

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave Blank)	2. REPORT DATE 30 January, 1999	3. REPORT TYPE AND DATES COVERED Progress: 1 February, 1998-30 January, 1999		
4. TITLE AND SUBTITLE Culture and work-groups. I: Effect of Information Presentation on Group Performance		5. FUNDING NUMBERS N00014-98-1-0347		
6. AUTHORS William O'Shea Dan Landis				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Center for Applied Research and Evaluation University of Mississippi University, MS 38677		8. PERFORMING ORGANIZATION REPORT NUMBER CApRE 99-1		
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Resarch Ballston Centre Tower One 800 North Quincy Street Arlington, VA 22217-5660		10. SPONSORING / MONITORING AGENCY REPORT NUMBER		
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release		12b. DISTRIBUTION CODE		
13. ABSTRACT (Maximum 200 words) This report is the first in a series on the effects of cultural heterogeneity on a cognitive decision making task, called RECON. In these studies cultural heterogeneity is examined in terms of the horizontal and vertical individualism and collectivism constructs. Group heterogeneity was manipulated by composing groups with different representations of the horizontal and vertical individualism and collectivism constructs represented by subjects with relatively high pretest scores on one of those dimensions. Subjects assigned to the vertical cultural value conditions perceived their feedback on the constructs as less accurate than subjects in the horizontal conditions. The heterogeneity manipulation did not effect performance on RECON (omega squared=.002). Visual display elements of RECON did have a significant effect: the clutter of cities on the map (14%, 17%, 20%; omega squared=.20); the coding of information about each city (numeric, geometrical shape, and color, omega squared=.02). These main effects were qualified by an interaction between clutter and coding (omega squared=.24). Unanalyzed in this report are variables relating to the group process (e.g., time to a decision and affective reaction to the members of the group). The results are discussed in terms of the appropriateness of RECON for group research, perceived versus actual cultural value differences, and application of our laboratory findings to real-world project teams.				
14. SUBJECT TERMS Group heterogeneity Individualism vs. collectivisms Decision Quality		15. NUMBER OF PAGES 52		
		16. PRICE CODE		
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT	

NSN 7540-01-280-5500

Standard Form 298 (Rev. 2-89)
Prescribed by ANSI Std. Z39-1
298-102

DTIC QUALITY INSPECTED 1

Abstract

This report is the first in a series on the effects of cultural heterogeneity on a cognitive decision-making task. These studies examine cultural heterogeneity in terms of the horizontal and vertical individualism and collectivism constructs. Group heterogeneity was manipulated by composing groups with different representations of the horizontal and vertical individualism and collectivism constructs based on subjects' pretest scores. Subjects assigned to the vertical cultural value conditions perceived their feedback as less accurate than subjects in horizontal conditions. The heterogeneity manipulation did not effect performance on the decision-making task ($\omega^2 = .002$). Visual display elements of the task (i.e., clutter and coding) had a significant effect on group performance scores: increased clutter (14%, 17%, 20%) of the task elements improved performance ($\omega^2 = .20$); coding (numeric, geometric shapes, and color) of information had a small effect on performance ($\omega^2 = .02$); these main effects were qualified by an interaction of clutter and coding ($\omega^2 = .24$). The results are discussed in terms of the appropriateness of this task for group research, the application of our laboratory findings to real-world project teams, the impact of perceived verses actual cultural value differences, and the cognitive nature of cultural values.

Culture and work-groups. I: Effect on information presentation on group performance

William O'Shea and Dan Landis¹
Center for Applied Research and Evaluation
University of Mississippi

Interest in culturally heterogeneous work groups has grown over the last decade (e.g., Adler, 1991; Bettenhausen, 1991; Cohen & Bailey, 1997; Levine & Moreland, 1998; Williams & O'Reilly, 1998). This growth may be a function of contemporaneous trends in demography (i.e., increased intra-national racial diversity and international organizational collaboration; Davison, 1994; Johnston, 1991) and organizational work patterns (i.e., work groups; Davison, 1994; Daft, 1998; Guzzo, 1996; Jackson, 1996). However, the influence of cultural diversity on team performance has received relatively little attention in the research literature (Bettenhausen, 1991; Cohen & Bailey, 1997; Miller, 1994). In a series of papers we will explore how culture, task, and leadership impact culturally heterogeneous team processes. We begin the series with the present paper. First, through a review of selected research in those areas we point out a number of lacunae in the present state of research on culture's impact on work group performance. Then, as a preliminary to such an investigation, we develop and validate a measure of group performance.

Cultural Influences

The work of Hofstede (1980) has lead the way in understanding cultural variation in multinational organizations through his analysis of four cultural value dimensions (syndromes, Triandis, 1994), individualism, power distance, tolerance for ambiguity, and masculinity. Of these, individualism has been cited as one of the major themes in cross-cultural psychology

¹ The research reported here was supported by an Office of Naval Research grant (N00014-98-1-034) to the second author. The authors thank Layton Curl, Tehmina Banatwala, Lori Fox, and Andrew Hurley for their help with experimental design and data collection, Patricia E. O'Neill for useful comments regarding visual search paradigms, and Michael D. Landis for writing the RECON program used in this research. Comments should be addressed to the second author (e-mail address: landisd@watervalley.net).

(Kagitcibasi, 1997; Kagitcibasi and Berry, 1989), perhaps primarily due to the work of Triandis and colleagues (e.g., Triandis, 1995; Kagitcibasi, 1997). Triandis (1990, p. 52) offers the following definition of the individualism-collectivism continuum, individualism: "individual is an end in himself, and as such ought to realize his "self" and cultivate his own judgment, notwithstanding social pressures toward conformity," collectivism: "emphasis on (a) the views, needs, and goals of the (in)group; (b) social norms and duty defined by the group rather than pleasure seeking; (c) beliefs shared with the group rather than beliefs that separate self from the group; and (d) readiness to cooperate with the group."

In part of his work extending Hofstede's individualism construct, Triandis has recently (e.g., Triandis, 1995; Triandis, Chen & Chan, 1998; Triandis & Gelfand, 1998) reconsidered Hofstede's power distance factor as component of individualism, the horizontal-vertical dimension. Similar to low and high power distance, respectively, the horizontal pole represents a cultural emphasis on equality and the vertical pole represents a cultural emphasis on hierarchy (Triandis & Gelfand, 1998). It seems that the close relationship between the individualism-collectivism and horizontal-vertical factor structure (or individualism and power distance in Hofstede's [1980] terms) is acknowledged by Hofstede (1991) in contrast to the original (Hofstede, 1980) orthogonal structure.

This "reconsideration" of the originally orthogonal Hofstede factors, individualism and power distance, led Triandis and his colleagues to develop and confirm (Triandis & Gelfand, 1998) four components: horizontal-individualism, vertical-individualism, horizontal-collectivism, and vertical-collectivism. Triandis & Gelfand (1998, p. 276) defined these four components as follows:

Briefly, horizontal collectivists merge with in-groups (family, tribe, coworkers, nation) but do not feel subordinate to these in-groups. Vertical

collectivists, on the other hand, submit to the norms of their in-groups and even are willing to self-sacrifice for their in-group. ... The horizontal individualists do their own thing but do not necessarily compare themselves with others. They do not want to be distinguished.... The vertical individualists are especially concerned with comparisons with others. They want to be "the best," win competitions, and be distinguished.

The present experiment will focus on group productivity on a cognitive decision-making task as a function of group cultural heterogeneity measured in terms of representation of HI, VI, HC, and VC values in the group. However, many of the studies in this domain do not operationalize or "unpack" culture as recommended by van de Vijver & Leung (1997) and, instead, analyze culture through surrogates of nationality and race. Van de Vijver & Leung discuss the types of explanatory ambiguity this lack of specificity in measurement causes; for instance, it is unclear if perceived (e.g., race or ethnicity) or actual (e.g., norms, values) cultural differences are effecting group processes and outcomes. What's more, the present series of studies of group heterogeneity may well be the first to adopt the horizontal-vertical/individualism-collectivism paradigm. Therefore, the studies we will review will deal with individualism-collectivism separate from horizontal-vertical values and discuss horizontal-vertical values in terms of low and high power distance.

Individualism. Research conducted by Early (1993; 1989) has examined the affect of individualism on social loafing. Social loafing is a group phenomenon where individuals work less hard in groups than when alone. The reasons for loafing appear to be perceived dispensability and expectations of others' efforts (Early, 1989). The effect of social loafing is decreased group productivity (Latane, Williams, & Harkins, 1979).

Early (1993) found that this phenomena does not occur in groups of collectivistic cultures in the same way it does among groups of individualistic cultures. Collectivists are most apt to loaf in situations where the group is composed of out-group members and actually improve in performance when working with a group of in-group members, versus working alone. Individualists are most apt to loaf in groups regardless of the in-group or out-group status of the group members and work most productively alone.

Power distance. Power distance is a cultural construct regarding vertical relationships. Power distance norms dictate how much vertical inequality members of a culture will tolerate and believe is proper (Bochner & Hesketh, 1994). Within an organizational context, high power distance norms dictate submissive behaviors to management and top down organizational power structures.

Bochner & Hesketh (1994) studied the affects of power distance in the information systems department of a major Australian bank. Among their findings were significant differences in attitudes about management, frequency of interactions with management, and belief in Theory X among coworkers who were high or low on power distance. Specifically, employees from high power distance cultures (e.g., South East Asian) were less inclined to openly communicate with superiors, preferred high supervision and contact with managers, and believed that their coworkers did not work particularly hard.

Task Influences

The nature of the task to which a multicultural team is assigned may interact with the cultural variability of the team members (Adler, 1991). In other words, heterogeneous teams may be better at certain types of tasks (e.g., generating alternative solutions for a case analysis) and perform differently, compared to culturally homogeneous teams, on other types of tasks (e.g.,

willingness to commit to risky decisions). We will present Adler's (1991) discussion of the task conditions favorable to multicultural groups as well as explore the tendencies toward or away from risky shift in multicultural groups.

General task qualities. Adler (1991) cautions that multicultural groups can be among the most or least effective in an organization. The special dynamics of the multicultural group better enables the team to successfully execute some tasks better than others. Specifically, multicultural teams are best suited for broad idea generation or divergent task such as the planning phase of some organization function (Adler, 1991). These groups are less effective with more routine tasks such as implementation or convergent idea generation as in the need to quickly come to a unanimous decision.

In any task situation, multicultural teams need to overcome group interaction problems before they can begin to make optimal contributions (Watson & Kumar, 1992). Therefore greater feedback about performance and interaction processes may be necessary. Economic application of multicultural group efforts would help prevent its strengths from becoming its liabilities.

Risky shift. Risky shift is a phenomena of group behavior where the decisions made by a group are more risky than those made by the individual members when alone (Levine & Moreland, 1995). The research upon which the theory of risky shift is based on, like many psychological theories, was conducted on primarily monocultural groups in western cultures. Watson and Kumar (1992) examined this issue among culturally heterogeneous groups with different results.

The risky shift research methodology involves using scenarios describing some problem or issues leading up to a decision point and several options representing degrees of risk. Watson and Kumar (1992) found that the degree of risk the groups reported being willing to take varied

significantly along the degree to which the groups were culturally heterogeneous. The effect was such that Watson and Kumar (1992, p. 59) offered the rule regarding group consensus decisions of "the more diverse the more conservative" and "the more similar the more risky."

In sum, multicultural teams seem to perform better on divergent tasks and choose more conservative levels of risk when compared to monocultural teams. However, the literature lacks any systematic efforts to develop a taxonomy of task by cultural syndrome interactions. Further, moving away from the quasi-experimental (van de Vijver & Leung, 1997), paradigm in cross-cultural research experimenter-manipulated conditions, such as type of task, would extend the results of survey research and thus further theory development.

Leadership Issues

How might leading multicultural groups differ from leadership necessary for monocultural groups? Some variables, such as power distance, may significantly affect the demands made of a leader by his or her subordinates - even within self-managed-work-teams (SMWT) (Kirkman & Shapiro, 1997). Other factors of leadership, such as contingency theory, may be relatively unaffected by cultural differences (Fiedler, 1966).

Self-managed-work-teams. We noted previously that team members from cultures advocating high power distance norms have different expectations regarding hierarchical structures in the organization. People holding high power distance values expect greater direction and observation by management. This expectation may come into conflict with organizational models using self-managed-work-teams.

Kirkman and Shapiro (1997) propose that such a conflict between culture and organizational structures is likely. These authors cite such instances as performance losses among Russian employees when participative management strategies were implemented (Welsh,

Luthans, & Sommer, 1993 as cited by Kirkman and Shapiro, 1997) as evidence of cultural differences in response to organizational and management changes. They offer several propositions regarding SMWTs, organizational justice, organizational change and international business . While interesting, these recommendations currently lack direct empirical support but may have implications for the future design of the present project.

Conclusion

The final point to be drawn from this limited introduction to multicultural-group literature is that enough work has been done to suggest further attention, however, a more methodologically (i.e., van de Vijver & Leung, 1997) and theoretically (i.e., Triandis, Chen & Chan, 1998) sophisticated approach to the research will be necessary. Cultural heterogeneity affects the way a group interacts (Early, 1993, 1989), responds to risk (Watson & Kumar, 1992), executes a task (Adler, 1991), and responds to leadership conditions (Bochner & Hesketh, 1994). However, recent developments in cross-cultural research methodology (e.g., van de Vijver & Leung, 1997) have suggested more stringent methods of design and analysis when dealing with culture as a variable. The goal of these “new” methodologies is to help develop and test better theories regarding culture. It is our intention to assume this goal in our study of culture and group productivity.

Task Variables

From 1966 to 1985, a series of articles (Adams-Terem, Fross, Landis & Hayles, 1985; Landis, Slivka, & Silver, 1970; Landis, Slivka, & Silver, 1969; Landis, Slivka, & Jones, 1968; Silver, Jones, & Landis, 1966) explored variables related to a cognitive decision-making visual search task. These studies looked at the effects of various coding presentations, map characteristics (e.g., information clutter and compression), and instruction on such outcomes as

certitude, visual search time, and decision-making performance. Empirical information about the properties of this task in response to a wide variety of experimenter manipulations make it well suited for the demands of group research.

In one such study subjects engaged in the task examine a number of map-like pages on which there is an array of target cities, connected by flight paths, and distracter cities, unconnected by any flight paths. Subjects base their decision to fly to one city or another on the relative merit of four city characteristics (e.g., population of the city, strategic value of the city, probability of finding enemy troops, and probability of getting shot down). The former two are positive characteristics of a city such that higher values indicate a better city to reconnoiter. The latter two are negative characteristics of a city such that higher values indicate a poor city to reconnoiter. This information about cities can be communicated on the map through number values or color or geometric shape representation of the numerical values (a key is provided to interpret these values).

The value of a city and the array of cities and the flight paths are arbitrarily set by the experimenter. Additional aspects of the map set by the experimenter are the number of target and distracter cities (i.e., clutter), the type of coding of city characteristics (i.e., coding), the time available to work on the page (e.g., set to three minutes), and amount of gas available (e.g., set to allow travel for 75% of the total flight-path distance on the page). Further, subjects were required to return to the city from which they started and accrued a penalty for flying over the same route twice.

Although early versions of the task were not computerized, the stimulus presentation and manipulations are similar to the computerized version used in the present study. The levels of clutter and city information coding have demonstrated effects on subjects' performance.

Calculated from previous studies (i.e., Landis, Slivka & Silver, 1970; Landis, Slivka & Silver, 1969; Sliver, Jones & Landis, 1966), clutter, in terms of number of distracter and target cities, has a mean effect size of $\omega^2 = .11$; this can be described as medium-large effect (Keppel, 1991). In Landis, Slivka & Jones (1968) the coding of the information about the target cities had an very large effect on visual search time, $\omega^2 = .45$. The magnitude of these effects suggest that the outcomes of these manipulations can be expected to have a meaningful impact on subject performance.

Research with non-computerized versions of the task have demonstrated the flexibility and effectiveness of this task, however, a computerized version allows greater flexibility and reliable data collection with individuals and groups. For example, the task can be projected onto a screen and comfortably viewed by groups of four or more. Further, the task can be structured to fit many of the group interaction types outlined by Steiner (1972; e.g., disjunctive, conjunctive, additive, and discrepant) as Adams-Terem, Fross, Landis and Hayles (1985) did in their study of heterogeneous and homogeneous groups.

In the Adams-Terem, et.al. (1985) study, an anonymous group paradigm was used (i.e., subjects were told that their group, which did not actually exist, consisted of people "just like them," or "people very different from them"). This manipulation was crossed with instructions designed to induce one of the four group interaction types described by Steiner (1972). Results indicated that heterogeneous groups performed poorer under discrepant (a group benefit was to be decided by some kind of group consensus) and better under disjunctive (a group benefit was to be decided based on the highest scoring person in the group). The subjects in the Adams-Terem, et.al. study, Asian-Americans female students at the University of Hawaii's main campus in Honolulu, could be expected to be highly collectivistic and somewhat high on power distance.

Hence, they would, in the language of the present study fall into the vertical—collectivistic group. The homogeneous manipulation might have made the collective nature of the group especially salient encouraging such members to strive for the highest group benefit thus giving them higher scores under the discrepant instructions. On the other hand, the subjects believing that they were in a homogeneous group and that the benefit will be based on the highest performing person might well suppress performance because to not do so could embarrass or cause a loss of face to the other members of the team.

To sum up, a group version of the cognitive visual search task and interface may mirror real-world contexts where complex data are presented for analysis by a group of people who will then decide on a mutually agreeable course of action. Indeed, there is evidence that such a task may be sensitive to differences in cultural syndromes. What's more, this type of task allows for the objective assessment of the quality of those decisions made.

Hypotheses

The first of the hypotheses is with regard to the task characteristics of the cognitive decision-making task. These hypotheses are based on work done with the pre-computer versions of the task (Landis, Slivka, & Silver, 1970; Landis, Slivka, & Silver, 1969; Landis, Slivka, & Jones, 1968; Silver, Jones, & Landis, 1966). After Landis, Slivka & Silver (1970), Landis, Slivka & Silver (1969), Silver, Jones & Landis (1966) it is hypothesized that even small increases in clutter will effect performance, therefore:

H1 a. Performance scores (percent effectiveness) will increase as clutter level increases (i.e., 14%, 17%, 20%).

After Landis, Slivka & Jones (1968) it is hypothesized that differences in the coding of information about target cities will require effect search time and, therefore, negatively effect performance as follows:

H1 b. Performance scores (percent effectiveness) will decrease as coding level increases in difficulty (i.e., numeric, geometric shape, and color coding on a continuum from difficult to hard, respectively).

The remaining hypotheses are with regard to the manipulation of cultural heterogeneity in the work groups. After Adler (1991), Watson & Kumar (1992), and Adams-Terem, Fross, Landis, and Hayles (1985) the cognitive decision-making task will be effected by the heterogeneity of cultural values in the group. However, these authors would predict different directions for this effect: Adler (1991) may predict a negative effect due to the convergent and time limited demands of the task and Watson & Kumar (1992) may predict that overly conservative decision making may limit performance by creating a disinclination to reconnoiter more than a few cities. Adams-Terem, Fross, Landis, and Hayles (1985) have found that on a similar cognitive decision-making task, culturally heterogeneous groups performed poorer than culturally homogeneous groups under instructions suggesting that a group benefit would be based on a group consensus decision around reward allocation. All of the studies would predict that group heterogeneity would have a significant effect on group performance; the direction of the effect is what is disputed. Given the disagreement in the literature we make the following non-directional hypothesis:

H2 a. Levels of group heterogeneity effect performance on the cognitive decision-making task.

After the theoretical work of Lau and Murnighan (1998) and Earley (1998) it is thought that homogeneous and heterogeneous groups will perform better than moderately heterogeneous due to the potential for factions to develop in moderately heterogeneous groups, therefore:

H2 b. The degree of heterogeneity follows a curvilinear relationship with group productivity. Homogeneous and highly heterogeneous groups will be more productive than the moderately heterogeneous groups.

After Kirkman & Shapiro (1997) and Bochner & Hesketh (1994) lack of a hierarchical leadership structure in a group is averse to group members favoring vertical cultural values. Given the leaderless structure of the work groups in the present study, the following is hypothesized:

H3. Groups with high mean scores on the vertical value will perform less well than those groups that are more horizontal overall.

Method

Participants

Initially, 125 students were recruited through campus billboards, undergraduate psychology courses, and through advertisements posted in the International Programs Office, however, only 97 completed the study. Most participated in the experiment for course credit alone, 12 were paid US\$ 20 for about three hours of work, and seven participated for a proportionate combination of credit and cash payment.

The subjects were primarily white ($n = 75$); African-American was the next most numerous ethnic group ($n = 15$); there was one Hispanic-American; three international students: two Chinese, and one Korean; and two subjects who did not provide their ethnicity. Most of the subjects were female ($n = 66$), with 28 males, and three who did not provide their gender. Other

demographic data: the mean age was 20 ($SD = 2.91$), the mean years of college education were two (i.e., sophomores; $SD = 1.28$), the modal response to the socioeconomic status categories was "We were comfortable, but did not have money for a lot of luxuries." Average score on the measure of the individualism-collectivism continuum was 7.90 ($SD = 5.48$); this mean may be interpreted as moderately individualistic. The range of individualism-collectivism scores was from -6 to +18, with negative scores indicating collectivist values and positive scores indicating individualistic values. The average score for the measure of the horizontal-vertical continuum was 13.21 ($SD = 5.43$); this may be interpreted as a decidedly horizontal sample. The scores on the horizontal-vertical scale ranged from 0 to 24.00, where negative scores indicate vertical values and positive scores indicate horizontal values.

Materials

The primary dependant variable, group productivity, was measured using the RECON task. RECON is a computer based decision-making task that simulates a reconnaissance mission (Landis, Slivka, & Silver, 1970; Landis, Slivka, & Silver, 1969; Landis, Slivka, & Jones, 1968; Silver, Jones, & Landis, 1966). The basic elements of the task were described earlier. The instructions given to subjects regarding the RECON are provided in Appendix B.

The materials for this instrument include small hand calculators, instruction sheets with city coding, game rules, and equations for calculating city values, a Macintosh computer (RECON is a Macintosh native program), and a LCD projector. The subjects played three games of three pages each. The three games were coded for different levels of clutter, 20% (10 target and 12 distracter cities), 17% (12 target and 14 distracter cities), and 14% (14 target and 16 distracter cities). These are labeled "High," "Medium," and "Low," respectively. Within each game were three pages (i.e., the maps with the array of cities); in the first page, city information

was communicated with number values, in the second page, city information was communicated by geometric shapes (subjects had keys to interpret these values), in the third page, city information was communicated by color codes (again, subjects had keys to interpret these values).

Measure of cultural syndromes. We used Triandis, Chen, & Chan's (1998) Scenarios for the Measurement of Collectivism and Individualism (SMCI). This scale of 30 items measures four dimensions of cultural syndromes, Horizontal-Individualism (HI), Vertical-Individualism (VI), Horizontal-Collectivism (HC), and Vertical-Collectivism (VC). Triandis (personal communication, October, 1998) suggested that, given recent research (i.e., Peng, Nisbett, & Wong, 1997), these scenarios are the preferred method for measuring these cultural syndromes. He explained that scenarios are preferred because, they converge with expert assessments better than other methods of measurement. These items have the additional benefit of being written in the context of campus life, which is appropriate for our university undergraduate sample (Triandis, Chen, & Chan, 1998).

Design

The design was a 3 (heterogeneity of the work group) X 3 (clutter of cities in the RECON map) X 3 (coding of the city characteristics on the RECON map) mixed factorial. The levels of the between subjects factor, group heterogeneity, were homogeneous, moderately heterogeneous, and heterogeneous. Heterogeneity was manipulated using pretest scores on individualism-collectivism and horizontal-vertical cultural constructs to assign subjects to groups that were composed of all the same cultural value dimension, two dyads of the same cultural value, and all four cultural values. The levels of the two within subjects factors, clutter and coding, were 20%,

17%, 14% distracter by target proportions of clutter, and numerical, geometrical shape, and color coding.

Subjects met with the experimenter in three sessions, in large groups to respond to the individual difference battery, in small groups for individual administration of the RECON task, then in groups of four (three in three cases due to subject mortality) for group administration of the RECON task; these sessions were called Stage 1, Stage 2, and Stage 3, respectively. Subject response to the HVIC scale in Stage 1 was used to make assignments in Stage 3. We assigned subjects to the groups based on their relative standing on the four cultural value conditions, horizontal-individualistic, vertical-individualistic, horizontal-collectivist, vertical-collectivist. A "feedback" condition in which the subjects relatively high cultural value was primed served two purposes, create cultural heterogeneity in the groups and prime cultural values for the group sessions.

The feedback conditions were used to compose groups of homogeneous, moderately heterogeneous, and heterogeneous cultural values. Most of the homogeneous cultural value groups consisted of four subjects who scored relatively high on the horizontal-individualism scale. The value composition of the moderately heterogeneous groups varied, but one example might be a group composed of two horizontal-individualists and two vertical-collectivists. Members of the heterogeneous groups represented all four cultural value conditions, one horizontal-individualist, one vertical-individualist, one horizontal-collectivist, one vertical-collectivist.

The second purpose of the feedback involves a methodology used by Trafimow, Triandis, & Goto (1991) where they manipulated individualism and collectivism in a sample of US undergraduates using a priming technique. The results of their manipulation implied that cultural

cognition may be more complex than a single self-structure model, they called this a two basket model of cultural cognition. Further, their results implied that this complex cognitive structure can be manipulated in the laboratory to facilitate the study of culture; they concluded that this should open a new methodology or line of research in the study of culture. The present study followed the lead of Trafimow, Triandis, & Goto's (1991) methodology to bring cultural research into a mono-cultural laboratory. We used the feedback given to the subject to prime their different cultural cognitions along the horizontal and vertical individualism and collectivism dimensions.

Procedure

A cover story was developed to reduce demand effects with regard to research on culture and race. To manipulate heterogeneity, we first measured subject response to four cultural dimensions (i.e., each subject had a score on each dimension). We then assigned subjects to groups based on their relative standing on the four dimensions. To increase the impact of this manipulation, we gave the subjects feedback sheets that reiterated prototypical value statements for their value condition and informed them about the status of the other students in their group (i.e., "all have the same values as you," "only half have the same values as you," "none have the same values as you").

The cover story suggesting that the study was investigating the effect of visual display on complex decision making (Landis, Slivka, & Silver, 1970; Landis, Slivka, & Silver, 1969; Landis, Slivka, & Jones, 1968; Silver, Jones, & Landis, 1966). The purpose and design were described in terms of assessing individual difference variables in relation to the map reading and decision making task. In this context, we told subjects that the group work was an attempt to economize data collection.

Stage 1. At the first meeting, we provided brief overviews of the purpose, design, and requirements of the experiment. This information was given in the informed consent form, that they were asked to sign, and a brief presentation. After the consent forms were signed, we administered the timed Wonderlic Personnel Test (Wonderlic Personnel Test, 1992). After the twelve minutes for the Wonderlic had passed, the subjects were instructed to stop working on the Wonderlic, complete the remainder of the battery and be attentive to the directions for each scale. In some cases, the battery of tests could not be completed in one sitting. For some of these cases we scheduled a second time to come in and finish the battery while others finished the battery at the Stage 2 meeting. Once the subjects were finished with the battery or time had run out, they were asked to sign-up for times to meet at a computer lab for Stage 2.

Stage 2. The purpose of the Stage 2 meeting was to check for color blindness and conduct the individual administration of the RECON task. This stage took place in a small computer lab where six Macintoshes were setup with the RECON task. No more than six subjects met at a time so each had his or her own computer to work on the RECON task alone. As was mentioned previously, some subjects finished some of the Stage 1 battery of instruments at this time. The color-blindness test was conducted with the Ishihara Color Plates (Ishihara, 1997). RECON instructions provided to subjects are given in Appendix A. An experimenter elicited questions from the subject and then walked the subjects through an example page describing the point-and-click interface and reiterating the directions and goals of the task. If there were no additional questions, the experimenter set up the first of nine test pages of the RECON task and left the subject to complete them. No discussion between subjects was permitted at this point. Once the subjects were finished, they were told they would receive a call to arrange the final meeting for Stage 3.

Stage 3. The procedure for Stage 3 was the same across the three group composition manipulations. The protocol used by the experimenter is provided in Appendix B. Once all subjects were present for the session they were given the feedback forms, told the forms were some of the results of the Stage 1 surveys, asked to review the information and respond to the two questions regarding the feedback. The protocol used by the experimenter and the copies of feedback sheets are provided in Appendix C. When finished, subjects were asked to complete a state anxiety scale. Next, the subjects were asked to review the instructions for the RECON task (these were basically the same as those used in Stage 2), after which the experimenter provided a summary of the instructions and clarified the group procedure. The group was instructed to practice working together and giving their decisions to the experimenter who controlled the movement in RECON. After the practice pages, subjects were asked to complete another state anxiety scale and four sets of 12 semantic differential scales (Osgood, May, & Mirin, 1975; one for each of the three other groups members and one self report). Once finished, the test RECON task pages were started and completed. Copies of RECON pages, with number and shape coding at 17% clutter, are given in Appendix C. When finished, the subjects were asked to complete another state anxiety scale, another set of semantic differential scales, and a reward allocation form. The experimenter then elicited any questions or comments, told the subjects that further information about the project would be available once all data collection was complete, then thanked and dismissed them.

Analyses of Data

This report presents only the analysis of the RECON scores. Succeeding reports will focus on the other measures. Group performance was scored as a proportion consisting of the points earned on a page of RECON over the number of total points possible on that page. These

percent effectiveness scores (PES) were screened for normality and outliers removed. The extent to which the values feedback manipulation was successful was tested through ANOVA of the subjects rated agreement with the values feedback. The primary analysis of the RECON and group heterogeneity manipulations was analyzed through a mixed-factorial ANOVA. The significant effects were analyzed through the Tukey HSD (Keppel, 1991).

Results

Results are presented on data screening, checks of the manipulation, and the effects of the experimental manipulations. The results of data screening for normality and outliers is presented and the solutions explained. The results of manipulation check will include an examination of pretest cultural value endorsement by feedback and of the subject reported accuracy of the feedback. The results of the experiment will examine the effects of RECON map clutter, RECON city information coding, and cultural heterogeneity in the groups.

Data screening

Prior to analysis, group RECON performance score, manipulation check, and individual level manipulation check were examined for accuracy of data entry, missing values, and fit between their distributions and assumptions of normality. Data screening for univariate normality was conducted using significance tests of distribution skewness (Tabachnick & Fidell, 1996), and screening for univariate outliers was conducted by examining z-score transformations. One group with an extremely low z-scores on the RECON performance and manipulation check variables was dropped from further analysis. An additional seven groups, based on low RECON scores, had from one to four trials dropped for a total of 16 across all trials. For the manipulation check analysis, individual level data were screened and two cases with extreme z-scores were removed from further analyses.

Manipulation check

Two oneway analyses of variance were performed on the individual level data with the manipulation check response as the dependant variable and individual feedback condition and group heterogeneity condition as the independent variable. The results indicated a significant difference in manipulation check response at the levels of the individual feedback condition $F(3, 91) = 3.35, p = .02, \omega^2 = .07$. Post-hoc t-tests indicated significant differences in agreement with the feedback between the horizontal-individualist feedback condition ($M = 5.31, SD = .66$) and the vertical-individualist feedback condition ($M = 4.93, SD = .70$), and the vertical-collectivist feedback condition ($M = 4.82, SD = .87$). Further, significant differences were indicated between vertical-individualist feedback condition and the horizontal-collectivist feedback condition ($M = 5.45, SD = .60$) and the horizontal-collectivist feedback condition and the vertical-collectivist condition. These mean effects are graphed in Figure 1. Response to the feedback manipulation check did not significantly vary by levels of group heterogeneity, $F(2, 92) = 1.07, p = .35$.

Figure 1 about here

Post hoc examination of the differences in agreement with feedback by levels of the individual feedback condition suggested a difference along the horizontal-vertical quality of the feedback. An independent samples t-test was conducted with manipulation check response as the dependant variable and the horizontal-vertical condition of the feedback (collapsed across individualism-collectivism) as the independent variable. A significant difference was indicated $t(93) = 3.07, p = .003$; subjects receiving horizontal values feedback agreed more with the feedback ($M = 5.36, SD = .64$) than did subjects receiving vertical values feedback ($M = 4.88, SD = .77$). This effect is graphed in Figure 2.

Figure 2 about here

Primary analysis

A 3x3x3 mixed factorial analysis of variance was conducted with the group scores on the RECON task as the dependant variable and group heterogeneity as the single between group factor, the clutter of cities on the RECON pages as one of the within group factors, and the coding of city characteristics on the RECON pages as the other within group factor. The results indicate a main effect for clutter on the RECON score, $F(2, 173) = 37.39$, $p = .000$, $\omega^2 = .20$. Follow-up comparisons indicated that group's mean RECON score was significantly lower in the 14% clutter ($M = .37$, $SD = .06$) than in the 20% clutter ($M = .50$, $SD = .12$) and the 17% clutter ($M = .47$, $SD = .11$). Homogeneity of variance among the clutter levels was checked with the $F_{\max}$ test, $F_{\max} = 3.7$; $F_{\max}$ values over 3 usually indicate heterogeneity of variance. However, Tabachnick & Fidell (1996) qualify that interpretation of $F_{\max}$ when cell N sizes are relatively equal and suggest that $F_{\max}$ values up to 10 may be acceptable under those conditions; the cell N sizes in the present study seem to meet Tabachnick & Fidell's qualification ($N = 61, 71, 67$ for the 20%, 17%, 14% levels of clutter, respectively).

The results also indicate a main effect for coding on the RECON score, $F(2, 173) = 3.91$, $p = .022$, $\omega^2 = .02$. However, in the follow-up comparisons none of the mean differences were significantly different. The means for these main effects are presented in Figure 3. Finally, the results indicate an interaction effect for clutter by coding on the RECON score, $F(4, 173) = 24.48$, $p = .000$, $\omega^2 = .24$. Tukey HSD follow-up comparisons indicate that under the 20% clutter condition, mean RECON scores are higher for pages using numeric coding ($M = .61$, $SD = .08$)

than are mean RECON scores for pages using geometric shape coding ($M = .48$, $SD = .09$) and pages using color coding ($M = .39$, $SD = .07$), and mean RECON scores for pages using geometric shape coding were higher than pages using color coding. Further, under the 17% clutter condition, mean RECON scores for pages using color coding ($M = .54$, $SD = .06$) are significantly higher than for pages using numeric coding ($M = .42$, $SD = .05$) and pages using geometric shape coding ($M = .45$, $SD = .16$). This interaction effect is graphed in Figure 4.

Figures 3 and 4 about here

There was no main effect for heterogeneity and this variable did not enter into any of the interactions, $F(2, 173) = .544$, $p = .581$, $\omega^2 = .002$. The correlation between RECON score and average group horizontal-vertical value orientation is $-.04$ ($N = 24$).

Discussion

These results indicate that our manipulation of RECON parameters did have an effect on RECON performance in the direction expected, thus supporting H1a and H1b. However, these results also indicate that, despite relative success in manipulating culture conditions to create the levels of heterogeneity (subjects' perceived heterogeneity will be presented in future reports once the semantic differential data is analyzed), heterogeneity did not have an effect on RECON performance, thus failing to support H2a and H2b. Further, there was no effect of the horizontal-vertical cultural dimension on RECON performance, thus failing to support H3. Finally, there was no effect on RECON performance indicated in post hoc analyses for group gender composition ($r = -.07$), mean age ($r = .05$), mean individualism-collectivism ($r = .01$), and, using the Blau index (Blau, 1977), group ethnic composition ($r = .01$).

Effects of RECON Clutter and Coding

The effects found in previous versions of RECON (i.e., Adams-Terem, Fross, Landis & Hayles, 1985; Landis, Slivka, & Silver, 1970; Landis, Slivka, & Silver, 1969; Landis, Slivka, & Jones, 1968; Silver, Jones, & Landis, 1966) were replicated in the present study. The effect of clutter was in the expected direction and somewhat greater in magnitude. This is exceptional because the relatively small increments of clutter (i.e., 14%, 17%, 20%) in this study compared to previous studies (e.g., 0%, 25%, 50%, 75% in Landis, Slivka & Silver, 1970) still produced a rather larger effect. Further, effects of coding and the interaction between clutter and coding also replicate previous findings. These results support the use of the RECON task in group research contexts but are unique among the visual search literature.

The requirements of the RECON task are different from the basic visual search paradigm in which the subject looks for a target among distracter items (Wolf, 1996). Further, the ability of the subject to identify the target is analyzed in terms of reaction time as a function of the characteristics of the target and distracters and the set size (i.e., number of objects in the stimulus field; Wolf, 1996). One difference between the RECON task and the typical visual search task is that RECON involves finding the target cities and then evaluating the information about the city to decide whether it is worth flying over; the visual search task basically ends at the identification stage. What's more, performance in visual search (i.e., measured as reaction time) decreases (i.e., reaction time increases) as a function of set size; however, the present RECON task results and Landis, Slivka, & Silver's (1970) results show improved performance as a function of increased set size (note: set size and clutter are inversely related in the present study and positively related in the Landis, Slivka, & Silver's (1970) study).

Two possible reasons for the incongruous effects between the RECON task and the typical visual search results may include functions of figure-and-ground distinctions and the

meaning conveyed by the different coding levels. Landis, Slivka, & Silver (1970) first hypothesized a figure and ground effect for similar results with a non-computerized version of RECON. This possible explanation posits that the greater distracters are more readily organized by the subject as part of the background in the display. This effect may be strengthened by the flight paths connecting the target cities; these paths may function as a basic feature (Wolfe, 1996) and create a more unified figure to further contrast against the ground or distracter cities. The better performance for numeric coding contrasts with typical visual search findings in which color or shape coding best facilitates search. The difference with the RECON task may be that the numeric coding is directly understandable from the display while the color and shape coding require further translation using the values on the map key, thus requiring more cognitive processing.

While the RECON task may differ from traditional visual search research in the above mentioned ways, it may be more similar to a new direction in visual search research, visual search in continuous, naturalistic stimuli (Wolf, 1994). However, even under more complex display arrays, the type of cognitive demand required by RECON (i.e., search for targets, interpret city value profile, and assemble a maximally profitable flight path) is still fundamentally different from the simple identification of the single target in visual search. One sub-field of the naturalistic visual search that may require more than identification of targets is research on x-ray interpretation (e.g., Swensson & Judy, 1981; Swensson, 1980). These differences will have to be resolved as hypotheses in future studies.

Effect of Group Heterogeneity

With reference to the failure to find a heterogeneity effect on RECON task performance, it seems that the primarily mono-cultural sample we obtained may have washed out some of our cultural values manipulation and, therefore, also washed out the effect of heterogeneity.

Specifically, it seems that our subjects were less receptive to the vertical value dimension and, overall, were quite naturally individualistic-horizontal in their primary cultural orientation, as would be expected of a US sample (Hofstede, 1980). Our attempt to use a minimal group paradigm (Tajfel, 1982) to prime four different cultural orientations in the subjects and assign them to groups while informing them of the status of their cultural orientation in the group (i.e., homogeneous, moderately heterogeneous, and heterogeneous) did not have enough impact.

Previous studies (Trafimov, Triandis, and Goto, 1991) were successful in producing the desired manipulation of cultural "orientation" along the individualism-collectivism dimension, an effect replicated in the present study. However, as the significant differences in manipulation check responses indicated, assigning subjects to vertical cultural dimension was met with some resistance. This restriction of range in the horizontal-vertical cultural values dimension also prevented the analysis of the effect of vertical values on performance under leaderless group structures. Further, post hoc examinations of the data indicated that there was no effect of group gender or ethnic composition.

Another factor that could have mitigated against the manipulation has to do with the highly homogeneous nature of the sample. As mentioned in the methods section, our sample is almost totally Caucasian, primarily female, and of a rather restricted age and socioeconomic status range. Since the institution is relatively small, it may even be true that many of members of the group were possibly more or less acquainted. Hence, they might be reluctant to believe that their group mates actually held significantly different value orientations. Future studies will have to use procedures which make it reasonable for group members to form beliefs about their group mates' values in accordance with the design of the experiment. There are at least two solutions to this problem. The first would use the anonymous group paradigm employed by

Adams-Terem, et. al. The second would involve accepting the idea proposed by Triandis some years ago (e.g., Triandis, 1961; Triandis and Davis, 1965) that racial and ethnic markers are major determinants of prejudice and hence of perceived dissimilarity of beliefs. This would imply that for subjects to believe that the others in a group are truly heterogeneous in world values, some physical markers (e.g., race or ethnicity) would have to be present. Such markers could be made salient by the use of an obviously racially heterogeneous sample. The next study will use such a sample.

Like most negative findings, there are some interesting and testable insights. It seems that in real groups where subjects have a chance to interact face-to-face a cognitive set toward a particular level of cultural syndrome can overcome potentially disruptive effects due to value differences. In our case, we feel that it is likely that perceived horizontal similarity trumped any differences in the collective/individualist dimension. Subjects, when racial or cultural markers are not salient, use process time to attribute self-similar values to the other members of the group. If this is the case, then removing the possibility of process interaction should produce effects similar to those seen by previous investigators (e.g., Adams-Terem, et. al., 1985). It is also reasonable to suppose that the effect of process time would weaken over time if further validation were not available. So, allowing process interaction before the task and forbidding it during the task should produce a gradually increasing heterogeneity effect over the number of trials.

Application of the Results

Translating the results of the present laboratory study to real-world work group may benefit from a brief review of Cohen and Bailey's (1997) four types of work groups in organizations. The first type is the "work team." A work team is the one most people think of

when discussing groups, and are characterized by a stable, full-time membership and are responsible for producing good and services. The second type is the "parallel team." Parallel teams combine "people from different work units or jobs to perform functions that the regular organization is not equipped to perform," and typical task is to provide recommendations to management (Cohen & Bailey, 1997, p. 242). The third type of work group is the "project team." Project teams have a time limited existence, produce one-time outputs, and draw their members from experts from "different disciplines and functional units" (Cohen & Bailey, 1997, p. 242). The final type of work group is the "management team." According to Cohen and Bailey, (1997, p. 243) "Management teams coordinate and provide direction to the sub units under their jurisdiction, laterally integrating interdependent sub-units across key business processes" and "are responsible for the overall performance of a business unit."

The results of the present group research design may be best applied to project-teams (Cohen & Bailey, 1997) in fields involved in complex decision making based on numerous visually-coded parameters. Such situations occur in many military (e.g., interpreting large scale situation displays) and civilian (e.g., analyzing x-rays for the presence of disease and other diagnostic imaging techniques) contexts. All contexts where experts from many different fields and, perhaps, cultures need to optimally combine their expertise to meet the goal at hand.

Conclusion

The present study supports the use of the RECON task in group contexts and replicates large effects of clutter and coding manipulations, thus allowing us to manipulate the difficulty of a cognitive task with objective assessments of group productivity. The absence of an effect of group heterogeneity may imply support for Triandis' (1961) argument for the stronger effect of ethnicity on interpersonal interactions versus Rokeach (1960) who argued that values are a more salient determinant. Perhaps future versions of our design that include more ethnicities may

allow an empirical test of this important issue. Last, we replicated Trafimow, Triandis, & Goto's (1991) manipulation of individualism and collectivism in a mono-cultural sample. However, we were not able to generalize this manipulation to the horizontalism and verticalism cultural dimension, which suggests a different cognitive structure for this cultural dimension. This is also a unique finding and may impact how the cognitive structure of culture is understood.

References

- Adams-Terem, R., Fross, J., Landis, D., & Halyes, R. (1985). Perceived heterogeneity and its effect on various types of tasks. (ONR Publication No. ONR 85-1). Arlington, VA: Organizational Effectiveness Branch, Office of Naval Research.
- Adler, N. (1991). International dimensions of organizational behavior, 2ed. Boston, MA: The Kent International Dimensions of Business Series.
- Bettenhausen, K. (1991). Five years of groups research: What we have learned and what needs to be addressed. Journal of Management, 17, 345 - 381.
- Blau, P. (1977). Inequality and Heterogeneity: A Primitive Theory of Social Structure. New York: The Free Press.
- Bochner, S. & Hesketh, B. (1994). Power distance, individualism/collectivism, and job-related attitudes in a culturally diverse work group. Journal of Cross-Cultural Psychology, 25, 233 - 257.
- Cohen, S. & Bailey, D. (1997). What makes team work: Group effectiveness research from the shop floor to the executive suite. Journal of Management, 23 (3), 239 - 291.
- Daft, R. (1998). Organization Theory and Design. Cincinnati, Ohio: South-Western College Publishing.
- Davison, S. C. (1994). Creating a high performance international team. Journal of Management, 13, 81 - 90.
- Early, P. C. (1998). Exploring cultural implications of intragroup processes. In P. Smith (Convenor), Cross-Cultural Challenges to "Mainstream" Social Psychology: A Progress Review. Symposium conducted at the meeting of the International Association for Cross-Cultural

Psychology Fourteenth International and Silver Jubilee Congress, Bellingham, Washington, USA.

Early, P. C. (1993). East meets west meets mideast: further explorations of collectivistic and individualistic work groups. Academy of Management Journal, 36, 319 - 348.

Early, P. C. (1989). Social loafing and collectivism: A comparison of the United States and the People's Republic of China. Administrative Science Quarterly, 34, 565 - 581.

Fiedler, F. (1966). The effect of leadership and cultural heterogeneity on group performance: A test of the contingency model. Journal of Experimental Social Psychology, 2, 237 - 264.

Guzzo, R. (1996). Fundamental considerations about work groups. In M. West (Ed.) Handbook of Work Group Psychology. London: John Wiley & Sons, Ltd.

Hofstede, G. (1991). Cultures and Organizations: Software of the Mind. London: McGraw-Hill.

Hofstede, G. (1980). Culture's Consequences: International differences in work-related values. Beverly Hills: Sage Publications.

Ishihara, S. (1997). The Series of Plates Designed as a Test for Color-Deficiency, Concise Edition. Tokyo: Kanehara & Co., Ltd.

Jackson, S. (1996). The consequences of diversity in multidisciplinary work teams. In M. West (Ed.) Handbook of Work Group Psychology. London: John Wiley & Sons, Ltd.

Johnston, W. (1991). Global work force 2000: The new world labor market. Harvard Business Review, March-April, 115 - 127.

Kagitcibasi, C. (1997). Individualism and collectivism. In J. Berry, M. Segall, and C. Kagitcibasi (Eds.) Handbook of Cross-Cultural Psychology: Vol. 3. Social Behavior and Applications. (2nd ed., pp. 1 - 50). Needham Heights, MA: Allyn & Bacon.

Kagitcibasi, C. & Berry, J. (1989). Cross-cultural psychology: Current research and trends. Annual Review of Psychology, 40, 493 - 531.

Keppel, G. (1991). Design and Analysis: A Researcher's Handbook (3rd ed.). Englewood Cliffs, NJ: Prentice Hall.

Kirkmen, B. L. & Shapiro, D. L. (1997). The impact of cultural values on employee resistance to teams: Toward a model of globalized self-managing work team effectiveness. Academy of Management Review, 22, 730 - 757.

Landis, D., Slivka, R., & Jones, J. (1968). Visual search time in a structured field. The Psychological Record, 18, 543 - 552.

Landis, D., Slivka, R., & Silver, C. (1970). The effect of three types of visual irrelevancy on complex decision making. The Journal of Psychology, 74, 29 - 42.

Landis, D., Slivka, R., & Silver, C. (1969). Some determinants of certitude judgements in a complex decision-making task. Psychological Reports, 24, 447 - 460.

Latane, B., Williams, K., & Harkins, S. (1979). Many hands make light the work: The causes and consequences of social loafing. Journal of Personality and Social Psychology, 37, 822 - 832.

Lau, D. & Murnighan, J. (1998). Demographic diversity and faultlines: The compositional dynamics of organizational groups. Academy of Management Review, 23, 325 - 340.

Levine, J. & Moreland, R. (1998). Small groups. In D. Gilbert, S. Fiske, G. Lindzey (Eds.) The Handbook of Social Psychology, Vol. 2, (4th ed., pp. 415 - 469). New York: Oxford University Press.

Levine, J. & Moreland, R. (1995). Group Processes. In A. Tesser (Ed.) Advanced Social Psychology. New York: McGraw-Hill, Inc.

Miller, M. C. (1994). Relationships among cultural heterogeneity, group processes, & Group Outcomes: A model and empirical study. Unpublished dissertation, University of Houston.

Osgood, C. E., May, W., & Mirin, M. (1975) Cross-Cultural Universals of Affective Word Meaning. Urbana, IL: University of Illinois Press.

Peng, K., Nisbett, R., & Wong, N. (1997). Validity of problems comparing values across cultures and possible solutions. Psychological Methods, 2, 329 - 344.

Rokeach, M. (1960) The open and closed mind: Investigations into the nature of belief systems and personality systems. New York: Basic Books.

Silver, C., Jones, J., & Landis, D. (1966). Decision quality as a measure of visual display effectiveness. Journal of Applied Psychology, 50, 109 - 113.

Steiner, I. (1972). Group Process and Productivity. New York: Academic Press.

Swensson, R. (1980). A two-stage detection model applied to skilled visual search by radiologists. Perception and Psychophysics, 27, 11 - 16.

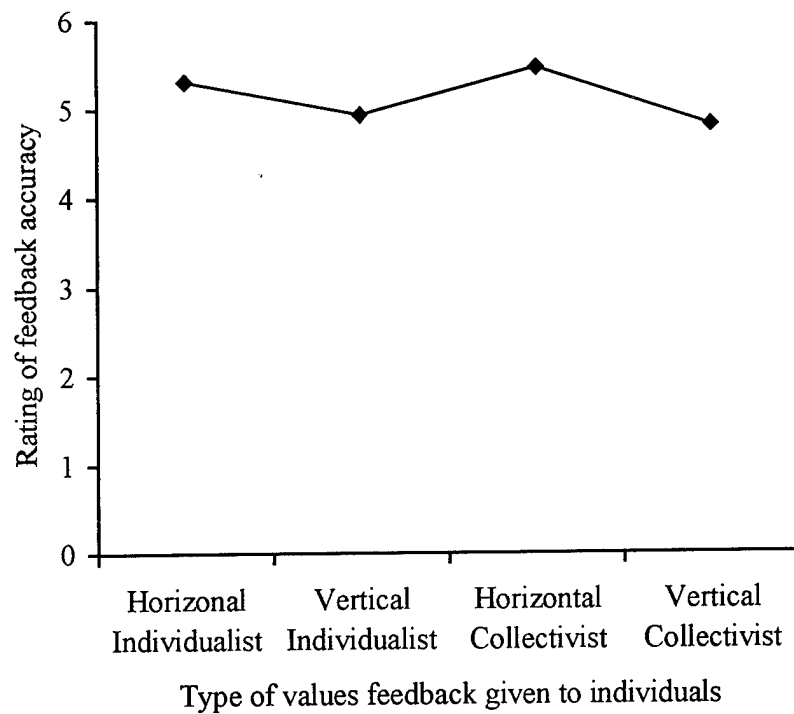
Swenssen, R. & Judy, P. (1981). Detection of noisy visual targets: Models for the effects of spatial uncertainty and signal-to-noise ratio. Perception and Psychophysics, 29, 521 - 534.

Tabachnick, B. & Fidell, L. (1996). Using Multivariate Statistics. (3rd ed.). New York: HarperCollins College Publishers.

- Tajfel, H. (1982). Social identity and intergroup relations. Cambridge, England: Cambridge University Press.
- Trafimow, D., Triandis, H. C., & Goto, S. (1991). Some tests of the distinction between private and collective self. Journal of Personality and Social Psychology, 60, 649-655.
- Triandis, H. C. (1995). Individualism and Collectivism. Boulder, CO: Westview.
- Triandis, H. C. (1994). Culture and Social Behavior. New York: McGraw-Hill, Inc.
- Triandis, H. C. (1990). Cross-cultural studies of individualism and collectivism. In R. Dienstbier (Series Ed.) & J. Berman (Vol. Ed.), Nebraska Symposium on Motivation, 1989: Cross-Cultural Perspectives. Lincoln, Nebraska: The University of Nebraska Press.
- Triandis, H.C. (1961). A note on Rokeach's theory of prejudice. Journal of Abnormal and Social Psychology, 62, 184-186.
- Triandis, H.C. & Davis, E.E. (1965). Race and belief as determinants of behavioral intentions. Journal of Personality and Social Psychology, 2, 715-725.
- Triandis, H. C. & Gelfand, M. (1998). Converging measurement of horizontal and vertical individualism and collectivism. Journal of Personality and Social Psychology, 74, 118 - 128.
- Triandis, H. C., Chen, X., & Chan, D. (1998). Scenarios for the measurement of collectivism and individualism. Journal of Cross-Cultural Psychology, 29, 275 - 289.
- Watson, W. & Kumar, K. (1992). Differences in decision making regarding risk taking: A comparison of culturally diverse and culturally homogeneous task groups. International Journal of Intercultural Relations, 16, 53 - 65.
- Williams, K. & O'Reilly, C. (1998). Demography and diversity in organizations: A review of 40 years of research. Research in Organizational Behavior, 20, 77 - 140.

- Wolf, J. (1996). Visual search. In H. Pashler (Ed.), Attention. London: University College London Press.
- Wolf, J. (1994). Visual search in continuous, naturalistic stimuli. Vision Research, 34, 1187 - 1195.
- Wonderlic Personnel Test, Inc. (1992). Wonderlic Personnel Test User's Manual. Libertyville, IL: Wonderlic Personnel Test, Inc.
- van de Vijver, F. & Leung, K. (1997). Methods and data analysis for cross-cultural research. Thousand Oaks, California: Sage Publications, Inc.

Figure 1. Mean manipulation check response by levels of individual feedback.



Note: There are only three levels of value feedback for the homogeneous work group, horizontal individualist, vertical individualist, and horizontal collectivist.

Figure 2. Mean manipulation check response by levels of individual values feedback collapsed across individualism/collectivism and horizontal/vertical value dimensions.

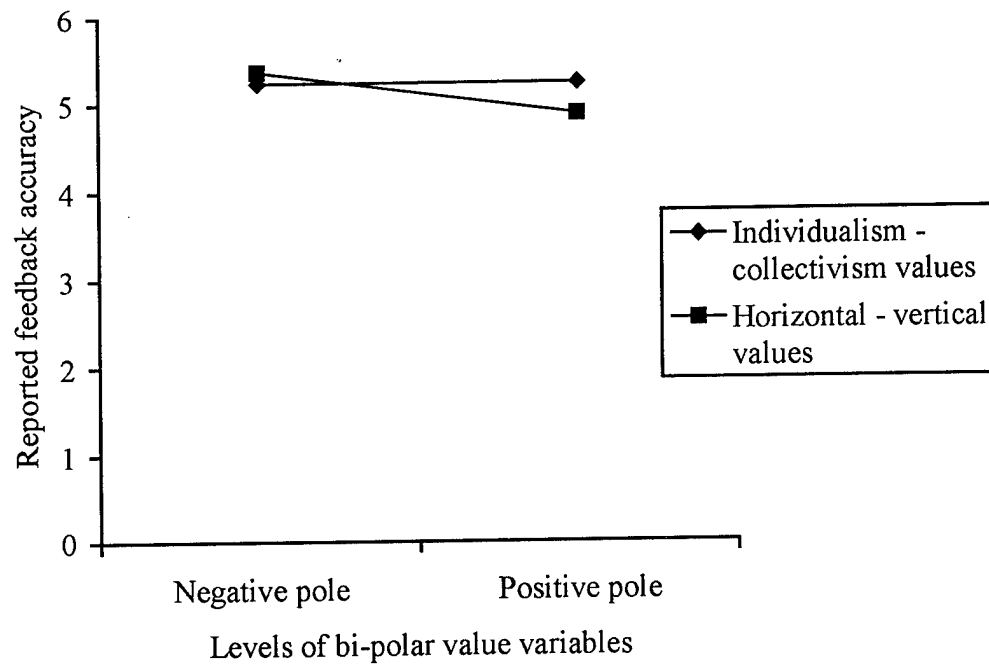
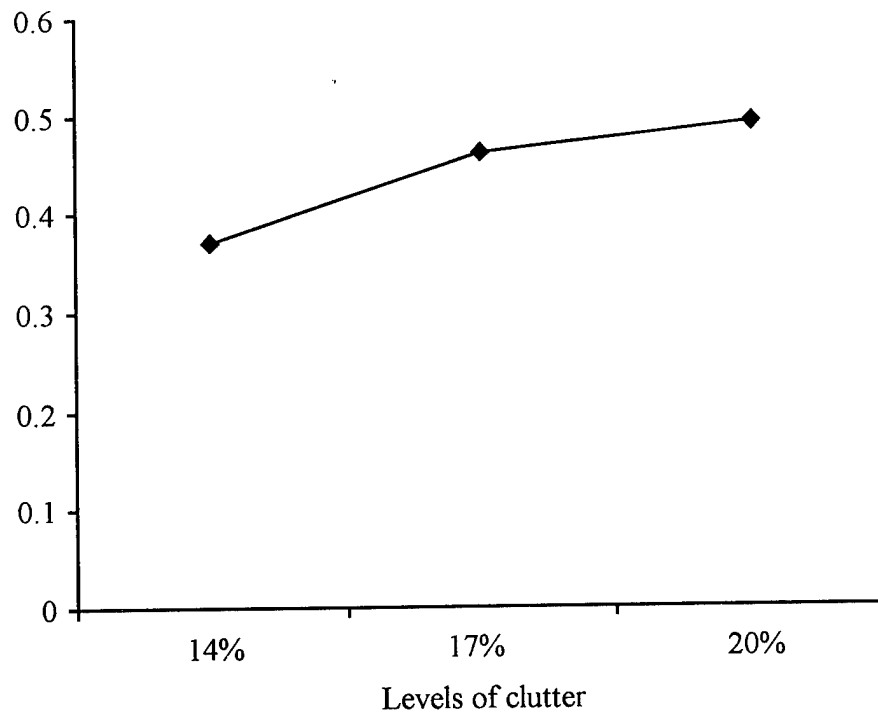
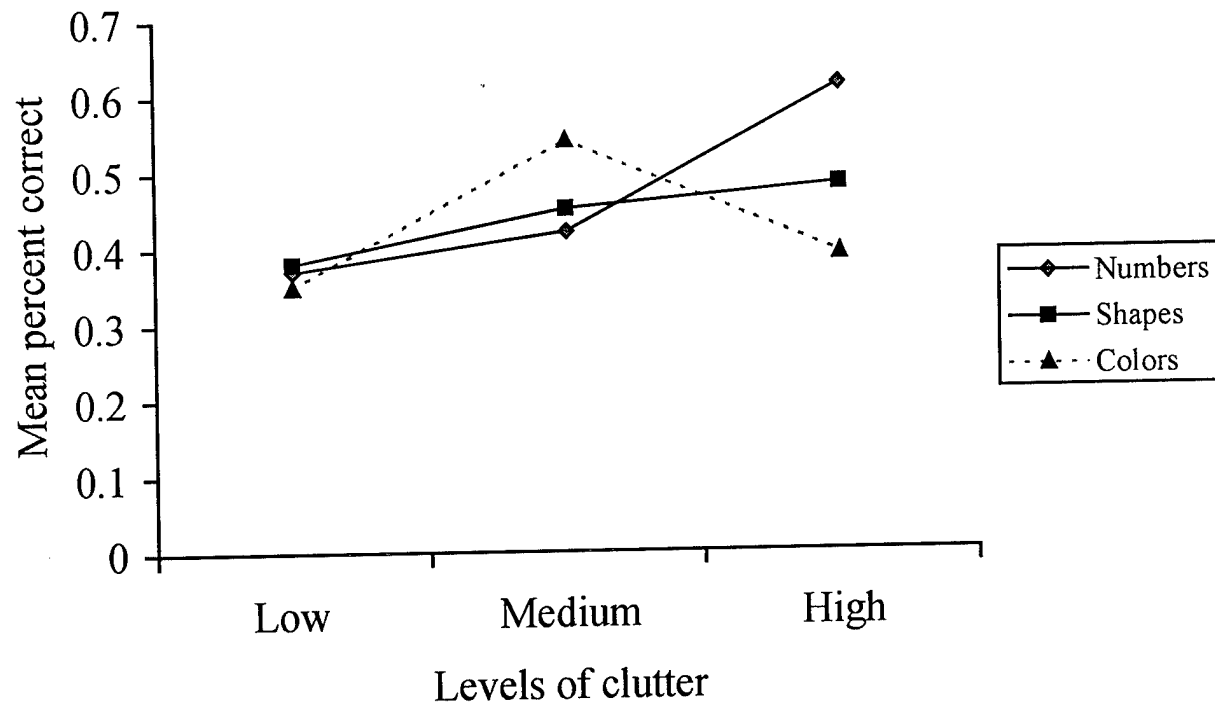


Figure 3. Mean percent effectiveness (PES) score as a function of map clutter.



Note: Low, medium, and high levels of difficulty for map clutter are 14 target and 16 distracter cities, 12 target and 14 distracter cities, and 10 target and 12 distracter cities.

Figure 4. Mean percent effectiveness score (PES) as a function of the interaction of map clutter and city coding.



Note: See definition of clutter in the footnote to Figure 3. Tukey HSD = .08.

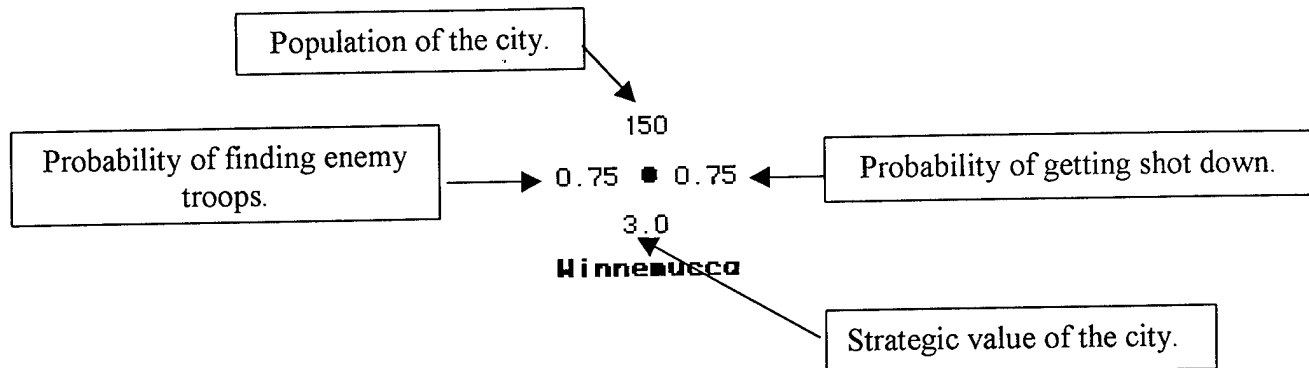
Appendix A

RECON Task Instructions

RECON Users Guide

City Codes

There are four pieces of information about each city for your use in decision making, the population of the city, the probability of getting shot down, probability of finding enemy troops, and the strategic value of the city. The diagram below shows where each of these facts are positioned around the map representation of a city, in this case, Winnemucca.



In the above example, the values for the four facts about Winnemucca are represented numerically. However, these four facts may also be conveyed using colored circles, geometric shapes, or a combination of numerals and shapes or numerals and colors. Regardless of the media used to convey this information about the city, the location of that information is always the same. In other words, the population of the city is always given by the number or symbol at the top of the city representation and the strategic value is always given at the bottom of the city representation just above the name.

Key for City Information Symbols

Population of the city.		Probability of getting shot down.	
50	●	.25	● ●
100	● ●	.50	● ●
150	● ●	.75	● ●
200	● ●		
250			
300	● ●		
Probability of finding enemy troops.		Strategic value of the city.	
.25	● ●	1	● ●
.75	● ●	2	● ●
		3	● ●
		4	● ●

Instructions

Note: The person who has the highest average score on this part of the study will receive a bonus of \$5.00.

This is a game designed to see how well you can interpret data from a computer display. In this game, you are given an aircraft to see what is in as many cities as possible. Each city has certain important information which is coded in a certain way. Each city is worth a specific number of points; some are worth more than others. The more cities you cover, the more points you get.

A time limit will be placed on each map. Your task will be to choose what you consider to be the best flight route and to complete your flight by returning to your point of departure within the specified time limit. You will not be able to visit all the cities on a map.

The purpose of the simulation is: To cover as many cities as possible and get back to your starting point. If you do not get back to your starting point or you run out of time (note the timer at the top of the screen), or you go over the range of your aircraft, your total points will be 10 per cent of what you have earned. On the second sheet is the way in which the information on the cities is coded. Study it carefully.

When you have studied the coding, we have a couple of sample for you to play. Let me know when you are ready to begin.

Game Rules

1. If you run out of gas on any page, the points you have earned will be divided by 10. The travel distance includes the return to the starting point.
2. Points will not be given for a city visited more than once.
3. The probability of finding enemy troops in a given city (**Pfet**) will be .25 or .75.
4. The probability of being shot down (**Psd**) by enemy ground-air weapons will be .25, .50, or .75.
5. The strategic value of a city (**Svc**) will be rated as 1, 2, 3, or 4.
6. The population of a given city (**Pop**) in thousands will be 50, 100, 150, 200, 250, or 300 inhabitants.
7. The value of visiting a given city is equal to the population of that city times the probability of finding enemy troops there, plus the strategic value of that city times the population of that city (**value = (Pop x Pfet) + (Psd x Pop)**).
8. The disadvantage of visiting a given city is equal to the value of the aircraft (\$3000) times the probability of being shot down by enemy ground-air weapons (**disadvantage = (aircraft value x Psd)**).
9. The total value of visiting a given city is equal to the population of that city times the probability of finding enemy troops there, plus the strategic value of that city times the population of that city, minus the value of the aircraft times the probability of being shot down by enemy ground-air weapons (**total value = ((Pop x Pfet) + (Psd x Pop)) - (aircraft value x Psd)**).
10. The total value of the reconnaissance flight plan is equal to the sum of the values as computed in rule 10 for each city reconnoitered in the flight plan.

Appendix B

Stage 3 Protocol and Cultural Value Feedback Forms

Experimenter Directions

- Stay Calm
- Put the group ID # (from the sign-up sheet I give you) on the black board or on piece of paper on the table in front of where the students will sit.
- As students come in, give them the name tags to fill out.
- When they are all there, hand out the Personality Type papers according to the code at the bottom of the page and the sign-up sheet. Then say:

I have some feedback from some of the surveys you took in Stage 1. This information will be relevant to your task today so read this over carefully by yourself and answer the two questions at the bottom. Also, don't forget to put your ID # (last four digits of your social security number) and the group ID # at the bottom. We'll take about five minutes to do this. (Please don't talk among yourselves during this part.)

- Collect the paper as soon as they are finished (we do not want them to compare) and hand out the Everyday Feelings Survey # 1 (out of 3).
- Collect when finished and introduce the group rules for RECON.

The reason for the personality sheets is that previous research has found that people acting according to those descriptions are more successful in group activities such as RECON.

This game should be familiar to you all. There are a few differences with how we will play it this time, however. First, there is a \$50 bonus for the team that does best in this stage. Second, this group must come to a unanimous decision on each of your moves. Third, once the group has come to a unanimous decision, tell me where you want to direct the plane and I will move it for you. Lets review the rules on the directions sheet. (Read over directions and show the example calculation – point out paper and calculators). Any questions? Lets start with three practice pages.

- Start Stage_3_Practice_Game and allow the group to work through the pages reminding them to stay on task and make unanimous decisions as necessary. Elicit any questions.

- Give Everyday Feelings Survey #2, Self Rating Scale #1, and three Group Member Rating Scales #1.

Please write the name of the other three group members on one of each of the three Group Member Rating Scales (one name per page, don't forget self and group ID #s). Now rate the other people in your group as best you can. When finished use the Self Rating Scale to rate your self. Then please fill out the Everyday Feelings Survey. (Try to avoid sharing answers among group members.)

- Collect all forms (check for ID #s) and start the test games.
- When finished with test games, repeat Step 8 with Everyday Feelings Survey #3, Self Rating Scale #2, and three Group Member Rating Scales #2. Then ask them to fill out the Reward Allocation sheet.
- Let 'em out of there. Give class credit for those who ask and note the amount on the signup form.

Alpha Personality Type

In part one of this study you completed a series of reliable and frequently used personality assessment scales. According to these measures, the statements below are typical of the majority of people answering as you did. Please consider these values as you work with your group. Of the members of your group, only half have the same values as you.

- The best society is one in which people do their duty and enjoy it!
- If you were on a trip and only had time to write one letter, you would think of your parents and write them.
- On Spring break you often spend time with your family and friends back home.
- If your best friend and parents weren't getting along very well, you would help their relationship by showing your friend how to understand their family better.
- You are always satisfied by doing your duty, as expected by important groups.

1. Over all, how well do you think these statements describing you? These statements are...

Not at all like me

Very much like me

O O O O O O

2. Please give a brief description of a situation from your life that reflects one or more of the above values in the space below or on the back of this paper.

Last four digits of your ID #: _____

Group ID #: _____

Stage 3

2/4

Beta Personality Type

In part one of this study you completed a series of reliable and frequently used personality assessment scales. According to these measures, the statements below are typical of the majority of people answering as you did. Please consider these values as you work with your group. Of the members of your group, only half have the same values as you.

- Linking with a lot of friendly people gives you happiness.
- While at a pizza restaurant you and your friends select the type of pizza most people prefer, and don't spend time arguing like other groups.
- If a famous photographer offered you a very reasonable price for having a picture taken, you would choose to have your three best friends in the picture with you.
- You have spent some of the best hours having fun with your friends.
- If you were planning to take a major trip. The trip is likely to inconvenience a lot of people at your place of work during your absence. You would manage to work out problems by discussing the trip and solving problems with your spouse.

1. Over all, how well do you think these statements describing you? These statements are...

Not at all like me

Very much like me

O O O O O O

2. Please give a brief description of a situation from your life that reflects one or more of the above values in the space below or on the back of this paper.

Last four digits of your ID #: _____

Group ID #: _____

Stage 3

2/3

Omega Personality Type

In part one of this study you completed a series of reliable and frequently used personality assessment scales. According to these measures, the statements below are typical of the majority of people answering as you did. Please consider these values as you work with your group. Of the members of your group, only half have the same values as you.

11. After eating out with your friends, everyone chips in and pays for his part of the bill separately.

No one is stuck with paying for more than he or she should.

12. In the future of a perfect world each person has one vote, and equality is achieved!

13. When selecting your courses for next semester, you pick the classes that are really interesting to you.

14. You are not swayed by the views of others and are happy to be involved in campus organizations that you like, not ones people tell you to belong to.

15. Despite the propaganda, you select the candidate that you like the best, when voting for President of the Student Government Association.

1. Over all, how well do you think these statements describing you? These statements are...

Not at all like me

Very much like me

O O O O O O

2. Please give a brief description of a situation from your life that reflects one or more of the above values in the space below or on the back of this paper.

Last four digits of your ID #: _____

Group ID #: _____

Stage 3

2/1

Lambda Personality Type

In part one of this study you completed a series of reliable and frequently used personality assessment scales. According to these measures, the statements below are typical of the majority of people answering as you did. Please consider these values as you work with your group. Of the members of your group, only half have the same values as you.

1. When selecting a band for a fundraising event, you picked the one that drew the largest crowd.
2. Making the tough decision of who to honor in your social or work group, you successfully selected the person having contributed to the group the most over the past years.
3. If you were hiring a new employee, the most important factor would be selecting a person who had been "an especially valued employee by a competitor."
4. You are fair person. Teams of five people entered a science project contest, and won \$100! You and one friend did 95% of the work on the project, so when it came time to divide up the money you both spoke up and received 95% of the money.
5. When picking out an outfit, you always choose the most impressive clothes in social situations

1. Over all, how well do you think these statements describing you? These statements are...

Not at all like me

Very much like me

O O O O O O

2. Please give a brief description of a situation from your life that reflects one or more of the above values in the space below or on the back of this paper.

Last four digits of your ID #: _____

Group ID #: _____

Stage 3

Appendix C

Examples of RECON displays

