SOCIAL SCIENCES

Selfish Games

David Krakauer

The paradoxical seriousness of games was reviewed synoptically by the Dutch historian Johan Huizinga in his 1938 book *Homo Ludens* (*1*). It includes a description of a community of states whose "diplomatic forms, its mutual obligations in the matter of honoring treaties … in the event of war … all bear a formal resemblance to play-rules inasmuch as they are only binding while the game itself … is recognized."

In 1944, John von Neumann and Oskar Morgenstern published *Theory of Games and Economic Behavior* (*2*). This monograph consolidated mathematical game theory and provided fortuitous support for the humanistic insights of Huizinga. Although the essential ideas for game theory grew out of the analysis of parlor games, they were quickly generalized to matters as serious as the chilling cold war strategy of mutually assured destruction.

Game theory provides a mathematical tool kit for analyzing strategic interactions by assigning payoff values (utility values) to sets of individual strategies and seeks to determine strategy stability. The best-known stability criterion is the Nash equilibrium, which defines pairs of strategies from which any deviation will reduce the payoff.

In *The Calculus of Selfishness*, Karl Sigmund provides a comprehensive and accessible mathematical exposition of the evolutionary game theory of selfishness. The book should prove accessible to natural and social scientists as its mathematical arguments employ intuition, geometry, and simulation with a minimum of axiomatic formality. The demands on the reader typically involve little more than linear algebra and calculus.

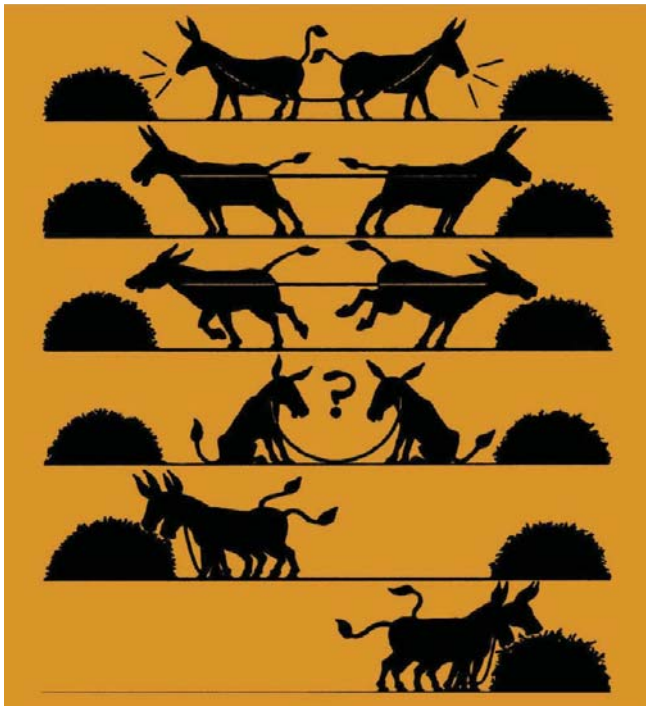
For Sigmund (a mathematician at the University of Vienna), in the spirit of Adam Smith, selfishness implies the enlightened self-interest of individuals. The problem that game theory seeks to explain is reciprocity among selfish individuals. After opening the book with a short history, Sigmund structures it through a sequence of games. The first is the prototype of reciprocal gaming, the prisoner's dilemma. In subsequent chapters, he includes player identity and memory, allowing for indirect reciprocity. He then introduces the ultimatum game and, finally, public goods games. This hierarchy of games corresponds to an expansion of the volume of social concepts to include fairness, trust, incentives, sanctions, and moral sentiments.

The Calculus of Selfishness
by Karl Sigmund
Princeton University Press, Princeton, NJ, 2010. 184 pp. $35, £24.95. ISBN 9780691142753. Theoretical and Computational Biology.

Sigmund's preferred approach to game theory is to consider a well-mixed population of players, with those obtaining the highest payoffs preferentially replicating or imitated. Over time, these strategies increase in frequency at the expense of others. This is an evolutionary approach to game theory that replaces rational deliberation by individuals with a Darwinian population dynamic. At the center of this approach is replication, typically modeled in deterministic systems by using the replicator equation. Some of the more technical elements in the book are devoted to the analysis of this equation and its derivation through imitation processes. The key insights supporting the use of dynamics are that the saturated rest points of the replicator equation correspond to Nash equilibria and that, through Brouwer's fixed point theorem, all symmetric games possess Nash solutions.

The author's style of model building is incremental. He adds spatial and temporal dimensions to an initial one-shot, bimatrix game. His simplest game has two dimensions of strategy, memory for one round, and one shot of play (2D, 1M, 1T). He builds the models up to include more strategies, increased memory depth, and iterated rounds of play: (2D, 1M, 1T), (2D, 1M, *m*T), (2D, *n*M, 1T), … (*n*D, *n*M, *m*T). He also introduces errors to allow for a small probability that the wrong strategy is adopted, and he analyzes continuous strategy spaces in an adaptive dynamics setting. This makes for a lucid communication of ideas grounded on a foundational dynamical system.

Having reviewed methods, what of concepts? I consider the three chapters on reputation, fairness and trust, and public goods the richest in new insights. These chapters provide the strongest evidence for the ability of simple mathematical ideas to illuminate complex psychological and social phenomena. Moreover, these models are often of greatest value when they fail in interesting ways to account for the results of experimental economics studies, suggesting either a flaw in assumptions or insufficient complexity of the models. Such failures are interesting because the models tend to bias solutions in the direction of individual, short-sighted outcomes coupled to low payoffs.



The Two Mules.

These model-data discrepancies appear frequently in studies of indirect reciprocity and in experimental game-based studies of fairness. Indirect reciprocity arises in repeated games where one's behavior is directed against individuals with whom one did not interact in a previous round. Vicarious reciprocity describes the case where altruistic behavior is directed toward an altruist with whom one did not interact in a previous round. Misguided reciprocity is altruistic behavior directed toward a recipient of altruism in a previous round. Models can generate robust vicari-

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ous reciprocity but not misguided reciprocity, which is a common feature in the experimental data on human subjects.

Similar anomalies are observed in models of the ultimatum game in which a proposer offers a fraction of her wealth to a responder, who can accept the sum or reject it (in which case both parties receive nothing). Simple models discover Nash solutions with the minimum offer, whereas the data frequently reveal fair offers (e.g., 50%). In this case, augmenting the models to allow for reputation effects can restore fairness to the game solutions.

The Calculus of Selfishness offers a valuable review of recent progress in evolutionary approaches to prosocial phenomena. In a world where selfishness has been called the defining human characteristic, we need all the thoughtful help we can get.

References

1. J. Huizinga, *Homo ludens: Proeve eener Bepaling van Het Spelelement der Cultuur* (Tjeenk Willink, Haarlem, Netherlands, 1938).
2. J. von Neumann, O. Morgenstern, *Theory of Games and Economic Behavior* (Princeton Univ. Press, Princeton, NJ, 1944).

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ECONOMICS

Identity Matters

Robert Sugden

Until quite recently, most economic theories were based on a priori assumptions about the rationality of individuals' choices. Much of the most prestigious work in economic theory was directed at refining the concept of rationality, developing rational-choice explanations for what had previously been seen simply as reliable empirical regularities, and extending the scope of rational-choice theory to colonize the domains of other social sciences. Now, however, there is a move toward the relaxation of rationality assumptions and the import of explanatory principles from other disciplines. Game theorists are borrowing modeling techniques from theoretical biology, explaining human decisions as the result of trial-and-error learning or of blind processes of selection. Behavioral economists are drawing on the ideas and experimental methods of cognitive psychology and neuroscience. George Akerlof and Rachel Kranton's *Identity Economics* opens a new front in this transformation of economics by incorporating ideas from sociology and anthropology. Given economists' traditional suspicion of these disciplines as lacking in theoretical rigor, this is a particularly brave move.

The key concept that Akerlof and Kranton (economists at, respectively, the University of California, Berkeley, and Duke University) take from sociology is identity. Societies are structured by commonly understood categorizations (such as those of age, class, race, and gender) into groups with their own norms of behavior. Understanding their identities in terms of these categories, individuals feel pressure to follow the corresponding norms. Akerlof and Kranton translate this idea into economic language by postulating that individuals gain (or lose) "identity utility" by conforming to (or deviating from) the norms of their identities.

Identity Economics
How Our Identities Shape Our Work, Wages, and Well-Being
by George A. Akerlof and Rachel E. Kranton
Princeton University Press, Princeton, NJ, 2010. 191 pp. $24.95, £16.95. ISBN 9780691146485.

The authors apply the idea of identity to four issues having important economic dimensions: incentives and motivation in the workplace, motivation to learn in schools, gender asymmetries in labor markets, and interactions between race and poverty. Akerlof and Kranton review a wide range of ethnographic studies that demonstrate the importance of identity. Take the case of gender. Many occupations and modes of working are still stereotyped as male or female. A female corporate lawyer who is ambitious and forceful is perceived by her workmates as unfeminine; a male nurse who is sympathetic and caring is perceived as unmasculine. Women who enter male-dominated occupations are systematically harassed by their male co-workers. Akerlof and Kranton argue convincingly that individuals' desires to maintain their gender identities are crucial for the reproduction of gender asymmetries. They conclude that public policy should aim to shift perceptions of the norms associated with identity. Thus, they give the women's movement much of the credit for recent reductions in the extent of gender asymmetries in the labor market and highlight the significance of gender-neutral job titles (such as "firefighter" rather than "fireman"). Similarly, they commend African-American leaders who have sought to "change what it means to be black."

The main analytical work in these studies is sociological and ethnographical. It is by consulting the findings of researchers who have used the methods of these disciplines that Akerlof and Kranton discover which categories are socially recognized, what norms are associated with each identity, and how perceptions of identity can be influenced by policy. So it is surprising that, when urging their fellow economists to adopt new methodologies, the authors' main emphasis is on representing identity in economic models. They acknowledge that the results of their models are often not particularly surprising, once the sociological ingredients are understood: "What is new … is the assumptions." But they seem reluctant to propose that economists do the work necessary to find which assumptions are required. Just as behavioral economists have learned to run the sorts of experiments that once were the preserve of psychologists, one might have thought that identity economists would learn to write ethnographies. But perhaps that would be taking bravery too far.

Identity Economics is a popular account of work that will already be familiar to economists who have read the authors' journal articles. It is admirably short, written in a clear, nontechnical style but without the condescending breeziness of many books aimed at the airport market. Nonspecialist readers will find a lot of insightful and well-informed analysis of how issues of identity have an impact on real economic problems. However, these readers may be bemused by Akerlof and Kranton's descriptions of their models and discussions of their general modeling strategy. The authors defend this strategy on the grounds that it generates more satisfactory explanations of economic reality than traditional economic theory can supply. But their presentations of the models themselves are so brief and nontechnical that the reader ends up having to take that claim on trust. Presumably, Akerlof and Kranton judged that their readers would be bored by more detailed discussion or would not understand it. But then why are the same readers expected to be interested in, or able to evaluate, the relative merits of different modeling strategies in economics? One sometimes has the sense that arguments that really are addressed to fellow economists are being played out in front of a general audience.

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