In generalized exchange, the rewards that an actor receives usually are not directly contingent on the resources provided by that actor; therefore free riding can occur. The actor can receive benefit without contributing. Scholars interested in generalized exchange systems have often overlooked this inherent free-riding problem and thus have been overoptimistic in concluding that generalized exchange promotes mutual trust and solidarity among the participants. A more complete understanding of generalized exchange requires that the underlying social dilemma in such situations be appreciated fully. This paper represents our initial efforts to bridge two research traditions—research on social exchange and research on social dilemmas. With few exceptions, research in this tradition often ignores the internal structure of the social contexts in which such dilemmas arise. We present the results of a series of experimental studies. The findings suggest that "network-generalized" exchange systems promote higher levels of participation (or cooperation) than do "group-generalized" exchange systems, regardless of the size of the network or group. In addition, mutual trust promotes a higher level of participation, especially in network-generalized exchange systems.

In this article we report our first attempt to bridge two major research traditions which thus far have developed independently: research on social exchange networks and research on social dilemmas. We believe that cross-fertilization of these two research traditions will benefit both, and is long overdue.

Research on social exchange networks began with the seminal work of Emerson (1972a, 1972b). Realizing that traditional social exchange theory had been limited primarily to the analysis of dyadic exchange relations, Emerson and his associates launched a series of theoretical and empirical efforts to extend social exchange theory beyond the initial, fairly narrow dyadic perspective (K. Cook and Emerson 1978; R. Cook et al. 1983; K. Cook and Gillmore 1984; Stolte and Emerson 1977; Yamagishi, Gillmore, and Cook 1988). Emerson (1972a, 1976) originally conceived of two major ways of extending social exchange theory beyond dyadic relations. The first avenue was to treat those relations as embedded in larger network structures. Until recently Emerson and his associates followed this route, which culminated in the development of exchange network theory (K. Cook 1982; R. Cook and Emerson 1978; K. Cook et al. 1983; K. Cook and Yamagishi 1992; Emerson 1976, 1981, 1987; Markovsky, Willer, and Patton 1988; Stolte and Emerson 1977; Yamagishi 1987; Yamagishi et al. 1988).

The second avenue of theoretical development involved the investigation of corporate groups and of exchanges occurring between individuals in the group as well as between corporate groups and other actors. Exchanges involving corporate groups take the form of generalized exchange (Ekeh 1974). Ekeh distinguishes two basic forms of social exchange: restricted and generalized.1 Re-

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1 Emerson also introduces a distinction between elementary exchange and productive exchange. This distinction should not be confused with the distinction between restricted and generalized exchange discussed below. Whether an exchange is restricted or generalized depends on whether a direct give-and-take relationship exists between two partners. Whether an exchange is elementary or productive depends on whether extra value is produced by the combination of resources. For example, a productive exchange takes place between two people when one has fresh tuna and the other has rice; eating tuna and rice separately is much less pleasurable than eating tuna on rice as sushi. This exchange is productive and, at the same time, restricted; the two participants trade the tuna and the rice directly.
stricted exchange occurs between two parties when the resources that one party provides are directly contingent on the resources that the other provides in return. All of the studies of exchange networks cited above involve this type of exchange. In generalized exchange, in contrast, what one party gives to another is not directly contingent on what he or she receives from the other. One example of generalized exchange is matrilateral cross-cousin marriage, in which women pass from one family to another along a unidirectional chain among families linked by kinship relations. A family receives a woman from the mother’s brother’s family, and gives a daughter to the father’s sister’s family. In order to receive a woman from another family, a family need not return their daughter to the same family. Helping a stranded driver on a mountain road is another example of this form of generalized exchange because the help one provides in such a situation ordinarily will not be repaid by that driver. The helper, however, may receive aid from some third party in the event of future car trouble. Generalized exchange often takes a different form, one which involves resource pooling and public goods. For example, villagers pool their labor to dig an irrigation ditch, build a school, or construct a bridge, and then collectively enjoy the benefits.

In either case, generalized exchange is characterized by the lack of one-to-one correspondence between what two parties directly give to and take from one another; this is the primary quality distinguishing generalized from restricted exchange. Nonetheless, participation in generalized exchange requires that each actor provide resources at some time and eventually receive some benefit in return. In this sense it can be conceived as a form of exchange. Except for anthropological studies of primitive societies, however, empirical research involving corporate groups and systems of generalized exchange has been scarce compared to research focused on exchange networks. This article reports the results of the first in a series of studies designed to further pursue this avenue of theoretical development.

The second major research tradition that concerns us in this article is the extensive research on social dilemmas (for recent reviews see Dawes 1980; Edney and Harper 1978; Messick and Brewer 1983; Stroebe and Frey 1982; Yamagishi 1989a). The work on social dilemmas derives from its predecessor, research on dyadic dilemma games such as the prisoner’s dilemma. A social dilemma is defined as a situation involving a particular type of incentive structure, such that 1) if all group members cooperate, all gain, whereas 2) for each individual it is more beneficial not to cooperate. The classic example of such a dilemma is the “tragedy of the commons” discussed by Garrett Hardin (1968). When villagers have free access to a common grazing ground, it is rational for each villager to place more sheep on the commons because the marginal damage caused to the grazing ground by each additional sheep is shared by all of the villagers, while the profit is retained privately by the owner. If all villagers act in this fashion, however, eventually the common ground will be overgrazed and the villagers will lose their sheep. Since the early 1970s, many studies of social dilemmas and related problems have been conducted in the social sciences (for reviews of the literature outside social psychology, see Albanese and Van Fleet 1985; S. W. Cook and Berrenberg 1981; McMillan 1979; Seiyama and Umino 1991; Stroebe and Frey 1982).

The relevance of these two general fields of research to each other is clear: any system of generalized exchange involves the incentive structure characteristic of a social dilemma. In generalized exchange, the benefit that one participant receives is not directly contingent on the resources he or she gives to another participant. Therefore it is possible for each participant to receive benefits without giving up his or her own resources unless formal or informal sanctions are used to encourage all participants to cooperate in this system of indirect exchange. Because the possibility of free riding is inherent in the underlying structure of generalized exchange situations, a basic social dilemma must be resolved in these situations (see Yamagishi 1991 for further discussion of this issue).

Despite the close relationship between generalized exchange and social dilemmas, neither students of generalized exchange nor those of social dilemmas have paid much attention to the links between these research traditions. This insularity is unfortunate for several reasons. First, Ekeh, a major exchange theorist, failed to consider the impli-
cations of social dilemmas and the free rider problem in his analysis of generalized exchange. As a result, he pictured generalized exchange too optimistically in comparison to restricted exchanges. Ekeh argued that generalized exchange promotes mutual trust and solidarity among participants, whereas restricted exchange breaks down into isolated dyadic relations. Research on social dilemmas, on the other hand, with few exceptions (e.g., Hayashi 1993; Hayashi, Jin, and Yamagishi 1993; Jin, Hayashi, and Shinotsuka forthcoming), has failed to acknowledge the importance of the internal structure of social dilemma situations; it treats all social dilemmas as one particular form of generalized exchange involving only resource pooling (to which we will refer as “group-generalized exchange”). Most studies of social dilemmas, both theoretical and empirical, assume that group members are “independent” actors in the same way as economic actors are assumed to be independent decision makers. As shown by the recent studies of integrated markets, economic actors’ decisions are influenced strongly by their locations in the network structure of the transactions. Group members’ decisions may be influenced similarly by the internal network structure of the relations among group members. We will illustrate how new insights into both topics are provided by the integration of these two research traditions: considering the implications of the social dilemma aspect of generalized exchange and analyzing the effect of network structures on group members’ decisions in the face of a social dilemma.

Two Structures of Generalized Exchange

As noted above, Ekeh (1974) distinguishes two major forms of generalized exchange. In the first type, group members pool their resources and then receive the benefits that are generated by pooling. This exchange structure, which we call “group-generalized,” involves the typical social dilemma situation. If we assume that each participant receives an equal share of the total benefits generated by resource pooling, it is rational for each person not to contribute his or her resources fully while still receiving an equal share of the benefit. It is predicted that group-generalized exchange structures often fail to persist because of the existence of this free-rider problem. Maintaining a clean kitchen in a shared house, for example, involves generalized exchange; each resident provides some labor to clean the kitchen, and in return each enjoys a clean kitchen. Unless residents’ actions are monitored closely and sanctioned strongly, however, it is rational for each resident to free ride—that is, not to participate in cleaning the kitchen but to rely on someone else to clean it.

The second form of generalized exchange discussed by Ekeh (1974) is what we call a “network-generalized” exchange structure. In this structure, each participant provides benefits to an actor in the network who does not return benefits directly to that participant. Instead the provider receives benefits from some other actor in the network. The simplest form of a network-generalized exchange structure is the three-person unidirectional chain in which Member A benefits B, B benefits C, and C benefits A. The network structure, however, can be more complex than a simple circular chain. For example, it may take the form of several partially overlapping circles (e.g., in the case of the kula ring or trading system among South Pacific islanders, as depicted by Malinowski 1922). In network-generalized exchange, each actor gives to and receives from particular individuals rather than to or from the group as a whole. In this way it is distinguished from group-generalized ex-

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3 From Ekeh’s perspective, ignoring the social dilemma aspect of generalized exchange is not a failure. That is, from the collectivistic view of generalized exchange (which is also the view adopted by Ekeh), the social dilemma does not or should not exist in a society characterized by the spirit of generalized exchange. Ekeh argues that generalized exchange generates a morality characterized by credit mentality (1974, pp. 58–59). He does not explain, however, how such morality is generated; he simply assumes it as a matter of empirical fact. Yamagishi (1991) offers an explanation of the genesis of such morality based on Ekeh’s argument.

4 Ekeh further distinguishes two forms of group-generalized exchange: group-focused generalized exchange and individual-focused generalized exchange. In individual-focused generalized exchange, participants pool their resources to benefit one participant at a time, as when villagers gather to build a barn for a particular villager. In group-focused generalized exchange, the benefits provided by pooling resources are shared by all of the participants. In either case, however, resource pooling and the sharing of the benefits are involved.

change. Network-generalized exchange also is distinct from the restricted exchanges taking place in network structures, on which recent studies of exchange networks have focused, in that the exchange relationship (or the network path) in network-generalized exchange is unidirectional. In this respect a network of “weak ties” characterized by the unidirectional flow of information, if we may build on Granovetter’s (1973) work, may be considered a network-generalized exchange structure, whereas a network of strong ties containing a bidirectional flow of information may be considered a restricted exchange structure.6

Network-generalized exchange has had critical theoretical importance in the development of anthropological theories. Explaining the dominance of matrilateral over patrilateral cross-cousin marriage was once a central issue in that discipline (Homans and Schneider 1955; Levi-Strauss 1949). Beyond its historic role in the development of exchange theories in cultural anthropology, network-generalized exchange also has more current theoretical relevance. It is especially pertinent to the issue of trust and cooperation in social dilemmas, which we will discuss below.

On the surface, network-generalized exchange does not seem to involve a social dilemma. Each participant benefits from the ongoing generalized exchange; otherwise there would be no reason for the exchange to occur. Each participant, however, also can free ride; that is, receive benefit without giving up his or her resources. One of the authors lives in a snowy climate, where cars often are stuck in a ditch or on an icy slope. When this happens, passing pedestrians or drivers of other cars usually stop before long to help push the car. The help provided in such a situation is unidirectional; the helpers do not expect that particular driver to help them in the future. At the same time, however, they can and do expect that someone will help them. The stranded driver need not have helped others to receive help; thus people can free ride in this network-generalized exchange of aid. They can receive help without providing it. If most people free ride by failing to stop and help, however, eventually everyone will suffer. This is the heart of the social dilemma (like the common grazing ground in Hardin’s example). Because network-generalized exchange involves such a social dilemma, it is expected that over time “rational” participants will free ride and that the system eventually will collapse. We also expect, however, that the network-generalized exchange system will persist longer than the group-generalized exchange structure for several reasons.

Let us compare the two generalized exchange structures shown in Figure 1. Figure 1a represents a group-generalized exchange structure involving four participants. This is actually the structure we created in our experimental laboratory. Each of the four participants has resources (10 cents per trial), all or a portion of which they may contribute to the group (or to the resource pool). The pooled resources generate benefits that are shared equally by all four participants, regardless of how much each contributes individually. Specifically, each participant’s contribution to the resource pool is doubled in value and then is allocated equally among the other three participants.9 Thus if all four contribute 10 cents, each receives 20 cents in return. If no one contributes on a trial, each participant ends with only the original 10 cents. If one person contributes 10 cents and the other three contribute nothing, the person who contributed 10 cents to the resource pool ends with nothing because he or she contributed all of his resources while receiving nothing in return from the others. On the other hand, those who contributed nothing ultimately have 17 cents: their original 10 cents plus $2 \times 10/3 = 7$ cents obtained from the resource pool as a result of the contribution made by one participant.

Figure 1b represents the network-general-

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6 Granovetter (1973, p. 1361) develops an interesting distinction between “strong” and “weak” ties based on the notion of strength as a combination of amount of time, emotional intensity, and the reciprocity of services involved. He focuses primarily upon positive, symmetric ties, but acknowledges that a comprehensive theory would include asymmetric ties as well. We treat the unidirectional nature of the relationship as a possible defining feature of a weak tie, assuming that strong ties are more likely to involve the bidirectional flow of information or resources. This distinction requires further theoretical and empirical work.

7 We adopted this operationalization of the group-generalized exchange structure rather than simply dividing the total amount of money contributed among the four to make this condition compatible with the network-generalized exchange condition. See Yamagishi (1986) for more justification of this operationalization.
ized exchange structure used in our study. As in the group-generalized exchange structure depicted in Figure 1a, each participant has a resource (10 cents per trial). Instead of pooling the money, however, each person may use his or her resources to benefit the person linked directly to him in the network (known here as the recipient). The amount that each contributes is then doubled in value and given to the recipient. For example, if A (who is linked to B) contributes 6 cents, \(2 \times 6 = 12\) cents is given to B.

The two generalized exchange structures in Figure 1 are identical in terms of the potential "gain of cooperation" and the degree of "temptation to defect," the two most important measures of the seriousness of social dilemmas (Bonacich et al. 1976; R. Hardin 1971). In either structure, each person earns 20 cents when all four contribute 10 cents; each earns only 10 cents if no one contributes. The difference (20 - 10 = 10) is called the gain of cooperation; that is, the amount of additional benefit each can enjoy if all cooperate fully. Each person, however, can save up to 10 cents (the original amount) by contributing nothing, in either structure, regardless of what the other three participants do. In the social dilemma literature, this amount (the saving of 10 cents) is called the temptation to defect. It is now clear that the two generalized exchange structures discussed above have the same general features of a social dilemma: the gain of cooperation and the temptation to defect. The internal group structures, however, are quite different. Group-generalized exchange involves no internal group structure, whereas the network-generalized exchange takes place in a network of unidirectional relations. This difference, we expect, has important implications for the level of cooperation in the social dilemma situation (or for the degree of participation in generalized exchange).

First, the group-generalized exchange involves the incentive structure of an n-person prisoner's dilemma (nPD), whereas the network-generalized exchange of the circular form, such as that shown in Figure 1b, resembles the incentive structure of an n-person assurance game (nAG) more closely than that of an nPD. In an assurance game, free riding is impossible; one's own noncooperative action destroys the public good and thus the opportunity to free ride. If only a small proportion of the participants in a group-generalized exchange system free ride, free riding can continue for a long time without reducing the free riders' benefits (and without destroying the system). On the other hand, one participant's continued free riding...
in a unidirectional network-generalized exchange system eventually will make everyone in the system stop cooperating (the length of time depends on the size of the network). As a result, the free rider himself or herself will lose the benefit he received from another participant. Therefore, insofar as all of the others are cooperating, it is better to cooperate than not to cooperate. If others are not cooperating, however, noncooperation provides better individual outcomes than cooperation. Because of this difference in the long-term incentive structures involved in the two forms of generalized exchange, participants will be less strongly tempted not to cooperate (i.e., to free ride) in the network-generalized than in the group-generalized exchange structure.

Second, the two structures differ as to each participant's subjective efficacy or diffusion of responsibility. In the network-generalized structure, each participant depends totally on the one actor to whom she or he is linked for receiving any benefit. For example, Member B in Figure 1b is totally dependent on A. In contrast, B's dependence on A (or on each of the others) in the group-generalized structure in Figure 1a is one-third (or, more generally, \(1/(n-1)\)) of that in the network-generalized structure. Thus participants in the group-generalized exchange structure will believe that their actions affect each of the other participants less seriously than in the network-generalized exchange structure. In other words, participants will feel less responsibility for the benefits that each of the other participants receives.

This "diffusion of responsibility" effect increases as the group size increases, as demonstrated in the experimental studies of social dilemmas that take the form of what we call group-generalized exchange (e.g., Allison and Messick 1985; Bonacich et al. 1976; Chamberlin 1974, 1978; Fox and Guyer 1977; Hamburger, Guyer, and Fox 1975; Kerr 1989; Kerr and Bruun 1983; Komorita and Lapworth 1982; Sato 1988; Yamagishi 1990). In large group-generalized exchange structures, one participant's decision (whether or not to contribute resources to the common pool) has virtually no consequence for the benefit received by each of the other members. In the group-generalized exchange structure, this diffusion of responsibility thus may lead to a lower overall level of contribution than that observed in the network-generalized exchange structure.

On the basis of these two factors—the difference in the long-term incentive structures and the diffusion of responsibility—we derived the following hypothesis:

**Hypothesis 1:** Participants will cooperate more in the network-generalized exchange structure than in the group-generalized exchange structure.

The Role of Trust in Generalized Exchange Structures and Social Dilemma Situations

One of the major issues, both in the study of generalized exchange and in the research on social dilemmas, is the role of trust. Ekeh (1974) argues that a system of generalized exchange promotes mutual trust among those who participate. This argument is called into question, however, when the social dilemma aspect of generalized exchange situations is recognized. In such situations, people may free ride in response to the social dilemma involved; if they do so, over time the system will collapse. In many social dilemma studies, on the other hand, mutual trust has been shown to have a strong effect on the level of cooperation. When people have a high level of mutual trust or expect that others will be cooperative, they tend to contribute at a high level to the provision and maintenance of a public good (see Alcock and Mansell 1977; Dawes, McTavish, and Shaklee 1977; Fox and Guyer 1977; Marwell and Ames 1979; Messick et al. 1983; Rutte 1989; Samuelson et al. 1984; Sato 1988; Sato and Yamagishi 1986; Tyszka and Grzelak 1976; Yamagishi 1988, 1988a; Yamagishi and Sato 1986). These findings imply that if a generalized exchange system involving such a social dilemma is to survive, the people engaged in the exchange must have a relatively high level of mutual trust. A continuing system of generalized exchange may promote mutual trust among the participants, as Ekeh (1974) argues. The successful continuation of the system, however, requires that people already have a high level of mutual trust, as demonstrated in the research on social dilemmas.

We are not currently interested in determining the causal priority of these two factors—in deciding whether we should treat trust as an independent variable determining...
the success of the generalized exchange system or as a dependent variable generated by the successful survival of the system. Generalized exchanges and mutual trust among the participants most likely are related to each other in a dynamic, mutually reinforcing way. Rather, the key point we wish to make here is that the relationship between trust and generalized exchange varies depending on the structure of the generalized exchange situation. More specifically, trust is predicted to have a stronger effect on cooperation in the network-generalized exchange structure than in the group-generalized exchange structure. The reasoning behind this prediction is based on the difference between the long-term incentive structures involved in these two different forms of generalized exchange, as noted earlier. Trust should have a stronger effect on cooperation in an n-person AG than in an n-person PD because in an assurance game it is individually (as well as collectively) more beneficial to cooperate insofar as others also cooperate, whereas it is better not to cooperate if others do not. In an assurance game, actors’ decisions depend on their expectations of the other participants’ actions. Their expectations, at least in part, should reflect their levels of trust in the other participants.

On the basis of previous findings about the positive effect of trust in social dilemma situations and about the difference in incentive structures between nPD and nAG, we derived two additional hypotheses:

*Hypothesis 2*: High trusters will cooperate more than low trusters in both structures.

*Hypothesis 3*: The positive effect of trust predicted in Hypothesis 2 will be stronger in the network-generalized exchange structure than in the group-generalized exchange structure.

The Effect of Strategies and the Role of Information

One of the most significant findings in the experimental gaming research concerns the effect of strategic actions. In an iterated, dyadic PD game, for example, mutual cooperation is likely to occur if at least one of the partners uses the tit-for-tat (TFT) strategy (for a discussion of the effect of the TFT strategy see Axelrod 1984; Oskamp 1971; Wilson 1971). On the other hand, it is also the case that the effect of such strategies is limited primarily to dyadic relations; that is, the TFT strategy has little effect in nPDs. The reason is that the effect of one actor’s strategic action aimed at affecting another actor’s choices is diffused among the group members and thus becomes weak (for more complete discussions of this issue, see Dawes 1980; Yamagishi 1989b). Therefore it is predicted that the effect of strategies will be weak in the group-generalized exchange system, which is actually an nPD. Yet in the network-generalized exchange system, one actor depends heavily on another; the actor who unilaterally provides resources has total control over the recipient’s outcomes. If the giver notices that the recipient is not giving to another, he or she can punish the recipient by withholding resources until the recipient becomes more cooperative and provides his or her resources to another. If this is to occur, however, the giver must know what the recipient is doing. If the giver does not know whether the recipient is cooperating, it is impossible for the giver to punish or reward the recipient. In other words, the positive effect of strategic actions can exist in the network-generalized exchange system if and only if each actor is provided with information about the recipient’s actions.

We manipulated the information feedback in our study to test the following hypothesis derived from this argument:

*Hypothesis 4*: Information about the other participants’ actions will have a positive effect on levels of cooperation in the network-generalized exchange structure, but this positive effect of information feedback is not expected to emerge in the group-generalized exchange structure.

STUDY 1

We conducted a series of experimental studies to examine the hypotheses derived from our theoretical discussion of the implications of these two types of generalized exchange structures for cooperation.

**Procedure**

We conducted the study using four-person groups like those depicted in Figure 1. Participants in the experiment were recruited from various classes and through advertise-
ments at a major state university campus. When four participants indicated the same available time on their application forms, they were scheduled for an experimental session.10

As soon as each participant arrived at the laboratory, he or she was led immediately to an isolation room to avoid personal contact with the other participants. Each room was equipped with a microcomputer connected to a host computer (IBM PS2). All relevant information was relayed to the participants via the computer display, and the participants’ decisions were relayed by computer connection to the host computer. The participants’ screens displayed the instructions explaining the nature of the task and the incentive structure. The presentation of the instructions was interrupted periodically by questions to test each participant’s level of understanding. Unless the participant gave correct answers, he or she could not move on to the next section of the instructions. When the participant could not answer a question, the experimenter went to the room and provided further explanation. No deception was involved in the study except that the participants were not informed of the exact number of trials in the experiment (to prevent the occurrence of behavior peculiar to the final few trials). The participants were told that the number of trials would be determined randomly between 40 and 60.

Design of the Experiment

The experimental design consisted of three factorially crossed between-groups factors: 1) generalized exchange structure (group vs. network), 2) participants’ level of trust (low vs. high), and 3) level of information (partial vs. complete information). In addition, each cell was counterbalanced by gender (i.e., each cell contained five male and five female groups). The study included a total of 320 participants in 80 four-person groups.

The group-generalized exchange structure. The group-generalized exchange structure (see Figure 1a) used in this experiment was a replication of the social dilemma experiments conducted by Yamagishi (1986, 1988a, 1988b). The experiment consisted of 48 trials. On every trial, each of the four participants was given a resource (in this case, money—10 cents per trial). Then they were asked how much of the 10 cents they wanted to contribute to the other participants. The amount contributed by each participant was then doubled in value and distributed equally among the other three participants at the end of every trial. After all four participants had decided how much they would contribute, the trial was ended and a new trial began. No time limit was imposed on the trials, but they took less than one minute on average. A new trial period started with a display of the amount of the participant had contributed on the previous trial, and of the total amount of benefit the participant had received on the previous trial from the other three participants’ contributions (i.e., two times the total amount of contributions made by the other three participants, divided by 3). In addition, the screen displayed the participants’ overall earnings on the previous trial (i.e., 10 cents minus the amount he or she had contributed plus the total amount of benefit he or she had received from the contributions of the other three) and the participant’s cumulative earnings up to the previous trial. Below this display of the feedback information on the screen, the participant was prompted to key in the amount he or she wanted to contribute during the current trial. In each case the participant was asked to enter a number between 0 and 10.

The network-generalized exchange structure. As in the group-generalized exchange structure, each of the four participants was given a resource (10 cents on each trial). Then they were asked how much of the 10 cents they wanted to contribute to benefit another participant located “next to” them in the four-person unidirectional network (see Figure 1b). In the experimental instructions, the participants were informed of the structure of the network, but they did not have a chance to see each other. The amount contributed by each participant was doubled in value and given to his or her partner. When all four participants had made their decisions, a new trial began with the display of the feedback information concerning the previous trial: how much the participant had contributed, how much benefit he or she had received from the contributions made by another participant (i.e., the giver to the participant),

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10 Usually we scheduled five or six participants for each session to guarantee that at least four people would show up. The extra participants were rescheduled for another session if more than four arrived on time.
the overall earnings on the previous trial, and the cumulative earnings up to the previous trial. The participant then was prompted to decide how much (between 0 and 10) he or she would like to contribute to the recipient on the current trial.

**Information manipulation.** The information manipulation consisted of two conditions: full information and partial information. In the partial information condition, only the feedback described above was provided to the participants; that is, each participant was informed only about his or her own behavior and benefits. In the complete information condition, the same information concerning all the other participants was provided as well.

**Measurement of trust.** We measured participants' trust in others with a questionnaire, designed to measure the participant's general level of trust, consisted of eight items such as "in dealing with strangers, one is better off to be cautious until they have provided evidence that they are trustworthy" and "most people tell a lie when they can benefit by doing so." (For more information about the questionnaire, see Yamagishi 1988a). The eight-item trust scale and previous versions of that scale have been used in several studies of social dilemmas, in which it was demonstrated, both in the United States and in Japan, to be an accurate predictor of the participants' level of cooperation (Sato 1988; Yamagishi 1986, 1988a; Yamagishi and Sato 1986). The average contribution was much higher among high trusters (6.02, sd = 2.39) than among low trusters (3.96, sd = 2.42). Hypothesis 2 also was clearly supported.

**Hypothesis 3.** The trust-by-structure interaction was also significant, F(1,72) = 5.58, p<.05, and the direction of the interaction was consistent with the prediction. That is, the effect of trust was stronger in the network-generalized exchange structure (4.55 for low trusters vs. 7.69 for high trusters; the difference is 3.14) than in the group-generalized exchange structure (3.37 for low trusters vs. 4.35 for high trusters; the difference is 0.98). Thus Hypothesis 3 also was clearly supported.

**Hypothesis 4.** The predicted information-by-structure interaction was not significant; F(1,72)=0.00, ns. Hypothesis 4 was not supported by the results of the experiment.

In addition, the analysis revealed two other significant effects. First, we found an information-by-structure-by-trust interaction, F(1,72)=4.04, p<.05. This three-way interaction shows that the information-by-structure interaction predicted in Hypothesis 4 existed among high trusters, but not among low trusters. Among high trusters, the effect of information was positive and marginally significant in the network-generalized exchange structure (4.55 for low trusters vs. 7.69 for high trusters; the difference is 3.14) than in the group-generalized exchange structure (3.37 for low trusters vs. 4.35 for high trusters; the difference is 0.98). Thus Hypothesis 3 also was clearly supported.

**Findings**

We used a repeated-measures analysis of variance to test the above hypotheses. In this analysis, individual participants are nested within experimental groups, and groups are nested within the combinations of exchange structure, trust, and information factors. We analyzed the 48 trials in eight trial blocks (six trial per block). The dependent variable is the average cooperation level—that is, the amount of money the participants contributed per trial.

**Hypothesis 1.** The main effect of exchange structure was highly significant; F(1,72)= 24.33, p<.001. As predicted, the average contribution was much higher in the network-generalized exchange structure (6.12 cents, sd = 2.80) than in the group-generalized exchange structure (3.86, sd = 1.80). Hypothesis 1 thus was clearly supported.

**Hypothesis 2.** The main effect of trust also was highly significant; F(1,72)= 20.17, p<.001. Again as predicted, and in keeping with the previous findings in studies using the trust scale (Sato 1988; Yamagishi 1986, 1988a; Yamagishi and Sato 1986), the average contribution was much higher among high trusters (6.02, sd = 2.39) than among low trusters (3.96, sd = 2.42). Hypotheses 2 also was clearly supported.
suggests that the structure-by-trust interaction predicted in Hypothesis 3 became more prominent over time.

STUDY 2

Participants in Study 1 contributed more (almost twice as much) in the network-generalized exchange structure than in the group-generalized exchange structure, even though the two structures had exactly the same general incentive features of a social dilemma. These findings, however, may be limited to extremely small networks and groups. This possible limitation in the generalizability of the current findings seems likely because the network-generalized exchange structure in particular may be vulnerable to only one or few “hard-core” noncooperators. For example, if one participant never contributes to his or her partner, that partner eventually will stop contributing. Thus, in a network-generalized exchange structure, only one hard-core noncooperator may initiate a domino effect, and eventually no one will contribute. The probability that a network contains at least one such noncooperator increases as the size of the network increases. The danger that this domino effect will occur is especially serious in the partial information condition, where the hard-core noncooperator cannot be detected and punished. In contrast, when the participants know the level of their recipients’ contributions, they can engage in a unidirectional tit-for-tat strategy, punishment their recipients when they do not contribute and rewarding them when they do so. Thus, even large network-generalized exchange structures may avoid the domino effect when the participants know each other’s actions.

To investigate this possible size limitation, we conducted a second experiment using eight-person networks, double the size of the groups in the first experiment. Only the partial information condition was replicated in the second experiment because the limitation in the generalizability of the findings is expected to be more serious in that condition than in the complete information condition. We did not replicate the group-generalized exchange structure in the follow-up study because the effect of group size in this type of social dilemma has been investigated elsewhere (see Allison and Messick 1985; Bonacich et al. 1976; Chamberlain 1974, 1978; Fox and Guyer 1977; Hamburger et al. 1975; Kerr 1989; Kerr and Bruun 1983; Komorita and Lapworth 1982; Sato 1988; Yamagishi 1990, forthcoming). In these studies, group size usually has a negative effect on the participants’ level of cooperation: the larger the group, the lower the level of cooperation.

We realize that the eight-person network still is quite small; however, it is twice as large as the four-person network. If size is related negatively to the level of the participants’ contributions, we should expect the negative size effect to show up even between groups of four persons and groups of eight.12

11 Cost and the difficulty of conducting eight-person experiments are the major reasons militating against replicating the full design of Study 1.

12 Yamagishi (1999) states that the negative size effect is stronger when the size is relatively small than when it is large (between 10 and 50 or between 50 and 500).
Although we cannot generalize the results obtained in the eight-person network to much larger networks, we will be fairly confident if we do not find a negative effect of size when comparing groups of four and of eight persons. If we find a negative effect, we must question the generalizability of our findings.

**Procedure**

In the second experiment we replicated the same procedures as we used in the network-generalized exchange structure (the partial information condition); the only difference was the size of the networks. The experimental design consisted of only one factor, trust. Each trust condition was counterbalanced by sex (i.e., each trust condition contained eight male and eight female groups). The study included a total of 256 participants in 32 same-sex, eight-person groups.

**Findings**

We compared the results of the second experiment with those in the same condition (network-generalized, partial information) of the first experiment. Because the cell Ns differed between the two experiments (20 in Experiment 1 vs. 16 in Experiment 2), we used the general linear model approach in the size-by-trust repeated-measures analysis of variance.

Our suspicion about the limitation of the findings of the first experiment was found to be groundless. In fact, participants in the eight-person networks contributed more (6.29, sd = 1.80) than those in the four-person networks (5.89, sd = 2.29), although the difference was not statistically significant; F(1,45) = 0.43, ns. Again, the main effect of trust was highly significant; F(1,45) = 19.37, p < .001. High trusters (7.21, sd= 1.49) contributed much more than low trusters (5.06, sd = 1.85). The size-by-trust interaction was not significant; F(1,45) = 0.00, ns.

**DISCUSSION**

Generalized exchange indeed may enhance mutual trust and solidarity among participants, as Ekeh (1974) argues. Even so, the social dilemma aspect inherent in any generalized exchange system encourages free riding among the participants, and eventually the generalized exchange may cease as a result. Neither of these two pictures, however—the bright picture of the generalized exchange system, promoting mutual trust and solidarity among its participants, and the gloomy picture of the generalized exchange system, destined to collapse because of the free-rider problem—is necessarily accurate. Instead we have argued that the scenario which predominates depends on the nature of the generalized exchange structure. In particular, we believe that the network-generalized exchange structure promotes a higher level of participation (or cooperation) than the group-generalized exchange structure. This prediction was clearly supported in the initial experiment; the results of the second experiment suggest that the high level of contribution in the network-generalized exchange structure is not related negatively to the size of the network.

We realize that unidirectional loops are not the only type of network-generalized exchange. Actually, any form of network consisting of unidirectional paths may be considered a network-generalized exchange system. The example of stranded drivers, used earlier, represents a network-generalized exchange system, but it is not an example of a complete loop, as shown in Figure 1b. Similarly, the kula ring discussed by anthropologists actually consists of several partially overlapping unidirectional loops. In this study involving one special type of network-generalized exchange system we have demonstrated that the social dilemma problem plays different roles in different types of generalized exchange network structures. Future study must determine whether the conclusions based on the current experiments involving a single, complete loop can be generalized to other forms of network-generalized exchange systems.

The findings summarized above point to the merit of bridging the two research traditions—research on social exchange networks and research on social dilemmas—which thus far have developed in relative isolation from each other. As we argued in the introduction, generalized exchange structures and social dilemmas are mutually entailed: generalized exchange involves a true social dilemma, and participants' responses to this dilemma are affected by the internal structure of the generalized exchange system. The results of our studies demonstrate clearly that the nature of the generalized exchange structure affects participants' responses to
social dilemmas with the same general incentive features.

One interesting theoretical implication of this study concerns the interaction between participants' strategic actions in social dilemma situations and the structure of generalized exchange. Strategic actions aimed at changing other participants’ decisions are known to be instrumental in promoting mutual cooperation in dyadic dilemma situations. According to Pruitt and Kimmel (1977), the level of cooperation in a dyadic prisoner's dilemma usually increases over time after an initial decline because participants start to engage in strategic actions once they realize that the independent pursuit of self-interest leads to mutual defection. This rebound in the level of cooperation usually does not exist in iterated social dilemma experiments involving more than two participants because strategic actions are ineffective in groups of more than two (see Dawes 1980; Yamagishi 1991). Strategic actions regain their utility, however, once a unidirectional network structure is introduced into a social dilemma situation. In such a structure, strategic actions can be as effective as in dyadic situations because the consequence of one's strategic action is focused on a particular recipient rather than being diffused, as in the case of group-generalized exchange or nPD. Furthermore, the unidirectional nature of the resource flow in the network structure makes it unlikely that a conflict spiral (Lawler 1986) will take place (see Yamagishi 1991).

Although the network structure we examined in this study involved only the unidirectional circular chain, other types of network structures may have the similar positive effect of making strategic actions effective and of reducing the likelihood of vicious conflict spirals. Further research should compare various forms of generalized exchange networks to investigate their implications for the promotion of mutual cooperation and trust. The social structure of some networks (even large networks) may make cooperation more likely than in other groups of equivalent size.

The network ties may generate bonds of obligation that are more difficult to generate in groups without a system of norms or sanctioning (see Coleman 1991).

REFERENCES


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