

Chinese and American Differences in Group Performance and Strategies in Problem Solving Groups

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ABSTRACT

Under one of two drive-arousing conditions (luck or skill) manipulated within a laboratory setting, 12 American and 12 Chinese 3-male-student groups were compared in terms of group strategies and group performance outcomes in solving five jigsaw puzzles. Chinese students were assumed to be more group oriented and cohesive than American students because of their different cultural structures. Results showed that support for the hypotheses was found on measures of anticipated strategies used by Chinese vs. American groups ($p < .05$). Chinese groups, as compared to American groups, intended to use more group as opposed to individual orienting strategies. The hypotheses were not confirmed on the actual strategies used and the task outcome measures. Contrary to the hypothesis, groups performed better under the luck condition than the skill condition. Under the luck condition, American groups had better performance outputs than Chinese groups. Several factors that might account for this outcome are discussed.

The study of group dynamics and performance has attracted the attention of social psychologists for several decades. Of particular interest has been the search for factors and principles underlying group performance. Most of these studies have focused on group performances in Western societies. A major purpose of this research is to continue the search for underlying factors and principles of effective group performance by contrasting performances of members of Western

culture with those of an Eastern culture---in this case, the Chinese.

The present study is based on the assumption that within the American culture, group performance is governed more by individual rather than collective activity; the opposite assumption is held for those raised in the Chinese culture. That is, their group performance is based more on group activity than on individual activity. These different characteristics of two groups may be accounted for by cultural differences--that is, the differences in the social systems, philosophy, training, education methods between the two cultures. It appears that in the United States of America, individual differences are emphasized in home, in school, and in society. For example, individual freedom is stressed in the Constitution, as well as in the Bill of Rights. Developing individuals characteristics and accomplishing individual achievement appears to be highly expected and greatly reinforced. In school and society, there are a variety of arrangements and directions that satisfy individual needs, e.g., flexible course requirements and various school activities. However, in China, individual differences seem to be ignored frequently. A person will be rejected by the society if he/she does not accept the main philosophy that was suggested by Confucius and developed later by many other scholars. This philosophy emphasizes some specific role expectations for each person as members of a family, a society, a country, etc. Each person is considered to belong to different kinds of organizations and he/she is expected to have close relationships with other organization members; to share bliss, as well as adversity. Each person is also expected to follow the same moral standards and to have similar value systems. In addition, because of the high population density (in Taiwan and in mainland China), the

Chinese historically have tended to use military-like training in education in order to enhance efficiency. Competitive activities among classes, schools, and organizations are often held in order to improve group performance and the efficiency of group management. Therefore, being brought up in this system, Chinese tend to be more group-oriented, to have higher group cohesiveness and to perceive themselves more as part of a group than do Americans.

Following the assumptions mentioned previously, the present study asks the question: Do Chinese students, as compared to American students, have different group behaviors, such as performance outputs and work-splitting strategies in accomplishing a task? The question is important for both theoretical reasons, e.g., building a comprehensive theory of group performance, and practical reasons, e.g., manufacturers who are considering locating establishments in a variety of countries need to know whether to organize tasks around the group or the individual.

The role of group cohesiveness in the group problem study literature is extensive; and in general, shows that group cohesiveness is related to some behavioral responses. In the social psychological literature, group cohesiveness has been measured in a number of ways. Cartwright (1968) has summarized five indices of group cohesiveness: (1) interpersonal attraction among members, (2) evaluation of a group as a whole, (3) closeness or identification with a group, (4) expressed desire to remain in a group, and (5) composite indexes or a combination of the above.

Since cohesive groups are generally supposed (Husland, 1940; Moreno, 1953) to be better coordinated than non-cohesive groups and to have a greater sense of "we" feeling (group togetherness), it should follow that the more cohesive the group, the greater should be its

productivity. Research on experimental groups as well as operating organization has yielded data on the positive relationship between productivity and group cohesiveness (Horwitz & Cartwright, 1953; Cohen, Whitmyre & Fund, 1960; Pelz & Andrews, 1966). However, these findings are not conclusive, other researchers (Schacter, Ellertson, McBride & Gregory, 1951; Fiedler, 1954; Palmer & Myers, 1968; Stinson, Note 1) have pointed out that the productivity of a group is not necessarily a direct function of cohesiveness. They indicated that a highly cohesive group could have norms encouraging low rather than high rates of productivity.

In an earlier analyses, Stodgill (1959) found that group productivity tends to be related positively to another variable--group drive. Group drive has been defined as a degree of group arousal, motivation, freedom, enthusiasm, or esprit. This group drive has been largely ignored as a dimension of group performance. Most of the research that relates drive to productivity is concerned with work groups in industry and the results indicate that productivity and drive tend to be positively related (Mann, Indik & Vroom, 1963; Pepinsky, Pepinsky & Pavlick, 1956).

Very few theories of group performance or the studies of productivity, group drive and cohesiveness have considered the relationship between these three variables. The research is usually based on any two of these three variables and conducted independently of the third variable (e.g., Shaw & Shaw, 1962; Fiedler, 1967). There are few researchers who have investigated group productivity under different conditions of drive and cohesiveness (Schacter, Ellertson, McBride & Gregory, 1951; Berkowitz, 1954; DeCharms, 1957). Results of the available research do not support the view that high group cohesiveness

necessarily leads to high productivity. It is found, instead, that group drive is the variable most consistently related to productivity. In addition, the relationship between drive and productivity tends to be positive.

This study proposes to investigate how group drive levels influence group strategies, and how the interactions between group drive and group cohesiveness influence group productivity and group strategies. The underlying assumption of the different structures between Chinese and American cultures leads to the concept of different degree of group cohesiveness between these two groups. That is, Chinese, as compared to American Caucasians, perceive and act together more as a group than as individual achievers; in other words, they are more group oriented and more cohesive. Further, it is expected that this pattern will be most apparent under conditions in which drive has not been aroused. That is, Americans will exhibit fewer group behaviors than Chinese, particularly when the task is presented as not being contingent upon hard working. One way of increasing or decreasing the drive is by ascribing luck or skill to the task. That is, instructions of "skill" or "luck" determining "success" or "failure" can be used to manipulate the degree of drive variable in the experiment. Subjects with skill instructions in a group might believe that their performance will depend upon their effort. Therefore, it is assumed that they will increase their motivation and drive, and work as a group to finish a task. Oppositely, subjects with luck instructions will perceive that chance or other forces outside their control would determine their success and therefore they are not going to try as hard to accomplish the task.

This research, then, is intended to partially test the veridicality of these assumptions by comparing the relative presence of group versus individual strategies and behaviors exhibited by groups of Chinese

students and by groups of American students. The specific hypotheses are: (1) Chinese groups, as compared to American Caucasian groups, will use more group as opposed to individual orienting strategies. (2) Chinese groups will have better group outputs than American groups, (3) The pattern described in hypothesis 2 will be accentuated under conditions of decreased drive (luck), (4) Both groups will have better performance outputs under skill condition than the luck condition.

METHOD

Overview

Under conditions of luck or skill, manipulated within a laboratory setting, 3-person groups of Chinese and 3-person groups of American Caucasian students were asked to put puzzles together as quickly as possible. Just prior to starting the experiment, the participants filled out a questionnaire in which they indicated how long they thought it would take to complete the puzzles and what the best strategies were (e.g., working in pairs, three working together) for maximum performance. Following the actual assembling of the puzzles, each participant also filled out a questionnaire in which various demographic characteristics (age, education, living arrangements--with roommate or not, etc.) and general feelings about the experiment were obtained. Measures of group strategy were obtained from the first questionnaire and from analysis of the videotaped interactions. The time it took the group to complete the puzzles was the only measure of actual group performance outcome.

In order to obtain a comparative baseline of individual performance outcome, a number of the participants were called back one month after their participation, and the time it took them to put together the same puzzles was recorded.

Subject

Twenty-four 3-person groups* (72 male students) were selected from the Washington University (St. Louis) student population. One-half of the sample were consisted of Chinese foreign students (from Hong Kong or from Taiwan) and the other half of the sample were consisted of American Caucasian students. Twelve Chinese students and 12 Caucasian students were selected by personal contact and each of them was asked to bring two male friends of his own race to the lab to participate in this study. The purpose of asking 24 students to bring friends with them was to control the degree of familiarity among group members for each group. (Since the Chinese foreign student population was so small, almost all Chinese students knew each other.) Each subject was paid two dollars for his participation.

Prior to participation in the study, the subjects were requested to sign consent forms which secured their permission to videotape the experimental tasks.

Manipulation of experimental conditions

The manipulation of experimental condition was based on the instructions given to the participants. First, the experimenter gave some general instructions for the experiment. "We are trying to investigate the cross-cultural differences between Americans and Chinese in problem-solving behaviors. In the past, many studies have been done, using jigsaw puzzles, to compare puzzle solving behaviors between American children and Chinese children. You can see that jigsaw puzzles are not just a children's game.

* An additional 12 subjects (4 groups) were run but had to be discarded because of equipment failure.

Therefore, this study is going to investigate the differences in puzzle solving between Chinese adults and American adults." Then different instructions were given to each of the two experimental conditions: (1) Skill condition--" In a previous study of children's problem solving behavior, it was found that skill was important in solving jigsaw puzzles. In other words, if you get high scores in this game, you have high puzzle-solving skill." (2) Luck condition--"In a previous study of children's puzzle-solving behavior, it was found that no special skill was needed to solve a jigsaw puzzle. The solution depends upon luck only. If you have good luck, you will solve it quickly. Otherwise, you may take a long time to solve it."

Procedure

Experimenter. Two experimenters were used to control for possible experimenter-race effects; half of the Chinese groups had a Chinese experimenter and half of them had an American experimenter. The same was true for American groups.

The experimental tasks. The equipment for the study was five jigsaw puzzles--two 20-piece, two 30-piece and one 35-piece puzzles.

The experimental procedure. The groups were asked to solve five puzzles as quickly as possible. They were also told that if they could not finish one 25-piece puzzle and one 35-piece puzzle within 10 minutes, their group scores would be zero no matter how fast they could finish the puzzle later. Then they would get only half the pay the experimenter had promised earlier, that is, only one dollar. Therefore, prior to starting the task, each participant was asked to write down his own opinion about the best strategy to work on the task (e.g., working individually on each puzzle, or working together on one puzzle) and to estimate the time

to complete all puzzles. Later they were asked to work on the puzzles. The entire session was videotaped for subsequent analysis of the actual work-splitting strategies. After the experiment, subjects were asked to complete two questionnaires. Finally, the students were debriefed by the experimenter.

Design

The independent variables were the subject's race (American or Chinese) and arousing drive instructions (skill or luck). Chinese subjects are assumed to be more group oriented and cohesive than American subjects. The drive variable was manipulated by giving two different instructions to the subjects.

The dependent measures of this study can be divided into three categories: (1) Paper and pencil responses to (a) pre-experimental questionnaire (to indicate the estimated time to complete the puzzles and perceived best strategies to finish the task) and (b) responses to two post-experimental questionnaires. One of them was about general information on the subjects (age, education, etc.). The other one consists of six open-ended questions, one multiple choice question and 10 7-point scale questions concerning each subject's perception of the purpose of the study, familiarity with two partners, experience in playing jigsaw puzzles before, the group team work, willingness to play with the same partners, how much they think that the game depends upon luck and skill, etc. (2) the actual work-splitting strategies to finish the task, (3) overt group performance output-- the total time (minutes) the group spent to finish five puzzles.

RESULTS

The hypotheses of the study were tested by the F statistic employing an analysis of variance model. All tests, including those of simple effects, were two-tailed, $\alpha = .05$.

Manipulation checks

A check on the effectiveness of the arousing drive instruction manipulation in the post-experimental questionnaire revealed that the subjects in the luck condition perceived the game as being more dependent upon luck ($M = 3.83$, $SD = 1.87$) than the subjects in the skill condition ($M = 3.06$, $SD = 2.44$) ($p < .05$). However, there was no difference in the subjects' perceptions of the importance of skill in playing a puzzle game ($p > .05$). The probable explanation of this result was that subjects more or less believed that skill was necessary to solve jigsaw puzzles because of their intuitive impressions or based upon some past experience.

From the responses to post-experimental open-ended questionnaire, there was no evidence to suggest that subjects were suspicious about the drive arousing instruction. A check on the control of the degree of familiarity among group members in the post-experimental questionnaire showed that the main effect for race of subject on knowing each other did not reach statistical significance at 0.05 level. That is, two race groups were not different in the degree of familiarity among group members for each group.

Perceived best strategies

In this study, strategies were defined as the subjects' work-splitting decisions in order to finish the task as quickly as possible. Since there

were five puzzles to be solved and there were three subjects in a group, three different strategies could be used to accomplish the group work: (a) three subjects worked independently, (b) two subjects worked together and one worked individually, and (c) three subjects worked together. As predicted, there was a significant effect for race of subject on perceived best strategy $\chi^2(2) = 5.99, p < .05$. Table 1 indicates that Chinese subjects would rather work together than independently. That is 89% of the Chinese subjects intended to choose to work all together or to work in pairs, while only 11% of them intended to work independently. In contrast, only 61% of the American subjects said that they would like to work together.

Table 1

Frequency of perceived best group strategy.

Strategy*	Race	
	American	Chinese
#A	14 (38.9%)	4 (11.2%)
#B	17 (47.2%)	26 (72.2%)
#C	5 (13.9%)	6 (16.6%)
Total	36 (100.0%)	36 (100.0%)

$\chi^2 = 5.99, df = 2, p < .05$

* Strategy A: 3 subjects worked independently.

B: 2 subjects worked on 1 puzzle, and the other worked independently.

C: 3 subjects worked together.

Actual group strategies

The measures of actual strategies were coded through the video-tapes. The results revealed that the two race groups were using a different number of strategies for accomplishing the task. Though the frequency differences were not statistically significant, the Chi square $\chi^2_{(2)} = 5.84, p = .06$ was very close to the significant level and might prove fruitful to briefly examine the frequencies in order to get some flavor of the strategies of the two groups. Table 2 suggests that the frequencies of group-orienting strategies were different, though not enough to reach statistical significance (87% of the strategies made by the Chinese, as opposed to 70% by the Americans, were group-orienting strategies [either three worked all together or two worked in pairs]). Specifically, for Chinese subjects the frequencies of three participants working all together were three times greater than those of three working independently. Oppositely, for American subjects, the frequencies of three working all together was lower than those of three working independently. These results more or less confirmed the hypothesis that Chinese subjects, as compared to American subjects, would use more group-orienting strategies than individual-orienting strategies.

Table 2

Frequency of different group strategies for solving jigsaw puzzles.

Strategy*	Race	
	American	Chinese
A	18 (29.1%)	8 (12.5%)
B	30 (48.3%)	34 (53.1%)
C	14 (22.6%)	22 (34.4%)
Total	62 (100.0%)	64 (100.0%)

$$\chi^2 = 5.84, df = 2, p = .06$$

* Strategy A: 3 subjects worked independently.

B: 2 subjects worked on 1 puzzle, and the other worked independently.

C: 3 subjects worked together.

Experience and attitudes of playing jigsaw puzzles

Before proceeding with the analysis of the hypotheses regarding group performance (total time in solving jigsaw puzzles), several considerations had to be made concerning the experience in solving jigsaw puzzles and attitude toward puzzles in order to present a more valid picture of the results.

The responses to the questionnaire revealed that the groups differed significantly ($p < .01$) on experience in solving jigsaw puzzles. It shows that the American subjects had more experience ($M = 3.69$) than the Chinese subjects ($M = 1.86$) ($t(22) = 5.92, p < .05$).

It also reveals that no group differences were found for liking jigsaw puzzle games ($p > .05$). Subjects did not show any negative attitude to solving jigsaw puzzles.

Group performance outputs

Since it was shown above that the two race groups had different experience in playing jigsaw puzzles, the Chinese group performance data was statistically adjusted in order to compare it with American group data. A follow-up experiment was developed to deal with the problem of these experience differences. The available subjects in each race group were asked to come to the laboratory and assemble the same five puzzles individually one month after the first experiment. The adjusted score (minutes) was the mean difference in individual puzzle solving time of two race groups divided by three. That is, Chinese new scores would be the original group scores subtracting the adjusted scores. For Chinese groups, only new group scores will be used in later analysis.

A 2 X 2 analysis of variance was tested to examine the effects of race and drive arousing instructions on group performance. In table 3 are the results of the analysis of variance and in table 4 are the means of four cells. Contrary to the prediction, both groups performed worse in the skill condition than in the luck condition, $F(1, 20) = 5.59, p < .05$. The longer time (minutes) they used in solving the puzzles, the worse the group performance. Combining two drive arousing conditions, American groups performed better than Chinese groups, $F(1, 20) = 10.29, p < .01$. The interaction effect of these two factors was not statistically significant ($p > .05$). Contrary to the prediction, Chinese, as compared to Caucasian groups, did not emit more outputs in the luck condition but

had poorer performances than Caucasians under the luck condition.

Table 3

Summary of the race of subject x condition analysis of variance on the group puzzle solving time^a

Source	<u>MS</u>	<u>df</u>	<u>F</u>
Race of Subject (S)	199.96	1	10.29**
Condition (C)	108.71	1	5.59*
S x C	2.09	1	0.11
Error	19.44	20	

^a New adjusted group scores were used for Chinese groups in data analysis.

* $p < .05$.

** $p < .01$.

Table 4

Group means involved in the interaction effects of race of subject x condition on puzzle solving time^a

Race of Subject	<u>Condition</u>	
	Skill	Luck
American	15.38	11.71
Chinese	21.74	16.89

^a New adjusted group scores were used for Chinese groups. The longer the time, the worse the performance.

Estimated group performance

A check of differences in expectation of group performance between the two race groups under different conditions was tested by a 2 x 2 factorial analysis of variance. The results of estimated group performance revealed that the main effect for race of subject on estimated group performance achieved statistical significance, $F(1, 20) = 7.46$, $p < .01$. The Chinese subjects were found to estimate longer times to finish five puzzles than American subjects. No significant differences were found on either condition or interaction effects of race of subject by condition.

Responses to post-experimental questionnaire

Responses to post-experimental questionnaire indicated that American subjects had more positive feelings after the experiment. That is, they liked the distribution of the work better; they perceived more contribution on the part of their partners; they perceived that they worked well together as a team more and they were willing to play with the same partners again more than the Chinese subjects.

DISCUSSION

With respect to the findings of the current study, support for the hypotheses was found on measures of anticipated strategies but not on actual strategies used by Chinese versus American groups. These two findings indicated that Chinese groups said that they preferred to work together rather independently, but they did not act as they said. The hypotheses were not confirmed on the task outcome measure. Contrary to the prediction, group performance was better under the luck condition than under the skill condition. In addition, American groups performed

better than Chinese groups under the luck condition. Furthermore, American groups anticipated better performance than did Chinese groups before the game. These outcomes might be due to a number of factors. First, the analysis of the subjects' pre-experimental and post-experimental questionnaires revealed an interesting picture that may help to explain this phenomenon. The results indicated that the race condition was confounded with degree of experience in solving jigsaw puzzles. American subjects had much more experience than Chinese subjects. An attempt was made to solve this problem by adjusting the group scores. The new Chinese group scores were adjusted by subtracting the original group scores by one third of the individual score mean differences. However, the adjustment may not have made the two groups on the same level.

Secondly, the effects due to no confirmation on the outcome measure must also be examined in terms of the strength of the effect under the luck versus skill condition. From the responses of post-experimental questionnaire, it shows that the manipulation of skill-luck condition was somewhat weak. The distribution of perceived importance of skill and luck in solving jigsaw puzzles were highly overlapping rather than being independent. That is, subjects who believed that the game depended upon luck might also think that skill was important.

Finally, it is suggested that an anxiety variable be considered in this kind of drive arousing manipulation study. In this study, it appeared that subjects had already reached a very high level of drive condition, probably because of exposure to a complicated experimental setting or because of the knowledge that group performance would be compared with that of another race group. The arousing of a higher drive level (skill instruction) would not increase the drive level but would induce anxiety and anxiousness which would interfere with the

group performance. Further, it was assumed that lack of experience would aggravate the arousing anxiety and nervousness of the subjects. These two assumptions were supported by the data which showed that (1) under the luck condition (low drive arousing and thus arousing low anxiety), subjects performed better than under the skill condition (high drive arousing and thus arousing higher anxiety), and (2) the less experienced group (Chinese groups), as compared to more experienced groups (American groups) performed worse and experienced more negative feelings about the contributions of the partners, the willingness to play with the same partners, etc., shown in the questionnaire after the experiment.

There is one more possibility that might explain the inconsistent findings between strategy and group performance. It is hypothesized that Chinese might not be really interested in task outcome but more concerned with friendship--in which case it might be expected that their ratings of friends would be higher than Americans. This supposition has to be tested in the future. This assumption is consistent with Deutsch's finding (1968) that hinderings (i.e., time loss) appeared in cooperative group due to the need to reduce tension, or in other words, to maintain friendship.

Interestingly, another finding from questionnaire responses indicates that after the game, the preference group strategy patterns of two groups were different from the anticipated group strategies and actual group strategies, American subjects preferred to play with one or two partners, but Chinese subjects preferred to play individually. The probable explanation might be that the feeling of anxiety, frustration and failure changed Chinese subjects' decisions and the feeling of confidence and success also changed American subjects' decisions. This supposition has also to be confirmed by further studies.

The problems of methodology in cross-cultural studies have been emphasized by Triandis (1972). He mentioned that most people attempted to measure behaviors cross-culturally without equating their cultural groups on such obvious variables as familiarity with the task, response styles, levels of anxiety generated by testing situations, etc. Further, he was strongly concerned with the equivalence of any experimental manipulations and indicated that sometimes it is impossible to know whether the experimental manipulation was equivalent in strength.

To summarize, the results of the group strategies partly confirm the basic hypothesis of this study. Chinese subjects, as compared to American subjects, preferred more group-orienting strategies than individual-orienting strategies. Though the results of group performance did not support the hypothesis, an important finding was the indication that the patterns of group strategies were not necessarily consistent with the output of the group performance. These two phenomena are quite independent. That is, the group-orienting strategies may improve group performance, or it may not.

Finally, the findings of this study strongly suggest that future researchers in the area of cross-cultural studies of group behaviors should select an appropriate experimental task that both race groups have equivalent experience with in order to test the group strategies and group performances. Further, the group strategy task must be more complicated and enable the subjects to make more decisions than a simple assembling task.

Up to now, very few cross-cultural studies have been done on group behaviors, especially the comparison between Chinese and Americans. Although this study, like many others, might raise more questions than it answers, it was attempted to establish a baseline of a series of

cross-cultural group strategy and performance studies. In the future, advanced studies will be planned in an attempt to discover more about the nature of crosscultural differences in group behaviors. Specifically, studies are needed to clarify at least three major issues.

1. Would the same pattern of expected behaviors be found using other tasks that two race groups are equally familiar with?
2. Would the group-orienting strategy differences between Chinese and Americans be more significant using a complicated task rather than a simple assembling task?
3. Under what condition would the group strategy pattern be consistent with the group performance outputs?

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中、美大學生在問題解決小團體中 團體成績與工作分配策略之比較

陳 彰 儀

摘 要

本研究之目的是探討美國學生與中國學生所組成之三人小團體，在實驗室進行團體作業（五個拼圖）時，(1)其工作分配策略是否不同；(2)其團體成績是否受不同之動機喚起指導語（運氣或技巧）而有所差異。根據12個美國學生團體與12個中國學生團體的反應，本研究結果發現在進行團體作業前之問卷調查中，中國團體認為理想之工作分配策略是較趨於團體取向（例如三人合作），而美國團體則趨於個人取向（三人分別做），這個發現支持本研究之假設。但在實際作業時，兩組所用的策略與團體成績在統計上都沒有達到顯著差異。在接受不同指導語時，團體成績有顯著不同，接受「運氣」指導語之團體比接受「技巧」指導語之團體在團體成績上較高。接受「運氣」指導語之情況中，美國學生的團體成績明顯優於中國學生的團體成績。上述發現之解釋，本文有詳細的討論。