GREENING TRANSPORTATION
One student’s whole-brain engineering approach to sustainable transportation policies

Madison Fitzpatrick comes across as one of those people who could do anything. At 9 years old she took up playing the string bass. At 17 she landed a spot as a chemistry lab assistant at the Georgia Institute of Technology. As an undergraduate she competed as a dancer on Northwestern’s Ballroom, Latin, and Swing Thing.

But with her talent comes a certain shrewdness. That lab assistant gig? She hated it.

“That pure lab science was not for me,” she says. “The pace was really slow, and I wanted to do something more applied.”

That desire brought her to Northwestern, which had the resources to satisfy both her scientific and artistic needs. After spending a few hours with the course catalog, she chose civil engineering as a major, thinking she might go on to become an architect and have a career where science blends with aesthetics. But when an internship with a civil engineering firm introduced her to the world of transportation, she knew she had found the multifaceted work she craved.

“I realized that only a certain number of people interact with any building, but everyone uses the transportation network,” she says. “Transportation involves the community, politics, economics—it’s a confluence of different disciplines.”

When Fitzpatrick finished her bachelor’s degree requirements in three years, her adviser, associate professor of civil and environmental engineering Pablo Durango-Cohen, convinced her to enroll as a graduate student in his research group, where he and his students work on the formulation and analysis of mathematical models to support and improve safety, efficiency, reliability, sustainability, and equity in the provision, management, and operation of transportation infrastructure systems.

“Madison was a sought-after graduate student, and we were lucky her love of transportation and public policy has directed her to our field,” Durango-Cohen says.

“I was still having a good time here, and I enjoyed my research, so I decided to stay,” Fitzpatrick says. Two years into her graduate work, she spends her days conducting statistical modeling of urban passenger travel. Working with a Chicago Metropolitan Agency for Planning survey of Chicago-area residents, Fitzpatrick is constructing models of when, where, and how people travel. The research builds on similar studies but uses current computing power to produce estimations of more complex, realistic models. Fitzpatrick is applying modeling methods from the social sciences to transportation problems and integrating them with tools to conduct environmental life-cycle assessments of transportation infrastructure and operations.

Durango-Cohen is impressed with her work. “By explaining the relationships between travel outcomes, the proposed models have the potential to provide significantly more accurate representations of travel and to reveal profound and otherwise obscure insights about the synergies that exist among policy alternatives,” he says.

Fitzpatrick’s ultimate goal is to build a case for transportation policies—including pricing strategies, urban growth boundaries, zoning policies, and urban design guidelines—that could help reduce pollution. About 30 percent of U.S. greenhouse gas emissions come from the transportation sector. “How can we influence people to travel in a sustainable way?” she says. “I’m interested in working with government agencies on new policies.”

Too many concepts for promoting sustainable transportation derive from anecdotal and emotional evidence, she says. She hopes her models will prompt policy makers to find new insights in hard data. Yet Fitzpatrick knows that people, not data, change minds. “It’s really important that scientists don’t get stuck in their labs thinking what they do is really important and failing to communicate what they do to the people who implement policies,” she says.

Communication comes easily for Fitzpatrick, whose broad interests have kept her from becoming “a single-faceted scientist.”

“In high school I loved physics and calculus, but I also loved literature and world history,” she says. “I’m a performer and an organizer. I don’t want my professional life to be sitting at a bench by myself in a lab.”

She called on her multifaceted skills while a Northwestern undergraduate, serving on the executive committees of her sorority and of the Society of Women Engineers. Now she offsets computer time with dance as a member of Northwestern’s Ballroom, Latin, and Swing Thing. She competed with the group as an undergraduate and for the past two years has been a show producer. She also recently took up ballet: “There is so much to think about in terms of your body and the muscles you are using that you can’t think about anything else. It’s a release.” And she still plays bass in the Northwestern Philharmonia.

This year Fitzpatrick also is mentoring high school students in Chicago as part of the National Science Foundation’s GK12 fellow program, which partners graduate students with a local classroom. GK12 fellows spend one day a week teaching students and inspiring excitement about science and math. “I hope to be able to tie my research methods and statistical methods into what they do in class,” she says. “My goal is to give them a better idea of how science is used in the real world.”

Being able to teach others will be a priority whatever Fitzpatrick does in the future, whether she remains in academia, goes into consulting, or pursues another career path. “I really, really care about being a good communicator,” she says. “That’s a skill that is extremely valuable and not common enough. Communicators are the people who influence lives.”

- Emily Ayshford