

Matthew Jackson

On human networks, the friendship paradox, and the information economics of protest movements

As a young economist out of Stanford, Matthew Jackson trained his sights at first on game theory, the highly mathematical area devoted to strategic decision-making. But before long, in the early 1990s, he began to focus on social networks — that is, human networks. (Facebook was not yet a gleam in Mark Zuckerberg’s eye, and Twitter was more than a decade from launching.) Jackson started researching the effects of social networks on employment, inequality, and the spread of behavior, good or bad.

Jackson’s interest in networks grew out of a lunch conversation with another economist, Asher Wolinsky of Northwestern University, about how people become influential in their networks. They realized there were many unknowns about networks and how they influence people. “There was already a large literature in sociology studying networks,” he says today. “But the central role that networks play in economic behaviors was underexplored. So there was a lot for us to begin to try to understand.”

In addition to numerous papers and journal articles — according to a recent study, he is one of the half-dozen most published authors in the top five economics journals from 1994 to 2017 — Jackson is the author of *Social and Economic Networks* (Princeton, 2008), a book for researchers, and *The Human Network: How Your Social Position Determines Your Power, Beliefs, and Behaviors* (Pantheon, 2019), for the general public.

David A. Price interviewed Jackson by phone in January 2021.



EF: How did you become interested in economics?

Jackson: Economics was not my childhood calling. I grew up in the Apollo era and was looking more to the stars. The space race and watching Neil Armstrong land on the moon were fascinating to me. I dreamed of being an astronaut. But my eyesight precluded that, and I enjoyed mathematics and physics quite a bit. Science was being pushed at that time, so that drew me in.

When I was in college, we were supposed to do undergraduate research in our junior and senior years. In studying math, I craved ways to apply it. I went to Harold Kuhn, who was a game theorist in Princeton’s math department, and asked him where on campus could I find somebody who actually applies some of the mathematics to the real world. He pointed me to Hugo Sonnenschein, who was a professor in the economics department. So I started working with Hugo in trying to model people’s preferences and choices using mathematics. I realized I could do two things I loved at the same time: to use the tools of mathematics and to understand the world better.

EF: A lot of your research has involved looking at the effects of social networks — in the old-fashioned sense of networks among people. Most people understand that social networks can be important to finding a job. You’ve argued that their importance is much more than that. In what way?

Jackson: As an example, one key network phenomenon is known among sociologists and economists as homophily. It’s the fact that friendships are overwhelmingly composed of

people who are similar to each other. This is a natural phenomenon, but it's one that tends to fragment our society. When you put this together with other facts about social networks — for instance, their importance in finding jobs — it means many people end up in the same professions as their friends and most people end up in the communities they grew up in.

From an economic perspective, this is very important, because it not only leads to inequality, where getting into certain professions means you almost have to be born into that part of society, it also means that then there's immobility, because this transfers from one generation to another. It also leads to missed opportunities, so people's talents aren't best matched to jobs.

EF: In your book *The Human Network*, you described four ways of assessing a person's importance within a network: popularity, connections, reach, and brokerage. How are these different, and which are the best to have?

Jackson: Pure popularity is great for direct influence. It enables somebody simply to get a message out quickly to many people directly or to be a role model to many other people. An example is somebody on Twitter who has hundreds of thousands or millions of followers.

The idea of influence in terms of connections is the old idea of, "It's not what you know, but who you know." Here, it's not the raw number of friends that one has that's important but having friends who are well connected. And they're in turn well connected because their friends are well connected and so forth. The idea of how well connected someone is in a network is what underlies things like the Google search engine and how it was originally programmed: They were looking to see how important a webpage was by looking at the importance of the webpages that linked to

it. That turned out to be a powerful concept in identifying key positions in a network beyond just counting connections.

The third measure, that of reach, looks at the layers of a person's connections: How many friends does a person have, how many friends of friends does a person have? This kind of measure turns out to be useful in other contexts, like studying the spread of a disease, for instance, or the diffusion of an idea.

The fourth type of influence, brokerage, is perhaps the most distinct. Somebody is influential in this way if he or she is a key connector between people in at least two other discrete groups. You can think of someone who, for instance, does work at the interface of different sciences and talks to people in both camps. These people can be brokers or key connectors who transfer knowledge from one group to

"Stratification varies greatly by region. In some places, the poor are as well connected to the rich as they are to other poor, while in other places, you have the poor completely isolated."

another. These key connectors have been studied by sociologists; they turn out to be important conduits for information flows between groups and also end up often benefiting from those key positions.

STRATIFICATION

EF: Do you think social networks in the United States are becoming more stratified economically or less so?

Jackson: I'd love to know the answer to this question — especially to have data that tracks this over time, which is hard to come by. But what we can see is that economic stratification is very strong geographically in the United States. We see also that this stratification varies greatly by region. In some

places, the poor are as well connected to the rich as they are to other poor, while in other places, you have the poor completely isolated. This turns out to be highly predictive of whether children born into poor families grow up to be poor themselves.

In terms of the time trend, I think what we have seen is the substantial increase in inequality in the United States and a lot of other countries over the past few decades. So understanding that stratified and segregated societies play a key role in driving inequality is critical to designing better policies. We can track it from year to year and we can look at micro trends, but getting long-term trends about network structure will take a lot of data gathering over time.

EF: You mentioned that there's a lot of variation regionally in how much connection there is between the poor and the affluent. Is there any pattern to that? Is there anything different about the areas where there's more connection?

Jackson: That's something we have a pretty large team studying at the moment, and

I hope we'll be able to release some research on that shortly. There's a lot that goes into it, and it's a complex question — it's not just one factor.

You can see differences in certain kinds of settings. Let's take two high schools. One is a small high school and the other is a very large high school, and both of them are fairly diverse. When we compare the friendships within those high schools, the small high school will usually be more integrated than the large one. If you have a high school of less than a hundred students, they'll integrate; however, once they get to a thousand or more students, they'll tend to self-segregate. So it has to do with how the institutions are either putting people in close contact with each other or allowing them to separate — as well as whether

different groups are large enough for them to sustain enough friendships just among themselves. There's a whole series of different factors like that. We're trying to uncover those now and diving deeper and deeper into micro-data on this question.

EF: If social networks have a great effect on inequality and social mobility, what does this mean for policies to try to reduce inequality and promote social mobility?

Jackson: It means reducing inequality and improving mobility require more than just imposing taxes and shifting money around. They require overcoming the information and access barriers that are there. Moreover, network effects can lead well-targeted policies to have multiplicative or even exponential impact. And I think this is true of all sorts of policy problems. From inequality to halting the spread of a disease, when you really understand the network patterns and the feedback effects, it gives you an idea of how to structure policies and why certain policies can be much more effective than you would have anticipated.

I think of cash transfers as treating the symptoms, the pain, but they're not treating the disease: What are the root causes of the inequality, the reasons that people are stuck in poverty? Shifting money around can help alleviate some of that, but it doesn't necessarily get at all the root causes. And until you really attack those, you're going to have this problem be persistent. It means getting people information about how important it is to educate their children. It means getting people access to opportunities to go to universities, to get jobs, and to pursue whatever their dreams might be.

FAMILY FOOTSTEPS

EF: Often the role of networks plays out at the family level. An example is following in a parent's footsteps.

Matthew Jackson

■ PRESENT POSITION

William D. Eberle Professor of Economics, Stanford University

■ SELECTED PAST POSITIONS

Professor of Economics, California Institute of Technology, 1997 - 2006

Assistant Professor, Associate Professor, and Professor of Managerial Economics and Decision Sciences, Kellogg Graduate School of Management, Northwestern University, 1988 - 1996

■ SELECTED ADDITIONAL AFFILIATIONS

External Faculty Member, Santa Fe Institute
President, Game Theory Society

■ EDUCATION

Ph.D. (1988), Graduate School of Business, Stanford University; B.A. (1984), Princeton University

Your mother or father is a doctor, which gives you information about the medical profession, so you decide to become a doctor. Does that seem to be a typical way that networks influence mobility?

Jackson: When you look at professions, people are overwhelmingly, by factors of 10 or higher, more likely to be in the same profession as their parents than in another profession randomly picked. That happens for some natural reasons in the sense that you have more information about that profession and more connections in that profession and so forth. Those network effects naturally push people toward similar professions as their parents.

On one hand, that means people are better prepared for those jobs, but it also means you have more of a chance of ending up being stuck, especially in professions that end up being replaced by automation or other things.

It also means that people aren't necessarily being matched to their talents. I think that that's one of the most important aspects from a macro-economic perspective — we're not using

the talents in the economy as well as we could. There are people who have a lot of skills and abilities and talents that aren't being matched to professions that would make use of them.

EF: What can be done to fill in when the family connections aren't there? Are there good ways that society can more effectively pluck smart kids out of the hinterlands or out of the inner city and expose them to possibilities that are a good match for them?

Jackson: The challenge is that the homophily and segregation that we see in a network exist for a reason. Some of the reasons are good and some are bad.

When you look at people's networks, part of the reason they associate with people who are similar to themselves is that those people's experiences are going to be most informative. So if I'm that teenager, the people who can give me the most clear picture of what it's going to be like for me to undergo something are other teenagers who are in similar circumstances. If I'm growing up in an inner-city high school and I want to figure out what it's like to go to a university, I don't look for understanding from somebody who went to a wealthy prep school; I want to talk to somebody else who's in an inner-city high school who's gone through that experience. That's going to be much more informative to me. But there's a lot fewer of those people, so it's a lot harder for me to get that information.

Once we realize that there's this structure, it doesn't mean that we want to go around the world trying to completely rewire everybody's networks. That might end up not being efficient. What it does mean is that we have to figure out ways of getting them information and overcoming the access barriers that are inherent in these structures.

THE FRIENDSHIP PARADOX

EF: In a recent journal article, you analyzed the effects of friendship

networks on college students' behavior. You found that students tend to overestimate how much a typical student drinks or abuses drugs because their perceptions are distorted by the average amount of drinking or drug abuse in their own circle of friends. Why does this distort their perceptions?

Jackson: This concerns another network phenomenon, which is known as the friendship paradox. It refers to the fact that a person's friends are more popular, on average, than that person. That's because the people in a network who have the most friends are seen by more people than the people with the fewest friends.

On one level, this is obvious, but it's something that people tend to overlook. We often think of our friends as sort of a representative sample from the population, but we're oversampling the people who are really well connected and undersampling the people who are poorly connected. And the more popular people are not necessarily representative of the rest of the population.

So in middle school, for example, people who have more friends tend to have tried alcohol and drugs at higher rates and at earlier ages. And this distorted image is amplified by social media, because students don't see pictures of other students in the library but do tend to see pictures of friends partying. This distorts their assessment of normal behavior.

There have been instances where universities have been more successful in combating alcohol abuse by simply educating the students on what the actual consumption rates are at the university rather than trying to get them to realize the dangers of alcohol abuse. It's powerful to tell them, "Look, this is what normal behavior is, and your perceptions are actually distorted. You perceive more of a behavior than is actually going on."

EF: As many Americans moved last year out of large cities, presumably they've been incorporating new neighbors into their networks, perhaps people with quite different experiences and values from theirs. What effects, if any, would you expect from such interactions taking place on a large scale?

Jackson: Affluent people tend to move to more like-minded suburbs. Also, social media enables people to connect with people who are very similar to themselves at greater distances. So it's not clear that a lot of the moving around will actually result in a melting pot. Getting neighborhoods to integrate on a level that's not just having people live side-by-side, but actually being friends with each other and communicating with each other, is not necessarily easy to achieve.

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EF: Is it hard to measure the effects of social networks empirically?

Jackson: Most definitely, yes. This is a major challenge that faces network scientists.

Establishing causality is extremely hard in a lot of the social sciences when you're dealing with people who have discretion over with whom they interact. If we're trying to understand your friend's influence on you, we have to know whether you chose your friend because they behave like you or whether you're behaving like them because they influenced you. So to study causation, we often rely on chance things like who's assigned to be a roommate with whom in college, or to which Army company a new soldier is assigned,

or where people are moved under a government program that's randomly assigning them to cities. When we have these natural experiments that we can take advantage of, we can then begin to understand some of the causal mechanisms inside the network.

Once we have that evidence and that understanding, then we can go back and further study the influence of friends and peers even when we don't have good causal identification, as we're sure from previous studies that the effect we're seeing really is causal.

PROTESTS

EF: In work with Salvador Barberà, you've looked at social network theory in the context of popular revolts. You found that mass protests are important to revolts and that social media isn't necessarily a good substitute. Please explain.

Jackson: A simple way to put it is that it's cheap to post something; it's another thing to actually show up and take action. Getting millions of people to show up at a march is a lot harder than getting them to sign an online petition. That means having large

marches and protests can be much more informative about the depth of people's convictions and how many people feel deeply about a cause.

And it's informative not only to governments and businesses, but also to the rest of the population who might then be more likely to join along. There are reasons we remember Gandhi's Salt March against British rule in 1930 or the March on Washington for Jobs and Freedom in 1963.

This is not to discount the effects that social media postings and petitions can have, but large human gatherings are incredible signals and can be transformative in unique ways because everybody sees them at the same time together with this strong message that they convey.

EF: Looking at the government's side of such a situation, you suggested that suppressing the flow of information can hinder a revolt, but you also found that free information flows can also do so. Why is that?

Jackson: Suppressing information obviously keeps people in the dark about how strong support might be for things, and you see that in various countries trying to suppress the ability for people to protest or to speak out.

On the other hand, giving people the ability to freely exchange information doesn't always go in the direction you might imagine. That gets back to some of these network effects that we've been talking about: People are influenced by their friends and those friends aren't always representative of the fuller population, and that can distort things in either way. So it could be that I personally feel strongly about a cause and then I listen to some of my friends who happen not to support it, and then I become discouraged, even though lots of the population does support it.

WRITING FOR GENERAL AUDIENCES

EF: Let's talk about your experience in writing *The Human Network*. Your previous writing was almost entirely meant for sophisticated researchers. What was hard about making the adjustment from writing for fellow

researchers to writing for a general readership?

Jackson: I think there are three challenges. One, I think it's important to have a really clear conceptual framework of how all the different ideas in the field fit together.

The second is that in technical writing, as scientists, we're very cautious in what we say. Everything is qualified with lots of statements like, "In these very specific circumstances, we saw a correlation that we can't quite be sure is causation, but we believe might be for these kinds of reasons." The long sentences with ifs and maybes and perhapses do not make for great reading for the public. I think that in writing for the public, you have to find good examples where all those nuances come out and are clear but aren't ones that you have to keep reminding people of.

Finally, it just takes a lot of time and care and thinking about how to make the points in ways that are easy to understand and also make for pleasant reading.

EF: You mentioned your work on sorting out where interconnectedness between the poor and rich is strongest. What else are you working on now?

Jackson: We're just about to release a paper on social capital — how to measure people's social capital, how

it varies regionally, and what's most predictive of people's economic mobility.

I'm also working with a group of psychologists here at Stanford University in studying how student support networks evolve over time and affect their mental health and well-being. We're tracking things like how they form their networks, whom they interact with, which groups of students tend to have the most diverse networks, do they connect with people who are empathetic, how does that affect their choice of majors, how does it affect their performance in the classroom, how does it affect whether they become depressed?

With the unique circumstances of the pandemic, we have a study in place where we've been studying several cohorts of students who formed friendships on campus, and now we have a cohort that's forming friendships via social media and via Zoom and other forms of connection. I think that comparing these cohorts will help us understand a lot of the dynamics of these networks.

And I still nurture a love for theory. I'm working on some game theoretic models of culture and norms and trying to understand patterns of behaviors in societies and why some societies might have systematic corruption and others have very little corruption. These issues, I think, can be understood fairly well from a game theoretic perspective, and I hope that some of our models will be useful in that. **EF**

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