UC SANTA BARBARA
THE Current

October 10, 2018
Harrison Tasoff

# Investigating Team Networks

In the office, the lab and the field, teams are now the basic unit of productivity. Work has become complex enough to require a wide variety of skills and expertise, so organizations increasingly rely on teams to tackle challenges. However, the growing role of teamwork in the modern world begs a question: What factors contribute to team performance?

Several studies have explored this issue, often focusing on individual personality traits that promote team performance. But team members' proficiencies only establish the potential for their output. They constrain, rather than define, the actual performance.

Researchers at UC Santa Barbara decided to delve further into the dynamics of a successful team in a study now published in the journal PLOS ONE. What's more, they've developed theories about how team managers might be able to leverage these factors to improve productivity and overall experience.

"Many of us are interested in team performance," said co-author Young Ji Kim, an assistant professor of communication at UC Santa Barbara who studies group collaboration. "How to make teams perform better, more effectively, and understand some factors that contribute to improving team performance and processes."

Lead author Victor Amelkin, a former computer science doctoral student at UC Santa Barbara, collaborated with the university's Omid Askarisichani and Ambuj Singh, as well as MIT's Thomas Malone, to study the dynamics of teamwork. The group used

data collected in 2014 on the interactions within four-person teams as they completed a series of tasks over the course of an hour. After each task, the researchers had awarded the teams a score which reflected the overall quality of their output.

Amelkin and his colleagues analyzed the team members' communication primarily based on chat message timestamps and senders. They modeled interactions as a network where a connection between one individual and another represented how intensively one person communicated with the other.

The group found that the members of high-performing teams communicated well and often between each other. What's more, most teams with high average performance started performing well early on, and performed consistently well throughout the experiment.

Amelkin and his colleagues discovered that two network features had particularly strong links to high performance: connectedness and robustness. If you picture a network like a subway system, the degree of connectedness would be the percentage of stops that are linked to each other directly. The system's robustness represents how many ways you can get from one station to another. In a robust subway system, you could still get around even if multiple lines were closed.

In a well-connected communication network, most people are in direct contact with each of the other group members. And robust collaboration means that even if one team member goes silent, the rest of the team can continue to communicate effectively.

Although the study established a connection between team performance and network features, the researchers have yet to establish which way the underlying relationship goes. "Figuring out the true causal relationship between collaboration dynamics and performance outcomes is probably the biggest [question in] future work," said Amelkin.

The paper's results suggest that teams should create environments that encourage reciprocal communication between co-workers. For instance, collaboration tools like Slack have lots of features for promoting communication within a team.

The platform the researchers used for this study is currently receiving a major upgrade. The system is called the Platform for Online Group Studies (POGS), and it

allows researchers to conduct experiments over the internet.

It’s a challenge to do group research in-person, said co-author Kim. It is difficult to recruit a group of participants together at the same time and standardize procedures from one trial to the next — and logistical problems can ruin your experiment. POGS allows participants to join these studies and work synchronously from anywhere with internet connectivity in pre-programmed group tasks, Kim said.

A supplement to the original Multidisciplinary University Research Initiative award from the Army Research Office that launched this project has allowed the team to expand upon their work, including the upgrade for POGS. In particular, the grant comes with funds designated for software development, which has increased the resources that the university’s computer science department can contribute to the project.

POGS 2.0 will automate task administration and scoring within the experiment. Additionally, researchers will be able to manipulate the channels of communication between participants by, for instance, creating subgroups within a team or toggling between a person-to-person messaging and team chatrooms. This control will allow the researchers to more directly test causal hypotheses, rather than simply extracting correlations from the data.

Kim’s current work focuses on decomposing team performance into the effects of individuals’ unique contributions versus overall team dynamics. “Team performance is largely the combination and interplay of individual inputs and team-level processes,” she said. To disentangle these two influences, Kim and her team compare performance on tasks that team members can do independently to similar tasks which require a more interdependent approach. POGS 2.0 will include these features, too.

“Social scientists are interested in team dynamics, but our tools to examine the dynamics have been limited,” said Kim. “When I collaborate with Victor and other computer scientists, they come with a lot more sophisticated analytic tools. So through their analysis, we’re able to find a lot more about the fine-grained dynamics of team collaboration.”

## About UC Santa Barbara

The University of California, Santa Barbara is a leading research institution that also provides a comprehensive liberal arts learning experience. Our academic community of faculty, students, and staff is characterized by a culture of interdisciplinary collaboration that is responsive to the needs of our multicultural and global society. All of this takes place within a living and learning environment like no other, as we draw inspiration from the beauty and resources of our extraordinary location at the edge of the Pacific Ocean.