



Social, Behavioral and Economic Sciences

The National Science Foundation’s Social, Behavioral, and Economic Sciences Directorate

The social, behavioral and economic sciences illuminate many aspects of human behavior, from how we think and learn to how we interact individually and in groups. SBE-funded researchers develop and use scientific methods to discover fundamental principles of human behavior, at levels ranging from cells to society, from neurons to neighborhoods, and across space and time. Such fundamental principles help us understand patterns of stability, change, conflict, and cooperation which can be applied to promote the progress of science; to advance the national health, prosperity and welfare. From cybersecurity to social security, the results of SBE research will provide a deeper understanding of what we can do to ensure a more prosperous future.

Why do we cooperate? Why do we fight?

Conflict and competition are almost inescapable aspects of human social interaction. They result when groups of people — ranging from small communities to national governments — have different beliefs, agendas, or disputes over resources. Research in the social, behavioral, and economic sciences helps us understand the roots of conflict and cooperation in various settings, and helps determine the most efficient paths toward achieving cooperation and collaboration, the foundation of functioning societies possible.

Predicting Conflict

What if we could more accurately predict where conflict will arise next? What if we could tease apart the variables most likely to lead to war?

A team of researchers — including political scientists Skylar Cranmer of Ohio State University and Bruce



Desmarais of the University of Massachusetts Amherst and statistician Shankar Bhamidi, of the University of North Carolina at Chapel Hill — set out to improve mathematical modeling of complex networks¹. When they applied their research to the field of international conflict, they found they had developed a model that predicted historical conflicts more accurately than the previous standard. In fact, the new model proved 47 percent better.

According to their model, trade and the strength of governmental organizations are more important variables in limiting conflict than the types of

governments involved. This work contradicts a commonly held theory known as democratic peace. A model that predicts conflict more reliably can inform U.S. foreign policy efforts. In a time of increasing international conflict, understanding the role trade can play in reducing conflict provides policymakers with vital perspective.

Cooperation in Communications

Cooperation and competition are at the heart of economics, a field where basic research can lead to profound breakthroughs with important, real-world impact. SBE-funded researchers Paul Milgrom² and Robert Wilson³ of Stanford University studied game theory — mathematical models of conflict



and cooperation between decision-makers — with a focus on designing successful auctions. That research became the cornerstone of the Federal Communications

Commission’s first auction of spectrum in 1994.

Milgrom helped the FCC devise a method to allocate the nation's telecommunications spectrum through simultaneous, multi-round auctions. The FCC has continued to put those principles into practice, netting well over \$120 billion⁴ through subsequent auctions. The wireless spectrum auction that closed in early 2015 raised over \$40 billion⁵ in federal revenue—equivalent to over five years of funding for the entire NSF from just one auction. This U.S. system is considered a best practice on which other countries have based their own spectrum auctions, resulting in hundreds of billions in worldwide revenue.

Life-Saving Exchanges

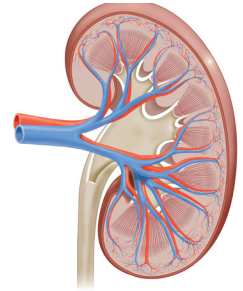
Almost 20,000 kidney transplants take place in the U.S. each year, and the waiting list continues to grow. The problem goes beyond finding willing donors — they need compatible blood types.

Economist and 2012 Nobel Laureate Alvin Roth⁶ led a team of researchers who developed a computational technique to bridge that donor gap — and demonstrated how basic research in his field can have huge impacts in unexpected areas of society.

SBE Investments

SBE supports fundamental research across the social, behavioral, and economic sciences and collaborates with other scientific disciplines, providing an invaluable perspective on the human dimension of complex challenges facing our nation: cybersecurity, disaster response, sustainability, national security and inequalities. The directorate accomplishes this work through its Division of Behavioral and Cognitive Sciences, Division of Social and Economic Sciences, Office of Multidisciplinary Activities, and the National Center for Science and Engineering Statistics (NCSES), which is the nation's premier source for data on science and engineering.

The research from Roth's team led to kidney exchanges — a kind of “barter” market for kidneys. Donors who wish to help a family member or friend but are incompatible donors for that individual can join pairs or groups of people in the same situation. The exchanges match donors to compatible recipients by decoupling donors from their intended recipients, broadening the donor pool dramatically.



Paired transplants have risen dramatically, from just two in 2000 to more than 1,600 since 2008.⁶ In 2014 alone, 544 paired transplants took place, with exchange chains growing to the point where they can involve more than a dozen donors.

The same technique developed by Roth's team has been used to match families to their top choices of public school in cities including New York and Boston. Roth was also able to use that basic research as a foundation to create the National Resident Matching Program, which pairs new doctors with hospitals nationwide.

¹NSF awards 1357622, 1461493 “Kantian fractionalization predicts the conflict propensity of the international system,” *PNAS* 2015 112 (38) 11812-11816 <http://www.pnas.org/content/112/38/11812.abstract>

²NSF awards including 1525730, 0648293, 0946124, 0239910, 0427770, 9320733, 9022792

³NSF awards including 0205633, 0963478, 9207850, 9224907, 8908269, 9730205

⁴<http://www.forbes.com/sites/realspin/2015/04/28/spectrum-favoritism-is-bad-economics/>

⁵NSF awards including 1061932, 0616733 http://wireless.fcc.gov/auctions/default.htm?job=auction_factsheet&id=97

⁶ <https://www.kidney.org/news/newsroom/factsheets/Organ-Donation-and-Transplantation-Stats>

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