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Social Poker: A Paradigm for Studying

the Formation of Self-Organized Groups

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Technical Report No. 99-01

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Social Poker web pages:
http://darkwing.uoregon.edu/~harrow/spdes.htm (general information)
http://tyler.cs.uoregon.edu/SocialPoker/v1.0/index.html
(Computer-Mediated Interface 1.0 Release)

Abstract

When individuals seek one another out to combine their resources and produce collective benefits not available by acting alone, they form a self-organized group. Drawing on club theory from economics, theories of motivation and social integration from psychology, and theories of coalition formation and bargaining from political science and psychology, we presume that multiple such groups can form from a pool of potential members, and that members have control over their membership choices subject to the constraints posed by others' preferences and choices. We presume that the benefits produced by a group will depend on the composition of members, and that members may differ both in the resources they bring to the group and the benefits they hope to obtain. Based on these presumptions, the relevant elements of self-organized group formation are identified as follows: At the individual level, resources and preferences or needs are relevant. At the interpersonal level, individuals gather information about the resources and preferences of others and negotiate whether or not to form or join groups. At the group level, some production function turns resources into group goods. The composition of member resources will affect what the group produces, and the composition of member preferences and relative member power will affect how goods are divided. Member satisfaction with outcomes and the perceived costs and benefits of attempting to join or form an alternative group should affect the stability of membership in newly formed groups.

The social poker paradigm translates these elements into a card game that allows for the manipulation of individual resources, interpersonal information, relative power among members, the minimize effective size of groups, and other variables of potential interest. Individual resources are represented by playing cards, which individuals can combine by forming a group and pooling their cards to form card hands that earn the group money.

Social Poker:* A Paradigm for Studying the Formation of Self-Organized Groups

In this paper we (1) present a theoretical framework for analyzing the formation of self-organized groups, and (2) introduce a laboratory paradigm for studying the processes involved in the formation of groups within a controlled setting. The paradigm uses a social card game to create conditions under which players may form ephemeral acting coalitions or more stable standing groups.

Our focus in on groups formed by people who will become the group's members, and who expect to gain some individual benefit from their membership in the group. Examples are academic collaborations, youth gangs, revolving credit organizations, neighborhood watch associations, and new businesses. Our model does not apply to groups formed primarily to serve the purposes of some wider organization, which is typical of work groups, or to groups formed in a "top down" fashion by non-members who assign others to the group, as is typical in the military, for example. In self-organized groups, members themselves make decisions about who will be a member.

We presume that self-organized groups form out of some larger pool of potential members, and that these potential members have access to resources that they could contribute to collaborative ventures. These include both tangible resources and intangible resources such as knowledge and skills. We presume that potential members are motivated to form or join groups by needs, desires, and expectations about what the group might provide, and that they are free to choose whether or not to join forces with one another. We also presume that different configurations of individuals will form groups that are relatively more or less productive and satisfying to their members, based on what members contribute, what they receive, and what they value. We presume that the "optimal" set of groups, which would be maximally productive and satisfying for a given population of people, will not necessarily form. We also presume that in some cases, multiple potential groupings will provide equivalent levels of productivity and satisfaction.

We are interested in (1) the temporary coalitions that form out of a pool of individuals; (2) whether these coalitions stabilize into standing groups, and, if so, how stable these groups are over time; (3) how the distribution of group resources among members interacts with membership choices and group stability; and (4) what factors lead to the formation of more or less "optimal" sets of groups. The distinction between standing and acting groups (Arrow & McGrath, 1993) is that acting groups only exist as long as members are actively interacting; standing groups (examples are a family, a work group, a basketball club) continue to exist as entitites in the minds of group members even when members are not assembled.

In the first section of the paper, we discuss ideas from several theoretical traditions: the theory of clubs from economics, motivation and social integration perspectives from social psychology, and coalition and bargaining theory as developed in several disciplines.

1. Theoretical Perspectives

1.1. Club theory

Club theory (Buchanan, 1965) addresses the production of local public goods by decentralized market processes. The general economic problem of public goods is as follows: When goods are jointly produced and non-divisible in consumption (i.e., one person's

consumption does not deplete the capacity of others to consume it), then theories of rationality, egoistic preferences, and decentralized decision-making predict that these goods will be, at best, under-provided or, at worst, not provided at all—despite a general preference that such goods should be provided (Buchanan, 1968; Olson, 1965; Samuelson 1954, 1955).

If goods are produced even if everyone does not contribute, and contributions are costly, then rational individuals will not contribute. If sufficient numbers of people *do* nevertheless contribute, than non-contributing "free-riders" will enjoy access to the good produced by others' payments. Anticipating that others will not contribute, people may also anticipate that a contribution from themselves would be wasted, being insufficient to produce the good by itself. Thus rational individuals will not act as necessary to provide public goods that all desire. [1]

Buchanan recognized that a subset of individuals within a wider population *could* produce goods *for their particular subset* within the same assumptions of rationality, egoistic preferences and decentralized decision-making, while solving the free-rider problem. This could happen if individuals were free to sort themselves into "clubs," limiting membership only to an optimal number of contributing individuals. Access to club goods would be restricted to members only. Thus clubs provide a kind of good that is intermediate between public goods and purely private goods.

Club theory predicts that when individuals are free to sort themselves into appropriate clubs, a socially optimal *set* of clubs will emerge from the decentralized decision-making of rational, egotistic individuals. These optimal clubs should include others according to their capacity and willingness to pay, and exclude others when crowding effects undermine the value returned from membership. Individuals

are presumed to join or abandon clubs based on calculating the value derived from membership relative to the costs. In an important aside, Buchanan notes that the theory applies: "only to the extent that the motivation for joining in sharing arrangements is itself economic; that is, only if choices are made on the basis of costs and benefits of particular goods and services as these are confronted by the individual. In so far as individuals join clubs for camaraderie, as such, the theory does not apply" (1968, p. 548).

For consideration of a broader range of motives than the economic one addressed by Buchanan, we turn next to social psychological theories.

1.2. Psychological needs

Schutz's (1958) model of group behavior incorporates three basic psychological needs that groups satisfy: inclusion, control, and affection.[2] *Inclusion* corresponds to the need for affiliation with others who provide social approval and validation. *Control* corresponds both to the need for power and dependency needs — the desire to exert influence over others as a way to control the environment, and the desire to rely on the influence and guidance of others. *Affection* corresponds to a need for intimacy and close relationships (which Buchanan refers to as "comraderie"), and includes the need to both express and receive affection.

Schutz proposed that the importance of these needs varies depending on a group's stage of development, with inclusion dominating in the first stage, control in the second, and affection in the third. In the final stage, ties of affection, mutual influence, and affection are dissolved. We add a fourth need not addressed by Schutz: the need for achievement (McClelland, 1985),

which is served when groups are able to reach valued goals that cannot be attained by an individual acting alone. These four needs can be added to the basic economic need (or desire) for goods and services presumed by club theory as a fundamental motivation.

Drawing both on club theory and on this broader analysis of member motivation, Arrow, McGrath, and Berdahl (in press) propose that clubs, which they define as groups oriented primarily toward the satisfaction of member needs, can be distinguished according to their relative emphasis on addressing different types of needs. Economic clubs are those envisioned by standard club theory — collectives formed to provide concrete resources that members desire. Social clubs are those whose main attraction for members is the "camaraderie" and social support provided. In these groups, the primary source of reward is affiliation with the group and interaction with other members. Activity clubs are groups that are attractive to members because they allow them to engage in enjoyable activities--often ones that require more than one person, like playing bridge or softball--or to complete valued tasks. Opportunities to influence others and be influenced in turn (control) are provided by group interaction in a variety of clubs and work groups.

1.3. Social integration

Moreland (1987) identified four forces that lead to the social integration of people into groups. Environmental integration is the tendency of people who live in the same physical or social environment to form groups; it emphasizes the importance of proximity in determining, out of a large pool of individuals, who will become connected to whom. Affective integration refers to emotional forces such as interpersonal attraction. The proliferation of dyads formed on the basis of mutual attraction can lead to the formation of larger groups through the chaining together of overlapping dyads. Cognitive integration occurs as people develop shared methods of communication and shared interpretations of reality. According to social comparison theory (Festinger, 1954), people seek out others to help them make sense of the world, and are attracted to those who validate their own existing beliefs. Perceived similarity among individuals is thus a basis for cognitive integration. Behavioral integration occurs as people coordinate their actions so as to satisfy one another's needs. Common fate, or outcome interdependence, can promote behavioral integration when collective action can affect shared outcomes.

While club theory provides a model by which decentralized decision-making can lead to theoretically optimal group formation, and basic social psychological theories provide insight into a broader range of motives and factors that affect who will join with whom in what types of groups, the coalition formation literature addresses the problems of unequal resources and reward allocation, and considers how these factors affect the choice of group partners.

1.4. Coalition formation and bargaining theory

The two main issues addressed by the literature on coalition formation are which coalitions will form, and how members of coalitions will divide up their rewards. In a typical experiment, players have differing resources, and some minimum number of resources are necessary to form a coalition and receive a payoff. Only one coalition can form

from the pool of players.   Experimental results to date provide support for Komorita and Chertkoff's (1973) bargaining theory and Komorita's (1979) equal excess model. The former predicts that weak members will emphasize the equality norm, strong members will emphasize the equity norm, and the actual distribution will at first be midway between what these two norms predict, but over time will be adjusted to reflect the maximum that a member could receive in alternative coalitions. The latter predicts that players will initially expect equal splits but will use the values of alternative coalitions in bargaining for a larger share, with the actual distribution reflecting the value of each player's best alternative followed by an equal division of any resources left over after meeting these values. Both models suggest that actual outcomes are a compromise between conflicting distribution principles: (1) equality norm, (2) equity norm, and (3) relative power (which is exploited in the bargaining process), and that the distribution will change over time.

As far as which coalitions will form, the normative prediction for "simple games" (in which only one payoff is available) is that minimal winning coalitions will form: that is, the smallest effective group will form, since the payoff is the same regardless of which group forms. In a smaller group, members will expect a larger overall reward than they would in a larger group. Both experimental studies and political research suggests than actual coalitions commonly exceed this minimum, however (Komorita & Kravitz, 1983; van de Kragt, Orbell, & Dawes, 1983).

2. Elements of a Model

2.1. Presumptions

Drawing on the theoretical traditions just reviewed, we have constructed a theoretical framework for studying self-organized group formation based on the following presumptions:

Membership choices:
(1) Multiple groups (clubs) can form out of a pool of potential members. Thus all or most individuals will have the potential to be included in a variety of different possible groups.
(2) Members can freely choose what groups they want to form or join, and they may also leave a group at any time.

Social exchange:
(3) Potential members have resources that they can contribute toward the production of club goods. Different individuals may have different resources.
(4) Individuals form (or join) groups to receive something of value that they either cannot obtain alone or that can be obtained more cost effectively through collective action. Valued benefits can include both economic and psychological rewards.
(5) Expected rewards may vary across individuals and across groups for the same individual.

Collective goods:
(6) The goods produced by a group will differ depending on the composition of members, the resources they contribute, and the production function. Some goods will be indivisible, and some divisible.
(7) Members will allocate divisible goods amongst themselves based on some combination of norms and bargaining power. Because members are free to leave, the rewards anticipated in alternative groups and the threat of defection can be used in bargaining for rewards.

Member-group relations:
(8) Individuals will base their decisions about membership and their demands for rewards on their information about the resources, expectations, and power of themselves and

other potential members, and on expectations of relative rewards in different groups derived from this information.[3]

2.2. Building blocks

From these presumptions, we propose the following core elements as basic building blocks for group formation:

Individual level:
C   Individuals (potential members)
C   Resources attached to individuals
C   Motives: Individual needs, desires, intentions, and expectations

Interpersonal level:
C   Knowledge about other individuals and their resources, needs, and expectations
C   A way for individuals to communicate information and negotiate with one another

Group level:
Each potential grouping of individuals has a composition of relevant individual elements
C   Composition of resources
C   Composition of preferences (needs, intentions, goals)

Once groups have formed, the following group-level processes are needed:
C   A production function that turns combined resources into group goods.

Goods produced and enjoyed by members can be both divisible and non-divisible.   If there are any divisible goods, the group will also need:
C   A collective decision process that determines how divisible group goods will be divided

The production function and the decision process together yield at set of outcomes, at the individual, group, and societal level. One can consider what the group collectively is able to produce, what the set of groups in the society produce, and the outcomes each individual group member receives.

Some groups disband as soon as the members have assembled, completed their interaction, and received the immediate benefits of that interaction. Standing groups that continue their existence will also need to develop:
C   A collective decision process to regulate membership, including the admission or rejection of prospective new members.

In the next section of the paper, we elaborate on these building blocks. Then we introduce the social poker paradigm, and explain how the elements are modeled in this paradigm.

2.3. Individual-level elements

Individual resources. Individuals have control over resources that they might put to varying private uses but that also can be combined with the resources of others to produce group goods (which corresponds to local public goods). Where private goods are concerned, a diversity of resources is necessary for productive exchange. Individuals who hold diverse goods and whose values differ with respect to those goods can often increase their private welfare by "trucking and bartering."

With group goods all individuals' having the same resources would not *necessarily* preclude successful production. Sets of individuals can pool their resources to reach some critical amount; simple aggregation, for example, might produce enough lumber and labor to build a barn, for example. Other group products require individuals with *diverse* resources. Building a modern brick house, for example, requires diverse skills—in design, bricklaying, electrical wiring, plumbing, carpentry, etc. A similar diversity of skills is often present in academic collaborations with

scholars bringing different technical skills, literature backgrounds, writing skills and other capacities to their joint effort.

Individual preferences for goods. According to club theory, the production of club goods requires some homogeneity of preferences among those who join together to produce them. However, homogeneity is not required within the wider population from which such groups emerge. Subsets of this wider population might quite satisfactorily produce a mosaic of diverse clubs with different club goods.

If we broaden the scope to include psychological "goods" that satisfy needs for inclusion, control, and affection, then complementary needs may be just as important. People who want to control others are better matched with others who seek guidance and direction, rather than with others who have a high need for power, like themselves.

2.4. Interpersonal-level elements

Interpersonal knowledge. When resources and preferences differ across individuals, people need information about the resources others have and whether others are interested in using these resources for collective projects. Because such information should help people find partners for successful collaborations, people should be motivated to acquire it.

Interpersonal communication. Knowledge about others' resources and others' goals for employing those resources can be acquired directly from potential collaborators or indirectly from others who know potential collaborators. It can also sometimes be extracted from a public data base or inferred from other publicly available information about a person. A new faculty member, for example,

may be inferred to have fresh ideas and lots of energy; a senior faculty member with a history of successful grant writing and collaborative research (which can be determined by reading a web page) may be inferred to have grant writing expertise and an interest in pooling research ideas with others. People interested in collaborations may also advertise their resources and interests publicly.

Social networks, proximity, experience and other criteria influence the ease of accessing information and the cost of acquiring it. The problem of finding individuals interested in pooling resources with one's own can be a stronger constraint on developing a successful group effort than the problem of finding people with complementary resources. Not everyone who holds such resources will reciprocate one's interest in a joint endeavor.[4]

2.5. Group composition elements

Composition of resources. What a group can potentially produce as a group good will depend in part on the resources that members of that group would contribute. We expect people to form expectations about how they might benefit from various possible collaborations, given what they know about the composition of resources of different plausible subsets of group members.   In a field of opportunities for group membership (and assuming, for simplicity, that individuals can only belong to a single group), the resources that the individual controls might be more or less attractive to others in *their* efforts to construct groups

Complementarity or conflict among member goals. People with complementary resources might or might not have complementary goals for what they hope to achieve from forming a group, pooling resources, and producing some kind of group

good.[5] When goals are complementary, people can pursue these goals via joint action. We presume that individuals will join together only when they expect this will yield some benefit beyond the returns they would enjoy from private use of their resources.
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2.6. Group process elements

A production function. There must be some process by which resources are used to produce group goods once individuals have formed a group. Some goods may be generated automatically as soon as the group forms; some will require joint action. Consider the example of three members of Congress who discover that they feel the same way about a controversial issue and form a group to write legislation. As soon as they get together, they have increased their political power in the larger environment because they are no longer isolated. Coordinated action is still needed, however, to produce the proposed bill. Goods that are produced may be non-divisible (automati-cally available to all members) or divisible.

A collective decision process for allocating divisible goods to members. Individuals' bargaining power will differ depending on the alternative nascent groups to which their resources might be taken, and the relative value of the resources they hold. Consequently, individuals will often be in a position to bargain with others about whether they bring their resources to one nascent group rather than to another. Their bargaining power is a function of the value that other individuals place on the resources they hold, the existence of alternative uses for those resources, and the skill with which they exploit their position in this respect.[6] Once the group has been formed and the goods produced, the manner in which bargaining power can be deployed varies between:

1. *Goods that are not divisible.* By definition, all individuals share these benefits equally. Individuals are still in a position to threaten to "take my resources elsewhere," but they cannot bargain for a relatively greater share of nondivisible goods.

2. *Divisible goods.* Here the individual with bargaining power *is* in a position to use that power in an effort to get a disproportionate share of the group product.

As a practical matter, of course, most natural groups are likely to provide some of both types of goods. Status within a group, for example, is a divisible good, but the status of belonging to a particular group (seen from the outside) is not divisible.

Groups may develop a range of allocation procedures. They may depend on consensus decision-making, on the decisions of a group leader, or on a majority voting process. Groups may also rely on an "honor" system of members simply taking what they need from the group. Such a system depends on trusting members not to exploit the group by overusing or depleting the group goods.

3. A Laboratory Paradigm for Group Formation: Social Poker

Formal or mathematical modeling, computational modeling, and empirical data (experimental and observational) all can be used to address the problem of "bottom up" formation of groups. The social poker laboratory paradigm embodies many (but not all) of the above elements of a satisfactory model.[7] It is designed to collect data on the

process of self-organization into groups in a controlled setting, in which individual resources, interpersonal information, minimum effective group size, and other variables of interest can be systematically manipulated.

The name *social poker* comes from parallels with the well known card game. In the latter, players are randomly allocated resources (the cards they are dealt) and they try to use their resources to form a card "hand" that is superior to the hands formed by competitors. The outcome is a product of luck (the "draw") and of the skill with which players use the cards that they are dealt. In social poker, participants also receive and try to use those resources to their best advantage. As in the standard game, the outcome depends on the distribution of cards and on people's skill in making good use of those resources. Distinct from the standard game, however, in social poker no one has enough cards to form a hand by themselves. Instead, they must join forces with others and combine their cards to form a hand. Hence the *social* element: While in the standard game each player is locked in zero sum competition with each other player, in social poker subjects cannot form a hand unless they form a group and pools their resources.

Next, we show how the building blocks of group formation described in the model are represented in social poker.

3.1. Individual-level elements

A pool of individuals. The experimenter determines how many individuals will constitute the population from which groups can form.

Individual resources. In social poker, "resources" are cards that are dealt by the experimenter to each of the participants in the experiment. Rules of the game specify the ways in which these "resources" might be combined,

and the value of different possible combinations. For example, all the standard poker hands could be deemed valid, and earn specific monetary payoffs. Alternatively, only particular hands (straights and full houses, for example) may be designated as hands that earn payoffs.

The experimenter determines the pattern of cards that are dealt to players. Cards, valid hands, and payoffs can be set up so that all players have equally valuable resources; the game can also be set up so that some players have an advantage. The distribution of cards will determine how profitable different possible groups will be, and whether a given set of people can form a hand or not. Once dealt, cards are under the private control of the players. In economic terms, they are "private goods." The problem is to find the most valuable use for the resources that they have been dealt.

Critically, these cards acquire value only when they are combined with cards controlled by others, and players are not allowed to trade or sell cards. In the natural world, of course, there is a market for private goods, and those who control them are free to trade with others. However, some private resources -- specialized knowledge or skill, for example, is not so easily transferred from one person to another. Our interest is in the processes by which individuals come together in group enterprises, and in social poker as presently developed the only way a subject can gain financially from the cards he or she has been dealt is by pooling them for a joint enterprise.[8]

Individual goals and preferences. In social poker, individuals should all seek to pool their resources with others to produce joint goods. We presume that they will put a higher value on using their resources in a way that generates higher payoffs for a group. Beyond the economic value of their resources, we

presume that individuals will also vary in their needs for affiliation (how important it is for them to be included in a group). This is not a variable that is manipulated in the game, however, and the game is constructed so that *all* members have a motive to form groups, as a means to gain access to goods.

3.2. Interpersonal-level elements

Interpersonal information. In social poker, full information about resources exists when everyone knows the cards that everyone else has been dealt. Coupled with knowledge about the value of different hands, people should be able to recognize the value of different groupings of players based on the card distribution. They may also infer the preferences of others based on this knowledge. When multiple possible groups will yield the same payoff, however, players will not have a clear economic basis for preferring one combination of people over another, and should also find it difficult to infer the preferences of others.

Information about the cards of others can also be restricted, so that players have information only about their own cards, and need to communicate with other players to gather information about their cards.

Interpersonal communication. In contrast to regular poker, in social poker players should be motivated to share information about their cards, if that information has not been made public at the beginning of the game. Unlike in regular poker, however, there is little reason to lie about one's own cards; since forming a group based on a lie about cards will not form a valid hand. Instead, there is considerable reason for subjects to *advertise* their cards truthfully, even if those cards are not particularly valuable. This is because the main problem in a social poker game is to discover the optimal use for one's own cards, a problem that is best solved by full and free disclosure.[9]

Interpersonal communication in social poker can be handled by natural conversation among players, via a note passing system, in which players disclose information about cards or suggest forming groups with others, or via a computer-mediated version of the game that allows players to talk via a "chat" interface.[10] Players can learn about who has what cards (in games without full information), and find out what groups other players want to form either directly from the players or indirectly, by hearing this information from a third party.

3.3. Group-level elements

Composition of resource and preferences. Players' preferences for group products are "induced" (Smith 1979) by the experimenter's specification of valid hands and the payoff for those hands. If some hands earn more money than others, then players will have a financial interest in becoming members of groups with more lucrative hands.

However, this does not ensure that the most lucrative set of groups will form, given a particular population of players and distribution of cards. The distribution of cards can be organized so that certain players have incompatible goals. If, for example, subject A holds a card that is a critical resource for subjects B and C in their effort to form the most rewarding hand (say a royal flush) and is *also* a critical resource for subjects D and E in their effort to form a somewhat less rewarding hand (say a full house), then a clear conflict exists between the goals of B & C and D & E—a conflict that revolves around the choice of the pivotal individual A.

The production function. In the social poker paradigm, the experimenter specifies both the range of group goods that might be produced and the aggregate value that each of those goods will generate for the group. The value that attaches to any card hand a group might produce is specified by the experimenter. In our games, we use monetary rewards. Following the conventions of regular poker, a straight may earn less than a full house, which earns less than a flush. The critical point is that any set of individuals who put together a particular hand can expect a group return of some specified value. In the term used by experimental economists, the experimenter has "induced preferences" (Smith 1979) among subjects for hands that are differently constructed in this manner.[11]

In the standard game of poker, players contribute money to a "pot" which then goes *in toto* to the winner, but in social poker (at least as presently developed) the experi-menter provides the payoff for different hands, and multiple groups can form and receive payoffs. Thus, the participants in a social poker experiment do not have purely competitive interests, unlike the situation in the standard game of poker. Instead, players have a common interest in forming a valuable hand. In social poker, the experimenter (more accurately, the funding agency) is the ultimate source of whatever wealth that subjects take home, not other players.

Collective decision processes. While the experimenter specifies the payoff going to a successful group, the returns going to each constituent member of that group may be left for the group itself to decide (if the group is given the whole amount directly) or specified in the experiment. In one version, we require members to fill out a group decision form that all members must initial. Individual members are then paid the share specified on the form.

In another version that implements a social dilemma within the group, group members make private claims on the group earnings. The sum of private claims can exceed the full value of group earnings, a situation equivalent to the "commons dilemma" (Dawes 1975), in which "over-grazing" tends to deplete the shared good.

If the total claim is equal to or less than the amount earned by the group, each member is paid what they claimed (no degradation of the group good). If the total claim exceeds what the group actually earned, then each member is paid what they claimed, *minus* some penalty (50 cents for each dollar that the total exceeded the group earnings in a current version of the experiment). If this results in a negative amount, the member earns nothing (but is not required to pay the experimenter).

This version not only provides theoretical continuity between the social poker and social dilemma laboratory paradigms, but adds an important new consideration to the problem subjects confront when constructing groups. Absent the capacity to exploit the resource provided by group action, players need only be concerned with finding individuals whose cards, in conjunction with their own, will form a successful hand and with persuading those individuals to join them in that effort. With the capacity for exploitation, however, players must also consider the probability of a given individual's making claims against the group product that will damage the value of that product for others in the group.

The structural, institutional and personal variables influencing players' judgments in this respect, and the extent to which such judgments weigh against the "value added" that an individual brings to the group effort, comprise a rich agenda for empirical study.

Bargaining power. When the division of

group earnings is decided collectively by group members, people whose cards could be used in more than one group may use their power to bargain for a larger share of the earnings. Thus a player may have more bargaining power in a nascent group attempting to form a relatively *less* valuable hand (with the other players offering a larger share of the earnings to a critical member) than in a group attempting to form a *more* valuable one (if they insist on a more equal division, for example). The extent to which the gains that are formally available—that might be predicted by a game theoretic analysis—are realized in practice is, of course, an empirical issue.

Collective decisions about membership. When the game is played once, people make individual decisions about who they want to form a group with; dyads who have agreed to join forces may jointly decide who they want to recruit as additional member(s) (when the minimum effective group size is three or more). When the game is played in a series of rounds, the group as a whole may also make decisions about whether to "regroup" in the following round. In multiple round experiments we have already run, for example, some players form relatively stable groups, and develop reciprocity norms that function across rounds.

4. Extensions of the paradigm

Based on the initial response of other researchers to our presentations of the social poker paradigm, we are optimistic that it will prove a flexible and useful approach to studying group formation under controlled conditions. Unlike tasks that involve complex written materials, which depend heavily on language and thus require careful translation and back-translation to be adapted in other cultures, we believe the use of an easily explained card game will make this paradigm relatively easy to adapt to different languages and cultures. Researchers interested in exploring group formation can easily manipulate parameters such as minimal group size and the relative power of players by changing the distributions of cards. Minimum group sizes of four or five, for example, could be arranged based on giving players fewer cards and limiting the types of hands that earn payoffs.

We are also extending the paradigm by developing a computer-mediated version of social poker, which is programmed in Java and uses a web-based interface. The difficulty of collecting and analyzing naturalistic group process data from freely interacting groups has, we believe, impeded progress in the study of groups (McGrath, 1997). Although coding videotaped interaction is an improvement over coding interaction as it occurs, working with interaction process data remains extremely labor-intensive. Many researchers also lack access to a laboratory space suitable for videotaping interaction in the face-to-face version of social poker. When group members interact via a chat-based system, however, the free flow of interaction can be captured automatically in log files, which makes process analysis a less daunting task.

The formation of social and work groups in cyberspace is one of the most striking social uses to which Internet users have adapted this new communication medium. As documented by many researchers (see McGrath & Hollingshead, 1994, for a recent review), computer-mediated interaction differs from face-to-face interaction in a variety of ways. In a series of experiments in progress, we will compare results in the two media to define similarities and also document limits to

generalizing about group formation across media.

Researchers interested in using the social poker paradigm in their own work are encouraged to visit the social poker web sites (see title page) for more information and to download the current release of computer-mediated social poker. For information about card distributions and experimenter protocols for different versions of the game, please contact the first author.

Notes

1. Exceptions exist, of course. Notably, Olson (1965) pointed out that groups in which some single individual values the good sufficiently to bear the full cost personally—which he called "privileged" groups—will be successful in providing such goods, even when all other members can free ride. Similarly, even if not able to carry the full cost of the good themselves, individuals who believe (rightly or wrongly) that their own contribution is "critical" to provision of the public good will go ahead and contribute, as long as the cost they pay is less than the benefit they receive (van de Kragt, Orbell, & Dawes, 1983).

2. Our summary of Schutz's theory is based on discussions by McCollom (1995) and Forsyth (1990).

3. This conception of member-group relations draws on Thibaut and Kelley's (1959) notion of comparing alternatives and on Moreland and Levine's (1982) model of group socialization.

4. For simplicity, we ignore the possibility of theft. We assume that all parties who control resources must agree before those resources are used in any way; that is what "controlling resources" means.

5. Note that "complementary" goals are not necessarily identical goals. The critical issue, from each individual's perspective, is whether the goals that he or she holds can be better advanced by joint action rather than individual use of private resources. Individuals' goals might be quite different, but those individuals could see private advantage from working in collaboration with each other to advance those different goals.

6. On the related distinction between power and power resources, see Dahl (1956). A person's bargaining resources must be both useful and scarce, and that person must have somewhere else to go—or be able to convince people that he or she would be willing to sit out rather than join the group under poor payoff conditions—to be in a strong bargaining position. While such negotiations are susceptible to formal (and empirical) analysis, the strategic interaction involved implies limits to the power of such analysis to predict actual outcomes (Elster, 1989). We are analyzing cooperation structures—in which jointly held goals are advanced by collective action—not coalitions, in which the purpose is to defeat the goals of some other individual or individuals via collective action. The critical issue is the commonality of interest within the group that is getting together.

7. Humphrey (1976) coined the term "social chess" to describe the strategic games he saw as characteristic of social species (other than the social insects). Both chess and poker are, of course, highly strategic games, and the power of Humphrey's metaphor was that it did direct attention to the strategic interactions that appear to preoccupy social animals. In the present context, however, poker provides the better metaphor because of the problem it presents players of finding an optimal use of the resources that they are dealt—an attribute that is absent from chess, but that is, we believe, a frequent problem in social life when individuals pool resources for jointly productive action.

8. Social poker differs from social dilemma paradigms in which subjects are given a dollar endowment at the outset of the experiment and have the option of using all or some of that endowment as a contribution toward a group good. In these experiments, any part *not* so contributed remains part of the individual's "take home" pay. (See, for example, Isaac, McCue, and Plott 1985; Marwell & Ames, 1979). We are currently piloting a version of social poker in

which players who are not included in groups receive a small amount of money. This would model resources that retain private uses if not contributed to a joint endeavor.

9. There *might* be a rational basis for lying about what cards *another* individual holds. A third party, misinformed in this manner, might choose to collaborate in a hand with the liar. Yet the incentive for individuals to reveal their own cards, even if they are not particularly strong cards, makes such deceit risky.

10. See the web sites noted on the title page for more information about the current software used for the computer-mediated game.

11.Neither experimental economists nor we, of course, imply that such "induced preferences" are the *only* preferences that subjects bring to their laboratory actions. Subjects might attach substantial value to particular distributions of payoffs—equality or fairness, for example. The only implication is that subjects attach *some* value to the monetary payoffs that the experimenter is offering, thus that those payoffs are motivating, to *some* extent. Notice, however, that use of monetary incentives can provide an opportunity for observing the extent to which subjects are willing to diverge from their monetary incentives—thus, in a sense, the dollar value that they attach to such "other values."

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