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COGNITIVE AND INTERPERSONAL VARIABLES ASSOCIATED WITH PERFORMANCE AND SATISFACTION IN SMALL PHYSIOLOGY LABORATORY GROUPS

By

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ABSTRACT

COGNITIVE AND INTERPERSONAL VARIABLES ASSOCIATED WITH PERFORMANCE AND SATISFACTION IN SMALL PHYSIOLOGY LABORATORY GROUPS

By

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Measures of interpersonal style and scales addressing selected constructive and nonconstructive modes of automatic thinking were administered to advanced physiology laboratory students after term-long assignments to 5 triads, 19 quartets, and 2 quintets for technical exercises requiring cooperative effort. Group-based performance and satisfaction indicators were devised and correlated with group-averaged cognitive and interpersonal measures to test hypotheses drawn from pertinent literature. Group performance (lab grade) linked sparsely to the interpersonal measures but more often correlated significantly with favorable scores on scales of Constructive Thinking and Emotional Coping. Satisfaction, in contrast, was more strongly related to interpersonal than cognitive variables. It was significantly higher in groups rated more favorably for Friendliness, Task-Orientedness, and Categorical

Thinking. A brief reading comprehension (Validity) scale generated puzzling findings. Meaningfully assessing group performance proved problematic and alternative approaches were suggested. Linkages of group performance and satisfaction to cognitive and interpersonal variables plainly require further study.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

The coordinated performance of individuals in small groups can be of vital importance in many situations. Examples include aircraft requiring more than a solo pilot, astronauts engaged in space exploration and living, people wintering over in Antarctica, and other situations where individuals rely on each other for the performance of essential functions. More mundane group situations also seem likely to be substantially impacted by the configuration of personalities among group members, such as is encountered in the work environment of many professionals. The more smoothly the individuals in these groups can cooperate, the more effectively they seem likely to attain their goal(s). The present study investigates the links between group performance, as defined by grades in a physiology laboratory class, and interpersonal and cognitive style of their working groups.

Interpersonal style can be usefully conceptualized as the individual's characteristic manner of communicating with others along the two orthogonal dimensions of dominance and affiliativeness, according to Leary (1957), Carson (1969), and others (Wiggins, 1982). A third dimension, task-orientedness - emotional expressivity, was

added by Bales (1970) from work with student groups. While Carson (1969) theorized that dyads with certain configurations of dominance and affiliation should communicate most efficiently, some researchers (e.g., Altman & Haythorn, 1967; Smith & Haythorn, 1972) have shown that dyads with these more compatible configurations of interpersonal style performed better on syllogistic reasoning and vigilance tasks than less well-matched dyads.

Approaching the description of human functioning from a different perspective, Epstein (1973; in press) developed the Cognitive-Experiential Self Theory (CEST). CEST posits that preconscious thoughts are guided by three fundamental conceptual systems: (1) a rational system regulating rational and cognitively oriented mentation, as represented by a person's IQ, (2) an experiential system which is associated with emotions and processes information more crudely than the rational system, and (3) an associationistic system which operates at a predominantly unconscious level and is the source of creativity and inferences about the future as well as the past. Epstein asserted that the experiential system, which is largely irrational and emotional, determines most of our ordinary every-day behavior. He subsequently developed measures of the experiential system which correlated positively with success in work and social relationships--sectors which seem highly relevant to the performance of groups. Both interpersonal style and preconscious thinking patterns will

now be addressed in more detail to show how they relate to the performance and satisfaction of small groups.

Interpersonal Theory

While Sullivan (1953) was among the first to formulate a theory of interpersonal behavior, Leary (1957) made important modifications and framed interpersonal behavior in terms of a circumplex model (see Figure 1). The two orthogonal bipolar dimensions of behavior in Leary's model are Dominance (in the vertical dimension) and Love (in the horizontal dimension). Persons high in Dominance tend to display behaviors which are predominantly controlling in nature (cocky, demanding, domineering) and persons low on this scale tend to display more submissive behaviors (undemanding, forceless, bashful). Similarly, persons high in Love would tend to display affiliative type behaviors (warm, cheerful, kind) and persons low on this dimension would favor less affiliative, more hateful behaviors (ruthless, cold-hearted, crafty). Other circumplex models of interpersonal behavior were reviewed rather comprehensively by Wiggins (1982).

Carson's (1969) elaboration of Leary's (1957) circumplex model addressed the characteristic of complemetarity which has also been supported by more current research (e.g., Locke & Horowitz, 1990). This concerns the hypothesized tendency for persons to pull complementary behaviors from others along the Dominance-Submission axis (Dominance tends to induce Submission and vice versa),

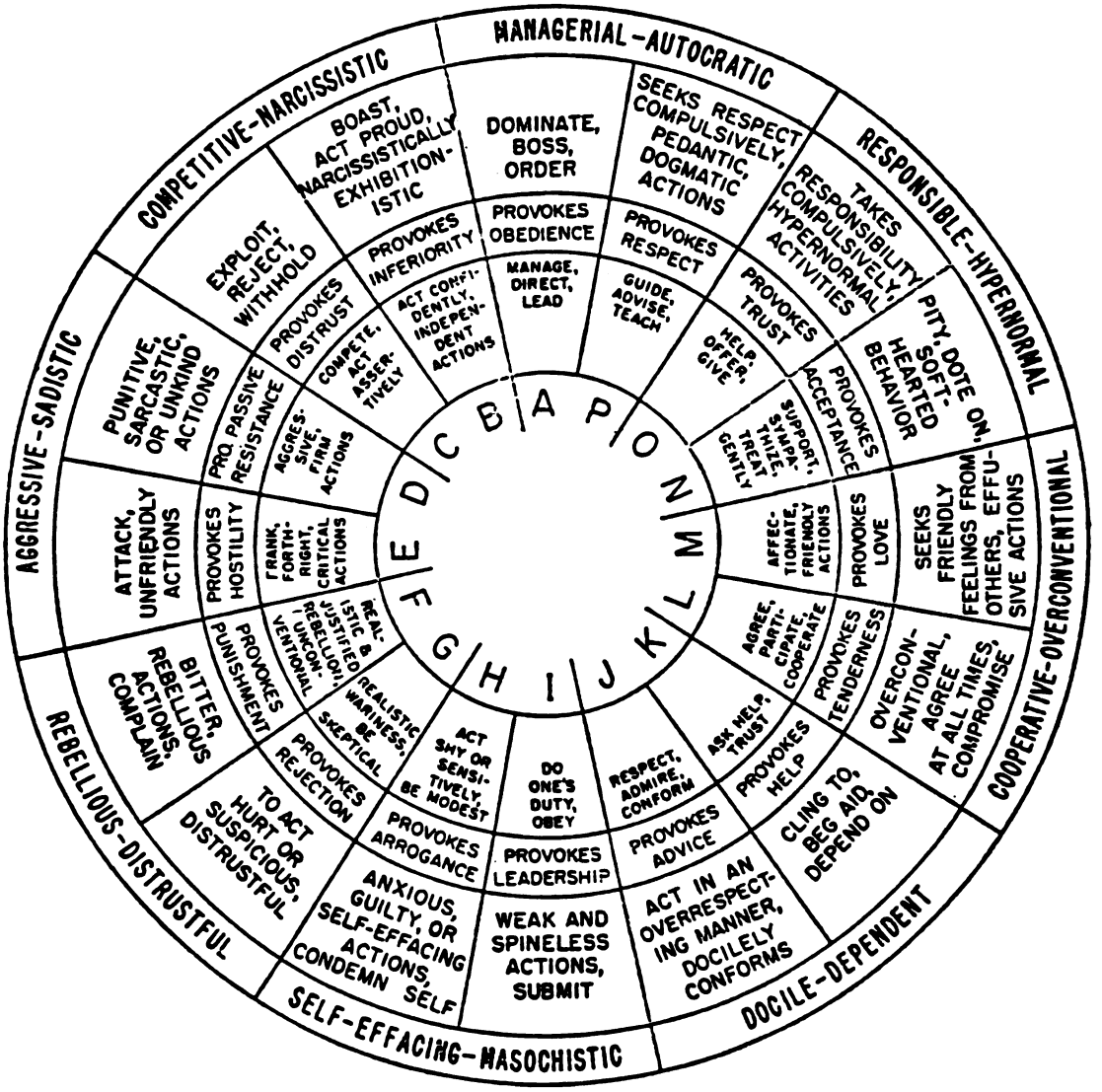

Figure 1

Leary's Interpersonal Circumplex Model

while pulling for corresponding behaviors on the Love-Hate axis (Love induces Love and Hate induces Hate). Although some studies have questioned this theoretical assumption (Orford, 1986), others have found that dyads and triads who differ on the Dominance-Submissiveness dimension, but who are similar on the Love-Hate dimension tend to perform better to together and to be less anxious with each other than the three other combinations (Haythorn, 1973; Jones & Annes, 1983; Kanas, 1987).

Bales's Interpersonal System

Bales (1950; 1970) independently formulated an interpersonal interaction theory that supplements Leary's two axes (which Bales denoted as the Up-Down [Dominant-Submissive] and Positive-Negative [Love-Hate] poles) with a third orthogonal dimension, Task-Orientedness-Expressivity (Bales & Cohen, 1979). The Bales model thus extends Leary's circumplex to a three-dimensional space. Bales's observational and self/peer-report scoring scheme is called the System for the Multiple Level Observation of Groups, or SYMLOG. In support of this model, several researchers have replicated clusters in factor analytic studies that correspond to behavioral task-orientedness (Wish, 1976; Wish, Deutsch, & Kaplan, 1976) as well as the other two dimensions of the Leary system. At least one other study (Solomon, 1981) has provided support for some major features of SYMLOG peer ratings with the Jackson Personality Research Form measures of analogous dimensions

(Jackson, 1965).

Although there is less theoretical background pertaining to compatibility along the Task-Orientedness axis, some isolation studies of dyads and triads of military personnel have indicated that homogeneous high levels of need for achievement, which seems functionally similar to Bales's Task-Orientedness dimension, facilitated cooperation and yielded greater overall group performance than lower and more heterogenous levels of the need for achievement (Haythorn, 1973; Smith & Haythorn, 1972).

Prior Compatibility Studies

Leary's (1957) theory of interpersonal behavior was primarily based on an intrapsychic model and did not directly address the issue of two or more persons' compatibility. Carson (1969) explicitly discussed the compatibility of interpersonal behavior in dyads, but did not consider larger units. The present study, then, draws on the experimental studies by others related to the theories of Leary and Carson as the base for formulating hypotheses.

One of two studies relevant to compatibility involving the three interpersonal dimensions of dominance, love, and task-orientedness is that of Altman and Haythorn (1967). They studied the impact of social isolation and group personality factors on the performance of individuals and teams of military recruits over 10-day periods. The 36 participants were organized into 18 dyads representing

groups homogeneously high, homogeneously low, and heterogeneous for each selected personality factor. The participants were isolated together for a 10-day period, and as part of the study were asked to complete diverse tasks involving vigilance, syllogistic reasoning, and combat information manipulation once or twice daily, with the latter two requiring some coordinated effort between participants. The researchers had predicted that dyads homogeneously high in need for affiliation, homogeneously high in need for achievement, but heterogenous in need for dominance would outperform the other combinations.

Their findings often contradicted these predictions. Groups homogeneously high in need for dominance, heterogenous in need for achievement, and homogeneously high in need for affiliation tended to outperform the other personality combinations. The only prediction supported was that groups homogeneously high in need for affiliation would outperform those heterogeneously and homogeneously low in need for affiliation (Altman & Haythorn, 1967)

Addressing the same compatibility hypotheses, an extension of this study (Smith & Haythorn, 1972) involved 81 US Navy enlisted men during a 21 day isolation experiment. Half of these men were assigned to dyads and triads theorized to be maximally compatible while the other half were assigned to maximally incompatible groupings. Results indicated that theoretically incompatible groups reported feeling significantly more "hostile" toward their

partner(s) regardless of group size. It seems likely that those reporting the most hostility were also least satisfied with their small group experience.

That both studies involved conditions of isolation does not necessarily preclude their relevance to more common conditions. In relation to the issue of generalizability, Altman and Haythorn (1967) stated,

> It seems quite possible that composition effects will be accentuated in isolation and confinement because of greater member interdependence and because close and extended contact may make personality differences more salient and visible (p. 314).

Testing for the effects of interpersonal compatibility on performance and satisfaction in relatively nonconfining environments may be a more rigorous test of the theory than more demanding conditions because confinement may simply accentuated behavioral patterns which are buffered by less confining circumstances. This assumption remains to be tested empirically. In view of these considerations, however, the works cited seem likely to have at least some relevance to interpersonal compatibility within small groups which are less socially isolated.

Constructive Thinking

Practical intelligence (e.g., Sternberg & Wagner, 1986), as distinct from the intellectual abilities addressed by IQ tests, has recently become a topic of psychological research and theory. After exploring this topic among undergraduate psychology students, Epstein

(Epstein & Meier, 1989) asked, "why do smart people think dumb"? As they stated,

> ...it became evident that a disconcertingly large number of students in [my] Epstein's class on emotions often thought counter-productively about many potentially stressful situations. Included were concerns over failure, love relationships, relationships with the family, concern over what people thought of them, and ambivalent strivings over independence" (p. 333).

Epstein's (in press) CEST theory, which attempts to explain these and similar phenomena, posits that every person operates under three semi-independent conceptual systems: a rational system, an experiential system, and an associationistic system. According to CEST, the rational system operates on socially established rules of logic and functions at a fully conscious level. Epstein & Meier (1989) likened the functions of the rational system to the abilities addressed by the standard IQ test. In contrast, the experiential system operates at a predominantly preconscious level, is not as logical as the rational system, and is closely tied to one's emotions: it processes information more "crudely" than does the rational system. The associationistic system operates at an "unconscious" level, and is primarily responsible for creativity and drawing inferences about the past as well as the future (Epstein, in press). However, it is the experiential system, Epstein maintains, which is most useful in helping to explain counterproductive behaviors sometimes observed in otherwise reasonably intelligent persons.

The Experiential System

Perspectives on constructive (positively toned) and nonconstructive (negatively toned) automatic thought processes have been proposed before and used in other theories of personality and therapeutic change (e.g., Beck, 1976; Ellis, 1962; Lazarus, 1966; Meichenbaum, 1977). Automatic thought processes associated with Epstein's experiential system have not, however, previously been used to explain human behavior independent of general intellectual abilities. CEST assumes that most human behavior is very automated and is largely guided by modes of constructive and nonconstructive thinking associated with the experiential system. But if asked to explain one's everyday behavior, individuals commonly attribute it to the rational system, incorrectly believing that they make conscious decision to do just about everything (Epstein & Meier, 1989). In short, CEST assumes that automatic thought processes, operating at the preconscious level, greatly influence everyday efficacy. They wrote:

> Because behavior in everyday life is determined mainly by the experiential system, experiential intelligence should play a vital role in determining effectiveness in living. It follows that if one wishes to understand and predict success in living, it would be very helpful to have a measure of the experiential system (p. 333).

Furthermore, their empirical studies have significantly linked measures of the experiential system with "success in

work, love, social relationships, and in maintaining emotional and physical well-being" (p. 332). It is likely that their Constructive Thinking Inventory (CTI), an instrument for assessing modes of constructive and non-constructive thinking, may have some value in predicting effective group performance since success in work and social relationships seems especially important to the cooperative functioning of groups extendedly engaged in common tasks.

Group Verses Individual Performance

Although used extensively throughout this paper and the writing of others, "cooperative functioning" or "group performance" are difficult terms to define, no to mention measure. Groups performance has been described by others (e.g., Helmreich, 1987) as being dependent on "the managerial, interpersonal aspects of [group] behavior" (p. 66). This is distinct from individual performance which does not depend on the input from or communication with others. Close to the ideal of assessing group performance, Foushee and Manos (1981) have used high-fidelity simulators to track flight errors of commercial airline pilot crews when presented with realistic high workloads of simulated bad weather coupled with aircraft mechanical malfunctions. Increasing numbers of incorrect or unsafe aircraft maneuvers decreased the crews' performance scores in these studies. This often contrasted with ratings of technical proficiency for individual crew members at their respective

jobs of captain, copilot, and flight engineer under the same circumstances. Artificially separated in this example, there is likely to be moderate to substantial overlap between group and individual performances in determining most teamwork outcomes. A study by Helmreich (1987) supported this overlap by finding a correlation of .40 between individual and group-based measures of performance with airline pilots (p. 40).

Development of This Study

There seems little empirical work that addresses relationships between the interpersonal and cognitive style of small groups and subsequent performance and satisfaction, but many occupational and personal circumstances are likely influenced by these variable. The National Aeronautical and Space Administration (NASA) is particularly interested in the links between group interpersonal and preconscious thinking styles as they relate to subsequent group performance of astronauts. Although funding has been allocated by NASA and other research agencies to explore these areas, surprisingly little progress seems to have been made. Christensen & Talbot (1985), co-editors of a recent review of the latest research opportunities in human behavior and performance for NASA stated that,

> ...basic studies in the interactions of individual personality factors and group performance should be accorded a high priority. Effort should be focused on personality characteristics that favor compatibility and cohesiveness of small groups and should emphasize the real world of the physical and operational environment of the space station.

> In addition, the effects of group training in modulating individual personality characteristics toward improving group cohesiveness and productivity should be investigated (p. 209).

Subsequently, as pointed out earlier in this text, there is an obvious need to ascertain performance links to interpersonal style and preconscious thinking patterns of goal-oriented groups. However, long-term group satisfaction may also be important, as evident by Christensen and Talbot's mention of group "cohesiveness" as a desirable outcome of compatibility.

It has been shown that the configuration of interpersonal and thinking styles within groups can, at least theoretically, substantially influence their performance and satisfaction. Homogeneously high group affiliativeness and heterogeneous dominance appear linked with performance and satisfaction. Epstein and Meier (1989) have correlated increasing levels of constructive thinking and decreasing levels of nonconstructive thinking with individual success in interpersonal as well as achievement situations, suggesting potentially functional relationships to the performance of small groups engaged in goal-oriented tasks. Based on this evidence, the following hypotheses (H1 to H4) were posed for investigation:

H1: Groups homogeneously high in affiliativeness will manifest higher levels of performance and satisfaction than others.

H2: Groups heterogeneous in dominance will manifest higher levels of performance and satisfaction than others.

H3: Groups higher on measures of constructive thinking will manifest higher levels of performance and satisfaction than others.

H4: Groups lower on measures of nonconstructive thinking scales will manifest higher performance and satisfaction than others

METHOD

Participants

All were college undergraduates enrolled in an advanced Physiology course (PSL 401) which consisted of separate lecture and laboratory sections. For the laboratory portion, the focus of this study, participants were organized into triads, quartets, and quintets to conduct exercises using live animals and tissues obtained from euthanized animals, as well as electrophoretic, spectrophotometric, and polygraphic equipment. The lecture portion met three times weekly for one hour, accounting for 60% of the final grade, and the laboratory portion met once

Table 1

General Characteristics of the Sample (N = 101)

	Number	Percent of Total
Gender		
- Male	52	51.5
- Female	49	48.5
Ethnic minorities	22	24.2
- African-American	9	9.1
- Asian	5	5.1
- Native American	4	4.0
- Hispanic or Mexican American	4	4.0
Mean age	21.3 years	
Age range	19 - 29 years	

weekly for three hours, contributed the remaining 40%. Of the total possible laboratory points (160), 84% (135) were from nine 15-point individually written laboratory reports, and 16% (25) were from two unannounced 5-item quizzes on recently presented laboratory material.

Table 1 shows that, with a total of 101 participants, the mean age was 21.3 years (N = 94, 7 omitted age reports), ranging from 19 to 29 years. This sample included 52 males and 49 females; also 22 of 99 were ethnic minorities (two omitted ethnicity reports). Each

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Table 2

Number of Groups with Women Members

	# of Groups	% Women
Triads(5)		
Three	1	100
Two	2	67
One	1	33
None	1	0
Quartets(19)		
Three	5	75
Two	8	50
One	4	25
None	2	0
Quintets(2)		
Four	1	80
Two	1	40

Total = 26 groups

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laboratory section was composed of about 20 students, and Table 2 shows the gender composition of the smaller work groups featured in this study. After forming voluntarily on the first day of the laboratory, work groups remained

together for the 10-week term to conducted a total of nine physiology exercises. Participation in this study was not mandatory, but was encouraged at the first laboratory session by both the professor in charge of this course and the author. Each person signed an informed consent form stating that he or she was participating on a voluntary basis, could withdraw from the experiment at any time, and could choose not to answer questions they found inappropriate or offensive. Time was set aside at the end of four of the nine exercises (#2, #4, #7 and #9) to complete the paper and pencil measures described later.

Setting

The physiology laboratory, where all exercises were conducted, was approximately 30 x 20 ft, with three 10 x 4 ft black slate experiment tables set parallel to each other in the direction of the room's shorter dimension. Five work groups of between three and five persons sat across from each other at the tables, one group per side of each table. The last table's spare side was used as a preparation area for the animals and chemicals to be used. There were six sections of five groups that arrived on different days or at a different time during a given day to avoid overlap. The laboratory was always set-up by the professor and two Teaching Assistants (TAs) ahead of time (the TAs helped the professor in the laboratory and grading for the term).

Laboratory procedures and theoretical aspects of each

exercise were presented to the students by the TAs during each section's initial 10-15 minutes, while the supervising professor demonstrated particularly difficult laboratory techniques, usually within an additional 10 minutes. Students then conducted their exercises with the TAs available for assistance as needed. When data were to be collected for the current study during the laboratory period, the author presented and explained the measures after the TAs or professor had discussed the relevant exercise techniques. The author and an assistant then distributed and collected the measures as each of the groups completed their exercises at the end of the laboratory period.

Measures

Satisfaction and Performance

Satisfaction. An original questionnaire consisting of four items was administered after each exercise involving other measures from this study, or four times during the term. These items were:

1. On a scale from 0 to 10, how satisfied were you with your laboratory group?
2. On a scale from 0 to 10, how satisfied were you with the laboratory class?
3. On a scale from 0 to 10, how well did you personally get along with the rest of your group?
4. On a scale from 0 to 10, how well did your group personally get along with each other as a whole?

Mean satisfaction for a group was determined by first averaging the responses to all items per person for all administrations, then by taking the mean of those averages

for each group's members. Mean responses to individual items averaged across occasions and group members were also considered as independent measures of satisfaction.

Performance. Performance was measured three ways:

1. Lab-P was the group's mean laboratory points received. The higher this number, the better the performance. Addressing only members' performance in the laboratory setting, it was the simplest and most direct index of group performance.

2. LabG-C weighted group performance relative to the previous individual performance of group members. It was derived by converting each group's mean laboratory points (Lab-P) into a percentage of the total possible points. This percentage was then transformed into a grade on a 4.0 scale, in 1/10 point increments, starting at 90% and above = 4.0, decreasing to 50% and below = 0.0. The group's mean cumulative grade point average (GPA), in 1/10 point increments, was then subtracted from the transformed lab grade to arrive at a GPA-corrected score that attempted to account for the influence of previous individual knowledge on the performance of the group.

3. Lab-Lec was the group's mean laboratory grade received minus the group's mean lecture grade received, each being the transformed grade equivalents described by the above procedure. This indicator reflected group's lab performance relative to lecture performance: higher values indicating better performance in the lab relative to lecture performance.

Lab-P was the most direct, and perhaps the most face-valid indicator of performance because no transformations were used. However, others have found that the best predictor of a person's future individual performance is their past performance in similar situations (e.g., Owens & Schoenfeldt, 1979). Based on this, LabG-C appears a performance indicator which would ideally tease-out the

individual GPA-based factors. This would leave a refined group factor, a "purer" measure of group performance. Lab-Lec was another way of subtracting individual factors (lecture grade) from the group-plus-individual factors (laboratory grade).

Interpersonal Adjective Scales - Revised (IAS-R)

Based on Leary's (1957) interpersonal circumplex model, the IAS-R (Wiggins, Phillips, & Trapnell, 1988; 1989) is a 64-item interpersonal style checklist designed to assess the strength and direction of an individual's self-reported personal attributes along the Love and Dominance dimensions of behavior. Each item consists of an interpersonal adjective (e.g., assertive), and the respondent rates how accurately each item describes him or her on a Likert scale ranging from 1 (extremely inaccurate), to 8 (extremely accurate). Each interpersonal scale or "octant" includes 8 items. The scale names,

Table 3

Interpersonal Adjective Scales - Revised

Name	Vector angle	Alpha*
Warm-agreeable	0°	.86
Gregarious-extraverted	45°	.85
Assured-dominant	90°	.84
Arrogant-calculating	135°	.85
Cold-hearted	180°	.80
Aloof-introverted	225°	.85
Unassured-submissive	270°	.83
Unassuming-ingenuous	315°	.75

N = 1161 * Coefficient Alpha (Wiggins et al., 1988).

vector angles, and alpha reliabilities are displayed in Table 3.

A scoring formula trignomically combines each octant's sine and cosine components into summary scores for the orthogonal Dominance and Love dimensions, yielding a number typically ranging between +2.8 and -2.9 for Dom scores (M = .14), and between +2.3 and -3.8 for Lov scores (M = -0.16), using the minimum-maximum values from Wiggins' validation sample of 1232 undergraduate psychology students (personal communication, November 28, 1989).

Constructive Thinking Inventory (CTI)

Epstein and Meier (1989) developed the 64-item CTI to address preconscious constructive and nonconstructive thinking patterns, which are constituents of the experiential conceptual system. Table 4 gives the names and alpha reliabilities of the CTI scales for the 64-item form used with a normative sample of 124 undergraduate psychology students.

Table 4

Constructive Thinking Inventory

Scale	Alpha*
Constructive Thinking	.87
Emotional Coping	.85
Behavioral Coping	.84
Categorical Thinking	.70
Superstitious Thinking	.75
Naive Optimism	.67
Negative Thinking	.73

N = 124 * Coefficient Alpha (Epstein & Meier, 1989).

Presented below (Epstein & Meier, 1989) are the CTI constructive thinking (the first four) and nonconstructive thinking (the latter four) scales and the types of personal characteristics that are tapped by each.

(Global) Constructive Thinking: This 26-item bipolar scale assesses the denial of nonconstructive thinking as well as the acknowledgement of constructive thinking. Persons scoring high on this scale are accepting of self and others and generally interpret events optimistically. This optimism, though, has realistic bounds and is generally an adaptive characteristic for the person.

Behavioral Coping: This 12-item bipolar scale assesses a persons tendency to engage in thinking that promotes effective action toward a desired outcome.

Emotional Coping: This 9-item bipolar scale measures a person's tendency to not take things personally, to not be overly sensitive to disapproval from others, and to not worry excessively about past or current failure.

Validity Scale: This 5-item unipolar scale only serves to assess respondents' reading comprehension of the test items.

Naive Optimism: This 7-item unipolar scale measures a person's tendency to grossly overgeneralize experiences following positive outcomes.

Superstitious Thinking: This 9-item bipolar scale assesses the degree to which a person believes their thoughts alone can influence future events and how strongly they believe in "questionable phenomena" such as astrology and ghosts.

Categorical Thinking: This 12-item bipolar scale taps into a person's polarized thinking patterns that may be extremely rigid and unyielding to moderation.

Negative Thinking: This 10-item bipolar scale taps into a person's tendency to think about life events in a negative light (i.e., pessimistically). Person's scoring high on this scale tend to interpret the present and future with a negative bias, not recognizing or acknowledging the positive aspects of life.

SYMLOG

SYMLOG is a 26-item self- and peer-report questionnaire designed to measure the Dominance, Friendliness, and Task-orientedness dimensions of interpersonal behavior as described by Bales & Cohen (1979). For each item respondents rate themselves, or another person, on how often he or she exhibited behaviors briefly described (e.g., "active, dominant, talks a lot"). Evaluations are made on a Likert scale ranging from never (0), to always (4). The rating form is designed for administration to small groups, and each respondent is requested to rate themselves as they think others in their group see them, and to rate the others in the group based on behavior in the group setting. Instructions were given to participants to use the form in this manner.

The 26-items represent three, 18-item scales that overlap in content which is predictably correlated with adjacent scales. The reliabilities for the Dominance (Up), Friendliness, and Task-Orientedness dimensions are .62, .97, and .75 respectively (Bales & Cohen, 1979).

Other Measures

The *Student Instructional Rating System*, a standard course evaluation form used at Michigan State University, is a 25 item survey which asks students to rate the course instructor(s) as Superior, Above Average, Average, Below average, or Inferior on teaching style and effectiveness,

likability, responsibility, ease of note taking, and several other pedagogical attributes. Of interest to this study, the last five items address (1) general enjoyment of the course, (2) whether course is required for major or not (3) gender (4) Overall GPA, and (5) class level (junior, senior, etc.).

The author added a 12-item questionnaire designed to gather information on laboratory variables such as the quality of assistance by the TAs, ways of improving the laboratory, ways of improving the group structure, and on participant variables such as the number of previous laboratory classes taken, ethnicity (Caucasian, African-American, Native American, Hispanic or Mexican-American, or Asian), and cumulative grade-point average (GPA) to two decimal places.

Procedures

Participants selected a four digit confidential code (two letters designating a unique group, and two numbers unique to that group) which they used on all questionnaires to maintain anonymity. A key to match these codes with university-established student identification numbers was kept in confidence to allow later correlations with class grades used in computing "performance" scores. No other person, including the supervising faculty member, had access to the identifying list. The confidential code/ student number list was only used for two purposes: (1) to identify group members who may not have been turning in

questionnaires (these people were politely encouraged to complete them), and (2) to match a list of final grades by student numbers to the respective confidential codes.

At the beginning of lab exercise two, subjects were informed that they would be filling out the IAS-R about themselves and a satisfaction questionnaire about themselves and their lab group experiences at the end of the period after completing their exercises. It was explained that the consent form would also be distributed, and only those groups with all members volunteering could participate in the study. The participation rate was 26 out of 30 groups (87%) or 105 out of 117 students total (90%). Four participants dropped the class by the end of the term, lowering the individual student participation rate to 86% (101 out of 117), shifting one quintet to a quartet and three quartets to triads.

During lab exercise four, participants were shown how to fill-out the CTI and were informed that a satisfaction questionnaire would also be given. The author and research assistant distributed the CTI and satisfaction questionnaire to participants as they completed their exercises.

At the beginning of lab laboratory seven, the author gave a five-minute demonstration on how to fill out SYMLOG. At the end of the period large name tags were distributed and individuals in each group selected a unique number between one and "X", the number of people in the group

(usually four); this was written on the tag. Only one of the six parallel columns on the SYMLOG rating form was necessary to evaluate each member of the group. Person number one (wearing tag #1) was rated on the 26 items of the SYMLOG by everyone in the group, including themselves, in column #1, person number two in column #2, etc., until all group members were rated. The author and assistant distributed the SYMLOG and satisfaction questionnaires to each participating group as they completed their exercises.

During exercise nine, the author explained how to fill out the *Student Instructional Rating System* and the other questionnaire designed to elicit background information on participants and feedback about the course structure. The author stipulated that the forms were to be filled out for the laboratory section of the class only. The author and an assistant distributed the satisfaction questionnaire and the other two measures to participants as they completed their exercises. Table 5 summarizes when and which questionnaires were administered throughout the 10-week term.

Table 5

Sequence of Instrument Administration

	Week of Term			
	2	4	7	9
Instruments Administered	IAS-R, SAT #1*	CTI, SAT #2*	SYMLOG, SAT #3*	Two Student/Class information forms, SAT #4*

*SAT = Satisfaction Questionnaire (same form in all administrations)

RESULTS

Performance and Satisfaction Measures

As shown in Table 6, performance and satisfaction indicators correlated substantially with same-facet measures, but not across facets. Performance indicators interlinked less firmly (mean r = .61) than satisfaction indicators (mean r = .75). Lab-Lec linked least strongly (median r = .49) with the other performance measures, probably because of the heavy correction involved in comparing one's performance in the laboratory with that in the lecture section. The grand mean of satisfaction ratings (SatM) correlated highest with all other satisfaction indicators, while Sat2 (laboratory class) manifested the weakest links (median r = .46) with other satisfaction measures.

Interestingly, no present satisfaction and performance measures correlated significantly, although most (12 of 15) of these associations were positive (mean r = .04). It had been anticipated that these outcome measures would overlap appreciably, but this did not occur. Instead, these performance and satisfaction indicators were virtually independent.

Table 6

Means, Standard Deviations, & Intercorrelations of Satisfaction and Performance Measures (N = 99)

	Satisfaction					Performance		
	SatM	Sat1	Sat3	Sat2	Sat4	Lab-P	LabG-G	Lab-Lec
SatM	-							
Sat1	92[a]	-						
Sat3	92[a]	86[a]	-					
Sat2	72[a]	42[a]	46[a]	-				
Sat4	93[a]	89[a]	93[a]	46[a]	-			
Lab-P	05	01	08	06	03	-		
LabG-P	11	06	11	12	06	84[a]	-	
Lab-Lec	03	-05	-01	-03	-01	42[a]	57[a]	-
Mean	8.64	8.85	8.90	7.95	8.87	133.2	.30	7.98
St.Dev.	.96	1.04	1.02	1.31	1.05	18.6	.83	10.6

[a] $p \leq .0005$

Interpersonal and Cognitive Style Measures

Interpersonal: Individual's SYMLOG and IAS-R Dominance and Affiliativeness scale scores linked moderately and significantly within analogous measures, but weakly across dimensions, suggesting that these measures tapped functionally similar constructs (see Table 7). Whereas the respective affiliativeness scales did not correlate significantly at the group level, the dominance scales linked positively and appreciably. Although SYMLOG Task-orientedness significantly correlated with IAS-R Dominance for individuals ($r = .20$, $p \leq .05$), its links to this and other scales were generally weak, showing Task-orientedness's relative independence from the other dimensions.

Table 7

Correlations between SYMLOG & IAS-R dimensions for Individuals (N = 101: Bottom) and Groups (N = 26: Top)

	Group				
Individual	Frnd	Lov	Up	Dom	Task
Frnd	-	26	-16	-01	29
Lov	40[a]	-	-22	-08	03
Up	05	01	-	48[b]	-26
Dom	06	-06	34[a]	-	-09
Task	04	-01	05	20[c]	-

[a] $p \leq .0005$ [b] $p \leq .01$ [c] $p \leq .05$

CTI: These intercorrelations are displayed in Table 8, showing that, for individuals, the subsets of scales of constructive and nonconstructive thinking correlated positively within subsets, but negatively across subsets. For groups' mean scores the patterns were generally similar, except that Validity scores were inclined to correlate negatively (median r = -.04) with other constructive subset scales, and were weakly positively correlated with Negative Thinking. Otherwise, the intercorrelations of the CTI subscales for groups and individuals were quite similar.

Performance and Satisfaction as Outcomes:

Groups' SYMLOG means and standard deviations for Dominance (Up*M*, Up*sd*), Friendliness (Frnd*M*, Frnd*sd*), and Task-Orientedness (Task*M*, Task*sd*), and their parallel Dominance (Dom*M*, Dom*sd*), and Love (Lov*M*, Lov*sd*) scores on the IAS-R were correlated with three performance (Lab-P,

Table 8

Intercorrelations of CTI Scales Individual (N = 101: Bottom) & Group Data (N = 26: Top)

	Groups							
Individual	Conth	Behco	Emoco	Valsc	Naive	Supth	Catth	Negth
Conth	-	85	75	-04[a]	-31[a]	-74	-67	-68
Behco	82	-	52	-04[a]	-17[a]	-58	-42	-57
Emoco	80	52	-	-12[a]	-52	-63	-39	-41
Valsc	09[a]	02[a]	04[a]	-	-25[a]	-19[a]	00[a]	03[a]
Naive	-19	-07[a]	-30	-04[a]	-	37	03[a]	21[a]
Supth	-59	-43	-44	-17	17	-	27[a]	61
Catth	-74	-58	-53	-06[a]	13[a]	28	-	38
Negth	-75	-60	-54	-02[a]	08[a]	48	46	-

[a]*r*s not significant at $p \leq .05$ level

LabG-C, Lab-Lec) and five satisfaction (Sat*M*, Sat1 to Sat4) indicators. These eight latter measures were also correlated with groups' mean scores on the CTI's scales of constructive (Con*M*, Beh*M*, Emo*M*, Val*M*) and nonconstructive (Naiv*M*, Sup*M*, Cat*M*, Neg*M*) thinking. To identify possible relationships to group size, the data of four-person groups (Quartets) were analyzed separately from the complete data set (26 Groups), which also included five triads and two quintets. Table 9 presents all pertinent correlations.

Insert Table 9 About Here

Groups' mean scores on the interpersonal variables (SYMLOG & IAS-R) more often correlated significantly (18 of 50 cases) with group satisfaction than did their

TABLE 9

Correlations of Cognitive and Interpersonal Measures with Performance and Satisfaction Separately for 26 Groups: 19 Quartets

	PERFORMANCE			SATISFACTION				
	Lab-P	LabG-G	Lab-Leg	Sat1	Sat2	Sat3	Sat4	Tot_Sat
Means								
Constr[x]	25 : 49[b]	14 : 31	29 : 38[b]	02 : 12	15 : 32	06 : 41[b]	04 : 35	08 : 37
Behav[x]	30 : 42[b]	19 : 27	25 : 35	06 : 04	28 : 51[b]	10 : 29	08 : 22	15 : 36
Emot[x]	44[a] : 46[b]	37[b] : 36	40[b] : 39[b]	04 : 06	-08 : 07	10 : 33	10 : 31	04 : 22
Valid[x]	-29 : -14	-44[b] : -34	-40[b] : -34	-34 : -39	-25 : -29	-38 : -39	-31 : -37	-36 : -45
Naive[y]	-27 : 02	-10 : 17	16 : 28	-21 : -06	24 : 31	-24 : -14	-26 : -16	-12 : 03
Supers[y]	-03 : -12	16 : 13	-17 : -17	24 : 31	07 : 00	13 : -03	10 : -17	15 : 09
Categor[y]	04 : -39[b]	-01 : -36	-07 : -19	-01 : -43[b]	-13 : -26	04 : -48[b]	09 : -44[b]	-01 : -49[b]
Negative[y]	-12 : -33	09 : -09	-09 : -22	-25 : -15	-32 : -33	-24 : -34	-28 : -36	-31 : -37
Frndl[x]	02 : -03	00 : 07	04 : 16	74[a] : 67[a]	18 : -17	64[a] : 61[a]	66[a] : 60[a]	62[a] : 46[b]
Love[x]	-22 : 01	-16 : -02	00 : 04	08 : 43[b]	10 : 02	13 : 46[b]	06 : 44[b]	10 : 39[b]
Up-Down	20 : 11	29 : 25	16 : 29	00 : 00	-12 : -02	08 : 08	00 : -08	-01 : -01
Dominance	24 : -07	18 : -15	20 : 03	12 : -05	-02 : -02	23 : 10	12 : -05	12 : -01
Task-Or[x]	19 : 27	05 : 17	08 : 16	38[b] : 40[b]	33[b] : 51[a]	23 : 37	27 : 35	34[b] : 53[a]
Dispersions								
Frndl[y]	-37[b] : -28	-24 : -17	-29 : -30	-41[b] : -20	-11 : -05	-40[b] : -23	-47[a] : -30	-39[b] : -18
Love[y]	-09 : -36	-37[b] : -46[b]	07 : 05	-17 : 04	-15 : -09	-20 : 02	-24 : 00	-22 : -02
Up-Down[x]	-09 : 09	-02 : 08	-32 : -36	15 : 34	29 : 29	13 : 21	11 : 25	19 : 35
Dominance[x]	06 : 12	05 : 02	-02 : -12	16 : 00	41[b] : 24	22 : -09	17 : -13	28 : 04
Task-Or[y]	-08 : -23	-06 : -29	-17 : -40[b]	-35[b] : 01	-16 : 03	-25 : -01	-30 : 10	-30 : 04

Note: That all correlations of the Validity scale were negative was inconsistent with expectations, so the two-tailed test of significance was used for these correlations and for the mean scores for Up-Down and Dominance. The one-tailed test was used for all other correlations.

[a] $p \leq .01$ [b] $p \leq .05$

[x] positive correlations hypothesized

[y] negative correlations hypothesized

dispersions or standard deviations (6/50). The opposite pattern held for the links with performance measures, which never correlated significantly with any mean score on an interpersonal variable. Performance was much better predicted by groups' mean scores on the thinking scales, as 11 of these 48 correlations were significant, versus merely 4 of all 60 correlations (means and dispersions) involving the interpersonal measures. The CTI scales also correlated significantly with performance (11/48) more often than with satisfaction (12/80). The dispersion of groups' SYMLOG Friendliness scores consistently correlated moderately and inversely with several performance and satisfaction indicators in a pattern also followed by CTI Validity scores.

Performance: These indicators correlated positively, consistently, and moderately with groups' mean CTI constructive thinking scales, reaching significance in five out of six cases with Emotional Coping. Contrary to predictions, mean CTI Validity scores also linked moderately but inversely with each performance index, attaining significance in two of six cases. Dispersions of Friendliness (Frndsd) consistently and moderately linked negatively with performance, but attained significance only with Lab-P. Lovsd tended to have modest negative links with performance (Lab-P & LabG-C), but reached significance only with LabG-P in a pattern inconsistent with Lovsd's weak positive correlations with Lab-Lec.

Task*sd* had weak to moderate negative correlations with all performance measures, attaining significance only with Lab-Lec, for Quartets.

Satisfaction: The most striking associations of satisfaction were with mean SYMLOG Friendliness scores, which largely ranged from .60 to .74. Only among Quartets did mean IAS-R Love scores show a similar pattern. Moderate to substantial correlations also held between groups' mean SYMLOG Task-Orientedness scores and satisfaction, consistently reaching significance for three measures. Groups' CTI Validity and Categorical Thinking scores linked moderately and negatively with most satisfaction items. Additionally, SYMLOG Friendliness dispersions correlated negatively with most satisfaction items. Only for Groups did Task*sd* also correlate moderately and inversely with most satisfaction items.

DISCUSSION

Comparison of SYMLOG, IAS-R, and CTI with Normative Data

SYMLOG: Bales and Cohen (1979) did not provide normative data for SYMLOG scales. However, pertinent data was available from a sample of 91 Michigan State University undergraduate students (mostly seniors and juniors) enrolled in Small Interpersonal Groups for Experiential Learning (SIGEL), a course aimed at enhancing communication skills in small groups (Hurley, 1990). Table 10 compares the present sample's SYMLOG means and standard deviations with Hurley's sample. The physiology lab students scored mildly lower on Dominance and significantly lower on Friendliness scores than did the interpersonal groups. These differences seem reasonable because SIGEL students were rating behaviors within small groups which were intended to enhance both expressive and affiliative behaviors. The present study's group means for Task-Orientedness were slightly higher than those in SIGEL, consistent with the more external goals of this physiology lab course.

IAS-R: Means on the IAS-R's eight component scale (Assured-Dominant, Arrogant-Calculating, etc.) varied no more than 12.5% from the normative sample of 1162 undergraduates from Introductory Psychology courses at the

Table 10

Cross-Sample Comparisons of CTI, SYMLOG, & IAS-R Scores

	CTI					SYMLOG			
	Prior(N = 124)[a]		Present(N = 100)			Prior(N = 91)[b]		Present(N = 101)	
	M	SD	M	SD		M	SD	M	SD
Con	94.3	12.8	94.4	11.2	Dom	2.8	7.3	1.9	3.7
Beh	43.6	7.2	45.5	5.3	Frnd	13.7	6.5	9.0	3.5
Emo	27.0	7.0	27.1	6.3	Task	1.3	4.7	2.0	2.3
Val	*	*	21.9	2.2					
Nav	25.1	3.9	25.4	4.1		IAS-R			
Sup	19.0	5.6	20.4	5.9		Prior(N = 1232)[c]		Present(N = 101)	
Cat	24.6	5.4	25.6	5.1	Dom	.14	.91	.39	1.0
Neg	28.3	5.7	28.1	5.8	Lov	-.16	.87	.29	1.1

[a](Epstein & Meier, 1989) [b](Hurley, 1990) [c](Wiggins et al., 1988)
*N/A Boldface = significant difference at $p \leq .05$ level

University of British Columbia (Wiggins et al., 1988). However, the present groups' mean Dominance and Love scores were considerably higher than those in this prior sample (see Table 10). This may be because the present sample was more interpersonally oriented by its cooperative group nature and the older average age of its participants.

CTI: Present CTI scale scores differed little from those of Epstein and Meier's (1989) normative sample. Although the physiology lab sample scored significantly ($p \leq .05$) higher for Behavioral Coping (mean = 45.5), the absolute difference (1.9) was not substantial.

The sample data for the SYMLOG, IAS-R, and CTI differed from the normative data of previous studies in a few respects. However, when participant (e.g., age) and setting (e.g., objectives and motivation) differences

between prior and present samples are taken into account, observed deviations are not surprising. Accordingly, data obtained from the present sample appear representative and valid for the purposes of this study.

Performance and Satisfaction

When formulating the present study's hypotheses, it was assumed that group performance and satisfaction would show moderate positive overlap. Clearly this did not occur. Therefore, these initial hypotheses were set aside and a more empirical approach was taken to understanding these findings separate from the hypotheses.

Performance: The more critical of the two outcome measures, performance never linked significantly with groups' mean scores on an interpersonal variable (0 of 30 chances), and only in four (of 30) instances with dispersions. On the other hand, the constructive thinking scale means did link with performance from moderately to substantially, attaining statistical significance in 8 of 24 instances. Five of these significant connections involved the Emotional Coping scale. Thus, a modest set of positive associations held between groups' mean performance and their constructive thinking scores. The converse pattern was less clear for correlations of the CTI's nonconstructive scales with performance. Although most of these correlations were negative (16/24), as expected, merely one reached statistical significance.

Satisfaction: Although a lesser outcome variable than performance, it linked substantially with groups' means on both Friendliness and Love (Quartets only) and to a slightly lesser degree to dispersions on Friendliness. Satisfaction had similar moderate to substantial positive links with groups' mean Task-orientedness. However, neither SYMLOG (Up-Down) or IAS-R Dominance measures were linked to satisfaction. It appears, then, that groups higher in ratings of affiliativeness and Task-orientedness had a moderate to substantial tendency to report greater satisfaction with their goal-oriented group experiences.

Groups' mean CTI Validity and Categorical Thinking scales linked significantly and inversely to satisfaction. Although there were no global ties between nonconstructive thinking and ratings of group satisfaction, the Categorical Thinking scale provided all of the four significant links, suggesting a clear but isolated finding.

Of the 18 group interpersonal and thinking variables analyzed, only dispersions of Friendliness bridged the present performance-satisfaction dichotomy by correlating significantly with both kinds of outcome. Further evidence of the relative independence of the present performance and satisfaction indicators was shown by the relative abundance (18/50) of significant correlations of interpersonal variables (SYMLOG & IAS-R) with satisfaction versus none with performance. Why did groups' mean affiliativeness and Task-orientedness scores not link strongly to performance,

yet had several substantial links to satisfaction?

At least one study (Helmreich, 1986) reported that individuals' personality factors were unrelated to work performance measures at the end of a three-month period for new employees, although the same personality variables became significantly predictive of work performance six months later. Labeled the "honeymoon effect", this phenomenon could be relevant to the present study, but the 9-week life of these lab groups may have been insufficient for group interpersonal factors to substantially impact upon performance. Future studies could attempt to ascertain whether increasing satisfaction is a precursor to increasing group performance, or if the two are sometimes as independent as the present findings suggest.

Other Findings

A puzzling set of negative correlations was obtained between groups' mean CTI Validity scores and all satisfaction and performance indicators, reaching significance with Lab-C and Lab-Lec. Since Validity seemingly measures reading comprehension, these connections are counter to common sense, and almost beg for some explanation. Speculatively, the Validity scale may also be an indicator of compulsivity. Only those people most driven to read each test item in great detail would score high on Validity, which asks logical self-evident questions that could be answered correctly if attended to carefully (e.g., "I have never seen anyone with blue eyes before"). If this

is true, it may make more sense for those groups scoring low on Validity (compulsivity) to rate higher in performance and satisfaction since increasing this attribute would likely be detrimental to these outcomes. Many other possible scenarios could be produced to rationalize the link of low Validity to high performance and satisfaction, but no evidence to differentially support these was apparent.

The Table 9 correlations of Groups and Quartets sometimes differed substantially. The five triads of the present study permitted *t*-test comparisons of their mean scores with those of the Quartets on the outcome measures. The results clearly indicated that these Quartets were significantly more satisfied than the triads (*t*-values for Sat*M*, Sat1, Sat3, & Sat4 = 2.4, 2.3, 2.4, & 2.8 [$p \leq .01$], respectively), although they did not perform significantly better (Lab-P *t*-value = 1.7 [ns]).

Five physiology lab groups worked side-by-side for each of the six sections included in this study. It can be speculated that the triads, especially those in a section also containing quartets and quintets, might feel less satisfied with this lab experience in the sense that they might have felt excessively burdened because merely three persons were expected to do the same amount of laboratory work as groups which contained from 33% to 67% more persons. Thus a sense of unequal workloads between groups (i.e., social comparison) may have fostered feelings of

dissatisfaction. Perhaps in combination with such a phenomenon, quartets may inherently be more satisfying to work in than triads. This may be because any two people within a triad who chose to form a closer alliance with each other will tend to exclude the third person. The latter may well report being less satisfied because of their dislike for being the "oddball", feeling inadequate, isolated and rejected. However, external evidence that would support either of these interpretations is lacking.

Implications

Although having face validity, the present performance and satisfaction measures were not previously established as valid indicators for their intended purposes. The performance indicators especially needed external validation because they attempted to assess the performance of *groups* engaged in a technically demanding task that required cooperation by merely averaging the performances of several individuals rather than indicators of coherent group performance. Individuals' and groups' laboratory point totals (Lab-P) correlated .42 ($p \leq .0005$) and .44 ($p \leq .01$) with their own and group self-reported GPAs, respectively. These findings suggest at least moderate validity as performance indexes, but how well these indicators addressed group versus individual performance was not elucidated. External criterion validation could be enhanced by correlating a group performance rating system of known validity with averaged group laboratory grades, or

by including behavioral ratings of group performance on a longitudinal basis. Additionally, a more "group-oriented" criterion of performance, perhaps time taken to successfully complete each lab might have been more fruitful in assessing these factors.

Although high intercorrelations and face validity of the items did indicate at least moderate usefulness, the satisfaction measures also required external validation. It would add support for the utility of this measure if it were employed in a variety of other work-group settings, and if it could be proportionally correlated with established scales of positive emotions.

Generalization from these findings to other small groups should be approached cautiously. The specific nature of this study and motivations of its participants seem relatively unique. It does appear, however, that there was considerable ego-involvement in the small group tasks since college students are often concerned about grades they receive for a class in their major field. Thus, these results may be more "realistic" than those obtained from similar studies in a more contrived laboratory setting. More thorough longitudinal studies involving a variety of age ranges across diverse settings and skills will be needed to ascertain any systematic unfolding of performance and satisfaction in the context of small groups with respect to interpersonal and preconscious thinking styles.

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