How creativity works: What Broadway musicals really teach us about collaboration.

By Jordan Ellenberg | Posted Friday, March 23, 2012, at 9:00 AM ET
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Slate.com

Six Degrees of Innovation

What Broadway musicals tell us about creativity.

Is there a social-network model that explains the success of Cats?

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In 2012, with every 20th -century mode of public expression writing its living will, you might not expect the dowdy Broadway musical to have much to teach us about creativity in a networked world. Social scientists Brian Uzzi and Jarrett Spiro say differently, and their research—thanks to its featured billing in Jonah Lehrer's New Yorker essay on brainstorming and his best-selling book Imagine: How Creativity Works—has now been cited everywhere as a window into the mysterious world of collaboration.

Uzzi and Spiro studied 474 Broadway musicals released between 1945 and 1989, analyzing the complex web of collaborations and relationships between producers, librettists, choreographers, and the rest. The sociologists analyzed the features that correlated with success on the Great White Way. The take-away message echoing through the business blogosphere is pretty simple: For optimal innovative bang, your team shouldn't have too much experience working together, but they shouldn't be total strangers either. Their relationship structure (quantified by a factor alluringly denoted by the single letter "Q") ought to be somewhere in the middle—like Goldilocks' porridge, just right. When Q veers outside the optimal range, the team founders: either they find no common ground at all, or, surrounded by the same old faces, they produce the same old stuff.

There's only one problem—that's not really what's in Uzzi and Spiro's study. But their actual findings are even more interesting!

Let's start with that mysterious Q. It's made up of two parts. The first is the average number of connections you need to join two random people in a network. That number can be surprisingly small, even in a very big network; for example, you can connect two random Facebook users, on average, . The second part of Q measures the extent to which two people who are connected to the same person are likely to be connected to each other: the "clusteredness" of the network. You might imagine that a highly clustered network, where people glom together into small, interwoven groups, would require long chains of connections to get from one incestuous clique to another. But applied mathematicians in the 1990s, most notably Duncan Watts and Steven Strogatz, found that many real-world networks don't obey that intuitive relation. In real networks ranging from Facebook friendships down to neurons in the hippocampus, small-scale groups are indeed tightly clustered, but the presence of rare but crucial connections between distant clusters means you can hop from any person to any other in surprisingly few steps. Networks with this property are called "small worlds," and it's the small worlds that have high values of Q. A network with connections chosen randomly and with no interesting structure, on the other hand, will have a low Q.

Which one is the network of Broadway artists like? Uzzi and Spiro found that it depends when you ask. Q starts big in 1945 and then gets bigger, hitting Peak Small World in 1947; at this point, Q is higher than Uzzi considers optimal. Q then steadily drops, passing through the "sweet spot" in around 1950, the year of Guys and Dolls, and bottoming out in the early 1970s. Apart from a brief rise in the late '70s and early '80s (I knew there had to be some explanation for Cats) it doesn't recover. Moreover, the trends in Q track corresponding trends in the financial and artistic success of Broadway as a whole. Shows were more likely to be successful when they were embedded in a network whose Q was not too high and not too low. Associations of this kind can be hard to interpret, but they keep popping up in the social science literature, in contexts from scientific collaboration to hip-hop.

What's the difference between this story and the oversimplification we started with? It's that Q is not a property of an individual show; it's a property of the whole network. In mathematical language, we'd say it's global, not local. That distinction is vital. Suppose you found that countries that were more economically stratified enjoyed better overall health. It would be nuts to respond by increasing the income differential between yourself and your spouse, on the grounds that economic stratification keeps the doctor away. Stratification, like Q, is a global measure, which applies to the whole society. It is not a local value, one that can be attached to a single person or family. And sometimes global measures matter most. Uzzi and Spiro found little or no relation between success and local measures, such as the extent to which team members had worked with each other on previous shows. The success or failure of a Broadway show had less to do with the relationships between the names in the Playbill than the shape of the broader network at the time the show was produced.

Even with simpler measures, you can veer way off track by inferring local conclusions from global statistics. Andrew Gelman's book Red State, Blue State, Rich State, Poor State provides a telling example. The richest U.S. states, like New Jersey and Connecticut, tend to vote Democratic, while the poorest, like Mississippi and Arkansas, are substantially more Republican. This fact, easy to see on the election-night map, helps drive a popular narrative that the Democrats represent the economic elite. But what's true at the global level of states is false at the local level of individuals. Richer voters support Republicans; richer states support Democrats.

How can this be—if poor people like Democrats more, and poor states have more poor people, why don't the Democrats win in Mississippi? Gelman's research identified two reasons. First, Mississippians are more Republican than Connecticuters at every income level, presumably for cultural reasons independent from income. Second, Gelman finds that the relationship between income and GOP voting is much stronger in the poorer states. In Mississippi, rich people skew heavily Republican and the poor tend to support the Democrats. Republicans dominate in places like Mississippi by racking up huge margins among the richest residents. In Connecticut, by contrast, the rich are almost as likely to vote Democratic as the poor. That's what allows coastal pundits to maintain their impression that Democratic voting goes hand-in-hand with expensive cars and exclusive private schools.

The global nature of Q—and the difficulty of using global measures to craft local strategies—might be a disappointment for business people who want to use the lessons of Broadway to out-innovate the competition. But it shouldn't be. The new social science of complex networks is addressing a different kind of problem, a deeper and potentially more important one. This research is concerned less with how to construct teams to maximize their creativity than with the question of what kind of society maximizes everyone's creativity. And real progress on that front would be something worth singing and dancing about.