CHAPTER 3
INTERPERSONAL DIFFERENCES IN AN N-PERSON MULTI-STAGE MIXED-MOTIVE GAME

Starting with the Club of Rome Project on the Predicament of Mankind (Meadows, 1971) and triggered by the 1973 oil embargo, the common notion of the finite nature of natural resources arose. Subsequently, within the social sciences, the studying of issues involved in conservation promotion was emphasized (McClelland & Canter, 1981). One such research paradigm is the social dilemma paradigm. This paradigm has been characterized by Hardin (1968), Olson (1965), Platt (1973) and others as one in which the immediate self-interest of decision makers is in conflict with their collective long term interest. Given this confrontation between private and public interest, some important questions arise. One could ask, for example, whether there are interpersonal differences in responding to such a conflict situation. Next, the question arises as of how to promote the kind of behavior which is in the service of the common interest.

The present research attempts in several ways to extend prior research which has employed n-person games to examine the resource conservation dilemma. Namely, it employs a decision task which is dynamic, it assesses the effects of individual differences in value orientation between actors, and it manipulates a subset of structural factors that are assumed to influence decision making regarding resource utilization.
A DYNAMIC DECISION TASK

A modification of the n-person game format normally employed is introduced in this research to permit the choices made by players on a given trial to modify the payoff matrix available to self and others on subsequent trials. Prior empirical research using traditional n-person games like the Prisoner's Social Dilemma and the Chicken Social Dilemma (Caldwell, 1976; Dawes, McTavish & Shaklee, 1977; Kelley & Grzelak, 1972; Meux, 1973) have presented subjects with binary choices between alternatives that afford either a moderate payoff that does not damage the collective interest, or a high payoff that entails some cost to all subjects. In these studies the numerical outcomes attached to each alternative are fixed over the trials of the game. Findings obtained in such studies are consistent with the hypothesis that, in small face to face groups (5 to 13 members) which make choices without communication with one another, the majority of members select the alternative that serves to maximize their own short term interests at the expense of the long term interest of the group of which they are a member.

Although there are strong similarities between the structural properties of the choice dilemma established in the preceding studies and those operating in actual conservation of resource situations, there is also an important dissimilarity. Namely, as noted above, the decisions by actors on any given trial do not change the resources available on subsequent trials. In most real-life conservation of resource situations, of course, the situation is more dynamic. There, the outcomes produced by decisions at time "t" influence the size of the pool of resources available at time "t + 1".

There are several studies of conservation of resource dilemmas (Brechner, 1977; Rubenstein et al., 1975; Stern, 1976) using simulated
dilemma situations which are not formally conceptualized as n-person games, but which permit the total resources available on each trial to vary as a function of subjects' prior choices and/or some form of experimenter intervention. That is, in a manner similar to many dilemmas in the "real world", the interdependent decisions of actors not only influence the distribution of outcomes available at the time of choice, but also the outcomes available subsequently. In Dawes' (1980) terminology these games are called "variable games". These studies report that changes in the outcomes available through time can influence players' decisional strategies. Hence, in the present study subjects are afforded the opportunity to make choices in a multi-stage n-person mixed-motive game, which we have called the Sequence Dilemma (Liebrand, 1981; Van Koppen & Liebrand, 1978).

The Sequence Dilemma (SD) differs from the n-person games mentioned above in that there are more than two decisional alternatives at each stage and the decisions made at a particular stage influence the remaining resources, and hence the range of outcomes available on subsequent stages. The SD differs from the conservation of resource dilemmas in that subjects are provided information concerning the amount of resources left for the remaining stages. This property enables the subjects to derive an expected payoff at each decision point during the whole game. Although being in part a departure from the reality of many resource decisions, such feedback makes the present task analogous to prior n-person social dilemma games.

THE ASSESSMENT OF VALUE ORIENTATION

As second extension of prior resource conservation research, the present study considers the way in which the own-other outcome deci-
sion matrices presented by the experimenter are actually experienced by individual subjects. As was stated previously, the "given" matrix presented by an experimenter may not be the one on which the decisions of the actors are based. Rather one can expect actors to differentially transform the given matrix cell entries according to the personal values they place on the alternative own-other outcome distributions (cf. Harris, 1969; Kelley & Thibaut, 1978; McClintock, 1972). Kuhlman and Marshello (1975a, 1975b) demonstrate that systematic differences in choices to a given matrix are made by subjects identified apriori as being cooperative, individualistic or competitive in value orientation. Hence, the second major extension of prior research involves a prior assessment of the preferences of actors for specific outcome distributions. That is, the specific value orientation or social motive of each subject are assessed prior to their participating in the Sequence Dilemma task, so as to provide a basis for examining the preceding transformational process.

STRUCTURAL MECHANISMS THAT AFFECT DECISION MAKING

The ultimate relevance of using experimental games to study behavior is not only to describe the process of decision making, but to achieve a better understanding of the structural mechanisms that may affect decision making in settings of social interdependence. The third extension of prior resource conservation research involves the examination of communication and group size, both of which are mentioned by Dawes (1980) as mechanisms capable of affecting decision making in dilemma situations.

One might assume that communication would increase group oriented decision making. The overall effect of communication has indeed been
found to be "ubiquitous" in several studies (Brechner, 1977; Dawes et al., 1977; Dawes & Orbell, Note 3). This finding may in part be due to the fact that prior research has not taken into account differences in value orientations between subjects. For example, being confronted with opinions of others may be more effective in promoting cooperative behavior for people with a cooperative value orientation than for those more individualistically or competitively oriented, who might use the information in a self-interested or exploitative manner. In the first experiment reported here, communication opportunity is manipulated, since subjects in one condition are permitted to discuss the dilemma problem, and in another no communication is allowed.

The second structural mechanism considered is group size, mentioned among others by Olson (1965) and Messick (1973) to be an important factor in determining the probable amount of cooperative behavior in resource dilemma tasks. One can assume that with increasing group size, both the individual's share of responsibility for exhausting or conserving the resources decreases and the perception of relative anonymity increases. Hence, in larger groups persons should feel less constraint against behaving in a self-interested way for the short term. In analyzing the effect of group size on the behavior in the common interest, Messick (1974) points out that concern for the group might be a factor that covaries with increasing group size. He further suggests that a little concern for the interest of the group might be enough to avoid the undesirable long term consequences characteristic for the underlying dilemma.

Additional support for the hypothesis that in larger groups, persons should feel less constraint against behaving in a self-interested way, can be found in theoretical and empirical research concerning the relation between group size and group performance (Shaw, 1976; Steiner, 1972). According to Steiner's (1972) theory of group productivity, group performance should increase with group size if the outcome depends upon the more competent group members (a disjunctive
group task), or if the outcome is determined by some additive combination of individual products (an additive group task). It is obvious that in the present non-communicating groups the experimental task cannot be considered to be either disjunctive or additive. In the present study the task may be considered conjunctive: every group member must perform a task, while asking extreme amounts of resources for self, severely restricts the amount of resources left for others. For this conjunctive task it is predicted by Shaw (1976), that group performance should decrease with increasing group size.

Prior studies assessing the effect of group size indeed do report somewhat less cooperation in larger groups (Bixenstine, Levitt, & Wilson, 1966; Bonacich, Shure, Kahan, & Meeker, 1976; Hamburger, Guyer, & Fox, 1975; Marwell, & Schmidt, 1972). However, in these studies the range of group size is relatively small (up to nine persons), and no efforts were made to assess the subject's concern for the interest of the group. The present study attempts to more closely approximate and examine those processes which Olson and Messick describe as obtaining in resource dilemmas in larger groups. More specifically, the behavior of seven person groups (Experiment 1) is compared with that of twenty person groups (Experiment 2).

DEPENDENT MEASURES: OWN DECISIONAL BEHAVIOR; EXPECTATIONS ABOUT OTHERS

Studies on game behavior (Kelley & Stahelski, 1970; Kuhlman & Wimberley, 1976) have shown that in interdependent situations, own decisional behavior covaries with the expectations about the decisional behavior of others. In the present study the dependent variables consist of the strategy and choices actually made by subjects in the Sequence Dilemma, and their expectations concerning the decisional
behavior of others. The specific predictions made as regards how the dependent variables will vary as a function of the subject's value orientation and the two manipulated structural variables, communication and group size, will be described at the beginning of each study. First, however, the following will be described: (a) the decision making task, namely the Sequence Dilemma; and (b) the procedure for assessing individual differences in value orientation.

THE SEQUENCE DILEmma

In the experimental task, the Sequence Dilemma, there are five decision stages. At each stage, each subject can take between $1.50 and $9.00 from a common pool of resources. Further, subjects make their choices in private and are then informed about the total amount of resources consumed. Before making choices at any given stage, the experimenter announces the total amount of money chosen by subjects in the prior stages. In following these procedures, the resources consumed individually by subjects remain unknown to the other players. If the total amount requested by the players at the end of the five stages is greater than the initial pool size, each subject receives nothing. If it is less, then each person gets the amount he or she requested.

The size of the total resource pool, or the total amount of money available is not fixed. Subjects are informed that there are five different pool sizes and that which one of these is their pool is randomly determined after choices have been made at all five stages. The sizes of the five total resource pools fall in between the extremes set by players choosing consistently the maximum amount of money for self at each stage, and their choosing consistently the minimal amount.
Possible outcomes for the Sequence Dilemma for 7 persons given 5 stages where the minimal amount of money for each person per stage is $1.50; the maximum $9.00; a: cumulative minimal amount of money across choosers; b: possible cumulation curve; c: cumulative maximal amount of money across choosers; S(low): lowest resource pool size; S(high): highest resource pool size.

of money (see Figure 3). Since subjects are fully informed on all the constraints, they are confronted with the following dilemma. Choosing much money for self, which is the most-threatening strategy, can result in high earnings. However, if everybody does so, all five limits will be exceeded, and the earnings will equal zero. Hence, behaving in a self-interested way in the short term has a negative impact on both self and the common interest in the long run. Or, choosing the
most-threatening strategy will result in a deficient outcome.

The Sequence Dilemma can be regarded as a multi-stage generalization of the Take Some Games discussed by Hamburger (1973; 1974). As Hamburger points out, the strategic properties of a Take Some Game can be derived by considering the probability distribution of the pool size at any given stage of decision making. To illustrate this point, an analysis of the strategic properties of the procedures used in Experiment 1 is provided. In Experiment 1, each of 7 players could choose at each stage options worth either $1.50 or $9.00 or some amount in between. There were five stages and five equally spaced resource pool sizes, the lowest being $95, the highest $115. Each pool size had a probability of .2 of being drawn (see Figure 3). Consider any single player, say Player A. Consider two strategies he or she might use. The first strategy might be to receive the amount of money chosen with certainty, provided that on the average the other six persons would choose the same amount of money. Player A must then choose $13.50 across the 5 stages. Asking for $13.50 will result in a total that is below the lowest pool size and therefore, given that others have made similar choices, Player A would always receive $13.50. A second strategy might be to achieve an equal share of the average pool size which is $105. This strategy therefore prescribes each player asking for $15.00 across stages. If this $15.00 strategy is used by all players there is a chance that the pool size to be drawn will be exceeded since the $95 and the $100 sizes are below the total amount chosen. The probability of getting a payoff with the $15.00 strategy is then .6, being the probability that the pool size will be $105, $110, or $115.

Thus far, the amount of money chosen by the others was considered identical to the amount for Player A. Varying the amount of money chosen by the others yields an expected payoff function for each of the two above strategies (see Figure 4). It is apparent from Figure 4 that the more is chosen by the other players, the lower the expected
Payoff functions in Sequence Dilemma (Experiment 1) for two strategies by Player A and by others.

payoff of Player A will be. By assuming that others picking higher amounts is less preferred by Player A, it is possible to describe preference orderings among expected payoffs. If, given Player A's $13.50 and $15.00 strategies, A believes that the average amount to be chosen by others is either $13.00 or $14.00, the preference ordering of expected payoffs for Player A is identical to a Prisoner's Dilemma preference ordering (Table 2). By varying Player A's strategies as well as the pair considered equally likely regarding the expected
average choice of the other players, a different family of games (Ham-
burger, Guyer & Fox, 1975) can be constructed. As appears from Table
2, all three types of social dilemma preference orderings for Player A
can be constructed in this way. In fact, given two strategies by
Player A and the assumption that the more money is picked, the less
the common interest is served — all possible preference orderings of
outcomes for Player A are shown in Table 1 (p. 7). That is, Player A's
preference orderings then exactly matches Player A's preference order-
ing of outcomes in all 2 x 2 games possessing a most-threatening stra-
tegy.

Table 2

Preference orderings for Player A, best possible outcome 4, worst
possible outcome 1, given 2 strategies by Player A and by others;
Matrix A: Prisoner's Dilemma ordering; Matrix B: Chicken Dilemma
ordering; Matrix C: Trust Dilemma ordering.

<table>
<thead>
<tr>
<th>OTHERS</th>
<th>$13.00</th>
<th>$14.00</th>
<th>$13.00</th>
<th>$13.50</th>
<th>$14.00</th>
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</thead>
<tbody>
<tr>
<td>&quot;ask for $13.50&quot;</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>&quot;ask for $15.00&quot;</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Matrix A Matrix B Matrix C

It follows from the above analysis that the combination of own
strategy and the expectations about the behavior of the other players
is important in determining the player's perception of the structure of the game. It is also evident that the structure of a game depends on the specific stage of decision making since with each successive stage more information is released to players. Therefore, the transformation process from the given matrix into the effective matrix is expected to depend on personal influences like own strategy and expectations concerning others' strategies, as well as contextual influences like the increasing information on the amount of resources that have been expended.

INDIVIDUAL DIFFERENCES IN VALUE ORIENTATIONS

Recent literature dealing with situations in which the behavior of an individual 'affects not only own but also others' outcomes has stressed the importance of assessing differences in preference for specific self/other outcome distributions, that is, of value orientations (McClintock 1972; Maki, Thorngate, & McClintock, 1979; Messick & McClintock, 1968; Kuhlman & Marshello, 1975a, 1975b). In the definition and measurement of value orientations, it is assumed that each orientation has its own utility function as determined by the linear combination of own and others' outcomes (Wyer, 1969; Griesinger & Livingston, 1973). That is, differential weighting of the two components, own and others' outcomes, yields various utility functions. Using this procedure, a geometric taxonomy defining various values was independently devised by Hofstee (Note 3) and by Griesinger and Livingston (1973).

In these geometric models, the utility functions are represented as motivational vectors of infinite length extending from the origin of a two-dimensional space defined by the outcomes to self (horizontal
axis) and the outcomes to the other (vertical axis). Given two self/other outcomes defined as points in this space, players are assumed to choose the outcome with the greatest projection on their preferred value vector. For example, as can be seen in Figure 3, a player with a value vector with slope $-1$ in quadrant 4, prefers the outcome 4 units to self and 2 units to the other (S) to the outcome which affords both players 4 units (R). Consistent with existing literature, in the present study the labels "competitive", "individualistic", "cooperative" and "altruistic" will be used to refer to four classes, each class consisting of persons whose value vectors are about the same with respect to slope and direction (see Figure 5).

To assess which value vector is dominant for a particular individual, various measurement techniques using Decomposed Games (Messick & McClintock, 1968; Pruitt, 1967) have been proposed (Griesinger & Livingston, 1973; Kuhlman & Marshello, 1975b). The subjects' task in a Decomposed Game is to select out of "n" own/other outcome distributions their most preferred one. Each distribution affords a certain payoff to the subject and to some other player. Generally, the other player remains unknown to the subject to avoid considerations of strategy (Maki et al., 1979). The payoffs for each distributional option can be represented as a point in the own/other outcome space, and subjects are expected to choose outcomes with the greatest projection on their preferred value vector. Confronting subjects with a series of Decomposed Games, using different combinations of outcomes, provides a measure to determine the direction of the subject's preferred vector. The Decomposed Games procedure used to assess values in the present study is derived from the procedure originally proposed by Griesinger and Livingston (1973). However, in order to avoid the on-line computer connection required by their procedure, a straightforward paper and pencil version to be described in the Procedure section was developed.
Figure 5

Own-other Outcome Space; Q1 to Q4 = quadrant 1 to 4; all value vectors in between degree 22.5 and 67.5 are labelled "cooperative"; all vectors in between degree 67.5 and 112.5 are labelled "altruistic"; all vectors in between degree 292.5 and 337.5 are labelled "competitive"; all vectors in between degree 337.5 and 22.5 are labelled "individualistic".

BEHAVIOR IN THE SEQUENCE DILEMMA AND VALUE ORIENTATIONS

Since the amount of money available in the Sequence Dilemma is restricted, there exists a strong interdependency between the outcomes of the persons involved. The outcome of the game depends on a combina-
tion of own strategy and the behavior of the other players, and hence a chooser is likely to consider others' probable choices in making his or her own. Therefore, two dependent variables are added to the main dependent variable, which is subject's resource choices. These two variables provide an indication of a subject's relative position in his or her decision making group. The first variable, relative strategy, consists of a combination of the resource choices considered by the subject, minus the average of his or her expectation of others' strategies. The second variable, relative choice, consists of the choices actually made minus the average of the choices actually made by the others in that decision making group.

Starting with Kelley and Stahelski (1970), attention has been given to interpersonal differences in the relationship between own game behavior and the perception of others. Specifically, Kelley and Stahelski have shown that there exist differences between persons who describe their own intentions as cooperative and persons who describe themselves as competitive. Their triangle hypothesis states that competitive players, in general, expect others to be competitive as well, while cooperative players expect others to be either cooperative or competitive. Miller and Holmes (1975) and Kuhlman and Wimberley (1976) were successful in replicating and extending the Kelley and Stahelski findings in the traditional two person, two choice Prisoner's Dilemma Game. For other classes of game settings however, it appears that interpersonal differences do exist but not in the specific pattern hypothesized by Kelley and Stahelski. The data from Kuhlman and Wimberley (1976) and Ross, Greene and House (1977) suggest that, in the absence of any base rate, the expected dominant value orientation is the one preferred by the person himself. According to this egocentric attribution perspective, players would expect others to choose similar amounts of money in the Sequence Dilemma as they choose for themselves.

Contrary to the above egocentric model of attribution, it is
predicted in this study that in the process of receiving more information, a subject will behave in a way corresponding to his or her preference for the distribution of outcomes for self and others. Specifically, it is predicted that during the game, a subject's relative choice behavior (to be reflected in the variables "relative strategy" and "relative choice") corresponds to the value vector of this player in the own/other outcome space. Therefore, in terms of the geometric models from Hofstee (Note 1) and Griesinger and Livingston (1973), it is predicted that a person characterized by a value vector with slope +1 (cooperative) chooses the same amount of money he expects others to choose. Persons characterized by value vectors with a slope smaller or greater than +1, along the positive own-outcome axis, are expected to choose more or less respectively than they expect others to choose. In the present study, the term conditional attribution hypothesis is used to indicate the above prediction concerning the pattern of relative strategies and relative choices.
EXPERIMENT 1

In this experiment the influence of the subject's value orientation on the dependent variables Own resource choices, Relative strategy and Relative choice, was investigated in two experimental conditions. In one of these conditions, subjects were permitted to discuss the dilemma problem. In the other no communication was allowed. It was predicted that the non-communicating groups would request more money than the communicating groups.

By means of the Decomposed Games Technique subjects were classified apriori as "altruistic", "cooperative", "individualistic" or "competitive". It was predicted that subjects classified as having a cooperative value orientation would choose about the same amount of money for self that they expect others to choose; those classified as altruistic would choose less than the cooperative ones, and moreover, less than they expect others to do; those classified as individualistic or competitive both would choose more than the cooperative subjects. Furthermore, it was predicted that scores on the variable Relative strategy will be positive both for individualistic and competitive subjects, and that the average Relative strategy score for the competitive subjects will be greater.

Finally, the value orientation-by-communication interaction was investigated. Subjects classified as "cooperative" or "altruistic" (Group 1) were compared with those classified as "individualistic" or "competitive" (Group 2). It was predicted that Group 1 would be more compliant to the appeals made by others in the communication condition than Group 2.
METHOD

Subjects. Subjects, 132 volunteers (67 males, 65 females) responding to an advertisement in a local newspaper in Groningen, the Netherlands, were randomly assigned to one of 20 groups. Ten groups were in the communication condition; ten in the non-communication condition. Since eight of the 140 scheduled subjects did not show up, groups consisted of either six or seven persons. If the Sequence Dilemma requirements were met, subjects received the total sum they had chosen; otherwise they received a consolation payment of $1.50 per hour.

PROCEDURE

Subjects, who were seated in cubicles during the first part of the session, received instructions concerning the structure of the Decomposed Games, and then made 32 Decomposed Games choices. Thereafter, the instructions for the Sequence Dilemma were presented, and a quiz was administered to ensure complete understanding of this task. Once all the incorrect quiz-answers were explained, the subjects were brought to a large (9 x 9 ft) table to participate in the second part of the session. Subjects were seated behind a small screen which prohibited them from seeing each others' response sheets, while at the same time permitting them to see each other. Throughout the session, subjects were assigned and then addressed with a subject number ranging from 1 to 7.

Procedure for the Decomposed Games. The Decomposed Games Tech-
unique employed consisted of making 32 choices between two own/other outcome combinations. The 32 pairs of outcomes lie either on a Circle A or on a Circle B in the own/other outcome space depicted in Figure 5. The center of both the circles coincided with the origin of the outcome plane; the radius for Circle A was $7.00 and $8.50 for Circle B. There were 16 equally spaced pairs of outcomes on each of the circles while each pair consisted of two adjacent own/other outcome combinations. An example of such a pair is the choice between $3.30 for self and $7.90 for the other versus $6.00 for self and $6.00 for the other. This pair of outcome combinations is equivalent to the (A,c) versus (B,b) pair in Figure 6 when the radius of the circle is $8.50. Out of the 32 pairs of outcomes for the two circles, the subjects selected the pair of outcomes they preferred most.

Subjects were told that the other person in the Decomposed Games was another person whom they never would know. In the instructions the structure of the Decomposed Games format was thoroughly explained by means of two examples, but no advice was given on how to select the outcomes. Adding up the chosen amounts separately for self and for other yields an estimate of the subject's value vector. For example, suppose Subject P's value vector is the one depicted in Figure 6. For P the most preferred outcome is (C,a) and the least preferred outcome is (−C,−a). In selecting between (C,a) and the two adjacent outcomes (B,b) and (D,o), the most preferred outcome will of course be (C,a). For the remaining pairs of outcomes, the outcome with the shortest distance to (C,a) will be chosen. Since any outcome has two adjacent outcomes, it is presented in two different pairings of outcomes to the subject. In one and only one of these two pairings this outcome has the shortest distance to the subject's preferred value (C,a). Therefore, all the outcomes but (C,a) and (−C,−a) should be chosen just once, (C,a) will be chosen twice and (−C,−a) will never be chosen. As noted above, the projections of the selected outcomes on the own- and on the other-outcome axis are added up. If the subject is choosing
Distribution of self/other outcomes choices for Decomposed Games

consistently with a given value, all the selected outcomes, except (C,a), are cancelled by the one on the opposite side on the circle. For example, (B,b) is cancelled by (-B,-b) and (D,o) by (-D,o). Since (C,a) was chosen twice, the resultant of the adding procedure has twice the projection of (C,a) on the two axes, indicating the direction of Subject P's value vector.

In the above analysis of the Decomposed Games it is assumed that the subject's choices are consistent with a particular value vector. Indications for the internal consistency of the measure can be derived from the percentage of consistent choices GIVEN the resultant of the
adding procedure. For the subjects from Experiment 1, the percentage of such consistent choices is 76, for the subjects from Experiment 2 this number is 80.

**Procedure for the Sequence Dilemma.** After the subjects had completed the set of Decomposed Games choices, the structure of the Sequence Dilemma was explained and the quiz was administered. The structure of the Sequence Dilemma was explained in terms of a conservation of energy paradigm, in order to make the abstract characteristics of the task both more concrete and more realistic. A conservation of energy paradigm has the advantage that on the one hand there exists uncertainty about the total amount of resources available, while on the other hand, conservation of this resource is in general seen as desirable.

The decision making groups consisted of six or seven persons. Each of the persons made four anonymous pair-wise selections at each of five stages. The options to be selected involved a certain consumption of energy which was expressed in monetary units available to the subject: Selection 1: using a private car (yielding $3.00) vs. public transport (yielding $.50); Selection 2: dish washer ($3.00) vs. no dish washer ($.50); Selection 3: color TV set ($1.00) vs. black and white TV set ($.25); Selection 4: laundry dryer ($2.00) vs. no laundry dryer ($.25). The minimum amount of energy used or alternatively the minimum amount of money that each person could choose for self at each stage is $1.50, the maximum amount is $9.00.

Subjects were told that the stages corresponded to a certain amount of time (period) and that the total amount of energy resource (money) available across the five periods would be $95, $100, $105, $110, or $115. For the six person groups these pool sizes were adjusted to fall between $80 to $100, and subjects were informed that each pool size had a probability of .2 to be drawn after all the decisions had been made.

Actually, the monetary units presented to the subjects were Dutch
guilders. These guilders are translated here into dollars (1 dollar = 2 guilders). Subjects were told that they were making real money decisions and that they would be paid the amount of money they had chosen for self, if the total amount chosen in their group across stages had not exceeded the pool size drawn.

After each stage of decision making, subjects were informed concerning the total cumulative amount of money chosen. No information was given concerning the cumulation of money by individual subjects. Prior to each stage, subjects had to report in writing their own intended strategy: "At this moment I expect to choose across the stages $\ldots\ldots\"$, and their expectations about the intended strategy of each of the other group members. Subsequently, they made their choice for that particular stage.

Throughout the instructions, no reference was given to the desirability of selecting particular options. In the non-communication condition subjects were not allowed to communicate. Subjects in the communication condition could discuss the dilemma for 10 minutes before stage one, and for 5 minutes before each of the remaining stages. There were no restrictions on the topics to be discussed, as long as the choices remained secret. Following the discussion, subjects privately filled out a sheet containing questions on the strategy of each of the players and made their choices for that particular stage of decision making.
RESULTS

Overall trends. In 7 of the 10 decision making groups within the communication condition, the total amount of money chosen across stages was lower than the lowest possible pool size; the probability of getting the amount of money chosen in each of the remaining groups was .8. In contrast, within the non-communication condition, the lowest possible pool size was exceeded by all the groups. In addition, the amount of money chosen in one of these groups exceeded the highest possible pool size; the remaining 9 groups in the non-communication condition had an average probability of .54 to receive the amount of money chosen.

To investigate the comparability of the stimulus situation for the subjects within each condition, differences between the decision making groups in the total amount of money requested across subjects and stages, were analyzed. Because the scores of subjects within a decision making group are assumed to covary, the resulting large within-groups variability is not a convenient error term. Therefore, for each condition, the variability of observed group means was compared to the variability of statistical groups with subjects randomly assigned. No significant observed-by statistical group variability ratios were found: $F(9,9) = .43$ for the communication condition and $F(9,9) = 1.58$ for the non-communication condition. Hence, in the following subjects will be taken as units of observation.

The number of subjects choosing high, average or low amounts of money for each condition is shown in Table 3. The data support the communication hypothesis: discussing the dilemma problem results in a different distribution of payoffs ($\text{Chi-sq}(2) = 21.05, p < .05$). Namely, the non-communicating groups request more money ($M = 15.11$) than the communicating groups ($M = 13.52, t(102) = 2.3, p < .05$; based on
Table 3
Mean, standard deviation and number of subjects choosing low average or high amounts of money in 7-person sequence dilemma for two conditions.

<table>
<thead>
<tr>
<th>Amount of money</th>
<th>Non-Communication Condition</th>
<th>Communication Condition</th>
<th>Total</th>
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<tr>
<td>Less than $13.00</td>
<td>24</td>
<td>18</td>
<td>42</td>
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<tr>
<td>Between $13.00 and $15.50</td>
<td>17</td>
<td>40</td>
<td>57</td>
</tr>
<tr>
<td>More than $15.50</td>
<td>26</td>
<td>7</td>
<td>33</td>
</tr>
<tr>
<td>Total number of Ss.</td>
<td>67</td>
<td>65</td>
<td>132</td>
</tr>
<tr>
<td>Average amount in $</td>
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<td>Standard deviation</td>
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separate variance estimates). Further, there is less variability between subjects in the amounts taken for self in the communication than in the non-communication condition: (F(66,64) = 3.6, p < .05). In addition, a communication by sex analysis of variance was carried out. Besides the above effect for communication, a significant effect for sex (F(1,128) = 4.4, p < .05) was found. On the average males chose $1.36 more than the females did. There was no communication by sex interaction.

The amount of money chosen as a function of communication, sex and stage of decision making is shown in Figure 7. The five resource choices made by each subject were analyzed using a 2 x 2 analysis of repeated measures model (Finn & Mattson, 1978), with communication and sex as the two between subjects factors and stages as the within subjects variable. The analysis yielded significant univariate effects
for the linear, quadratic and cubic trends and a multivariate effect for the three polynomials \( F(3,126) = 33.73, p < .05 \). Besides the polynomials by communication interaction \( F(3,126) = 15.73, p < .05 \) no further interactions were significant. The polynomials by communication interaction was analyzed by comparing the proportion of the total effect variance accounted for by the linear, the quadratic and the cubic polynomial, separately for each condition (Lewis, Note 4; Keppel, 1973). In the non-communication condition the linear polynomial accounted for 96%, the quadratic polynomial for 3%, and the cubic polynomial for 0% of the total average choices variance. In the communication condition, these proportions were 28%, 24% and 47% respectively.

Effects of value orientation. In order to test the conditional attribution hypothesis that value orientation affects decision making in the Sequence Dilemma, the variables of RELATIVE CHOICE and RELATIVE STRATEGY were analyzed. RELATIVE CHOICE corresponds to the total amount of money a subject chose for self minus the average amount of money which was actually chosen by the other subjects in that particular group. The subjects, before each of the five stages of decision making, reported their own strategy as well as separate expectations regarding the strategies of the other subjects. Therefore, the variable RELATIVE STRATEGY, that is a subject's strategy minus the average of the expectations of others' strategies, consists of five differences, one for each stage. Scores on the dependent variables relative strategy and relative choice are shown in Figure 8, separately for subjects classified apriori as "competitive", "individualistic", "cooperative" or "altruistic". As depicted in Figure 8, at the end of the decision making process, the pattern of relative strategies in general fits the predicted pattern. The strategy of subjects with a competitive value orientation is to take more resources than they expect others to, while subjects classified as "altruistic" show the reverse pattern. Subjects classified as "cooperative" or "individualistic"
Average amount of money chosen for self by stage, separately for males and females in each condition. N-C,M = Non-Communication Male; N-C,F = Non-Communication Female; C,M = Communication Male; C,F = Communication Female.

"Competitive" expect to take about the same or slightly less than the average other.

Besides the data on relative strategies, the actual choice behavior of the four distinguished value classes of subjects support the interpersonal differences hypothesis (Figure 8). "Competitive" and "individualistic" subjects chose more resources for self than the average other (M = 2.66 and M = .44, respectively), "cooperative" subjects about the same (M = -.30), and "altruistic" subjects less than
Relative strategies for four classes of value orientations by stage and relative choice across stages for four classes of value orientations in 7-person Sequence Dilemma; COMP = competitive, n = 13; IND = individualistic, n = 35; COOP = cooperative, n = 60; ALT = altruistic, n = 5.

the average other in their group (M = -4.23). As noted previously, the classification of subjects by value orientation is based on the subject's value vector resulting from the Decomposed Games Technique. To assess the effect of value orientation on relative choices, the projection of the subject's value vector on the own-outcome axis (Fig-
ure 5) and the projection on the other-outcome axis, were taken as two continuous predictor variables. Using the variable relative choice as the dependent variable, a regression analysis yielded a significant joint effect for the two predictors (F(2,119) = 5.32, Mult. R = .29, p < .05), indicating thereby the effect of value orientation on choice behavior in the Sequence Dilemma.

Finally, to assess the value orientation by communication interaction, the total amount of money chosen in each condition by subjects classified as "cooperative" or "altruistic" (Group 1), was compared to the amount chosen by "individualistic" or "competitive" subjects (Group 2). A 2 x 2 (group by communication) analysis of variance showed that the value orientation by communication interaction accounted for virtually no variance.

DISCUSSION OF EXPERIMENT 1

As was expected from the review presented by Dawes (1980), communication did have an effect on the decision made in the conservation of resources situation. When subjects can discuss the dilemma, there is less variability among the choices made. Moreover, the total amount of resources is less exhausted across subsequent stages of decision making.

The existence of sex differences in n-person mixed-motive games has not been found to be a consistent phenomenon. Caldwell (1976) reported no sex differences in a five-person Prisoner's Dilemma Game, and Dawes et al. (1977) found that females were more likely to cooperate in only one of the two Prisoner's Dilemma experiments conducted. In this experiment, females chose less for self than males. A tentative conclusion might be that in n-person mixed-motive games, fe-
males are less self interested than males.

The hypothesis that actors with different value orientations would make different resource choices is strongly supported in this experiment. As was predicted, subject classified as having a competitive value orientation chose more for self than the other subjects, and conversely, subjects with an altruistic value orientation willingly chose less than the average other. The fluctuations between the relative strategy responses of the group of altruistic subjects might be due to the small number (N = 5) of subjects classified as such. The choice behavior of individualistic and cooperative subjects also fits the predicted pattern.

Finally, no evidence was found indicating that communication had a differential effect on subjects having different value orientations. The present findings concerning the effect of communication, seem to support also Festinger's (1953) hypothesis that pressures toward uniformity among members of a group may occur, because uniformity is considered desirable, or necessary, in order for the group to achieve its goal. Further implications of the findings reported above will be discussed in the general discussion of Chapter 3.
EXPERIMENT 2

In Experiment 2, resource choices in the Sequence Dilemma were made in twenty-person groups. No communication was allowed. Because of the large group size, some minor changes were introduced in the design of the Sequence Dilemma. These will be noted in the procedure section. All the other important parameters, the number of stages, the range of resource choices on each decision making stage, and the average amount of resources expected to be available for each subject, were identical with those employed in the first experiment.

As noted previously, one can assume that in larger groups persons should feel less constraint against behaving in a short-term self-interested way. Therefore, it was predicted that in general subjects in 20-person groups would choose more money for self than the subjects in the non-communicating 7-person groups. The hypotheses regarding the relationship between the value orientation of actors and their choice behavior in the Sequence Dilemma remain the same.

METHOD

Subjects. Participants in this experiment were 101 volunteers (58 males; 43 females) responding to an advertisement in a local newspaper in Groningen, the Netherlands. Subjects were randomly assigned to one of five groups, each group consisting of either 19, 20 or 21 persons. If the Sequence Dilemma requirements were met, subjects received the total amount of money they had chosen for self, otherwise as in Experiment 1, they received $1.50 per hour.
PROCEDURE

Subjects were seated in a 3 x 7 pattern in a large room at a minimal distance of 6 feet from each other. First, they received the Decomposed Games instructions, and then made the 32 Decomposed Games choices. The procedure for the Decomposed Games was identical to the one used in Experiment 1. Thereafter, the subjects received instructions for the Sequence Dilemma and completed a short quiz. Questions in the quiz concerned the structure of the experimental task. All the incorrect quiz-answers were explained to ensure complete understanding. Finally, subjects were informed concerning the number of decision-makers in their particular group.

Procedure for the Sequence Dilemma. As in Experiment 1, the Sequence Dilemma was explained in terms of a conservation of energy paradigm. In Experiment 1, subjects were required to make 4 pair-wise selections at each stage of decision making; the four options selected determined the total amount of money chosen for self at that particular stage. Since, for the 20-person groups, this procedure would have caused elaborate calculations during the experimental task, it was decided to reduce the amount of calculations. This was done by letting the subjects select only one out of five options at each stage of decision making. The five options used in Experiment 2 were created in such a way that the minimum and the maximum amount of money the options afford were identical to those employed in Experiment 1.

All the options involved a certain consumption of fossil fuels for the heating of water. Again the subjective value of an option to self was expressed in monetary units: Option 1: heating the water by means of natural gas (yielding $9.00); Option 2: using natural gas and a very small solar boiler (yielding $6.00); Option 3: using natural
gas and a small solar boiler (yielding $4.50); Option 4: using natural gas and a solar boiler (yielding $3.00); Option 5: using natural gas and a large solar boiler (yielding $1.50). No reference was given to the desirability of selecting options in a specific way. Again the monetary units presented to the subjects were Dutch guilders, which are translated here into dollars (1 dollar = 2 guilders).

There were five fossil fuel pool sizes, each with a probability of .2 of being drawn after all the decisions were made. For the earlier 7-person group condition (Experiment 1), the middle pool size was $105, which is $15 per subject. In order to make the pool sizes comparable between the two experiments, pool sizes were adjusted in such a way that the middle pool size always equaled 15 times the number of subjects. In the 20-person groups, the total amount of money which could be expended across subjects at each stage varied between $30 and $180. This range is proportionate to that for the 7-person groups. Though the middle pool size is strictly comparable, equal proportional changes differentially affect the range of the pool size. The lowest pool size was 12.5 times the number of subjects, and the highest pool size was 17.5 times the number of subjects in the 20-person groups. The corresponding numbers for the 7-person groups were 13.5 and 16.5, respectively.

As in Experiment 1, subjects were fully informed concerning the five different fossil fuel pool sizes and the probability of each pool size to be drawn. Furthermore, subjects were told that they were making real money decisions and that they would be paid the amount of money they had chosen for self, only if the cumulative amount across subjects and stages would not exceed the pool size drawn. After each stage of decision making, subjects were informed concerning the total cumulative amount of money chosen. No information was given concerning the cumulation of money by individual subjects. Prior to each stage, subjects had to report in writing their own intended strategy: "At this moment I expect to choose across the stages $\ldots$". Immediately
after filling out their own intended strategy, subjects were presented a sheet containing all the amounts of money which possibly could be chosen for self across the five stages. For each amount of money on that sheet, subjects had to indicate the number of subjects out of their own group, which according to them, planned to choose that particular amount of money. Subsequently, they made their choice for that particular stage.

RESULTS

In one of the five decision making groups the total amount of money chosen across stages exceeded the highest possible pool size; in the remaining four groups the average probability of receiving the amount of money chosen was .4.

As in Experiment 1, the variability between the decision making groups in the total amount of money chosen across subjects and stages was compared to the variability between groups with subjects randomly assigned. This analysis yielded no significant F-ratio (F(4,4) = 1.06). Therefore, as in Experiment 1 subjects will be the units of observation.

The average amount of money chosen for self across subjects is $16.13 (sd = 7.02), which is higher than the average amount chosen in the 7-person non-communicating groups (M = $15.11, sd = 4.95). Though it was predicted that subjects in the 20-person groups would choose more money, the difference is not significant (t(165) = 1.10, separate variance estimates). However, the variability between the amounts taken for self is significantly higher in the 20-person condition than in the 7-person non-communicating groups (F(100,66) = 2.0, p < .05).

Across all stages there is a large sex effect (F(1,99) = 13.6, p
Figure 9
Average amount of money chosen for self by stage separately for males and females in 20-person Sequence Dilemma.

< .05). Again, males choose more for self (M = 18.24) than females (M = 13.29). Figure 9 shows the amount of money chosen as a function of sex and stage of decision making. The five resource choices were analyzed using a multivariate analysis of repeated measures (Finn & Mattson, 1978) with sex as between subjects factor. Besides the multivariate effect for the linear and quadratic trends (F(2,98) = 38.4, p < .05), both polynomials had a significant univariate effect. No sex by polynomials interaction was found.

Effects of value orientations. The two dependent variables, relative strategy and relative choice, were calculated in the same way as in Experiment 1. Figure 10 shows the scores on these two dependent variables for subjects who were classified apriori into one of the
Relative strategies for four classes of value orientations in 20-person Sequence Dilemma; COMP = competitive, n = 10; IND = individualistic, n = 29; COOP = cooperative, n = 54; ALT = altruistic, n = 5.

four classes of value orientations. At the end of the decision making process, the ordering of the relative strategies by classes of value orientation was the same as the ordering found in the 7-person groups. The major relative strategy difference between the 7-person and the 20-person groups appears to be the sign of the scores. With the excep-
tion of the altruistic subjects, the average relative strategy score in the 20-person condition is above the zero level, indicating that subjects were planning to take more than they expected the average other to take. In the 7-person groups only competitive subjects clearly planned to choose more for self than they expected the others to do.

Finally, the impact of value orientation on subject's relative choice scores was analyzed. As in Experiment 1, the subject's value vector was estimated by means of the Decomposed Games Technique. Again, the projection of the value vector on the own-outcome axis (Figure 5) and the projection on the other-outcome axis were taken as two continuous predictor variables. A regression analysis, with relative choice as the dependent variable, yielded a significant joint effect for the two predictors ($F(2,98) = 6.12, \text{Mult. } R = .33, p < .05$). There was no value orientation by sex interaction.
DISCUSSION OF EXPERIMENT 2

Again, the hypotheses concerning the relationship between value orientation and choice behavior in the Sequence Dilemma, are supported. However, in the 20-person groups, for altruistic and cooperative subjects (Group 1), there is a discrepancy between their relative strategies and their relative choices across stages (Figure 10). Although subjects in Group 1 apparently believe they will choose slightly more than the average other, the data reveal that across stages they actually chose $1.68 less than the average other in their group. On the other hand, for competitive and individualistic subjects (Group 2), no such discrepancy between relative strategy and relative choice is apparent. An analysis of variance with the difference between stage-5 relative strategy and relative choice as dependent variable, yielded indeed a significant distinction between Group 1 and Group 2 (F(1,96) = 6.21, p < .05). A possible explanation for the difference between Group 1 and Group 2 is that competitive and individualistic subjects (Group 2) are more accurate in predicting the overall amount of money chosen by others. Though this differential accuracy hypothesis is not supported by the data of the present 7-person groups, support is found in studies reported by Tyszka and Grzelak (1976) and Dawes et al. (1977). They found defectors to be more accurate in predicting overall cooperation rates in two-alternative experimental games, than cooperators.

A second interesting finding concerns the relationship between group size and the amount of resources chosen for self. It appears that, on the one hand, the average amount taken for self is not significantly greater in the 20-person groups than in the 7-person non-communicating groups. However, on the other hand, the variability between the amounts taken in the 20-person condition is greater than
in the 7-person non-communicating groups. This finding indicates that the exploitative behavior of some subjects in the 20-person groups is compensated by the behavior of subjects taking only a modest share of the common resources. These differences between subjects are shown in Figure 10. Those subjects taking more than the average other, mainly can be found among the competitively and individualistic oriented subjects. Compared to these two classes of value orientations, cooperative and altruistic subjects on the average chose $4.12 less for self. The corresponding amount of money for the 7-person groups is $1.64. These data do suggest that, among subjects with cooperative or altruistic value orientations, promoting of the group's welfare at the cost of one own's economic gain can be found. As Messick (1974) pointed out, in large group mixed-motive situations, given some concern for the group, the ultimate deficient outcome for all members can be postponed a long time.
DISCUSSION OF EXPERIMENT 1 AND EXPERIMENT 2

One major finding in this study is that, as expected, there is a covariation between interpersonal differences in value orientations and game behavior. The game format used in the present study allows subjects to compare their own behavior with that of others, while more information concerning the behavior of others is gradually released. It appears that competitively oriented subjects, while becoming more and more aware of the fact that they take more out of the common pool than the others in their group, persist in this behavior. This obtains both in the seven and in the twenty-person groups. Likewise, in both experiments, individualistic subjects also take more out of the resource pool than the average other in their group, although not to the degree as competitive ones. Cooperative and altruistic oriented subjects on the other hand take about the same or less resources than the average other.

A second finding concerns the relative strategies of subjects classified as competitive or cooperative. The pattern of data is not consistent with Kelley and Stahelski's (1970) triangle hypothesis. Namely, in both experiments, after information on the behavior of other's becomes available, competitive subjects do not assume that others have strategies similar to their own. Rather they continue to expect differences between their own and others' strategies. Furthermore, there is no behavioral assimilation of the cooperative subjects to the competitive subjects' strategy of taking more resources for self than is requested by the average other. It appears that the specific pattern of expectancies hypothesized by Kelley and Stahelski to obtain for actors with particular value orientations, is not valid for the game format used in this study. The present finding as well as those reported in several other studies, support the assertion that
the validity of the triangle hypothesis is restricted to the traditional 2-person 2-alternative Prisoner's Dilemma (Dawes et al., 1977; Kuhlman & Wimberley, 1976; Messe & Sivacek, 1979; Miller & Holmes, 1975).

Part of the present relative strategy findings are more consistent with the hypothesis proposed by Kuhlman and Wimberley (1976). They state that subjects expect most others to hold values similar to themselves. According to this hypothesis and according to egocentric attribution theory (Ross et al., 1977), when no information on others' behavior is available, persons with differing value orientation assume that the others will be similar to self. Relative strategy data prior to the first stage decision making in the Sequence Dilemma, before any feedback, are relevant to this hypothesis. It appears that in the 7-person groups (Figure 8), the data are consistent with Kuhlman and Wimberley's hypothesis: between the four distinguished classes of value orientations there were no significant differences in first-stage relative strategies \( F(3,101) = .21, \text{n.s.} \), and moreover, the hypothesis that the grand mean would be zero cannot be rejected \( F(1,101) = .76 \). However, the data for the 20-person groups do not support Kuhlman and Wimberley's hypothesis: there the differences between the four classes of value orientations on first-stage relative strategies are significant \( F(3,94) = 3.17, p < .05 \), and the hypothesis that the grand mean would be zero is rejected \( F(1,94) = 6.37, p < .05 \).

There are two mechanisms that may account for the different first-stage relative strategy patterns between the 7-person and the 20-person groups. First, in 20-person groups the influence of one person on the group's resources is much smaller than the corresponding influence in the 7-person groups. Feelings of responsibility for the common resources, therefore, are expected to be relatively low in the 20-person groups. Second, though all resource choices remain secret, feelings of social pressure in 7-person face to face groups are
presumably greater than those feelings in 20-person groups. The joint effect of relatively low responsibility and low social pressure makes it more likely that, prior to the decisions for the first stage, a person's intended strategy is considered easier to accomplish in the 20-person groups than in the 7-person groups. Consequently, differences in first-stage relative strategies between classes of value orientations, should appear first in the 20-person groups.

A new hypothesis, the so called conditional attribution hypothesis, was proposed to explain the pattern of relative strategies and relative choices throughout the decision making process, that is after feedback was given. This hypothesis states that, given information on the behavior of others, subjects will behave in a way corresponding to the utility function that defines their dominant value in the self-other outcome space. As was stated previously, the data for both group sizes strongly support this hypothesis. This result is seen as a conceptual and empirical extension of research concerning the relationship between own behavior and expected behavior of others.

As was pointed out by Kelley et al. (1970, p. 413), "the formulation of laws of general validity requires identifying functional relationships between variables which either obtain over various samples of subjects, settings, etc., or which change in known ways in relation to variations in such conditions". In the present research, the functional relationship between the variables "own behavior" and "expected behavior from others", expressed in the hypothesis, will be investigated in a replication study to be described in Chapter 4. In this replication study, one experimental condition consists of a new sample out of the subject population available at the laboratory in Groningen, the Netherlands, the other condition consists of subjects out of a different society, i.e., the U.S.A. The experimental design of Experiment 3 allows between-sample differences in values, norms and/or strategies to be reflected in the functional relationship under
Ordinarily, differences between findings obtained from different subject populations and different experimental procedures, are subject to varying interpretations. However, the procedures used for the present experimental conditions, i.e., distributing a limited amount of money, possesses a high degree of comparability. Consequently, in this particular experiment differences between the two samples are likely to be reflections of societal differences.