

Quantifying Hierarchy and Prestige in US Ballet Academies as Social Predictors of Career Success

Yessica Herrera-Guzmán¹, Alexander Gates², Cristian Candia^{3,4}, and Albert-László Barabási⁵

¹Research Center for Social Complexity, Universidad del Desarrollo, Chile.

²School of Data Science, University of Virginia, USA. ³Data Science Institute, Universidad del Desarrollo, Chile.

⁴Northwestern Institute on Complex Systems (NICO), Northwestern University, USA.

⁵Center for Complex Network Research (CCNR), Northeastern University, USA.

In the past decade, we have seen major progress in quantifying the behaviors and the impact of scientists by means of methodologies from the fields of network science [1] and *science of science* [2]. The extension of these methods to other creative domains has similarly empowered insights on the impact and social network effects in creative careers [3, 4]. However, due to the subjectivity in the valuation of creative performance quality, many difficulties remain in quantitatively disentangling the effect of individual performance and social influence in other creative professions, such as performing arts.

Here, we focus on ballet because of its stable social structure that allows us to quantify the relationship between individual performance, institutional prestige, and career outcomes. Historically, the success of ballet dancers required artistic talent and physical abilities, yet it was significantly facilitated by membership in a guild or by access to the king [5]. Our hypothesis is that, in the modern era, dancers affiliate with prestigious ballet academies to have access to a larger network of dance professionals and better career prospects.

To test this hypothesis, we analyze data on competition outcomes from 6,363 ballet students affiliated with 1,603 schools in the United States, who participated in the Youth America Grand Prix (YAGP) [6] between 2000 and 2021. From the structured YAGP data, we build the network of ballet academies based on their students' participation in the competition (see Fig. 1). In this network, nodes are schools and the link between two schools captures a degree of similarity in training quality. We validate **betweenness centrality** as a proxy for social prestige by measuring the correspondence between the top schools by the network ranking and those identified by leading ballet experts (AUC=0.75). The resulting network-based ranking of ballet academies reveals the hierarchical social stratification of prestige within the ballet academic environment.

To understand the influence of social prestige on career success—here defined as obtaining a job placement in a ballet company—, we build a logistic regression model where the dependent variable is success S , measured as a binary outcome, where $S_i = 1$ if student i obtained a job placement in a ballet company and $S_i = 0$ otherwise. The independent variables include the aggregated measures of students' achievement within the YAGP competition, such as total awards by type and total number of competitions, as well as the normalized and re-scaled schools' betweenness centrality measure for social prestige.

We find that prestige has a significant increase in the probability of job placement with the increase of social prestige, with a 200% increase for students affiliated to the most prestigious school. Then, we conduct an experiment in which we match students who have identical performance (medal and competition counts), but who differ on their school's pres-

tige. We compute the Average Treatment Effect and observe that by comparing equally skilled dancers, there is a significant effect of 65% in the odds of obtaining a job for students who attended prestigious schools. The reduction from 200% to 65% indicates that biases of social prestige are reduced based on performance, but the role of social prestige strongly benefits students affiliated to prestigious schools to obtain a job in a ballet company.

This work reveals the importance of institutional prestige on the hiring processes of ballet companies to select the most talented students, while showcasing the potential of network science approaches to provide quantitative viewpoints for the professional development of careers beyond science.

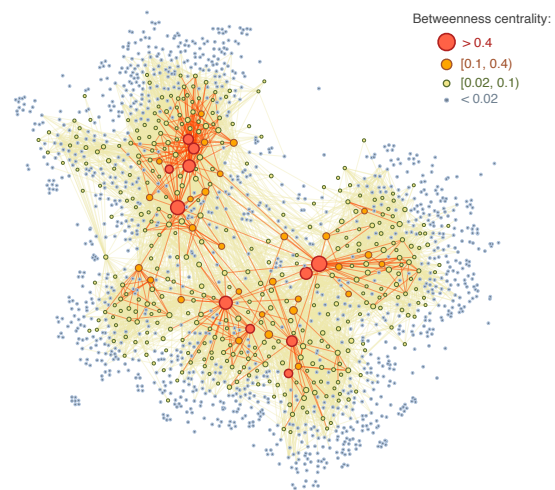


Fig. 1. **Network of ballet schools.** Node size and color reflect schools' normalized betweenness centrality, B_k . The weak structure (in yellow) shows dense connectivity within network clusters and sparser connections to the periphery; the strong structure (in red), comprises strong edges between highly central ballet schools in strategic positions.

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- [1] Albert-László Barabási. *Network science*. Cambridge University Press, 2016.
 - [2] Dashun Wang and Albert-László Barabási. *The science of science*. Cambridge University Press, 2021.
 - [3] Samuel P. Fraiberger et al. *Quantifying reputation and success in art*. en. In: *Science* 362.6416, pp. 825–829. issn: 0036-8075, 1095-9203. DOI: [10.1126/science.aau7224](https://doi.org/10.1126/science.aau7224), 2018.
 - [4] Milán Janosov, Federico Battiston, and Roberta Sinatra. *Success and luck in creative careers*. In: *EPJ Data Science* 9.1, p. 9. <https://doi.org/10.1140/epjds/s13688-020-00227-w>, 2020
 - [5] Jennifer Homans. *Apollo's angels: A history of ballet*. 1st edition. Random House Publish-412 ing Group, 2010.
 - [6] Youth America Grand Prix. <https://yagp.org>