Sociology and game theory: Contemporary and historical perspectives

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Since the mid-1980s game theory has become increasingly popular among sociologists and a number of interesting studies have been produced. This development, however, has not been accompanied by much comment in the profession nor by a general discussion of game theory from a sociological perspective; and it would therefore seem appropriate that such a discussion should take place. This article has as its main goal to contribute to a broad discussion of game theory and also to raise the question of whether it would be possible to develop a distinctly sociological version of game theory. By a broad discussion, I mean a discussion that is not limited to technical game theory but also includes games more generally and other approaches to analyzing reality in terms of games (what I shall call "game-related sociology"). By the expression *a distinctly sociological version of game theory*, I mean a version of game theory that is such that it will both draw on and renew the sociological tradition – just like economists have developed their own version of game theory and used it to improve economic analysis. This article is a companion piece to an earlier study in which the major works in game theory are analyzed from the perspective of sociology.[1] In this second work, however, the focus has been shifted from game theory itself to the use that sociologists have made of game theory. Both studies are non-technical and built on the premise that game theory is of interest also to sociologists who are not trained in technical game theory.

The article is structured in the following manner. I first look at the early use of game theory by sociologists, which roughly covers the years from the 1950s to the mid-1970s ("old sociological game theory"). This is followed by a presentation of the current revival of game theory, which started in the mid-1980s ("new sociological game theory"). The article ends with a discussion, based on what sociologists have accomplished

Theory and Society **30**: 301–335, 2001.

since the 1950s, when it comes to game theory. I also make the suggestion that one way for sociologists to use game theory would be to conceptualize it as a way to explore *counterfactuals*. Using counterfactuals in this way, I argue, may be a way of anchoring game theory in empirical reality and thereby counter some of its artificiality.

A small warning should be issued before the reader embarks on the pages to come. The account of the way that sociologists have used game theory is somewhat laborious and filled with longish accounts of various studies and arguments, something that makes the reading taxing at times. There are two reasons why I nonetheless have chosen to proceed in this manner and have not produced a conventional survey article, which would be easier for the reader to get through. The first is that much of the material on game theory and games in sociology may be unknown to many sociologists and hence deserves to be explicated in some detail. The second is that this article has as its main purpose to contribute to a debate, and for this reason it may be helpful to have a fairly detailed account of the various positions involved.[2]

A remark on the terms "game theory" and "game," as these are used in this article, is also in place. By the former is meant the mathematical type of analysis that was introduced into social science through *Theory of Games and Economic Behavior* (1944) by John von Neumann and Oskar Morgenstern, and which has been further developed by such people as John Nash, John Harsanyi, and Richard Selten.[3] "Interactive decision theory" may describe what game theory is about more accurately than what its conventional name does.[4] "Games," on the other hand, can be defined as recreational activities that are often interactive and played according to specific rules.[5] "Game" is also often used as a metaphor for many other human activities. There exists no necessary logical connection between game theory and ordinary games; they simply both contain the word "game." It is, however, also true that sociologists and other social scientists have often made references to game theory in their studies of games and vice versa.

The early use of game theory by sociologists (the 1950s to the mid-1970s)

Most commentators agree that game theory has had some very distinct ups and downs in its popularity.[6] Already in the mid-1950s, for example, Luce and Raiff stated in their well-known *Games and Decisions* that,

> Initially there was a naive bandwagon-feeling that game theory solved innumerable problems of sociology and economics, or at the least, that it made their solution a practical matter of a few years' work. That has not turned out to be the case.[7]

In this review of *Games and Decisions* for the *American Sociological Review*, Herbert Simon expressed his agreement with the judgment of Luce and Raiffa on this particular point; and also other commentators have noted the "over-enthusiasm" that characterized the first years of work on game theory.[8] When Luce and Raiffa spoke of the hope that game theory could solve a large number of problems in "sociology," it is not clear if they thought that sociologists, economists, or just game theoreticians in general would be the ones who produced this "sociology." In any case, it is clear that game-theoretical work by sociologists also has had its ups and downs, even if these have not been identical to the ones in mainstream game theory. If one were to hazard a guess, it would be that there has been a lag of something like ten years in the reaction of the sociologists. This, in any case, fits their initial reaction to game theory, which can be dated to the mid-1950s, and also the current revival of game theory in sociology, which began in the mid-1980s.

Two early events took place in the mid-1950s that can be said to sum up the reactions of U.S. sociology to game theory during its initial phase.[9] One was that Luce and Raiffa's famous *Games and Decisions* (1957) was produced at Columbia University, under the auspices of Paul Lazarsfeld; and the other was that Jessie Bernard in 1954 produced an important programmatic statement on game theory in the *American Journal of Sociology*.[10] Raiffa and Luce had been engaged by Lazarsfeld in the Behavioral Models Project, which was part of the Bureau for Applied Social Research at Columbia University and had as its main task to introduce sociologists to the use of mathematical thinking in the social sciences. It was also at Columbia that *Games and Decisions* was conceived; and when this work was published, it was presented as a product of the Behavioral Models Project.

But despite these favorable conditions for a reception of game theory at Columbia, sociologists were not interested. Lazarsfeld himself does not appear to have seen any particular use for game theory in sociology. When, for example, he and Neil Henry in the mid-1960s published a volume called *Readings in Mathematical Social Science*, they included a game-theoretical study by Martin Shubik but cautiously stated *apropos* game theory that "this newly conceived branch of mathematics

received its impetus from problems in economics; its application to other sciences is [however] still much under debate."[11] Robert K. Merton – Columbia's main theoretician in sociology during the period – does not mention game theory in any of the three editions of *Social Theory and Social Structure* (1949, 1957, 1968) and has recently confirmed that "I was and am wholly unconnected with game theory."[12] And Raiffa himself has said that when he was at the Bureau for Applied Social Research in the 1950s, he was never asked for advice about game theory by any of the sociologists.[13] James Coleman, who was a student during this period at Columbia, has similarly remarked that, "I did have some exposure ... to game-theoretical ideas, at the Bureau for Applied Social Research, both through exposure to von Neumann and Morgenstern's book, and because it was then and there [at Columbia] that Duncan Luce and Howard Raiffa were working on *Games and Decisions*.... Yet, I did not see much value in carrying over the economist's paradigm of rational action into sociology."[14]

Other key people at the main sociology departments in the United States during the 1950s and the 1960s also appear to have shown little, if any, interest in game theory. This was, for example, the case with Talcott Parsons, who during this period was generally regarded as *the* leading sociologist. According to Neil Smelser, "[Parsons] was certainly aware of the work of von Neumann and Morgenstern, and mentioned it from time to time, but never as being of special theoretical interest to his work."[15] The people who were attracted to game theory and wanted to use it in their own work appear, in contrast, to have been little known in the profession and were often at an early stage of their career.

The pioneer: Jessie Bernard

Jessie Bernard (1903–1996) was introduced to game theory around 1950, and in 1954 she published an article on game theory in the *American Journal of Sociology*, which can be characterized as a general introduction for sociologists to game theory as well as a programmatic article. The tone in the article is very enthusiastic, and it is argued that game theory has much to offer sociology, in particular the analysis of social conflict and social organization. To realize "the great potential" of game theory in this regard, it is suggested that sociologists make use of two-person zero-sum games – but even more so of the concept of coalition and the idea that "standards of behavior" are important in determining which of several solutions will be chosen.[16] It is of great

importance, Bernard stresses, that sociologists learn to translate sociological problems into games. Bernard's treatment is non-mathematical, and she reassures the reader that one can use game theory, just like statistics, without a full understanding of the underlying theorems. Game theory is mainly of help for making predictions, and nothing is said about the problem of verifying the results of game-theoretical analyses with the help of data. Bernard, as we soon shall see, actually envisioned much of the sociological work as being done *before* the game was ready to be played.

One of the many interesting points that Bernard makes in her programmatic article is that "sociologists ought to be enlisted in the conceptualization of the theory."[17] She also notes that "some modification" of game theory in its current shape is needed if it is to be useful in sociology.[18] The reason for demanding these changes, she explains, is that sociological phenomena present their own distinct problems. Institutions, for example, affect the way a game is played. There is also the fact that culture affects what is happening in a society and changes the rules of the game. Another difference between game theory in general and sociological game theory, according to Bernard, is the difficulty that the latter has in determining exactly what are the rules and the payoffs. This is often so laborious that one can say that the most difficult part in the analysis for the sociologist comes *before* the game-theoretical exercise: "The invention or discovery of the strategies may have involved creativity of the highest order; the calculation or discovery of the payoff function may have required a tremendous research effort."[19] In many cases, Bernard adds, it may also be impossible to determine what the payoff for a specific strategy is or to compare the payoff of one strategy to that of another. On the whole, however, Bernard was optimistic about solving these difficulties; and in this respect she especially set her hope to the discovery of new forms of mathematics.[20]

After her programmatic article in *AJS*, Bernard in particular tried to use game theory to analyze social conflicts. All in all, she wrote two general articles in this area and two specialized ones, both dealing with the conflicts between men and women.[21] In one of the general articles, she tried to analyze social problems from a game-theoretical viewpoint. Her general conclusion was that while game theory did not solve all the difficulties involved, it did help to clarify matters quite a bit: "Sometimes [game] theory makes its chief contribution by simply offering a conceptual framework within which to think about the problem under consideration."[22] In her second general article, Bernard expressed

great enthusiasm for the work of Thomas Schelling and stated that "the whole of [game] theory has been recast by his work."[23] She was especially impressed by Schelling's ideas about tacit coordination, mixed games, and communication. The issue of the relationship of game theory to empirical reality is not mentioned, but she notes with great approval in her discussion of Schelling that

> In his hands game theory, which began as, in effect, a theory of protection against interaction, has converged with the social-interactionist school. Schelling and Goffman represent the meeting point.[24]

There was little discussion among sociologists of Bernard's article, when it appeared in the mid-1950s. She herself would continue to work for about a decade with game theory, but then she moved on to other matters. There appear to have been two main reasons for this. On the one hand, she found it increasingly hard to analyze the problems she was interested in with the help of game theory, especially gender relations. And, on the other hand, the mathematics involved was discouragingly difficult. In an autobiographical article she tells the following anecdote from the days when she was very interested in game theory:

> When in a faculty seminar [on game theory] in the mathematics department one of the men put an equation on the board that traversed two walls of the classroom. Everyone followed him admiringly. Then, after several minutes, one member of the class raised his hand and pointed to one particular point on the long equation. The others studied it a moment, and then, without a word being said by any one, they all nodded their heads in agreement. Not a word was needed. This was clearly a kind of communication I could *never* master.[25]

Other pioneers (Phillip Bonacich, Theodore Caplow, William Gamson, and Gerald Marwell)

In her programmatic article from 1954, Bernard had singled out the concept of coalition as especially suitable for sociologists to work with, and this was also the opinion of many other game theorists. In most games, to repeat, it is not possible to determine one specific outcome, according to von Neumann and Morgenstern, among other reasons because "standards of behavior" affect the outcome. In the 1950s and the 1960s quite a bit of research on coalitions was indeed carried out, and the two key issues were the following: which players would join together with whom, and how were the proceeds to be split? This research was conducted by several different types of social scientists – by experimental social psychologists, sociologists, and political scien-

tists. The impact of game theory on this type of work was, however, uneven. While political scientists like William Riker drew heavily on game theory, social psychologists did not do so at all. Sociologists can be placed somewhere in the middle, as the examples of the two most prominent sociologists in this genre show, namely Theodore Caplow and William Gamson.

Theodore Caplow was much more influenced by Simmel's work on triads and by what was going on in small group research than by game theory. Still, it is clear from his work that he took the analysis of van Neumann and Morgenstern quite seriously and that he was especially interested in the role of initial differences of power between the players.[26] Since von Neumann and Morgenstern did not consider this issue, and since Caplow thought that it was absolutely central to the analysis of coalitions, he soon lost interest in game theory.[27]

William Gamson, on the other hand, was much more interested in game theory than Caplow, and states in retrospect, "I was very involved and read everything that seemed relevant in game theory in the late 1950s."[28] This knowledge of game theory comes out very clearly in an influential *ASR* article from 1961, in which Gamson very carefully goes through what *Theory of Games* has to say about coalitions.[29] He also takes a close look at what people like Vickrey and Luce had done to narrow down the range of possible solutions, but nonetheless argues that game theory is basically "inadequate" to provide assistance in research on coalitions, due to the profusion of solutions that it suggests.[30] Gamson's main thesis about coalitions – that each player will demand from a coalition roughly the same as her share of the initial resources – was also of his own invention. Finally, it should be noted that Gamson, just as Caplow, did not discuss the issue of empirical verification of game-theoretical analyses. When someone like William Riker in the late 1960s concluded that "much more energy has been expended on the elaboration of the theory of coalitions than on the verification of it," this is a criticism that also can be aimed at much of the sociological research on coalitions.[31]

Two sociologists who began publishing on game theory a little later than Gamson and Caplow, but who are still active and contribute to sociological game theory are George Marwell and Phillip Bonacich. The former was especially interested in cooperative games and his early work culminated in the book *Cooperation* (1975). In his very first article on game theory, however, Marwell had touched on the prisoner's

dilemma, a topic that was also central to Phillip Bonacich's first publications.[32] Bonacich's work from this period can be characterized as experiments on the N-person prisoner's dilemma, centered around social dilemma problems.[33] After this work in the late 1960s and early 1970s, Bonacich says, he lost interest in game theory and began to do work on networks.[34] As in the case of Marwell, however, there will be reason to return to his subsequent work on game theory later on in this article.

The broader discussion and the use of game theory and games in sociology (1950s to the mid-1970s)

It would be wrong to limit the discussion of the use of game theory in sociology during the period between the 1950s and the mid-1970s to the studies of Jessie Bernard and the rest of the pioneers. Several other sociologists also drew on game theory, in one way or another, or discussed the role of games in sociology more generally. Thomas Scheff, for example, tried to develop a theory of coordination, which was very much influenced by Thomas Schelling's work.[35] Bernard noted in the early 1960s that "games are definitely 'in'" and "everyone appears to be getting into the act."[36] This popularity would continue at least until the early 1980s, when Clifford Geertz stated that,

> The game analogy is both increasingly popular in contemporary social theory and increasingly in need of critical examination. The impetus for seeing one or another sort of social behavior as one or another sort of game has come from a number of sources (not excluding, perhaps, the prominence of spectator sports in mass society). But the most important are Wittgenstein's conception of forms of life as language games, Huizinga's ludic view of culture, and the new strategics of von Neumann's and Morgenstern's *Theory of Games and Economic Behavior.* From Wittgenstein has come the notion of intentional action as "following a rule"; from Huizinga, of play as the paradigm form of collective life; from von Neumann and Morgenstern, of social behavior as a reciprocative maneuvering toward distributive payoffs.[37]

Leaving the impact of Wittgenstein and Huizinga to the side,[38] it is nonetheless clear that the idea of games and game theory was used in a number of different ways by sociologists during these years. While Bernard and Gamson, for example, favored a low-tech version of game theory, there were several other ways in which games and game theory were used as well (see Table 1). A few laboratory experiments involving game theory were carried out, and there was quite a bit of interest in using games as a general metaphor. The role of games in social life was studied, and attempts were made to use games as a

Table 1. The different uses of game theory and game-related analysis in sociology, 1950–2000

Type of game theory or game-related approach	General characteristic	Examples of studies	Topics
1. High-tech game theory	Standard game theory is used; high technical level (deductive mathematics, simulation models)	Raub (1988), Raub and Weesie (1990), Heckathorn (1988, 1989), Macy and Skvoretz (1988), Montgomery (1998)	Social dilemmas related to cooperation, collective action, norms, etc.
2. Low-tech game theory	Basic logic and the conceptual language of game theory is used, including the payoff matrix	Bernard (1964, 1968), Gamson (1961), Boudon (1979), Coleman (1990)	Conflicts, coalitions, coordination, education, norms
3. Games as a general metaphor	Vocabulary of game theory is used – in a non-technical and metaphorical way (game, player, strategy)	Goffman (1961), Elias (1970), Crozier and Thoenig (1975), Crozier (1976), Burawoy (1979)	Power, work, organizations, prisoner's dilemma, strategic interaction
4. Special games used analytically	Special games are used to analyze social events	Vinacke and Arkoff (1954), Boorman (1967), Coleman (1967, 1969)	Pachisii, wei-ch'i, collective decisions games
5. The study of games in society	Games that can be found in society are analyzed	Anderson and Moore (1960), Goffman (1961), Leifer (1988, 1991)	Games in general, e.g. chess
6. Laboratory studies	Experiments with people	Bonacich (1972, 1976), Snijders and Raub (1998)	Power, prisoner's dilemma, cooperation

Game theory proper is covered by categories 1 and 2; and game-related sociology especially by categories 3–5 but also by 6.[39] One can roughly distinguish between two periods in the use of game theory by sociologists. During the late 1950s to the mid-1970s, a small number of sociologists became interested in game theory and started to use it and/or discuss it. Then came a lull. From the late 1980s and onwards the use of game theory has revived in sociology, drawing heavily on developments in mainstream game theory. The first generation of sociologists who were interested in game theory used a low-tech form, was very interested in the game metaphor, sometimes constructed its own games, and studied the kind of games that can be found in society. The second generation (mid-1980s–) typically uses a high-tech form of game theory, is very interested in social dilemmas, and has begun to use laboratory experiments. A few critiques of mainstream game theory by sociologists also exist. For full references to the items cited in the table, see note.[40]

device to develop sociological theory further. To this should finally also be added that even though game theory during these years never got a real foothold in mainstream sociology, it was nevertheless discussed quite a bit.

Much of this material on games and game theory is mainly of historical interest today, but there also exist some studies that are very much worth reading and that deserve to become part of today's discussion of game theory among sociologists. Three of the most original contributions from this period are those by Michel Crozier, Erving Goffman, and Scott Boorman, and I present these in some detail. At least a mention should also be made of some other studies – such as James Coleman's work on collective decision games and their use in education, Norbert Elias's analysis of power as a game on different levels, and various studies in industrial sociology, from Donald Roy to Michael Burawoy, which look at work in the factories as a way of "making out."[41]

Example #1: Michel Crozier on organizations

My first example of an interesting early work in which sociologists draw on game theory in a broad sense is Michel Crozier's work on organizations. The general idea here is to use game as a metaphor and to introduce some key terms from game theory into sociology. As soon will become apparent, there are several advantages to drawing on game theory and the idea of a game in this way. For one thing, the very idea of looking at some social phenomenon as if it were a game, may throw new light on it. Secondly, the concept of a game can be viewed as anti-deterministic in the sense that the actor is assumed to be able to devise several different strategies – not just one – in each situation. And thirdly, the idea of a game brings out the interactional quality of social phenomena with great force. As opposed to low-tech game theory, those who use games as a metaphor usually do not try to map out all the possible strategies and present the reader with a complete pay-off matrix.

Through *The Bureaucratic Phenomenon* (1963), Crozier quickly established himself as a leading sociological expert on organizations, and in this work there is a sprinkling of references to games and game theory, especially to power as a game.[42] In a couple of articles from the 1970s, Crozier expanded on these references and suggested that organization theory was in need of a new paradigm, centered on games. He describes the new research paradigm in the following way:

> An organization can thus be considered as a set of games, more or less explicitly defined, between groups of partners who have to play with each other. These games are played according to some informal rules which cannot be easily predicted from the prescribed roles of the formal structure. One can discover, however, these rules, as well as the pay-offs and the possible rational strategies of the participants, by analyzing the players' recurrent behaviour. This could eventually be formalized according to rough game theory models.[43]

To Crozier, the idea of system is very important and also that the players can be individuals as well as groups. Depending on one's position in the system, he states, different problems will emerge, and games are conceptualized as a way of dealing with these problems. Sometimes the players may try to maximize, but at other times their strategies will rather grow out of power tensions. Crozier argues that the existing theories of power are outmoded and that the concept of power needs to be reconceptualized with the help of the notion of game. He also emphasizes the advantages of a comparative approach to games and notes that it would help the researcher to realize that there often exist several solutions to a problem. While it was Crozier's ambition to reach a stage where the analysis of organizations could be formalized, he also thought that this goal was still far off:

> Focusing on games [in organizational studies] has the disadvantage of making formalizing much more difficult and of preventing for quite some time any kind of measurement, at least at the organizational level. We have, I think, to accept this and to try to move first from literary description to some kind of qualitative assessment instead of requiring immediately some irrelevant statistical sophistication.[44]

Example #2: Erving Goffman on games and strategic interaction

My second example of sociologists who reacted in some interesting way to game theory is Erving Goffman. Clifford Geertz has stated that Goffman's work "rests ... almost entirely on the game analogy."[45] This is an exaggeration, but one can indeed find references to games and game theory in quite a few of Goffman's studies; it is also clear that he had studied the works of von Neumann-Morgenstern and Schelling very carefully. Goffman especially discusses games and game theory in two essays from the 1960s, "Fun in Games" and "Strategic Interaction."[46] In the former, Goffman says that he wants to analyze games in order to see what they can tell you about society in general; and this essay can therefore be seen as an example of what I have called "games

as a general metaphor" (see Table 1). The second essay is more difficult to put a label on, but what Goffman basically does is to evaluate Schelling's idea that there exists a specific social phenomenon that is characterized by "strategic interaction."

In "Fun in Games" Goffman suggests that the analysis of games can throw some light on the analysis of interaction in general. As an example of this, he cites the tendency in many games to exclude a number of aspects of reality as irrelevant to the game. These "*rules of irrelevance*" are, according to Goffman, also common in society at large; and as an example he cites the rules in a market, according to which buyers and sellers ignore each other's attributes and instead focus on what is being traded. The way that game theory goes about the analysis, Goffman continues, can be quite helpful – but he also adds that "a game-theoretical approach also involves ... important limitations for the study of face-to-face interactions."[47]

In "Strategic Interaction" Goffman argues that Schelling in *The Strategy of Conflict* (1960) has identified an area of social life that sociology has more or less missed, namely situations in which the actors are mutually aware of each other, where every move that someone makes affects all the actors, and where the decision that Actor A makes depends on what Actor B thinks that she will do. Goffman states that the kind of situations that game theory draws on – "*miniature scenarios of a very farfetched kind*" – can be quite helpful. For the empirical study of strategic interaction, however, "too much is left out" in game theory.[48] For one thing, game theorists ignore the existence of norms or treat these in a simplistic and formalistic manner. Game theory is also unable to handle a number of other empirical phenomena:

> Persons often don't know what game they are in or whom they are playing for until they have already played. Even when they know about their own position, they may be unclear as to whom, if anybody, they are playing against, and, if anyone, what his game is, let alone his framework of possible moves. Knowing their own possible moves, they may be quite unable to make any estimate of the likelihood of the various outcomes or the value to be placed on each of them. And bad moves often lead not to clear-cut penalties as such but rather to diffuse and straggling undesired consequences – consequences that result when persons do something that throws them out of gear with the social system. Of course, these various difficulties can be dealt with by approximating the possible outcomes along with the value and likelihood of each, and casting the result in a game matrix; but while this is justified as an exercise, the approximations may have (and be felt to have), woefully little relation to the facts.[49]

Example #3: Scott Boorman on wei-ch'i and Chinese revolutionary strategy

The third example I have chosen to illustrate sociologists' concern with games and game theory during this period is a little-known study by Scott Boorman, *The Protracted Game* (1969). The basic argument in this work is that the Chinese game of wei-ch'i (known in the West as "go") has inspired the military strategy of Mao Zedong and therefore can help to explain the route to power of the Chinese Communist Party. According to Boorman, wei-ch'i can itself be seen as a kind of "game theory":

> wei-ch'i may be more realistically used as an analogic model of [Chinese Communist] strategy than any purely theoretical structure generated by a Western social scientist.... If indeed wei-ch'i and Chinese Communist strategy are products of the same strategic tradition, wei-ch'i may be more realistically used as an analog model of that strategy than any purely theoretical structure generated by a Western social scientist.[50]

Another fascinating quality of Boorman's study is that he has chosen to analyze a game that clearly has influenced empirical reality, namely the military strategy of the Chinese Communist Party. Equally evocative is his argument that wei-ch'i represents a more sophisticated form of "game theory" than anything that the West has come up with, including the ideas of von Neumann and Morgenstern:

> The wei-ch'i analogy is a type of model still rare in the social sciences: flexible yet formalistic. On the one hand, because it is not bound by the restrictions of the axiom-theorem method or the ability of mathematicians to integrate a differential equation, wei-ch'i analysis of a strategic system can go far beyond the limits of present-day, or even potentially obtainable, social science formalism. At the same time, wei-ch'i provides what might be termed the most important single feature of the formalist approach: a logical and consistent *point of view* from which to analyze one facet of Chinese civilization and decision-making. These dual characteristics contribute to the significance of wei-ch'i as a simple, efficient, and accurate similation model of specific motifs of Chinese Communist insurgent warfare.[51]

The current revival of game theory in sociology (mid-1980s and onwards)

There exists quite a bit of difference between the kind of game-theoretical sociology that was popular from the 1950s until the mid-1970s, and the one that can be found today. The old form of game-theoretical sociology was basically low-tech, while the current one is high-tech.

Game theory itself was also very different in the 1950s and the 1960s from what it is today. Iterated games, evolutionary game theory, and computer-based tournaments are all innovations that have been made since the days of Jessie Bernard and the other pioneers.

In between the old and the new sociological game theory there was something like a decade, during which very little happened. Exactly why this is the case is not clear; perhaps it was this period that Daniel Bell had in mind when he noted that game theory, after years of excitment, had begun to lose its attractiveness because its major points had been absorbed.[52] In any case, some interesting game-related activities did take place among sociologists during the years from the late 1970s to the mid-1980s. Especially the following deserve to be mentioned: James Coleman's continued work on various types of games, Raymond Boudon's argument for game theory as a way of generating models, and the discussion of game theory among sociologists, set off by Jon Elster's plea for a game-theoretical version of Marxism (the reader who wants to know more about these studies is referred to note 53).[53]

The current generation of high-tech game theorists in sociology (Werner Raub, Douglas Heckathorn, Michael Macy, and others)

Somewhere around the mid-1980s a new type of game-theoretical studies started to appear in sociology (see Table 2). While in the 1950s there existed probably only a handful of sociologists who were able to understand technical game theory, the situation was quite different by the 1980s and even more so today.[54] Sociologists of a new breed have emerged during the last few decades in sociology who are fully capable of understanding recent game theory and using it for purposes of their own. To draw exclusively on mathematical game theory in the analysis is, however, not that common among sociologists; and some other method is often used, such as simulation or experiments. Connected to this is the tendency among today's game-theoretical sociologists to have close ties to other fields of sociology, which demand a high technical capacity, such as rational choice sociology, social dilemma research, social exchange theory, or mathematical sociology more generally.

It is also possible to notice differences between old and new game-theoretical sociology on a number of other points than technical skill. In the 1950s and the 1960s, people who were interested in game theory were, for example, much more marginal in the profession than they are

Table 2. Old and new game-theoretical sociology

	Old game-theoretical sociology	New game-theoretical sociology
Type of game theory	Low-tech (concepts of game theory used, but not the mathematics)	High-tech (mainstream game theory used, including iterated games and simulations)
Time period	1950s to mid-1970s	Mid-1980s and onwards
Central topics	Topics mainly inspired by von Neumann-Morgenstern and Schelling, such as coalitions, conflicts, coordination, commitment and communication	Topics that have grown out of the work of Nash and often are social dilemma related, such as cooperation, collective action and norms
Key people	Jessie Bernard, Philip Bonacich, William Gamson	Douglas Heckathorn, Michael Macy, Werner Raub, Jeroen Weesie, Trond Peterson
Examples of studies	Bernard (1964), Gamson (1961), Scheff (1967)	Raub (1988), Raub and Weesie (1990), Heckathorn (1988, 1989)
Place of game theory in the profession	Very marginal, practically non-existing	Seen as a technique, used e.g. in rational choice sociology, social dilemma research and mathematical sociology
Response to game theory in the profession	Scattered but lively discussion of games and game theory (e.g. Goffman [1961], Crozier [1976] and Coleman [1969])	Occasional discussion (e.g. Hechter [1990], White [1992] and Stinchcombe [1997])
Strengths	Introduction into sociology of mathematics and an analytical perspective; very broad discussion of games and game theory	High technical skill; further development of an analytical perspective
Weaknesses	Low technical capacity; little discussion of the link to empirical reality	Little discussion of the link to empirical reality; little general discussion of games and game theory

Comment: For full references to the items cited in the table, see note.[55]

today. They also had fewer links to practitioners of game theory in the neighboring social sciences, such as economics, political science, and psychology. Finally, the topics that have been broached in old and new game-theoretical sociology are quite different. The first generation of sociologists was mainly interested in areas of research that had been

initiated by von Neumann-Morgenstern, such as coalitions and conflicts. They were also fascinated by Thomas Schelling's attempt to re-orient game theory and by his discussion of such topics as coordination, commitment, and communication. Today's sociologists, on the other hand, mainly work on topics that have grown out of the work of John Nash, such as prisoner's dilemma, cooperation, and collective action.

A different way of describing the kind of work that characterizes current game-theoretical research among sociologists would be to say that it falls in the general category of social dilemma research.[56] (This does not cover all of it; there is, for example, a growing literature that attempts to link up game theory to social exchange theory[57]). Social dilemma research, it should also be noted, is interdisciplinary and has its origin in the 1970s. Social psychologists, economists, and political scientists have all been considerably more active within this field of research than sociologists, who furthermore were late-comers – with the exception of Gerald Marwell and Ruth Ames.[58] According to Douglas Heckathorn and Michael Macy – two of the most active and interesting members of the current generation of game-theoretical sociologists – *all* of sociology can actually be seen as social dilemma-related.[59] A social dilemma can roughly be defined as a situation in which there is a sharp conflict between individual rationality and collective rationality. A more formal definition would be that a social dilemma exists when strategies, which are individually dominant, converge toward a deficient equilibrium.[60]

The following three ideal typical situations are often taken as the point of departure for research on social dilemmas: the tragedy of the commons, prisoner's dilemma, and the problem of creating a public good. The first of these situations is associated with a famous article from the 1960s by Garret Hardin, and describes how a number of herders destroy their livelihood by individually increasing the number of livestock that graze on a common pasture.[61] The prisoner's dilemma had already been identified around 1950 and grew out of non-cooperative game theory of the Nash version.[62] It covers the situation in which two prisoners choose a course of action that is individually rational, but which makes both of them end up much worse than if they had cooperated. The difficulty of creating a public good can finally be illustrated by Mancur Olson's *The Logic of Collective Action* (1965), with its famous analysis of the free rider.

Research on social dilemmas mainly attempts to establish under which conditions it would be possible to let collective rationality triumph over individual rationality. From a sociological point of view one can say that social dilemmas are typically involved in the creation of order, in matters of cooperation, and in getting collective action going. The literature on social dilemmas is sometimes divided up according to the way in which the solution to the dilemma is sought: by affecting the motivation of the actors (*motivational solutions*), by changing the structure of the situation (*structural solutions*), and through the strategies of the actors (*strategic solutions*). The line between structural solutions and strategic solutions is somewhat fluent. Sociologists have mainly been interested in structural and strategic solutions, but occasionally also in motivational solutions.

Social psychologists, as one would predict, have been very active in researching *motivational solutions*, and they have among other things established that people have different orientations to social dilemmas and also tend to cast other people in the same category to which they see themselves as belonging ("individualists," "cooperators," and "competitors"). The basic solution to social dilemmas, from this perspective, is to change the motivation of the actors from egoistic to altruistic. Research that claims that people in reality are more cooperative than the theory assumes belongs to this category as well.[63] And so does research that is more sociological in nature, and that looks at such issues as group identity and various ways of strengthening this type of identity, for example through intergroup competition.[64]

Structural solutions involve, for example, a change of incentives and are often preferred by economists. Actors, it is argued, are likely to change their behavior in the direction of cooperation, if the reward for doing so is increased. Another structural solution would be to change the size of the group, since it is more difficult to be altruistic in a large group than in a small one.[65] It may also be possible to introduce a coercive organization or norms that ensure a collectively rational solution.[66]

In the *strategic solutions* it is assumed that the actors remain egoistic – but also that they are aware that it is in their own interest to behave in an altruistic or cooperative manner. According to a well-known review of experimental findings, the average actor in a prisoner's dilemma soon comes to realize the absurdity of the situation and is willing to cooperate, if others also are willing to do so.[67] The problem then

becomes how trust is established, and a number of different ways of proceeding are possible at this point. One would be to post hostages, and another that the actors get to know the past behavior of one another, or in some other way can discern potentially cooperative partners.[68] One particularly famous strategy of this type is tit-for-tat, which was invented by Anatol Rapoport and popularized by Robert Axelrod in *The Evolution of Cooperation* (1984). The actor starts out by being cooperative and then continues to do so – as long as the other actor cooperates. Sociologists have explored many aspects of the tit-for-tat strategy and more generally also the role of learning in iterated games.[69]

For those sociologists who have not been trained in game theory, much of the work that has been carried out within the social dilemma paradigm may seem very technical and hard to follow. This, however, should not prevent a realization that some excellent sociology has been produced in recent game-theoretical sociology, which deserves general appreciation within the profession, and to be integrated into the sociological tradition. It can be added that many of the authors who do high-tech game-theoretical studies today often try to show the general sociological relevance of their analyses, and to indicate how their work is connected to earlier studies with a similar problematique and to the sociological enterprise as a whole. Three very interesting game-theoretical studies that illustrate this are Douglas Heckathorn's study of collective sanctions, Jeroen Weesie and Werner Ruab's study of the posting of hostages, and Michael Macy and John Skvoretz' study of trust and cooperation among strangers.[70]

The broader discussion and use of game theory and games in sociology (mid-1980s and onwards)

There has not been much discussion in sociology of the second wave of game-theoretical sociology, including its most popular form, analyses of social dilemmas with the help of iterated games. This is true despite the fact that game-theoretical sociology has resulted in quite a few studies in highly visible places, such as the *American Journal of Sociology* and the *American Sociological Review*. There has also been much less discussion of game theory in general and of related issues, as compared to the situation from the 1950s to the mid-1970s.[71] Today's game-theoretical sociologists are also, it appears, not very interested in what earlier sociologists had to say about games and game theory, such as Goffman, Crozier, and so on.

Whatever there has been of debate about the current version of game theory in sociology, which is very much centered around social dilemmas and especially the prisoner's dilemma, is the following. Arthur Stinchcombe raised the question early, to cite the title of his article: "Is the Prisoner's Dilemma All of Sociology?"[72] His answer was a sharp "no," and the reason for this is that prisoner's dilemmas are routinely solved by people in their everyday lives, without them ever being aware of the existence of a dilemma. The only time that people do become conscious of a prisoner's dilemma, and are able to formulate something like payoffs, Stinchcombe says, is when they are confronted with a new situation – and then they are usually able to solve the dilemma.[73]

A much more radical critique of the standard version of prisoner's dilemma games can be found in two studies by Michael Hechter and James Montgomery, which also allow us to draw a distinction between prisoner's dilemma as a conceptual tool and as a description of a situation, in which the actors behave in a rational manner. Michael Hechter has made a head-on attack on the use of iterated prisoner dilemma games as a tool to solve collective action problems.[74] The assumption that the players in game-theoretical analyses have perfect knowledge, Hechter argues, is highly unrealistic; and to use iteration as a way of solving all problems deserves to be called the "game theorists' version of the economists' infamous 'assume the can opener' ploy."[25] The way to proceed, if one wants to solve collective action problems in real life, Hechter continues, is through "observation of people's actual behavior in the field."[76] This may be an untidy way to proceed, he notes, but if it is done in combination with a rational choice approach, it will yield much better results than iterated games.

While Hechter wants to retain the idea of rational choice but get rid of the method of solving prisoner's dilemma situations through iteration, James Montgomery has recently advocated the opposite strategy.[77] The standard version of a prisoner's dilemma, he argues, is much too closely connected to the idea of rational actors and ignores experimental evidence. In reality, a high percentage of the actors in a prisoner's dilemma *do* cooperate; and when the situation is repeated, the level of cooperation tends to go down, not up.[78] As opposed to Hechter, however, Montgomery does not see this as a reason for not using a repeated-game model of the prisoner's dilemma type. Montgomery's position can be characterized as one that is critical of rational choice, but positive to the use of modelling techniques in sociology, including the use of game theoretical models.[79]

Montgomery's position that game theory is hampered by the assumptions of rational choice can also be found in Harrison White's work. Harrison White has not made use of game theory in his own work, but has been very influential in mathematical sociology and as an advocate of structural analysis in sociology. In his major theoretical statement, *Identity and Control* (1992), he, however, concisely sums up his view of game theory in the following manner:

> It could be argued that the crippling of game theory is the worst effect of rational-choice theory.... At its introduction by von Neumann, game theory had the potential of refounding the theory of social action. Unfortunately, it devolved into the hands of economic theorists. Except in the work of Schelling, who eschews systematic theory or modelling, the results for many years were increasingly arid exercises. New developments may be afoot, but effective game theory has to concern the induction of identities and disciplines, of social organization.[80]

While there has been a general paucity of game-related sociology during the current period of high-tech game theory, there do exist some exceptions, and the most interesting of these is Eric Leifer's study of chess.[81] Leifer's general argument is that one has to distinguish between *solving* a game and *playing* a game, and that the two demand very different skills from the players. In a two-person zero-sum game you do not need to play the game, and according to von Neumann and Morgenstern the solution (a mixed strategy) can just as well be implemented by a third party. The reason for this, Leifer explains, is that when you solve a game, the options have been narrowed down and can easily be apprehended and surveyed by the two players, say in the form of a payoff matrix. But when you play a complicated game, such as chess, the options are usually so manifold that only the player herself understands clearly why a specific move was made. A complicated game – in contrast to the games that are used in traditional game theory – always makes room for the skillful player as well as for the poor player, and the two play the game very differently. The poor player uses the same strategy to play the game as she uses to solve the game, that is, a routinized and "rational" strategy that is easily understood by a skillful opponent. The latter, however, uses a very different approach while playing the game and when finishing it off, and consequently draws on two different skills. Leifer's conclusion is that "game theory seeks solutions that would eliminate the need to actually play the game and hence cannot explain why some games are played with skills that are widely admired and emulated."[82] That social games are much closer to a game like chess, than to two-person zero-sum games, is something that is implied, if not explicitly stated by Leifer.

Concluding remarks: Opening up the discussion of game theory – and introducing counterfactuals into it

> With respect to the future, my feeling is that sociologists don't know game theory and economists, who do, are hopelessly naive about social structures. The best work remains to be done by those who have mastered both disciplines.
>
> *Phillip Bonacich*[83]

The main purpose of this article, to repeat, is to open up the discussion of game theory in contemporary sociology. The following three questions seem central to address:

- *What, if anything, have game theory and game-related perspectives contributed to sociology?*
- *Is not the game-theoretical perspective much too artificial for an empirical science such as sociology?*
- *Would it be possible to develop a distinctly sociological version of game theory?*

As the reader soon will notice, most of my answers to these questions grow out of the material that has already been presented in this article. The exception is when I discuss the possibility of renewing sociological game theory, and here I raise the question if one perhaps could use game theory to counter sociology's obsession with what *is*, by analyzing what *could have happened* – what choice was open to the actor(s) at a specific point in time. My argument on this point is that game theory could help to explore these possibilities, and that it therefore can be seen as a tool to map out and investigate a certain type of *counterfactual.*

My answer to the first question – *What, if anything, have game theory and game-related perspectives contributed to sociology?* – is that they have in fact made several important contributions. Game theory has expanded the repertoire of sociological theory as well as increased its analytical potential; it has added to the growth of mathematical sociology; and it has established important links between sociologists, on the one hand, and economists and other social scientists who are interested in game theory, on the other. Game theory has also helped to introduce an actor-based type of explanation, as opposed to the one that is centered around variables. Finally, game theory and game-related perspectives have inspired some excellent sociology.

It deserves to be emphasized that game theory has an intrinsic value in its capacity as a theory – a theory centered around the idea of a game, with players who take each other's actions into account and develop strategies with payoffs that can be represented in the form of a matrix. Thomas Schelling has even argued that it is precisely these "rudiments [which] may be of most interest to the social scientists."[84]

One option for the sociologist, in other words, would be to settle for a low-tech version of game theory, of the kind that Schelling advocates. Game theory also has the capacity to simplify and crystallize out what is essential in a situation. To cite Peter Blau: "a matrix grossly oversimplifies the social situation [but] it does highlight the implications of various strategies."[85] It is futhermore clear that game theory has helped mathematical sociology to advance in several ways. One is to have added a new tool to its arsenal, based on a very different type of mathematics; and another to have increased the interest for simulations in contemporary sociology.[86] There is finally the fact that game theory has helped to produce some excellent studies in sociology. And this game theory has done, both in its classical-technical version and in its game-related versions; and as an example of this I would primarily point to the works of Goffman, Boorman, and Crozier in the first generation of game-theoretical sociology, and to the works of Heckathorn, Macy, Raub, and Leifer in the second. A few other studies can be added as well, especially those by Boudon and Coleman.

I also would argue that the full width of the contribution of game theory to sociology first becomes visible when we look at not only game theory proper, but also game-related studies. My own view is that when von Neumann and Morgenstern invented game theory they chose to focus on a few types of games and to handle these in very specific ways. In reality, however, the whole area of games is extremely suggestive and fruitful to explore for the sociologist – as the works of Goffman, Coleman, Boorman, and many others testify to.

As to the second question that needs to be discussed – *Is not the game-theoretical perspective far too artificial to be of much value to an empirical science such as sociology?* – one answer has already been given, namely that game theory has an intrinsic value as a theory, regardless of its relationship to empirical reality. This answer, however, does not get to the heart of the question, which may not be as easy to answer as it first appears. Sociology is often presented as an empirical science – as a *Wirklichkeitswissenschaft* (Weber) – and the traditional way of testing

a proposition, which has been derived from a theory, is to compare its predictions to empirical reality, and see how well the two fit. This is in principle also possible in studies drawing on game theory, as, for example, Werner Raub and Gideon Keren have pointed out in their argument that game theory can be seen as a "normative" as well as a "descriptive" theory.[87] After having established that "the model has to be tested with regard to how well it approximates actual behavior," Raub and Keren use experiments to test their theory of using hostages to produce commitment.

Although it is rarely explicitly stated in the game-theoretical literature, it seems easier to reproduce the kind of situations that game theory studies in experiments than to locate them in reality. Trond Petersen, for example, notes that "unfortunately, it has turned out to be very difficult to do empirical work, in particular quantitative empirical work, using GT models."[88] While these difficulties must be openly acknowledged, and also that they detract from the value of game theory for an empirical science like sociology, they do *not* in my opinion amount to an argument for the elimination of game theory from sociology. The main strength of game theory lies elsewhere, mainly as an analytical tool. Game theory, as Boudon says, is very good to raise "questions of the *why* type" as opposed to "questions of the *how much* type."[89] There is also the fact that the relationship between theory and facts is considerably more difficult in sociology than is sometimes acknowledged. Earlier in this article, I mentioned several studies that illustrate this, such as Boorman's study that describes how a certain kind of game theory came to be embodied in a military strategy. There is also *The Evolution of Cooperation* by Axelrod, which is centered around a number of tournaments in which the players were all skillful game theorists – and where the gap between theory and fact was consequently narrowed.

Game-theoretical studies by sociologists can also be more or less related to actual empirical situations and use these as their point of departure for establishing the strategies of the players, their payoffs, and so on. While some studies start from a purely hypothetical situation, others begin with an empirical puzzle or some counterintuitive fact. Without ruling out the usefulness of the former way of proceeding, it may well be that the latter is more congenial to sociology. As examples of research that start out from an empirical puzzle, one can mention the work of Boudon, Schelling, and to some extent Goffman. If we move outside of sociology, a special mention should be made of behavioral

game theory and game theory as recently used by some economic historians.[90] My own argument about the use of game theory as a way of countering sociology's obsession with what *is*, as opposed to what *could be*, represents another way to relate game theory to empirical reality.

Quite a bit can also be said in response to the third question – *Would it be possible to develop a distinctly sociological version of game theory?* It should first of all be noted that the expression "a sociological game theory" can be interpreted in at least two different ways. On the one hand, it can simply be used to describe the kind of game-theoretical studies that sociologists have produced; and this is also the way that this expression has been used until this point. But it may also mean something quite different, namely a type of game theory that is *distinctly sociological* – just as there exists a mathematical version of game theory, an economic version, and so on. Such a theory, it can be argued, would have its own take on the tradition that begins with von Neumann-Morgenstern, continues with Nash and so on until today. A sociological version of game theory may, for example, be considerably closer to the kind of game theory that Thomas Schelling tried to elaborate in *Strategy of Conflict* (1960), than to the one that Nash worked out in the early 1950s and that today has become the foundation for economic game theory.[91]

What a truly sociological version of game theory would look like is perhaps what most deserves a discussion. It is also a topic that demands deeply innovative thinking rather than general arguments, drawn from the past experiences of game-theoretical sociology. My own suggestion in this context would be to argue for the use of game theory as a way to explore *counterfactuals.*[92] As I see it, sociology is by tradition far too concerned with the way things have turned out or *the* one strategy that was eventually chosen. As is well known, however, each social situation could have ended differently; and what I argue for is that game theory could perhaps be used as an instrument to explore these alternatives: to map out the strategies involved and to establish the payoffs.

To use game theory as a method to explore counterfactuals may also help to restore the proper role of *choice* to mainstream sociology. Sociologists all too often present their actors as if there existed only one way for these to proceed, because of the impact of social forces. The fact that actors often do not know what choice to make, hesitate, and perhaps later think that they chose the wrong alternative is

often forgotten in mainstream sociology – to the detriment of its realism.

What falls under the label "counterfactuals" in the literature, it should also be noted, covers very different situations, and the ones that I have in mind represent a distinct category, namely the alternative strategies of the actors themselves in a specific situation. This is also the position that Weber takes in his well-known article on Eduard Meyer:

> The historical agent, to the extent that he is acting, as we are here assuming, in a strictly "rational" way, takes into account those "conditions" of the future course of events which interests him, which are "external" to him and, as far as he knows, given in reality. He then, in his mind, fits into the causal nexus various "possible" courses of action for himself, together with the consequences to be anticipated from them in combination with those "external" conditions, in order to decide on one or another of the courses of action appropriate to his "goal" in accordance with the "possible" outcomes which he has worked out in his mind.[93]

Focussing on these *ex ante* strategies, rather than on the *ex post* result, also makes it natural to incorporate a *Verstehen* dimension into the analysis. Paying proper attention to the subjective dimension, as this is experienced by the actors themselves, is unfortunately something that has been much neglected in conventional game theory. If *sociological game theory*, then, is not to end up as an artificial exercise – or as a "puppet show," to use the colorful terminology of Alfred Schutz[94] – it is absolutely essential that the beliefs, ideas, and experiences of the actors themselves are moved onto center stage.

Acknowledgments

For many useful suggestions, I would especially like to thank the participants at seminars at the Departments of Sociology at Cornell University and Stockholm University as well as at CNRS ("Networks and Regulation") in Paris. For important information and much assistance I would also like to thank especially Patrik Aspers, Mie Augier, Reza Azarian, Phillip Bonacich, Raymond Boudon, Michel Crozier, Christofer Edling, Thomas Fararo, William Gamson, Douglas Heckathorn, Peter Hedström, Thorbjorn Knudsen, Siegward Lindenberg, Gerald Marwell, Robert K. Merton, James Montgomery, Michael Macy, Victor Nee, Trond Petersen, Werner Raub, Wendelin Reich, Thomas Schelling, Lars Udehn, and Hans Zetterberg. Financial sup-

port from the Social Behavior and Mechanisms Project, financed by STINT in Sweden, is gratefully acknowledged.

Notes

1. Mie Augier and Richard Swedberg, "Game Theory and Sociology: Landmarks in Game Theory from a Sociological Perspective," paper presented at the Conference on "New Economic Sociology in Europe 2000," at Stockholm University, June 2–3, 2000.
2. While this article no doubt contains material of interest to the history of sociology (which has ignored the relationship of game theory to sociology), it is not primarily conceived as a contribution to this particular genre. Its main goal, to repeat, is rather to contribute to the discussion of game theory in contemporary sociology.
3. For a brief history of game theory, see, e.g., R. J. Aumann, "Game Theory," 460–482 in Vol. 2 of John Eatwell et al., editors, *The New Palgrave. A Dictionary of Economics* (London: Macmillan, 1987); and for an easy-to-understand introduction to game-theoretical analysis, see, e.g., David Kreps, *Game Theory and Economic Modelling* (Oxford: Clarendon Press, 1990).
4. Aumann, "Game Theory," 460.
5. See, e.g., Erving Goffman, "Fun in Games," 15–72, in *Encounters: Two Studies in the Sociology of Interaction* (Penguin: Harmondsworth, [1961] 1972).
6. As one reviewer has remarked, it would have added to the value of this article if a Social Science Citation analysis had been used to indicate the popularity (and lack of popularity) of game theory among sociologists during various time periods. It may be added that it is possible to find some relevant material when it comes to game theory also in the works of the sociological classics – which, however, were all written well before the birth of game theory. This is particularly true for Simmel's comments on "social games" (*"Gesellschaftsspiele"*); Weber's analysis of the game of skat; and Mead's discussion of games in relation to the formation of the self. See Georg Simmel, "Sociability: An Example of Pure, or Formal Sociology (1911)," 49–50, in Kurt Wolff, editor, *The Sociology of Georg Simmel* (New York, The Free Press, 1950); Max Weber, "Analysis of the Concept of a Rule: The Concept of a 'Rule of the Game,'" 98–143, in *Critique of Stammler* (New York: The Free Press, [1907] 1977); and George Herbert Mead, *Mind, Self and Society* (Chicago: University of Chicago Press, 1934), 151–173. The relevance of especially Mead's ideas to game theory has frequently been noted in the secondary literature; that of Simmel only occasionally; and that of Weber not at all. See, e.g., Thomas Scheff, "A Theory of Social Coordination Applicable to Mixed-Motive Games," *Sociometry* 30 (1967): 215–234; Alan Ross Anderson and Omar Khayyam Moore, "Autelic Folk-Models," *Sociological Quarterly* 1 (1960): 203–216. Simmel essentially argues that all types of interactions that exist in society can also be found in games – but without the seriousness that attaches to interaction in reality. Weber notes that a player of skat takes into account what the opponent does ("stragetic interaction," to use a post-Weberian term). He also points out that one can proceed in two different ways, when analyzing the game of skat. One can either make a purely conceptual analysis of games (roughly of the type that is found in marginal utility analysis) – or one can analyze the way that games are played in actual reality. Mead, finally, stresses the role that games play for the formation of the self: by

taking the role of other players in a game, the child develops her psyche. It may finally be mentioned that also some anthropologists have been interested in game theory. See in particular, Fredrik Barth, "Segmentary Opposition and the Theory of Games: A study of Pathan Organization," *The Journal of the Royal Antropological Institute* 89 (1959): 5–21, and "Models of Social Organization, I–III" [and] "Models Reconsidered," 32–104, in Vol. 1 of *Process and Form of Social Life* (London: Routledge & Kegan Paul, 1981); Claude Lévi-Strauss, "The Mathematics of Man," *International Social Science Bulletin* 6 (1954): 581–590, and "Social Structure," 273–323, in *Structural Anthropology* (New York: Basic Books, 1963).

7. Duncan Luce and Howard Raiffa, *Games and Decisions: Introduction and Critical Survey* (New York: John Wiley & Sons, 1957), 10.
8. See Herbert Simon, "Review of R. Duncan Luce and Howard Raiffa, *Games and Decisions*," *American Sociological Review* 23 (1958): 343. See also, e.g., Daniel Bell in Richard Swedberg, *Economics and Sociology* (Princeton: Princeton University Press, 1990), 223–224.
9. It is clear that game-theoretical sociology also has an interesting history in other countries than the United States, such as France and the Netherlands. A non-technical form of game theory was, for example, used in the 1970s by Sigward Lindenberg and Reinhard Wippler at the Interuniversity Center for Sociological Theory and Methodology (ISC), later to be followed by sophisticated game theory by scholars such as Werner Raub and Jeroen Weesie. In France, many other sociologists besides Crozier and Boudon (whose work is commented on in the text) have carried out game-theoretical studies.
10. Jessie Bernard, "The Theory of Games of Strategy as a Modern Sociology of Conflict," *American Journal of Sociology* 59 (1954), 411–424.
11. Paul Lazarsfeld and Neil Henry, editors, *Readings in Mathematical Social Science* (Chicago: Science Research Associates, 1966), 11. Boudon, who was at Columbia University in 1962–1963 on a Ford Foundation scholarship, has the following to say on Lazarsfeld and game theory: "As far as I remember, Lazarsfeld never expressed an interest in game theory during the many meetings I had with him over the years. He appreciated Luce & Raiffa's book and recommended it. But he was interested in it rather because it illustrated the interest of mathematics for the social sciences and because of course promoting the uses of mathematics applied to social sciences was one of his many goals. Intellectually and scientifically though, I think he had only a moderate interest for game theory, probably because he saw more or less clearly that the utilitarian axiomatics of game theory, its a priori simple psychology was little compatible with his own views on the 'empirical analysis of action.'" Cf. Raymond Boudon, e-mail to the author, March 26, 2000. Information supplied by Hans Zetterberg further supports the view of Boudon, and confirms that "game theory within Columbia sociology was part of the efforts to create a mathematical sociology by Paul Lazarsfeld." Howard Raiffa, Zetterberg also says, was a member of many dissertation committees in sociology at Columbia University. Cf. Hans Zetterberg, e-mail to the author, March 26, 2000.
12. Robert K. Merton, e-mail to the author, April 2, 2000.
13. Angela O'Rand, "Mathematizing Social Science in the 1950s," 194–195 in Roy Weintraub, editor, *Toward a History of Game Theory* (Durham: Duke University Press, 1992).
14. Coleman in Swedberg, *Economics and Sociology*, 49.
15. The full statement by Neil Smelser reads as follows: "As far as I can remember (mainly from seminars, conversations, etc.) with Talcott, he was certainly aware of

the work of von Neumann and Morgenstern, and mentioned it from time to time, but never as being of special theoretical interest to his work. Talcott and I never really thought of game theory in working out the theoretical framework for *Economy and Society*" – Neil Smelser, e-mail to the author, March 13, 2000.

16. Bernard, "The Theory of Games," *American Journal of Sociology* 59 (1954): 412.
17. Ibid., 411.
18. Ibid., 414.
19. Ibid., 416.
20. In commenting on Bernard's article and her statement that more and better mathematics is needed, Thomas Schelling states the following in *The Strategy of Conflict*: "My own view is that the present deficiencies are not in the mathematics, and that the theory of strategy has suffered from too great a willingness of social scientists to treat the subject as though it were, or should be, a branch of mathematics" – Thomas Schelling, *The Strategy of Conflict* (Cambridge: Harvard University Press, [1960] 1980), 10).
21. Bernard's first study of a particular topic, which draws on game theory, appeared in the mid-1960s in *Handbook of Marriage and the Family.* Here she bases her analysis nearly exclusively on Schelling's ideas and suggests, for example, that couples often come to agree on what type of sex they will engage in through tacit coordination. A spouse who refuses to listen to the other spouse is similarly analyzed with the help of Schelling's ideas on commitment: if you close your ears and do not listen to what the other person says, she will be forced to take this into account when deciding on her next move. Bernard's last attempt to use game theory in her sociological work is to be found in *The Sex Game* (1968), which is a study of communication between the sexes. A very small part of this study, however, draws directly on game theory, and it is clear that Bernard by now was experiencing difficulties in using game theory on the kind of topics she was interested in. Still, one can find some very interesting remarks in *The Sex Game*, for example about the role of emotions in games and about the different ways in which males and females play games; see, Bernard, *The Sex Game* (New York: Atheneum Paperbacks, [1968] 1975), 301–302.
22. Jessie Bernard, "Social Problems as Problems of Decision," *Social Problems* 6 (1959): 221.
23. Jessie Bernard, "Some Current Conceptualizations in the Field of Conflict," *American Journal of Sociology* 30 (1964): 444.
24. Ibid.
25. Jessie Bernard, "A Woman's Twentieth Century," 345, in Bennett M. Berger, editor, *Authors of Their Own Lives* (Berkeley: University of California Press, 1990), 345.
26. Theodore Caplow, "A Theory of Coalitions in the Triad," *American Sociological Review* 21 (1956): 489.
27. In a later work Caplow again refers to game theory, especially to the prisoner's dilemma. See Theodore Caplow, *Peace Games* (Middletown: Wesleyan University Press, 1989).
28. William Gamson, e-mail to the author, March 21, 2000.
29. William Gamson, "A Theory of Coalition Formation," *American Sociological Review* 26 (1961): 373–382.
30. Ibid., 382.
31. William Riker, "Coalitions. I. The Study of Coalitions," 527 in Vol. 2 of David L. Sills, editor, *International Encyclopaedia of the Social Sciences* (New York: The Macmillan Company, 1968). Some years later Gamson published a [illegible] society game, which can be described as an extended [illegible]

See William Gamson, *SIMSOC: Simulated Society* (New York: The Free Press, third edition, 1968).

32. Gerald Marwell and David Schmitt, "Are 'Trivial' Games the Most Interesting Psychologically?" *Behavioral Science* 13 (1968): 125–128; Phillip Bonacich, e-mail to the author, May 9, 2000.
33. E.g., Phillip Bonacich, "Norms and Cohesion as Adaptive Responses to Potential Conflict: An Experimental Study," *Sociometry* 35/3 (1972: 357–375, and "Secrecy and Solidarity," *Sociometry* 39/3 (1976: 200–208).
34. Phillip Bonacich, e-mail to the author, May 9, 2000.
35. See Thomas Scheff, "A Theory of Social Coordination Applicable to Mixed-Motive Games," *Sociometry* 30 (1967): 215–234, and "Toward a Sociological Model of Consensus," *American Journal of Sociology* 32 (1967): 32–46.
36. Bernard, "Some Current Conceptualizations in the Field of Conflict," *American Journal of Sociology* 30 (1964): 453.
37. Clifford Geertz, "Blurred Genres: The Refiguration of Social Thought," 20, in *Local Knowledge* (New York: Basic Books, 1983).
38. It would be difficult, within the framework of this article, to trace properly the impact of Huizinga and Wittgenstein on the discussion of games in social science discourse during the period in question; and, as part of this, to try to sort out the exact impact of game theory on this discussion. As a rule of thumb, however, it can be said that when reference is made to "payoffs," "strategy," and "matrix," there is an influence of game theory and not of Huizinga or Wittgenstein. For Wittgenstein's influential discussion of language games, and for Huizinga's analysis of the role of play in civilization, see Johan Huizinga, *Homo Ludens: A Study of the Play-element in Culture* (London: Routledge, [1938] 1949); and Ludwig Wittgenstein, *Philosophical Investigations* (New York: Macmillan, [1953] 1968).
39. By "low-tech game theory" is meant what is sometimes referred to in the game-theoretical literature as "non-mathematical game theory," that is, a study of inter-dependent decisions in which the use of mathematics is minimal but that includes a matrix or a decision tree as well as stringent game-theoretical arguments. "High-tech game theory," on the other hand, includes a technical analysis and typically consists of an application of some well-established way of doing game theory.
40. Anderson and Moore, "Autelic Folk-Models"; Jessie Bernard, "The Adjustments of Married Mates," 675–739 in Harold T. Christensen, editor, *Handbook of Marriage and the Family* (Chicago: Rand McNally & Company, 1964), and *The Sex Game*; Bonacich, "Norms and Cohesion," and "Secrecy and Solidarity"; Scott Boorman, *The Protracted Game: A Wei-Ch'i Interpretation of Maoist Revolutionary Strategy* (New York: Oxford University Press, 1969); Raymond Boudon, "Generating Models as a Research Strategy," 51–64 in Robert K. Merton et al., editors, *Qualitative and Quantitative Social Research* (New York: The Free Press, 1979); Michael Burawoy, "The Labor Process as a Game," 77–94 in *Manufacturing Consent: Changes in the Labor Process under Monopoly Capitalism* (Chicago: University of Chicago Press, 1979); James Coleman, "The Possibility of a Social Welfare Function: Reply," *American Economic Review* 57 (1967): 1311–1317, "Games as Vehicles for Social Theory," *American Behavioral Scientist* 12 (1969): 2–6, and *The Foundations of Social Theory* (Cambridge: Harvard University Press, 1990); Michel Crozier, "Comparing Structures and Comparing Games," 193–207 in Geert Hofstade and M. Sami Kassem, editors, *European Contributions to Organization Theory* (Amsterdam: Van Gorcum, 1976), and Michel Crozier and Jean-Claude Thoenig, "La Régulation des Systèmes Organisés Complexes," *Revue Française de Sociologie*

16 (1975), pp. 3–32; Norbert Elias, "Game Models," 71–103 in *What Is Sociology?* (New York: Columbia University Press, [1979] 1978); Gamson, "A Theory of Coalition Formation"; Goffman, "Fun in Games"; Douglas Heckathorn, "Collective Sanctions and the Creation of Prisoner's Dilemma Norms," *American Journal of Sociology* 94 (1988), 535–562, and "Collective Action and the Second-Order Free-Rider Problem," *Rationality and Society* 1 (1989): 78–100; Eric Leifer, "Trials of Involvement: Evidence for Local Games," *Sociological Forum* 3 (1988): 499–524, and *Actors as Observers: A Theory of Skill in Social Relationships* (New York: Garland, 1991); Michael Macy and John Skvoretz, "The Evolution of Trust and Cooperation between Strangers: A Computational Model," *American Sociological Review* 63 (1988): 638–660; James Montgomery "Toward a Role-Theoretic Conception of Embeddedness," *American Journal of Sociology* 104 (1988): 92–125; Werner Raub, "Problematic Social Situations and the 'Large-Number Dilemma': A Game-Theoretical Analysis," *Journal of Mathematical Sociology* 13 (1988): 311–357, and Werner Raub and Jerome Weesie, "Reputation and Efficiency in Social Interactions: An Example of Networks Effects," *American Journal of Sociology* 96 (1990): 626–654; Chris Snijders and Werner Raub, "Revolution and Risk: Paradoxical Consequences of Society 10 (1998): 405–425; and W. Edgar Vinacke and Abe Arkoff, "An Experimental Study of Coalitions in the Triad," *American Sociological Review* 22 (1957): 406–414.

41. See, e.g., Coleman, "The Possibility of a Social Welfare Function," 1311–1317, and "Games as Vehicles for Social Theory"; Elias, "Game Models"; Donald Roy, "'Banana Time'; Job Satisfaction and Informal Organization," *Human Organization* 18 (1960): 158–168; William Foot Whyte, *Money and Motivation* (New York: Harper & Brothers, 1966), 31–38; and Burawoy, "The Labor Process as a Game."
42. Michel Crozier, *The Bureaucratic Phenomenon* (Chicago: University of Chicago Press, [1963] 1964), 145–174.
43. Crozier, "Comparing Structures and Comparing Games," 196.
44. Ibid. The difficulty in formalizing the analysis comes out very clearly in the one empirical study in which Crozier and a colleague tried to apply the new paradigm. See Crozier and Thoenig, "La Régulation des Systèmes Organisées Complexes"; see also Michel Crozier and Erhard Friedberg, "The Game as an Organized Instrument of Organized Action," 45–63, in *Actors and Systems: The Politics of Collective Action* (Chicago: University of Chicago Press, [1977] 1980).
45. Geertz, "Blurred Genres," 24.
46. A special mention should also be made of "Expression Games," which deals with the capacity of people to reveal and conceal information; cf. Erving Goffman, "Expression Games," 1–103 in *Strategic Interaction* (New York: Ballantine Books, [1961] 1972). At one point in this essay, Goffman, for example, says that "The game-theory assumption that one's opponent is exactly as smart as oneself is not a wise one in daily affairs" – ibid., 92. Goffman's important concept of "the team" in *The Presentation of Self in Everyday Life* originates, according to the author, in the work of von Neumann and Morgenstern; cf. Goffman, *The Presentation of Self in Everyday Life* (New York: Doubleday & Company, [1956] 1959), 80. For a discussion of Goffman and game theory, see, e.g., Randall Collins, "Neorationalism and Game Theory [in the Work of Goffman]," 238–246 in *Theoretical Sociology* (New York: Academic Press, 1981); and for a critique of the idea that ethnomethodology, like Goffman's approach, can be understood in terms of games, see Douglas Maynard, "Goffman, Garfinkel, and Games," *Sociological Theory* 9 (1991): 277–279, and Harold Garfinkel, "Passing and the Managed Achievement of Sex Status in an

'Intersexed' Person, Part 1," 140 ff. in *Studies in Ethnomethodology* (London: Polity Press, 1967). It can finally be noted that Goffman, on an invitation from Thomas Schelling, spent the years 1966–1968 at the Center for International Affairs at Harvard; cf. Diane Vaughan, "How Theory Travels: Analogy, Models, and the Case of A. Michael Spence," paper presented at ASA in San Francisco in 1998; and Thomas Schelling, e-mail to the author, June 15, 2000.

47. Goffman, "Fun in Games," 32 in *Encounters.*
48. Goffman, "Expression Games," 143 in *Strategic Interaction*, emphasis added.
49. Goffman, "Strategic Interaction," 149–150 in *Strategic Interaction.*
50. Boorman, *The Protracted Game*, 5.
51. Boorman, *The Protracted Game*, 164–165.
52. Daniel Bell in Swedberg, *Economics and Sociology*, 224; cf. Douglas Heckathorn, "Game Theory and Sociology in the 1980s," *Contemporary Sociology*, 15 (1986), 206). Again, as one of the reviewers pointed out, it would have been useful to have a Social Science Citation analysis at this point to be able to trace better the ups and downs of the popularity of game theory among sociologists.
53. Jon Elster suggested that game theory can be used as a micro foundation for sociology in general and for Marxism in particular, something that Anthony Giddens, Claus Offe, and Johannes Berger responded to. One of the key points of the respondents was that game theory is problematical in that it enters so late in the sociological analysis, that is, after the various strategies and payoffs have been delineated. Cf. Jon Elster (with replies by Anthony Giddens, Claus Offe, and Johannes Berger), "Marxism, Functionalism and Game Theory: The Case for Methodological Individualism," *Theory and Society* 11 (1982): 453–482, 521–526, 527–539. Raymond Boudon wrote on game theory mainly in the 1970s and argued, somewhat similarly to Goffman and Schelling, that there exist certain areas in social reality where game theory may be applicable: "it has seemed to me that it [game theory] can be used with benefit in situations where its axiomatics may be held as realistic." Cf. Raymond Boudon, e-mail to the author, March 26, 2000. James Coleman, finally, was enormously interested in games – but not in game theory. Games, he argued, constitute an excellent tool for the sociologist, who can use these for a better understanding as well as an elaboration of social theory. Coleman constructed several sociological games of his own, the best-known of which is the so-called legislative game, in which a number of legislators trade votes. According to information from one of Coleman's students, Gudmund Hernes, Coleman's theory of collective decisions grew out of his legislative game. "Coleman loved games," Hernes says, and he conducted at one point a seminar in which the participants all constructed games of their own. (Author's conversation with Gudmund Hernes on October 1, 2000.) For Coleman's fascination with the use of games as an educational tool in the schools, see Sarene Spence Boocock, "Games with Simulated Environments: Educational Innovation and Applied Sociological Research," 132–146 in Jon Clark, editor, *James S. Coleman* (London: Falmer Press, 1996).
54. It is significant that a non-sociologist was chosen by *American Journal of Sociology* and *American Sociological Review* to review the works of von Neumann-Morgenstern (1944) and Luce-Raiffa (1957). See Herbert Simon, "Review of von Neumann and Morgenstern, *Theory of Games and Economic Behavior*," *American Sociological Review* 23 (1958): 342–343. According to Simon, when he wrote the review of von Neumann-Morgenstern he tailored his argument to the fact that "my audience, sociologists, would be ... mostly quite unable to follow any of the mathematical

arguments." Cf. Herbert Simon, e-mail to Mie Augier, February 2, 1999, as cited in Augier and Swedberg, "Game Theory and Sociology."

55. Bernard, "The Adjustments of Married Mates'; Coleman, "Games as Vehicles for Social Theory"; Crozier, "Comparing Structures and Comparing Games"; Gamson, "A Theory of Coalition Formation"; Goffman, "Fun in Games"; Michael Hechter, "*Comment* [on Michael Taylor, 'Cooperation and Rationality': On the Inadequacy of Game Theory for the Solution of Real-World Collective Action Problems," 240–249 in Karen Cook and Margaret Levi, editors, *The Limits of Rationality* (Chicago: University of Chicago Press, 1990); Heckathorn, "Collective Sanctions," and "Collective Action and the Second-Order Free-Rider Problem"; Raub, "Problematic Social Situations and the 'Large-Number Dilemma'"; Raub and Weesie, "Reputation and Efficiency in Social Interactions"; Scheff, "Toward a Sociological Model of Consensus"; Arthur Stinchcombe, "Game Theory, Procedure, and Consent: Focusing on Fair Division," *Law & Society Inquiry* 22 (1967): 1087–1105; and Harrison C. White, *Identity and Control: A Structural Theory of Social Action.* (Princeton: Princeton University Press, 1992).
56. See, e.g., Toshio Yamagishi, Social Dilemmas," 311–335 in Karen Cook et al., editors, *Sociological Perspectives on Social Psychology* (Boston: Allyn and Bacon, 1995); and Peter Kollock, "Social Dilemmas: The Anatomy of Cooperation," *Annual Review of Sociology* 24 (1998): 183–214.
57. See, e.g., Ellen Bienenstock and Phillip Bonacich, "Network Exchange as a Cooperative Game," *Rationality and Society* 9 (1997): 37–66, and Barry Markovsky, "Network Games," *Rationality and Society* 9 (1997): 67–90.
58. Gerald Marwell and Ruth Ames, "Experiments on the Provision of Public Goods, I–II," *American Journal of Sociology* 48 (1979): 1335–1360, 1335–1360, 85 (1980): 926–937; "Economists Free Ride, Does Anyone Else?" *Journal of Public Economics* 15 (1981): 295–310.
59. Douglas Heckathorn, conversation with the author, April 28, 2000; and Michael Macy, conversation with the author, May 1, 2000.
60. A social dilemma may be formally defined as a group structure "...involving individually dominating strategies that converge on a deficient equilibrium. A strategy is dominating if its personal payoffs are superior to those of all other strategies no matter what others do; an outcome is 'deficient' when that outcome is less preferred by *all* choosers to some other outcomes; such an outcome in a social dilemma will, however, be in equilibrium because no individual chooser has an egoistic incentive to depart from selecting a dominating strategy." See Robyn Dawes as cited in Yamaghisi, "Social Dilemmas," 311.
61. Garret Hardin, "The Tragedy of the Commons," *Science* 162 (1968): 1243–1297.
62. E.g., Sylvia Nasar, *A Beautiful Mind* (New York: Touchstone, 1999), 118.
63. E.g., David Sally, "Conversation and Co-operation in Social Dilemmas: A Meta-Analysis of Experiments from 1958–1992," *Rationality and Society* 7 (1995): 58–92.
64. E.g., Peter Kollock, "Transforming Social Dilemmas: Group Identity and Cooperation," 186–210 in P. Danielson, editor, *Modelling Rational and Moral Agents* (Oxford: Oxford University Press, 1998).
65. E.g., Raub, "Problematic Social Situations and the 'Large-Number Dilemma.'"
66. E.g., Heckathorn, "Collective Sanctions," and "Collective Action and the Second-Order Free-Rider Problem."
67. Dean Pruitt and Melvin Kimbell, "Twenty Years of Experimental Gaming: Critique, Synthesis, and Suggestions for the Future," *Annual Review of Psychology* 28 (1977), 363–392.

68. E.g., Peter Kollock, "'An Eye for an Eye' Leaves Everybody Blind: Cooperation and Accounting Systems," *American Sociological Review* 58 (1993), 768–786; and Jeroen Weesie and Raub, "Private Ordering."
69. E.g., Michael Macy, "Walking Out of Social Traps: A Stochastic Learning Model for Prisoner's Dilemma," *Rationality and Society* 1 (1989): 197–212.
70. Heckathorn, "Collective Sanctions"; Weesie and Raub, "Private Ordering"; and Michael Macy and John Skvoretz, "The Evolution of Trust and Cooperation between Stangers: A Computational Model," *American Sociological Review* 63 (1998): 738–760.
71. The fact that Pierre Bourdieu, for example, draws on the metaphor of the game in his sociology has hardly been noticed. See, for example, the following summary statement, from p. 98 in Pierre Bourdieu and Louïc Wacquant, *An Invitation to Reflexive Sociology* (Chicago: University Chicago Press, 1992), on the role of the concept of game in Bourdieu's work: "We can indeed, with caution, compare a field to a game (*jeu*) although, unlike the latter, a field is not the product of a deliberate act of creation, and it follows rules or, better, regularities, that are not explicit and codified. Thus we have *stakes* (*enjeux*) which are for the most part the product of the competition between players. We have an *investment in the game, illusio* (from *ludus*, the game): players are taken in by the game, they oppose one another, sometimes with ferocity, only to the extent that they concur in their belief (*doxa*) in the game and its stakes; they grant these are cognitions that escape questioning. Players agree, by the mere fact of playing, and not by way of a "contract," that the game is worth playing, that it is "worth the candle," and this *collusion* is the very basis of their competition. We also have *trump cards*, that is, master cards whose force varies depending on the game: just as the relative value of cards changes with each game, the hierarchy of the different species of capital (economic, social, cultural, symbolic) varies across the various fields. In other words, there are cards that are valid, efficacious in all fields – these are the fundamental species of capital – but their relative value as trump cards is determined by each field and even by the successive states of the same field." For a critique of Jean Tirole's game-theoretical version of industrial economics, as compared to the earlier, more empirically oriented research set off by Edward Mason, see Pierre Bourdieu, "Le Champ Économique," *Actes de la Recherche en Sciences Sociales* 119 (September 1997): 55–56.
72. Stinchcombe, "Is the Prisoner's Dilemma All of Sociology?"
73. Stinchcombe also discusses game theory in a more recent article. His main point here, insofar as game theory and sociology is concerned, is quite similar to what Goffman tried to express through his concept of rules of irrelevance, namely that in ordinary games "like [in] formal models for bargaining" a certain reality is "carefully set off from everyday life and everyday discourse." See Stinchcombe, "Game Theory, Procedure, and Consent," 1090. George Homas has made a somewhat similar point in a review of Axelrod's *The Evolution of Cooperation*. Homans was very favorable to Axelrod's argument about tit-for-tat as a solution to cooperation among egoists, but he also made clear that cooperation could evolve in many other situations than the ones discussed in *The Evolution of Cooperation*: "Cooperation does not evolve only from the reiterated Prisoner's Dilemma. Indeed, it is much more apt to evolve in simpler situations, especially in the exchange of goods and services among individuals and groups. And we know from accounts of barter in primitive societies, such collaboration, too, can evolve perfectly tacitly and without friendship between the parties" – George Homans, "Review of Robert Axelrod, *The Evolution of Cooperation*," *Theory and Society* 14 (1985: 896–897).

74. Hechter "Comment"; cf. Hechter, *Principles of Group Solidarity* (Berkeley: University of California Press, 1987), 73–77; and for a rebuttal, Werner Raub, Thomas Voss, and Jeroen Weesie, "On the Usefulness of Game Theory for the Resolution of Real-World Collective Action Problems," *Rationality and Society* 4 (1992): 95–102.
75. See Hechter, "Comment," 248.
76. Ibid., 245.
77. James Montgomery, "Toward a Role-Theoretic Conception of Embeddedness," *American Journal of Sociology* 104 (1998): 92–125.
78. E.g., Roby Dawes and Richard Thaler, "Anomalies: Cooperation," *Journal of Economic Perspectives* 2 (1988): 187–197.
79. In an e-mail to the author, dated April 21, 2000, Montgomery specifies: "The critique of rational choice in my 1998 *AJS* paper was a narrowly-focused attack on the standard assumption that the individual is a unitary actor."
80. White, *Identity and Control*, 201–202.
81. Leifer, "Trials of Involvement"; cf. Leifer, *Actors as Observers.*
82. Leifer, "Trials of Involvement," 499.
83. Phillip Bonacich, e-mail to the author, May 9, 2000.
84. Thomas Schelling, "What is Game Theory?," 221 in *Choice and Consequence* (Cambridge: Harvard University Press, 1984).
85. Peter Blau, *Exchange and Power in Social Life* (New York: John Wiley & Sons, 1964), 46.
86. E.g., Michael Macy, "From Factors to Actors: The Third Wave in Social Simulations," *International Encyclopedia of the Social Sciences* (forthcoming).
87. See Werner Raub and Gideon Keren, "Hostages as a Commitment Device: A Game-Theoretic Model and an Empirical Test of Some Scenarios," *Journal of Economic Behavior and Organization* 21 (1993): 47.
88. Trond Petersen, "On the Promise of Game Theory in Sociology," *Contemporary Sociology* 23 (1994): 501. In an answer to the question if he had changed his opinion, as expressed in the article from 1994, Trond Petersen answered (in an e-mail to the author, dated April 16, 2000): "My views are the same as before. I may have become even more insistent on the need for broad scale empirical work than before. Much GT [game theory] is for small-scale social situations, unless say the work of A. Przeworski on social democracy."
89. Raymond Boudon, "Comment on Hauser's Review of *Education, Opportunity, and Social Inequality*," *American Journal of Sociology* 81 (1976): 1178–1179.
90. See, e.g., Boudon, "Generating Models as a Research Strategy," and *The Logic of Social Action* (London: Routledge & Kegan Paul, [1977] 1981), 108ff.; Goffman, "Strategic Interaction"; Schelling, *The Strategy of Conflict*; Colin Camerer, "Progress in Behavioral Game Theory," *Journal of Economic Perspectives* 11/4 (Fall 1997): 167–188; Paul Milgram, Douglass North, and Barry Weingast, "The Role of Institutions in the Revival of Trade: The Law Merchant," *Economics and Politics* 2 (1990): 1–23; Avner Greiff, "Contract Enforceability and Economic Institutions in Early Trade: The Mahgrebi Trader's Coalition," *American Economic Review* 83 (1993): 525–546.
91. See, e.g., Augier and Swedberg, "Game Theory and Sociology."
92. For counterfactuals, see especially Max Weber, "Logic of Historical Explanation," 111–131 in Weber, editor, W. G. Runciman, *Weber – Selections in Translation* (Cambridge: Cambridge University Press, [1905] 1978), and *Economy and Society* (Berkeley: University of California Press, [1992] 1987), 11; Jon Elster, "Counterfactuals and the New Economic History," 175–221 in *Logic and Society* (New York:

John Wiley & Sons, 1978); and Neil Ferguson, *Virtual History: Alternatives and Counterfactuals* (London: Papermac, 1997).

93. Weber, "Logic of Historical Explanation," 112.
94. For "puppet show," see, e.g., Alfred Schutz, *Collected Papers, I. The Problem of Social Reality* (The Hague: Martinus Nijhoff, 1971), 42. For Schutz's argument that economic theory neglects the subjective reality of the actors and that the complexity of the rationality assumption dramatically increases when two actors take each other into account, see ibid., 31–35. For a rare reference to game theory in Schutz's work, see Richard Grathoff, *Philosophers in Exile: The Correspondence of Alfred Schutz and Aron Gurwitsch, 1939–1959* (Bloomington: Indiana University Press, 1989), 176.