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PERSONALITY, PAYOFF INFORMATION, AND BEHAVIOUR IN A TWO-PERSON BARGAINING GAME

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by

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ABSTRACT

Previous studies of the influence of personality on behaviour in experimental games have provided conflicting and inconclusive results. The present investigation was designed to search on a broad front for personality correlates of behaviour in a two-person bargaining game, the one used being a derivation of the Deutsch and Krauss Trucking Game.

Five personality tests, covering fifty-three personality traits, were administered to 192 undergraduate students attending courses at The University of Stirling, and from these the experimental groups were randomly chosen, the only constraint being the sex of the subjects. The tests were The Sixteen Personality Factor Questionnaire, The Guilford/Zimmerman Temperament Survey, The Study of Values Test, The Edwards Personal Preference Schedule, and The Test of Social Insight.

The trucking game was played for 30 trials by two groups of subjects, each containing 24 male dyads and 24 female dyads, under two experimental conditions: Condition I, where subjects had access to full information regarding the other's payoffs, and Condition II, where only incomplete information of the other's payoffs was available.

It was hypothesized that behaviour in the game would be influenced by (i) amount of information available about the payoffs of the other; (ii) sex of the players (comparing single-sexed dyads); and (iii) players' personality.

No differences due to either amount of information available about the other's payoffs, or sex of the players, were found. An analysis of the data provided by the combined experimental groups, however, successfully located indications of personality effects on behaviour in the game, as measured by total joint payoff summed over 30 trials, total time taken, the number of concessions made to the other player, and first strategy-choice on individual trials.

The personality variables concerned were Emotional Stability and Radicalism/Conservatism, (Factors C and Q1 of The Sixteen Personality Factor Questionnaire); Personal Relations, (Factor P of The Guilford/Zimmerman Temperament Survey); Theoretical Value, (T scale of The Study of Values Test); Exhibition, ('exh' variable of The Edwards Personal Preference Schedule); and Cooperativeness, (Scale III of The Test of Social Insight). It is suggested that the relationship of these personality variables to game-playing behaviour should be the subject of further investigation.

SECTION ONE : A REVIEW OF THE RELEVANT AND RELATED LITERATURE

PART ONE : THE THEORY OF GAMES

CHAPTER ONE : INTRODUCTION

The ascription of importance to group participation in decision-making situations in the world of practical affairs has been accompanied by a proliferation of books and articles in the psychological literature. Diverse theoretical, technical, and experimental approaches to the decision-making process are represented in this proliferation. One source of constributions has been the experimental research on behaviour in small groups (cf. Hare, Borgatta, and Bales, 1955; Strodbeck and Hare, 1954; Raven, 1959; and Terauds, Altman, and McGrath, 1960). Here attempts have been made to study under controlled conditions aspects of decision-making long studied by case history.

In the experimental study of small groups, one well-defined precise approach has resulted from the development of the theory of games, and during recent years there has been considerable attention given to "mixed-motive" games (behavioural situations in which individuals must choose between responses which are assumed to serve different motives - that is, situations in which the goals of the players are partically coincident and partially in conflict).

The selection of such situations seems to be based on both theoretical and practical reasons. The major theoretical reason is that much research in this area stems from theories of small group behaviour in which a fundamental assumption is made that mutually cooperative behaviour between members leads to the formation and maintainance of groups, and mutually competitive behaviour results in the disruption of groups.[1]

The major practical reason for emphasis upon cooperation versus competition in the game situation is the interest by researchers in this field in problems of business and industrial economics, and international politics. The fundamental assumption

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1. These notions have been expressed by Thibaut and Kelley (1959), and by Homans (1961).

made here is that cooperation leads to the resolution of conflict, whereas competition leads to its continuation and intensification. On the business economics scene, this is amply illustrated in everyday life by the cut-price "wars" that rage between supermarkets.[1] At the international level, it is perhaps best epitomized in the "arms race" between the countries commonly referred to as world powers, This arms race is, in many ways, another version of the prisoner's dilemma game. There is no escape from paradox, but that the 'dilemma' is realized to exist and its implications understood is obvious. The late President John F. Kennedy of the United States, speaking of the arms race between Russia and his own nation at the Commencement, Americal University, Washington, D.C. in July 1963, said:

> "Today, should total war ever break out again - no matter how, - our two countries will be the primary targets. It is an ironic but accurate fact that the two strongest powers are the two in most danger of devastation..... and, even in the cold war .... our two countries bear the heaviest burdens. For we are both devoting massive sums of money to weapons that could be better devoted to combat ignorance, poverty, and disease.
> We are both caught up in a vicious and dangerous cycle with suspicion on one side breeding suspicion on the other, and new weapons begetting counter-weapons .....
> Both the United States and its allies, and the Soviet Union and its allies, have a mutually deep interest in a just and genuine peace in halting the arms race."

The rejoinder to this statement may well be found in

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1. An analogous example is provided by Cassady (1957), who recounts details of a price war which raged among taxicab companies in Hawthorne, California in 1949, in his paper "Taxicab rate war : counterpart of International Conflict".

President Lyndon B. Johnson's Defence Message to Congress (January 18th, 1965) :

> "But all our experience of two centuries reminds us that 'To be prepared for war is one of the most effectual means of preserving peace'."

In short, the dilemma has long been recognized and has been reiterated time and time again.

The Development of Game Theory

The new mathematical approach of game theory to the problem of interest conflict is generally attributed to Von Neumann in his papers of 1928 and 1937, although Frechet (1953) has raised a question of priority by suggesting that several papers by Borel (1953) in the early nineteen-twenties really laid the foundations of game theory.[1]

Regardless of any debateable priority, the fact remains that neither group of papers attracted much attention on publication. Other than those mentioned, there were almost no other papers before the publication of Von Neumann and Morgenstern's book in 1944.[2] For two decades much of the material lay forgotten, and it is to their great credit that Von Neumann and Morgenstern attempted to write their book in terms that could, with patience, be comprehended by the non-mathematical scientists. The result was highly successful if one is to judge from the attention subsequently given to the theory.

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1. These papers have been translated into English and republished with comments by Frechet and Von Neumann (1953).

2. The original edition of "Theory of Games and Economic Behaviour" appeared in 1944, but the revised edition of 1947 is the more standard reference, and it includes the first statement of the theory of utility.

The Approach of Game Theory

The term "theory of games" may well be decried as misleading, and indeed has been by many authors (e.g. Luce and Raiffa, 1957; Rapoport, 1960; Shubik, 1964). Although for many purposes the analogy is good, the word "game" carries with it many undesirable connotations. In the context of game theory, "game" is not meant to imply the lack of seriousness which might be associated with its usual meaning, but rather the idea that so-called "parlour games", (more appropriately called "games of strategy"), offer the purest examples of situations which are taken as prototypes in this new theory of conflict. In these situations "rationality" is central. A familiar example of such rationality is seen in the way people play, for example, chess. For each player there are three possible outcomes; win, draw, and lose. A player prefers win to draw and draw to lose, and so does his opponent, except for the opponent the outcomes are reversed. Each player makes his choice of moves on the basis of reasoning which goes something like this: "If I do this he is likely to do that, in which case I will have a choice of this or that ..." We consider a player rational who imputes rationality to his opponent.

Games of strategy[1] offer a good model of rational behaviour in situations where there are conflicts of interest with a number of alternatives open at each phase of the situation, and where people are in a position to estimate consequences of their choices, taking into consideration the very important

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1. A strategy in politics (or business or war or chess) can be defined generally as a general plan of action containing instructions as to what to do in every contingency.

circumstance that outcomes are determined not only by one's own choices but also by the choices of others, over whom one has no control.

What exactly, then, is game theory ? Basically, it provides a method for the study of decision making in situations of conflict. It deals with human processes in which the individual player (or decision-making unit)[1] is not in control of other players (or units) entering into the environment. It is addressed to problems involving conflict, cooperation, or both, at many levels; and "the stage may be set to reflect primarily political, psychological, sociological, economic, or other aspects of human affairs." (Shubik, 1964). Boulding (1962) has described game theory as "an intellectual X-ray" which reveals "the skeletal structure of those social systems where decisions interact, and ... therefore, the essential structure of both conflict and cooperation."

Although the concept of strategy is not relevant to certain forms of competition, (Namely, non-interactive contests in which contestants match prowess or skill, but are not permitted, or have no opportunity, to impede the efforts of their competitors, and which therefore fall outside the scope of game theory), the distinction is not one of which non-specialists are aware. Frequent mentions of game theory in popular writings on related subjects have given the impression that a basis has finally been found for uniting in a single conceptual scheme all situations where parties vie for positions of advantage or compete for prizes: points in a parlour game, profits or shares of the market in business competition, or, in the context of international relations, the real or imagined gaines in security, power, prestige,

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1. The decision unit may be an individual, a group, a formal or an informal organization, or a society. "The distinguishing feature of a player is that he or it has an objective in the game and operates under its own orders in the selection of its actions." (Shubik, 1964).

and strategic advantage in future contests. Once game theory is defined as the "science of rational conflict" (Rapoport, 1964), it is easy and tempting to conclude that a mastery of the theory makes one a successful competitor.

Presented in this way, the widespread interest in a theory which was first presented in an involved and abstruse mathematical treatise becomes understandable.

In an age of summit meetings, of action by the Joint Chiefs of Staff, of conferences within the United Nations Security Council, and of industry-wide collective bargaining with countrywide impact, social scientists can expect the pressure for knowledge concerning the decision-making process to increase, and it is not surprising therefore that game theory has attracted widespread interest, especially in the United States where, according to Rapoport (1964) that attitude of a faith in science as a tool for mastering the environment is prevalent. "Here game theory seems especially pertinent, for it purports to be a science of rational decision in conflect situations." (page 4).

CHAPTER TWO : SOME PREREQUISITES OF A THEORY OF GAMES

Utility

The game situation essentially requires each player to choose one of a number of alternatives. In game theory therefore, it is required that the outcomes are specified and that each player is aware of his preference for one outcome over another - that is, that he values each outcome differently.

It is assumed in game theory that all outcomes can be represented by numbers. For example, if the only outcomes are win, lose, or draw, 1 can stand for win, -1 for lose, and 0 for draw. How these numbers are assigned is not the concern of game theory.

While the actual determination of the payoffs is not the game theoretician's concern, he does specify the scale on which such determination should be made. In order to verify any rule produced by means of the theory, it is necessary to know the values (utilities) which people assign to outcomes and the probabilities of all the possible outcomes associated with each choice of action. It is then possible to compare the expected utility gain of the action taken with the expected utility gains of other actions.

Expected utility gains are sums of products of utilities and probabilities. This means essentially that utilities must be assigned numerical values, and not merely ordinal ranks. Von Neumann and Morgenstern (1947) in compiling their treatise on game theory felt it necessary to put utility theory on a rigorous basis, because numerical utilities played an essential part in the theory. In terms of modern concepts of rigor, this meant that a procedure had to be specified for ascertaining a given decision-maker's utility scale. In order to specify such a procedure Von Neumann and Morgenstern assumed that a preference can always be determined between any two 'risky' outcomes. Their method has the advantage of substituting preferences among probability mixtures of outcomes for the task of assigning numerical values directly to outcomes, and it is assumed that choice decisions of this sort can be obtained