COGNITIVE CONFLICT IN 2-PERSON TEAMS

by

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INTRODUCTION

Background

In recent years, social psychology has paid increasing attention to the problem of interpersonal conflict. Most of the work on this problem has been conducted within the framework of game-decision theory and has therefore been limited to competitive situations. However, it has been suggested (Rapoport, 1960) that interpersonal conflicts cannot be fully explained in terms of competition. It is frequently the case that conflict occurs between persons who wish to cooperate to attain a mutual goal. That is, persons working together on a common problem may think differently about the most appropriate solution for their mutual problem in the absence of an obvious, compelling solution. Thus, cognitive differences emerge as the major cause of conflict in non-competitive situations.

Indeed, Hammond (1966, p. 65) has suggested that in the future

> " ... conflict between men will be derived from their cognitive differences concerning the means by which physical, biological and social problems are to be managed so that dignity may be achieved. But cognitive conflict over means is dangerous because of its escalation potential, and because of our notorious lack of scientific information about its control."

Hammond further suggests a research paradigm which is appropriate for empirical studies of conflicts caused by cognitive differences.

Research Paradigm

The cognitive conflict paradigm described by Hammond (1965, 1966) and Rappoport (1965) is based on Brunswik's theory of probabilistic functionalism. A fundamental principle of probabilistic functionalism is that the environment is a "semi-erratic medium "to which persons must adapt in a probabilistic fashion. Brunswik developed the lens model to carry out empirical studies within the framework of probabilistic functionalism. In brief, the lens model allows the study of S's behavior in a situation in which he is faced with an uncertain stimulus manifold. A detailed description of the lens model, and its usefulness for investigations of cognitive processes, is provided by Hammond, Hursch, & Todd (1964) and by Hammond (1965).

The cognitive conflict paradigm is based upon a two stage extension of the lens model. In the first stage, different Ss are trained to place different values on the same cue stimuli. Following this training stage, Ss are brought together to work cooperatively on a new version of the training task that may contain new cue values. To work together efficiently Ss must agree on joint judgments about the cue stimuli. However, they must first reconcile their personal judgments, and, it is at this point that conflict emerges.

The paradigm, outlined by Hammond, creates the following experimental situation:

> "two persons who: (1) attempt to solve problems which concern both of them, (2) have mutual utilities (their gain (or loss) derives from their approximations to the solution of the problem), (3) receive different training in the solution of a problem involving uncertain inference, and then brought together and find themselves dealing with a familiar problem which their experience apparently prepared them for but, (4) find that their answers differ, and that neither answer is as good as it has been, although each answer is logically defensible, (5) and who provide a joint decision as to the correct solution, and, therefore (6) must adapt to one another as well as to the task if they are to solve their problems" (Hammond, 1966, p. 50).

Previous Research

Cognitive conflict has thus far been investigated in three different studies by Hammond and his associates. Rappoport (1965) constructed a multiple probability learning task to study the effects of discrepant training and cognitive set upon conflict and conflict resolution. In this uncertain task, Ss were trained to assign different values to intrinsically meaningless geometric cues. The Ss were also given instructions designed to induce an intuitive or an analytic orientation toward their problem. Results showed that: 1) cognitive conflict can be generated under controlled conditions, and 2) conflict is greater among persons with an analytic set.

Todd, Hammond, & Wilkins (1965) constructed a task involving novel cues to democratic institutions and compared the effects of exact and ambiguous feedback on compromise and conflict. In the exact feedback condition, Ss were told precisely how accurate their joint judgment was after each trial. In the ambiguous feedback condition, Ss were merely told that their joint judgment was "right" or "wrong". The results indicated that type of feedback does not affect conflict reduction, but the type of feedback does differentially affect compromise. Compromise between Ss was greatest in the exact feedback condition.

Hammond, Todd, Wilkins, & Mitchell (1966) are currently studying the effects of various types of verbal interchange upon compromise, conflict, and cognitive change. The Ss are trained in different verbal interaction techniques that are expected to increase the likelihood of compromise between persons with different cognitive systems.

In general, the work described here provides evidence that cognitive conflict is a meaningful problem. However, thus far, research in this area has been limited to purely conceptual tasks. Cognitive differences have been defined in terms of cue values assigned to stimuli which appear repeatedly in serial tasks, and Ss' responses consist of a series of judgments of a continuous covert variable.

The purpose of the present study is to apply the cognitive conflict paradigm to a situation which: 1) confronts Ss with a simple, discrete strategic decision, and 2) requires an extended act of perceptual-motor coordination between Ss if they are to implement their decision successfully.

Research on the implementation of strategic decisions is needed because conflicts frequently do not involve probability learning and repeated series of judgments, but rather a binary decision followed by extended period of cooperation. That is, prior investigations have placed the entire emphasis upon the decision alone. This work is interesting because Ss have typically been required to agree on difficult, repeated decisions. In contrast, the present study involves a simpler decision, but one with more complex consequences. Although many situations involve complex decisions with multiple, uncertain alternatives, many other situations exist in which the decision itself may be simple, but the activity required to carry it out is complex, and conflict may reoccur during the activity.

The Problem

The essential problem for the present research concerns the application of the cognitive conflict paradigm to a situation involving both cognitive and perceptual-motor activity. A mixed cognitive, perceptual-motor task was therefore developed in which pairs of Ss were required to complete a three choice point maze

(See Fig. 1) using a hand control device (HCD), an apparatus constructed by Cross, Trumbo, & Noble (1964) (See Fig. 2). The maze was constructed in such a way that Ss had to choose between difficult but short paths, and easy but long paths. The Ss had to agree on a series of strategic decisions about which paths to follow and then had to coordinate their perceptual-motor activity to carry out these decisions. This study extends the paradigm to a more realistic situation which includes a cognitive (strategic) decision phase, and a perceptual-motor (implementation) phase. In the present context, cognitive conflict involves disagreements between Ss who must cooperate in the performance of a cognitive, perceptual-motor task. Thus, by requiring Ss to implement their decisions as a team, it becomes possible to investigate the effects of cognitive conflict in an extended cooperative activity.

Research Plan

The general purpose of the present study was: 1) to determine the types of perceptual-motor training and cognitive experience which will effectively influence cognitive (strategic) decisions, 2) to investigate the ways in which conflict-inducing prior experience influences joint decision making, and 3) to determine how conflicts over strategy decisions influence the efficiency of subsequent team perceptual-motor performances.

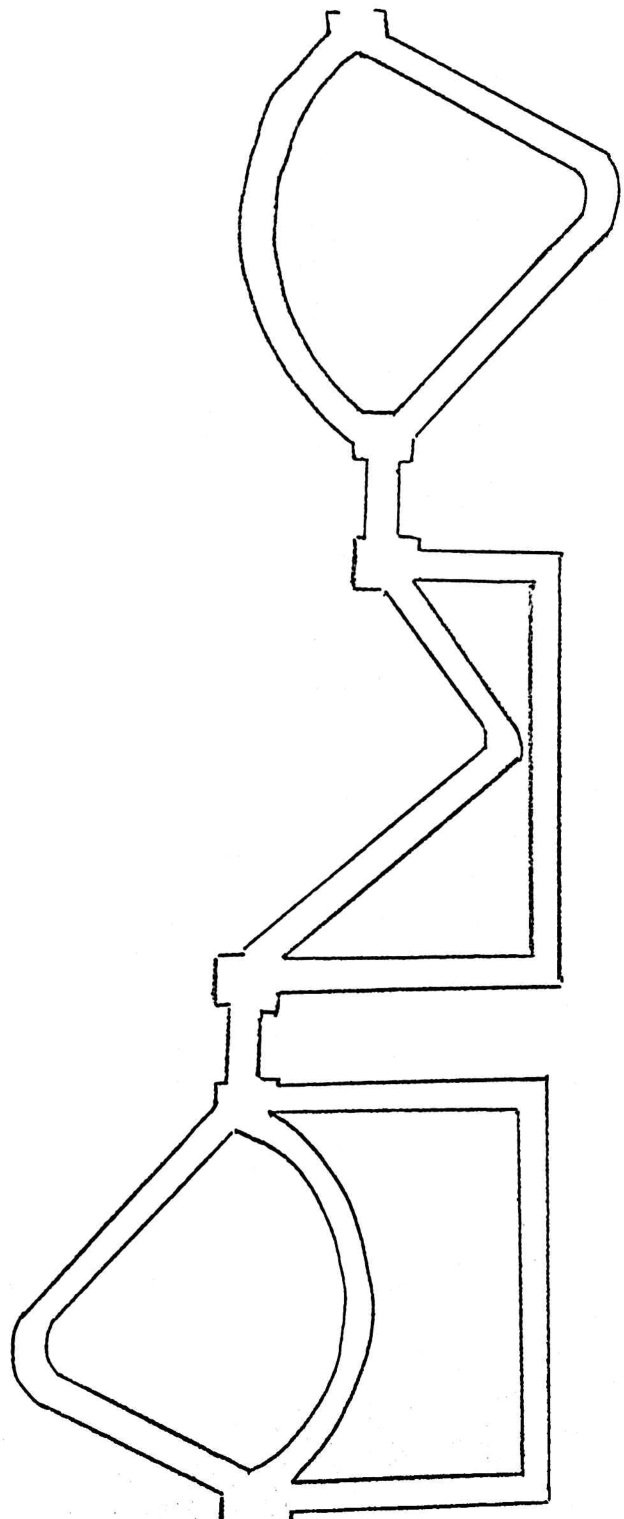

Fig. 1 . The maze to be completed by Ss on the apparatus.

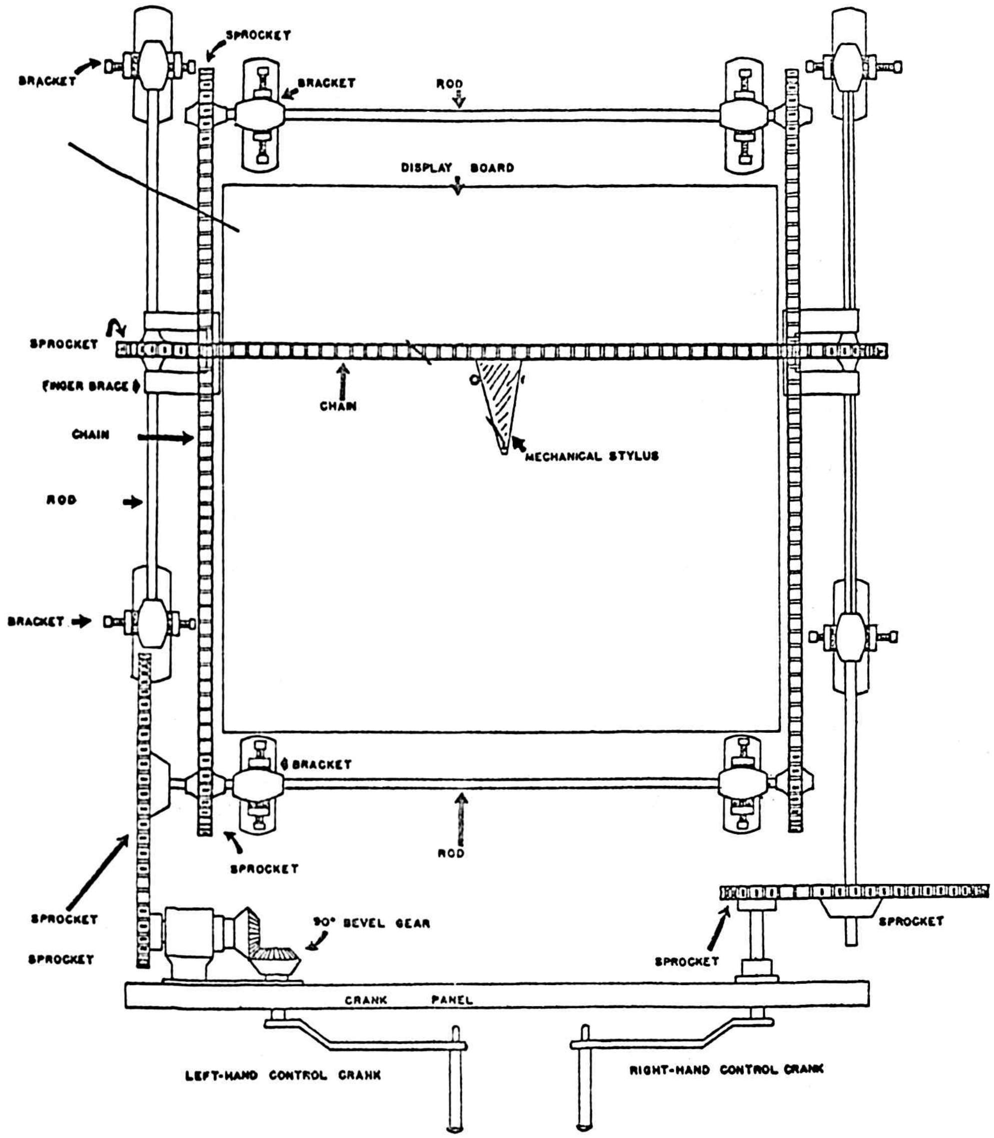

Fig. 2. Schematic replication of S's control apparatus.

The overall research plan involved two experiments. The purpose of the first experiment was to determine whether prior experience can be manipulated so that Ss would disagree on a cognitive, perceptual-motor task. The purpose of the second experiment was: 1) to investigate the ways in which cognitive differences influence team decision making, and 2) to determine how conflict-inducing prior experience influences the efficiency of subsequent team perceptual-motor performances.

EXPERIMENT I: EFFECTS OF PERCEPTUAL-MOTOR TRAINING AND COGNITIVE EXPERIENCE ON STRATEGIC DECISIONS AND PERCEPTUAL-MOTOR PERFORMANCE

Purpose.

The purpose of this experiment was to determine if: 1) decisions could be manipulated by prior training, and 2) if differential prior training affects performance. Thus, the problem here may essentially be reduced to a comparison of cognitive and perceptual-motor transfer effects with respect to two criteria: decision making and perceptual-motor performance.

Task and Apparatus.

The basic task used throughout the research involved the maze shown in Fig. 1. The alternatives at each choice point are shown in Table 1.

The experiment was designed to determine if: 1) cognitive training is more effective than perceptual-motor training in influencing strategic choices, and 2) if some combination of cognitive and perceptual-motor training is more effective than either type of training alone, in influencing strategic choices. The distance of each path (i.e., short, medium, or long) was varied by a factor of 50% (e.g., a long path was 50% longer than a medium path). Distance was measured along the imaginary center

Table 1

Alternative Paths at Each Choice Point in the Maze

Choice Point	Alternative Paths
1	Medium*Diagonal, Short Curve, Long Straight
2	Short Diagonal, Medium Straight
3	Short Curve, Medium Diagonal

* Refers to length

line of each path. The S was instructed to complete the maze as quickly as possible with as few errors as possible. (An error was defined as touching or crossing a path boundary).

To complete the maze, S was required to use the HCD (See Fig. 2), a device was originally designed to provide a two-hand adjustment task for a single S. Basically, the HCD is a system of chains and gears which control the movement of a stylus on a 16" X 18" display board. For the purposes of this study, a pen was attached to the HCD stylus. The S can draw a line by turning the two hand cranks which separately control the horizontal and vertical movement of the stylus. The stylus may be moved to any position on the display board by using the two hand cranks.

Using the HCD it is easy to move the stylus along a straight horizontal/vertical path, but more difficult to move it accurately along a curve or diagonal path. Because of these performance constraints, the choice of any path involves a strategy decision (e.g., a choice between an easy, long path and a difficult, short one).

Two training procedures were tested:

Perceptual-Motor Training Procedure.

The Ss were told that the experiment in which they were participating involved performance on a test of motor skill. They were instructed on the operation of the HCD and watched E demonstrate the apparatus. The S was then told that he would be given a chance to practice using the HCD. E attached a practice sheet, on which there was drawn a curve or diagonal path (4 mm wide, 180 mm long) (See Figs. 3 & 4), to the HCD display board. The practice path was designed to be easy enough for S to complete with little difficulty. The S was instructed to use the HCD to complete the path as quickly as possible with as few errors as possible. (See Appendix A for verbatim instructions).

Cognitive Training Procedure.

The cognitive training stimulus materials consisted of a deck of 5" X 8" index cards. On the face of each card there were two paths(e.g., curve and diagonal) of the type shown in Fig 1. After seeing E demonstrate the HCD, S was seated and shown one card at a

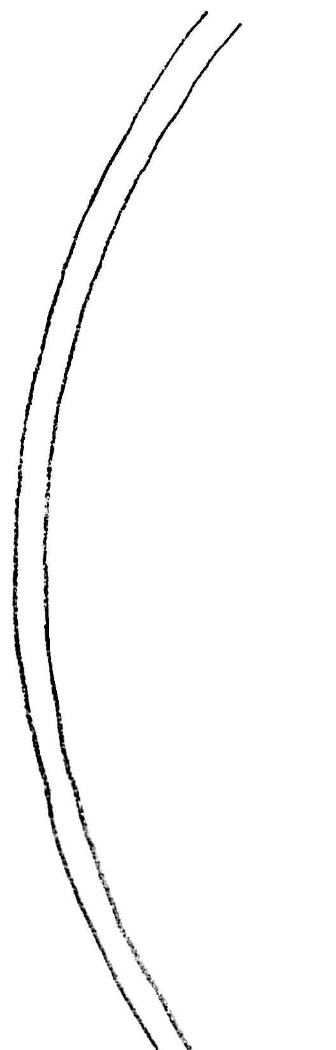

Fig. 3. The curve practice path to be completed by _S_s during the Perceptual-Motor Training Stage.

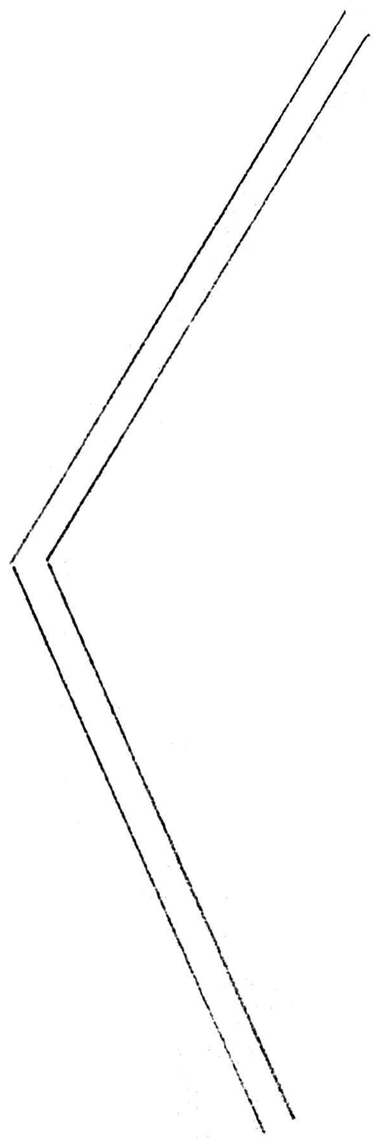

Fig. 4. The diagonal practice path to be completed by Ss during the Perceptual-Motor Training Stage.

time. The S's task consisted of telling E, after examining each card, which path he thought would be easiest to complete on the HCD. After each of S's choices, E showed S the correct answer (i.e., curve, diagonal, or straight) which was printed on the back of each card. After S completed his series of judgments about the paths, he was praised for his performance.

Criterion task.

After completing their training, all Ss were required to complete the maze using the HCD. The S was told to complete the maze as quickly as possible, with as few errors as possible. The S was told that at each choice point he should select the path which he thought would be easiest to complete. The E emphasized that speed and accuracy were equally important (See Appendix A for verbatim instructions).

Subjects.

Fifteen undergraduate students were assigned randomly to each of the six experimental groups and to the control group.

Design.

The basic experimental design involved comparisons of 3 general training procedures: perceptual-motor, cognitive, and a combination of these two. However, a question arises concerning the ease with which preferences for diagonals and curves may be induced. It is possible that Ss would have an intrinsic bias to favor one or the other. To control for such a bias, the final experimental design was counterbalanced with respect to the different paths. The Ss in the first two experimental groups (E_1 & E_2) received both perceptual-motor and cognitive training designed to induce a preference for diagonals and curves, respectively. The Ss in the third and fourth experimental groups (E_3 & E_4) received perceptual-motor training alone, designed to induce a preference for diagonals and curves, respectively. And, Ss in the fifth & sixth experimental (E_5 & E_6) received cognitive training alone, designed to induce a preference for curves and diagonals, respectively. Finally, a group of Ss which received no training (C) was employed to provide a criterion group against which all variations of training would be evaluated. Table 2 summarizes the design.

Table 2

Training Procedures Employed to Induce Path Preferences in Seven Groups of Subjects (N = 15 Ss/Group), in Experiment I.

	Groups						
Training	E_1	E_2	E_3	E_4	E_5	E_6	C
Perceptual Motor	D	C	D	C	--	--	--
Cognitive	D	C	_	_	C	D	_

Perceptual-Motor D - training on the diagonal practice path
Perceptual-Motor C - " " " curve " "
Cognitive D - Training in which the diagonals are the "correct" choices
Cognitive C - training in which the curves are the "correct" choices

The six experimental groups were used to study the effect of the two types of perceptual-motor, the two types of cognitive training, and the two combinations of perceptual-motor and cognitive training. If cognitive training is more effective than perceptual-motor training in influencing strategic choices, one would expect: 1) Ss in E_5 to prefer curves more often than Ss in E_4, and 2) Ss in E_6 to prefer diagonals more often than Ss in E_3. Or, if the combination of perceptual-motor and cognitive training is more effective than either type of training alone, one would expect Ss in E_1 & E_2 to prefer diagonals and curves, respectively, more often than: 1) Ss in E_3 & E_4 respectively, and 2) Ss in E_6 & E_5, respectively.

In short, by employing the six experimental groups and a control group, it is possible to: 1) compare the effects of the cognitive and perceptual-motor training procedures, and 2) determine which training procedure most effectively influences strategic choices (i.e., path preferences).

Dependent Variables.

While each S completed the criterion task using the HCD, the following dependent variable measures were taken:

1) Path Preference - measured by the frequency with which S chose each type of path (i.e., curve, diagonal, or straight) in the maze.

Table 3

Experiment I: Mean Frequency of Path Choices, Mean Time (in seconds), and Mean Number of Errors Made by 105 Ss While Completing the Experimental Maze on the HCD.

	Group						
	E_1	E_2	E_3	E_4	E_5	E_6	C
Curve Choices	0.27	1.80	0.40	0.67	1.93	0.07	0.20
Diagonal Choices	2.27	0.33	00.80	0.67	0.40	2.47	1.07
Straight Choices	0.47	0.87	1.80	1.67	0.67	0.47	1.73
Speed	86.87	73.07	87.93	99.47	100.07	133.38	97.47
Accuracy	15.40	12.07	17.20	15.60	13.87	20.30	12.46

2) <u>Speed</u> - measured by the amount of time required by <u>S</u> to complete the maze on the HCD.

3) <u>Accuracy</u> - measured by the number of errors made by <u>S</u> while completing the maze on the HCD. Here, an error was defined as touching or crossing a path boundary with the HCD pen stylus.

Results

The general results of the various training techniques are shown in Table 3, which compares <u>Ss</u> on path preferences, and speed and accuracy of performance on the HCD. One-Way Analyses of Variance indicated that the seven treatment groups of <u>Ss</u> differed significantly on each of the above three dependent variables.

<u>Path Preference.</u>

The path preferences of the seven groups of <u>Ss</u> differed significantly ($F^{6}_{98} = 24.32$, $p < .005$) (See Table 4).

Table 4

Summary of Analysis of Variance of the Frequencies with Which the Ss (N = 105) Chose Diagonal Paths on the Maze

Source	df	SS	MS	F
Treatments	6	68.59	11.43	24.32 $p < .005$
K 1	1	28.03	28.03	59.64 $p < .005$
K 2	1	0.01	0.01	0.02 n.s.
K 3	1	32.03	32.03	68.15 $p < .005$
Error	98	46.27	0.47	
Total	104	114.86		

K 1 = Comparison between E_1 & E_2
K 2 = Comparison between E_3 & E_4
K 3 = Comparison between E_5 & E_6

The data indicate that cognitive training alone was the most effective procedure in influencing Ss' path preferences. That is, training appears to influence path preferences in groups receiving either cognitive training (E_5 & E_6) or the combination of cognitive and perceptual-motor training (E_1 & E_2). However, because there is no significant effect for perceptual-motor training alone (E_3 & E_4), the effects of the combination of cognitive and perceptual-motor training are due to cognitive training.

Comparisons between the training methods indicated that cognitive training alone (E_5 & E_6) produced the highest significant differences in path preferences ($F^1_{98} = 68.15$, $p < .005$), in contrast to the combination of perceptual-motor and cognitive training (E_1, E_2) and perceptual-motor training alone (E_3, E_4) (See Table 4).

Speed.

The seven groups of Ss differed significantly ($F^6_{98} = 3.65$, $p < .005$) on the speed (in seconds) with which they completed the maze on the HCD (See Table 5). The data show that Ss who received the combination of cognitive and perceptual-motor training on diagonals and curves, respectively, required the least amount of time to complete the maze. However, a Least Significance Difference Analysis (LSD = 27.64, $t_{.05}$) indicated that only one group of Ss differed significantly from the other

Table 5

Summary of the Analysis of Variance of the Time, in Seconds, Required by the Ss (N = 105) to Complete the Maze on the HCD, in Experiment I.

Source	df	SS	MS	F
Treatments	6	31914.40	5319.07	3.65 $p < .005$
Error	98	142800.40	1457.15	
Total	104	174714.80		

Six groups: Ss trained cognitively to prefer diagonals (E_6) required significantly more time ($\bar{X}$ = 133.38) to complete the maze than any other group.

Accuracy.

The seven groups of Ss differed significantly ($F^{6}_{98} = 2.83$, $p < .025$) in the number of errors they made while completing the maze on the HCD (See Table 6).

Table 6

Summary of the Analysis of Variance of the Errors Made by the Ss (N = 105) While Completing the Experimental Maze on the HCD.

Source	df	SS	MS	F
Treatments	6	743.66	123.94	2.83 $p < .025$
Error	98	4291.33	43.79	
Total	104	5034.99		

The data show that Ss who received the combination of cognitive and perceptual-motor training (E_1, E_2) made fewer errors than Ss who received perceptual-motor training alone (E_3, E_4), and cognitive training alone (E_5, E_6). However, a Least Significant Difference Analysis (LSD = 4.79, $t_{.05}$) indicated that: 1) Ss trained by both methods (E_1, E_2) made significantly fewer errors only with respect to Ss trained cognitively to prefer diagonals (E_6), and 2) Ss trained by both methods to prefer curves (E_2) made significantly fewer errors than Ss who received perceptual-motor training alone to prefer diagonals (E_3).

Discussion

The results of Experiment I indicate that cognitive training was the most effective method of influencing strategic decisions. This finding is true for both curves and diagonals.

The most direct explanation for the effectiveness of the cognitive training procedure concerns Ss' familiarity with the criterion task. The Ss in the cognitive training groups have no opportunity to actually use the apparatus during training. Instead, they must rely on what E tells them (i.e., whether Ss' choices were "correct" or "incorrect" during cognitive training). In contrast, Ss who received perceptual-motor training were given an opportunity to practice on the HCD; the latter Ss may have relied more on their own judgments because of their familiarity with the HCD.

Although the differences in performance efficiency between the seven treatment groups of Ss were generally not significant, they do suggest that the combination of perceptual-motor and cognitive training was the most effective procedure to maximize Ss' performance efficiency on the HCD.

In summary, the results of Experiment I indicate that: 1) cognitive training is more effective in influencing strategic decisions than is: a) perceptual-motor training, and b) the combination of perceptual-motor and cognitive training, and 2) the combination of perceptual-motor and cognitive training leads to the highest efficiency of subsequent perceptual-motor performance on the HCD.

EXPERIMENT II: COGNITIVE CONFLICT IN 2-PERSON TEAMS

The Problem.

The purpose of this experiment was: 1) to investigate the ways in which cognitive differences influence decision making in 2-person teams, and 2) to determine how conflict-inducing prior experience influences the efficiency of a cooperative perceptual-motor performance.

Design.

To investigate the effects of cognitive differences upon decision making and subsequent joint perceptual-motor performances, three groups of 2-person teams were tested on the same maze and apparatus described in Experiment I:

1) Group E_1 - same-training teams in which both Ss were trained cognitively to prefer diagonals.

2) Group E_2 - discrepant-training teams in which S 1 was trained cognitively to prefer diagonals; whereas his partner, S 2 was trained cognitively to prefer curves.

3) Group C - a control group in which Ss received no training.

The 3 treatment groups were compared according to the following measures of decision conflict and performance efficiency:

Decision Conflict - measured by:

1) Path Preference Discrepancy - the individual Ss' private path preference prior to the team discussion. Each S was presented with the maze and was asked to indicate which paths he would choose if he were to complete the maze using the HCD. Path preference was indicated by the number of S's diagonal choices, since this was the only path that appeared once at each choice point.

2) Team Discussion Time - the amount of time required by each team to reach strategic agreement about which path to follow in the maze.

3) Verbal Disagreement - the number of statements of disagreement made by the team members during their discussion at each choice point.

Performance Efficiency - measured by:

1) Speed - the amount of time required by each team to complete the maze on the HCD.

2) Accuracy - the number of errors made by each team while completing the maze on the HCD. Here, an error is defined as touching or crossing a path boundary with the HCD pen stylus.

Hypotheses.

The following exploratory hypotheses were tested:

1) Discrepant-training teams (E_2) will have more decision conflicts than same-training teams (E_1).

2) Decision conflict in discrepant-training teams (E_2) will be greatest at maze Choice Point #1.

The two hypotheses were based on the findings of previous research which indicated that: 1) cooperating persons with discrepant prior experience have difficulty in making joint decisions, and 2) disagreements between these persons is greatest during the initial portion of their joint task, but tapers off as learning occurs on subsequent trials.

Procedure.

Twelve Ss were randomly assigned to each of the experimental groups (E_1, E_2) and to the control group (C). Each S was instructed individually about the operation of the HCD. (See Appendix B for verbatim instructions). Prior experience was manipulated during the Cognitive Training Stage (See pp. 12 & 16, and Appendix B for description and verbatim instructions, respectively). For example, Ss in E_1 received individual cognitive training showing diagonals to be the easiest paths (i.e., diagonals were the "correct" choices). In contrast, E_2 teams consisted of one S who was trained to believe that diagonals were easy and his partner who was trained to believe that curves were easy. The six teams in the control group (C) received no cognitive training.

After completing the cognitive training, each S was presented individually with the maze and was asked to indicate the paths he would follow if he were to complete the maze using the HCD. Thus, a record of his personal choices of different paths was obtained. After indicating his private path choices, S 1 was asked to leave the experimental room temporarily. Then, S 2 was asked to enter the room and was given the same instructions and tasks as S 1. After indicating his private path choices, S 2 remained in the room while E called in S 1.

The E introduced S 1 and S 2 to each other and told them that they would both participate in this latter portion of the experiment. The Ss were asked to perform as a team to complete the maze on the HCD. That is, each S controlled one crank on the HCD. The E emphasized that speed and accuracy were equally important. Ss were told that they were under no obligation to choose a particular kind of path. The E explained that at the junctions before each choice point, Ss were to stop and reach a decision about which path to follow at that choice point. The Ss were given as much time as they wished, at each choice point, to arrive at a joint decision. They were told that only actual running time (i.e., time during which Ss were operating the HCD) counted. The Ss were also informed that their conversations would be tape recorded.

Results

The general results of Experiment II are shown in Table 7, which compares the teams on measures of decision conflict (i.e., path preference, team discussion time, and verbal disagreement), and performance efficiency (i.e., speed and accuracy). One-Way Analyses of Variance indicated that the three groups of Ss differed significantly on each of the measures of decision conflict, but not on the measures of performance efficiency.

Table 7

Experiment II: Decision Conflicts (Path Preference, Team Discussion Time, and Verbal Statements of Disagreement) and Performance Efficiency (Time and Errors) of Eighteen 2-Person Teams Completing the Maze on the HCD

Measures	Group Means		
	E 1	E 2	C
Decision Conflict:			
Path Preference for:			
Diagonal	2.75	1.58	0.92
Curve	0.25	1.00	0.42
Straight	0.00	0.42	1.67
Team Discussion Time (in secs.)	47.00	118.00	31.33
Verbal Statements of Disagreement	2.83	9.00	0.50
Efficiency of Performance:			
Speed (in secs.)	82.17	64.67	75.83
Accuracy (in errors)	11.83	12.17	10.00

Decision Conflict:

1) Path Preference - Table 7 presents the mean frequency of individual Ss' path preferences prior to the team discussion. The same-training Ss chose diagonals more often ($\bar{X}$ = 2.75) than discrepant-training Ss ($\bar{X}$ = 1.58) and control Ss ($\bar{X}$ = 0.92). A One-Way Analysis of Variance indicated that Ss in the three treatment groups differed significantly in their mean number of diagonal choices (F^{2}_{33} = 10.66, $p < .005$) (See Table 8).

Table 8

Experiment II: Perceptual-Motor Implementation Stage

Summary of Analysis of Variance of 36 Ss' Path Preferences Prior to the Team Discussion

Source	df	SS	MS	F
Treatments	2	20.67	10.34	10.66 $p < .005$
K 1	1	8.16	8.16	8.41 $p < .01$
K 2	1	12.50	12.50	12.89 $p < .005$
Error	33	32.08	0.97	
Total	35	52.75		

K 1 = Comparison between E_1 & E_2
K 2 = Comparison between $\frac{E_1 + E_2}{2}$ vs. C

Figure 6 presents a longitudinal view of diagonal choices at each maze choice point made by individual Ss prior to the team discussion.

It can be seen here that differences in diagonal choices between the three treatment groups are greatest at Choice Point #1. One-Way Analyses of Variance across choice points showed that Private Path Preferences differed significantly at Choice Point #1 (F^2_{33} = 6.93, $p < .005$), and #2 (F^2_{33} = 21.08, $p < .005$), but not at Choice Point #3 (See Tables 9 & 10).

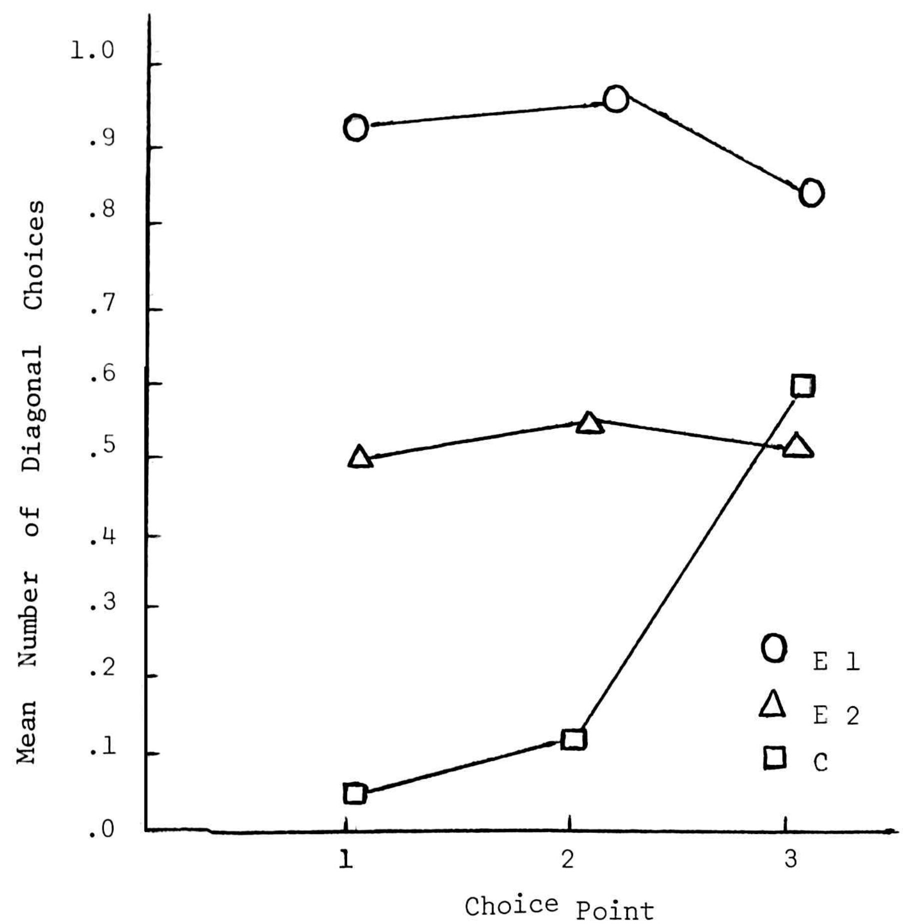

Fig. 6. Mean number of diagonal choices made at each choice point, by 36 Ss prior to the team performance.

Table 9

Summary of the Analysis of Variance of Private Path Preferences (of Diagonals), at Choice Point #1, of 36 Subjects Prior to the Team Discussion, in Experiment II.

Source	d.f.	SS	MS	F
Treatments	2	4.17	2.06	13.73** $p < .005$
K 1	1	1.04	1.04	6.93** $p < .025$
Error	33	4.83	0.15	
Total	35	9.00		

K 1 = Comparison between E_1 & E_2

Table 10

Summary of the Analysis of Variance of Path Preferences (of Diagonals), at Choice Point #2, of 36 Subjects Prior to the Team Discussion, in Experiment II.

Source	d.f.	SS	MS	F
Treatments	2	5.06	2.53	21.08** $p < .005$
K 1	1	1.04	1.04	8.67** $p < .01$
Error	33	3.83	0.12	
Total	35	8.89		

K 1 = Comparison between E_1 & E_2

Comparisons of the three treatment groups indicated that same-training Ss (E_1) chose diagonals significantly more than discrepant-training Ss (E_2) at Choice Points #1 & #2, but not at Choice Point #3 (See Tables 9 & 10).

2) Team Discussion Time - Table 7 presents the mean time required by the 18 teams to reach strategic agreement about which path to follow in the maze. Discrepant-training teams (E_2) required more time ($\bar{X}$ = 118.00 secs.) to agree than same-training teams (E_1) ($\bar{X}$ = 47.00 secs.). No-training Teams (C) required the least amount of time ($\bar{X}$ = 31.33 secs.) to reach agreement. A One-Way Analysis of Variance indicated that the differences between these three mean discussion times were significant ($F^{2}_{15} = 6.78$, $p < .01$) (See Table 11).

Table 11

Summary of the Analysis of Variance of the Time Required by 18 Teams to Reach Strategic Agreement about which Path to Follow in the Maze, in Experiment II.

Source	df	SS	MS	F
Treatments	2	25595.12	12797.56	6.78 $p < .01$
K 1	1	15123.00	15123.00	8.01 $p < .025$
K 2	1	10472.11	10472.11	5.55 $p < .05$
Error	15	28307.33	1887.16	
Total	17	53902.45		

K 1 = Comparison between E_1 & E_2
K 2 = Comparison between $\frac{E_1 + E_2}{2}$ vs. C

Comparisons indicated that: 1) discrepant-training teams (E_2) required significantly more time to reach agreements than same-training teams (E_1), and 2) when the discussion times of these two treatment groups are combined and averaged, they are significantly higher than those of the no-training group (C) (See Table 11).

Table 12 permits a longitudinal view of the Team Discussion Times. It can be seen here that differences between the three treatment groups are greatest at Choice Point #1. Discrepant-training teams (E_2) required the most time to agree at each choice point. No-training teams (C) required the least time to agree at each choice point.

Table 12

Mean Team Discussion Time (in secs.) and Mean Statements of Disagreement of Eighteen 2-Person Teams at Each Maze Choice Point on the HCD, in Experiment II.

	Discussion Time/Choice Point			Statements of Disagreement/Choice Point		
Group	1	2	3	1	2	3
E 1	23.33	8.83	14.83	1.33	0.17	1.33
E 2	70.83	26.33	20.83	6.50	2.00	0.50
C	12.17	8.00	11.17	0.33	0.00	0.17

A One-Way Analysis of Variance of the mean discussion times at each choice point indicated that: 1) the 3 groups of teams differed significantly at Choice Point #1 (F^{2}_{15} = 5.20, p .05), but not at Choice Points #2 or #3 (See Tables 13, 14, & 15).

Table 13

Summary of the Analysis of Variance of the Time Required by 18 Teams to Reach Strategic Agreement about which Path to Follow at Maze Choice Point #1, in Experiment II.

Source	df	SS	MS	F
Treatments	2	11645.45	5822.73	5.20 p .05
K 1	1	6768.75	6768.75	6.05 p .05
K 2	1	11271.36	11271.36	10.07 p .01
Error	15	16791.00	1119.40	
Total	17	28436.45		

K 1 = Comparison between E_1 & E_2
K 2 = Comparison between $\frac{E_1 + C}{2}$ vs. E_2

Table 14

Summary of the Analysis of Variance of the Time Required by 18 Teams to Reach Strategic Agreement about which Path to Follow at Maze Choice Point #2, in Experiment II.

Source	df	SS	MS	F
Treatments	2	1286.11	643.06	3.69 $p < .10$
K 1	1	918.75	918.75	5.27 $p < .05$
K 2	1	1284.03	1284.03	7.36 $p < .025$
Error	15	2616.17	174.41	
Total	17	3902.28		

K 1 = Comparison between E_1 & E_2
K 2 - Comparison between $\frac{E_1 + C}{2}$ vs. E_2

Table 15

Summary of the Analysis of Variance of the Time Required by 18 Teams to Reach Strategic Agreement about which Path To Follow at Maze Choice Point #3, in Experiment II.

Source	df	SS	MS	F
Treatments	2	285.28	142.64	0.97 n.s.
K 1	1	108.00	108.00	0.73 n.s.
K 2	1	4578.78	4578.78	31.15 $p < .005$
Error	15	2205.00	147.00	
Total	17	2490.28		

K 1 = Comparison between E_1 & E_2
K 2 = Comparison between $\frac{E_1 + C}{2}$ vs. E_2

Comparisons of the mean discussion times, at each choice point, indicate that discrepant-training teams (E_2) required significantly more time to reach agreement than same-training teams (E_1) at Choice Point #1 ($F^1_{15} = 6.05$, $p < .05$) and Choice Point #2 ($F^1_{15} = 5.27$, $p < .05$), but not at Choice Point #3 (See Tables 13, 14 & 15). And, when the discussion times of the same-training teams (E_1) and the discrepant-training teams (E_2) were combined and averaged, at each choice point, they were significantly greater than those of the no-training teams (C) at all three choice points (See Tables 13, 14 & 15).

3) Verbal Disagreement - Table 16 presents the mean number of statements of disagreement made by the 3 groups of teams during their discussions. In general, discrepant-training teams (E_2) disagreed more ($\bar{X} = 9.0$) than same-training teams (E_1) ($X = 2.8$). The no-training teams (C) showed the least amount of disagreement ($\bar{X} = 0.50$). Analysis of Variance demonstrates that these differences are significant ($F^2_{15} = 23.39$, $p < .005$) See Table 16).

Comparisons indicated that: 1) same-training teams (E_1) disagreed significantly less than discrepant-training teams (E_2), and 2) when the number of disagreement statements of E_1 and E_2 are combined and averaged, they are significantly larger than those of the no-training teams (C) (See Table 16).

Table 16

Summary of the Analysis of Variance of the Number of Statements of Disagreement Made by 18 Teams During Their Discussion about which Path to Follow in the Maze, in Experiment II.

Source	df	SS	MS	F
Treatments	2	231.54	115.77	23.39 $p < .005$
K 1	1	114.08	114.08	23.05 $p < .005$
K 2	1	215.11	215.11	43.46 $p < .005$
Error	15	74.23	4.95	
Total	17	305.78	17.99	

K 1 = Comparison Between E_1 & E_2
K 2 = Comparison Between $\frac{E_1 + C}{2}$ vs. E_2

Table 12 presents a longitudinal view of the Disagreement Statements at each choice point. Here it can be seen that disagreement was highest at Choice Point #1. Comparisons of Disagreement Statements, at each choice point, indicated that: when the number of Disagreement Statements of same-training teams (E_1) and discrepant-training teams (E_2) are combined and averaged, they are significantly more than those of the no-training teams (C) (See Table 17).

Performance Efficiency:

Results obtained for performance efficiency (i.e., measures of speed and accuracy), in the three treatment groups, indicated

Table 17

Comparisons of the Mean Number of Statements of Disagreement Made by 18 Teams During Their Discussions at Each Choice Point, in Experiment II.

Choice Point	Comparison	df	SS	MS	F
1	K 1	1	80.08	80.08	16.18 $p < .005$
	K 2	1	106.78	106.78	21.57 $p < .005$
2	K 1	1	10.08	10.08	2.04 n.s.
	K 2	1	14.69	14.69	2.97 n.s.
3	K 1	1	2.08	2.08	0.42 n.s.
	K 2	1	0.25	0.25	0.005 n.s.

K 1 = Comparison between E_1 & E_2
K 2 = Comparison between $\frac{E_1 + C}{2}$ vs. E_2

that there were no significant differences between the groups with respect to either speed or accuracy (See Appendix C). Analyses of Variance were computed on the speed and accuracy data separately for each choice point, and no significant differences were found between the three treatment groups at any of the choice points (See Appendix D).

Discussion

The results of this study provide clear-cut evidence that cognitive training consisting of discrepant prior experience can produce cognitive differences which generate conflict between cooperating persons.

The data support the hypothesis that discrepant-training teams (E_2)will have more decision conflicts than same- training teams (E_1). On all measures of decision conflict (i.e., Private Path Preference, Team Discussion Time, and Disagreement Statements) discrepant-training teams (E_2) showed significantly more conflict than same-training teams (E_1). It can be inferred from these results that the cognitive basis for strategic disagreement was effectively manipulated.

The data also support the hypothesis that decision conflict in discrepant-training teams (E_2) will be greatest at Choice Point #1. These results may be explained by the fact that Choice Point #1 represents the first time that each team member has the opportunity to realize that his partner wants to adopt a strategy different from his. In most cases, S initially resisted capitulating to his partner's proposed strategy. Then, both Ss exchanged their reasons for proposing their respective strategies and compromised on testing one of the strategies at Choice Point #1. Typically, there appeared to be an implicit (and frequently explicit) understanding between Ss that if S 1's strategy failed at Choice Point #1, S 2's strategy would be implemented at Choice Point #2. (See Appendix E for an illustrative transcript of a team discussion).

The decision conflict findings are parallel to those reported by Hammond and his associates who worked with purely conceptual tasks such as probability learning. That is, Ss with discrepant prior experiences disagree when they are required to make joint decisions. Their disagreements are greatest during the initial portion of their joint task, but taper off as learning occurs on subsequent trials. Moreover, the earlier studies measure conflict in terms of the degree to which Ss make different private judgments of a continuous variable. In the present study, Ss make private judgments that are discrete but discussion time and disagreement statements are taken as additional conflict measures. The latter measures provide results congruent with the judgment measure, and should be useful in future research.

In the present study, the team decision conflicts may have decreased at Choice Points #2 & #3 because Ss, at Choice Point #1, had already agreed to implement an alternative strategy in the event that the initial one failed. Thus, by the time Ss reached Choice Point #3, they had previously had the opportunity to test two strategies. Since the number of untested strategies typically decreased after the completion of each choice point, the possibilities for strategic conflict also decreased. Hence, it was expected that decision conflict would decrease after the completion of Choice Point #1.

Cognitive Differences & Performance Efficiency.

Turning to the second aim of the experiment, there were no significant effects of conflict over joint decisions upon subsequent perceptual-motor performances required to implement those decisions. Apparently, cognitive training did not influence subsequent perceptual-motor performance. That is, there were no significant differences between the three treatment groups with respect to either speed or accuracy of performance at any of the three choice points.

It can be noted, however, that some of the data in Table 18 suggest a link between cognitive conflict and performance. The discrepant training teams had the highest conflict at Choice Point #1, and they had the highest error score at that choice point. Thus, the data here are not entirely negative, and it should be kept in mind that the analyses are based on a relatively small number of teams.

Although it is possible that there may be no significant relationship between cognitive differences and performance efficiency of cooperating persons, it is also likely that: no significant relationship between cognitive differences and performance efficiency was found in this experiment because our measures of performance efficiency were inadequate. Additional possibilities include the fact that: 1) cognitive differences

Table 18

Mean Speed (Running Time in Seconds) and Accuracy (in Number of Errors) with Which Eighteen 2-Person Teams Completed Each Maze Choice Point on the Apparatus, in Experiment II.

		Group Means		
		Choice Point		
Performance Efficiency		1	2	3
Speed:				
	E_1	39.50	23.67	19.00
	E_2	26.33	20.67	17.67
	C	32.00	19.17	24.67
Accuracy:				
	E_1	3.67	3.00	5.00
	E_2	5.33	2.17	4.67
	C	3.17	1.67	5.17

between team members were not large enough to influence joint perceptual-motor performances, and 2) differences were resolved before performance began. In general, more research is needed before any conclusions may be made about the influence of conflict-inducing prior experience upon team perceptual-motor performance.

General Conclusions.

The general findings of Experiments I & II confirm the anecdotal reports and earlier experimental evidence that discrepant prior experience is a critical factor affecting decision making of cooperating persons. Moreover, the results of Experiment II indicate clearly that discrepant prior experience can provoke serious disagreements between cooperating Ss. (See Appendix E for a transcript of a team discussion).

Although other studies have demonstrated that the cognitive conflict paradigm may be applied to realistic situations (e.g., foreign policy decisions and integration problems), decision implementation within this paradigm has remained a relatively unexplored area. Thus, the major accomplishment of this research is the demonstration that the paradigm can be extended to a realistic situation in which persons must: 1) first agree on a series of strategic decisions, and then 2) coordinate their perceptual-motor activity to implement these decisions.

Summary

The cognitive conflict paradigm described by Hammond (1966) has heretofore only been demonstrated with purely cognitive, uncertain tasks. This study extends the paradigm to a realistic situation in which persons must: 1) first agree on a series of strategic decisions, and then, 2) coordinate their perceptual-motor activity to implement these decisions.

The purpose of the present study is threefold: 1) to determine the types of perceptual-motor training and cognitive experience which will effectively influence cognitive (strategic) decisions, 2) to investigate the ways in which cognitive differences influence decision making, and 3) to determine how conflicts over strategy decisions influence the efficiency of subsequent perceptual-motor performances.

The overall research plan is divided into two experiments. The purpose of the first experiment is to determine the types of perceptual-motor training and cognitive experience which will effectively influence cognitive (strategic) decisions. The purpose of the second experiment is: 1) to investigate the ways in which cognitive differences influence team decision making, and 2) to determine how conflict-inducing prior experience influences the efficiency of subsequent team perceptual-motor performances.

The following exploratory hypotheses were tested and confirmed: 1) 2-person teams with discrepant cognitive training will have more decision conflicts than teams with the same cognitive training, 2) decision conflicts in discrepant-training teams will be greatest at maze Choice Point #1.

Earlier findings are supported in this more realistic, mixed cognitive perceptual-motor situation. Discrepant prior experiences made it relatively difficult for cooperating persons to reach joint decisions. Conflict over joint decision making, however, does not appear to influence subsequent joint perceptual-motor performances.

APPENDIX A

Experiment I Instructions

The experiment in which you will participate involves performance on a test of motor skill. You will be using this apparatus --- the Hand Coordination Device (HCD). The HCD is basically a system of chains and gears which control the movement of that pen on the display board. These two hand cranks control the movement of the pen stylus. The crank on the right controls the vertical movement of the stylus. The crank on the left controls the horizontal movement of the stylus. By properly turning these cranks, you can draw any slope or slant of line. Let me show you. (E demonstrates the operation of the HCD).

Now that you have some familiarity with the operation of the HCD, we can start the first part of the experiment. (E attaches the practice path sheet on the HCD display board). You will now have a chance to practice using the HCD by completing this path. The object is to go from start to finish in as short amount of time as possible, with as few errors as possible. Here, an error is defined as touching or crossing a path boundary. Please remember that speed and accuracy are equally important. Do you understand the instructions? Do you have any questions?

O.K. You may begin when I say "start". (S completes the practice path). You did very well. With a little more practice, this task would be very easy to complete.

Now that you have some idea as to how the HCD operates, we can begin the second part of the experiment. I will show you this deck of cards, one card at a time. On each card there are two paths. Your task is to tell me, after examining each card, which path you think is easiest to complete on the HCD. That is, if you had to complete one of the two alternatives on the HCD, which one do you think you could complete most quickly, with as few errors as possible. In other words, speed and accuracy are equally important. After each of your choices I will turn the card over so that you can see the correct answer. This answer is based on the results of a study which we conducted during the summer. Also, after you complete this task, I would like you to tell me the optimal strategy. That is, you are to determine which type of path (i.e., curve, diagonal, or straight horizontal/vertical), in general, would be easiest to complete on the HCD. Do you understand the instructions? Do you have any questions? O.K. (The S completes the task).

Now, what is the optimal strategy, the kind of path which you think is easiest, in general, to complete on the HCD? (The S gives his optimal strategy). That's right. The path you chose is generally the best all-around path when time and accuracy are considered equally important. That path does represent the optimal strategy.

Now, I would like you to actually complete a maze on the HCD. (_E_ attaches the experimental maze sheet to the HCD display board). As you can see, this maze has three choice points. At each choice point there are two or three alternative paths. Your task is to complete the maze as quickly as possible, with as few errors as possible. Here, an error is defined as touching or crossing a path boundary. In other words, in order to complete the maze quickly and accurately, you should choose the paths which you think will be easiest to complete. Speed and accuracy are equally important. (You are under no obligation to choose a particular kind of path. Nor do you have to choose the same kind of path at each choice point.) Do you understand the instructions? Do you have any questions? O.K. You may begin when I say "start".

APPENDIX B

Experiment II Instructions

The experiment in which you are about to participate involves performance on a test of motor skill. You will use this apparatus --- the Hand Coordination Device (HCD). The HCD is basically a system of chains and gears which control the movement of that pen on the display board. These two hand cranks control the movement of the pen. The crank on the right controls the vertical movement of the stylus. The crank on the left controls the horizontal movement of the stylus. By properly turning these cranks, you can draw any slope or slant of line. Let me show you. (E demonstrates the operation of the HCD).

Now that you have some familiarity with the operation of the HCD, we can start the first part of the experiment. I will show you this deck of cards, one card at a time. On each card there are two paths. Your task is to tell me, after examining each card, which path you think is easiest to complete on the HCD. That is, if you had to complete one of the two alternatives on the HCD, which one do you think you could complete most quickly, with as few errors as possible. In other words, speed and accuracy are equally important. After each of your choices I will turn the card over so that you can see the correct answer. This answer is based on the results of a study which we conducted during the summer. Also, after you complete this task, I would like you to tell me the optimal strategy. That is, you are to determine which type of path (i.e., curve, diagonal, or straight horizontal/vertical), in general, would be the easiest to complete on the HCD. Do you understand the instructions? O.K. Do you have any questions? O.K. (The S completes the task).

Now, what is the optimal strategy, the kind of path which you think is easiest, in general, to complete on the HCD? (The S gives his optimal strategy). That's right. The path you chose is generally the best all-around path when time and accuracy are considered equally important. That path does represent the optimal strategy.

Now, I would like you to take a look at this. As you can see, this maze has three choice points. At each choice point there are two or three alternative paths. Your task is to indicate which paths you would choose if you were to complete this maze on the apparatus, as quickly as possible with as few errors as possible. Here, an error is defined as touching or crossing a path boundary. In other words, in order to complete the maze quickly and accurately, you should choose paths which you think will be easiest to complete. Speed and accuracy are equally important. You are under no obligation to choose a particular kind of path. Nor do you have to choose the same kind of path at each choice point. Do you understand the instructions? Do you have any questions? O.K. (S completes the task). You did very well. Now I would like you to have a seat in the hall. I'll tell you when you may come back into the room for the next part of the experiment. (The S leaves the room).

The second S, who will later become the first S's partner, is given the same instructions and tasks. Upon completing the experimental maze on the HCD, S_2 remains in the room while E calls in S_1.

(E introduces the Ss to each other). You will both be participating in the last part of this experiment. Now that both of you have some idea as to how the HCD operates, I would like you to perform as a team. That is, each of you will control one crank. As a team you will complete the maze as quickly as possible, with as few errors as possible. Speed and accuracy are equally important. As you can see, there are three choice points. At each choice point there are two or three alternative paths. You are under no obligation to choose a particular kind of path. Nor do you have to choose the same kind of path at each choice point. Notice the box-like junctions immediately before each choice point. These junctions represent time that has been alloted to you, as a team, to reach an agreement about which path alternative you will choose at that particular choice point. Since you are not penalized for the time you need to reach the decision, may I suggest that you talk this matter over carefully. I am going to record your conversation. After the experiment, I'll explain the reasons for recording the conversation and what we plan to do with it.

Do you understand the instructions? Do you have any questions? O.K. You may begin when I say "start." (The Ss complete the task). You both did very well as a team.

APPENDIX C

Summary of the Analysis of Variance of the Time Required by Eighteen 2-Person Teams to Complete the Experimental Maze on the HCD, in Experiment II.

Source	df	SS	MS	F
Treatments	2	942.12	473.06	.749 n.s.
Error	15	9463.00	630.87	
Total	17	10405.12		

Summary of the Analysis of Variance of the Errors Made by Eighteen 2-Person Teams While Completing the Experimental Maze on the HCD, in Experiment II.

Source	df	SS	MS	F
Treatments	2	16.33	8.17	.237 n.s.
Error	15	517.67	34.51	
Total	17	534.00		

APPENDIX D

Summary of the Analysis of Variance of the Errors Made by 3 Groups of 2-Person Teams at Maze Choice Point #1, in Experiment II.

Source	df	SS	MS	F
Treatments	2	15.44	7.72	1.58 n.s.
Error	15	73.50	4.90	
Total	17	88.94		

Summary of the Analysis of Variance of the Errors Made by 3 Groups of 2-Person Teams at Maze Choice Point #2, in Experiment II.

Source	df	SS	MS	F
Treatments	2	5.44	2.72	0.78 n.s.
Error	15	52.17	3.48	
Total	17	57.61		

Summary of the Analysis of Variance of the Errors Made by 3 Groups of 2-Person Teams at Maze Choice Point #3, in Experiment II

Source	df	SS	MS	F
Treatments	2	0.72	0.39	0.03 n.s.
Error	15	182.17	12.14	
Total	17	182.94		

Summary of the Analysis of Variance of the Speed with which 3 Groups of 2-Person Teams Completed Maze Choice Point #1, in Experiment II.

Source	df	SS	MS	F
Treatments	2	523.45	261.73	1.43 n.s.
Error	15	2744.83	182.99	
Total	17			

Summary of the Analysis of Variance of the Speed with which 3 Groups of 2-Person Teams Completed Maze Choice Point #2, in Experiment II.

Source	df	SS	MS	F
Treatments	2	63.00	31.50	0.32 n.s.
Error	15	1481.50	98.77	
Total	17	1544.50		

Summary of the Analysis of Variance of the Speed with which 3 Groups of 2-Persons Teams Completed Maze Choice Point #3, in Experiment II.

Source	df	SS	MS	F
Treatments	2	165.77	82.89	1.73 n.s.
Error	15	720.67	48.04	
Total	17	886.44		

APPENDIX E

Experiment II: Perceptual-Motor Implementation Stage

Discussion of an E_2 team (#1) at Choice Point #1

S_1 "We'll take the triangle on the left. OK?"

S_2 "Well, I actually think the circle would be better. I think the movement would be pretty hard to get, especially with two of us working together. I'd say either the circle or the rectangle."

S_1 "No. Your triangle is better. If we go around the circle, it will be harder to stay inside the lines. You're going more on a straight line with the triangle on the left, and you're going too far out of your way if you take the rectangle on the right."

S_2 "True, it would take longer with the rectangle, as far as time is concerned, but, you would be exact with it, and there would be less chance of mistakes. Whereas, on the triangle, both of us will have to work together."

S_1 "You mean if we go to the right, then we can operate one at a time."

S_2 "Right. That way, you can go to the side as fast as you want to, and I can go up as fast as I want to.

S_1 "Well, if we go at the same rate, it should go right up there."

COGNITIVE CONFLICT IN 2-PERSON TEAMS

by

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The cognitive conflict paradigm described by Hammond (1965) has heretofore only been demonstrated with purely cognitive, uncertain tasks. This study extends the paradigm to a realistic situation in which Ss must first agree on a strategic decision and then coordinate their perceptual-motor activity to implement this decision.

The overall research plan involves two experiments. The purpose of the first experiment is to determine whether prior experience can be manipulated such that Ss will disagree on a cognitive, perceptual-motor task. The purpose of the second experiment is: 1) to investigate the ways in which cognitive differences influence decision making, and 2) to determine how conflicts over strategy decisions influence the efficiency of subsequent perceptual-motor performances.

To carry out Experiment I it was necessary to construct a two stage task. Such a task was required in order to administer various types of training and then observe the effects of training on a criterion task. The basic task was a three choice point maze leading to a single goal. Each choice involved curve, diagonal, and straight paths of different lengths. Ss were required to complete the maze by using a 2-channel control system. In this system, two hand cranks control, respectively, the horizontal and vertical movements of a stylus through the maze. With this control system it is easy to move the stylus along a straight path, but more difficult to move it along a curve or diagonal path.

Experiment I was designed to: 1) compare the effects of two types of perceptual-motor training, two types of cognitive training, and two combinations of cognitive and perceptual-motor training, and 2) determine which training procedure most effectively influence strategic choices.

The results of Experiment I indicate that: 1) cognitive training is more effective in influencing S's strategic decisions than is: a) perceptual-motor training, and b) the combination of perceptual-motor and cognitive training, and 2) the combination of perceptual-motor and cognitive training tends to increase the efficiency of Ss' subsequent perceptual-motor performance.

Using the same task and apparatus described in Experiment I, the second experiment was designed to compare 3 groups of 2-person teams. Six teams in each group were required to complete the maze by using the apparatus. Prior to the team run with one S on each crank, Ss in the same-training group all received individual cognitive training showing diagonals to be the easiest paths. In the discrepant-training teams, one S learned that diagonals were easy and his partner learned that curves were easy. Six teams in a control group received no training. By employing the two experimental groups and the control group, it was possible to investigate the ways in which cognitive differences influence team decision-making, and the ways in which conflict-inducing prior experience influences the efficiency of subsequent team perceptual-motor performances.

Decision conflicts were measured by individual Ss' private path preferences prior to the team discussion, team discussion time, and statements of disagreement during discussion. On all three measures, the discrepant-training teams showed significantly more conflict than the same-training teams. There were no significant differences between the groups on speed and accuracy measures.

Earlier findings are supported in this more realistic, mixed cognitive perceptual-motor situation. Discrepant prior experience made it relatively difficult for cooperating persons to reach joint decisions. Conflict over decision making, however, does not appear to influence a subsequent joint perceptual-motor performance.

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