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The Application of Game Theory in Collective Behavior: A Critique of Berk's "Gaming Approach"

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The game theory approach to collective behavior is examined in this paper by critiquing Richard A. Berk's application of it (1974). Given relative payoffs for different action choices, game theory may offer certain solutions for actors; however, Berk's use of game theory falls short of these solutions. Using matrices to present actors' payoffs is the only appropriate application of game theory used by Berk. A more proper application of game theory solutions to the same payoff values from Berk's work shows how an emergent norm approach might better fit the empirical problem than Berk's contagion approach.

Early interest in collective behavior may be found in the works of several writers, but most often "...identified as the founder of collective behavior..." is Gustave LeBon (Turner and Killian, 1957: 5). LeBon's approach focuses on the suggestibility, irrationality, and abnormal, psychological states of crowd members, and has been criticized by many (see Turner and Killian, 1957; Turner, 1964; Couch, 1968; Elsner, 1972). Smelser (1962) has argued for a more system-oriented approach for the study of crowds in a theory of necessary conditions for the occurrence of "hostile outbursts." Two other approaches have attempted to refute LeBon's claims by more closely examining the internal dynamics of crowd behavior. Turner's "emergent norm" approach directs attention away from psychological states and toward an analysis of the group and its processes (1964). More recently, Richard A. Berk has attempted to show how individuals in crowds behave very rationally (1974). This attempt was accomplished with the use of game theory.

This essay concerns itself with the latter two approaches, focusing on the internal dynamics of crowd behavior. It will attempt to demonstrate how Berk's application of game theory supports a severe reductionist philosophy and, in one sense, an overly rational conception of human nature. In a phrase, Berk's approach is a cognitive contagion approach offering little more than LeBon's where "...some process of contagion which brings a heterogeneous aggregation under the sway of common impulse explains the development of a crowd..." (Turner, 1964: 126). Had Berk applied game theory more appropriately, such a perspective might not have resulted, and the explanation of the observed behavior would have been sought and better explained through an emergent norm approach. However, Berk thinks his approach has greater value than the emergent norm approach.

Berk suggests that his gaming approach differs from the emergent norm approach in at least three ways. First, although some normative emergence may be evident, it is "...misleading to assume that 'suggestion' fostered by emergent norms cripples the cognitive abilities of participants or that people in crowds are somehow less able than people in other circumstances to examine their situation critically..." (1974: 371). Second, the emergent norm approach never suggests where these norms come from in the first place. Crowd behavior might be better assessed by examining individual motives. Third, the emergent norm approach "...rests on the unconscious tendency to accede to group norms...," while Berk's approach "...involves a conscious calculus in which the best anticipated outcomes are selected..." (372).

The first and third differences specify that the emergent norm approach assumes less rational and less conscious behavior on the part of crowd participants than does Berk's gaming approach. Conforming to norms in Berk's thinking is an irrational and unconscious act. We are to understand then that conforming to a norm of driving on the right hand side of the road is irrational and unconscious? Had Berk been able to move beyond an individual level of analysis and further explore the empirical situation under game theory more rigorously he might have never come to such conclusions. He could have discovered that there are varying definitions of rationality and consciousness.

The second difference, that the emergent norm approach lacks specification as to where norms emerge from initially, seems to be more a refutation of the approach rather than merely a difference. The reanalysis which follows should demonstrate that this refutation was indeed Berk's intent. Although this argument by Berk bears a striking resemblance to one from ignorance (since there is no proof for the emergence, then norms must not exist), it does point to one of the major weaknesses in the emergent norm approach. This weakness and the issues of rationality and consciousness will be addressed at the close of this paper after a closer examination using game theory is made of Berk's analysis. This reanalysis is intended to show how Berk's use of game theory is only a guise for a contagion approach and how game theory when properly applied to his empirical work necessitates the emergence of a norm in order to explain the behavior which occurred there.

BERK'S APPLICATION OF GAME THEORY

The individual motives of college students gathered at a rally on the campus of Northwestern University were analyized by Berk to show why no action took place (1974). The choices of action were between "trashing," the more violent act, and "marching." Each act was supported respectively by militants and moderates. The payoff matrices for these different individuals as presented by Berk are attached as Appendix A. Individual action choices were cross-tabulated with the degree of group support. These four matrices can more readily be presented by cross-tabulating the individuals' action choices with each other while retaining the same payoff information and making the matrices more congruent with game theory. Figure 1 presents Berk's four matrices collapsed into two. (The upper left hand value in each cell will always represent the payoff for the decision maker on the left, in this case, militant. The lower right hand value will represent the decision maker on the top of the matrix, moderate.)

Militants	Moderates: trash	Moderates: not
trash	2 -2	-2 -2
not trashing	1 -2	-1 -1

Militants	Moderates: march	Moderates: not
march	-2 2	-2 -2
not marching	-2 -2	1 -2

Figure 1. Combinations of Berk's Matrices for Trashing and Marching

Berk attempts to explain through the use of these matrices why nothing happened, at least no march or trashing, at the rally. This solution is to be understood within the framework of game theory. However, the only resemblance Berk's analysis thus far has with game theory is that he used matrices, although somewhat inadequately, to present the individuals' payoffs. Contrary to Berk, game theory does offer a solution to the problem. In the right hand matrix in Figure 1 the appropriate course of action based on game theory is for the moderates to march. This is based on what is called a "minimax" strategy for the moderates. Before continuing this reanalysis of Berk, a brief digression is offered to explain this minimax concept.

GAME THEORY APPLIED

Game theory is a mathematical construct used in making decisions. It assumes two interdependent decision makers in a situation where the outcome for one participant's choice of action is dependent on the other's choice. The appropriate course of action for either actor is what is known as a "minimax" strategy. "The usual definition of the minimax strategy is that [choice] which minimizes the maximum loss" (Forester, 1968: 33). This minimax criterion can be used with only one actor, where he or she is confronted with two or more choices of action given variable states of nature which differentially influence those choices or where there is more than one actor and where the other actors' choices of action are equivalent to the variable states of nature in the former case. It is the latter case with more than one actor with which we are concerned here. The "Prisoners' Dilemma" should help elaborate the minimax strategy with two actors (Brown, 1965: 738):

> Two men suspected of a crime have been taken into custody and separated. The district attorney is confident that the two together have committed the crime, but he does not have evidence that is adequate to convict them. He points out to each prisoner alone that each has two alternatives: to confess to the crime...or not to confess. If they both do not confess...each will get one year in the penitentiary. If both confess...both will get eight years in the penitentiary. However, if one confesses and the other does not then the one who confesses will receive lenient treatment for turning state's evidence while the other will get the maximum penalty. The lenient treatment might mean six months in jail and the maximum might be twenty years.

Years in Prison

A	B: not	B: confess
not confess	1, 1	20, .5
confess	.5, 20	8, 8

Ordinal Payoffs

A	B: not	B: confess
not confess	1, 1	-2, 2
confess	2, -2	-1, -1

Figure 2. Prisoner's Dilemma

The matrices for this dilemma are presented in Figure 2. The matrix on the left depicts the actual years of imprisonment. The right hand matrix contains the years of imprisonment transposed to relative payoffs on an ordinal scale (Ullmann-Margalit, 1977: 18).

The minimax strategy, or what Brown prefers to call the "rational solution," obtains in the lower right hand cell where both prisoners confess (1965: 741). For each actor the maximum loss in this matrix is -2. This occurs when one actor confesses and the other does not. In order to minimize this maximum loss, the non-confessing actor is compelled to confess, thereby reaching a payoff of -1 in the lower right hand cell: the minimax. This strategy is also known as an "equilibrium" which "...is a combination in which no one would have been better off had (one) alone acted otherwise" (Lewis, 1969: 14). Minimax will be the term most often used in the ensuing discussion; however, the definition for an equilibrium offers a somewhat easier mechanism for establishing the minimax strategy.

Returning now to the issue presented by Berk in the right hand matrix of Figure 1, we see that the only action available to the moderate to minimize the maximum loss of -2 is to march. Of course the militant minimax strategy in this matrix is not to march, so, not too surprisingly, we find that the lower left hand cell where the moderate marches and the militant does not is an equilibrium condition as well. That is, "...no one would have been better off had (one) alone acted otherwise."

While claiming to be operating under the conditions of game theory, Berk asserted that no action would occur in regard to marching or trashing. It has been presented above that game theory's minimax strategy does offer a course of action. This disagreement, however, may be a hasty conclusion. Allowing Berk the benefit of the doubt, we might be able to establish the source of his line of reasoning. His conclusion might have been drawn, not from the two matrices with choices of "trashing-not trashing" and "marching-not marching" as presented in Figure 1, but from one matrix with alternatives of trashing and marching. Both moderates and militants have the choices of action of either marching or trashing, and the matrix for this game situation is presented in Figure 3. The payoff values in the cells where the actions by both moderates and militants are in concert, e.g., both march, are specified by Berk and may be found in either Appendix A or Figure 1. The values in the upper right and lower left hand cells in the matrix seem reasonable

Militant	Moderate: trash	Moderate: march
trash	2, -2	-2, -2
march	-2, -2	-2, 2

Figure 3. Recombination of Berk's Matrices

although not directly specified by Berk.[1] Whatever values might be assigned to these cells, the general form of the matrix remains the same: a game of conflict. This matrix conceptualization as one of conflict, from Berk's originals, appears especially acceptable, since he concludes, "Hence, moderate and militant individuals are in conflict" (364).

Game theory's resolution to games of conflict is simple. Each actor elects his desired action, and this is the opposite of the other actor's. The minimax for Berk's matrix in Figure 3 has the moderates marching and the militants trashing. Or, as Brown put it, where there is "...conflict of interest or competition in the matrix...the game would be a trivial one since everyone would without hesitation act so as to produce the desired outcome" (1965: 755). This is not the solution that Berk suggested. The inherent conflict led to a compromise of barricading a road near the campus.

THE COMPROMISE ALTERNATIVE

Berk's solution might be construed as offering a new proposition in sociology, that conflict leads to compromise. However, since Berk claims to be operating under game theory, the more logical assumption is that there were actually more than two choices of action. The moderates and militants may have had choices of action among trashing, marching, or barricading — the compromise. Analyzing this third alternative as a matrix choice brings more doubt about Berk's thinking. Figure 4 presents one possible matrix entailing this action choice of compromise along with another that will be considered.

A joint compromise should have a payoff value at some point half-way between one's most and one's least desirable outcomes. Since the moderates receive a -2 for the joint action of trashing and a $+2$ for the joint action of marching, and since the payoffs for the militants are the same, yet reversed, the compromise of barricading would produce payoffs of zero for each of these joint actions.

Even with careful placement of the payoffs in the non-joint activity cells, Berk would find it hard to demonstrate how the compromise could be a minimax. The essential character of the matrix would still be one of conflict, leading the militants to trash and the moderates to march. Moreover, the zero value for the joint compromise raises the question as to why this action would be any better than simply going home.

	Moderate			
Militant	trash	march	barr.	go home
trash	2, -2	-2, -2	-2, -2	-3, -1
march	-2, -2	-2, 2	-2, -2	-3, -1
barricade	-2, -2	-2, -2	0, 0	-3, -1
go home	-1, -3	-1, -3	-1, -3	0, 0

Figure 4. A Possible Matrix Given Four Action Choices

Berk mentioned the possibility of going home. Even if the moderates would leave the rally where no trashing and no marching are the action courses, they would still receive a negative payoff, since "...anti-war students can be labeled as rabble..." (1974: 364). However, it seems that the moderates' relative payoff for going home would not be as bad had they stayed and done nothing while the militants trashed. Having gone home the moderates might still be labeled "rabble" but they would have clearly decreased the probability of being mistakenly arrested for trashing had they stayed.

Minimax strategy does not rest on this line of reasoning, however. We need to ask what the moderates' payoffs would be like for *any* action they took if the militants had gone home. I cannot think of a less desirable outcome. For either party to engage in action when the other goes home increases the police attention to the now smaller group and the chance of arrest. The way to minimize this maximum loss when the other party has gone home is for the deciding party to go home too. Given these four alternatives presented in Figure 4, the minimax strategy is for all to go home.[2] How then are we to account for the action that did indeed occur in the situation studied via game theory?

THE COORDINATION RECONCEPTUALIZATION

There are two routes available to explain this confusion. The first requires reexamining and changing some of the payoff values of Berk's original matrices. The second reconceptualizes who the actors are and what the choices of action should be. Both of these routes will be explored, but each leads to the same conclusion. The situation proposed by Berk is not one of conflict and compromise but one of coordination, requiring the emergence of a norm for resolution.

Route 1: From Berk's original values for the joint activities of trashing and marching, it was shown how the joint compromise of barricading would have to have a value of zero for each actor. It was then suggested that the joint action of going home would have payoffs equal to the compromise of zero. This might well be an untenable equivocation if we assume that *some* joint activity is more desirable than *no* joint activity, such as going home. With this assumption, going home jointly may offer negative rewards for the actors, thereby dropping this action choice out of the matrix. However, allowing this assumption presents a challenge to Berk's original matrices.

Although trashing with the militants is not the most desired activity for the moderates, this joint activity must have a better payoff than no activity. A continuation of this line of reasoning would lead to a matrix similar to the one presented in Figure 5.

	Moderate			
Militant	trash	march	barr.	go home
trash	2 / 0	-2 / -2	-2 / -2	- / -
march	-2 / -2	0 / 2	-2 / -2	- / -
barricade	-2 / -2	-2 / -2	1 / 1	- / -
go home	- / -	- / -	- / -	0(-1) / 0(-1)

Figure 5. A Four Choice Matrix Reflecting Joint Action Assumption

This matrix entails what is known as a coordination equilibrium problem. A coordination equilibrium is "...a combination in which no one would have been better off had 'any one' agent alone acted otherwise, either himself or some one else." (Lewis, 1969: 114). Inspection should demonstrate that there are three combinations in Figure 5 which meet this criterion; these are the joint activity cells. The payoff values in the matrix are arbitrary and insignificant. Given the assumption that some joint activity is more desirable to all parties than no joint activity, any values which are assigned to the cells reflecting that assumption will produce the form of the coordination problem presented in Figure 5. Hence, the problem is one of coordination, not conflict. A reconceptualization of Berk's original matrices would have illuminated this different nature of the problem more easily and earlier.

Route 2: Berk suggested that the militants might "...try to alter the payoff matrices of the moderates..." in order to bring about joint trashing (1974: 364). Had this happened and trashing occurred, it becomes rather difficult to understand the difference between a militant and a moderate with a militant's payoff matrix. To avoid this proverbial whirlpool of attitude — behavior and to make the problem more fitting with game theory, the original matrix of Figure 3 could have been conceptualized as the matrix in Figure 6. This matrix makes no attitudinal assumptions about the actors involved, and the actors are presented with either opting for a militant or a moderate strategy. As one can see, this

A \ B	militant	moderate
militant	2, 2	-2, -2
moderate	-2, -2	2, 2

Figure 6. Figure 3 Reconceptualized

reconceptualization of the more simple, original matrices frames the problem as one of coordination between two mutually satisfying events, not one of conflict.

Regardless of which route is taken, we are led to the realization that the gaming problem put forth by Berk is more likely a problem of coordination. Such problems are not new to the study of human behavior. In analyzing how anything but the minimax solution might be attained in such problems as the prisoners' dilemma and the lynching mob where the coordination combination and the minimax are at odds, Brown suggests that coordination might come about with the emergence of a "group mind" (1965: 760). More recently, writers of a more philosophical bent have attempted to show how problems of these sorts are conditions under which norms are likely to emerge (Lewis, 1969; Ullmann-Margalit, 1977). Although these approaches could be criticized for not specifying how norms emerge, they clearly state that coordination games are norm-generating conditions. Without some prescription for conduct, the actor in these situations is left in a quagmire of n^{th} order expectations of the other's action. A coordination problem "...is a behavior situation in which each player's best choice of action depends on the action he expects the other to take, which he knows depends, it turn, on the other's expectations of his own..." which he knows depends, in turn, on his expectation of the other's expectation of his own, etc... ad infinitum (Schelling, 1963: 86). This is indeed a very rational and conscious exercise; however, without a norm for direction, no action will take place other than an available minimax in coordination problems. Game theory offers no solution to these problems. Explanations must be sought outside of it. An emergent norm approach is one solution presented by some. Berk offers us a contagion solution.

CONCLUSION

Whether the reconstruction from Berk's matrix of conflict in Figure 3 to the one of coordination presented in Figure 6 is granted, his solution remains the same: changing individuals' payoff matrices. It has been demonstrated that game theory offers a solution dissimilar to Berk's when considering the game as one of conflict. Game theory has moderates marching and militants trashing while Berk had everyone barricading. Consideration was given to this compromise of barricading as a possible alternative in the game matrix. If this conflict matrix is accepted, the only way for barricading to have occurred would be through a change of individuals' matrices, since the third alternative offers nothing better for the actors.

It was then shown how the compromise payoffs would have been the same as those for going home. Moreoever, going home would have been the solution of game theory unless the matrix could be reconceptualized. This reconceptualization necessitates changing the matrix to one of coordination, not conflict. Under Berk's thinking, action could only have occurred in this situation if some proportion of the actors changed their payoff matrices. Again, the same solution of contagion is required.

Berk's approach, although more cognitive, is little more than LeBon's contagion notion disguised in game theory matrices. Admittedly, this essay does not offer proof of an emergent norm nor does game theory. It only suggests that there are some instances where individuals' differential payoffs create situations that might lead to the emergence of norms. The notions that norms emerge out of interaction and that "norm" is a viable concept are still beliefs. However, it has been demonstrated that a contagion notion is also a belief. An application of game theory does not support the contagion notion; in fact, it yields contradictory solutions. Game theory has only been used as a guise.

FOOTNOTES

1. Figure 1 presents the original payoffs from which these values were drawn. If the moderates march along, they receive a payoff of -2. If the militants trash and the moderates do not, the moderates again receive a payoff of -2. Since the upper right hand cell in Figure 3 is where the moderates march alone and where they do not trash with the militants, it seems their payoff in this cell could reasonably be assumed to be -2. The application of the same reasoning for the militants in this cell produces the same value of -2. The lower left hand cell of the left matrix in Figure 3 is not as easily resolvable.

If the moderates trash while the militants march it is reasonable to assume that this is the same as trashing alone for the moderates: a -2 from Figure 1. However, the case for the militants where they march and the moderates trash is a bit more problematic. If the militants march and the moderates do not, the militants' payoff is -2 as in Figure 1. Yet, if the moderates trash and the militants do not, the militants do not have a payoff of -2 as might be expected, but one of $+1$, since their desired action of trashing has been undertaken at least by the moderates. The value of $+1$ was put forth by Berk in the context of an individual not trashing while the group did so. In the new context dealt with here, it seems more than reasonable to assume that if the moderates trashed and the militants marched this condition would be the worst of all possible worlds for the militants, yielding at least a value of -2 for the militants in this cell.

2. The assignment of the payoff values as $(-1, -3)$ in the cells where one actor goes home and the other engages in some other action may be questioned. Although a brief argument for these relative values was offered, an assignment of $(-2, -2)$ to these cells might be more fitting. However, doing such does not alleviate the problem. In this instance, both going home and barricading would be alternative minimax strategies or coordination equilibria; solving these kinds of problems is the thrust of the argument.

REFERENCES

Berk, Richard A.
1974 "A gaming approach to crowd behavior." American Sociological Review 39: 355-73.
Brown, Roger
1965 Social Psychology. New York: Free Press.
Couch, Carl J.
1968 "Collective behavior: An examination of some stereotypes." Social Problems 15: 310-22.
Elsner, Henry
1972 "Introduction." In Henry Elsner, Jr. (ed.), Robert E. Park: The Crowd and the Public and Other Essays. Chicago: University of Chicago.
Forester, John
1968 Statistical Selection of Business Strategies. Homewood, Ill.: Richard D. Irwin.
Lewis, David K.
1969 Convention: A Philosophical Study. Cambridge, Mass.: Harvard University.
Schelling, Thomas C.
1963 The Strategy of Conflict. New York: Oxford.

Smelser, Neil J.
1962 Theory of Collective Behavior. New York: Free Press.

Turner, Ralph R.
1964 "New theoretical frameworks." Sociological Quarterly 5: 122-32.

Turner, Ralph R. and L. M. Killian
1957 Collective Behavior. Englewood Cliffs, N.J.: Prentice-Hall.

Ullman-Margalit, Edna
1977 The Emergence of Norms. Oxford: Clarendon.