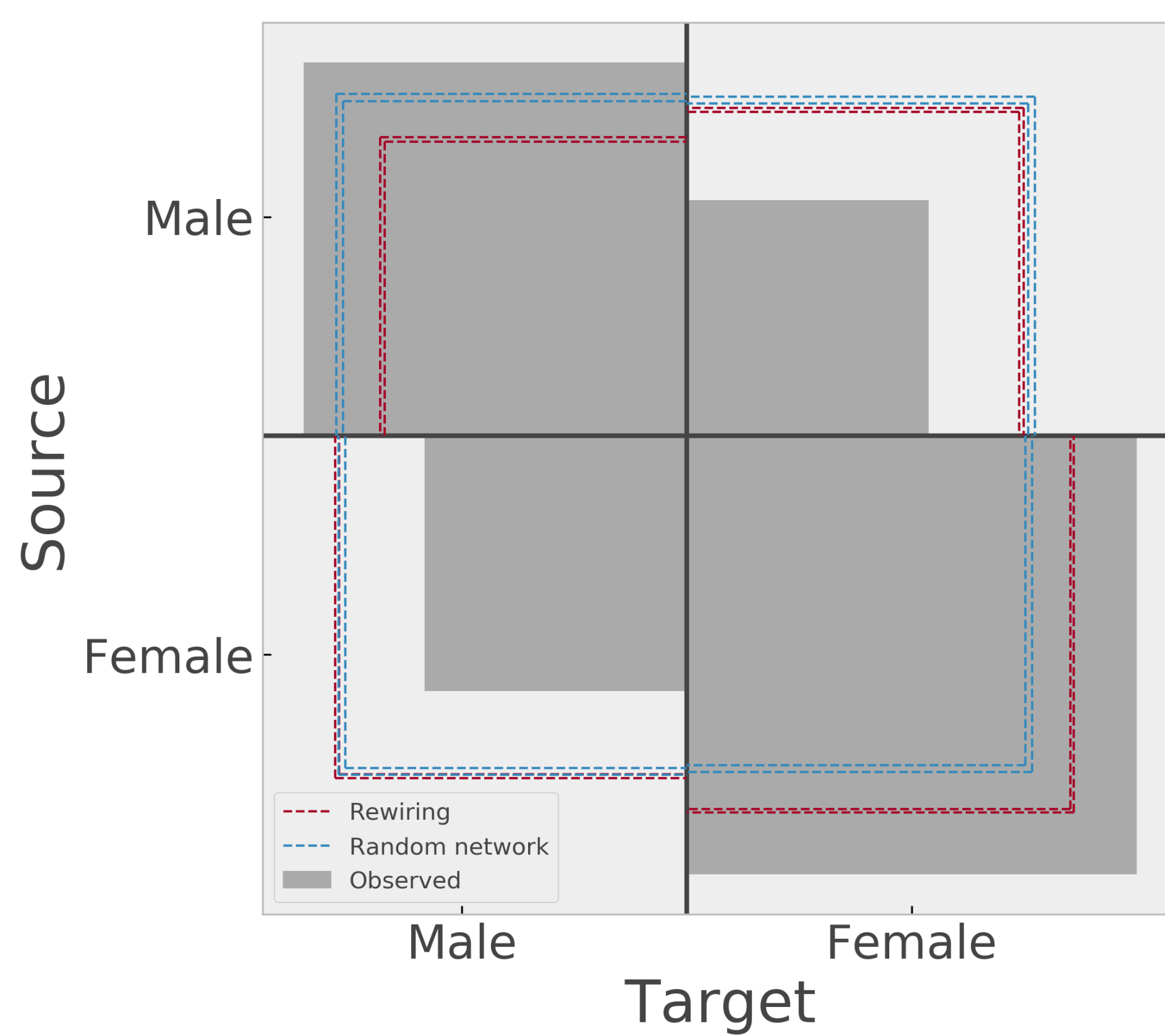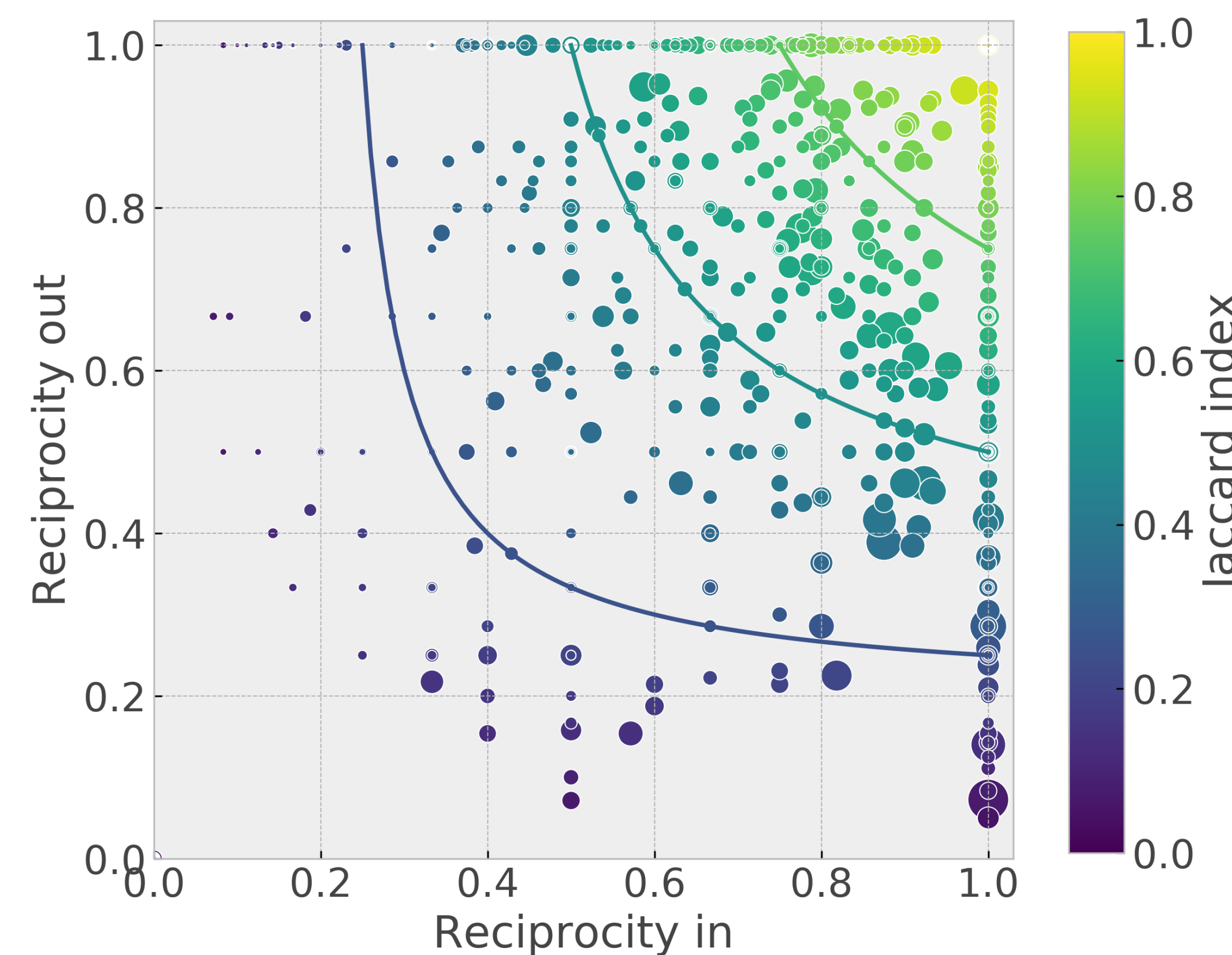
National assortativity

- Group edges by node's nations
- 74% of the edges connect individuals from the same nation
- Rewiring of the edges (keeping k_{in}, k_{out} and node properties), to obtain a z-score for the real connectivity:

$$z(\text{country } i \rightarrow \text{country } j) = \frac{w_{i \rightarrow j} - \langle w_{i \rightarrow j} \rangle_{\text{rewire}}}{\text{SD}(\langle w_{i \rightarrow j} \rangle_{\text{rewire}})}$$
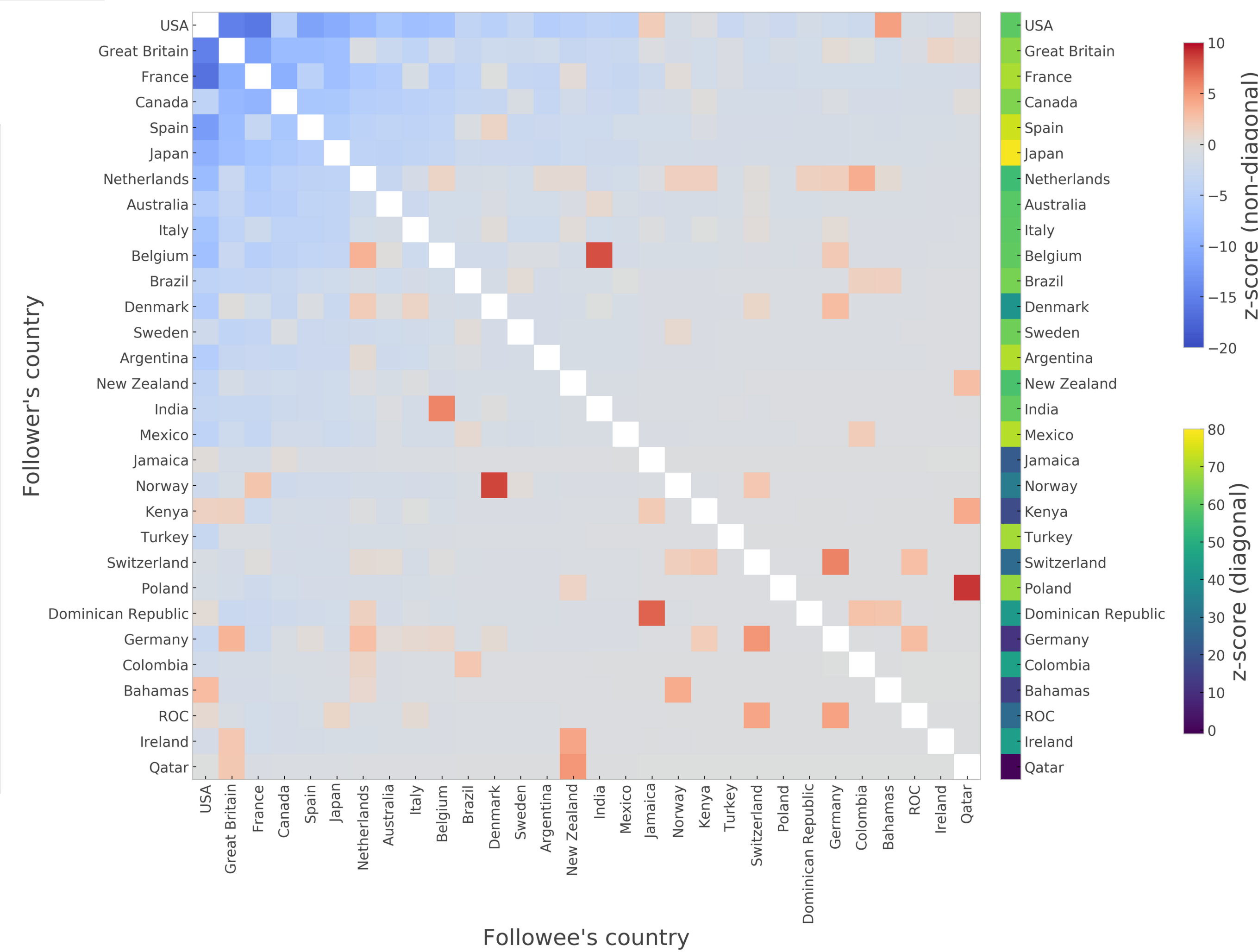
Reciprocity

- Directed network allows for asymmetry: A follows B but B does not have to follow A back
- High global reciprocity: out of 4898 unique connections, 2428 (49.6%) are reciprocal
- Quantify node reciprocity for each node with Jaccard index between its followers and its followees
- Alternative: reciprocity in (fraction of my followees that follow me) and reciprocity out (fraction of my followers that I follow)

Conclusions

- Men (women) are more followees (followers). Strong sex assortativity: less F-M and M-F edges than in null references.
- Observed assortative patterns at nations level. Lower degrees in implies lower assortativity.
- Jaccard index is not ideal for characterizing reciprocity
- Ongoing work: 1) Correlations between sport success and Twitter success, 2) Influential spreaders, 3) Link prediction