



Quantifying hierarchy and prestige in US ballet academies as social predictors of career success

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Quantifying Processes and Behaviors

- Data-driven methodological tools have made significant progress in predicting career patterns of scientific professions.
- Success in creative careers is hard to quantify due to:
 - **subjective** valuation of performance
 - multifaceted ways that success can be manifested through **recognition**
 - **data scarcity**
- Success is strongly influenced by **visibility** (network position) and **social prestige**

Address the relationship between individual performance, institutional prestige, and career outcomes in creative domains, in this case Ballet

Why Ballet?

- Promoted by King Louis XIV in the 17th century as a display of the elegance, power, and perfection of human beings. Access to court to dancers was facilitated by membership in a guild or access to the king
- Ballet performance strongly influenced by physical ability, often inhibited by stressors and perfectionism
- **Centralized social system** in ballet: a **network of relationships** and **hierarchies** between dancers, schools, companies and all other members of the ballet community
- Lack of systematic research on quantifying success in ballet: test *science of science tools*



King Louis XIV

YAGP Dataset

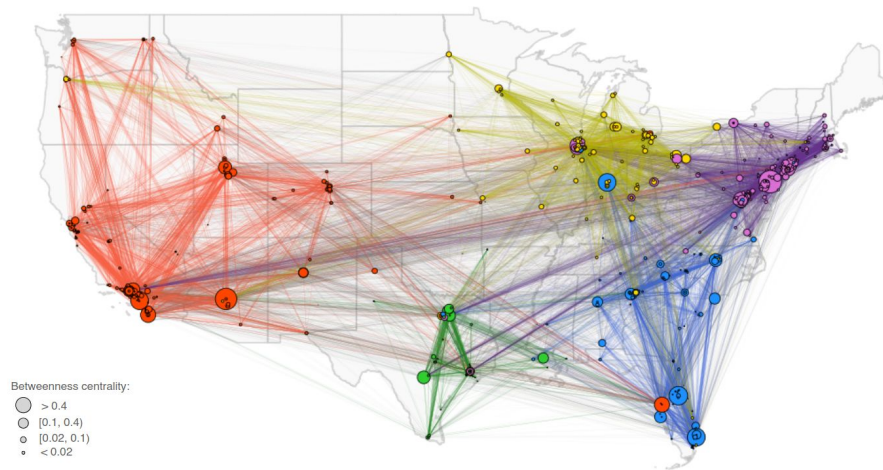
- Over **6000** students from ballet schools participating from 2000 to 2021 in the **Young America Grand Prix (YAGP)**, a ballet competition within the United States
- Woman are 83% of the population so there is a self-selection gender bias embedded in the competition system
- Competition performance is used as a proxy for dance performance quality

Framework

- Network of ballet academies according to students participation in competitions, with a ranking based on their **betweenness centrality**
- **Network centrality** is used as a measure of **social prestige**: the prestige of a school facilitates the professional development and job placement of its students
- Prediction of job placement based on the comparison of competition outcomes with the academic ranking of their affiliations

Network of Ballet Schools

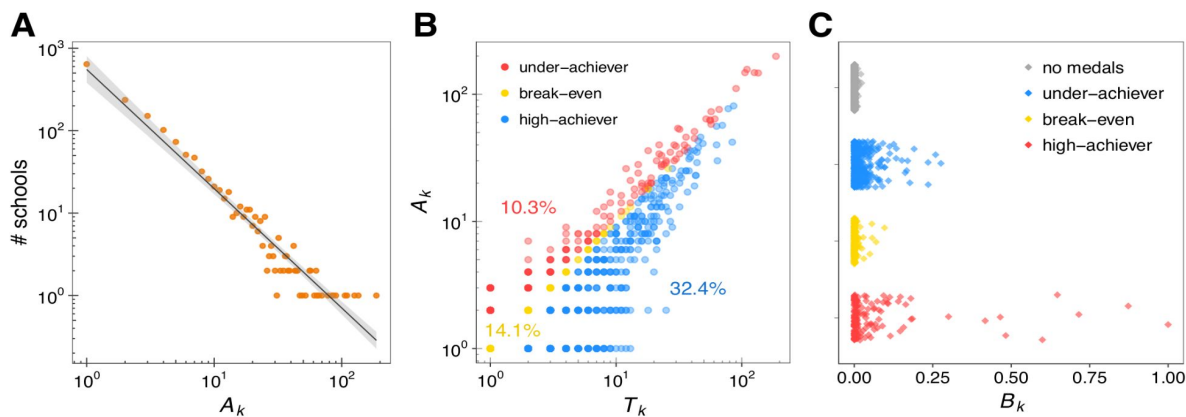
- **Schools** are represented as **nodes**, and a **link** is established between two schools if their **students** were **ranked among the top 12** in the same competition venue - degree of similarity between schools



Network of ballet schools in the USA, nodes are colored according to detected communities
1603 ballet schools and 55778 links

Achievement as Measure of Social Prestige

- Measured by the total number of awards a school gets (A_k) and a ratio of awards per school ($R_k = A_k / T_k$, with T_k being the total of top students)
- Schools categorized in 4 different groups: 'no medals' ($R_k = 0$), 'under-achiever' ($0 < R_k < 1$), 'break-even' ($R_k = 1$), and 'high-achiever' ($R_k > 1$)



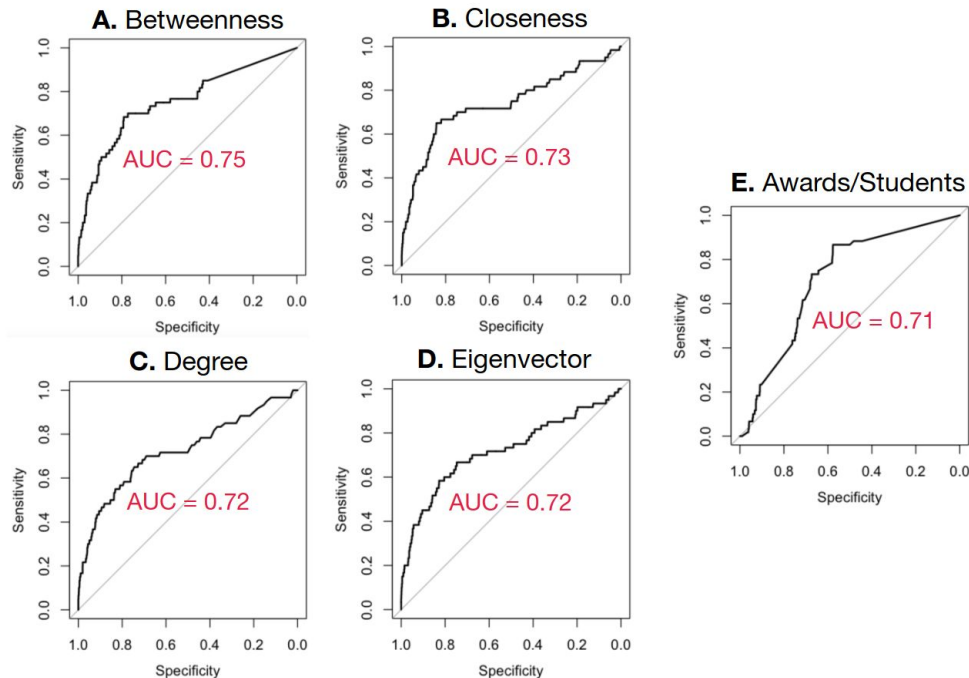
Awards and centrality of ballet schools

Centrality as Measure of Social Prestige

- Schools are ranked through a dense rank function using an ordered list of the schools by their centrality, in an ascending fashion
- Comparison of the predicted ranking of the schools and their place on a list of top 60 ballet schools in the United States, through a classification model evaluated by the AUC
- Betweenness centrality normalized with Min-Max scaling to have a linear range between 0-1, where $B_k = 1$ corresponds to the most central school

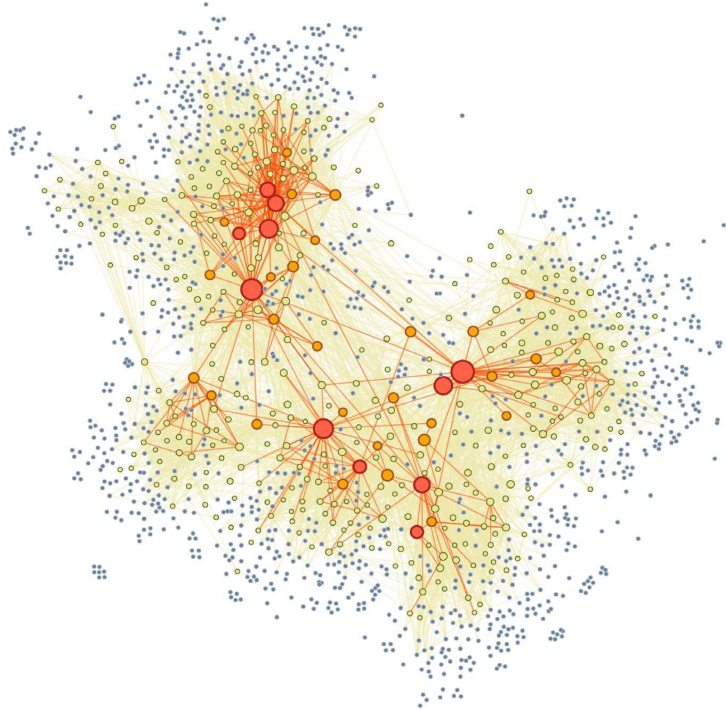
$$B_k = \sum_{\sigma(a,b) \in K} \frac{\sigma(a,b|k)}{\sigma(a,b)}$$

Centrality as Measure of Social Prestige



AUC for network centrality and ratio of awards

Network of Ballet Schools



Betweenness Centrality



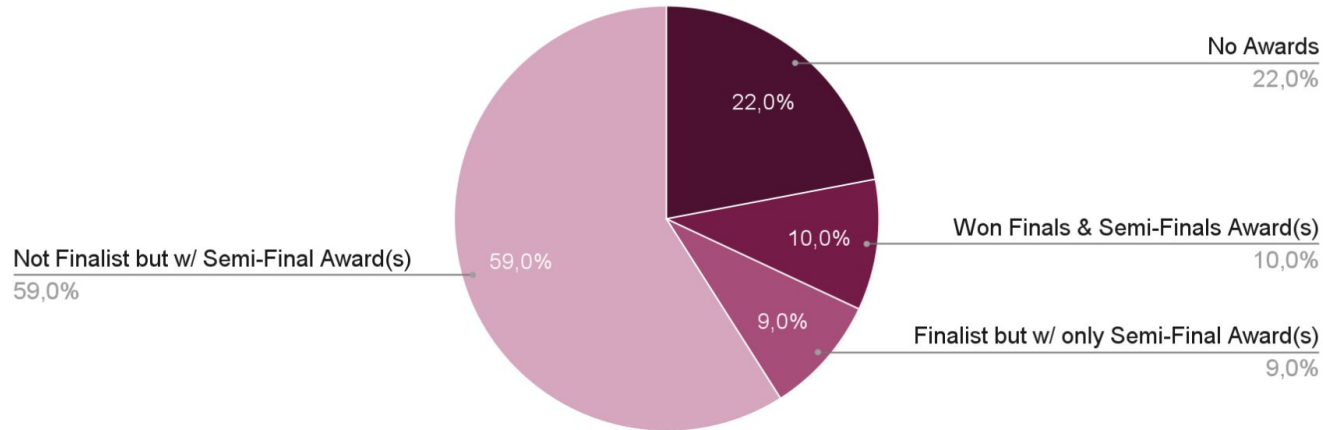
Final Reduced Network Layout

Network of Ballet Schools

- Betweenness centrality offers a more accurate measure of social prestige, compared to schools achievement
- Highly connected schools in the co-competition are more likely to repeatedly have top dancers in the competition
- Visibility of ballet schools is influenced by their potential to bridge between communities in the network, to leave their regional clusters

Career Success of Ballet Dancers

- Competition awards and the job placement of YAGP Alumni (6963 dancers)

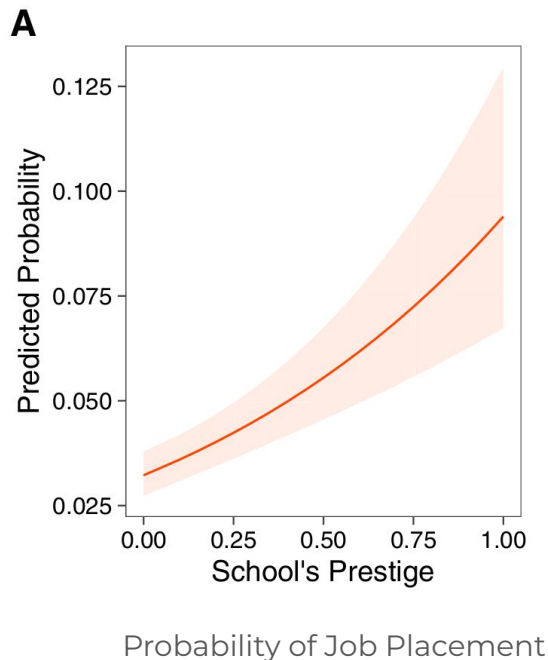


Career Success of Ballet Dancers

- Logistic model to study the effect of individual achievement and social prestige on job placements

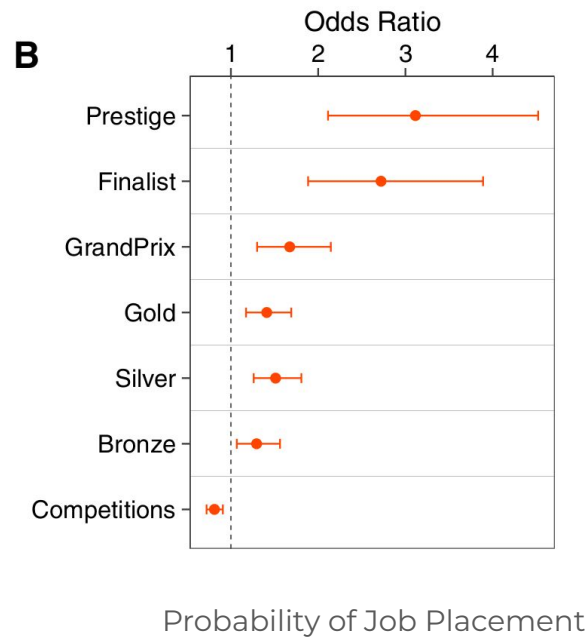
$$Pr(S_i = 1) = \text{Logit}^{-1} \left(\beta_1 \text{Gender}_i + \beta_2 \text{Bronze}_i + \beta_3 \text{Silver}_i + \beta_4 \text{Gold}_i + \beta_5 \text{GrandPrix}_i + \beta_6 \text{Competitions}_i + \beta_7 \text{Prestige}_{ki} + \epsilon_i \right)$$

- Added F_i as a dummy variable of becoming a finalist, to test the importance of achieving that on job placement
- Significant positive effect on the predicted probability of a job placement with the increase of school's prestige; likewise for students that are finalists



Career Success of Ballet Dancers

- Odds ratio increases with medal importance, especially with the Grand-Prix - 67% increase
- A long competition career may negatively impact job placement - 18% decrease with additional competition participation
- School prestige has the largest effect in determining job placement - 200% increase
- Still hard to disentangle school prestige with individual performance



Prestige Beyond Performance

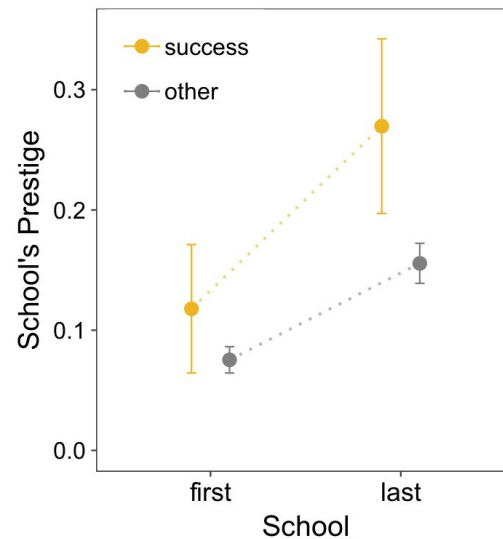
- Match students who have identical medal and competition counts, but who differ on their school's prestige, with YAGP awards as proxy for dancer's abilities

$$E(S|Y = 1, X) - E(S|Y = 0, X) = \frac{1}{N} \sum_{i=1}^N (S_i - S_{j(i)})$$

- Significant increase of 65% in the odds of obtaining a job placement for those who attended a prestigious school, by comparing similarly skilled students
- Reduction of bias due to observable confounders, from a 200% increase to a 65% increase

School Changes

- **85%** of students only attended **one school** while **15%** attended **two up to five schools**, which implies they transferred
- Students tend to change to more prestigious schools - difference of 0.086 in the schools' prestige, from first to last
- There is a larger increase in school's prestige for students who obtained a successful job placement
- No relationship between previous awards obtained in School 1 and the change in school's prestige of School 2



Change in Schools Prestige

Final Conclusions

- Use of *science of science* and network science to analyze creative career patterns in the US, revealing connections between arts, education, reputation, and prestige
- Social prestige is predictive of higher jury's recognition of students, competition advancement, and better career prospects
- High potential of data-driven methods to objectively analyze these effects in performing arts
- Despite their intense training, social aspects are crucial to success and dancers can leverage the learned principles by affiliating with prestigious academies

Research Limitations

- Analysis only captures the **short-term effect** of awards and social prestige on job placement
- **Selection bias** in the competitive fields: implementation of blind auditions as solution
- **Data limited to YAGP** competition outcomes: school level metrics to evaluate individual performance
- No account of omitted variables and unobserved factors like beauty standards, technique style, experience...
- No information about judge pools and company hiring staff, that can influence awards and job placements
- Nature of the data limits ability to measure peer effects on competition or career achievement