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Games Real Actors Could Play: The Problem of Connectedness

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Games Real Actors Could Play: The Problem of Connectedness

Fritz W. Scharpf

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Abstract

This paper continues the examination, begun in MPIFG Discussion Paper 89/9, of the validity of game-theoretic explanations in empirical social science research. Assuming that real actors with bounded rationality would be unable to cope with the explosive complexity of n-person games, discussion focuses first on the conditions under which corporate actors and coalitions, as well as collective and even aggregate actors can be legitimately treated as unitary players. In addition, the importance of functional differentiation and ingroup-outgroup segmentation for the segregation of game-like interactions is explored. The paper concludes with an examination of the capacity of hierarchical organization, and of network-like patterns of ongoing relationships, to reduce the complexity of, and to increase mutual predictability in, game-like interactions.

* * * * *

In Fortsetzung von MPIFG Discussion Paper 89/9 untersucht der Aufsatz zunächst die Bedingungen, unter denen korporative Akteure, Koalitionen von Akteuren, kollektive Akteure oder sogar bloße Aggregate von Akteuren in spieltheoretischen Erklärungen empirischer Sachverhalte legitimerweise als einheitliche "Spieler" behandelt werden können. Anschließend wird die Bedeutung segmenteller und funktionaler Differenzierung für die Erklärungskraft spieltheoretischer Analysen diskutiert. Abschließend untersucht der Aufsatz die relative Eignung von hierarchischen Organisationsformen und von dauerhaften Beziehungsnetzen zur Reduktion der Komplexität und zur Steigerung der wechselseitigen Erwartbarkeit in strategischen Interaktionen.

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I. INTRODUCTION: THE CHALLENGE OF COMPLEXITY

This is the second of two articles addressing the question of whether, and under which conditions, game-theoretical explanations may be applicable in empirical social-science research. The question is worth asking because mathematical game theory, when interpreted as a reconstruction of the strategically interdependent choices of rational actors, imputes cognitive and computational capacities to its idealized "players" that appear quite unrealistic when compared to the bounded rationality of real-world actors. While the first article (Scharpf 1990) discussed various mechanisms that might nevertheless justify the assumption that actors are able to predict each other's payoffs and strategy choices, the present paper will focus on mechanisms that real-world actors resort to, and that researchers may legitimately reproduce, to keep the complexity of strategic interactions within cognitively manageable bounds. It will explore justifications for the prevailing practices of treating several or many actors as a single "player" and of reducing the size of "games" by restricting the analytical focus to subsets of interactions within wider sets of interdependent choices. Its purpose is to show that the conditions under which game-theoretical explanations may be usefully employed are approximated in a wider range of real-world constellations than one might expect in view of the seeming unrealism of the underlying assumptions.

The complexity of a game constellation may not deter mathematical game theorists, but the problem is of obvious importance for empirical researchers. To find the solution of a game played among x players, each of whom must choose among y strategies, actors are required to identify y^x n -tuples of strategies and to compare their outcomes. With only five players having to choose among three strategies each, that would already require comparison among $3^5 = 243$ different outcomes.

Given the fact that the solutions of rational-analytic¹ game theory are

¹ Discussion will be limited to "rational-analytic" applications of game theory that derive equilibrium outcomes from a reconstruc-

premised on the assumption that every player should anticipate the rational responses of all other players to the rationally expected moves of each of them, it is clear that the exploding complexity of simultaneous optimization² would quickly overtax the computational capabilities of human minds operating with working memories that are narrowly constrained by the "magical number seven, plus or minus two" (Miller 1956).³ Thus, if real actors should in fact cope

tion of intendedly rational ex-ante choices. Evolutionary and game-learning theories modelling the retention, rather than the choice, of specific outcomes will not be considered here. In the social field, they have considerable explanatory power - but only for repetitive choices under relatively stable environmental conditions.

² The argument presupposes the general case of n-person games in which all players have different sets of strategies and different payoffs. If these assumptions are relaxed, complexity is much reduced and even interactions among large numbers of actors may be amenable to game-theoretical analysis. That is true of "sophisticated voting" games in which one assumes that (potentially large) groups of players share the same payoff matrix, that all groups are limited to the same set of (preferably binary) choices, and that outcomes are determined through the simple aggregation of individual votes (Farquharson 1969; McKelvey/ Niemi 1978). Similar simplifications facilitate game-theoretical solutions of large "compound games," which are constituted by pairwise interactions among large numbers of players, all of whom are playing the same symmetrical two-by-two game against each other. Under these restrictive assumptions, it is easy to derive solutions for n-person Prisoner's Dilemma games, n-person Chicken games, n-person Assurance games, and so on (Colman 1982: 156-166). In the general case, however, there are no computational procedures that could help actors or researchers in coping with the exploding complexity of n-person non-zero-sum games (Colman 1982: 145).

³ Miller's experimental findings seem to have held up well over time, and it is now generally accepted that his "magical number" does in fact constrain the number of distinct "chunks" of information that can be simultaneously processed within the short-term working memory of the human mind. It should be understood, however, that these chunks may contain quite different amounts of aggregated information (Fischer 1989; Turner/ Engle 1989; Johnstone/ El-Bana, 1989). Thus, cognitive skills are increased, and human capacity for information processing is extended as available primitive bits of information are "compiled" into more encompassing concepts (Ander-

with interdependent choice situations according to the prescriptions of mathematical game theory, the games they play would in fact have to be very narrowly circumscribed.

The question is what these limitations mean for the explanatory power of game-theoretical analyses in real-world contexts. Apparently, these are characterized by ever greater - potentially global - interdependence among ecological, economic, cultural, and political factors and developments and, at the same time, by the decentralization, or even fragmentation, of large hierarchical organizations in the public and private sectors. But decentralization does not seem to imply independence. In the public sector it goes hand-in-hand with the rising importance of intergovernmental and neo-corporatist networks in policy making and policy implementation, while in the private sector the establishment of profit centers and the hiving-off of independent firms by large corporations is associated with the rise of subcontracting, just-in-time production, joint ventures, and world-wide cooperation in research and development - practices, that is, which enormously increase the operational interdependence among formally separate units. In short, we seem to live in a world in which both the number of separate actors and the interdependence among their choices increase simultaneously. Thus it might indeed appear that the limited scope of game-theoretical explanations is far exceeded by the complexity of real-world networks of interdependence and interaction.

Yet when they are applicable, game-theoretical equilibrium solutions are unmatched in their power to explain the stable outcomes of interdependent choice situations. Thus, before we abandon a potentially most useful, and even indispensable, instrument of empirical social-science research, it seems worthwhile to explore the conditions under which the focus of game-theoretical analyses might be legitimately narrowed. To begin, we might well remind ourselves that, in the real world, interdependence is still not everywhere (Aldrich 1979: 75-76) and, even more important, that not all instances of real interdependence are of the kind requiring game-like interactions. Thus, vast numbers of interdependent choices of producers and consumers in

world-wide economic transactions are in fact coordinated through market mechanisms that will aggregate interaction effects into prices that all buyers and sellers can treat as parameters unaffected by their own choices. As a consequence, multi-actor constellations that otherwise would have been immensely complex n-person games, are transformed into very simple games against nature.

Furthermore, for situations where market coordination is unavailable, James D. Thompson (1967: 54-55) has introduced the useful distinction between "pooled," "sequential," and "reciprocal" interdependence, each associated with specifically appropriate coordinating mechanisms. Thus, "coordination by standardization" is said to be the adequate solution for pooled interdependence, while "coordination by plan" is best suited for sequential interdependence. It is only reciprocal interdependence which seems to require "coordination by mutual adjustment" (1967: 56). For present purposes, what matters is that standardization and planning, while requiring intensive interaction during their formative phases, will drastically reduce the need for direct interaction once they are in place. Interdependent actors are then merely required to observe severally the standards defined by "routines or rules" or the decision "schedules" established by a plan. In both cases, the mental operations required of individual actors in the implementation of rules or plans appear to be cognitively much less demanding than the simultaneous optimization of choices in an n-person game involving the same number of actors. Hence it is only under conditions of reciprocal interdependence requiring mutual adjustment, when "the outputs of each become inputs for the others" (Thompson 1967: 55), that actors find themselves in the paradigmatic "game" situation where each must try to anticipate others' choices in the knowledge that they will do so as well.

Thus, in many of the situations where game-theoretical explanations might run into unmanageable complexity, they are in fact not needed. But even if much interdependence may not be reciprocal, many interactions that do in fact require mutual adjustment still seem to hang together in complex patterns. Just as decisions within organizations will often affect choices within families and vice versa, so interactions between union members and leaders have predictable

consequences for collective bargaining between unions and employers as well as for "corporatist" negotiations between unions and governments or central banks. These, in turn, may affect the electoral competition between governments and opposition parties (Scharpf 1987), as well as the attempts to coordinate fiscal and monetary policy measures internationally (Putnam/ Bayne 1984). Similar connections may be construed for practically all instances of reciprocal interaction within and between business firms, interest associations, political parties, parliamentary committees, government departments or international organizations.

But it is also clear that not all of these linkages can be fully reflected in the choices of actors involved in the larger network. Shop-floor union activists will be unable to assess the implications of Big-Seven summits for their own choices, and central banks may not be very knowledgeable observers of intra-union politics. In most real-world interactions, in short, the populations defined by the criterion of reciprocal interdependence are likely to be larger than the sets of actors circumscribed by the criterion of mutual awareness, which are again more inclusive than the small-numbers constellations within which actors are able to anticipate each other's choices with any degree of confidence and precision. In other words, even if the empirical domain of game-theoretical explanations is restricted to instances of reciprocal interdependence, we are likely to encounter patterns of interdependent choices whose size and complexity are beyond the ability, of actors and researchers alike, to identify equilibrium solutions in large n -person games.

It is not surprising, therefore, that empirical and historical studies that have made use of game-theoretical explanations have generally avoided the problem by focusing narrowly on constellations involving only a very small number of actors with few strategy choices. In fact, they usually manage to get by with a small number of archetypical two-person-two-strategy symmetrical games (such as the Prisoner's Dilemma and Chicken). In order to do so, however, they must implicitly or explicitly (e.g. Snyder/ Diesing 1977: 81-86) reduce the complexity of real-world interactions in one of two ways - by treating a plurality or even a multitude of separate actors as a composite

single "player," or by concentrating on a small segment of real-world interactions and ignoring the larger network of interdependent choices within which these are embedded. Both of these practices have been roundly condemned by game-theorists (e.g. Alt/ Eichengreen 1987). There is indeed no general algorithm in game theory that would permit players to be aggregated, and it has always been clear that games change their character if the existence of additional players is ignored in an attempt to focus on two-person interactions (Von Neumann/ Morgenstern 1944). But that merely suggests that if justifications for the prevailing practice can be found at all, they must be sought outside the confines of mathematical game theory as such, in the cognitive practices and institutional arrangements that permit boundedly rational real-world actors to cope with the potential complexity of interdependent choices. That, again, points to the need to draw upon the whole body of available social-science theory and findings in the construction of any kind of rational-choice explanation. I will begin with a discussion of the reasons that could justify treating composite actors as unitary players in game-theoretical explanations.

II. THE CONSTRUCTION OF UNITARY PLAYERS

Even though individuals may have considerable difficulty in managing their "multiple selves" (Elster 1979; Schelling 1984; Wiesensthal 1990), their partners and opponents will generally not hesitate to treat them as unitary actors in everyday encounters. That points to the significance of external attribution: Individuals are considered "actors" not because they have an easy time in making up their multiple minds, but because they are held individually accountable for their actions by their social environment.⁴ In other words, actors are

⁴ The point is emphasized by Luhmann (1984: 229) who, after noting that most actions should be explained not psychologically but situationally (a proposition with which rational choice theorists would emphatically agree), goes on: "Und trotzdem wird alltagsweltlich Handeln auf Individuen zugerechnet. Ein so stark unrealistisches Verhalten kann nur mit einem Bedarf für Reduktion von Komplexität

constructed by the attribution of actions. The same is even more clearly true of composite actors composed of several or a great many individuals who are perceived and treated as a unit in social interactions.

In game theory, the notion of a "player" is also no more than a label that is attached to a range of alternative courses of action and a set of associated payoffs. Thus there seems to be no reason why this label could not be attached to individuals, organizations, coalitions of organizations, nation states or alliances of nation states - provided that it is meaningful to ascribe choices and payoffs to these composite units. If the notion of a composite player nevertheless appears problematic, the difficulties seem to arise not from the absence of peculiar qualities of personhood, but from the specific demands that game-theoretic solution concepts make on the quality of choices - which may or may not be met in the case of individual or composite actors.

Game-theoretic solution concepts all seem to rely on a basic notion of "strategic rationality" (Elster 1983: 77) that presupposes not only the ability to anticipate the rational choices of other players, but also an ability to choose among feasible outcomes by maximizing a unified utility function. While individual players are often simply assumed to meet these requirements, the conditions under which they are likely to be met must be explicitly specified for composite actors. The first requirement presupposes a capacity to integrate potentially diverse perceptions of choice situations (Eden et al. 1981), while the second one strains the capacity for internal conflict resolution. More specifically, it presupposes an ability to construct a unified payoff matrix in the face of inherently diverse *substantive* interests, *intertemporal* interests and *interpersonal* interests held by their individual members. Since it is impossible to maximize more than one value at the same time, it is also inevitable that some of these competing priorities - of one kind over another, of one group over another, or of short-term over long-term interests - will have to be consciously sacrificed in the

erklärt werden." That seems fair enough, but how much would complexity be reduced if expectations of purposeful and consistent individual action were routinely disappointed?

choice of an optimal strategy. In that sense, strategic rationality could also be defined as the ability to accept, or to impose, these necessary sacrifices.⁵

For composite actors, the problem of strategic capability may be reduced to its interpersonal dimension, since different individuals may also care about different substantive concerns, and may have different time preferences.⁶ Hence, in order to be treated as players with strategic rationality, composite actors must either achieve a high degree of cognitive and normative integration of their members' action orientations, or they must have a capacity for discriminating against certain perspectives and interests, and hence against certain members. Different types of composite actors will meet these preconditions to differing degrees. But even when strategic capability is limited or absent, it may still be useful to model composite actors as unitary "players" in game-theoretic analyses - but as players whose moves are determined by the choices of their constituent members.

1. Corporate Actors

Corporate actors (Coleman 1974, 1981, 1990) are characterized by the existence of rules under which it is possible to arrive at decisions that are collectively binding on members, and that are able to commit collective resources. In that sense, they will indeed appear as unit actors from the outside - in the same sense in which a yacht operated by a multi-person crew will appear as a unit to its competitors in a

⁵ This definition of strategic rationality is broader than Elster's (1979: 4-18) "generalized capacity for global maximization" - which perceives rationality in purely intertemporal terms as a capability to relate to the future by pursuing "indirect strategies" (e.g. by investing or by strategic waiting). It seems clear, however, that rationality is as much impaired by an inability to accept tradeoffs among several types of substantive interests (wanting to eat one's cake and have it) or interpersonal interests (trying to please everybody).

⁶ In addition, a perceived lack of individual control over future choices may shorten the time horizon of all participants in collective-decision processes (Brennan/ Buchanan 1985: 78).

race. Whether such unit actors are capable of strategic rationality in the sense defined above seems to depend on the state of their internal decision rules and/or on the interaction orientations prevailing among their members (Scharpf 1989).

If internal rules permit binding choices by majority or hierarchical decision, strategic rationality may be achieved through discrimination - by decisions favoring some member interests and ignoring others. If the (de-facto) decision rule should be unanimity, however, discrimination among insiders is impossible. When that is so, the capacity for strategic action depends entirely on the second condition. When all members are willing and able to define their own choice criteria within a solidaristic interaction orientation⁷ or in terms relating to the collective interest of the group or organization as a whole (Coleman 1990: 383-387), even corporate actors operating under the unanimity rule will be able to arrive at strategically rational choices.

But the stipulated conditions will often not be met in practice. Even organizations whose formal rules seem to provide for hierarchical control or for majority decisions often must operate under de-facto unanimity, and solidaristic orientations are hard to achieve and even harder to maintain. Sometimes, under such circumstances, the corporate actor will disintegrate into smaller units, each of which can then be treated as a separate player capable of strategic rationality in game-theoretical analyses. More often, however, the corporate actor will remain collectively accountable and retain the capacity for collectively binding decisions - but with de-facto decision rules approaching unanimity, and with members or groups of members maximizing their separate, rather than their joint, interests. Such conditions have been analyzed in my article on the "joint-decision trap" in German federalism and in the European Community (Scharpf 1988). But while the focus there had been on the internal bargaining

⁷ While solidaristic transformations of the "effective matrix" (Kelley/ Thibaut 1978) are easily identified in experimental game research (Liebrand/ van Rung 1985; McClintock/ Liebrand 1988), there is little systematic knowledge about their preconditions in real-world choice situations.

games among members, the present perspective demands a view from the outside.⁸

In games with external opponents, a corporate actor in the joint-decision trap⁹ may still be represented as a single player having to choose a single move within a well-defined set of options. Its choice, however, is not derived from a unified utility function and a single cognitive map; it is a mere resultant of the self-interested choices of its constituent members - individuals, organizational subunits, or coalitions of these. Thus, the corporate actor's own capacity for strategic action in the external game is constrained, and its actual choices, when considered in isolation, would not conform to standard game-theoretical solution concepts. But these choices can be modelled as the outcome of a lower-level or internal game among its constituent members (Putnam 1988).¹⁰ Thus, if the internal game is played among self-interested members, and if collective choices will be separately evaluated, unanimous agreement is possible only if it appears preferable to the outcome associated with non-agreement (usually the status quo) for all groups whose agreement is necessary.¹¹ As a consequence, the corporate actor will become a highly predictable player in the external game.¹²

⁸ The complete pattern of interactions may, of course, be modelled as a more complex two-level game. The question here is whether the corporate actor might nevertheless be modelled as a unitary actor.

⁹ While that may be generally true of the external relations of the European Community, the foreign-policy choices of the Federal Republic of Germany are not always affected by the consensus requirements of federal-state bargaining.

¹⁰ This, essentially, is also the solution which psychoanalysis has found for conceptualizing the multiple selves of individuals (Turkle 1988).

¹¹ The possibility of side payments and of package deals may help to relax the Pareto constraint somewhat.

¹² However, players in the external game may not always treat the unity of the corporate actor as a useful "fiction" (Schimank 1988), and may aim their strategies directly at some players in the internal game - as is often true in interactions between government and large

The implications of such constellations for the external game are ambiguous. On the one hand, corporate actors with high internal consensus requirements will be unable to exploit new opportunities that are attractive on balance, but not for each member individually, and they will be equally unable to cut their losses in response to worsening conditions. That is clearly a disadvantage in games against nature as well as in zero-sum games against opponents with greater strategic capability. On the other hand, their very lack of strategic rationality will also make them resist compromises and appeals to common interest in cooperative positive-sum games unless these should be unequivocally attractive for all their members. Thus, corporate actors caught in the joint-decision trap may drive a harder bargain in game constellations resembling Battle of the Sexes or the Chicken game (Schelling 1960), when their known inability to make strategic concessions may force their partners to act on the maxim "*der Klügere gibt nach*" - assuming that they cannot avoid dealing with such an unattractive player altogether.

2. Coalitions

Phenomenologically, the case of corporate actors with internal factions and veto groups shades over into ad-hoc coalitions among independent actors joining forces for certain purposes. They are extensively treated in the game-theoretical literature. Indeed, when opportunities to enter into binding agreements are assumed to be present at all, the game-theoretical interest in n-person interactions shifts entirely to the level of characteristic-function analysis - i.e. to the problem of identifying subsets of players who, by joining a coalition, can do better for themselves than they could do by playing independently. The theoretical focus is on which coalitions are likely to be formed, and how the payoff obtained by a coalition will be distributed among its members, rather than on the strategies that such coalitions may pursue against their opponents (Rapoport 1970: 67; Kahan/ Rapoport 1984).

industrial corporations in the field of industrial R&D (Häusler 1990).

Unfortunately, however, this work will not contribute much to our present concern with reducing the exploding complexity of n-person games. In trying to determine which coalitions could profitably be formed, analysts must first find the solution to the original n-person game to identify the payoffs that each player could obtain independently. Thus it is no wonder that practically all analytical treatments of coalition problems deal with extremely simple types of n-person games, such as voting games or "compound games," in which strategies and payoffs are standardized and easily aggregated.¹³ And even within these limitations, theoretically derived conclusions about which coalitions (e.g. "minimum winning coalitions") ought to be formed, and how the total payoffs obtained by a coalition ought to be distributed among its members (e.g. according to their "Shapley values"), are neither easily reproduced under experimental conditions (Selten/Schuster 1970) nor confirmed by empirical research on parliamentary coalitions (Nolte 1988). Perhaps it was unrealistic to expect that one might ultimately capture the multi-dimensional perceptions, preferences and strategic options involved in real-world coalition bargaining in such simple algorithms as the "size principle" or the Shapley value. But even if the size and composition of coalitions still need to be determined empirically, rather than by theoretical deduction, they may nevertheless be legitimately modelled as unitary actors in their external interactions. Hence the ubiquitous tendency of individuals and organizations to form coalitions will indeed help to reduce the empirical complexity of n-person interactions.

For present purposes, therefore, what matters are the processes and criteria by which coalitions define and select their collective strategies (Tsebelis 1988). While these will vary empirically, coalitions will generally differ from corporate actors by the fact that their existence, or at least their identity, is more affected by the exit of individual members. Thus it seems plausible to assume that all coalitions, while they last, must reach their decisions by unanimous agreement. If it is further assumed that members will join a coalition in order to maximize their individual self-interest (rather than solidaristically defined

¹³ See Riker/ Ordeshook (1973), Ordeshook (1986) and the literature cited in note 2 above.

common interests), conditions will correspond to the joint-decision trap discussed above - except that the exit option may be more readily available. But this difference would make a difference: When the cost of exit is low, agreements are more likely to reflect the current preferences of all members than is true in corporate actors where the "default condition" in case of non-agreement (Ostrom 1986) tends to favor the status quo of past decisions (Scharpf 1988).

3. Collective Actors

But corporate actors and coalitions of actors with a capacity for making collectively binding decisions are not the only type of composite actors that may legitimately be treated as unitary players in game-theoretical explanations. Under certain circumstances, even a multitude of individuals acting separately (rather than through an organization) may meet that condition. That is true of instances of "collective action" which are characterized by the purposeful self-coordination of individual choices. Such coordination may be possible without the intervention of an organized corporate actor, or even of informal leaders, not only in small face-to-face groups or in mass demonstrations and uprisings where everybody is able to observe everybody else, but even in geographically dispersed social movements. But self-coordinated collective action presupposes a highly salient interest or action motive that all members of the movement may impute to each other, and it must rely on highly visible and unambiguous events to which the response of all members may be safely predicted by each of them. When these conditions were in fact present, the anti-nuclear protest movement, the peace movement and the democratic protest movements in Eastern Europe were extremely effective collective actors indeed. Yet when the ordinary ambiguity of action situations reasserts itself, social movements must either transform themselves into corporate actors (such as organized interest groups or political parties) or they are likely to disintegrate into a plurality of divergent groups, or dissolve altogether (Offe 1988; 1989).

Even under the best of circumstances, however, the strategic capability of collective actors remains limited. Though their members may

share solidaristic orientations, and may even be willing to accept considerable sacrifice in the pursuit of their collective goals, their dependence on self-coordinated spontaneous action practically precludes the possibility of longterm or indirect strategies, or of strategic self-restraint to consolidate limited gains or to avoid overshooting. Moreover, being constrained to use coordination strategies that must be "obvious" for all members (Schelling 1960), their actions are also easily anticipated by others. Thus, if they do not succeed by the sheer force of direct mass action, they will often be outmaneuvered by organized opponents with lesser numbers and resources but a greater capacity for dissimulation, strategic waiting and indirect strategies.¹⁴ Nevertheless, if allowance is made for the limits of their strategic capabilities (and hence for the resulting asymmetries in games played against opponents with greater strategic rationality), there is no reason why collective actors should not be modelled as single players in game-theoretical explanations.

4. Aggregate Actors

At an even lower level of strategic capability, the same may also be true of mere aggregates of actors consisting of similarly situated individuals that do not even attempt to coordinate their separate actions. Still, if their interests and situational constraints are similar, it will make sense for others to anticipate their aggregate responses to a given stimulus as if they were a single composite actor. The resulting game will, of course, be highly asymmetrical - but it is still different from a game against nature, since the individual members of the aggregate actor will not only respond to, but are able to anticipate, the moves of other players who are capable of strategic action.¹⁵

¹⁴ A textbook example is provided by the rise and fall of the Paris Commune (Haffner 1987).

¹⁵ Thus, Monetarists and Rational Expectations theorists claim that governments lost their power to affect real economic activity when firms, workers, and households learned to anticipate the fiscal and monetary stimuli of countercyclical demand management. The

As George Tsebelis (1989) has argued, the proper way to model interactions between aggregate actors and corporate actors of comparable magnitude is as a sequential game in which the aggregate actor must move second, responding to available information about the first move of the strategic actor (who should be modelled as a "Stackelberg leader").¹⁶ The reason seems straightforward: If the aggregate player is constituted by a large number of uncoordinated actors, all of these must calculate their own choices individually without being able to count on their aggregate power. Thus, since each of them could not individually influence the choices of the strategic opponent, none of them will have reason to try making a preemptive first move.

It should be noted, however, that Stackelberg followership is not necessarily a disadvantage. As Tsebelis has further shown, moving first is clearly advantageous only in games with more than one Nash equilibrium (e.g. in Chicken and Battle of the Sexes), none of which is jointly preferred by both players (as would be true in the Assurance game). In games with a single equilibrium, the sequence of moves does not matter, while moving last is preferable in games that have no equilibrium in pure strategies. Thus, there are again certain game constellations in which composite actors, who as such are incapable of strategic rationality, will do well playing against corporate actors with fully developed rational capabilities.¹⁷

implication is, of course, that game-theoretic models should be superior to the response functions of conventional macro-economic models in representing the interactions between economic-policy makers and their target populations.

¹⁶ The implications of leadership and followership were first analyzed in the context of oligopolistic markets (Stackelberg 1934). They have since been generalized to characterize a specific "Stackelberg equilibrium" in sequential games (Rasmusen 1989: 79-80).

¹⁷ This corresponds well with my earlier reconstruction of the nested economic-policy coordination and election games played between unions, governments and electorates in the 1970s (Scharpf 1987). As it was played by Keynesian governments, the game had no overall equilibrium solution. Thus even organizationally fragmented unions, lacking the capacity for strategic commitment, were

Moreover, under certain conditions not considered by Tsebelis, aggregate actors may even be able to make the first move in interactions with corporate actors. That may be so when their members are responding to external events that could be construed as a move of "nature,"¹⁸ or of human actors outside of the game presently considered.¹⁹ Even more interesting from a theoretical point of view are "autodynamic processes" (Mayntz/ Nedelmann 1987) in which first-move capabilities are endogenously generated by the individual members of a population who are responding to each other's choices - without, however, attempting or achieving purposeful coordination.

Instances that seem amenable to a game-theoretical interpretation include interactions between currency speculation and national monetary policy or, even more dramatically, between mass emigration from the GDR and the unification policy of the West German government in the Winter and Spring of 1990. These events can be modelled as a sequential game in which the government, against its own time preferences, found it necessary to propose an early currency union under the threat of escalating emigration.²⁰ In the absence of purposeful coordination, this first-move capability of an aggregate player was generated by individuals responding to a deterioration of their present circumstances caused by the disappearance of fellow workers, teachers and doctors in the neighborhood, and to news about the rapid

able to exploit governments that were committed to maintain full employment. As played by Monetarist governments, however, the game had a single equilibrium outcome that could not be exploited by unions, regardless of their strategic capability.

¹⁸ Think of emigration in response to a famine.

¹⁹ Thus, the decision of the US Federal Reserve to raise dollar interest rates in 1980/81 had a massive impact on the investment behavior of European firms - which then could be construed as a first move by business (perceived as an aggregate actor) in the economic-policy games of European countries.

²⁰ While it was clear that not everybody could or would leave the GDR, there was no way in which the population that was "threatening" to leave could have been circumscribed - a fact which did not detract from the perception that governments were in fact playing a loosing game against a well defined opponent.

rapid overcrowding of housing and job markets in West Germany. Analytically, their relationship with one another might also be represented as game,²¹ and the overall pattern of interactions could perhaps be modelled as a complex multi-level game involving also the West German electorate, the East German government, several foreign governments and diverse international organizations.²² What matters here, however, is the simpler point that interaction effects among the members of a population may indeed transform that population into an aggregate player with first-move capabilities in games played against external opponents.

To summarize: I have tried to show that the prevailing practice of treating a plurality of actors as a single player in game-theoretical applications is often fully justified. In the case of corporate actors relying on institutional arrangements that permit collectively binding decisions to be made, that is perhaps obvious - and the same may be true of actors who have joined together in a coalition. What may be more surprising is the fact that "collective actors" depending on spontaneous self-coordination, and even uncoordinated "aggregate actors," may also be legitimately modelled as single players in game-theoretical analyses. What needs careful attention, however, are the ensuing asymmetries of strategic capabilities - that is in the ability of composite players to optimize their choices in the substantive, the intertemporal, and the interpersonal dimension. Nevertheless, a lack of strategic capability on the part of some or all players does not rule out game-theoretical analysis, and it does not even necessarily imply unfavorable outcomes in games played against more rational opponents.

²¹ It might be represented as a simultaneous n-person "Commons Dilemma" (Hardin/ Baden 1977), or as a sequential dilemma game with individual players having different "thresholds" of sensitivity or facing different constraints (Granovetter 1978; Granovetter/ Soong 1983).

²² But, as Werner Güth had reason to remark at a recent conference on Connected Games: "Modelling is easy; solutions are the problem."

III. THE SEGREGATION OF GAMES

While the first part of this article discussed various ways in which composite actors might legitimately be treated as unitary players in game-theoretical explanations, the focus is now shifted to the second simplifying strategy that is generally pursued in historical or empirical applications. It seeks to reduce the complexity of n-person games by focusing narrowly on some interactions among a few players, while ignoring other interactions in which the players are also involved. Again, the game-theoretical legitimacy of such practices is doubtful. When connections do exist, they may only be ignored if the narrower segment selected can be isolated as a subgame whose equilibrium solution does not depend on the wider context of interactions (Ordeshook 1986: 139-142) - a condition which usually is neither shown to be true nor a-priori plausible. At the same time, however, it can be shown that game-like interactions are in fact dependent on mechanisms that, somehow, are able to segregate relatively small "constituent games" from the wider networks of interactions in which they are embedded.

1. The Need for Barriers Against Uncertainty

Within empirically oriented game research, these questions are addressed by an emerging literature on "linked," "nested" or "multi-level games."²³ Even though there is as yet no explicit agreement on what distinguishes constituent games from mere connections among such games, information asymmetries (and hence an element of surprise) seem to be significant in most treatments. An example is provided by Ken Shepsle's (1985) discussion of "interconnections" among games. In the illustration he uses, A is simultaneously playing against B and C; he is trying to maximize the sum of his payoffs from both games, and he is constrained to use the same strategy in both games. What

²³ The literature includes works by Denzau/ Riker/ Shepsle (1985); Shepsle (1985); Alt/ Eichengreen (1987); Scharpf (1987); Alt/ Putnam/ Shepsle (1988); Putnam (1988); Milgrom/ North/ Weingast (1988); Tsebelis (1988; 1990).

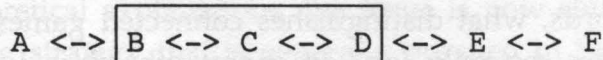
is critical is the further assumption that neither B nor C should be aware of the fact that A is playing against anyone else, so that A's choice of an optimal strategy may surprise one or both of them. However, if B and C had been aware of this connection, the linked game would have been transformed into an ordinary three-person game.²⁴ In other words, what distinguishes connected games from n-person games in this example (and in many others) is incomplete information about the payoffs of at least one player on the part of some other players - who are furthermore assumed to be unaware of their own ignorance.

These are special assumptions, that may bring to mind the caveat that "by cleverly choosing the nature of uncertainty ... one may get out of game-theoretic analysis whatever one wishes" (Kreps/ Wilson 1982: 276). At any rate, the conditions specified are unlikely to be stable. Some of the players will be surprised by the outcome, and hence will have reason to change their expectations and their strategies. If they become fully aware of the games that are in fact being played, the interaction will become an n-person game with complete information. Of greater theoretical and practical interest, however, is the possibility that actors will become aware of the fact of their interconnectedness without becoming fully informed of each other's strategies and payoffs - and hence of the precise form of the game that the "hinge player" is in fact playing. In other words, while information will still be incomplete, the fact that a game of incomplete information is being played is common knowledge.

To explore the implications of such constellations, consider a thought experiment in which actors are involved in an extended chain of Shepsle-type interactions in which each player is constrained to use a single strategy against both neighbors while trying to maximize the joint payoff from both games. Assume further that players are aware of the involvement of all other players, but that their knowledge of

²⁴ The point is made explicitly by Alt/ Eichengreen (1987: 17) when they state that "in a full information setting an overlapping game is analytically indistinguishable from a standard three-player noncooperative game."

others' strategy options and payoffs, and hence their ability to anticipate others' strategy choices, extends only to their proximate neighbors.



Take the case of player C, who will know that her neighbor D is also involved in a game with E, and is trying to maximize the combined payoffs from both games. But since C is unable to know E's true payoffs (which are known to D), she is also unable to estimate D's optimal response in the D-E game, and hence she will not be able to anticipate D's optimal strategy against herself. The same is true if C turns her attention to the game against B which is similarly affected by her ignorance of A's payoffs. The situation would not change if the information constraint was relaxed so that C would also know the payoffs of the D-E game, but remained ignorant about the E-F game. By a process of backward induction, ignorance of E-F would invalidate her estimate of D-E, and hence of D's optimal strategy in C-D as well. Thus, if information constraints apply anywhere in a network of connected games, uncertainty will spread throughout the network. In my preceding paper, I have argued that insuperable uncertainty about others' payoffs (and, hence, about their likely strategy choices) will persuade rational players to prepare for the worst by adopting cautious strategies themselves. The same conclusion is reached in discussions of the efficiency-losses resulting from expectations of "opportunism" in the transaction-cost literature (Williamson 1975; 1985). To illustrate these losses even under conditions in which the interests of the players potentially coincide, take the example of an Assurance game. Here, the optimal outcome of mutual cooperation is only assured if both players are informed of each other's payoffs, if each of them is certain of the other's knowledge of these payoffs, and if each of them trusts the other's rationality. If there should be doubt about any one of these elements in either player's mind, "defection" (assuring each player at least her maximin payoff) would become a rational choice (Raub/ Keren 1990). Moreover, if both should proceed from the same skeptical assumptions, the outcome would be self-

validating, since mutual defection is in fact a Nash equilibrium in the Assurance game.²⁵

	c	d		c	d
cooperate	4 4	1 3	c	4 ?	1 ?
defect	3 1	2 2	d	3 ?	2 ?

Diagram 1: Assurance Game With Incomplete Information

Of course, if all players pursue cautionary strategies, the outcomes they will be able to achieve will be individually and collectively suboptimal since they will be unable to take advantage of opportunities for cooperation or unilateral exploitation that might have arisen under complete-information conditions. But if inefficient outcomes are in fact game-theoretical equilibria, they will not be self-correcting. Hence there is no reason to think that generalized suspicion and caution cannot prevail in reality - they seem to have been approximated in 18th-century Naples (Pagden 1988) for instance, or in the GDR until very recently, and they also seem to prevail in many big-city ghettos. Nevertheless, highly interdependent modern societies could not function as they do if pervasive distrust were a universal characteristic of interactions (Luhmann 1988a). Thus our thought experiment encourages us to search for mechanisms that real-world actors could rely upon to increase their ability to predict each other's strategic choices.

A considerable degree of predictability is, of course, created by systems of rules, conventions and routines. They were mentioned

²⁵ The same would be true a fortiori when the cautious strategy is dominant, as is true in the Prisoner's Dilemma. In Chicken, a cautious player might be surprised by the opponent's cautious (and cooperative) move, and might be tempted to exploit it in the next round. But since the same idea might also occur to the opponent, caution would continue to be the better part of valor.

above as instruments of "standardization," facilitating coordination under conditions of "pooled interdependence." But rules, conventions and routines are also important in situations of "reciprocal interdependence" and in game-like interactions. If their prescriptions are common knowledge, they will create conditions of mutual predictability among actors who otherwise could not rationally anticipate each other's choices (Nelson/ Winter 1982; Heiner 1983).²⁶ Nevertheless, standardized rules provide at best limited solutions to the problem of mutual predictability. They will not be able to represent idiosyncratic concerns, nor will they be adequate for highly variable situations. They often need to be complemented by more fine-grained information about others' payoffs and strategy options. In my earlier paper, I have tried to show how the possibility of highly specific and trustworthy communication may arise endogenously from ongoing interactions among groups of actors benefitting from opportunities for mutual observation and sanctioning (Scharpf 1990). The question now is how such communication may be protected against the uncertainty and distrust arising from the outside contacts of all parties involved. There seem to be essentially three mechanisms that could effectively segregate sets of otherwise interdependent interactions from each other.

2. Ingroup-Outgroup Boundaries

The first of these mechanisms can be derived directly from the chain-like model used above. When further connections are added, players will have more immediate neighbors of whose payoffs they have complete information. If such highly connected clusters of actors were to form completely isolated groups, everybody could then anticipate

²⁶ When the underlying problem has the structure of a "game of pure coordination", standardization may be achieved through "conventions" arising spontaneously (Schotter 1981). By contrast, in "social dilemma" situations (where individual and collective interests diverge), the "evolution of norms" is either dependent on ongoing interactions within small groups (Kliemt/ Schauenberg 1984; Coleman 1986) or will require purposeful collective action (Brennan/ Buchanan 1985; Ostrom 1989; 1989a).

everybody else's choices. That is, of course, an unrealistic condition. But even if all members of a cluster have known outside contacts, the backward induction of uncertainty could be prevented by a rule according to which members of an ingroup should not trust the communication of outsiders. The rule would transform all external contacts into games with incomplete information in which ingroup players must derive their choices entirely from their own payoffs. Since these are known, the predictability of ingroup interactions would no longer suffer from outside contacts.²⁷

The resulting pattern would resemble the "amoral familism" which Edward Banfield (1958) had found in his study of backward villages in the South of Italy where trust and cooperation within the family coexisted with complete distrust and morally unrestrained cheating among individuals not belonging to the same family. Another, more modern example is provided by the norms of solidarity within, and ritualistic hostility between, partisan factions that Renate Mayntz and Friedhelm Neidhardt (1989) found in the political culture of the West German parliament.²⁸

Despite their archaic overtones, ingroup-outgroup boundaries do in fact seem to structure substantial areas of social interaction in which hostility, or a competitive orientation, toward outsiders help to maintain trustworthiness, and perhaps solidarity, among insiders. Examples that come to mind include not only organized crime or instances of intense religious, ethnic or national conflict, but much of competitive politics, competitive sports and competitive business - including the "clan"-like combinations of Japanese firms that are said to be internally solidaristic while engaged in fierce competition with each other (Ouchi 1984; Deutschmann 1989).

²⁷ Going beyond mere uncertainty, the same purpose would be served by a norm according to which outsiders are presumed to pursue hostile purposes.

²⁸ The findings fit perfectly with Carl Schmitt's (1932) famous definition of politics as a "friend-foe relationship."

If the ingroup/outgroup distinction were the dominant organizing principle, societies would be segmented into non-overlapping groups of actors within which trustworthy interaction is possible, while all contacts between such groups would be characterized by distrust and generalized caution. Yet modern societies could not function as they do²⁹ if competitors in business could not also cooperate in the same political party; if members of different political camps could not trust each other's research findings; or if adherents of different religions could not play together on the same soccer team. In short, while ingroup-outgroup segmentation may facilitate trust by creating boundaries of distrust, there must be additional mechanisms that are able to shield trustworthy communication from interference by the multitude of external interactions that actors must simultaneously maintain.

3. Functional Boundaries

In the interpretation of post-Parsonian functionalist sociology (Luhmann 1984), functionally specialized societal subsystems - including politics, law, science, or the economy - are construed as self-referential and "autopoietic" systems of meaning, each with its own function-specific "code" and "medium" of communication. Communications that are not expressed in the specific code of a particular subsystem, and that are not supported by its appropriate medium, are simply meaningless and hence irrelevant within that subsystem. As a consequence, "intersystemic discourse" is considered to be difficult if not downright impossible (Luhmann 1986; Willke 1989) - an interpretation that seems to find support in the apparent difficulties of political control of the

²⁹ Drawing upon insights from Max Weber's studies in economic history, Siegwart Lindenberg (1988: 43) has recently pointed out that it is not only the "opportunism with guile" expected from outsiders, but also the norms of "strong solidarity" among insiders, that would be incompatible with the functioning of a modern, capitalist economy. It seems indeed likely that groups united by their common distrust of outsiders will be *Gemeinschaft*-like (Tönnies 1935) in their internal interactions - and hence would operate under sharing norms that work against capital accumulation.

economy (Luhmann 1988), of the legal system (Teubner 1989), or of the science system (Mayntz/ Scharpf 1990).

In the present context, however, it is important that functional differentiation may be even more effective than ingroup-outgroup differentiation in protecting interactions against the backward induction of uncertainty. If communications pertaining to different systems of meaning are insulated from each other by boundaries of irrelevance, a vast range of outside contacts may simply, and safely, be ignored by the parties to a present interaction. Individual and corporate actors, in other words, may simultaneously participate in multiple interaction systems that are not necessarily separated by boundaries of suspicion and hostility. As a consequence, a much larger number of separate games can be played side-by-side in functionally differentiated societies than would be possible in societies that are merely segmented by ingroup-outgroup differentiation.³⁰

Yet while boundaries of irrelevance will protect trustworthy communications from external interference, they cannot create the positive preconditions of mutual predictability. Take the science system, whose boundaries are, of course, much too wide to structure mutual expectations among all scientists. While the truth "medium" may indeed validate communications within narrow disciplinary specialties, all other interactions among scientists must draw on precisely the same sources of trustworthiness that serve the rest of society - communication in the unspecific medium of ordinary language combined with personal familiarity or diffuse reputation mechanisms. The same is true everywhere else: the fact that communications are part of the same functional subsystem may assure relevance and facilitate understanding, but it cannot by itself create the preconditions of trustworthiness. Moreover, modern societies also depend on predictable

³⁰ Yet one should not deny, as Luhmann does, that it is actors, individual and corporate, that act within these functionally differentiated subsystems which, therefore, can never be watertight compartments. Thus, it may need conflict-of-interest rules to strengthen the boundary between business and politics, and ubiquitous instances of corruption and nepotism in high places suggest that, even when so reinforced, segregation mechanisms are far from failure proof.

interactions cutting across functional boundaries - as between scientists and corporate managers in industrial research, between lawyers and politicians in the legislative process, or between administrators and artists in a state orchestra. The fact that such communications between functional subsystems must cross boundaries of irrelevance may make them more difficult but not, apparently, impossible. Thus, we need to extend our search further to mechanisms that are not merely able to protect existing game-like interactions against the uncertainty arising from outside contacts, but that could also create the positive preconditions of mutual predictability in such interactions.

IV. PREDICTABILITY IN HIERARCHIES AND NETWORKS

There are two extreme conditions, both of them touched upon earlier, under which the problem of predictability is minimized. In anonymous markets, near certainty is assured by the combination of market prices and sanctioned systems of rules while in *Gemeinschaft*-like ingroups, or "clans" of such groups, the same effect is achieved by norms of solidarity.³¹ Beyond these extremes, the transaction-cost literature sees the solution to the problems of "opportunism" (which can be equated with our concern for mutual predictability) in the existence of two types of structural arrangements - vertically integrated firms and "relational contracts" among firms (Williamson 1975; 1985; Macneil 1980). Going beyond the economic realm, hierarchical organization and relatively permanent networks of intra- and interorganizational interactions appear to be generally available as (alternative or complementary) solutions to the problem of mutual predictability. The question is how they can be reconstructed and employed in game-theoretic analyses.

³¹ Like market prices, the norm of solidarity also has the effect of radically simplifying the cognitive complexity of interactions. If the "given matrix" is a mixed-motive game, the solidaristic injunction to "maximize joint gains" will always transform it into a much simpler game of pure coordination (Scharpf 1989).

1. Hierarchical Organization

In our discussion of corporate actors above it was implied that hierarchical organization may justify treating several or many individuals as a single actor with integrated goals and consistent strategies. In the present context, that assumption needs to be examined more closely by distinguishing among two different concepts, unilateral power and nested structural arrangements, that are generally associated with notions of hierarchical organization. Of these, the second one is more obviously important for present purposes.

As Herbert Simon (1962) has emphasized, in the physical and biological world, complex systems are most likely to evolve in hierarchical or modular form, with semi-independent units nested within more encompassing structures - e.g. atoms within molecules, molecules within cells, cells within organs, and so on. The superior evolutionary fitness of hierarchical forms of organization is said to rest on the "near decomposability" of constituent units - meaning that "intra-component linkages are generally stronger than intercomponent linkages" (Simon 1962: 477). Applied to human interactions, the notion of decomposability suggests that actors ought to be grouped into organizational subunits according to the intensity of their interactions. If decomposability were perfect, there would be no need for interactions across units - a state which, in game-theoretical terms, would correspond to the concept of subgame-perfect equilibria. If that ideal cannot be attained, Simon's approach suggests that the efficiency of hierarchical organization depends on the degree to which it is possible to confine strong interactions to smaller subsystems which, even though not independent from each other, are only linked by weaker second-order bonds. But what should that mean in game-theoretical terms?

It is here that the second aspect of hierarchical organization, unilateral or at least asymmetrical power, needs to be considered. Regardless of the benevolent or predatory purposes for which it is exercised,³²

³² Simon seems to consider only "natural" hierarchies that increase evolutionary efficiency. Similarly, the efficiency gains of

hierarchical power seems to imply three asymmetric capabilities: Superiors are able to define general rules and associated incentives to structure the strategy options and payoffs of subordinates acting alone or interacting with one another (one might call this the "legislative" function); superiors may override subordinates' choices in specific cases ("executive" function); and superiors may settle conflicts among subordinates ("adjudicative" function). In game-theoretical analyses, all three functions may be represented by appropriate models of sequential games (Thompson/ Faith 1980; Kliemt/ Schauenberg 1984).

The "legislative" (or "constitutional")³³ function of hierarchical direction implies that the superior must move first to set the parameters that are relevant for the subsequent games that are to be played among the subordinates.³⁴ Since games are completely specified by the set of permissible players, the set of their permissible strategies, and the set of payoffs associated with each n-tuple of strategies, the legislative function of hierarchical power may extend to all three types of parameters. It may affect the set of permissible players by creating organizational structure and by assigning subordinates to particular units; it may affect the set of permissible strategies by specifying tasks and assigning competencies to subordinates; and it may affect the set of outcomes by specifying the incentives and disincentives associated with specific outcomes. In the ideal case (that can hardly be realized in practice), well-specified parameters will so structure the game played among subordinates that its equilibrium outcome will

hierarchical solutions to opportunism or free-rider problems are emphasized in economic transaction-cost (Williamson 1975) and principal-agent (Pratt/ Zeckhauser 1985) theories. By contrast, public-choice theorists (e.g. Brennan/ Buchanan 1985) and political scientists (e.g. Levi 1988) have generally been more sensitive to the basic ambivalence of the Leviathan.

³³ The term suggests that hierarchical authority may be created and exercised through collective action of the "subordinates" involved (Brennan/ Buchanan 1985) - but, of course, that is not the historically typical way in which the state has come about (Coleman 1990).

³⁴ I will not treat the simpler case in which the superior is only involved in bilateral relations with subordinates that do not interact with one another.

serve the superior's purposes without any need for subsequent (executive or adjudicative) intervention. For an illustration, think of the story behind the Prisoner's Dilemma game (Diagram 2).

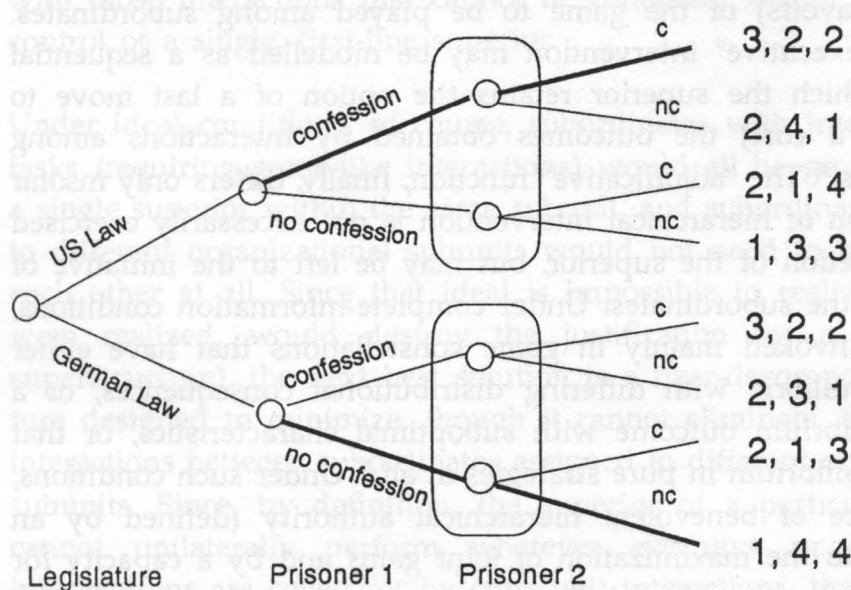


Diagram 2: Legislative Choice of Prisoners' Games

That story presupposes a prior exercise of the legislative function specifying American-type rules of criminal procedure (which permit the non-prosecution of crown witnesses). If the legislature had adopted traditional German rules of procedure instead (where a confession by one or both prisoners would at best buy a moderate reduction of the sentence), the prisoners would have found themselves not in Prisoner's Dilemma but in an Assurance game, in which non-confession would be a Pareto-superior equilibrium. For an American-type legislature, with a revealed preference for prosecutorial convenience,³⁵ that would be a worst-case outcome.

³⁵ In West Germany, the recent introduction of crown-witness privileges in certain types of cases also suggests a weakening of the traditional preference for punishing all known violators of the law.

What matters here is that the legislative aspect of hierarchical control can indeed be captured in game-theoretical models of sequential games permitting the superior to specify *ex ante* the rules (in this case, the payoffs) of the game to be played among subordinates. Similarly, "executive" intervention may be modelled as a sequential game in which the superior retains the option of a last move to correct (at a cost) the outcomes obtained by interactions among subordinates.³⁶ The "adjudicative" function, finally, differs only insofar as the option of hierarchical intervention is not necessarily exercised at the discretion of the superior, but may be left to the initiative of any one of the subordinates. Under complete-information conditions, it will be invoked mainly in game constellations that have either multiple equilibria with differing distributional consequences, or a single equilibrium outcome with suboptimal characteristics, or that have no equilibrium in pure strategies at all.³⁷ Under such conditions, the existence of benevolent hierarchical authority (defined by an orientation to the maximization of joint gains and by a capacity for redistribution) may indeed help actors to overcome the inefficiencies associated with noncooperative games or self-interested bargaining.

If we now return to the problem of near-decomposability, it is clear that organizational structure will matter only when we have at least a two-level authority relation. In a single-level hierarchy, legislative specification will only affect the permissible strategies and payoffs (incentives and disincentives) of subordinates. If they are not well specified (and often they cannot be), the share of interactions requiring executive or adjudicative intervention will be large. Given the bounded capacity of superiors, the need for frequent intervention³⁸

³⁶ The notion is similar to, but not identical with, the concepts of "moving power" and "staying power" developed by Steven Brams (1983) to characterize the power advantage of "superior beings."

³⁷ The game-theoretic notion of mixed-strategy equilibrium does not seem to make sense within the range of empirical phenomena - intra- and interorganizational interaction in policy processes - that this article draws upon.

³⁸ That is not meant to deny the importance of supervision even when subordinates are not engaged in game-like interactions with

will impose tight limits on the number of subordinates that can be assigned to a single unit. As a consequence, multi-unit organizations will be confronted with problems of organizational design to deal with those interactions that cannot be contained within the span of control of a single, first-line superior.

Under ideal conditions, of course, subordinates with interdependent tasks (requiring game-like interactions) would all be grouped under a single superior within the same subunit, and subordinates assigned to different organizational subunits would not need to interact with each other at all. Since that ideal is impossible to realize (and if it were realized, would destroy the justification for a hierarchical superstructure), the next best solution is a near-decomposable structure designed to minimize, though it cannot eliminate, the need for interactions between subordinates assigned to different organizational subunits. Since, by definition, the superior of a particular subunit cannot unilaterally perform whatever executive or adjudicative interventions are called for by cross-unit interactions, these interventions will be determined in a second-level game among the superiors involved - which again is subject to executive and adjudicative interventions from the next higher level of the organizational hierarchy.

Thus, an optimally decomposed organizational structure would be created first by rules defining strategy sets and payoffs of subordinates in such a way that the need for executive or adjudicative intervention by superiors is minimized and second by rules assigning subordinates to organizational subunits in such a way that the share of necessary interventions that can be handled by first-line superiors is maximized. Moreover, subunits should be grouped into higher-level units by the same criterion.

Under such conditions, the close and long-term association among subordinates, combined with the possibility of appeal to a common superior with the power to reward, punish or compensate, will create favorable (if not sufficient) conditions for trustworthy communication

each other.

and binding commitments within organizational subunits. Interactions cutting across such units could then be defined as being of a different quality. They would not be construed as games played among subordinates (in which case the possibility of hierarchical intervention on either side would reintroduce an element of irreducible uncertainty). Instead, their resolution would be delegated upwards to the game played among superiors at the next higher hierarchical level. To the extent that these interactions should not themselves have unproblematic equilibrium outcomes, resolution would again be delegated upward to a common superior - who also would have the power to impose redistributive solutions, to reward cooperation, and to compensate losers. When these conditions are met, nearly-decomposed hierarchical organization appears indeed as an eminently suitable mechanism for avoiding, or at least minimizing, the efficiency losses associated with the backward induction of uncertainty in overly complex game-like interactions.

But that optimistic conclusion rests on two critical assumptions - that hierarchical power is indeed unilateral power, and that the patterns of reciprocal task interdependence are decomposable to such a degree that the cognitive and conflict-resolution capacity of higher-level authority will not be overloaded by the need for hierarchical intervention. In the real world, however, both assumptions are often not fulfilled. To begin with unilateral control: In democratic institutions, governments or leaders may exercise hierarchical authority over citizens or members, but they are at the same time dependent on their constituents for the continuation of their authority. When that is true, authority turns into a circular relationship. And even within organizations that are not formally democratic, such as business firms and government bureaucracies, control relations are often ambivalent. Superiors become dependent on the skill, the information resources, and the outside contacts of their professional staffs, and they are vulnerable to shop-floor conflicts interrupting production schedules.

To the extent that this is true, unilateral control is eroded, and formal hierarchies are transformed into more balanced relationships of mutual dependence. In game-theoretic terms, these can no longer be represented as relatively simple sequential-game models, in which

superiors always have the first unconstrained move, while subordinates are struggling to reach their predefined subgame-perfect equilibria, or in which superiors can unilaterally correct subordinates' choices. Instead, interactions will turn into much more complex simultaneous games where everybody must try to anticipate everybody else's choices, and where subordinates' strategy sets will also include "most threatening strategies" (Liebrand 1983) against their superiors. When that is so, the conditions for successful hierarchical coordination are very narrowly circumscribed indeed (Bianco/ Bates 1990).

The same ambiguity affects the notion of near decomposability. Its underlying assumption, that most important interaction effects among task-related choices may be contained within the smallest organizational subunit, have become ever less plausible as the degree of real-world interdependence is increasing. But as cross-unit interaction increases in importance, the information and sanctioning capacities of second- and higher-level hierarchical superiors must become progressively overloaded. While reorganization may (at high costs) temporarily improve the goodness of fit between the task structure of an organization and its formal structure (Scharpf 1977), this is on the whole a losing battle. As a consequence, organizational hierarchies must either become bottlenecks, producing low-quality decisions behind schedule, or they must not only tolerate but actively encourage horizontal and diagonal interactions among subunits in different departments and at different hierarchical levels. Similarly, under conditions of high interdependence, any attempt by top management to monopolize outside contacts would also be self-defeating.³⁹ Instead, interorganizational interactions are routinely conducted at all levels of organizational hierarchies.

³⁹ A pertinent example in the context of European integration is the proliferation of the foreign relations of individual ministries (at the expense of the foreign office), and of German *Länder* and communes who not only promote alliances among European regions with similar interests (Späth 1989) but also maintain their own "embassies" in Brussels.

The consequence is, of course, an erosion of hierarchical control. As interactions cutting across the vertical and horizontal boundaries of formal organizations seem to increase in numbers and in importance in the public and private sector as well as between sectors, the games that are in fact being played will to a lesser degree be determined by the preferences of (benevolent or exploitative) hierarchical authority.⁴⁰ As a consequence, even though formal hierarchies and unilateral control remain important, their capacity to structure interactions is clearly limited, and seems to be declining. Instead, as relationships cutting across the boundaries of hierarchical organizations gain in importance, modern societies seem to be increasingly constituted by intraorganizational and interorganizational networks of interaction. But are we therefore back to square one in our search for mechanisms that could assure mutual predictability in game-like interactions?

2. Networks of Interaction

"Networks" have become the buzzword of much current work in the social sciences as well as (the keyword is "neural networks") in computer science and artificial intelligence. But, as is true of game theory, there is as yet a considerable distance between purely analytical and experimental research on the one hand, and empirical social-science applications on the other hand. Often, the network concept is used more metaphorically than analytically in descriptive studies of intra- and interorganizational decision processes (Heclo 1978; Hjern/Porter 1981; O'Toole 1988; Wellman 1988; Marsh/ Rhodes 1990). Moreover, and more constraining from our present perspective, most

⁴⁰ One way out of this dilemma seems to be provided by the decentralization of business corporations into semi-independent profit centers that are free to choose their own strategies and their external partners, and that are only accountable to top-level portfolio managers for their net rate of return. Analytically, this solution combines a radical reduction of the domain of hierarchical control with the utilization of performance information provided by external market competition (Eccles/ White 1986). It runs into the same difficulties discussed above when interdependencies among profit centers cannot be reduced to market-like exchanges (Häusler 1990).

of the self-consciously theoretical and methodological work has been of a structuralist nature, identifying, classifying, and analyzing different types of network topologies (Burt 1976: 1980; Aldrich/Whetten 1981; Pappi 1987) with little regard for the substance of interactions going on within the structures so identified. And even when network-analytic studies of political and administrative systems are also interested in the substance of policy choices (Laumann/Pappi 1976; Schneider 1988; Heinz et al. 1990), the methodological and theoretical sophistication of structural analysis is usually not matched in the more descriptive treatment of process and outcome variables.

Of greater promise for our purposes may be recent developments in a line of theoretical and experimental work that has integrated exchange theoretic and network theoretic analyses (Cook/ Emerson 1978; Willer/ Anderson 1981; Cook et al. 1983; Cook 1987; Yamagishi et al. 1988; Markovsky et al. 1988). While the focus has mostly been on the structure-outcome linkage, and on identifying the non-obvious power advantages and disadvantages of specific positions in complex exchange networks, some recent work has begun to focus on process variables as well, and to explore the joint dependence of outcomes on positional advantage and on the strategies chosen by the partners in an exchange relationship (Markovsky 1987; Molm 1990).

These developments seem to open up exciting possibilities of a theoretical bridge between network-exchange-theoretic research on the one hand and game-theoretic analyses on the other hand from which both sides could benefit. On the one hand, *n*-person game theory has largely ignored the structure of interactions among players (except for sequence), and its empirical applications could profit much from an awareness of the differing power potentials associated with different network positions. On the other hand, it seems that network-exchange theory has been largely limited in its generality by the original emphasis on the exchange of rewards (i.e. on interactions resembling the Battle-of-the-Sexes game),⁴¹ and its analyses could surely be

⁴¹ That is not true of David Willer and his associates whose "elementary theory" gives equal emphasis to relations of exchange, conflict, and coercion (Willer/ Anderson 1981). Similarly, the differ-

enriched by a consideration of the much greater variety of theoretically interesting and empirically plausible game constellations and of game-theoretic solution concepts.

But these are, at best, promising directions for future theory development, not presently realized theoretical solutions that we could draw upon in empirical research. And even if the theoretical bridge between game theory and network-exchange theory should soon be built, the present preoccupations of researchers on both sides of the divide make it unlikely that the problem with which this article is concerned would be immediately addressed. It can now be restated more narrowly: To the extent that network-like intra- and interorganizational interactions proliferate, the complexity-reducing functions of hierarchical organization will be reduced or become unavailable. Thus, the question is again how boundedly rational actors might cope with the exploding complexity of reciprocal interdependence, and how they might avoid regressing into generalized distrust in response to the backward induction of uncertainty in extensive chains of game-like interaction.

In approaching toward an answer, it is useful to consider what is lost if hierarchies are increasingly replaced by networks of interactions. Most obviously, purposeful organizational design, defining a vertical structure in which subunits of limited size are contained within more encompassing units, is replaced by de-facto patterns of horizontal interaction. At the same time, the asymmetrical authority relations specified in the organizational design are replaced by unilateral, bilateral or multilateral relations of de-facto resource and task dependence, that may or may not be more symmetrical in nature. As a consequence, the ability of hierarchical superiors to settle conflicts among subordinates, and to assume responsibility for the external relations of well-defined subunits, is replaced either by the equilibria of non-cooperative games or by the outcomes of bilateral or multilat-

ences between reward power and punitive power are emphasized in the work of Linda Molm (1989; 1990). But neither line of research seems as yet to make use of the variety of game constellations that have been analyzed in game theory (Rapoport et al. 1976).

eral negotiations that are determined by the respective bargaining power of the participants involved. In other words, what is lost is precisely the capability for unilateral rule definition, boundary setting and conflict resolution that makes hierarchical organization attractive as a solution to the twin problems of complexity and distrust in game-like interactions. So what, apart from the claim that hierarchies do not seem to work very well, has the network concept to offer in compensation?

If networks are at all to be considered as functional substitutes for, or complements to, hierarchies, they must also be conceptualized as relatively permanent structural arrangements. That this should be so is, of course, assumed in experimental and in empirical network research alike. In the one case, networks are designed to be constraining structures by the experimenter, and in the other case their existence is usually inferred from data about the empirical frequency of interactions. But when networks are expected to reach across and beyond the artificial channels defined by formal organizations, and in an age where practically everybody can reach everybody else in the world by phone, by fax, by car or by plane, the assumption that networks should have structural qualities is far from trivial. If it is to be justified, networks must be defined as a two-level concept, distinguishing the level of specific interactions among particular parties at a particular time from the level of the ongoing relationship among these parties (Scharpf 1978: 353).

If there were only one level of specific (single-shot) interactions, actors would (to the extent that general rules preclude the use of force and fraud) be limited to market-like exchanges that are of immediate benefit to all parties involved. By contrast, what makes networks potential competitors to hierarchical organization is their second-level connotation of ongoing relationships that have a history of past encounters and open-ended expectations of future interactions.⁴² Like

⁴² By contrast to the use of "iteration" in game-theoretical analyses of the evolution of cooperation in dilemma situations (Taylor 1987; Axelrod 1984), the two-level argument does not require that "specific interactions" should be repetitions of identical or highly similar games

hierarchical organization, these underlying relationships can be interpreted as relatively stable structural arrangements which, by reducing transaction costs, will selectively facilitate specific interactions.

On the other hand, networks are distinguished from hierarchies by the fact that their structure is (or at least may be) self-organizing,⁴³ while hierarchical organization is typically the product of purposive design. As is true of the cognitive structure of the human brain and of self-programming neural-net computers (Minsky 1985), the self-organization of intra- and interorganizational networks is driven by the history of specific interactions. Successful contacts will increase the probability that a particular connection will be used again, while disuse may slowly erase established connections from the network structure. There is also reason to think that erasure will occur much more rapidly if justifiable expectations are disappointed in specific interactions.

In rational-choice terms, what is at work here is the investment calculus of a reputation-based second-level game played under conditions of incomplete information (Scharpf 1990). It presupposes that actors prefer to deal with fair and reliable partners, while reputations for fairness and reliability take time to build up and are quickly lost. Thus, from the partner's point of view, the fact that an actor has invested in acquiring this particular reputation does actually make it more likely that he will be fair and reliable even in circumstances where his short-term self-interest might suggest otherwise - which will again add to his reputation. Moreover, interactions which are embedded in an ongoing relationship among the parties (Granovetter 1985) will not only profit from improved opportunities for trustworthy communication and commitment, but will also be able to deal with more idiosyncratic issues than could be handled among

(Scharpf 1990).

⁴³ In that sense, the network concept is more encompassing than the concept of (intentionally created) "relational contracts" as it is employed in the transaction-cost literature (Macneil 1980; Williamson 1985).

relative strangers that have only general institutionalized rules and social norms to guide their mutual expectations.

At the same time, the investment character of an established relationship also creates a convenient "hostage" to assure the enforceability of explicit agreements (Williamson 1985: 169-175; Raub/ Keren 1990). Knowing that mutual trust, while hard to build up, is easily destroyed, I will have reason to trust my partner's commitment in an Assurance game; I will think more than twice before double-crossing my business partner in a Prisoner's-Dilemma type constellation; and I will probably hesitate to exploit my threat potential in a Chicken-like encounter. Of even greater practical importance is the fact that, in constellations resembling the Battle of the Sexes, turn-taking will indeed become a feasible solution. More generally, in ongoing relations, a common memory for past benefits and sacrifices will permit the development of norms of "generalized" or "diffuse" reciprocity (Keohane 1984: 127-131) in which distributional conflict is less likely to prevent agreement on cooperative solutions favoring one player over another in the specific case.

Going one step further, ongoing relationships of symmetrical or asymmetrical exchange will create conditions of unilateral or mutual dependence among the parties involved (Emerson 1962). As investments and skills become specialized to particular exchange relationships (and useless for other purposes), they turn into involuntary "hostages" whose value is at the mercy of the other side (Williamson 1985). As a consequence, ongoing networks of interactions will develop into power structures in which "reward power" will be transformed into "punishment power" (Molm 1989) - with the consequence that threat games can be played whose game-theoretical characteristics will be quite different from those of a single-shot game played by the same players under the same external circumstances. To the extent that punishment power is distributed asymmetrically, its availability may also approximate the power of applying negative sanctions that is usually associated with hierarchical authority.

But even if networks may mimic hierarchies in some important respects, there remains one fundamental difference. While hierarchical

organization is able to create subunit boundaries to reduce, perhaps artificially, the complexity of mandated (or permissible) interactions at any one organizational level, self-organizing networks are neither limited by design nor are they self-limiting. They have no stopping rule that would keep them from expanding, and linking up with each other, until they ultimately form a "small world" or seamless web whose potential complexity is limited only by the maximum number of relationships each member is able to maintain simultaneously (Simon 1962: 476-77). Nevertheless it would be premature to conclude that the network concept could not help to reduce the otherwise unmanageable complexity of game-like interactions.

The key is, again, the distinction between the level of ongoing relationships and the level of specific interactions or games that are played within this structure. While the underlying networks may not be self-limiting, there is reason to think that games are. This reason is directly derived from the two-level conceptualization of network relationships, and from the investment character of the underlying structure. To explicate it, we need to refer back to the problem of the backward induction of uncertainty that is threatening the mutual predictability of players in extended, chainlike interactions. Players who have made a considerable investment in their own trustworthiness in an ongoing relationship⁴⁴ will want to defend this investment by not surprising their partners with moves that could not have been predicted within the confines of the game of which these partners are aware. They have, in other words, a strong interest in making themselves predictable to other members of the network.⁴⁵

Logically, there are only two ways in which actors could achieve this purpose in complex constellations of interdependent choices - by creating full-information conditions among all players with whom

⁴⁴ I.e. by not choosing exploitative strategies in situations (like the Prisoner's Dilemma or the Chicken game) where that would have benefitted them at the expense of the other player.

⁴⁵ Think for instance of Helmut Schmidt's constant reminder that foreign policy must, above all, remain "calculable" for allies and opponents alike (Schmidt 1985).

they are in contact, or by taking active precautions to buffer their multiple involvements against one another. As was pointed out above, the first strategy would transform the connected games into a single game with a larger number of players. Thus, as the number of connections increases, escalating complexity would rapidly exceed the cognitive capacity (and the goodwill) of everybody involved. The most likely outcome would then be general confusion, perplexity, and ultimately distrust, rather than universal predictability. In other words, in network-like interactions, honesty and openness may be solutions whose usefulness decreases rapidly with increasing complexity.

The feasibility of buffering strategies, on the other hand, depends very much on the type of connection that exists between interactions. Here, the literature on connected games is helpful even if it is generally addressed to the obverse problem of identifying linkages among games that observers might initially consider as separate from one another. There seems to be considerable agreement on a typology of linkages between otherwise separate games. Thus Alt and Eichen-green (1987) distinguish between "parallel games" (with completely identical sets of players) and "overlapping games" where at least one player, but not all, must participate in all connected games. In other words, sets of interactions which do not share at least one actor may safely be treated as separate games.⁴⁶ A second classification, introduced by Alt, Putnam and Shepsle (1988), focuses on the relationship among the strategies available in connected games. In the case of "strategic linkage", it would be objectively possible to play the several (parallel) games separately. Nevertheless, one or more parties may decide to use their strategy choices in one game to influence (through threats or promises, for instance) the outcomes in another one (McGinnis 1986). Under conditions of "inherent linkage," by contrast, there is at least one player for whom the choice of a move in one game necessarily affects (constrains or enlarges) the set of strategies

⁴⁶ For empirical purposes, unfortunately, the criterion is less clearcut than it seems. If one includes non-cooperative games, "interaction" does not depend on explicit negotiations, but is defined by the mutual awareness of de-facto interdependent choices.

available in another game. A more comprehensive specification of inherent linkages is provided by George Tsebelis' (1990) distinction between "games with variable payoffs" and "games with variable rules" - meaning that choices in one segment of a pattern of interactions may affect the rules of the game (permissible players and permissible strategies) or the payoffs in another segment.

Assuming that players have an interest in segregating their involvements, they can achieve that goal by the simple device of not creating artificial connections when linkages are of a strategic nature. Under conditions of inherent linkage, however, when the choices are objectively interdependent, that solution is not available. An extreme case is the one used above to illustrate the backward induction of uncertainty, where a player is constrained to use the same strategy in two games. If her partners are unaware that the hinge player is trying to maximize her joint payoffs in two games, chances are that at least one of them will find prior expectations disappointed. Under these conditions, a player may indeed have to choose between becoming unpredictable and trying to create complete-information conditions for at least one of the partners involved. However, conditions will not always be so extreme as to require the use of a single strategy in interactions with more than one partner. More often, "inherent linkage" will affect only subsets of the strategies available in connected games.

Under such conditions, the hinge player could buffer her involvements in multiple games by restricting the options she will consider (and communicate to other players) in each game to strategy subsets that are not incompatible with each other.⁴⁷ Just as potentially incompatible demands on one's time need not produce disappointment all around when managed with the help of a well-kept appointment calendar, a prudent management of commitments, combined with a firm resolution to keep promises entered, is also an effective way of

⁴⁷ Methods for the identification of compatible strategy sets have been developed, in the context of strategic planning, by John Friend and his associates (Friend/ Jessop 1969; Friend/ Power/ Yewlett 1974; Friend/ Hickling 1987).

coping with multiple engagements in extended networks of interaction.⁴⁸ But, of course, such buffering will often entail opportunity costs.

Their nature can be clarified by reference to the distinction between "positive coordination" and "negative coordination" which is grounded in empirical studies of interministerial coordination in the federal bureaucracy (Scharpf 1972; Mayntz/ Scharpf 1975: 145-50). Starting from the assumption that there is a high degree of de-facto interdependence among the policy choices of different ministries, positive coordination would require joint exploration of the interaction effects among all options with a view to selecting optimal policy combinations. In other words, positive coordination would require ministries to determine their policy choices in a cooperative game.⁴⁹ But given an even moderately high degree of de-facto interdependence, it is clear that attempts at positive coordination among all choices would turn into prohibitively complex and conflictful simultaneous n-person

⁴⁸ Buffering by itself does, of course, not explain how interaction across the boundaries of functionally differentiated subsystems may be facilitated by the existence of networks (or of hierarchies, for that matter). Yet the motive of protecting the integrity of mutual expectations under conditions of multiple involvements must be an essential element of the explanation. The other element is the multilingual capacity of individual and corporate actors who are able to communicate in more than one functional subsystem (Scharpf 1989a). Nevertheless, "intersystemic discourse" (Willke 1989) remains difficult - as is demonstrated by the ubiquity of organizations specializing in intersystemic translation: public relations, lobbying, consulting, contract research, technology transfer, etc.

⁴⁹ "Cooperative" merely implies the possibility of binding agreements, but does not assume a harmony of underlying interests. To complicate matters further, even with a given constellation of "objective" interests, the positive-coordination game may be played with quite different interaction orientations. The normative ideal is, of course, a "solidaristic" or "problem-solving" attitude all around, which seeks to maximize the joint gains of the ministries involved, of the government, or even of the polity as a whole. In actual practice, the best that can be attained is often "individualistic bargaining" which may even deteriorate into "competitive bargaining" or outright "confrontation" (Scharpf 1989).

games in which the machinery of government would grind to a halt. In other words, positive coordination must be treated as an extremely scarce commodity that can only be employed for limited ranges of interdependent issues. On the other hand, the chaos produced by non-coordinated policy choices under conditions of de-facto interdependence would be politically equally prohibitive.

Thus, if governments are in fact able to achieve a semblance of consistency in their policy choices, they must rely on a mechanism that is less demanding than positive coordination and more effective than non-coordination. This mechanism we have labelled negative coordination. It implies that the policy choices of different ministries are considered separately, rather than jointly, but that each initiative must be "cleared" with all other ministries whose portfolios might be negatively affected by it. In game-theoretic terms, that implies that the simultaneous game of positive coordination is replaced by a peculiar sequential game in which at any decision point a single actor is allowed to propose a policy option while all other actors can only accept or veto that proposal.⁵⁰ Since vetoes are easy to anticipate, ministries tend to unilaterally exclude from active consideration all options that might threaten another ministry's status-quo position. The effect is a radical reduction of complexity⁵¹ - which, in turn, makes it possible to achieve a degree of coordination within rather large policy networks.

⁵⁰ In principle, the veto of a single opposing ministry could be overridden by a majority vote in the full cabinet. But given the cabinet's crowded agenda, that is not a practical proposition for the great majority of policy initiatives that are continuously being processed in government.

⁵¹ While positive coordination played as a game among x ministries with y policy options would require the examination of y^x joint outcomes, negative coordination could be achieved by inspecting merely $y(x-1)$ impacts of a single ministry's policy options on all other ministries' status quo policies. In numbers, with five ministries and three options, that would mean having to examine either 243 or 12 different outcomes.

There is reason to think that the distinction between positive and negative coordination is not only useful for analyzing the highly structured processes of government policy making, but is generally applicable within stable networks of interaction. A case in point is the fundamental distinction in legal systems between the law of contract and the law of torts. While the former regulates conditions and implications of binding agreements among independent parties (i.e. cooperative games alias positive coordination), the latter presupposes a duty to anticipate and avoid damages to the legally protected interests of third parties (which is analogous to negative coordination). In the absence of legal protection, what is necessary for negative coordination to prevail is reasonably accurate information about the status-quo interest positions of other actors, and a reasonably strong interest in avoiding negative surprises for these other actors. Since both of these conditions are likely to be met in networks of ongoing interactions, negative coordination is indeed a mechanism that will maintain mutual predictability and trust even in rather extensive patterns of interdependent choices.

In government policy making, however, the greater predictability achieved through negative coordination is bought at a price. When the current policy stance of all other ministries must be accepted as given in the unilateral anticipation of potential vetoes, the need to avoid negative externalities will not only reduce the range of permissible policy initiatives (and hence opportunities for policy innovation), but may also produce highly inefficient outcomes when Pareto superior solutions that would require *mutual* policy adjustments are ruled out from the beginning. There is no reason to expect that similar inefficiencies should not be associated with patterns of negative coordination in non-governmental settings.

Thus, the dividing line between the narrow subsets of interdependent choices for which positive coordination will be attempted, and the wider range of interaction effects that are relegated to negative coordination, is extremely critical for the overall quality of outcomes that can be achieved. In government, the definition of that dividing line is sometimes the object of purposeful institutional reform - as when ministerial boundaries are reorganized or when interministerial

task forces are set up to produce integrative solutions for complex policy problems (Mayntz/ Scharpf 1975; Scharpf 1977). The same may be true of joint ventures between business firms controlling different production factors or technologies (Kogut 1988). In normative terms, the criteria that should govern such choices are also quite straightforward: The limited capacity for positive coordination should be reserved for those interaction effects where negative coordination has the greatest opportunity costs - which brings us back to Herbert Simon's (1962) criterion of near-decomposability.

In empirical terms, however, the optimal structuration of complex, multi-actor decision processes must be an extremely rare phenomenon. The technology of decision making is too poorly understood, and power is typically too widely distributed, to place much hope in purposeful design, while issues and circumstances will be too unstable to expect optimal structural arrangements to emerge from evolutionary selection. Thus, all that can be said in a general way is that not all de-facto interdependent issues can be treated together, but that it is unlikely that strong de-facto interdependencies will be completely ignored in reasonably stable networks of ongoing interactions. But which interdependencies will in fact be explored more thoroughly in game-like processes of positive coordination is likely to depend on accidents of timing and perception that are often best described by the "garbage can" model (Cohen et al. 1972; March/ Olsen 1976; 1989). Alternatively, one might use the concept of "framing" which suggests that individual, and even more so interactive choices occur within frames of reference that reduce real-world complexity and ambiguity by providing simplified definitions of what are pertinent outcomes, what strategies will be considered, and what is the nature of the underlying relationship between the parties.⁵² What needs to be

⁵² In response to the experimental findings of Kahneman/ Tversky (1984), the "framing" of choice situations is beginning to find acceptance among economists and rational-choice oriented social scientists (Frey/ Eichenberger 1989; Lindenberg 1988; 1989; Esser 1990; Sims et al. 1986). A similar concept of "social orientations" (or, in my own terminology, "interaction orientations") was found useful to explain the responses of subjects in experimental and empirical game research (McClintock 1972; Liebrand/ van Rung 1985; May/ Schultz

added is the notion that the framing of an interaction situation should also define the effective boundaries of games.⁵³ By their very nature, however, neither framing nor garbage-can theories will permit the prediction of specific patterns of interaction from a-priori assumptions or from information about the "objective" state of external conditions. Since the dividing line between positive and negative coordination is ultimately rooted in the potentially idiosyncratic cognitive maps of the actors involved, these need to be determined empirically, and while the methodological difficulties of such determinations may not be insuperable, they are certainly not negligible.⁵⁴

Nevertheless, what matters more for our original question is the fact that we have indeed identified theoretical reasons for expecting that extended networks of ongoing interaction need not be destroyed by the backward induction of uncertainty. Instead, they are likely to be characterized by a high degree of mutual predictability which is achieved by the self-interested efforts of actors to protect their reputational investment in ongoing relationships whenever they consider changes in their status-quo set of strategies. In order to do so, they must either create complete-information conditions, or they must unilaterally take care to avoid negative surprises for other players. The resulting pattern of interactions will be characterized by fluid divisions between small-scale positive-coordination games which are related to the larger network of ongoing interactions through negative coordination.

With this conceptualization we are also able to give a more precise meaning to the notion of "connected games". Small-scale positive coordination games within larger networks of ongoing interaction are assumed to be separated from each other through negative coordina-

1986; McClintock/ Liebrand 1988).

⁵³ The idea was first suggested by Andreas Ryll in commenting upon an earlier version of this paper.

⁵⁴ Methods for the empirical identification of cognitive maps have been explored by Axelrod (1976), Bougon et al. (1977), Hall (1984), and by Weick/ Bougon (1986).

tion. But negative coordination may break down when a player within one game finds herself compelled to choose a strategy that does have significant negative impacts on at least one of her partners in the larger network who is not himself involved in the first game. Depending on his available options, the disappointed partner may then adjust his own strategies, which may entail further adjustments of other parties with whom he is involved in a positive-coordination game. If the choices within that second game will again have repercussions for the equilibrium achieved within the first game, the two games will merge into a larger n -person game. Otherwise, the two games will remain sequentially (or hierarchically) "connected" in the sense that the outcome of the first game has affected the rules or the payoffs and hence the outcome of the second game.

V. FURTHER IMPLICATIONS

But what does this exercise in theoretical exploration add up to in real terms? What would the world be like if policy formation and policy implementation were indeed organized in interlocking networks rather than in hierarchies, and if actors would in fact rely on negative and positive coordination to manage their multiple involvements in extended networks? The answer can only be speculative. As a first approximation, one might expect network-like structures to be more resistant to change than hierarchies. While they may indeed perform many of the conflict-resolution functions ascribed to hierarchies, they nevertheless lack opportunities for hierarchical redistribution. Negative coordination is governed by a logic of conflict avoidance which reduces the scope of feasible policy innovation at any single decision point. Positive coordination, on the other hand, is limited to relatively small clusters of interactions, and it is more likely to be driven by a logic of "individualistic" exchange than by a logic of "solidaristic" sharing.⁵⁵ Since the "terms of trade" among self-interested actors are

⁵⁵ In addition to the exchange of resources, the importance of combining the "task related services" of several agencies has been emphasized in empirical studies of implementation networks (Provan/

defined by their respective endowments and by their relative dependence on the resources and services provided by the other side, outcomes will be determined by the respective bargaining positions (Nash 1950; 1953). Thus, network-like interactions must generally respect, and reproduce, the original distribution of endowments among the players - while hierarchical authority might be able (but need not be willing) to redistribute.

For the same reason, networks lack the ability to differentially reward, or compensate, players for efforts which they have made in the service of some overarching purpose, or in the production of a collective good. Hence it will be more difficult (by comparison to benevolent hierarchies) to create and maintain a consistent "program orientation" in multi-organizational "implementation structures" (Hjern/ Porter 1981; Gage/ Mandell 1990). The only way in which this deficit might be compensated is through "solidaristic" interaction orientations or a normative commitment of all actors to common program goals - conditions that cannot be generally assumed to exist, even though they are also not ruled out by what we know about the world of public and not-for-profit organizations (Gray 1989; Provan/ Milward 1990). In that sense, networks seem to be less efficient and effective in achieving public purposes than more hierarchical structures of policy formation and policy implementation.

However, if the standard of comparison should not be an idealized version of democratically responsive and thoroughly efficient hierarchical organization, but the autistic rigidity and inefficiency of many real-world hierarchical systems, networks might appear more attractive. Even if they are incapable of instantaneous and wholesale change, over the longer term the buffering mechanisms described will provide a good deal of flexibility and responsiveness to new problems. While actors may try to maintain the status quo of their

Milward 1990). This corresponds to the distinction between exchange and joint production which is recognized, but not fully developed, in the network-exchange theoretic literature (e.g. Yamagishi et al. 1988: 835). In either case, however, individualistic interaction orientations are generally assumed to prevail in network interactions.

relationships, they will often be unable to do so as external circumstances change and pressure builds up. Then expectations will be disappointed, conflict avoidance may fail and relationships may be disrupted. At the same time, however, actors will use their limited capacities for positive coordination to repair or recreate networks of predictable relationships. As a consequence, the overall pattern of positively and negatively coordinated interactions is likely to be in constant flux as everyone involved is trying to protect past commitments and, at the same time, to respond to new problems and opportunities. There is no reason to think that such a system will ever reach equilibrium since the frequency of exogenous changes is likely to be much greater than the speed of internal adaptation. Nevertheless, the multitude of players scrambling to maintain a semblance of equilibrium in their immediate environment must be a powerful force for the continuous responsiveness to external changes of network-like systems.

Clearly, however, networks will not produce the best of all worlds, and hierarchical organization as well as hierarchical power continues to be attractive in many ways. But its attractiveness will increase if it is not expected to carry too large a burden in the organization of societies. Just as firms are learning to optimize the combination of hierarchical portfolio decisions with market-like transactions among their profit centers (Eccles/ White 1986; Bradach/ Eccles 1989; Häusler 1990), other types of organizations, and political systems as a whole, may need to accept and exploit the structuring potential not only of competitive markets, but also of relatively stable networks of interorganizational interaction, and to use their limited capacities for hierarchical intervention sparingly and effectively for the one function that networks are incapable of performing: purposeful redistribution of endowments and purposeful changes of the terms of trade among the large corporate actors that dominate the network structures of modern societies. With that in mind it seems that the intersection of hierarchical organization and network structures might become a most promising focus of social science theory and empirical research.

Bibliography

- Aldrich, Howard / David A. Whetten, 1981: Organization-sets, Action-sets, and Networks: Making the Most of Simplicity. In: Paul C. Nystrom / William H. Starbuck, (eds.), *Handbook of Organizational Design*. Volume 1. Oxford: Oxford University Press, 385-408.
- Aldrich, Howard E., 1979: *Organizations and Environments*. Englewood Cliffs, NJ: Prentice-Hall.
- Alt, James E. / Barry Eichengreen, 1987: *Overlapping and Simultaneous Games: Theory and Applications*. Paper Prepared for the NBER Conference on "The Political Economy of International Macroeconomic Policy Coordination." Andover, MA, November 6-7, 1987.
- Alt, James E. / Robert D. Putnam / Kenneth A. Shepsle, 1988: *The Architecture of Linkage*. Paper Prepared for the Workshop on "Connected Games: Theory, Methodology, and Applications," Max-Planck-Institut für Gesellschaftsforschung, Cologne, November 17-18, 1988.
- Anderson, John H., 1982: Acquisition of Cognitive Skill. In: *Psychological Review* 89, 369-406.
- Axelrod, Robert, 1984: *The Evolution of Cooperation*. New York: Basic Books.
- Axelrod, Robert (ed.), 1976: *Structure of Decision. The Cognitive Maps of Political Elites*. Princeton: Princeton University Press.
- Banfield, Edward C., 1958: *The Moral Basis of a Backward Society*. New York: Free Press.
- Bianco, William T. / Robert H. Bates, 1990: Cooperation by Design: Leadership, Structure, and Collective Dilemmas. In: *American Political Science Review* 84, 133-147.
- Bougon, Michael / Karl Weick / Din Binkhorst, 1977: Cognition in Organizations: An Analysis of the Utrecht Jazz Orchestra. In: *Administrative Science Quarterly* 22, 606-639.
- Bradach, Jeffrey L. / Robert G. Eccles, 1989: Price, Authority, and Trust: From Ideal Types to Plural Forms. In: *American Review of Sociology* 15, 97-118.
- Brams, Steven J., 1983: *Superior Beings. If They Exist, How Could We Know? Game-Theoretic Implications of Omniscience, Omnipotence, Immortality, and Incomprehensibility*. New York: Springer Verlag.

- Brennan, Geoffrey/ James M. Buchanan, 1985: *The Reason of Rules. Constitutional Political Economy*. Cambridge: Cambridge University Press.
- Burt, Ronald S., 1976: Positions in Networks. In: *Social Forces* 55, 93-122.
- Burt, Ronald S., 1980: Models of Network Structure. In: *Annual Review of Sociology* 6, 79-141.
- Cohen, Michael D./ James G. March/ Johan P. Olsen, 1972: A Garbage Can Model of Organizational Choice. In: *Administrative Science Quarterly* 17, 1-25.
- Coleman, James S., 1974: *Power and the Structure of Society*. New York: W.W. Norton Co.
- Coleman, James S., 1981: *The Asymmetric Society*. Syracuse, NY: Syracuse University Press.
- Coleman, James S., 1986: Social Structure and the Emergence of Norms Among Rational Actors. In: Andreas Diekmann/ Peter Mitter (eds.), *Paradoxical Effects of Social Behavior. Essays in Honor of Anatol Rapoport*. Heidelberg: Physica, 55-83.
- Coleman, James S., 1990: *Foundations of Social Theory*. Cambridge, MA: Harvard University Press.
- Colman, Andrew, 1982: *Game Theory and Experimental Games. The Study of Strategic Interaction*. Oxford: Pergamon Press.
- Cook, Karen S. (ed.), 1987: *Social Exchange Theory*. Newbury Park: Sage.
- Cook, Karen S./ Jodi O'Brien/ Peter Kollock, 1990: Exchange Theory: A Blueprint for Structure and Process. In: George Ritzer (ed.), *Frontiers of Social Theory. The New Syntheses*. New York: Columbia University Press, 158-181.
- Cook, Karen S./ Richard M. Emerson, 1978: Power, Equity and Commitment in Exchange Networks. In: *American Sociological Review* 43, 721-739.
- Cook, Karen S./ Richard M. Emerson/ Mary R. Gillmore/ Toshio Yamagishi, 1983: The Distribution of Power in Exchange Networks Theory and Experimental Results. In: *American Journal of Sociology* 89, 275-305.
- Denzau, Arthur/ William Riker/ Kenneth Shepsle, 1985: Farquharson and Fenno: Sophisticated Voting and the Home Style, In: *American Political Science Review* 79, 1117-1137.

- Deutschmann, Cristoph, 1989: Der "Clan" als Unternehmensmodell der Zukunft? In: *Leviathan* 17, 85-107.
- Eccles, Robert G./ Harrison C. White, 1986: Firm and Market Interfaces of Profit Center Control. In: Siegwart Lindenberg/ James S. Coleman/ Stefan Nowak (eds.), *Approaches to Social Theory*. New York: Russel Sage Foundation, 203-220.
- Eden, Colin/ Sue Jones/ David Sims/ Tim Smithin, 1981: The Inter-subjectivity of Issues and Issues of Intersubjectivity. In: *Journal of Management Studies* 18, 37-47.
- Elster, Jon, 1979: *Ulysses and the Sirens. Studies in Rationality and Irrationality*. Cambridge: Cambridge University Press.
- Elster, Jon, 1983: *Explaining Technical Change. A Case Study in the Philosophy of Science*. Cambridge: Cambridge University Press.
- Emerson, Richard M., 1962: Power-Dependence Relations. In: *American Sociological Review* 27, 31-41.
- Esser, Hartmut, 1990: "Habits", "Frames" und "Rational Choice": Die Reichweite von Theorien der Rationalen Wahl (am Beispiel der Erklärung des Befragtenverhaltens. Ms, Universität Köln.
- Farquharson, Robin, 1969: *Theory of Voting*. Oxford: Basil Blackwell.
- Fischer, Klaus, 1989: Die kognitive Konstitution sozialer Strukturen. In: *Zeitschrift für Soziologie* 18, 16-34.
- Frey, Bruno S./ Reiner Eichenberger, 1989: Should Social Scientists Care About Choice Anomalies? In: *Rationality and Society* 1, 101-122.
- Friend, J.K./ J.M. Power/ C.J.L. Yewlett, 1974: *Public Planning: The Inter-Corporate Dimension*. London: Tavistock.
- Friend, J.K./ W.N. Jessop, 1969: *Local Government and Strategic Choice. An Operational Research Approach to the Processes of Public Planning*. London: Tavistock.
- Friend, John/ Allen Hickling, 1987: *Planning Under Pressure. The Strategic Choice Approach*. Oxford: Pergamon Press.
- Gage, R.W./ Myrna Mandell, 1990: *Strategies for Managing Inter-governmental Policies and Networks*. New York: Praeger.
- Granovetter, Mark, 1978: Threshold Models of Collective Behavior. In: *American Journal of Sociology* 83, 1420-1443.
- Granovetter, Mark, 1985: Economic Action and Social Structure: The Problem of Embeddedness. In: *American Journal of Sociology* 91, 481-510.

- Granovetter, Mark/ Roland Soong, 1983: Threshold Models of Diffusion and Collective Behavior. In: *Journal of Mathematical Sociology* 9, 165-179.
- Gray, Barbara, 1989: *Collaborating. Finding Common Ground for Multiparty Problems*. San Francisco: Jossey-Bass.
- Haffner, Sebastian, 1987: Die Pariser Kommune. In: Sebastian Haffner, *Im Schatten der Geschichte. Historisch-politische Variationen aus zwanzig Jahren*. München: Deutscher Taschenbuch Verlag, 61-103.
- Hall, Roger I, 1984: The Natural Logic of Management Policy Making: Its Implications for the Survival of an Organization. In: *Management Science* 30, 905-927.
- Hardin, Garrett/ John Baden (eds.), 1977: *Managing the Commons*. San Francisco: Freeman.
- Häusler, Jürgen, 1990: *Steuerungsmechanismen und Beziehungsmuster in divisionalisierten Großunternehmen*. MS, Max-Planck-Institut für Gesellschaftsforschung, Cologne.
- Heclo, Hugh, 1978: Issue Networks and the Executive Establishment. In: Anthony King (ed.), *The New American Political System*. Washington, DC: American Enterprise Institute, 87-124.
- Heiner, Ronald A., 1983: The Origin of Predictable Behavior. In: *American Economic Review* 73, 560-599.
- Heinz, John P./ Edward O. Laumann/ Robert H. Salisbury/ Robert L. Nelson, 1990: Inner Circles or Hollow Cores? Elite Networks in National Policy Systems. In: *Journal of Politics* 52, 356-390.
- Hjern, Benny/ David O. Porter, 1981: Implementation Structures: A New Unit of Analysis. In: *Organization Studies* 2, 211-227.
- Johnstone, A.H./ H. El-Bana, 1989: Understanding Learning Difficulties - A Predictive Research Model. In: *Studies in Higher Education* 14, 159-168.
- Kahan, James P./ Amnon Rapoport, 1984: *Theories of Coalition Formation*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Kahneman, Daniel/ Amos Tversky, 1984: Choices, Values, and Frames. In: *American Psychologist* 39: 341-350.
- Kelley, Harold H./ John W. Thibaut, 1978: *Interpersonal Relations. A Theory of Interdependence*. New York: John Wiley.
- Keohane, Robert O., 1984: *After Hegemony. Cooperation and Discord in the World Political Economy*. Princeton: Princeton University Press.

- Kliemt, Hartmut/ B. Schauenberg, 1984: Coalitions and Hierarchies: Some Observations on the Fundamentals of Human Cooperation. In: Manfred J. Holler (ed.), *Coalitions and Collective Action*. Wuerzburg: Physica, 9-32.
- Kogut, Bruce, 1988: Joint Ventures: Theoretical and Empirical Perspectives. In: *Strategic Management Journal* 9, 319-332.
- Kreps, David M./ Robert Wilson, 1982: Reputation and Imperfect Information. In: *Journal of Economic Theory* 27, 253-279.
- Laumann, Edward O./ Franz U. Pappi, 1976: *Networks of Collective Action: A Perspective on Community Influence Systems*. New York: Academic Press.
- Levi, Margaret, 1988: *Of Rule and Revenue*. Berkeley: University of California Press.
- Liebrand, Wim B.G., 1983: A Classification of Social Dilemma Games. In: *Simulation and Games* 14, 123-138.
- Liebrand, Wim B.G./ Godfried J. van Rung, 1985: The Effects of Social Motives on Behavior in Social Dilemmas in Two Cultures. In: *Journal of Experimental Social Psychology* 21, 86-102.
- Lindenberg, Siegwart, 1988: Contractual Relations and Weak Solidarity: The Behavioral Basis of Restraints on Gain-maximization. In: *Journal of Institutional and Theoretical Economics* 144, 39-58.
- Lindenberg, Siegwart, 1989: Choice and Culture: The Behavioral Basis of Cultural Impact on Transactions. In: Hans Haferkamp (ed.), *Social Structure and Culture*. Berlin: De Gruyter: 175-200.
- Luhmann, Niklas, 1984: *Soziale Systeme. Grundriß einer allgemeinen Theorie*. Frankfurt: Suhrkamp.
- Luhmann, Niklas, 1986: *Ökologische Kommunikation*. Opladen: Westdeutscher Verlag.
- Luhmann, Niklas, 1988: *Die Wirtschaft der Gesellschaft*. Frankfurt: Suhrkamp.
- Luhmann, Niklas, 1988a: Familiarity, Confidence, Trust: Problems and Alternatives. In: Diego Gambetta (ed.), *Trust. Making and Breaking Cooperative Relations*. Oxford: Basil Blackwell, 94-107.
- Macneil, Ian R., 1980: *The New Social Contract. An Inquiry into Modern Contractual Relations*. New Haven: Yale University Press.
- March, James G./ Johan P. Olsen, 1976: *Ambiguity and Choice in Organizations*. Bergen: Universitetsforlaget.

- March, James G./ Johan P. Olsen, 1989: Rediscovering Institutions. The Organizational Basis of Politics. New York: Free Press.
- Markovsky, Barry, 1987: Toward Multilevel Sociological Theories: Simulations of Actor and Network Effects. In: Sociological Theory 5, 101-117.
- Markovsky, Barry/ Travis Patton/ David Willer, 1988: Power Relations in Exchange Networks. In: American Sociological Review 53, 220-236.
- Marsh, David/ R.A.W. Rhodes, 1990: Policy Communities, Policy Networks and Issue Networks: Beyond a New Typology. Ms. University of Essex.
- May, Theo/ Ulrich Schulz, 1986: Social Values and Structures of Preferences in Experimental Games. In: R.W. Scholz (ed.), Current Issues in West German Decision Research. Frankfurt: P.Lang, 255-274.
- Mayntz, Renate/ Birgitta Nedelmann, 1987: Eigendynamische soziale Prozesse. Anmerkungen zu einem analytischen Paradigma. In: Kölner Zeitschrift für Soziologie und Sozialpsychologie 39, 648-668.
- Mayntz, Renate/ Friedhelm Neidhardt, 1989: Parlamentskultur: Handlungsorientierungen von Bundestagsabgeordneten - eine empirisch-explorative Studie. In: Zeitschrift für Parlamentsfragen 20, 370-387.
- Mayntz, Renate/ Fritz W. Scharpf, 1990: Guidance and Control of Research Systems. In: Helmar Krupp (ed.), Technikpolitik angesichts der Umweltkatastrophe. Heidelberg: Physica.
- Mayntz, Renate/ Fritz W. Scharpf, 1975: Policy-Making in the German Federal Bureaucracy. Amsterdam: Elsevier.
- McClintock, Charles G., 1972: Social Motivation - A set of Propositions. In: Behavioral Science 17, 438-454.
- McClintock, Charles G./ Wim B.G. Liebrand, 1988: Role of Interdependence Structure, Individual Value Orientation, and Another's Strategy in Social Decision Making: A Transformational Analysis. In: Journal of Personality and Social Psychology 55, 396-409.
- McGinnis, Michael D., 1986: Issue Linkage and the Evolution of International Cooperation. In: Journal of Conflict Resolution 30, 141-170.
- McKelvey, Richard D./ Richard G. Niemi, 1978: A Multistage Game Representation of Sophisticated Voting for Binary Procedures. In: Journal of Economic Theory 18, 1-22.

- Milgrom, Paul R./ Douglass C. North/ Barry R. Weingast, 1988: Third Party Enforcement of Norms and Contracts: A Theoretical-Historical Analysis. Paper Prepared for the "Workshop on Connected Games", Max-Planck-Institut für Gesellschaftsforschung, Cologne, November 17-18, 1988.
- Miller, G.A., 1956: The Magical Number Seven, Plus or Minus Two. Some Limits on Our Capacity for Processing Information. In: *Psychological Review* 63, 81-97.
- Minsky, Marvin, 1985: *The Society of the Mind*. New York: Simon & Schuster.
- Molm, Linda D., 1989: Punishment Power: A Balancing Process in Power-Dependence Relations. In: *American Journal of Sociology* 94, 1392-1418.
- Molm, Linda D., 1990: Structure, Action, and Outcomes: The Dynamics of Power in Social Exchange. In: *American Sociological Review* 55, 427-447.
- Nash, John F., 1950: The Bargaining Problem. In: *Econometrica* 18, 155-162.
- Nash, John F., 1953: Two-Person Cooperative Games. In: *Econometrica* 21, 128-140.
- Nelson, Richard R./ Sidney G. Winter, 1982: *An Evolutionary Theory of Economic Change*. Cambridge, MA: Belknap Press.
- Nolte, Detlev, 1988: Ist die Koalitionstheorie am Ende? Eine Bilanz nach 25 Jahren Koalitionsforschung. In: *Politische Vierteljahresschrift* 29, 230-251.
- O'Toole, Laurence J., 1988: Strategies for Intergovernmental Management: Implementing Programs in Interorganizational Networks. In: *International Journal of Public Administration* 11, 417-441.
- Offe, Claus, 1988: Reflections on the Institutional Self-Transformation of Movement Politics. A Tentative Stage Model. MS, Fakultät für Soziologie, University of Bielefeld.
- Offe Claus, 1989: Fessel und Bremse. Moralische und institutionelle Aspekte "intelligenter Selbstbeschränkung". In: Axel Honneth/ Thomas McCarthy/ Claus Offe/ Albrecht Wellemer (Hrsg.), *Zwischenbetrachtung. Im Prozess der Aufklärung. Jürgen Habermas zum 60. Geburtstag*. Frankfurt: Suhrkamp, 739-774.
- Ordeshook, Peter C., 1986: *Game Theory and Political Theory*. An Introduction. Cambridge: Cambridge University Press.

- Ostrom, Elinor, 1986: An Agenda for the Study of Institutions. In: *Public Choice* 48, 3-25.
- Ostrom, Elinor, 1989: Governing the Commons. The Evolution of Constitutions for Collective Action. Indiana University: Workshop in Political Theory and Policy Analysis.
- Ostrom, Elinor, 1989a: Microconstitutional Change in Multiconstitutional Political Systems. In: *Rationality and Society* 1, 11-50.
- Ouchi, William G., 1984: The M-Form Society. How American Teamwork Can Recapture the Competitive Edge. Reading, Mass: Addison-Wesley.
- Pagden, Anthony, 1988: The Destruction of Trust and its Economic Consequences in the Case of Eighteenth-century Naples. In: Diego Gambetta (ed.), *Trust. Making and Breaking Cooperative Relations*. Oxford: Basil Blackwell, 127-141.
- Pappi, Franz U. (Hrsg.), 1987: *Methoden der Netzwerkanalyse*. München: Oldenbourg.
- Pratt, John W./ Richard J. Zeckhauser (eds.), 1985: *Principals and Agents: The Structure of Business*. Boston: Harvard Business School Press.
- Provan, Keith G./ H. Brinton Milward, 1990: The Interorganizational Delivery of Mental Health Services Through a Service Implementation Network. MS, College of Business and Economics. University of Kentucky.
- Putnam, Robert D., 1988: Diplomacy and Domestic Politics: The Logic of Two-level Games. In: *International Organization* 42, 429-460.
- Putnam, Robert D./ Nicholas Bayne, 1984: *Hanging Together. The Seven-Power Summits*. Cambridge, MA: Harvard University Press.
- Rapoport, Anatol, 1970: *N-Person Game Theory. Concepts and Applications*. Ann Arbor: University of Michigan Press.
- Rapoport, Anatol/ Melvin J. Guyer/ David G. Gordon, 1976: *The 2X2 Game*. Ann Arbor: University of Michigan Press.
- Rasmusen, Eric, 1989: *Games and Information. An Introduction to Game Theory*. Oxford: Basil Blackwell.
- Raub, Werber/ Gideon Keren, 1990: Hostages as a Commitment Device: A Game-Theoretic Model and an Empirical Test of Some Scenarios. Ms. Faculty of Social Sciences, Utrecht University.
- Riker, William H./ Peter C. Ordeshook, 1973: *An Introduction to Positive Political Theory*. Englewood Cliffs: Prentice-Hall.

- Scharpf, Fritz W., 1972: Komplexität als Schranke der politischen Planung. In: Politische Vierteljahresschrift 13, Sonderheft 4, 168-192.
- Scharpf, Fritz W., 1977: Does Organization Matter? Task Structure and Interaction in the Ministerial Bureaucracy. In: Organization and Administrative Sciences 8, 149-167.
- Scharpf, Fritz W., 1978: Interorganizational Policy Studies: Issues, Concepts and Perspectives. In: Kenneth Hanf/ Fritz W. Scharpf (eds.), Interorganizational Policy Making. Limits to Coordination and Central Control. London: Sage, 345-370.
- Scharpf, Fritz W., 1987: A Game-theoretical Interpretation of Inflation and Unemployment in Western Europe. In: Journal of Public Policy 7, 227-257.
- Scharpf, Fritz W., 1988: The Joint Decision Trap: Lessons from German Federalism and European Integration. In: Public Administration 66, 239-287.
- Scharpf, Fritz W., 1989: Decision Rules, Decision Styles and Policy Choices. In: Journal of Theoretical Politics 1, 149-176.
- Scharpf, Fritz W., 1989a: Politische Steuerung und politische Institutionen. In: Hans-Hermann Hartwich, (ed.), Macht und Ohnmacht politischer Institutionen. Opladen: Westdeutscher Verlag, 17-29.
- Scharpf, Fritz W., 1990: Games Actors May Play. The Problem of Predictability. In: Rationality and Society 2, forthcoming.
- Schelling, Thomas C., 1960: The Strategy of Conflict. Cambridge, MA: Harvard University Press.
- Schelling, Thomas C., 1984: Choice and Consequence. Cambridge, Mass.: Harvard University Press.
- Schimank, Uwe, 1988: Gesellschaftliche Teilsysteme als Akteurfiktionen. In: Kölner Zeitschrift für Soziologie und Sozialpsychologie 40: 619-639.
- Schmidt, Helmut, 1985: A Grand Strategy for the West. New Haven: Yale University Press.
- Schmitt, Carl, 1932: Der Begriff des Politischen. Text von 1932 mit einem Vowort und drei Corollarien. Berlin: Duncker & Humblot, 1963.
- Schneider, Volker, 1988: Politiknetzwerke der Chemikalienkontrolle. Eine Analyse einer transnationalen Politikentwicklung. Berlin: de Gruyter.

- Schotter, Andrew, 1981: *The Economic Theory of Social Institutions*, Cambridge: Cambridge University Press.
- Selten, Reinhard/ Klaus G. Schuster, 1970: Psychologische Faktoren bei Koalitionsverhandlungen. In: H. Sauermann, (ed.), *Beiträge zur experimentellen Wirtschaftsforschung II*. Tübingen: Mohr, 99-135.
- Shepsle, Kenneth A., 1985: *Cooperation and Institutional Arrangements*. Paper Prepared for the Harvard Conference on International Regimes and Cooperation, February 13-15, 1986.
- Simon, Herbert A., 1962: The Architecture of Complexity. In: *Proceedings of the American Philosophical Society* 106, 467-482.
- Sims, Henry P./ Dennis A. Goia and Associates, 1986: *The Thinking Organization*. San Francisco: Jossey-Bass.
- Snyder, Glenn H./ Paul Diesing, 1977: *Conflict Among Nations. Bargaining, Decision Making, and System Structure in International Crises*. Princeton: Princeton University Press.
- Späth, Lothar, 1989: Regionalisierung des europäischen Raums - Die Zukunft der Bundesländer im Spannungsfeld zwischen EG, Bund und Kommunen. *Cappenberg Gespräche* 23. Köln: Grote.
- Stackelberg, Heinrich von, 1934: *Marktform und Gleichgewicht*. Berlin: Springer.
- Taylor, Michael, 1987: *The Possibility of Cooperation*. Cambridge: Cambridge University Press.
- Teubner, Gunther, 1989: *Recht als autopoietisches System*. Frankfurt: Suhrkamp.
- Thompson, Earl A./ Roger L. Faith, 1980: A Pure Theory of Strategic Behavior and Social Institutions. In: *American Economic Review* 71, 366-380.
- Thompson, James D., 1967: *Organizations in Action. Social Science Bases of Administrative Theory*. New York: McGraw-Hill.
- Tönnies, Ferdinand, 1935/ 1979: *Gemeinschaft und Gesellschaft. Grundbegriffe der reinen Soziologie*. Neudruck der 8. Auflage von 1935. Darmstadt: Wissenschaftliche Buchgesellschaft.
- Tsebelis, George, 1988: Nested Games: The Cohesion of French Electoral Coalitions. In: *British Journal of Political Science* 18, 145-170.
- Tsebelis, George, 1989: *Thucydides on Nash vs. Stackelberg. The Importance of Sequence of Moves in Games*. MS, Department of Political Science, UCLA.

- Tsebelis, George, 1990: *Nested Games. Rational Choice in Comparative Politics*. Berkeley: University of California Press.
- Turkle, Sherry, 1988: *Artificial Intelligence and Psychoanalysis: A New Alliance*. In: *Daedalus* 117: 241-268.
- Turner, Marilyn/ Randall W. Engle, 1989: *Is Working Memory Capacity Task Dependent?* In: *Journal of Memory and Language* 28, 127-154.
- Von Neumann, John/ Oskar Morgenstern, 1944: *Theory of Games and Economic Behavior*. Third Edition 1953. Princeton: Princeton University Press.
- Weick, Karl E./ Michel G. Bougon, 1986: *Organizations as Cognitive Maps*. In: Henry P. Sims, Jr./ Dennis A. Gioia and Associates, *The Thinking Organization*, San Francisco: Jossey-Bass, 102-135.
- Wellman, Barry, 1988: *Structural Analysis: From Method and Metaphor to Theory and Substance*. In: Barry Wellman/ S.D. Berkowitz (eds.), *Social Structures: A Network Approach*. Cambridge: Cambridge University Press, 19-61.
- Wiesenthal, Helmut, 1990: *Unsicherheit und Multiple-Self-Identität. Eine Spekulation über die Voraussetzungen strategischen Handelns*. Köln: MPIFG Discussion Paper 90/2.
- Willer, David/ Bo Anderson (eds.), 1981: *Networks, Exchange and Coercion. The Elementary Theory and its Applications*. New York: Elsevier.
- Williamson, Oliver E., 1975: *Markets and Hierarchies. Analysis and Antitrust Implications*. New York: Free Press.
- Williamson, Oliver E., 1985: *The Economic Institutions of Capitalism. Firms, Markets, Relational Contracting*. New York: Free Press.
- Willke, Helmut, 1989: *Systemtheorie entwickelter Gesellschaften. Dynamik und Riskanz moderner gesellschaftlicher Selbstorganisation*. Weinheim: Juventa.
- Yamagishi, Toshio/ Mary R. Gillmore/ Karen S. Cook, 1988: *Network Connections and the Distribution of Power in Exchange Networks*. In: *American Journal of Sociology* 93, 833-851.