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Aspiration of prestige in the selection of peer institutions

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Extended Abstract

Social hierarchies shape the interactions among individuals in many human and animal societies [1]. One measurable manifestation of such hierarchies is a *directional bias in interactions*, such that observed interactions tend to point from higher-ranked individuals to lower-ranked ones (as in parakeets' pecking orders [2]), or vice versa (as in networks of cash borrowing [3]). **Aspirational behaviors** represent a fascinating phenomenon in such systems, in which individuals ostensibly interact with their peers of equal status, yet routinely aim "higher" and nominate, pursue, or judge themselves to be peers of those of higher status. For example, in online dating markets, both men and women pursue partners who are on average more desirable than themselves [4], and high school friendships, when unreciprocated, are similarly aspirational [5]. Understanding aspirational behaviors can reveal the formation processes of a hierarchy, and shed light on the strategies that individuals use to improve their position, resources, or outcomes in social systems.

The U.S. academic system is shaped by a strong and self-reinforcing hierarchy of status and signaling. Past work on faculty hiring and the associated networks of faculty flows between institutions (D1) have revealed that hierarchies of institutional prestige play a dominant role in structuring faculty hiring, funding, and scientific publication rates [6, 7]. However, little is known about aspirational behavior in U.S. academia due to the lack of observable interactions that are, on paper, between institutions of equal status.

Recently, *The Chronicle of Higher Education* compiled survey data (D2) of U.S. universities' self-selected peer institutions [8], opening the door to an investigation of aspirational behavior. While the survey questions asked institutions to name their peer institutions, we instead observe an aspirational social hierarchy such that institutions name higher prestige institutions as their peers [Fig. 1(a)]. However, while peer nominations are aspirational for high status institutions, we also observe that nominations are explained by other, non-aspirational features for lower status institutions [Fig. 1(b)]. To better understand the peer nomination process beyond these high-level observations, we generated feature pairs (of the nominator and of the nominee) for all nominations—including enrollment, geographic location, public/private, and more—and then used a network LASSO strategy to identify which features are most predictive of the peer endorsement network.

Our network LASSO approach models peer nomination as a link prediction problem, using logistic regression [9]. We use features derived from datasets D1 (faculty hiring) and D2 (institutional features) to predict the presence ($y = 1$) or absence ($y = 0$) of peer nominations. To quantitatively represent prestige, we apply the SpringRank model to faculty hiring flows from D1, following past practices [10]. We focus on whether the prestige features derived solely from D1 can be predictive for the structure of D2. After a name-matching process, D1 and D2 amount to $n = 6084$ links and $p = 2697$ features. Since $n \not\gg p$, implying a possibly underdetermined regression, we use LASSO (or L1 regularization) to select the variables. To aid interpretation, we also stratify the data on prestige—i.e., we fit separate models for prestigious

and less prestigious schools—and then compare the predictors. A slice of the results, based on a feature group of the Carnegie Classification System, shows that schools of one type tend to (or tend not to) select schools of the other type [Fig. 2]. Notably, the aspiration of prestige is a significantly predictive feature in the prestigious stratum but is not a selected feature in the other stratum.

Our study's detailed analysis of the peer selection processes of current U.S. universities highlights the social signaling and status maintenance of the diverse levels of academic institutions. These results raise a critical question regarding whether the educational system is reproducing existing status hierarchies or favoring meritocracy. A future direction is to analyze the temporal, annual trends of peer nomination over the past decade.

References

[1] Mari Kawakatsu, Philip S. Chodrow, Nicole Eikmeier, and Daniel B. Larremore. Emergence of hierarchy in networked endorsement dynamics. *Proceedings of the National Academy of Sciences*, 118(16):e2015188118, April 2021.

[2] Elizabeth A. Hobson and Simon DeDeo. Social Feedback and the Emergence of Rank in Animal Society. *PLOS Computational Biology*, 11(9):e1004411, September 2015.

[3] Eleanor A. Power. Social support networks and religiosity in rural South India. *Nature Human Behaviour*, 1(3):1–6, March 2017.

[4] Elizabeth E. Bruch and M. E. J. Newman. Aspirational pursuit of mates in online dating markets. *Science Advances*, 4(8):eaap9815, August 2018.

[5] Brian Ball and M. E. J. Newman. Friendship networks and social status. *Network Science*, 1(1):16–30, April 2013.

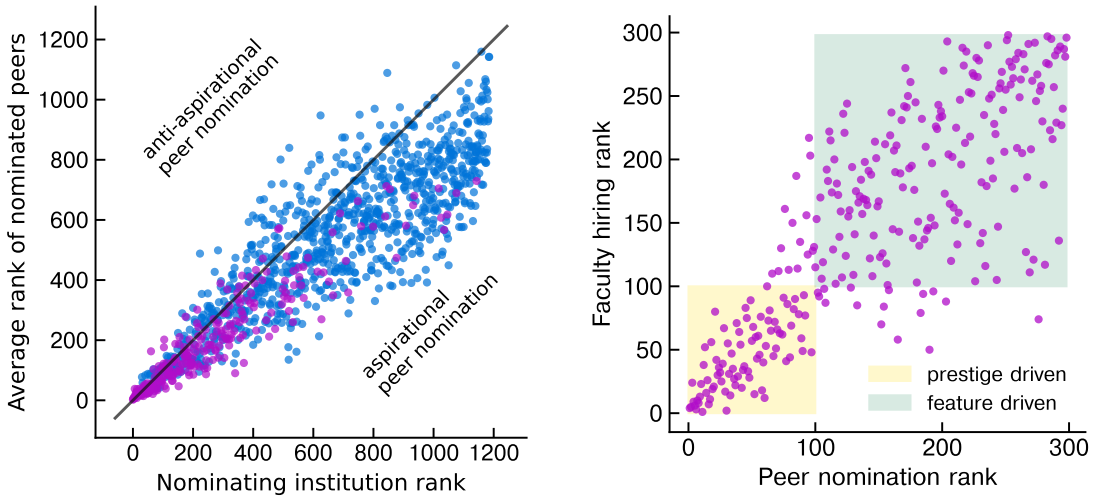
[6] K. Hunter Wapman, Sam Zhang, Aaron Clauset, and Daniel B. Larremore. Quantifying hierarchy and dynamics in US faculty hiring and retention. *Nature*, 610(7930):120–127, October 2022.

[7] Sam Zhang, K. Hunter Wapman, Daniel B. Larremore, and Aaron Clauset. Labor advantages drive the greater productivity of faculty at elite universities. *Science Advances*, 8(46):eabq7056, November 2022.

[8] Audrey Williams June. 'An Art and a Science': Colleges' Tricky Task of Selecting Peers. https://www.chronicle.com/article/an-art-and-a-science-colleges-tricky-task-of-selecting-peers, March 2022.

[9] Jonathan Tuck, Shane Barratt, and Stephen Boyd. A distributed method for fitting Laplacian regularized stratified models. *The Journal of Machine Learning Research*, 22(1):60:2795–60:2831, January 2021.

[10] Caterina De Bacco, Daniel B. Larremore, and Cristopher Moore. A physical model for efficient ranking in networks. *Science Advances*, 4(7):eaar8260, July 2018.



(a) (b)

Figure 1: (a) All universities ($N = 1179$) share some tendency to choose peers that are higher ranked (smaller in numerical value), resulting in a hierarchy. Purple dots are Ph.D.-granting institutions ($N = 266$, excluding those that have not filled out the survey) that overlap with faculty hiring network analysis. (b) Faculty hiring ranks of Ph.D.-granting institutions ($N = 298$) and their ranks in peer nomination. We use Ref. [10] to compute the ranks. Institutions that are higher in the peer nomination hierarchy tends to be more prestigious (lower left quadrant). However, the remaining schools seem to have a different value system, driven by other features.

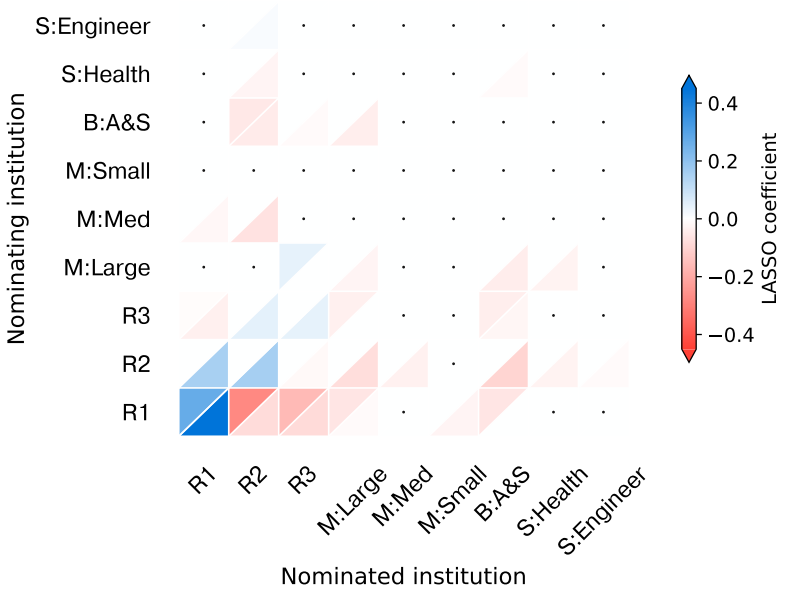


Figure 2: Predictive feature pairs for the peer endorsement in Ph.D.-granting institutions. Upper left triangle: prestigious institutions (100 schools; see Fig. 1); Lower right triangle: Other institutions (198 schools). A positive (negative) coefficient implies the tendency to (not) nominate; zero coefficient implies that the variable is not relevant. The variables are selected by LASSO and are regularized in a way that the values of a specific feature pair across the two strata are similar.