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## ABSTRACT

Physiological and behavioral indices of emotional arousal and mood during performance in a simulation game were investigated. The hypotheses tested were: (1) there will be attitude change following participation in the social simulation game, Ghetto; (2) this change in attitude will be related to the players' emotional involvement in the game as measured by heart rate and self-reported mood (i.e., both covert and overt measures); and there will be a "spread of affect" at times during the game, i.e., the emotional arousal (as indicated by fluctuations in heart rate) experienced by one participant in the game situation, would generalize to other participants. The essence of simulation games was assumed to be to capture (via structured situations) the psychological and environmental determinants of particular cognitions. The attitudes recorded were those of the 15 undergraduate players toward the consequences of living in a ghetto. The results provide some support for the validity of the hypotheses, but the complexity of the relationships calls for more controlled experimentation. Various explanations for attitude change through the use of simulation games are presented. (Author/KS)

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# Center for Social Organization of Schools

REPORT No. 111  
AUGUST, 1971  
EMOTIONAL AROUSAL AND ATTITUDE CHANGE  
DURING SIMULATION GAMES  
STEVEN J. KIDDER

Johns Hopkins  
University

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## INTRODUCTORY STATEMENT

The Center for Social Organization of Schools has two primary objectives: to develop a scientific knowledge of how schools affect their students, and to use this knowledge to develop better school practices and organization.

The Center works through five programs to achieve its objectives. The Academic Games program has developed simulation games for use in the classroom, and is studying the processes through which games teach and evaluating the effects of games on student learning. The Social Accounts program is examining how a student's education affects his actual occupational attainment, and how education results in different vocational outcomes for blacks and whites. The Talents and Competencies program is studying the effects of educational experience on a wide range of human talents, competencies and personal dispositions, in order to formulate--and research--important educational goals other than traditional academic achievement. The School Organization program is currently concerned with the effect of student participation in social and educational decision making, the structure of competition and cooperation, formal reward systems, ability-grouping in schools, and effects of school quality. The Careers and Curricula program bases its work upon a theory of career development. It has developed a self-administered vocational guidance device to promote vocational development and to foster satisfying curricular decisions for high school, college, and adult populations.

This report, prepared by the Academic Games program, explores the use of physiological and behavioral indices of arousal and mood during performance in a simulation game. The results, with those of further controlled experimentation, may provide guidelines for the optimum use of social simulation games in the classroom.

#### ACKNOWLEDGMENT

I thank Gail M. Fennessey and Phyllis K. Wilson for their help in completing this study. I also thank Mr. Harold T. Ray, Regional Representative, Narco Bio-Systems Inc., Houston, Texas, for his help in lending the instrumentation used in the present study.

## ABSTRACT

The present study explores the use of physiological and behavioral indices of emotional arousal and mood during performance in a simulation game. It was hypothesized that the above indices of general affect would be related to changes in attitudes, the cognitive components of which are dealt with in the simulation game Ghetto. In addition, it was hypothesized that the emotional arousal (as indicated by fluctuations in heart rate) experienced by one participant in the game situation would generalize to one or more subjects in the same game. The results provide some support for validity of these hypotheses.

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## INTRODUCTION

The present study analyzes the possible relationship between emotionality in a simulation game<sup>1</sup> and attitude change. This implies a close relationship between the cognitive and affective components of learning situations. Their interaction may result in subsequent behavioral change which can be studied immediately after a gaming exercise or after traditional approaches to teaching.

The importance of a student's involvement in the learning situation to the solidification of factual knowledge or skills may not be apparent immediately following game play. However, if a gaming approach were compared three months later to a traditional classroom approach (across the same content domain), the simulated exercise might be seen to produce longer lasting changes in knowledge and attitudes. Could longer lasting behavioral changes be a function of the greater involvement experienced in a simulation game? Answering this question requires some knowledge of the relationship between involvement and learning or attitude change during simulated exercises. The present study deals directly with this relationship.

In general, the importance of feeling (mood), emotion, cognition, and affect has been only recently emphasized. (See Feelings and Emotions

by Magda Arnold, 1970; Physiological Correlates of Emotion by Perry Black, 1970; Cognition and Affect by John Antrobus, 1970; Fantasy and Feeling in Education by Richard Jones, 1968.) Usually, research procedures in this area rely heavily on subjective measures of cognition and affect. When physiological parameters are included as objective measures of affect, they are usually recorded from one individual in highly controlled (and sometimes contrived) situations. Seldom are overt and covert measures of affect recorded on several individuals simultaneously, as is done in this study.

Some interesting theoretical relationships between cognition and affect (which may have theoretical implications for the present study) have been proposed recently. Lazarus, Averill, and Opton (in Arnold, 1970) have proposed a cognitive theory of emotion. They suggest that emotions be considered as complex response syndromes which can be characterized from three perspectives: (a) biological, (b) cultural, and (c) cognitive. They regard individuals as "evaluating organisms." Each person's evaluations are based on cognitive activity which can have an associated emotion. These authors also note that the determining conditions of these cognitions are of two types: (1) situational (referring to environmental factors), and (2) dispositional (referring to the psychological make-up of an individual).<sup>2</sup> Both of these conditions are very much a part of instructional simulations. The essence of simulation games is to capture (via structured situations) the psychological and environmental determinants of particular cognitions. This cognitive theory of emotion parallels our concerns in the present study (i.e. attitude modification, mood, arousal, generalization of affect).

Affective experience has been tricotomized by Ewert (in Arnold, 1970) as follows: (a) moods, (b) feelings, and (c) emotions. Ewert suggested that feelings and emotions could be regulated biologically and socially, respectively. Ewert also equated emotions with attitudes towards one's social environment (this general conceptual framework has been related to instructional simulations by Kidder, 1970a, 1970b). Thus, there may be a relationship, as this study hypothesizes, between the emotional impact of a simulation on the participants and a resulting attitude change.

The measurement approach to attitude change used in this study is based in Fishbein and Raven (in Fishbein, 1967). Fishbein and Raven hypothesized that attitudes have both belief and affective components. In addition, Anderson and Fishbein (in Fishbein, 1967) note that an ". . . attitude toward the [an] object is predicted to be a part function of the total affect associated with each of the beliefs about the object." The theory of Rosenberg (in Fishbein, 1967) is closely related to this approach. In fact, Rosenberg equates attitudes and beliefs with affective responses: ". . . attitude (here defined as relatively stable affective responses to an object)." This hypothesis is nearly synonymous with that proposed by Ewert, above.

The theoretical basis of the present study is related to the work of Triandis (1971), Triandis and Malpass (1970) and Greenwald (1969, 1970). The behavior of an individual participating in a simulation game has obvious cognitive and affective components, plus simulated realizations of behavioral intentions. These components are incorporated in a theory of

interpersonal attitudes (a cornerstone of social simulations) proposed and amplified by Triandis (1967, 1970). In addition, Triandis and Malpass (1970) note that measurement procedures are available for evaluating interpersonal attitudes " . . . by examining the cognitive component by means of logical tasks such as the antecedent-consequent method, the affective component by means of Osgood's semantic differential (Osgood, Suci, and Tannenbaum, 1957) and the behavioral intentions by means of the behavioral differential (Triandis, 1964)." The affective and belief components of selected attitudes were evaluated in the present study.

The theoretical relationship between the present study and those conducted by Greenwald (1969, 1970) is found in the structured role-playing of participants in social simulations and the information they are exposed to. In the game Ghetto (1970), players (when white, middle-class, and relatively naive) are usually exposed to counterattitudinal information or information opposing their own perceptions. With this in mind, the relationship between role-playing in simulation games and resulting attitude change can be interpreted within Greenwald's "amended learning model of persuasion" as clarified by the following excerpts from his works:

- (1) It was concluded that the effectiveness of role playing in inducing opinion change may be due in large part to its success in getting subjects to evaluate information opposing their own position in unbiased fashion. (Greenwald, 1969)

- (2) These results were interpreted in terms of an associative model of persuasion, and it was concluded that attitude change through role playing may depend on the role player's having an opportunity to consider counterattitudinal information that he has not previously rejected. (Greenwald, 1970)

Thus, attitude change may result from modifications of the cognitive (Greenwald; Triandis) and/or affective components (Triandis; Rosenberg; Fishbein and Raven; Ewert; Lazarus, et al.) of the original attitude.

The major hypotheses of the present study are: (1) There will be attitude change following participation in the social simulation game, Ghetto. (2) This change in attitude will be related to the player's emotional involvement in the game as measured by heart-rate and self-reported mood. (3) There will be a "spread of affect" at times during the game, meaning that one subject's excitement may excite another, causing positive correlations between the subject's heart-rates during the game.

To provide preliminary support for these hypotheses, the following measures were taken on participants in the social simulation game Ghetto (1970): (1) heart-rate in beats per minute as a covert measure of affect or involvement; (2) self-report measures of mood<sup>3</sup> at the beginning, during, and at the end of the simulation experience, to provide a second indication of involvement; (3) observations of each subjects' mood at the beginning, during, and after the game to provide a third measure of involvement in the game; (4) self-report measures of attitudes (before and after the game) whose factual characteristics are manipulated in the simulation game so that a participant is exposed, in an unthreatening environment, to information and situations counter to the participants' original conceptions of that same environment.

## METHOD

### Sample

Due to the complexities of recording physiological parameters from four individuals simultaneously during performance in the simulation, the sample was quite small. Fifteen undergraduate males at Johns Hopkins were paid to participate. Five different subjects participated in each game session. Heart rate was recorded simultaneously from four subjects in each game. However, one recording was terminated due to electrode failure during game one. Thus, complete heart rate records were available for eleven subjects.

### Procedure

The five subjects sat at one end of a large table in a conference room. A causal setting was desired, similar to a classroom, not like a laboratory. Three sessions were played with three different groups of five subjects each. The social simulation game used for each session was Ghetto (1970). Heart rate was monitored on four subjects during each session. A Narco Bio-Systems Physiograph<sup>R</sup> Six was used for recording purposes. Hardwire recordings were taken from three subjects, the wires leading under large, closed doors immediately behind the subjects. Telemetric recording was taken from one subject in each game session. Surface electrodes were used on all Ss. The two recording electrodes were attached to the upper distal surface of each subject's arm. The reference electrode was attached to the proximal surface of the left forearm. No reference electrode was necessary on the telemetered subject.

Baseline data were obtained from each subject. Then each was required to complete two pre-tests, one on attitudes and beliefs toward ghetto people (see Appendix A, Instrument I), and a second on the consequences of living in a ghetto (see Appendix A, Instrument II). The heart rate was recorded from four subjects simultaneously for 88 minutes during game one, 125 minutes during games two and three. Due to the lag between the base rate recordings and the "Introduction" to the game, and based on the fact that arousal and involvement during the game were of primary interest, the four simultaneous heart-rate recordings from the middle of the Introduction to each game through the post tests are reported.

While recording the heart-rates of the individual subjects, two measures of mood or involvement were taken. Both measures were based on the Mood Adjective Check List developed by Nowlis (1970). One was in self-report form (see Appendix B, Instrument I); the other (see Appendix B, Instrument II) was completed on each subject by the person conducting the game. The self reports and observations on mood or general affect were completed three times during each game: (1) immediately following the introduction to the game; (2) approximately mid-way through the game; and (3) after the game was terminated (but before the post-test instruments were completed).

### Variables

The dependent variables of interest in the present study were: (1) heart rate on each subject throughout the game experience as a measure of general involvement; (2) scores on an instrument dealing with beliefs and attitudes toward ghetto people; (3) scores on an instrument dealing with the consequences

of living in ghetto; (4) scores on the Mood Adjective Check List (MACL) completed three times by each game participant; (5) scores on the Modified Check List (MCL) completed by the game leader three times on each subject during game play.

The belief and attitude instrument (see Appendix A, Instrument I) is based on the form and theory originally suggested by Fishbein and Raven (1967). This approach is based on the measures of attitude suggested by Osgood et al. (1957). Fishbein and Raven (1967) modified the approach somewhat by including belief in the concept being rated along with the evaluative dimensions (positive or negative affect) of the concept. The form of the items on this instrument is provided in the following example:

Ghetto people are honest.

true	_____	_____	_____	_____	_____	_____	_____	false
impossible	_____	_____	_____	_____	_____	_____	_____	possible
probable	_____	_____	_____	_____	_____	_____	_____	improbable

Being honest is:

bad	_____	_____	_____	_____	_____	_____	_____	good
harmful	_____	_____	_____	_____	_____	_____	_____	beneficial
wise	_____	_____	_____	_____	_____	_____	_____	foolish

The dependent measures of interest then were the sum across the three seven-point scales on the belief component and the sum across the three seven-point scales for the affective component. These two sums on each concept were calculated for each subject before and after the game experience.

An attempt was made to factor analyze the scales on the instrument designed to tap the cognitive aspects of attitude toward ghetto people in order to develop sub-test scores within the instrument. Unfortunately, there were too many scales and too few subjects to validate the obtained factor structure. Thus, scores from this instrument were not used in subsequent analyses.

The Mood Adjective Check List completed by each subject and recorded by the game leader was obtained on the participants in the last two game sessions only. The instrument (see Appendix B) was based on those developed by Nowlis (1970). Each subject was simply asked to circle his choice on the following scale:

angry      vv    v    ?    no

where

vv means you definitely feel this way at the moment

v means you feel slightly this way at the moment

? means you cannot decide whether you feel this way  
or not

no means you are definitely not feeling this way at  
the moment

From these self-report measures taken by each subject at the beginning, middle, and end of the game, eleven factor scores were derived from the sums across particular adjectives checked. For instance, on each MACL, the symbols vv, v, ?, no are valued 3, 2, 1, 0, respectively. Then the values associated with particular adjectives (see below) were summed to provide mood factor scores. The moods and their associated adjectives were:

1. Aggression - angry, defiant, rebellious
2. Anxiety - clutched up, fearful, jittery
3. Surgency - carefree, playful, witty
4. Elation - elated, overjoyed, pleased
5. Concentration - concentrating, engaged in thought, intent
6. Fatigue - drowsy, sluggish, tired
7. Vigor or Activation - active, energetic, vigorous
8. Social Affection - affectionate, kindly, warmhearted
9. Sadness - regretful, sad, sorry
10. Skepticism - skeptical, suspicious, dubious
11. Egotism - boastful, egotistic, self-centered

Only the sum of the MACL factor scores for Surgency, Elation, and Activation was plotted for each subject and correlated with heart-rate variability and attitude change scores.

The modified checklist (MCL) used by the game leader involved subsections of the MACL. It contained some of the adjectives for all of the original mood factors except Surgency and Social Affection. The scale for each adjective was:

angry - Yes    So-So    No

where

yes = 3

So-So = 2

No = 1

The mood factor and associated adjective(s) were:

1. Aggression - angry
2. Anxiety - fearful, jittery
3. Elation - elated, overjoyed, pleased
4. Concentration - concentrating
5. Fatigue - sluggish
6. Vigor or Activation - active
7. Sadness - sad, sorry
8. Skepticism - skeptical, suspicious
9. Egotism - self-centered

These factors were recorded with the MACL scores. Little additional information, beyond the MACL, was gained from the MCL records.

### Analyses

Due to the exploratory nature of the present study, the analyses were mainly correlational. Additional descriptive statistics were employed where clarification was necessary. The heart-rate data was plotted for each subject within each game in order to observe parallel fluctuations (generalization of "affect") across subjects participating in the same game. Each game was artificially tricotomized in order to provide better understanding of each game in progress. This was especially important with the heart-rate data because an attempt could then be made to find out if the involvement experienced by one player generalized more consistently during a particular portion of the game experience. A study was then made of the intercorrelations of heart-rate variability, mood indicators, and the affective components of attitude change scores in an attempt to validate some aspects of the study's original hypotheses. Initially, positive relationships among these indicators were expected.

## RESULTS

The results from the present study are reported in the following order and form: (1) heart-rate data plotted for subjects one, two, and three of game one, period one plus descriptive statistics, followed by the same information for periods two and three of game one; (2) heart-rate data plotted for subjects one, two, three, and four, period one, game two, followed by descriptive statistics on this heart-rate data and summary data for the self-reports and observations of mood for this period in the game; followed by the same data for periods two and three of game two; (3) heart-rate data plotted for subjects one, two, three, and four, period one, game three, followed by descriptive statistics for this heart rate data and summary data for the mood indicators; followed by the same data for periods two and three of game three; (4) summary statistics for the belief and attitude measures taken before and after the game; (5) descriptive statistics and intercorrelations of the mood indicators, variance of heart-rate for each period and each game, plus the affective components of the attitude change scores.

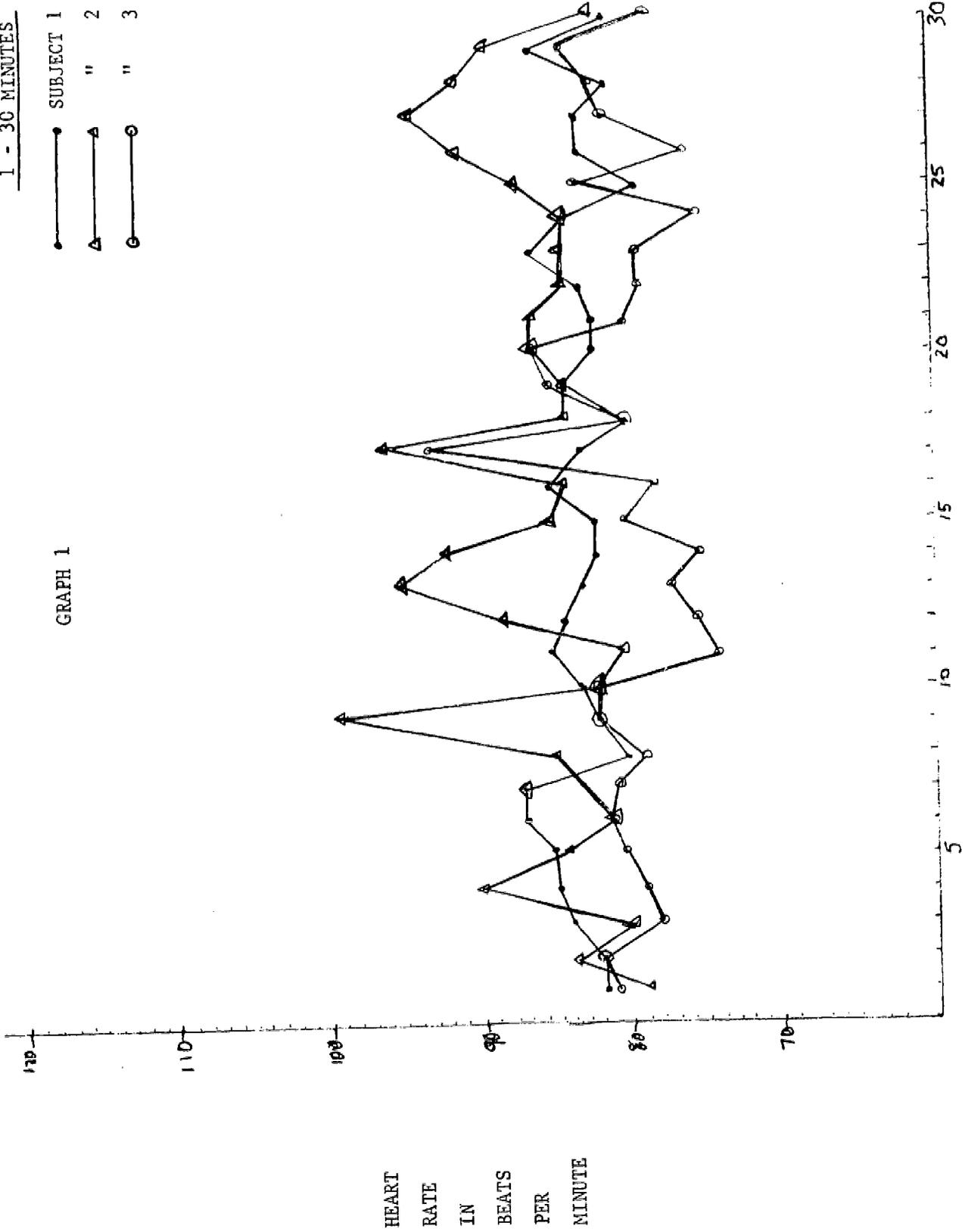
### Heart-Rate Data

Graph 1 contains the heart rates in beats per minute for subjects 1, 2, and 3 of game one, period one. Period one for game one represents the first thirty minutes of game one beginning near the middle of the introduction by the game leader. A close look at Graph 1, especially between minutes 15 and 20, reveals some "following" between subjects 2 and 3. This type of following was hypothesized in the beginning of this study. Theo-

GAME 1, PERIOD 1  
1 - 30 MINUTES

GRAPH 1

●——— SUBJECT 1  
 ▲——— " 2  
 ○——— " 3



MINUTES - (from introduction of game to 30 minutes of play)

HEART  
RATE  
IN  
BEATS  
PER  
MINUTE

retically, the following should increase during the game as participants become aware of each others' actions and begin to react to them.

Table 1 supports the conclusion that subjects 2 and 3 are responding to the game environment in similar ways. Table 1 also suggests that the variability of heart-rates at the beginning of play is quite low when compared to periods two and three (see Graphs 2 and 3 below).

TABLE 1

Game One - Heart-Rate Data

<u>Period 1</u>				<u>Intercorrelation Matrix</u>		
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>	<u>Subject</u>		
				<u>1</u>	<u>2</u>	<u>3</u>
1	83.2	30	5.00	1.000	-0.078	.125
2	86.9	30	23.2		1.000	.131
3	80.3	30	11.7			1.000

Table 2 provides the descriptive statistics for the data in Graph 2. One will notice that subject two has increased the variability in his heart-rate due to game participation from 23.2 in period 1, to 266.3 in period 2.

TABLE 2

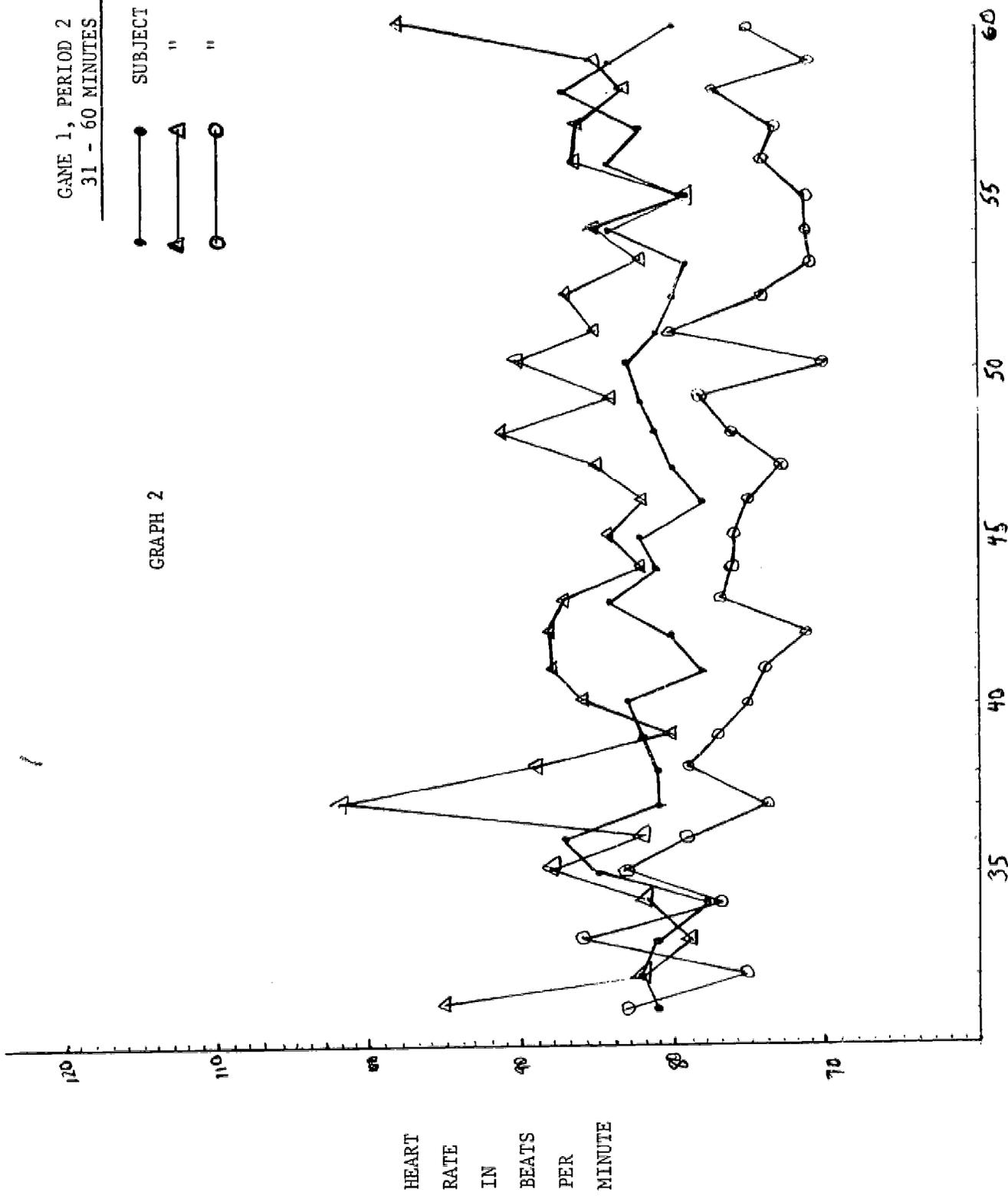
Game One - Heart-Rate Data

<u>Period 2</u>				<u>Intercorrelation Matrix</u>		
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>	<u>Subject</u>		
				<u>1</u>	<u>2</u>	<u>3</u>
1	81.8	30	4.5	1.000	-0.097	.097
2	82.9	30	266.3		1.000	.076
3	75.3	30	10.5			1.000

GAME 1, PERIOD 2  
31 - 60 MINUTES

GRAPH 2

● SUBJECT 1  
▲ " 2  
○ " 3



MINUTES - (from minute 31 to minute 60)

This seems to reflect rather individualistic play in the game with little attention being paid to the other participants. In fact, the intercorrelations in Table 2 reveal no consistent following by subjects.

Graph 3 provides the heart-rates for subjects one, two, and three, game one, period three. This is a continuation of Graph 2, period 2. One will notice that subject two maintains his high variability while subjects one and three maintain quite low variability and have begun "following" each other. In fact, subject three's affective response as reflected in his heart-rate seems "conditioned" by subject one's responses. Subject three's heart-rate at times parallels subject one's, with a time lag of about two minutes. This relationship between the reactions of subject one and subject three is apparent in Table 3 where their correlation equals 0.462.

TABLE 3  
Game One - Heart-Rate Data

<u>Period 2</u> <u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>	<u>Intercorrelation Matrix</u>		
				<u>Subject</u>		
				<u>1</u>	<u>2</u>	<u>3</u>
1	80.5	27	11.9	1		
2	82.9	27	222.7	1.000	.211	.462
3	72.0	27	12.3		1.000	.146
						1.000

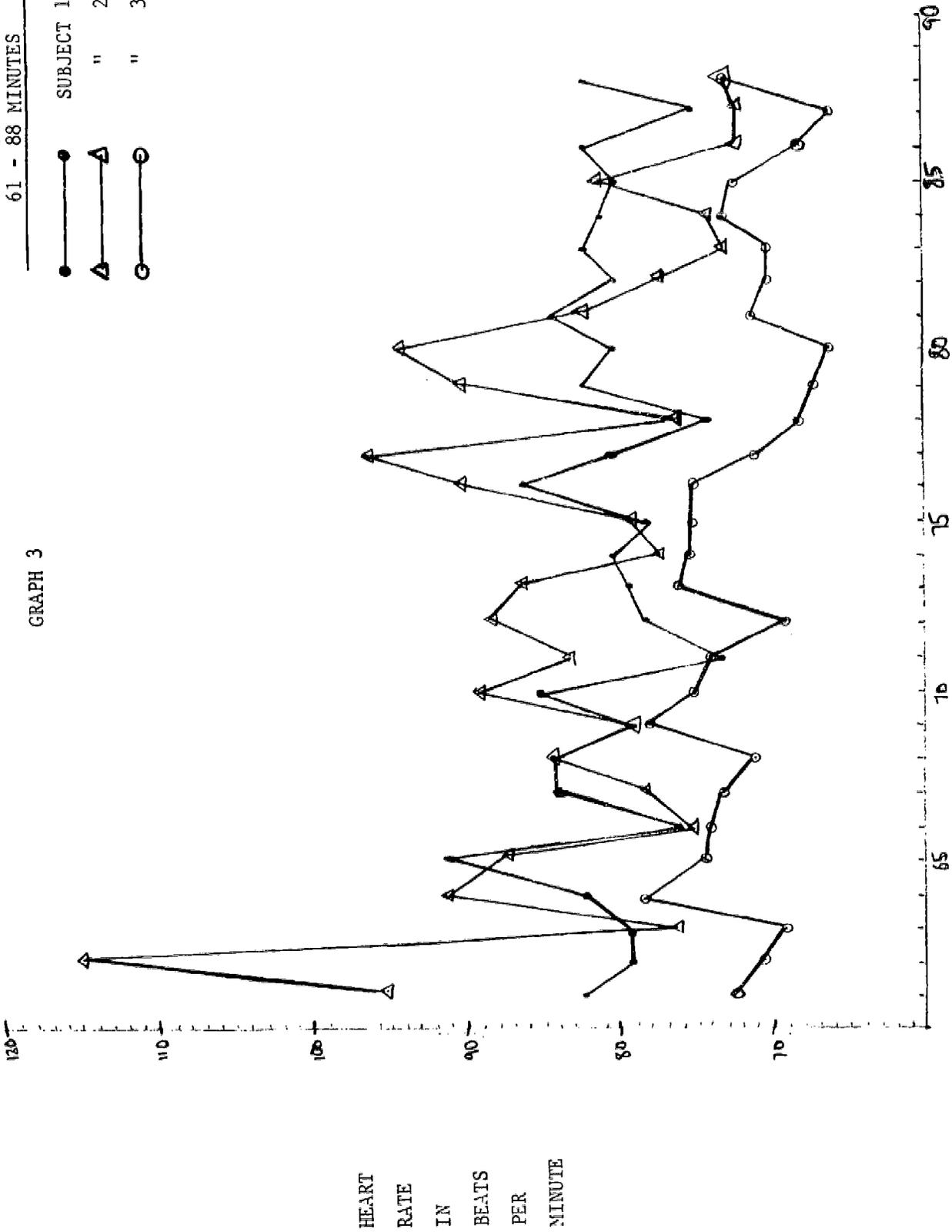
The latter correlation also lends support to the hypothesis that subjects in a simulation game may experience a "spread of affect" at particular times in the simulation.

Graph 4 contains the record for subjects one, two, three, and four of Game 2, period 1. This period in game two provides one of the most consis-

GAME 1, PERIOD 3  
61 - 88 MINUTES

GRAPH 3

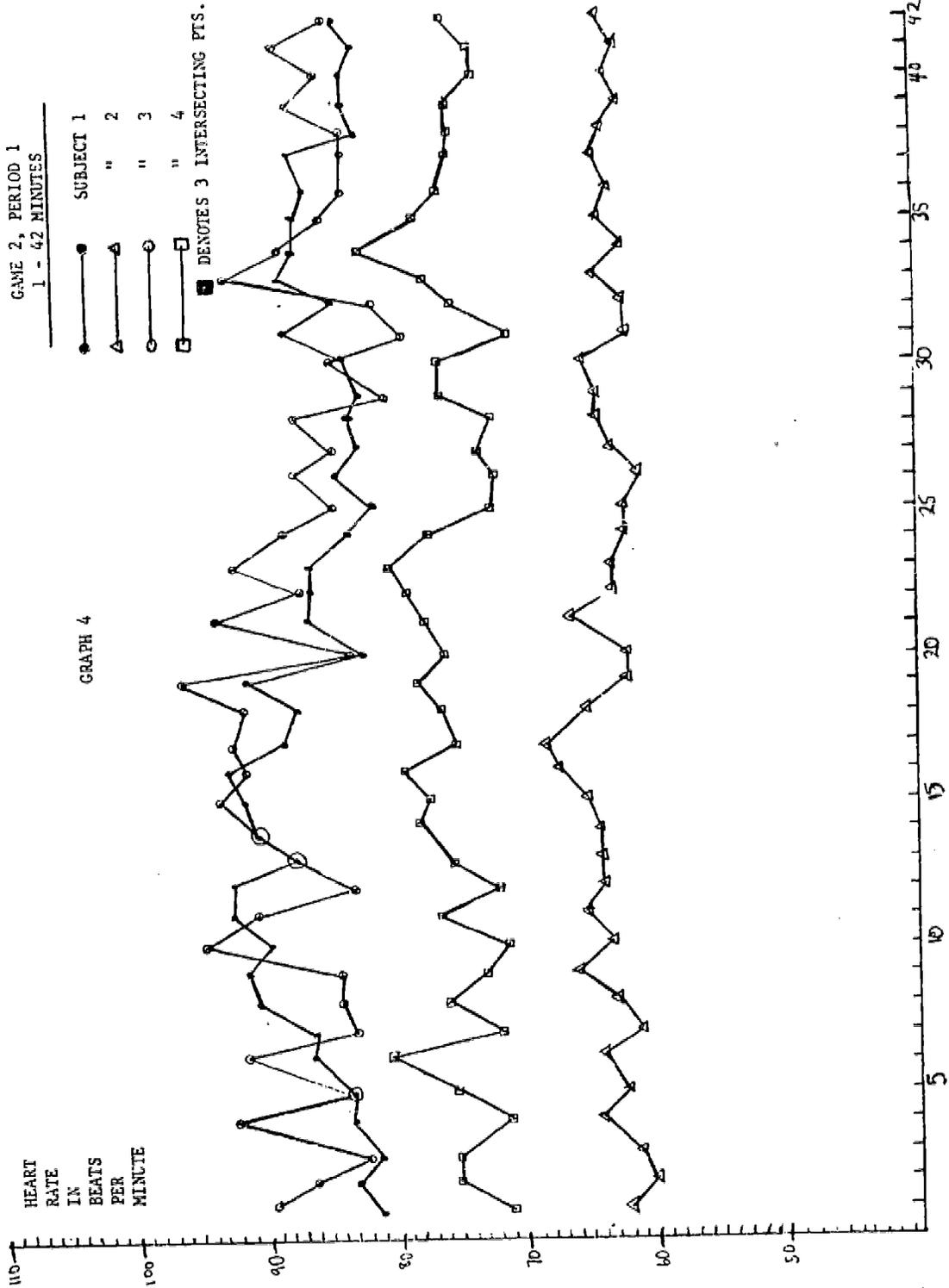
●	△	○	SUBJECT
●	△	○	1
●	△	○	" 2
●	△	○	" 3



MINUTES - (from minute 61 to minute 88 - end of graph and game)

GAME 2, PERIOD 1  
1 - 42 MINUTES

GRAPH 4



tent patterns of generalized arousal of all the games. Table 4 provides information on the closeness of these relationships. Subjects one and two had a heart-rate intercorrelation of 0.512. If reference is made

TABLE 4

Game Two - Heart-Rate Data

Intercorrelation Matrix

<u>Period 1</u>				<u>Subject</u>			
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
1	85.7	42	11.8	1	1.000	.512	.392
2	63.3	42	2.8	2		1.000	.363
3	86.9	42	17.6	3			1.000
4	75.2	42	7.4	4			1.000

to Graph 4, one will notice this parallel phenomena with a "reaction" time lag of about thirty seconds between subject two and one. Again, it should be noted that the variability of all subjects in period one is relatively low.

Graph 5 contains the heart-rate data on the four subjects in game two, period two. By comparison with Graph 2 of game one, the middle portion of game two is also quite variable. The heart-rate variance of subjects two and three has increased considerably. Table 5 suggests that the close relationship between subjects one and two at the beginning of the game has deteriorated. However, subject four seems to be responding to subject one at the beginning of period two. There is a negative relationship between subjects one and three for period two (i.e., as three peaks, one decelerates).

GAME 2, PERIOD 2  
43 - 84 MINUTES

● SUBJECT 1  
 ▲ " 2  
 ○ " 3  
 □ " 4  
 ■ DENOTES 3 INTERSECTING PTS.

GRAPH 5

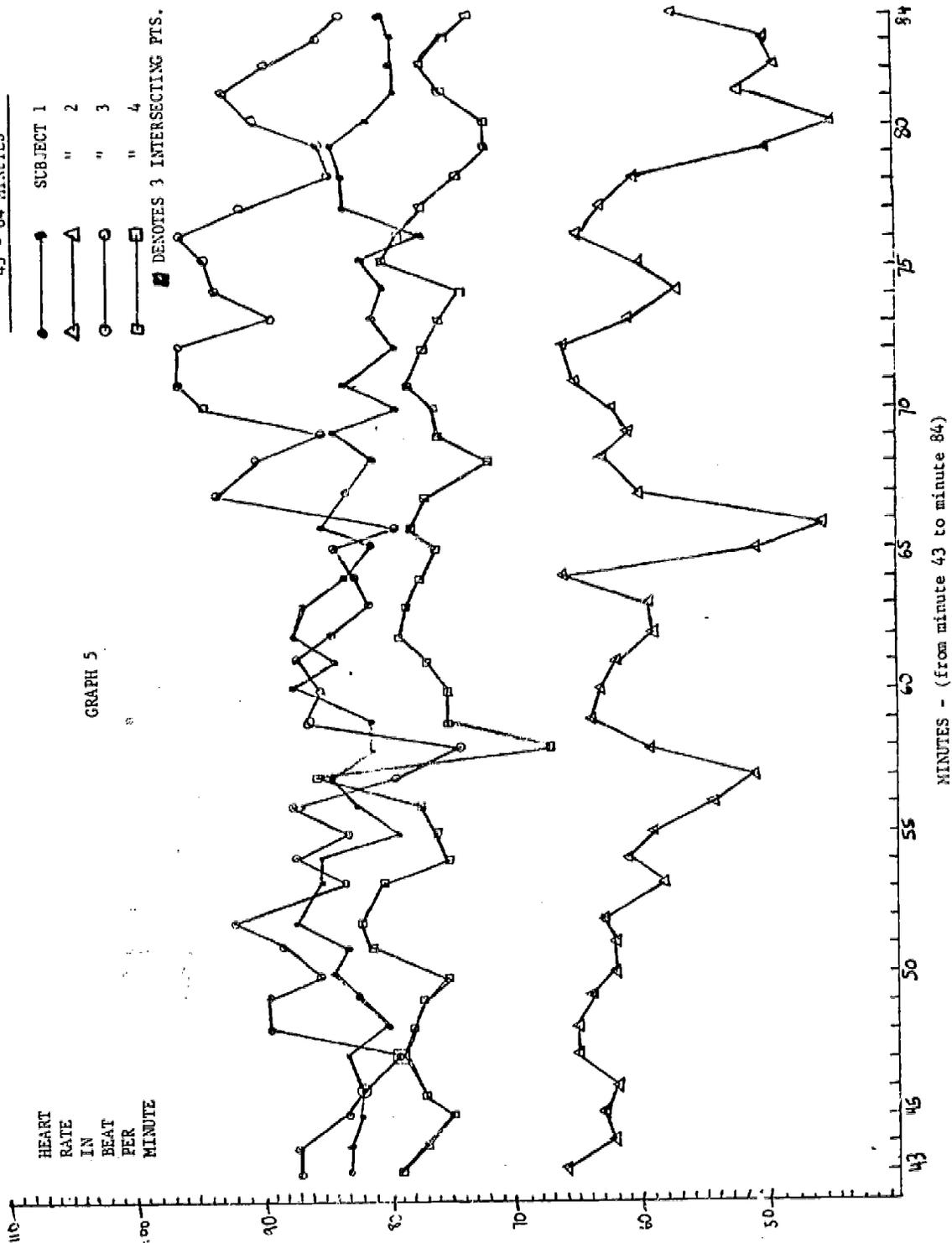


TABLE 5

Game Two - Heart-Rate Data

<u>Period 2</u>				<u>Intercorrelation Matrix</u>				
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>		<u>Subject</u>			
				<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
1	82.3	42	6.0	1	1.000	.095	-0.401	.304
2	59.3	42	32.3	2		1.000	.247	.181
3	87.1	42	22.3	3			1.000	-0.065
4	76.8	42	6.9	4				1.000

Graph 6 contains the continuation of those records in Graph 5. The variability of subjects two and three has again increased considerably. This may be related to the simple physical relationship between subjects during the study (i.e., subjects two and three were next to each other, subjects one and four were at opposite sides of the table.) Table 6 verifies these relationships and also provides a graphic example of the low variance of subjects one and four versus the high variance of subjects two and three.

TABLE 6

Game Two - Heart-Rate Data

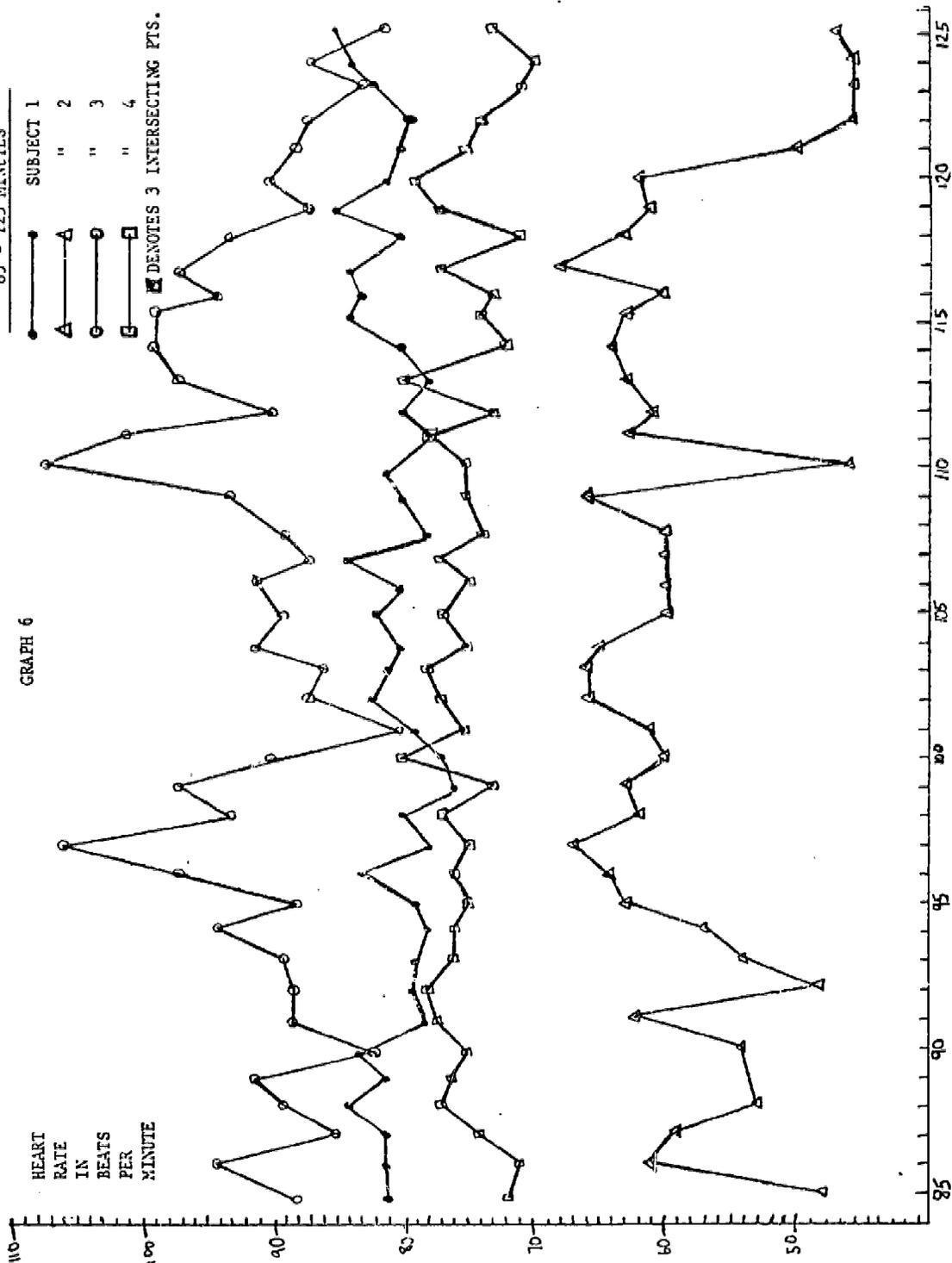
<u>Period 3</u>				<u>Intercorrelation Matrix</u>				
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>		<u>Subject</u>			
				<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
1	80.7	41	5.3	1	1.000	-0.141	.175	-0.167
2	57.8	41	75.6	2		1.000	.057	.312
3	85.8	41	526.9	3			1.000	-0.094
4	75.2	41	5.8	4				1.000

GAME 2, PERIOD 3  
85 - 125 MINUTES

GRAPH 6

HEART  
RATE  
IN  
BEATS  
PER  
MINUTE

■ DENOTES 3 INTERSECTING PTS.



MINUTES - (from minute 85 to minute 125)

Graph 7 contains the heart-rate data for game three, period one, for four subjects. If compared to games one and two, the patterns found in Graph 7 are quite dissimilar. Usually, the variability is lower at this point in the game. Table 7 contains the descriptive statistics for period one, game one. Subjects one and two are following each other somewhat. Subjects three and four are reacting to the game environment

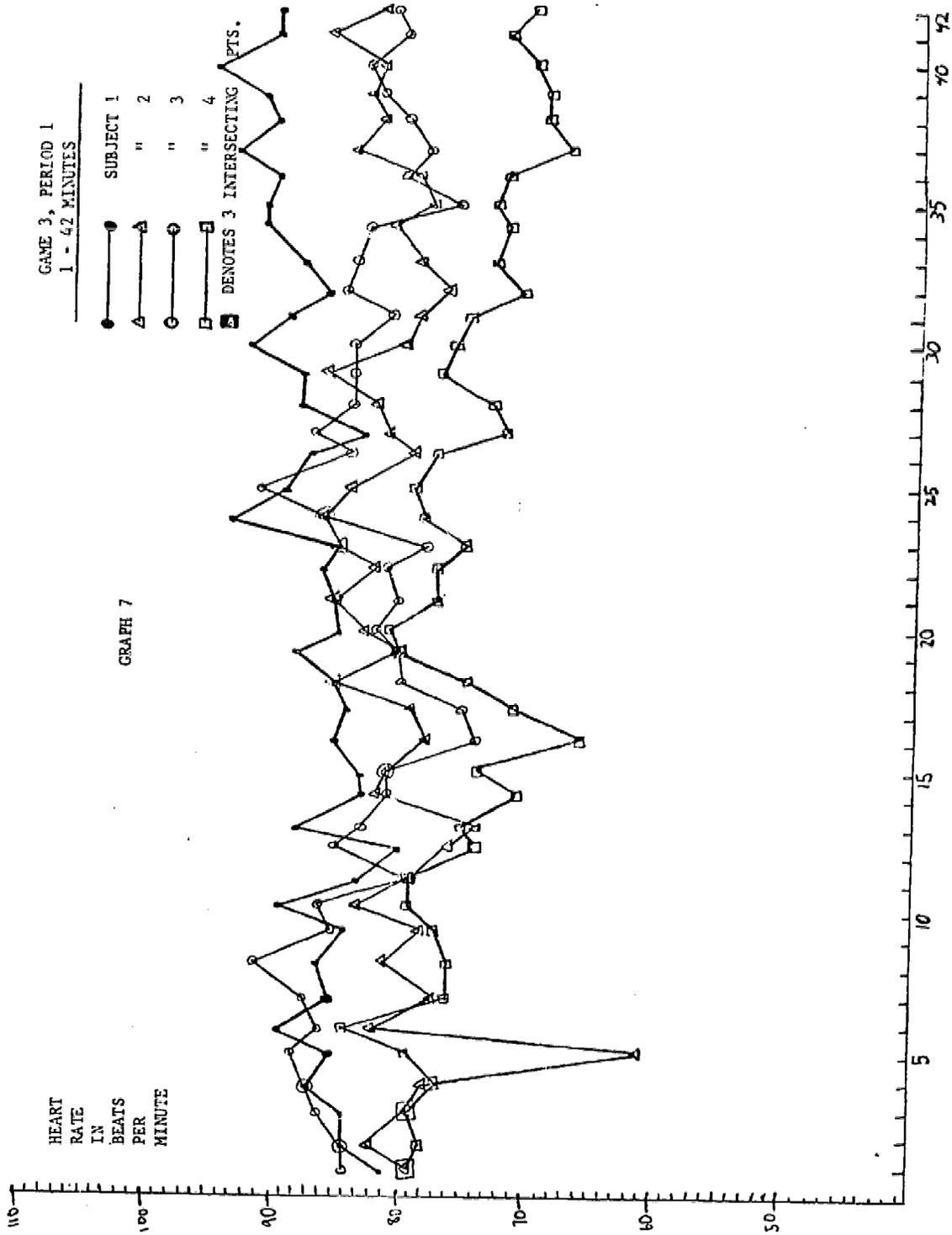
TABLE 7

<u>Game Three - Heart-Rate Data</u>				<u>Intercorrelation Matrix</u>				
<u>Period 1</u>				<u>Subject</u>				
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
1	87.1	42	11.7	1	1.000	.275	-0.054	-0.268
2	80.4	42	17.7	2		1.000	-0.179	-0.074
3	82.8	42	14.4	3			1.000	.490
4	74.9	42	15.6	4				1.000

quite regularly ( $r_{3,4} = 0.490$ ). There is very little lag between the fluctuations of subjects three and four. In fact, Graph 7 seems to indicate an oscillatory effect with first one subject leading the other for a few minutes, then the leader becoming the follower. In addition, Graph 7 provides information beyond the correlation coefficient which does not take into consideration auto-correlation (i.e. the effect of lagged relationships). When one compares subject two with four on Graph 7, even though the instantaneous correlation is low ( $r_{2,3} = -.179$ ), the relationship seems quite strong if the data on subject four is lagged about one minute at selected points in the period.

GAME 3, PERIOD 1  
1 - 42 MINUTES

GRAPH 7



MINUTES - (from introduction of game to 30 minutes of play)

Graph 8 represents a continuation of Graph 7 for period two of game three. In this game, as opposed to games one and two, the variability in heart-rate decreased. Table 8 contains the statistics associated with the data in Graph 8. The strongest relationship is between subjects

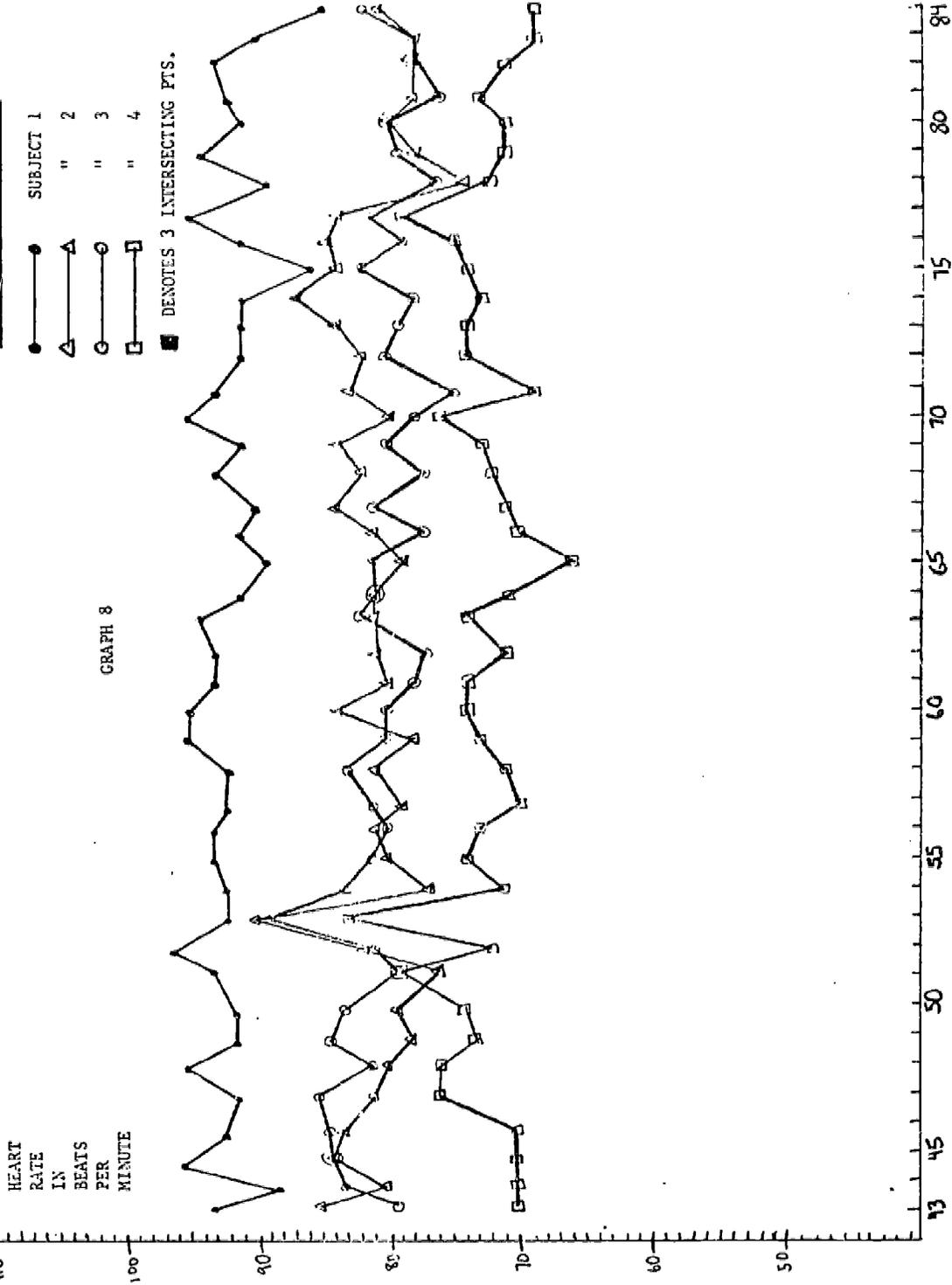
TABLE 8  
Game Three - Heart-Rate Data

<u>Period 2</u>				<u>Intercorrelation Matrix</u>				
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>	<u>Subject</u>				
				<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
1	91.9	42	5.5	1	1.000	.033	-0.131	.346
2	80.9	42	7.4	2		1.000	.088	.048
3	80.1	42	5.8	3			1.000	.035
4	72.4	42	6.9	4				1.000

one and four. Again, the correlations among the other subjects are instantaneous and do not reflect true relationships within isolated time blocks. This is clearly illustrated on Graph 8 between minutes fifty and sixty. Within this ten minute interval, subjects two, three, and four are behaving in similar fashion.

Graph 9 completes the data records for the subjects in game three. Table 9 contains the associated statistics for period three, game three. This graph provided information on subjects two and three who had the closest relationship during one period of all games. Their heart-rate correlated 0.594 over a forty-one minute interval. The relationships of

GAME 3, PERIOD 2  
43 - 84 MINUTES



subject two with subjects one and four were also of interest. The variability for game three, period three was much lower than for the same period in games one and two (see Appendix C for total game data).

TABLE 9

Game Three - Heart-Rate Data

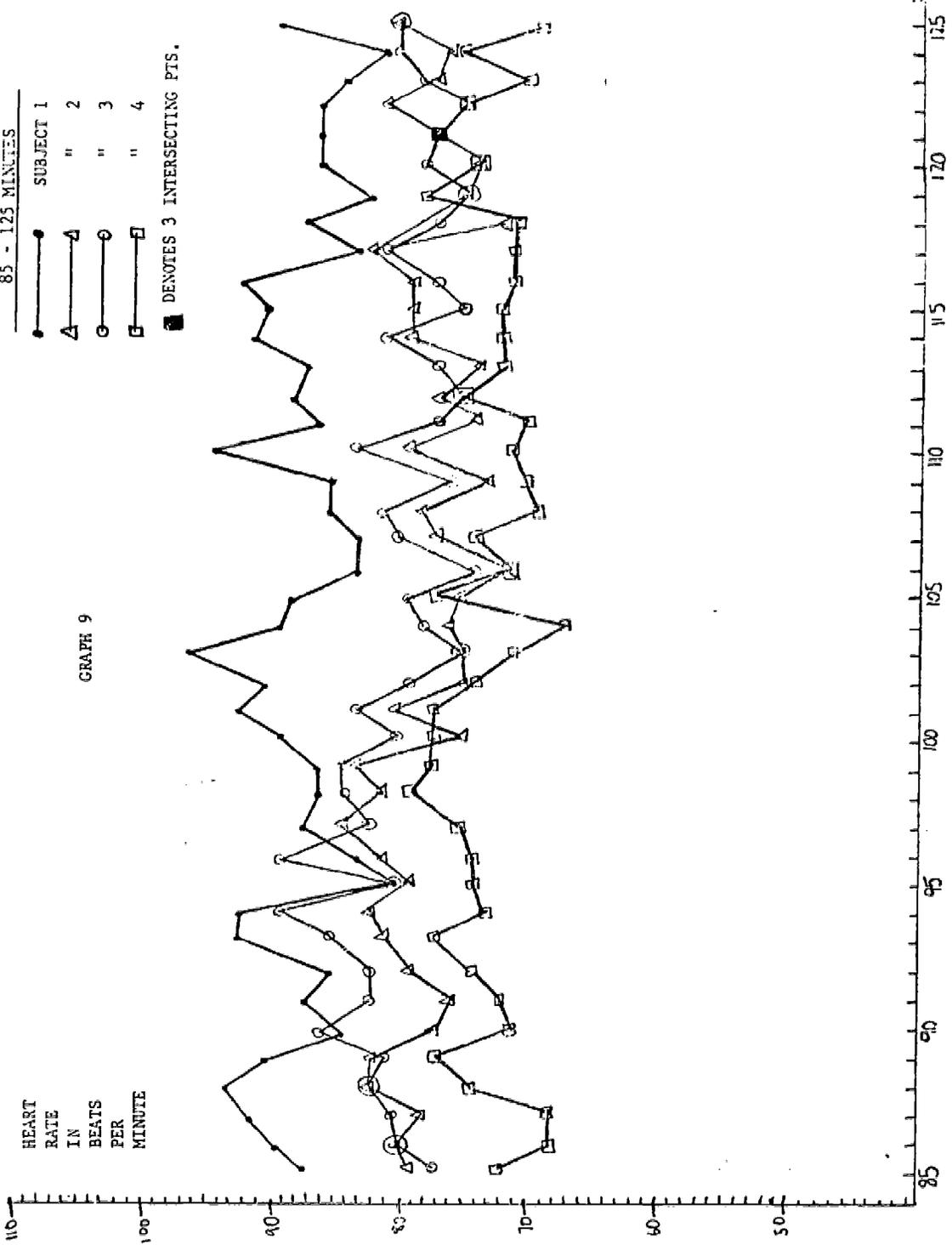
<u>Period 3</u>				<u>Intercorrelation Matrix</u>				
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>	<u>Subject</u>				
				<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	
1	87.4	41	13.6	1	1.000	.205	.080	-0.105
2	77.9	41	10.0	2		1.000	.594	.241
3	79.8	41	13.4	3			1.000	.193
4	73.0	41	9.3	4				1.000

GAME 3, PERIOD 3  
85 - 125 MINUTES

HEART RATE IN BEATS PER MINUTE	SUBJECT
●	1
△	2
○	3
□	4

■ DENOTES 3 INTERSECTING PTS.

GRAPH 9



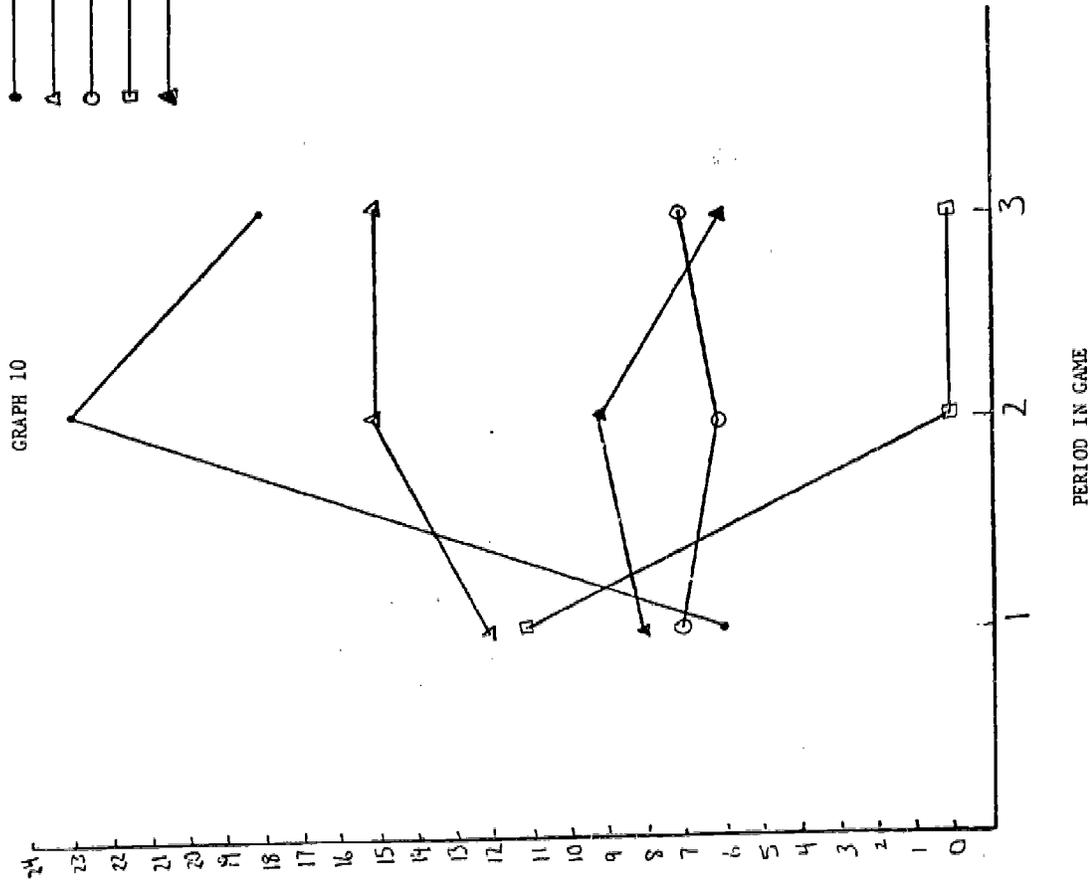
MINUTES - (from minute 85 to minute 125)

### Mood Indicators

As noted above, the measures of involvement in the game were the Mood Adjective Check List (MACL) and a Modified (Mood) Check List (MCL). Both instruments were based on the work of Nowlis (1970). Appendix B contains both checklists. The MACL was completed by each subject near the end of the game introduction, approximately half-way through the game, and at the end of the game. The MCL was recorded by the game leader on each subject at similar times. Little additional information was gained from the overt measures of arousal. However, the self-report check list did provide some relevant data on several subjects.

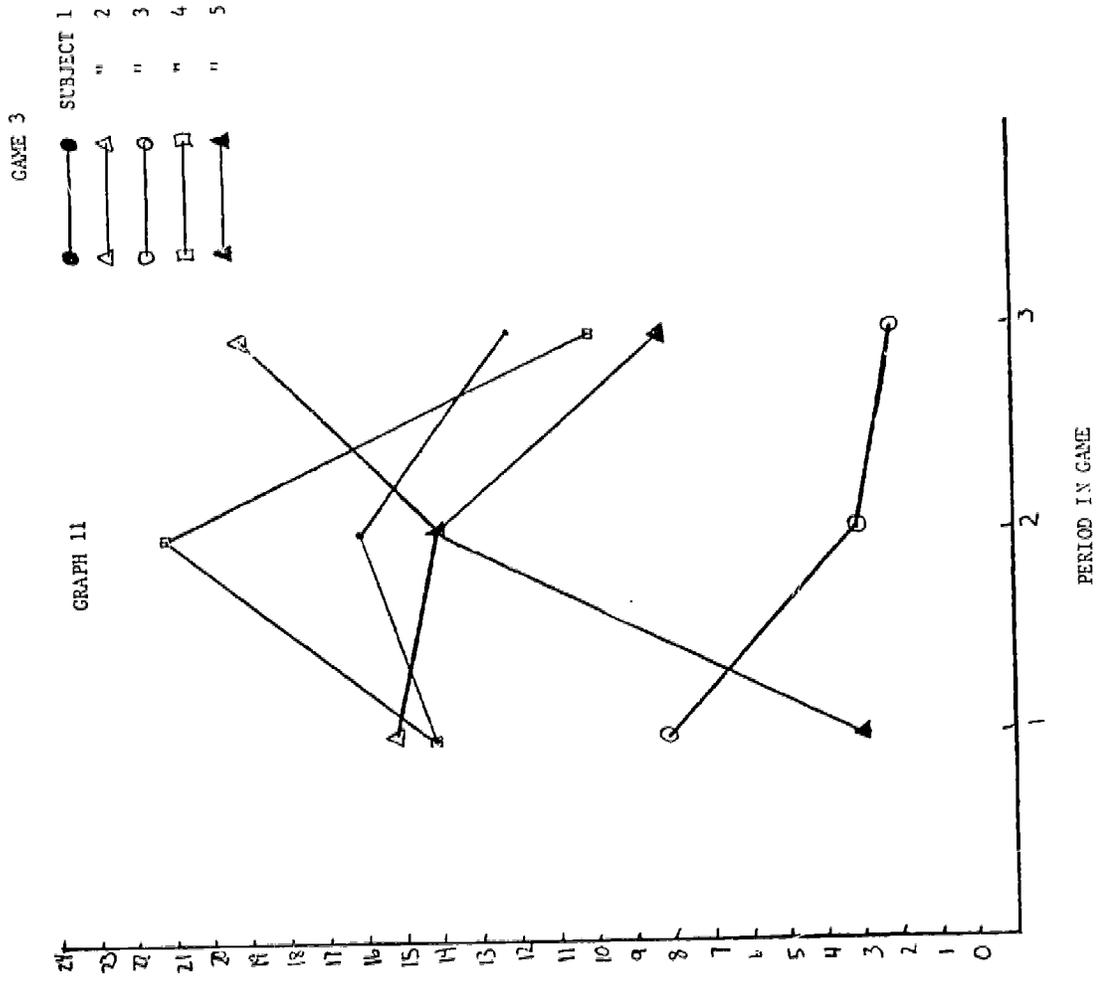
Of primary interest was the involvement experienced by each participant in games two and three. Thus, the factor scores on the following factors were summed for periods 1, 2, and 3 in order to provide a more stable measure of involvement: (1) Surgency; (2) Elation; (3) Activation. The MACL and MCL factor scores plus the sum of the above factor scores for each subject by period by game are provided in Appendix C, Item II. Graph 10 contains the sum of the three factor scores noted above for periods 1, 2, and 3 for all subjects in game two. This sum represents a general measure of involvement in the game. Theoretically, one would have expected an inverted U-shaped graph representing an increase in arousal until the middle of the game followed by a decrease. This hypothesis is supported somewhat by subjects one, two, and five. The reaction of subject four was unexpected. The latter subject seems to have been "turned off" by the game as it progressed.

- GRAPH 10
- |   |           |
|---|-----------|
| ● | SUBJECT 1 |
| △ | " 2       |
| ○ | " 3       |
| □ | " 4       |
| ▲ | " 5       |



GENERAL AROUSAL  
 (Sum of MAEL factor scores for SURGENCY, ELATION, ACTIVATION)

GENERAL AROUSAL  
(Sum of MAEL factor scores for SURGENCY, ELATION, ACTIVATION)



Graph 11 contains the sum of the factor scores reflecting involvement in game three for all subjects. Again, as in game two, the expected pattern was obtained from three of the five subjects. Subject five has a striking increase in involvement from period one to period two. The increase in involvement as reported by these subjects was also noted in several heart-rate changes from period one to two; variability of heart-rates tending to increase as the game progressed.

#### Attitude Change Scores

Appendix A contains the attitude questionnaire that all game participants completed before and after the game. Of primary interest was the affective component of these attitudes as measured by the evaluative bipolar adjectives on selected concepts. Thus, Table 10 contains the average change score within games for the selected concepts. Appendix C contains all data on all subjects for each game on these attitude change measures. The grand mean for each concept represents overall increases or decreases in affect associated with each concept (i.e. negative and positive changes are included in the grand mean for the attitude change score). The results indicate that the game participants believed that it was better to be honest and law-abiding after the game experience. However, the game did not affect their feelings about being a hard worker or being irresponsible and immoral. The relationship between these attitude change scores and the affective arousal experienced in the game is dealt with in the next section.

TABLE 10

Average Attitude Change Scores by GameConcept

Being honest is:

<u>Game</u>	<u>Pre Game<sup>a</sup></u>	<u>Post Game</u>	<u>Change<sup>b</sup></u>
1	4.80	13.20	8.40
2	4.20	6.80	2.60
3	4.20	8.60	4.40
GM (Grand Mean)	4.40	9.53	5.13

Being a hard worker is:

1	5.20	7.80	2.60
2	4.80	6.20	1.40
3	6.60	6.80	0.20
GM	5.53	6.93	1.40

Being irresponsible is:

1	20.20	16.40	-1.80
2	19.60	16.20	3.80
3	17.20	16.26	-1.00
GM	19.00	16.26	0.33

Being immoral is:

1	17.80	16.60	-1.20
2	16.40	16.60	0.20
3	13.60	14.40	0.80
GM	15.93	15.87	-0.20

Being law-abiding is:

1	6.54	11.20	5.80
2	6.56	6.80	1.20
3	7.60	10.80	3.20
GM	6.20	9.60	3.40

<sup>a</sup>Low values reflect positive affect; high values reflect negative affect.

<sup>b</sup>This change score is based on the relative differences between pre-post scores, and not absolute differences. Thus, the pre-post difference in some cases is not exactly equal to the mean change score.

### Correlation Among Involvement and Attitude Change Scores

Table 11 contains the inter-correlations among the affective components of the attitude change scores and the measures of heart-rate and variance in heart-rate for Game 1. Little weight can be given to Table 11 (also 12 and 13 which contain the same content) primarily because the intercorrelations are based on three (or four, see above) subjects. Nevertheless, if the directionality (sign) of the relationships across periods is consistent then some validity for the relationships may be assumed. This directional hypothesis is confirmed in Table 11 for the subjects' change in attitude on "Honesty." Interestingly, the heart-rate and not its variance is most highly correlated with this attitude change score. Thus, those individuals with low heart-rates and low variance during game one changed very little on this concept. The relationship between heart-rate and the change in attitude on the concept "hardworking" was opposite to the relationship for the concept of honesty. Thus, the change in attitude was relatively higher for those individuals with lower heart-rate variability.

Patterns quite similar to that for the concept of "hard working" occurred for "irresponsible" and "law abiding." The pattern for "honesty" was repeated by the pattern for "immoral."

Table 12 contains the intercorrelations among attitude change and heart-rate data for Game 2. The individuality of game experiences is clarified when the variance for game one and variance for game two rows are inspected. Each game has affected the participants uniquely on the "hard working" and "irresponsible" variables. The other attitude variables are in the same direction on both games.

TABLE 11

Intercorrelation of Heart-Rate Data and Change in Affect Associated with the Concepts of Honesty, Hard Work, Irresponsibility, Immorality, and Law Abidement.

## Game 1

Variable	1	2	3	4	5
1. Honesty <sup>a</sup>	1.0				
2. Hard Working	.15	1.0			
3. Irresponsible	.50	.93	1.0		
4. Immoral	.61	-.69	-.38	1.0	
5. Law Abiding	.12	.99	.92	-.71	1.0
6. H. R. Per. 1 <sup>b</sup>	.89	-.31	.05	.90	-.34
7. Var. Per. 1 <sup>c</sup>	.26	-.92	-.71	.92	.93
8. H. R. Per. 2	.99	-.16	.52	.60	.14
9. Var. Per. 2	.59	-.71	-.40	.99	-.72
10. H. R. Per. 3	.97	.38	.70	.40	.36
11. Var. Per. 3	.61	-.69	-.38	1.0	-.71
12. H. R. Game	1.0	.15	.50	.60	.12
13. Var. Game	.54	-.75	-.45	.99	-.76

<sup>a</sup>Based on change in affect associated with each of the first five variables.

<sup>b</sup>Heart-rate, Period 1, etc.

<sup>c</sup>Variance of heart-rate, Period 1, etc.

TABLE 12

Intercorrelation of Heart Rate Data and Change In Affect  
Associated with the Concepts of Honesty, Hard Work, Irre-  
sponsibility, Immorality, and Law Abidement.

Variable	Game 2				
	1	2	3	4	5
1. Honesty <sup>a</sup>	1.0				
2. Hard Working	.02	1.0			
3. Irresponsible	.20	9.0	1.0		
4. Immoral	.84	.22	.17	1.0	
5. Law Abiding	.26	.12	-.19	.72	1.0
6. H. R. Per. 1 <sup>b</sup>	-.58	.44	.54	-.74	-.75
7. Var. Per. 2 <sup>c</sup>	.16	.49	.79	-.19	-.72
8. H. R. Per. 2	-.59	.61	.63	-.62	-.57
9. Var. Per. 2	.99	-.66	.16	.78	.17
10. H. R. Per. 3	-.63	.56	.58	-.67	-.60
11. Var. Per. 3	.42	.73	.94	.23	-.32
12. H. R. Game	-.61	.55	.59	-.68	-.63
13. Var. Game	.46	.70	.92	.25	-.34

<sup>a</sup>Based on change in affect associated with each of the first five variables.

<sup>b</sup>Heart-rate, Period 1, etc.

<sup>c</sup>Variance of heart-rate, Period 1, etc.

Table 13 contains the intercorrelations for heart-rate and attitude scores for game three. When compared with the data for game one in Table 11, the directionality was reversed on three variables: (1) Honesty; (2) Hard Working; (3) Immoral.

TABLE 13

Intercorrelation of Heart-Rate Data and Change in Affect Associated with the Concepts of Honesty, Hard Work, and Irresponsibility, Immorality, and Law Abidement.

Game 3

Variable	1	2	3	4	5
1. Honesty <sup>a</sup>	1.0				
2. Hard Working	-.22	1.0			
3. Irresponsible	.69	-.76	1.0		
4. Immoral	.83	-.08	.71	1.0	
5. Law Abiding	.94	-.46	.88	.88	1.0
6. H. R. Per. 1 <sup>b</sup>	-.65	.79	-.70	-.27	-.70
7. Var. Per. 1 <sup>c</sup>	7.2	-.60	.10	-.44	.42
8. H. R. Per. 2	-.80	.55	-.60	-.38	-.76
9. Var. Per. 2	.16	-.89	.48	.20	.78
10. H. R. Per. 3	-.69	.67	-.60	-.25	-.68
11. Var. Per. 3	-.39	.87	-.59	.00	-.47
12. H. R. Game	-.76	.65	-.65	-.34	-.74
13. Var. Game	-.80	.63	-.68	-.42	-.79

<sup>a</sup>Based on change in affect associated with each of first five variables.

<sup>b</sup>Heart-rate, Period 1, etc.

<sup>c</sup>Variance of heart-rate, Period 1, etc.

Table 14 provides a summary of the attitude change measures and the heart-rate data across games 1, 2, and 3. Several correlations are quite high based on eleven subjects. It was originally hypothesized that changes in attitude would be related to the general involvement of a participant in a game as measured by his heart-rate. It was also expected that the variance in heart-rate would be a better predictor of attitude change than the average heart-rate. This hypothesis gains support when one compares the r's in row 12 of Table 14 with the r's in row 13.

TABLE 14

Intercorrelation of Heart-Rate Data and Change in Affect Associated with the Concepts of Honesty, Hard Work, Irresponsibility, Immorality, and Law Abidement.

Games 1, 2, 3

Variable	1	2	3	4	5
1. Honesty <sup>a</sup>	1.0				
2. Hard Working	.40	1.0			
3. Irresponsible	.57	.64	1.0		
4. Immoral	.27	-.48	.07	1.0	
5. Law Abiding	.49	.51	.81	.35	1.0
6. H. R. Per. 1 <sup>b</sup>	.01	.44	.16	-.23	-.26
7. Var. Per. 1 <sup>c</sup>	.19	-.23	-.29	.10	-.56
8. H. R. Per. 2	-.15	.48	.18	-.19	-.22
9. Var. Per. 2	.56	-.11	-.94	-.57	-.35
10. H. R. Per. 3	-.14	.48	.22	-.11	-.15
11. Var. Per. 3	.11	.44	.41	-.80	-.35
12. H. R. Game	-.10	.48	.19	-.20	-.21
13. Var. Game	.31	-.16	.31	-.99	-.44

Footnotes on page 37

Except for the concept of "hard working" the r's based on heart-rate variance are larger. For the concepts "immoral" and "law-abiding" high variability in heart-rate is associated with less attitude change. There is a positive relationship between heart-rate variability and change in attitude for "honesty" and "irresponsible." Thus, one might conclude that fluctuations in heart-rate as a measure of the affective impact of a game on participants can be related to attitude change.

In an attempt to increase the validity of the assumption of a relationship between involvement and attitude change, tables 15, 17, and 19 contain intercorrelation matrices for the sum of the surgency, elation, and activation factor scores (for periods 1, 2, 3) versus the attitude change scores. Tables 16, 18, and 20 contain the respective means and standard deviations for these tables.

The most consistent pattern of relationships in Tables 15, 17, and 19 is on the concept of "being a hard worker is". It is a negative relationship in all games thus supporting itself logically (i.e. if you are working hard playing your role in the game your attitude about the importance of hard work will not change). At the beginning of the game the participants "valued" hard work and at the end of the game they remained consistent in their feelings toward hard work (see Appendix C, Item III).

The unique characteristics of individual games are revealed in Table 19, where games 2 and 3 are combined. The relationships among variables not directly related to the game (opposite hard working) deteriorate

when unique games are combined. The game-specific phenomena are lost in an across-game analysis. In addition, the inconsistencies in Tables 15 and 16 lead one to conclude that greater control must be exercised in future research with simulation games when the hypotheses of interest are closely related to the very nature of the process involved.

TABLE 15  
Intercorrelations of Attitude Change Scores  
With Measures of Game Involvement  
For Game 2

Variable	1	2	3	4	5	6	7	8
1. Honesty <sup>a</sup>	1.0							
2. Hard Working	.02	1.0						
3. Irresponsible	.21	.91	1.0					
4. Immoral	.84	.22	.18	1.0				
5. Law Abiding	.26	.12	-.19	.72	1.0			
6. $\Sigma$ S, E, A, Per. 1 <sup>b</sup>	.49	-.15	-.36	.81	.93	1.0		
7. $\Sigma$ S, E, A, Per. 2	-.05	-.82	-.54	.36	-.66	-.38	1.0	
8. $\Sigma$ S, E, A, Per. 3	.76	-.55	-.24	-.50	-.18	.18	.61	1.0

<sup>a</sup>Based on change in affect associated with each of the first five variables.

<sup>b</sup>The sum of the following factors for the respective periods: sur-  
gency, elation, activation.

TABLE 16  
Game 2 - Heart-Rate Data and Attitude Change Scores

Variable	Mean <sup>a</sup>	S.D. <sup>b</sup>
1. Honesty <sup>c</sup>	2.8	2.75
2. Hard Working	1.2	1.50
3. Irresponsible	1.2	1.89
4. Immoral	1.8	1.25
5. Law Abiding	2.0	1.82
6. $\Sigma$ S, E, A, Per. 1 <sup>d</sup>	9.0	2.94
7. $\Sigma$ S, E, A, Per. 2	10.8	9.70
8. $\Sigma$ S, E, A, Per. 3	7.2	6.13

<sup>a</sup>N = 4

<sup>b</sup>Standard Deviation

<sup>c</sup>Based on change in affect associated with each of the first five variables.

<sup>d</sup>The sum of the following factors for the respective periods: sur-  
gency, elation, activation.

TABLE 17  
Intercorrelations of Attitude Change Scores  
With Measures of Game Involvement  
For Game 3

Variable	1	2	3	4	5	6	7	8
1. Honesty <sup>a</sup>	1.0							
2. Hard Working	-.22	1.0						
3. Irresponsible	.67	-.76	1.0					
4. Immoral	.83	-.09	.71	1.0				
5. Law Abiding	.94	-.46	.88	.88	1.0			
6. $\Sigma$ S, E, A, Per. 1 <sup>b</sup>	-.44	-.76	.33	-.35	-.14	1.0		
7. $\Sigma$ S, E, A, Per. 2	.00	-.19	.74	.15	.33	.87	1.0	
8. $\Sigma$ S, E, A, Per. 3	-.66	-.57	-.05	-.71	-.46	.90	.59	1.0

<sup>a</sup>Based on change in affect associated with each of the first five variables.

<sup>b</sup>The sum of the following factors for the respective periods: sur-  
gency, elation, activation.

TABLE 18  
Game 3 - Heart-Rate Data and Attitude Change Scores

Variable	Mean <sup>a</sup>	S.D. <sup>b</sup>
1. Honesty <sup>c</sup>	5.0	3.55
2. Hard Working	2.5	1.29
3. Irresponsible	2.5	2.38
4. Immoral	4.0	2.94
5. Law Abiding	3.8	2.09
6. $\Sigma$ S, E, A, Per. 1 <sup>d</sup>	12.8	3.20
7. $\Sigma$ S, E, A, Per. 2	13.5	7.59
8. $\Sigma$ S, E, A, Per. 3	10.8	6.99

<sup>a</sup>N = 4

<sup>b</sup>Standard Deviation

<sup>c</sup>Based on change in affect associated with each of the first five variables.

<sup>d</sup>The sum of the following factors for the respective periods: sur-  
gency, elation, activation.

TABLE 19  
Intercorrelations of Attitude Change Scores  
With Measures of Game Involvement  
For Games 2 and 3

Variable	1	2	3	4	5	6	7	8
1. Honesty <sup>a</sup>	1.0							
2. Hard Working	.09	1.0						
3. Irresponsible	.55	.18	1.0					
4. Immoral	.83	.24	.62	1.0				
5. Law Abiding	.76	.00	.59	.86	1.0			
6. $\Sigma$ S, E, A, Per. 1 <sup>b</sup>	.18	-.06	.21	.27	.39	1.0		
7. $\Sigma$ S, E, A, Per. 2	.04	-.66	.14	.03	-.01	.26	1.0	
8. $\Sigma$ S, E, A, Per. 3	.04	-.34	-.02	-.18	-.21	.62	.61	1.0

<sup>a</sup>Based on change in affect associated with each of the first five variables.

<sup>b</sup>The sum of the following factors for the respective periods: sur-  
gency, elation, activation.

TABLE 20  
Games 2-3 - Heart-Rate Data and Attitude Change Scores

Variable	Mean <sup>a</sup>	S.D. <sup>b</sup>
1. Honesty <sup>c</sup>	3.9	3.18
2. Hard Working	1.9	1.45
3. Irresponsible	1.9	2.10
4. Immoral	2.9	2.41
5. Law Abiding	2.9	2.53
6. $\Sigma$ S, E, A, Per. 1 <sup>d</sup>	10.9	3.48
7. $\Sigma$ S, E, A, Per. 2	12.1	8.20
8. $\Sigma$ S, E, A, Per. 3	9.0	6.36

<sup>a</sup>N = 4

<sup>b</sup>Standard Deviation

<sup>c</sup>Based on change in affect associated with each of the first five variables.

<sup>d</sup>The sum of the following factors for the respective periods: sur-  
gency, elation, activation.

## DISCUSSION

The present study was purely exploratory and as such should be interpreted with due caution. The findings suggest that gross measures of arousal or involvement in simulation games are related to attitude change but that the complexity of the relationship calls for more controlled experimentation. The findings also support the notion of a "spread of affect" during game sessions where fluctuations in individual heart-rates followed each other several times throughout the game sessions. This finding in itself should be of interest to people studying social group processes because it provides a covert indicator of the emotional reaction of several subjects within identical environments.

Research and theory in attitude and attitude change has risen sharply lately [see Beliefs, Attitudes, and Values by Rokeach (1970); Attitude Change by Kiesler, Collins, and Miller (1969); Psychological Foundations of Attitudes by Greenwald, Brock, and Ostrom (1968)].

Rokeach (1971) notes that ". . . the main theoretical focus of contemporary social psychology is on the concept of attitude and on theories of attitude change." He also notes that a necessary prerequisite for attitude change is a state of inconsistency. In addition, a state of inconsistency can be created in an individual by two methods:

- (1) to induce a person to engage in behavior that is incompatible with his attitudes and values,  
or
- (2) expose him to information about the attitudes or values of significant others that are incompatible with his own attitudes and values.

The experience of an individual in a simulation designed to expose players to what it really is like in inner-cities, namely the game of Ghetto (1970), fulfills the above experimental situations required for attitude change under two conditions: (1) when the player's attitudes and values are not compatible with his experience in the simulation; (2) when the player believes that the information he receives during the simulation was developed by known authorities in the field. These two approaches are the classical ways of inducing attitude change. Changes in attitudes from playing simulation games may be interpreted within this theoretical framework. It should be added that the approach requires no assumption as to the affective impact of the simulation experience on the participants. In fact, attitudes and values in Rokeach's scheme are cognitions that are related to the "self." The affective aspect of Rokeach's theory lies in the satisfaction or dissatisfaction the "self" experiences in a particular situation. For example:  $X = \text{self}$ ;  $Y = \text{one's perceived performance or behavior in whatever the situation}$ . " $X$  and  $Y$  are dissonant with one another if the person's behavior in any given situation leads him to become dissatisfied with himself;  $X$  and  $Y$  are consonant if his behavior in a given situation leads him to remain satisfied with himself." Thus, the cognitive aspects of attitudes are intimately related to a person's feelings (affective component) about himself in particular situations. The complexity of a simulation game is brought to light when the role playing aspects are noted. For instance, how would Rokeach handle the problem of "self" when the individual technically becomes another "self" in a role-playing environment?

Greenwald (1969, 1970) may provide a partial answer to the latter question. As noted previously, Greenwald (1970) believes that ". . . attitude change through role playing may depend on the role player's having an opportunity to consider counterattitudinal information that he has not previously rejected." McLaughlin (1971) noted that ". . . Greenwald concluded that it is not so much learning the contents of the communication that affects subsequent attitude change as the learning of self-generated cognitive reactions. The effectiveness of the communication appears to be significantly related to the retention of issue-related cognitions not contained in the communication itself but aroused and rehearsed by the recipient at the time of the communication." Thus, arousal and satisfaction with one's experiences are related to modifications in cognitions and attitudes as suggested above by Rokeach (1971) and Greenwald (1970). The present study represents a preliminary attempt to relate the affective aspects of particular experiences directly to attitude change thereof. Due to the complexity of relating process variables with produced changes, further controlled experimentation in line with the present study is required. Future research along these lines may provide guidelines for the optimal use of social simulation games in the classroom.

## FOOTNOTES

<sup>1</sup>The simulation game (Ghetto, 1970) employed in the present study was developed by Dove Toll with the Academic Games Program, The Johns Hopkins University. It is one of several social simulation games developed by the Hopkins group. They are games " . . . in which certain social processes are explicitly mirrored in the structure and functioning of the game. The game is a kind of abstraction of these social processes, making explicit certain of them that are ordinarily implicit in our everyday behavior. A social simulation game always consists of a player or players acting in a social environment. There are two ways in which the social environment is incorporated into a game's structure (1) each player can act as a portion of the social environment of each other player; (2) the rules of the game may contain contingent responses of the environment." (From Coleman, 1968.)

For further information and research on simulation games, see Coleman, 1961, 1962, 1966, 1967a, 1967b, 1967c, 1968; Boocock, 1966, 1967, 1968, and forthcoming; Gamson, 1969; Guetzkow, 1962; Inbar, 1969, 1970a, 1970b, and, in press; Livingston, 1970a, 1970b, and in press; Nesbitt, 1968; Raser, 1969; Stoll, 1969a, 1969b, 1970, and in press; Alelson, 1969.

<sup>2</sup>The situational and dispositional conditions determining this cognitive activity are nearly synonymous with an individual's performance in a simulated environment. The major asset of using a simulated environment for psychosocial or psychobiological research is the control one has over both of the determining conditions put forth by Lazarus, Averill, and Opton (in Arnold, 1970). Dispositional conditions can be controlled experimentally by selecting subjects with similar or dissimilar psychophysiological characteristics depending on the effect desired. Situational conditions can be effected by simple modifications of the structural properties of the simulated environment under study.

<sup>3</sup>Mood was assessed with the Mood Adjective Checklist (MACL) developed by Nowlis (in Arnold, 1970).

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APPENDIX A

- I. Attitude Questionnaire, Part I
- II. Attitude Questionnaire, Part II

Instructions for Part I

We would like to know your reactions (feelings about) to a number of concepts related to life in typical inner-city ghettos. On the following pages you will find statements similar to the following:

Ghetto people are poor.

true \_\_\_\_\_ false

If you feel that the concept being rated (Ghetto people are poor.) is very closely related to one end of the scale, you should place a checkmark as follows:

true  \_\_\_\_\_ or \_\_\_\_\_ false

true \_\_\_\_\_  false

If the concept is quite closely related to one or the other end of the scale (but not extremely), you should place your checkmarks as follows:

bad  \_\_\_\_\_ or \_\_\_\_\_ good

bad \_\_\_\_\_  good

If the concept seems only slightly related to one side as opposed to the other side (but is not really neutral), then you should check as follows:

wise \_\_\_\_\_  \_\_\_\_\_ foolish

wise \_\_\_\_\_  foolish

If you consider the concept to be neutral on the scale, then you should place your checkmark as follows:

probable \_\_\_\_\_  \_\_\_\_\_ improbable

You will be rating two types of statements, a complete sentence like "Ghetto people are poor." followed by an incomplete sentence of the form "Being poor is:" You are to rate each concept on the scales as noted above.

Work at a fairly high speed through this test. Do not worry or puzzle over individual items. It is your first impressions, the immediate "feelings" about the items, that we want.

Begin rating the concepts. If you are unsure of the procedure, ask the monitor. Work to the page in the booklet labelled Stop and End of Part I.

Ghetto people are honest.

true	_____	_____	_____	_____	_____	_____	_____	false
impossible	_____	_____	_____	_____	_____	_____	_____	possible
probable	_____	_____	_____	_____	_____	_____	_____	improbable

Being honest is:

bad	_____	_____	_____	_____	_____	_____	_____	good
harmful	_____	_____	_____	_____	_____	_____	_____	beneficial
wise	_____	_____	_____	_____	_____	_____	_____	foolish

Ghetto people are hardworking.

true	_____	_____	_____	_____	_____	_____	_____	false
impossible	_____	_____	_____	_____	_____	_____	_____	possible
probable	_____	_____	_____	_____	_____	_____	_____	improbable

Being a hard worker is:

bad	_____	_____	_____	_____	_____	_____	_____	good
harmful	_____	_____	_____	_____	_____	_____	_____	beneficial
wise	_____	_____	_____	_____	_____	_____	_____	foolish

Ghetto people are irresponsible.

true	_____	_____	_____	_____	_____	_____	_____	false
impossible	_____	_____	_____	_____	_____	_____	_____	possible
probable	_____	_____	_____	_____	_____	_____	_____	improbable

Being irresponsible is:

bad	_____	_____	_____	_____	_____	_____	_____	good
harmful	_____	_____	_____	_____	_____	_____	_____	beneficial
wise	_____	_____	_____	_____	_____	_____	_____	foolish

Ghetto people are immoral.

true	_____	_____	_____	_____	_____	_____	_____	false
impossible	_____	_____	_____	_____	_____	_____	_____	possible
probable	_____	_____	_____	_____	_____	_____	_____	improbable

Being immoral is:

bad	_____	_____	_____	_____	_____	_____	_____	good
harmful	_____	_____	_____	_____	_____	_____	_____	beneficial
wise	_____	_____	_____	_____	_____	_____	_____	foolish

Ghetto people are law-abiding.

true	_____	_____	_____	_____	_____	_____	_____	false
impossible	_____	_____	_____	_____	_____	_____	_____	possible
probable	_____	_____	_____	_____	_____	_____	_____	improbable

Being law-abiding is:

bad	_____	_____	_____	_____	_____	_____	_____	good
harmful	_____	_____	_____	_____	_____	_____	_____	beneficial
wise	_____	_____	_____	_____	_____	_____	_____	foolish

STOP!

END OF PART I

Instructions for Part II

We would like to know your opinion about the results of certain things. For example, what happens if you get drafted? Do you get sent to war? Get hurt? And so on. We are all aware that good and bad things result from events. Since most people are different, we need your personal opinions.

On the following pages, we have written incomplete sentences about different events. Below these are lists of different endings for each sentence. After each ending are numbers from 1-7 corresponding to the likelihood that the ending would happen if the thing mentioned in the first part of the sentence happened. We would like you to use the following rule in answering.

Always refer to the categories listed vertically on the righthand side of each page above each number. Circle 1 if there is no chance at all of the second event following the first--if it never happens; circle 2 if there is a small chance of the second thing following the first; circle 3 if there is some chance of the second thing following the first; circle 4 if the second thing may happen, but probably would not; circle 5 if the second thing mentioned probably would happen; circle 6 if the second thing almost always follows the first; circle 7 if the second thing always follows the first--with no exceptions.

The above rule should be applied to each statement. The following example will show more clearly how it should be used.

Example:

		No Chance	Small Chance	Some Chance	Probably Not	Probably Would	Almost Always	Always
If you drive fast all the time, you:								
a) will have an accident	1	2	3	4	5	6	7	
b) will get a speeding ticket	1	2	3	4	5	6	7	
c) get lower gas mileage	1	2	3	4	5	6	7	
d) hold up other traffic	1	2	3	4	5	6	7	

Begin reading sentences on the following pages, read each ending, and decide what number to circle that corresponds to the desired likelihood of the ending following the statement.

If you have any questions, ask the monitor. When you are through, give your booklet to the monitor.

	No Chance	Small Chance	Some Chance	Probably Not	Probably Would	Almost Always	Always
If you lived in a ghetto, you would:							
1. feel secure	1	2	3	4	5	6	7
2. have money	1	2	3	4	5	6	7
3. finish high school	1	2	3	4	5	6	7
4. improve the neighborhood	1	2	3	4	5	6	7
5. make a comfortable living	1	2	3	4	5	6	7
6. get robbed	1	2	3	4	5	6	7
7. be deprived	1	2	3	4	5	6	7
8. have a good job	1	2	3	4	5	6	7
9. steal from others	1	2	3	4	5	6	7
10. have control over your future	1	2	3	4	5	6	7
If you were on welfare in a ghetto, you would:							
11. be responsible for your children	1	2	3	4	5	6	7
12. try to get off welfare	1	2	3	4	5	6	7
13. help improve the neighborhood	1	2	3	4	5	6	7
If you were a thief in a ghetto, you would:							
14. lose the respect of others	1	2	3	4	5	6	7
15. continue stealing	1	2	3	4	5	6	7
16. be sent to jail	1	2	3	4	5	6	7
17. have a police record	1	2	3	4	5	6	7
18. feel secure	1	2	3	4	5	6	7

No Chance	Small Chance	Some Chance	Probably Not	Probably Would	Almost Always	Always
-----------	--------------	-------------	--------------	----------------	---------------	--------

If you were to work on community action groups in a ghetto, you could:

- |                         |   |   |   |   |   |   |   |
|-------------------------|---|---|---|---|---|---|---|
| 19. improve housing     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 20. improve the schools | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 21. decrease crime      | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

APPENDIX B

- I. Mood Adjective Checklist (MACI)
- II. Modified Adjective Checklist (MCL)

The Mood Adjective Check List

Each of the following words describes feelings or mood. Please use the list to describe your feelings at the moment you read each word. If the word definitely describes how you feel at the moment you read it, circle the double check vv to the right of the word. For example, if the word is relaxed and you are definitely feeling relaxed at the moment, circle the vv as follows:

relaxed v v ? no (This means you definitely feel relaxed at the moment.)

If the word only slightly applies to your feelings at the moment, circle the single check v as follows:

relaxed vv v ? no (This means you feel slightly relaxed at the moment.)

If the word is not clear to you or you cannot decide whether or not it applies to your feelings at the moment, circle the question mark as follows:

relaxed vv v ? no (This means you cannot decide whether you are relaxed or not.)

If you definitely decide the word does not apply to your feelings at the moment, circle the no as follows:

relaxed vv v ? no (This means you are definitely not relaxed at the moment.)

Work rapidly. Your first reaction is best. Work down the first column, then to the next. Please mark all words. This should take only a few minutes. Please begin.

angry	vv	v	?	no
clutched up	vv	v	?	no
carefree	vv	v	?	no
elated	vv	v	?	no
concentrating	vv	v	?	no
drowsy	vv	v	?	no
affectionate	vv	v	?	no
regretful	vv	v	?	no
dubious	vv	v	?	no
boastful	vv	v	?	no
active	v	v	?	no
defiant	vv	v	?	no
fearful	vv	v	?	no
playful	vv	v	?	no
overjoyed	vv	v	?	no
engaged in thought	vv	v	?	no
sluggish	vv	v	?	no

kindly	vv	v	?	no
sad	vv	v	?	no
skeptical	vv	v	?	no
egotistic	vv	v	?	no
energetic	vv	v	?	no
rebellious	vv	v	?	no
jittery	vv	v	?	no
witty	vv	v	?	no
pleased	vv	v	?	no
intent	vv	v	?	no
tired	vv	v	?	no
warmhearted	vv	v	?	no
sorry	vv	v	?	no
suspicious	vv	v	?	no
self-centered	vv	v	?	no
vigorous	vv	v	?	no

General Affective Condition

Reference Point in Treatment

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---

(What's happening,  
What's being said, etc.)

Subject \_\_\_\_\_ Observation \_\_\_\_\_

	Yes	So-So	No
angry	___	___	___
elated	___	___	___
concentrating	___	___	___
sluggish	___	___	___
fearful	___	___	___
overjoyed	___	___	___
active	___	___	___
sad	___	___	___
skeptical	___	___	___
jittery	___	___	___
pleased	___	___	___
sorry	___	___	___
suspicious	___	___	___
self-centered	___	___	___

APPENDIX C

- I. Total Game Heart-Rate Statistics
- II. Mood Adjective Checklist Factor Scores and Modified Checklist Scores for all subjects in Games 2 and 3.
- III. Attitude change scores for all subjects for all games.

Games 1, 2, 3 - Heart-Rate Data (ACI)

Game 1				Intercorrelation Matrix			
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>		<u>Subject</u>		
					<u>1</u>	<u>2</u>	<u>3</u>
1	81.9	87	8.0	1	1.000	.141	.437
2	83.1	87	174.9	2		1.000	.238
3	76.0	87	22.6	3			1.000

---

Game 2				<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>				
1	83.0	125	12.0	1	1.000	.242	.118
2	60.2	125	41.4	2		1.000	.168
3	86.0	125	185.4	3			1.000
4	75.8	125	7.1	4			1.000

---

Game 3				<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
<u>Subject</u>	<u>Mean</u>	<u>N</u>	<u>Variance</u>				
1	88.9	125	15.0	1	1.000	.270	-0.111
2	79.8	125	13.2			1.000	.051
3	80.9	125	12.8				1.000
4	73.4	125	11.0				1.000

---

Subject 1, Game 2 (ACII)

<u>Factors</u>	<u>1</u>	<u>2</u>	<u>3</u>
1. Aggression	00(01) <sup>a</sup>	00(02)	00(01)
2. Anxiety	00(03)	00(02)	00(02)
3. Surgency	04( ) <sup>b</sup>	07( ) <sup>b</sup>	02( ) <sup>b</sup>
4. Elation	02(07)	07(04)	05(05)
5. Concentration	08(03)	09(03)	02(03)
6. Fatigue	09(01)	09(01)	09(01)
7. Activation	00(02)	08(02)	00(02)
8. Social Affection	02( ) <sup>b</sup>	00( ) <sup>b</sup>	00( ) <sup>b</sup>
9. Sadness	00(02)	00(05)	00(02)
10. Skepticism	00(04)	00(03)	00(04)
11. Egotism	00(01)	00(01)	00(02)
12. Sum of 3, 4, 7	6	22	7

<sup>a</sup>00(01) - values outside parentheses are MACL factor scores;  
values in parentheses are MCL factor scores.

<sup>b</sup>scores for these factors were not recorded on the MCL.

Subject 2, Game 2

<u>Factors</u>	<u>Period</u>		
	<u>1</u>	<u>2</u>	<u>3</u>
1. Aggression	00(02) <sup>a</sup>	02(01)	04(02)
2. Anxiety	05(02)	02(02)	02(03)
3. Surgency	04( ) <sup>b</sup>	03( ) <sup>b</sup>	03( ) <sup>b</sup>
4. Elation	02(03)	07(03)	04(05)
5. Concentration	08(03)	09(03)	09(03)
6. Fatigue	00(01)	00(01)	00(01)
7. Activation	06(01)	05(01)	08(02)
8. Social Affection	03( ) <sup>b</sup>	02( ) <sup>b</sup>	00( ) <sup>b</sup>
9. Sadness	00(02)	03(02)	00(04)
10. Skepticism	08(05)	07(02)	08(04)
11. Egotism	03(01)	05(01)	06(01)
12. Sum of 3, 4, 7	12	15	15

<sup>a</sup>00(01) - values outside parentheses are MAFL factor scores;  
values in parentheses are MCL factor scores.

<sup>b</sup>scores for these factors were not recorded on the MCL.

Subject 3, Game 2

Factors	Period		
	1	2	3
1. Aggression	00(01) <sup>a</sup>	06(01)	00(02)
2. Anxiety	04(02)	06(03)	00(02)
3. Surgency	02( ) <sup>b</sup>	00( ) <sup>b</sup>	03( ) <sup>b</sup>
4. Elation	03(03)	00(03)	04(04)
5. Concentration	08(03)	09(03)	01(03)
6. Fatigue	00(01)	00(01)	02(02)
7. Activation	02(01)	06(01)	00(02)
8. Social Affection	03( ) <sup>b</sup>	00( ) <sup>b</sup>	04( ) <sup>b</sup>
9. Sadness	01(02)	01(01)	02(04)
10. Skepticism	01(04)	01(03)	00(03)
11. Egotism	04(01)	00(01)	00(01)
12. Sum of 3, 4, 7	7	6	7

<sup>a</sup>00(01) - values outside parentheses are MACL factor scores;  
values in parentheses are MCL factor scores

<sup>b</sup>scores for these factors were not recorded on the MCL.

Subject 4, Game 2

Factors	Period		
	1	2	3
1. Aggression	00(01) <sup>a</sup>	03(01)	06(02)
2. Anxiety	08(02)	08(03)	02(04)
3. Surgency	04( ) <sup>b</sup>	00( ) <sup>b</sup>	00( ) <sup>b</sup>
4. Elation	03(06)	00(06)	00(03)
5. Concentration	06(02)	06(03)	03(03)
6. Fatigue	00(01)	09(01)	09(01)
7. Activation	04(01)	00(02)	00(01)
8. Social Affection	04( ) <sup>b</sup>	00( ) <sup>b</sup>	00( ) <sup>b</sup>
9. Sadness	00(03)	08(02)	07(03)
10. Skepticism	07(02)	05(02)	02(03)
11. Egotism	07(01)	00(01)	00(01)
12. Sum of 3, 4, 7	11	00	00

<sup>a</sup>00(01) - values outside parentheses are MACL factor scores; values in parentheses are MCL factor scores.

<sup>b</sup> scores for these factors were not recorded on the MCL

Subject 5, Game 2

FACTORS	PERIODS		
	<u>1</u>	<u>2</u>	<u>3</u>
1. Aggression	00(01) <sup>a</sup>	00(02)	00(02)
2. Anxiety	01(02)	01(03)	01(03)
3. Surgency	06( ) <sup>b</sup>	07( ) <sup>b</sup>	06( ) <sup>b</sup>
4. Elation	02(07)	02(03)	00(04)
5. Concentration	07(02)	07(02)	06(03)
6. Fatigue	06(01)	04(01)	06(01)
7. Activation	00(02)	00(02)	00(02)
8. Social Affection	04( ) <sup>b</sup>	04( ) <sup>b</sup>	04( ) <sup>b</sup>
9. Sadness	00(02)	00(04)	00(04)
10. Skepticism	00(02)	00(03)	00(04)
11. Egotism	00(01)	00(02)	00(02)
12. Sum of 3, 4, 7	8	9	6

<sup>a</sup>00(01) - values outside parentheses are MACL factor scores; values in parentheses are MCL factor scores.

<sup>b</sup>Scores for these factors were not recorded on the MCL.

Subject 1, Game 3

FACTORS	PERIOD		
	<u>1</u>	<u>2</u>	<u>3</u>
1. Aggression	00(01) <sup>a</sup>	00(01)	00(01)
2. Anxiety	01(02)	02(03)	00(02)
3. Surgency	05( ) <sup>b</sup>	04( ) <sup>b</sup>	06( ) <sup>b</sup>
4. Elation	03(01)	06(06)	02(03)
5. Concentration	01(03)	05(02)	00(02)
6. Fatigue	01(01)	00(01)	03(03)
7. Activation	06(02)	06(03)	04(02)
8. Social Affection	06( ) <sup>b</sup>	03( ) <sup>b</sup>	03( ) <sup>b</sup>
9. Sadness	01(02)	00(02)	01(02)
10. Skepticism	03(02)	00(04)	00(02)
11. Egotism	04(02)	05(03)	00(03)
12. Sum of 3, 4, 7	14	16	12

<sup>a</sup>00(01) - Values outside parentheses are MAFL factor scores; values in parentheses are MCL factor scores.

<sup>b</sup>Scores for these factors were not recorded on the MCL.

Subject 2, Game 3

FACTORS	PERIOD		
	<u>1</u>	<u>2</u>	<u>3</u>
1. Aggression	01(02)	00(01)	00(01)
2. Anxiety	01(03)	00(03)	00(02)
3. Surgency	06( ) <sup>b</sup>	04( ) <sup>b</sup>	06( ) <sup>b</sup>
4. Elation	03(03)	05(06)	08(04)
5. Concentration	04(02)	03(03)	03(02)
6. Fatigue	02(02)	00(01)	00(02)
7. Activation	06(02)	05(03)	05(02)
8. Social Affection	05( ) <sup>b</sup>	03( ) <sup>b</sup>	00( ) <sup>b</sup>
9. Sadness	00(04)	00(02)	04(02)
10. Skepticism	01(04)	01(03)	00(02)
11. Egotism	01(02)	02(02)	04(01)
12. Sum of 3, 4, 7	15	14	19

<sup>a</sup>00(01) - Values outside parentheses are MACL factor scores; values in parentheses are MCL factor scores.

<sup>b</sup>Scores for these factors were not recorded on the MCL.

Subject 3, Game 3

Factors	Period		
	<u>1</u>	<u>2</u>	<u>3</u>
1. Aggression	00(01)	06(03)	04(01)
2. Anxiety	04(03)	07(04)	06(02)
3. Surgency	04( ) <sup>b</sup>	00( ) <sup>b</sup>	00( ) <sup>b</sup>
4. Elation	02(03)	00(03)	02(03)
5. Concentration	06(03)	07(03)	08(02)
6. Fatigue	07(02)	03(01)	04(02)
7. Activation	02(01)	03(01)	00(01)
8. Social Affection	00( ) <sup>b</sup>	00( ) <sup>b</sup>	02( ) <sup>b</sup>
9. Sadness	00(02)	06(04)	00(02)
10. Skepticism	04(03)	06(04)	04(02)
11. Egotism	00(01)	00(01)	00(01)
12. Sum of 3, 4, 7	8	3	2

<sup>a</sup>00(01) - Values outside parentheses are MACL factor scores; values in parentheses are MCL factor scores.

<sup>b</sup>Scores for these factors were not recorded on the MCL.

Subject 4, Game 3

Factors	Period		
	<u>1</u>	<u>2</u>	<u>3</u>
1. Aggression	00(01)	00(01)	00(02)
2. Anxiety	01(04)	00(03)	00(02)
3. Surgency	07( ) <sup>b</sup>	08( ) <sup>b</sup>	05( ) <sup>b</sup>
4. Elation	05(03)	05(09)	05(03)
5. Concentration	02(03)	00(03)	01(02)
6. Fatigue	01(03)	00(03)	03(02)
7. Activation	02(01)	08(01)	00(01)
8. Social Affection	03( ) <sup>b</sup>	02( ) <sup>b</sup>	02( ) <sup>b</sup>
9. Sadness	00(04)	00(02)	00(04)
10. Skepticism	01(04)	00(02)	00(04)
11. Egotism	00(01)	00(01)	00(01)
12. Sum of 3, 4, 7	14	21	10

<sup>a</sup>00(01) - Values outside parentheses are MACL factor scores; values in parentheses are MCL factor scores.

<sup>b</sup>Scores for these factors were not recorded on the MCL.

Subject 5, Game 3

Factors	Period		
	<u>1</u>	<u>2</u>	<u>3</u>
1. Aggression	00(01)	00(01)	00(01)
2. Anxiety	06(03)	00(03)	00(02)
3. Surgency	00( ) <sup>b</sup>	04( ) <sup>b</sup>	04( ) <sup>b</sup>
4. Elation	01( )	04( )	04( )
5. Concentration	06(03)	09(03)	00(03)
6. Fatigue	00(02)	00(01)	00(02)
7. Activation	02(01)	06(02)	00(01)
8. Social Affection	00( ) <sup>b</sup>	00( ) <sup>b</sup>	00( ) <sup>b</sup>
9. Sadness	01(02)	00(02)	00(02)
10. Skepticism	00(03)	00(02)	00(02)
11. Egotism	00(01)	00(02)	00(02)
12. Sum of 3, 4, 7	3	14	8

<sup>a</sup>00(01)- Values outside parentheses are MACL factor scores; values in parentheses are MCL factor scores.

<sup>b</sup>Scores for these factors were not recorded on the MCL.

Being Honest Is:  
(low score - good; high score - bad)

(ACIII)

	<u>Subject</u>	<u>Pre-Game</u>	<u>Post Game</u>	<u>Change</u> <sup>a</sup>
<u>Game 1</u>	1	3	15	+12
	2	3	16	+13
	3	9	15	+ 6
	4	3	14	+11
	5	6	6	0
	MEAN =	4.80	MEAN = 13.20	MEAN = 8.40
<u>Game 2</u>	1	6	6	+ 0
	2	3	9	+ 6
	3	6	10	+ 4
	4	3	4	+ 1
	5	3	5	+ 2
	MEAN =	4.20	MEAN = 6.80	MEAN = 2.60
<u>Game 3</u>	1	5	7	+ 2
	2	4	2	- 2
	3	6	13	+ 7
	4	3	12	+ 9
	5	3	9	+ 6
	MEAN =	4.20	MEAN = 8.60	MEAN = 4.40
MEAN FOR ALL SUBJECTS =		4.40	= 9.53	= 5.13

<sup>a</sup> Mean Change Scores are not based on absolute difference scores for each subject.

Being a Hard Worker Is:  
(Low Score - good; High Score - bad)

	<u>Subject</u>	<u>Pre-Game</u>	<u>Post Game</u>	<u>Change</u>
<u>Game 1</u>	1	3	9	+ 6
	2	5	3	- 2
	3	6	9	+ 3
	4	3	15	+12
	5	9	3	- 6
	MEAN =	5.20	MEAN = 7.80	MEAN = 2.60
<u>Game 2</u>	1	6	6	0
	2	3	3	0
	3	6	9	+ 3
	4	3	5	+ 2
	5	6	8	+ 2
	MEAN =	4.80	MEAN = 6.20	MEAN = 1.40
<u>Game 3</u>	1	8	11	+ 3
	2	5	3	- 2
	3	4	8	+ 4
	4	4	3	- 1
	5	12	9	- 3
	MEAN =	6.60	MEAN = 6.80	MEAN = 1.20
MEAN FOR ALL SUBJECTS		= 5.53	= 6.93	= 1.40

<sup>a</sup> Mean Change Scores are not based on absolute difference scores for each subject.

Being Irresponsible Is:  
(Low Score - good; High Score - bad)

	<u>Subject</u>	<u>Pre-Game</u>	<u>Post Game</u>	<u>Change</u>
<u>Game 1</u>	1	21	7	-14
	2	20	18	+ 2
	3	18	18	0
	4	21	21	0
	5	21	18	+ 3
	MEAN =	20.20	MEAN = 16.40	MEAN = -1.80
<u>Game 2</u>	1	18	18	0
	2	21	21	0
	3	19	15	+ 4
	4	20	21	+ 1
	5	20	6	+14
	MEAN =	19.60	MEAN = 16.20	MEAN = 3.80
<u>Game 3</u>	1	12	14	+ 2
	2	19	18	- 1
	3	19	18	- 1
	4	18	12	- 6
	5	18	19	+ 1
	MEAN =	17.20	MEAN = 16.26	MEAN = -1.00
MEAN FOR ALL SUBJECTS		19.00	16.26	.33

<sup>a</sup> Mean Change Scores are not based on absolute difference scores for each subject.

Being Immoral Is:

(Low Score - good; High Score - bad)

	<u>Subject</u>	<u>Pre-Game</u>	<u>Post Game</u>	<u>Change</u>
<u>Game 1</u>	1	21	20	- 1
	2	14	12	- 2
	3	16	15	- 1
	4	21	18	- 3
	5	17	18	+ 1
	MEAN =	17.80	MEAN = 16.60	MEAN = -1.20
<u>Game 2</u>	1	15	15	0
	2	21	18	- 3
	3	13	15	+ 2
	4	18	16	- 2
	5	15	19	+ 4
	MEAN =	16.40	MEAN = 16.60	MEAN = .20
<u>Game 3</u>	1	12	16	+ 4
	2	15	15	0
	3	13	18	+ 5
	4	16	9	- 7
	5	12	14	+ 2
	MEAN =	13.60	MEAN = 14.40	MEAN = .80
MEAN FOR ALL SUBJECTS		15.93	15.87	- .20

<sup>a</sup> Mean Change Scores are not based on absolute difference scores for each subject.

Being Law-Abiding Is:  
(Low Score - good; High Score - bad)

	<u>Subject</u>	<u>Pre-Game</u>	<u>Post Game</u>	<u>Change</u>
<u>Game 1</u>	1	3	14	+11
	2	3	3	0
	3	12	15	+ 3
	4	3	18	+15
	5	6	6	0
	MEAN =	6.54	MEAN = 11.2	MEAN = 5.80
<u>Game 2</u>	1	6	6	0
	2	3	6	+ 3
	3	10	9	- 1
	4	3	7	+ 4
	5	6	6	0
	MEAN =	6.56	MEAN = 6.80	MEAN = 1.20
<u>Game 3</u>	1	9	11	+ 2
	2	5	6	+ 1
	3	14	18	+ 4
	4	4	12	+ 8
	5	6	7	+ 1
	MEAN =	7.60	MEAN = 10.8	MEAN = 3.20
MEAN FOR ALL SUBJECTS		6.20	9.60	3.40

<sup>a</sup> Mean Change Scores are not based on absolute difference scores for each subject.

#### APPENDIX D

- I. Means and Standard Deviations for Attitude Change Scores and Heart-Rate Data in Tables 11, 12, 13, and 14.
- II. Intercorrelations of Measures of Involvement and Heart-Rate Data for Games 2, 3, and 2 plus 3.

Game 1 - Heart-Rate Data and Attitude Change Scores

<u>VARIABLE</u>	<u>Mean</u> <sup>a</sup>	<u>S.D.</u> <sup>b</sup>
1. Honesty <sup>c</sup>	10.3	3.78
2. Hard Working	3.7	2.08
3. Irresponsible	5.3	7.57
4. Immoral	1.3	0.58
5. Law Abiding	4.7	5.68
6. H. R. Per. 1 <sup>d</sup>	83.3	3.51
7. Var. Per. 1 <sup>e</sup>	13.3	9.07
8. H. R. Per. 2	80.0	4.35
9. Var. Per. 2	93.3	0.15
10. H. R. Per. 3	77.0	4.35
11. Var. Per. 3	82.3	0.12
12. H. R. Game	80.3	3.78
13. Var. Game	68.6	92.39

<sup>a</sup>Based on N = 3

<sup>b</sup>Standard Deviation

<sup>c</sup>Based on change in affect associated with each of the first five variables.

<sup>d</sup>Heart-rate, Period 1, etc.

<sup>e</sup>Variance of heart-rate for Period 1, etc.

Game 2 - Heart-Rate Data and Attitude Change Scores

VARIABLE	MEAN <sup>a</sup>	S.D. <sup>b</sup>
1. Honesty <sup>c</sup>	2.8	2.75
2. Hard Working	1.2	1.50
3. Irresponsible	1.2	1.89
4. Immoral	1.8	1.26
5. Law Abiding	2.0	1.82
6. H. R. Per. 1 <sup>d</sup>	77.8	11.24
7. Var. Per. 1 <sup>e</sup>	11.5	4.80
8. H. R. Per. 2	76.2	12.20
9. Var. Per. 2	16.8	12.53
10. H. R. Per. 3	74.5	11.62
11. Var. Per. 3	154.2	250.62
12. H. R. Game	76.2	11.62
13. Var. Game	61.2	83.85

<sup>a</sup>Based on N = 3

<sup>b</sup>Standard Deviation

<sup>c</sup>Based on change in affect associated with each of the first five variables.

<sup>d</sup>Heart-rate, Period 1, etc.

<sup>e</sup>Variance of heart-rate for Period 1, etc.

Game 3 - Heart-Rate Data and Attitude Change Scores

VARIABLE	MEAN <sup>a</sup>	S.D. <sup>b</sup>
1. Honesty <sup>c</sup>	5.0	3.55
2. Hard Working	2.5	1.29
3. Irresponsible	2.5	2.38
4. Immoral	4.0	2.94
5. Law Abiding	3.8	3.10
6. H. R. Per. 1 <sup>d</sup>	81.2	5.06
7. Var. Per. 1 <sup>e</sup>	15.0	2.58
8. H. R. Per. 2	81.2	8.22
9. Var. Per. 2	6.5	0.58
10. H. R. Per. 3	79.5	5.80
11. Var. Per. 3	11.5	2.38
12. H. R. Game	80.8	6.55
13. Var. Game	13.0	1.63

<sup>a</sup>Based on N = 3

<sup>b</sup>Standard Deviation

<sup>c</sup>Based on change in affect associated with each of the first five variables.

<sup>d</sup>Heart-rate, Period 1, etc.

<sup>e</sup>Variance of heart-rate for Period 1, etc.

All Games - Heart-Rate Data and Attitude Change Scores

VARIABLES	MEAN <sup>a</sup>	S.D. <sup>b</sup>
1. Honesty <sup>c</sup>	5.6	4.36
2. Hard Working	2.4	1.75
3. Irresponsible	2.8	4.14
4. Immoral	2.4	2.16
5. Law Abiding	3.4	3.41
6. H. R. per. 1 <sup>d</sup>	8.0	7.33
7. Var. Per. 1 <sup>e</sup>	13.3	5.27
8. H. R. Per. 2	79.1	8.61
9. Var. Per. 2	33.9	77.45
10. H. R. Per. 3	77.0	7.71
11. Var. Per. 3	82.7	160.90
12. H. R. Game	79.0	7.81
13. Var. Game	45.7	67.08

<sup>a</sup>Based on N = 3

<sup>b</sup>Standard Deviation

<sup>c</sup>Based on change in affect associated with each of the first five variables.

<sup>d</sup>Heart-rate, Period 1, etc.

<sup>e</sup>Variance of heart-rate for Period 1, etc.

Intercorrelations of Measures of Involvement  
And Heart-Rate Data for Game 2

VARIABLE	1	2	3	4	5	6	7	8	9	10	11
1. S, E, A, P1 <sup>a</sup>	1.0										
2. S, E, A, P2	-.38	1.0									
3. S, E, A, P3	.18	.61	1.0								
4. H. R. Per. 1 <sup>b</sup>	-.94	.05	-.48	1.0							
5. Var. P1 <sup>c</sup>	-.73	.09	.13	.70	1.0						
6. H. R. P. 2	-.82	-.19	-.64	.97	.64	1.0					
7. Var. P2	.43	-.06	.83	-.56	.19	-.60	1.0				
8. H. R. P3	-.85	-.14	-.64	.98	.62	.99	-.63	1.0			
9. Var. P3	-.37	-.30	.08	.45	.89	.48	.40	.43	1.0		
10. H. R. Game	-.87	-.11	-.60	.99	.65	.99	-.61	.99	.45	1.0	
11. Var. Game	-.36	-.26	.14	.42	.89	.44	.44	.40	.99	.42	1.0

<sup>a</sup>The sum of the following factors for the respective periods: Surgency, Elation, and Activation.

<sup>b</sup>Heart-rate, period 1, etc.

<sup>c</sup>Variance of heart-rate for period 1, etc.

Intercorrelations of Measures of Involvement  
And Heart-Rate Data for Game 3

VARIABLE	1	2	3	4	5	6	7	8	9	10	11
1. S, E, A, P1 <sup>a</sup>	1.0										
2. S, E, A, P2	.87	1.0									
3. S, E, A, P3	.90	.59	1.0								
4. H. R. Per. 1 <sup>b</sup>	-.24	-.45	-.13	1.0							
5. Var. P.1 <sup>c</sup>	.36	.20	.54	-.74	1.0						
6. H. R. P.2	.09	-.16	.17	.94	-.64	1.0					
7. Var. P2	.63	.61	.62	-.86	.89	-.67	1.0				
8. H. R. P3	-.08	-.27	-.02	.98	-.76	.98	-.80	1.0			
9. Var. P3	-.46	-.53	-.41	.96	-.87	.83	-.97	.92	1.0		
10. H. R. Game	-.04	-.27	.06	.98	-.69	.99	-.75	.99	.89	1.0	
11. Var. Game	.00	-.27	.18	.97	-.63	.99	-.71	.98	.86	.99	1.0

<sup>a</sup>The sum of the following factors for the respective periods: Surgency, Elation, and Activation.

<sup>b</sup>Heart-rate, period 1, etc.

<sup>c</sup>Variance of heart-rate for period 1, etc.

Intercorrelations of Measures of Involvement  
And Heart-Rate Data for Games 2 and 3

VARIABLE	1	2	3	4	5	6	7	8	9	10	11
1. S, E, A, P1 <sup>a</sup>	1.0										
2. S, E, A, P2	.26	1.0									
3. S, E, A, P3	.62	.61	1.0								
4. H. R. Per. 1 <sup>b</sup>	-.39	-.03	-.24	1.0							
5. Var. Per. 1 <sup>c</sup>	.04	.19	.36	.47	1.0						
6. H. R. P2	-.18	-.12	-.18	.95	.38	1.0					
7. Var. P2	-.10	-.04	.29	-.55	-.12	-.56	1.0				
8. H. R. P3	-.25	-.11	-.26	.98	.42	.99	-.63	1.0			
9. Var. P3	-.43	-.29	-.08	.27	.43	.24	.54	.21	1.0		
10. H. R. Game	-.26	-.10	-.22	.98	.41	.99	-.59	.99	.24	1.0	
11. Var. Game	-.43	-.26	-.04	.25	.43	.22	.67	.19	.99	.21	1.0

<sup>a</sup>The sum of the following factors for the respective periods: Surgency, Elation, and Activation.

<sup>b</sup>Heart-rate, period 1, etc.

<sup>c</sup>Variance of heart-rate for period 1, etc.