IMPROVED DECISION MAKING THROUGH GROUP COMPOSITION

THESIS

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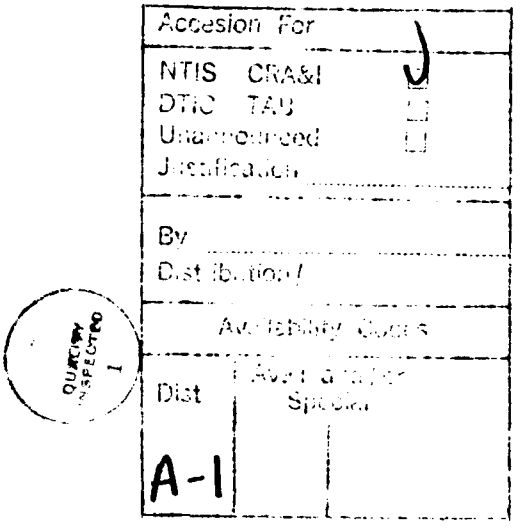

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THESIS

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The intent of this research was to determine if decision making could be improved by forming teams with dissimilar personality types, as predicted by the Myers-Briggs Type Indicator. Hopefully, this research can be of value to future investigations in this area.

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William E. Page III

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Abstract

This experimental study attempted to prove that teams formed with dissimilar personality types would have better decision making than teams which were not formed by dissimilar types. The Myers-Briggs Type Indicator, based on Jung's Theory of Psychological Type, was used to determine the subjects' personality type preferences. Subjects' perceptions of team processes were also investigated.

The sample population consisted of military officers and civil servants who attended the Advanced Program Management course at the Air Force Institute of Technology.

Decision making effectiveness was determined from team performance on the Time-by-Event-by-Member-Pattern-Observation system (TEMPO). esign for this research consisted of comparing the scores from teams formed by dissimilar MBTI personality types to scores from teams which were not formed by dissimilar MBTI personality types. The T-test was used to determine the differences between the teams' mean scores at an alpha equal to .1.

The research concluded that teams formed by dissimilar MBTI personality types were statistically no more effective than teams formed without the MBTI; however, the teams formed by dissimilar MBTI personality types did score higher than the teams that were not formed with the MBTI.

IMPROVED DECISION MAKING THROUGH GROUP COMPOSITION

I. Introduction

Introduction to the Chapter

This chapter introduces the research problem, the research objectives, and hypothesis. It also establishes the research questions, scope, limitations, assumptions, and key terms. Chapter I is structured so that the reader will have a clear idea of the relevance and direction of this research.

Introduction to the Problem

Historically, the United States has always held the edge over other countries in increasing its level of worker productivity. However, in recent times the United States has been unable to maintain this edge.

> Declining productivity growth is one of the most alarming trends to emerge in the United States. From the end of the Second World War through the 1960s, when U.S. productivity increased at an annual average rate of just over 3 percent, productivity declined in the 1970s to less than half the rate of the booming 1960s, or only 1.4 percent per year. (89:15)

The decreasing level of productivity in the United States is the source of many of the nation's economic problems, including inflation, unemployment, weak international competitiveness, the declining value of the

dollar, lower standard of living, and overall lower business profits (94:497; 89:15). To reverse this trend, United States business and industry have tried to increase productivity through statistical control techniques, new manufacturing methods, robotics, and other new technologies. These efforts have produced some positive results, but, according to Anderson, as "the United States enters the decade of the 1990s, the need to improve productivity for all organizations looms larger than ever before" (2:6). The United States still faces the challenge of increasing its productivity in the 1990s.

The Department of Defense (DOD) is also concerned with increasing the productivity of its employees. The DOD is committed to former President Reagan's vision of a 20% improvement in worker productivity by 1992 (67:69). Given improving US/USSR relations, President Bush plans to restructure the DOD (23:60). The Secretary of Defense, Richard Cheney, has stated that the new presidential initiative will reduce the forces to the "absolute minimum" required to adequately defend the U.S. and its allies (23:61). With the size of our forces decreasing, the importance of improving the productivity of the remaining forces becomes an increasingly vital national interest.

The Significance to the Air Force

The Air Force has already begun to feel the budget scalpel. According to the Air Force Magazine, "The Air

Force lost $37 billion that it expected to receive for this year (1991) and for Fiscal 1992 and 1993" (92:72). The Air Force is planning on reducing personnel and defense procurement in order to stay within the shrinking budget. The largest percentage of personnel cuts in the Air Force will be among the officers. The only way that the Air Force will be able to maintain its current level of readiness through the lean times ahead is by challenging the personnel who are left to do more with less. The commander of Strategic Air Command, Gen John T. Chain, summed up the situation by stating that,

> Modernizing our forces and supporting conventional initiatives will place a significant demand on both our pool of trained manpower and budgetary resources- and we know that both people and funds will be limited in the foreseeable future. Therefore, we have no choice but to work smarter and be more productive. (16:75)

It will be imperative for the continued success and survival of this nation's business, industry, and defense to find ways to improve the productivity of its people.

The Importance of Teams

A partial answer to the nation's productivity crisis is to improve the productivity of the teams and groups which make up our organizations. Indeed, teams and groups are the next step up from the individual with regards to the building blocks which make up organizations. Through group or team efforts, work objectives and tasks are accomplished. Peters and Waterman, in their book In Search of Excellence,

state that "small groups are, quite simply, the basic organizational building blocks of excellent companies" (74:126). The authors go further by adding, "the small group is critical to effective organizational functioning" (74:126). Since groups and teams are the basic entities which accomplish organizational tasks and objectives, then the quality of the decisions made at the group and team level will have a profound effect upon work performance and productivity.

Teambuilding

Many group development methods have been proposed to increase the productivity of America's work force (43:319). Team building is a strategy for breaking down the interpersonal, group, and organizational barriers which can inhibit the proper functioning of a group, thereby increasing group efficiency and productivity. For example, an organization will facilitate and make time available for work teams to focus on productivity and other operational problems within the organization while at the same time building cooperation and coordination within the group (43:325). Teambuilding has been widely used by both the government and businesses to increase productivity. Many approaches to teambuilding use the Myers Briggs Type Indicator (MBTI) to help the team members better understand themselves and their co-workers. When this is done, the

team members are then shown how to capitalize on their strengths to form a better team (80:530; 71:22).

The Myers-Briggs Type Indicator

The MBTI is a psychological instrument designed to measure personality differences. It is used during team building interventions to give participants a deeper understanding of themselves and their co-workers. Knowledge of one's own and co-worker's strengths and weaknesses is then used to facilitate group productivity by allowing the members to take advantage of their groups' different strengths. Also, people become more aware of the different perspectives which their co-workers bring to the problem solving and decision making process. According to Myers, "Good teamwork calls for recognition and the use of certain valuable differences between members of the team" (64:1).

Improving Productivity Through Group Composition

To improve productivity, the MBTI has also been used as the basis for forming a group's composition. This tactic is founded on the notion that the more perspectives which are examined during the problem solving and decision making process, the better the quality of the ultimate decision. On this basis, the more homogeneous a group is, the more likely it will solve problems and reach decisions similar to the psychological mode of the group. It is therefore possible that those decisions may be of lesser quality

because fewer perspectives may have been examined. Conversely, heterogeneous groups are likely to initially take longer to make decisions because of personality incompatibilities, but these decisions may be better because of the higher number of diverse perspectives from which the problem is examined (64:7; 57:3). Higher quality decisions made at the group level should increase the productivity of that group and ultimately the organization.

Specific Problem

The Air Force is faced with a future of manpower and budget reductions. Due to these constraints, the Air Force will need to make the most out of its remaining forces in the years ahead. Teams and groups form the critical link in carrying out the mission of the USAF, so any improvements which could increase the productivity of these work forces should be implemented as soon as possible.

The MBTI offers the Air Force one avenue which could increase the productivity of its groups and teams. Using the MBTI during teambuilding interventions improves the interpersonal competence of the team members which in turn increases a team's productivity. The MBTI can also be used as the basis for forming a team's composition. When heterogeneous teams are created on the basis of the MBTI, the decisionmaking and problem-solving aptitude of the team should improve. If the teams are making higher quality

decisions, then the productivity of the team should increase.

Research Question and Hypothesis

The main research question for this research is: Do teams formed with dissimilar MBTI personality preferences make more effective decisions than teams which are formed without the use of the MBTI?

Research hypothesis:

H_o: Teams formed with dissimilar MBTI personality preferences will be no more effective than teams which are not formed with the use of the MBTI.

H_a: Teams formed with dissimilar MBTI personality preferences will be more effective than teams which are not formed with the use of the MBTI.

Research Objectives

The following were the research objectives:

1. To conduct an experiment which will determine if teams formed with dissimilar MBTI personality preferences make more effective decisions than teams which are formed without the use of the MBTI.

2. To investigate the test subjects' perceptions of the group process during the experiment and the influence of the MBTI.

Subsidiary Research Questions and Hypothesis

The research objectives were fulfilled by addressing the following research questions and hypothesis:

1. How valuable did the subjects perceive the MBTI to be in relation to team process?

2. What attributes of group process were perceived to be important by the subjects?

3. What attributes of group process were perceived to be present by the subjects?

4. Were there any differences of opinion about the MBTI or attributes of group process between the different MBTI types?

5. Were there any differences of opinion on the post-game survey between the Male and Female subjects?

Scope

This research is limited to the following criteria:

1. The subjects observed during this research are those students who attended the Advanced Program Management course at the Air Force Institute of Technology (AFIT) from September 1990 through April 1991.

2. The data gathered for this research are the simulation game scores and the post-game surveys from both courses.

3. The psychometric instrument used during this research is the Myers-Briggs Type Indicator.

Limitations

The limitations of the research are:

1. The population used for this research is a limitation since this experiment only included students from the Advanced Program Management course offered at AFIT.

2. The MBTI is a limitation because there is no psychometric instrument which can identify all personality characteristics necessary for decision making and team interactions. Humans are complex beings, possessing a variety of variabilities.

Assumptions

The following assumptions were made in the conduct of this research:

1. It was assumed that the subjects who took the MBTI would fully understand and respond to the instrument as it was designed so as to yield accurate assessments of their personality types.

2. The researcher assumed that all the subjects who participated in the experiment did so to the best of their abilities.

3. It was also assumed that the subjects who participated in this research filled out both the MBTI and the post-game survey honestly and completely. Responses to these instruments were kept confidential, thereby eliminating any possibility of attribution.

4. The researcher assumed that having a disproportionate representation among the sixteen personality types would not hinder the attainment of the stated objectives.

5. It was assumed that the survey instrument was valid and able to measure the constructs it intended.

Definitions of Terms

Air Force Institute of Technology (AFIT): AFIT is located at Wright-Patterson Air Force Base Ohio. It provides degree level education and continuing professional continuing education to members of the military and civil service employees (19:2).

Decision making: Is defined as the process of (1) searching the environment for conditions calling for decision, (2) inventing, developing, and analyzing possible courses of action, and (3) selecting a course of action (31:5).

Effectiveness: Means to manage problems confronting a group and to accomplish group goals (101:166).

Interpersonal Competence: The capacity of a person to communicate his feelings and ideas to others, to receive such communication from others, and to respond to their feelings and ideas in such a manner as to promote better mutual understanding in specific situations and to foster individual behavior which more effectively takes into

account the many facets, complexities, and personal interests involved in those situations (42:39).

Problem solving: Is the process of: (1) identifying the problem, (2) determining alternative solutions, (3) evaluating the alternatives, (4) selecting a solution, and (5) implementing the solution.

Problem Solving Quality: The adequacy of the solution in terms of the objective facts of the problem (40:175).

Productivity: The degree to which a group approaches the optimal performance of a task (87:435).

Psychometric Instruments: These are standard tests which yield measured bits of information about mental ability, personality, character, and orientation. Although these tests cannot cover every aspect of the person, their advantage lies in the standardized nature of the information they yield. Individuals can be compared with one another on similar measures; the information has good storage life, is easily retrieved, and lends itself to long-term research and validation (5:167).

TEMPO: TEMPO is an acronym for the Time-by-Event-by-Member-Pattern-Observation system. The TEMPO military planning system is a problem solving exercise which takes four teams a day to play. This game is played during the Advanced Program Management course at AFIT (27:211; 35:1).

Type Theory: Refers to Jung's theory as interpreted by Isabel Myers and Katharine Briggs in the MBTI (63:11)

Summary

This chapter has introduced the research problem and objectives. It has covered the research hypothesis, the research questions, limitations, assumptions, scope, and key terms of the research accomplished. The next chapter will review the literature pertinent to the improvement of the decision making and problem solving process of small groups.

II. A Review of Literature

Introduction

This chapter examines the literature on team processes, decision making, and their relationship to the Myers Briggs Type Indicator. It begins with a review of team processes and explores different dimensions of team decision making and productivity. The Myers Briggs Type Indicator is introduced, and its relationship to improving team building, team processes, and decision making is examined. The chapter concludes with a review of applicable group composition experiments which have been conducted.

Teams

Since ancient times, people have formed teams to tackle tasks which were too difficult or too dangerous for a single person to accomplish. Fossil records show that cave men formed teams to hunt large animals. Teams were used to construct both the Irrigation Cities of Mesopotamia and the great Egyptian pyramids (22:599). In contemporary times, teams are still prevalent. According to Woodman, "Work groups of various structures, sizes, duration, and missions are a pervasive component of every organization" (101:167).

In the early 1900's, Frederick Taylor began the scientific management movement (50:3). This movement concentrated on improving the performance of the individual through a combination of time motion studies and improvements in equipment. Consequently, even though teams

and small groups were being utilized by organizations, individuals were viewed as the basic building blocks of organizations. Since that time, the increasingly complex environment in which organizations operate has changed the focus from the individual toward the small group or team. Organizations have to take advantage of their employee's pooled knowledge, skills, and experience to meet the new challenges which they now face (93:96). Tjosvold wrote that "Groups, not individuals, are becoming the basic building blocks of organizations, and how they perform will increasingly determine a company's success" (93:43).

There are variations on how teams are defined, but a well-accepted definition is that "Teams consist of people who have some relatedness to each other or reason for working together as a function of doing their jobs or accomplishing a task" (32:27). Teams and groups are assembled in many sizes and compositions depending on the nature of the work they are intended to accomplish. Teams can be permanently or temporarily formed to achieve some specific task or objective (32:28). In summary, teams form to accomplish one or more objectives through the combined efforts of all the members of the team.

Advantages and Disadvantages of Group Decision Making

There are both advantages and disadvantages to using groups for decision making. One advantage of group decision making is the availability of the larger knowledge base

provided by the group. When a group is implemented in the decision-making process, the members of the group bring all of their acquired education, experience, and unique perspectives to bear on solutions and alternatives (18:446). Small groups and teams also collectively display more creativity than an individual team member. (72:40). For Odiorne, the greatest advantage of the team is its potential creativity. He wrote, "The imagination of a group is wider in scope than the imagination of an individual and can be drawn upon for the development of numerous suggested options" (69:88-89). Peters was in agreement when he wrote, "The small group is, simply crucial to innovation" (73:141). Using groups also facilitates communication between members of the group so that all of the members know the issues facing the group (18:446). For Argyris "the value of the group is to maximize individual contributions" (3:95). Finally, group decisions are more easily accepted by the group because the participation provides the individual team members satisfaction and support for the decision.

According to Tom Peters and Nancy Austin, who co-authored A Passion For Excellence, small groups and teams are able to accomplish goals and objectives in less time. The work that teams accomplish is of high quality because they get down to business and don't "reinvent the wheel" (73:137). Team members have ownership of the team's decisions and objectives, and therefore their commitment and

motivation to reach them is enhanced (73:137-143; 96:350-351).

> We take our shape, it is true, within and against that cage of reality bequeathed to us at birth; and yet it is precisely through our dependence on this reality that we are most endlessly betrayed--JAMES BALDWIN. (100:82)

What James Baldwin is alluding to is that all of us are born with a certain cognitive disposition. Simon calls this phenomena bounded rationality. "Simon indicated that the human being can only analyze to a certain point, limited by his/her experience, education, insight and the degree of openness of others" (2:7). Bounded rationality occurs because each individual is limited by his or her own set of biases, attitudes, perceptions, and given ability to process information. Thus, as individuals "we are most endlessly betrayed" (100:82) by our inability to comprehend all of reality. However, when decision making teams and small groups are formed there is the possibility of overcoming these weaknesses. Tjosvold wrote that "to cope with the limitations of individuals, decision makers must work together successfully to solve problems" (93:96).

There are also some disadvantages to using groups for decision making. Group-generated decisions tend to be slower due to the time it takes to listen and evaluate team members' inputs. Although this discussion can be valuable in allowing group conflicts to be aired and opposing points of view to be presented, it is often a slow process (18:446). Another potential problem arises during the

evaluation of alternative solutions. During this time, a compromise may be reached that is a less-than-optimal decision (18:446). Another disadvantage is that:

> A critical aspect of group decision making is the leader. Regardless of whether the leader is appointed or emerges informally, he or she will tend to dominate the decision-making process. If the leader happens to be an effective problem solver, then it makes little difference. If the leader tends to block others or to stubbornly persist, then the group may be ineffective. (96:352)

For Odiorne group decision making had the following disadvantages.

> Much of the effect of group decision making among multiple decision makers is also to slow down the process, to reduce flexibility, and to limit the firms mobility in introducing change. The quality and acceptance of decisions is the aim of such multiple decisions. The unintended and unnoticed effect is to stop more than would be stopped by fewer decision makers. (70:190)

Finally, because group-produced decisions can take a long time, they will tend to be more costly than decisions made by individuals (96:352).

Types of Teams and Small Groups

To utilize the advantages of teams and small groups, organizations are using many different teams. For example, there are problem-solving groups, committees, project teams, task forces, quality circles, skunkworks, and work groups to list a few. Quality circles are organized primarily to solve work-related and performance problems (60:122; 79:95). Committees are formed to advise management on polices and procedures. Both of these teams are generally found in

organizations on a continuing basis because their objectives are broad and continuously changing. Skunkworks, task teams, and project teams are normally organized to achieve specific objectives within a set schedule, and they are usually disbanded after they have fulfilled their mission (79:95).

Group Size

Groups and teams can be as large as several thousand or as small as two people. The scope of this literature review is limited a review of the literature pertinent to small groups and teams of twenty-five or less people. One of the most widespread definitions of small groups was advanced by Bales:

> A small group is defined as any number of persons engaged in interaction with each other in a single face-to-face meeting or a series of meetings, in which each member receives some impression or perception of each other member distinct enough so that he can, either at the time or in later questioning, give some reaction to each of the others as an individual person even though it be only to recall that the other person was present. (33:10).

As group size increases, one would think that the amount of resources accessible to the group would increase in the same proportion. Actually, this is not the case. Hoffman claims that this phenomena is attributable to the increased difficulty members of the group have making their contributions to a larger group (37:379). Some considerations should be kept in mind when selecting the proper group size. First, there needs to be a proper blend

of personalities, so that there is little room for dissention and a strong likelihood of discussion. Also, everyone who is going to implement the decision should be included in the decision. This will make the members of the group more committed to the final decision. Group processes become even more important as the size of the group increases (37:37). For Drucker, the biggest restriction with the team structure is its size limitation.

> The greatest limitation of the team structure is size. Teams work best when there are few members. The aboriginal hunting band had seven to fifteen members. So do the teams in team sports such as football, baseball, and cricket. If a team gets much larger it becomes unwieldy. Its strengths, such as flexibility and the sense of responsibility of the members, attenuate. Its limitations-lack of clarity, communication problems, overconcern with the internal mechanism and internal relationship-become crippling weaknesses. (22:568)

Team Formation

When teams are formed, they go through four different stages of team development. The stages of team development are forming, storming, norming, and performing. Forming is the most immature stage where team members are getting acquainted and trying to feel out the other members with respect to "status, power, and knowledge" (96:246). The group members are also evaluating the benefits of team membership. Scholtes states that,

> Because there is so much going on to distract members' attention in the beginning, the team accomplishes little, if anything, that concerns its project goals. This is perfectly normal. (85:6-5)

Storming is the next stage, and it is characterized by conflict over "leadership, goals, norms, roles, task assignments, or other interpersonal issues" (96:246). Consequently, storming is the most difficult stage in group development (85:6-5). There does not always have to be conflict at this stage depending on the team's effectiveness to work through difficult issues. It is important to form norms for dealing with conflict at this point because if there is unresolved conflict present, it may impede the team's further development.

Norming is the next stage of team development. During the norming stage, team members are working together and intent on building social relationships. Ideas which are suggested are readily accepted by other team members so as not to disrupt the friendly atmosphere. Overall, there is a clearly defined leader, and the group has developed norms, roles, cooperation, and a shared sense of responsibility for team outcomes.

The stage which follows norming is the performing stage. "A natural follow-on to norming is when members actually work together as an effective team to get their task done" (96:247). At this point, the team has developed effective communication, achieved a sophisticated level of interdependence, and is focused on interpersonal and task relations (96:246-247; 98). Scholtes adds that "The team is now an effective, cohesive unit. You can tell when your team has reached this stage because you start getting a lot

of work done" (85:6-7). Throughout the process of team development, the importance of interpersonal skills and relations cannot be overstressed. If team members do not feel good about their other teammates, then they will not be open with their contributions and this can lead to a dysfunctional team. Finally, a team does not have to go through these stages of team development in a linear fashion, and it may be in several stages of team development at a single point in time (98).

Characteristics of Effective Teams

Teams can be either ineffective or effective at accomplishing their objectives. Effective teams share characteristics in common which have enabled them to be effective. Hanson summarized the characteristics of well-functioning teams which are presented in Table 1.

Dave Francis and Don Young in Improving Work Groups describe the following characteristics of high performing teams:

> Output--combined results beyond any individual contribution;
> Energy--strength that members take from one another for synergy;
> Structure--creative mechanisms for dealing with organization, procedure, roles, control, and leadership;
> Atmosphere--spirit and culture that is open and supporting, and permits risk taking and confidence sharing. (34:28)

Argyris investigated several different organizations and discussed the characteristics of effective teams in his

Table 1

Characteristics of Effective Teams (32:28)

1. A shared sense of purpose or common goals and a willingness of each team member to work toward achieving these goals.
2. An awareness of, and interest in, its own process and the examination of norms that are operating within the group.
3. Identification of its own resources and the utilization of these resources depending upon the needs of the team at any given time. At these times, the group is willing to accept the influence and leadership of the member whose resources are relevant to the immediate task.
4. A continuing effort on the part of group members to listen and to clarify what is being said, and an interest shown in what others say and feel and in hearing them out.
5. Differences of opinion are encouraged and freely expressed. The team does not demand narrow conformity or adherence to formats which inhibit freedom of movement and expression.
6. The team is willing to surface conflict and stay with it until it is either resolved or managed in a way that does not reduce the effectiveness of the individuals involved.
7. Energy is exerted toward problem-solving rather than being drained off by interpersonal issues or competitive struggles.
8. There is a balance of roles which are shared to facilitate both the accomplishment of task and feelings of group cohesion and morale.
9. Mistakes are seen as a source for learning rather than punishment, therefore, risk-taking and creativity are encouraged.
10. The team is responsive to the changing needs of its membership and to the external environment to which it is related.
11. Team members are committed to periodic evaluation of the team's performance.
12. The team is attractive to its members who identify with it and see it as a source of both professional and personal growth.
13. The development of a climate of trust is recognized as the crucial element needed to facilitate all of the above elements.

Table 2

Characteristics of an Effective Team (4)

1. Contributions made to the group are additive.
2. The group moves forward as a unit; There is a sense of team spirit, high involvement.
3. Decisions are made by consensus.
4. Commitment to decisions by most members is strong.
5. The group continually evaluates itself.
6. The group is clear about its goals.
7. Conflict is brought out into the open and dealt with.
8. Alternative ways of thinking about solutions are generated.
9. Leadership tends to go with the individual best qualified.
10. Feelings are dealt with openly.

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book Organization and Innovation. Those characteristics are presented in Table 2. Overall, it can be seen that common characteristics of effective teams have been found by researchers. In general, effective teams produce more than the sum of the individuals which make them up, and interpersonal relations between the members are well developed which contributes to an open atmosphere and swift conflict resolution amongst the team. It is not assumed that a team will exhibit all of these characteristics throughout all of the stages of its development. For the team to develop a high level of effectiveness takes a long time and considerable effort from the team members (32:28).

The Task and Social Dimensions of Decision Making

Task and social dimensions of decision making exist in every group. Each dimension is a part of the process towards an effective decision. For Fisher, these two dimensions were inseparable from each other, even though many other researchers examined them as separate entities (26:29). Fisher defined the dimensions as follows:

> The task dimension refers to the relationship between group members and the work they are to perform-the job they have to do and how they go about doing it. The social dimension includes the relationships of group members with each other-how they feel toward each other and about their membership to the group. (26:29)

Fisher also defines why these two aspects of group decision making process are defined as dimensions. Figure 1 illustrates the relationship between the task and social dimensions of group process. If either dimension of width or height is taken away from the rectangle then it will cease to exist. And the same is true about the relationship between the task and social dimensions of the group process (26:29).

Types of Problems Teams and Groups Work Address

The distinction of when to use groups or individuals to solve problems and make decisions is not always clear. There are problems which could be solved by either a group or an individual, such as a mathematics problem, crossword puzzle, or logic problem; however, according to Fisher, "the social dimension of the group process could add nothing to

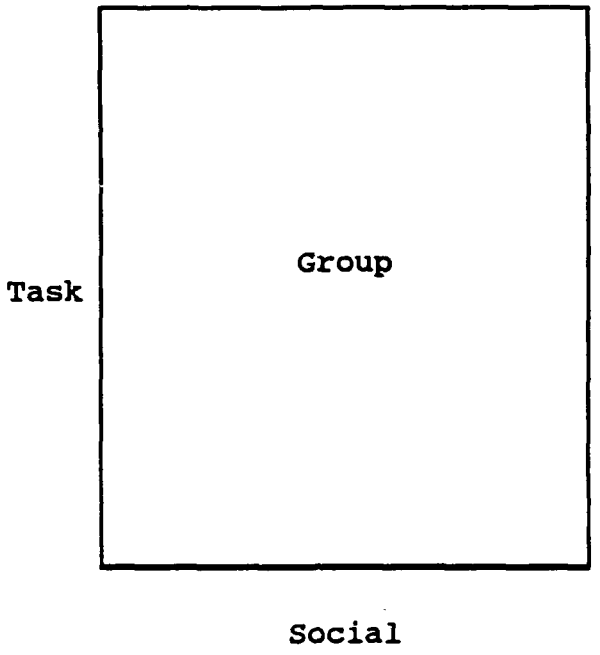

Figure 1. Relationship Between Task and Social Dimensions (26:29)

the solution of such a problem" (26:40). Therefore, a group approach to these types of problems would clearly be inappropriate. Davis differentiates the characteristics of group versus individual tasks by using political decisions as an example. Political decisions are group decisions because everyone has an opinion and no one is better qualified to make the decision, so that the result is a product of people discussing their differences which leads to a decision (26:39). These types of problems have no clear cut, or correct answer to them.

It has been shown through different experiments that individuals usually solve simple problems better than groups, and groups are more successful when dealing with

more abstract and complex problems (99:497). Argyris agreed and wrote that,

> If my data are valid, the search process in executive decision making has become so complicated that group participation is essential. No one man seems to have all the knowledge necessary to make an effective decision. (3:95)

For Drucker, the greatest use of the small group or team was in the knowledge professions where interdisciplinary cooperation is required (22:570).

If the group can only accomplish the tasks and objectives that each individual could just as easily have accomplished on his or her own, then the group will only produce a decision equal to the most knowledgeable member present (26:40). According to Fisher, nonsummativity is a requirement for group tasks.

> The output of the problem-solving group is of an entirely different nature. The contributions of the individual members do not accumulate by simple addition to determine the group's output. The output is more than the aggregate of individual contributions, or in some instances less. Such a group deals with the kind of problem that actually requires group activity for its resolution. (26:40)

The point is that if there is a task which needs to be accomplished, and it does not require anything that the people could not accomplish individually, then there is no need for a group or team effort.

Groups should also be used in the decision making/problem solving process when it is important to have group approval of the decision (97:33). This way, the group

will be more motivated to implement the decisions. Small groups and teams must solve problems which arise from their task and interpersonal dimensions. For Simon, there are two types of decisions. They are either programmed or nonprogrammed. The programmed decision is one which occurs frequently and has a standard solution which is usually applied to it. These types of problems are best handled by machines or individuals since they have nothing to be gained from the group problem solving process. The nonprogrammed decisions are defined as those decisions which arise from time to time that have no exact right or wrong answer, but are very important. These problems are amenable to group or team problem solving (90:46-49).

Group Decision Making and Problem Solving

To a large extent, the success or failure of any effort is directly linked to the quality of the decision making and problem solving processes. Odiorne wrote that, "more time is lost, success forfeited, careers stymied, and frustrations confronted from this inability to make a good decision than can be estimated" (69:3). Decision making and problem solving are terms which are not consistently defined. Some people define the two terms as the same while others attach different meanings to them. Decision making is a broader definition than problem solving and will be defined as the process of

> (1) searching the environment for conditions calling for decision, (2) inventing, developing, and analyzing possible courses of action, and (3) selecting a course of action. (31:5)

When a group decision is reached, it is usually the end result of the group evaluating several different alternatives before arriving at a final decision. Geist explained that,

> In essence, the decisions made in small group interaction are actually a collection of component premises communicated to other group members who, in turn, deny, accept, or modify these premises until a preferred decision is reached. (28:70)

Where decision making is broadly defined as the process of thought and action which results in a decision, problem solving is a more systematic process which deals specifically with problems dictated by team tasks and social interactions. Problem solving is defined as the process of: (1) identifying the problem, (2) determining alternative solutions, (3) evaluating the alternatives, (4) selecting a solution, and (5) implementing the solution. Obviously, there is some overlap in distinguishing decision making from problem solving.

Decision Effectiveness

The effectiveness of decisions is dependent on two criteria. The first criteria is if the decision is the "correct" one with regards to the objectives the decision is trying to accomplish. The second criteria is if the people

who have to implement the decision accept it (69:79; 51:3-9). Obviously, a group will work harder to implement a decision if they accept it. Maier defines the first dimension of an effective decision as,

> If the pragmatic test is to be used, an effective decision would be the one that produced the desired objectives most completely, achieved the desired objective most efficiently (costwise, energywise, and with the least undesirable side effects), and carried with it the most valuable by products. (51:2)

Maier later defines the second dimension of an effective decision as having "to do with its acceptance or the way the persons who must execute the decision feel about it" (51:3). The final dimension of an effective decision is the length of time required to make the decision.

For Hill, the following equation of group decision effectiveness was applicable. He wrote that "Group decision effectiveness is equal to the sum of independent individual effort plus process gains minus process losses" (96:352). Process gains are defined to include the synergistic gains in "individual motivation, creativity, and problem solving" (96:352). Process losses are defined to include "lost time, blocking roles, communication problems, and groupthink" (96:352). In summary then, an effective decision is one which correctly addresses the objectives, has a high degree of acceptance from the people who must carry out the decision, and the decision can be made in the required time.

Barriers to Effective Decision Making

Within small groups and teams there are many behaviors which can interfere with the decision making/problem solving process. The main barriers to effective decision making and problem solving are poor communication, group think, group cohesion, and dysfunctional behaviors. For Anderson, personality conflicts, personal biases/prejudices, predisposition tendencies, and not involving the right people in the process are the major contributors to faulty decisions (2:7).

Communication

If the individuals that comprise a small group or team are thought of as a plastic model, then communication can be thought of as the modeler's glue which holds the whole structure together (26:155). Communication between members of a team should be effective, clear, and timely. The most effective communication with someone takes place when there is two-way communication. Two-way communication occurs when there is open communication between two parties and either participant is invited to share their ideas and have a stake in the final decision (53:15). Margolis wrote that,

> Two-way communication, guided by the conscious intent to accurately understand the others' point of view contains the greatest likelihood for encouraging the cooperation needed for successful implementation of program objectives. (53:15)

Timing of comments is also important. For example, if suggestions are critiqued as they are presented, then people

are more likely to withhold information. Therefore, even though evaluation is important, it should be put off until all suggestions have been contributed. Margolis wrote that,

> Premature evaluation may result in (a) satisfactory ideas being dismissed with only superficial and incorrect evaluations; (b) the alienation and withdrawal of those whose ideas were dismissed; (c) increased and often unobjective commitment to dismissed ideas by those who presented them; and (d) silence by the other team members for fear that their ideas will be dismissed. (53:16)

Several principles for effective communication, according to Fisher, are to be sensitive to group process, confront social problems, avoid formula answers, be critical, be creative, and be honest (26:193). If these principles are followed, then open communication should ensue. Research has shown that more open communication may occur when groups have clear goals than groups with unclear goals (30:501). This may cast conclusions from group research into question because problems usually present themselves to organizations in very ill-structured ways. Most of the field and laboratory research conducted on groups has centered on well defined problems being given to groups to solve (37:376).

Dysfunctional Behaviors

Dysfunctional behavior encompasses all of those behaviors which would constrict team members' contributions to the group. Behaviors which arouse defensiveness have no place in the small group or team because they can obstruct

group members' contributions. Margolis explained how defensive feelings can influence the group members:

> Feeling defensive, individuals protect themselves and censor their ideas instead of pooling resources, sharing thoughts, and working to develop mutually satisfying interdisciplinary interventions. (53:14)

Thus, defensive feelings defeat the main purpose of using groups which is to combine everyone's ideas for the best decision. Group members can behave in such a manner as to arouse either defensiveness or supportive feelings among teammates. Margolis wrote that,

> Those behaviors which arouse defensiveness are: evaluation, control, strategy, neutrality, superiority, and certainty; While the following behaviors contribute to supportive, open climates: description, problem orientation, spontaneity, empathy, equality, and provisionalism. (53:14)

Those behaviors which encourage an open environment should be fostered, while those that arouse defensive feelings should be minimized.

Margolis had another point that comments made during a decision making and problem solving team should be descriptive in nature instead of evaluative. When comments are made in an evaluative manner, teammates will feel that they are being evaluated in a personal manner instead of their contributions being evaluated impartially. If comments are confined to the idea and are descriptive in nature, then the teammate will not be as defensive about what is being said (53:14). Sometimes people working together in teams with similar biases can reinforce each

other's biases which enhances their limitations. Other times, individuals will push for their own self-interests at the expense of the company (93:96).

Personality Characteristics of Group Members

During open discussions, there are certain personality characteristics which influence the involvement and impact of other team members. Hoffman has discovered that extroverted individuals have a "disproportionate influence over the solution" (37:377). Because these people are looked up to as leaders, more often than not their ideas are accepted by others on the team. And, because of their dominating style, they tend to rule discussions which prevents others from participating (37:377). People who have affiliative needs and are not confident of their team members' approval will tend to withhold thoughts which may run counter to the group's opinion about the problem or solution. There are also counterdependent types who resist the group to the extent that the group never has a chance to get anything accomplished.

> Both the dependent and counterdependent types represent a class of people whose participations in the group are more often expressions of "self-oriented needs"--aggression, power, status, insecurity--than they are of attempts at problem solving. (37:378)

Interpersonal Relations

Positive interpersonal relations are gained by group members when they are understanding of the needs and desires of others. Hanson explained that,

> It is extremely important for team members to recognize and accept their own needs and be sensitive to the needs of other team members and to maintain some balance between these needs. A principle of effective team functioning is accomplished when members have both high concern for their own needs and high concern for the needs of others. (32:28)

Positive feelings between group members allow team members to volunteer ideas and opinions which may run counter to those of the group. Also, team members feel more open so they will contribute more than if negative feelings existed within the group. Hoffman warns that when people are too positive, they may accept a solution which is incorrect because of initial group acceptance (37:379). However, the consequences of negative feelings between group members can be much more devastating than excessive positive feelings. Negative feelings among group members can lead to

> lack of confidence in the other members (Hamblin, 1958), fear and mistrust (Golembiewski & McConkie, 1975), and tend to block or distort communications among group members. (37:380)

Conflict Among the Team

Contrary to what one may think, conflict among a decision making/problem solving team is not detrimental to producing a quality decision. Conflict should actually be something that is a part of every discussion since it has been found to improve the quality of the final decision.

Conflict becomes a problem when it is mismanaged or allowed to be taken personally by the group members (53:16).

> Accepting conflict or disagreement as a stimulus that can provide opportunities for achieving a more complete and comprehensive understanding of the problem and more alternatives to the solution enhances the probability of choosing a superior solution. (53:16)

Individuals, because of their cognitive limitations, do not always follow a rational decision making process. Luckily, according to Tjosvold, "Conflict-filled discussions, when conducted cooperatively, can help the team to cope with cognitive limitations and biases of individual decision makers" (93:96).

Groupthink

Groupthink is a phenomenon which can be disadvantageous to the group decision-making process (18:447; 96:351; 45:267). Irving L. Janis discovered groupthink by reviewing historical records of events such as the Bay of Pigs, the "failure to be prepared for the attack on Pearl Harbor, the Korean War stalemate, and the escalation of the Vietnam War" (45:267). After analyzing these decisions, Janis defined groupthink as "a mode of thinking that people engage in when they are deeply involved in a cohesive in-group, when the members' strivings for unanimity override their motivation to realistically appraise alternative courses of action" (18:447). It is interesting to note that the people involved in groupthink do not intentionally suppress dissenting points of view; rather:

> Groupthink involves nondeliberate suppression of critical thoughts as a result of internalization of the group's norms, which is quite different from deliberate suppression on the basis of external threats of social punishment. The more cohesive the group, the greater the inner compulsion on the part of each member to avoid creating disunity, which inclines him to believe in the soundness of whatever proposals are promoted by the leader or by a majority of the group members. (45:269)

Janis identified the symptoms of groupthink and formulated safeguards to prevent it. The eight symptoms of groupthink are summarized in Table 3.

If the organization does start to exhibit some of these symptoms of groupthink, Irving came up with several safeguards a group can take to prevent groupthink from occurring. "Organizations can guard against groupthink by encouraging diversity and nonconformity during group decision making" (18:449). Another way to guard against groupthink is to pick someone in the group who will be the devil's advocate. It is the responsibility of the devil's advocate to challenge established points of view and to take the other side during arguments. Literature also suggests that the leader not make his opinions known until the group has had time to come to its own decisions. (18:449; 96:352; 45:278) Groupthink can have very negative consequences for the team and the organization.

Group Cohesion

Group cohesion has been defined in many different ways; however, the most prevalent definition is Festinger,

Table 3

Eight Warning Signals of Groupthink (18:448)

	Symptom	Description
1.	Illusion of Morality	Believe group's position is inherently ethical and moral compared to other views.
2.	Negative Stereotyping	View opposing groups as the enemy, as too different to negotiate with.
3.	Illusion of Invulnerability	Overly optimistic, take extreme risks, oversimplify potential feedback.
4.	Rationalizations	Discredit or explain away warning signals and negative feedback.
5.	Self-censorship of Dissenting Views	Keep doubts and conflicting ideas to oneself. Minimize doubts.
6.	Mindguards	Protect group from negative information that could cause conflict or threaten group cohesion.
7.	Strong Conformity Pressure	Dissenting views seen as disloyal, members pressured to agree.
8.	Illusion of Unanimity	Assume everyone believes in the group's judgment.

Schachter, and Back's (1950) notion of cohesion as "the total field of forces causing members to remain in their group" (9:276). It has been observed that the higher the level of a group's cohesion, the higher that group's productivity can be (52:504; 41:955). In a highly cohesive

group, "many of the values, goals, and norms of the group are perceived similarly" (15:92). Also, in highly cohesive groups people assume more individual responsibility for the group's results and performance (6:192). The more people want to stay in the group and be a part of it, the harder they will strive to accomplish that group's objectives. Schacter in 1951 came to the conclusion that,

> No matter what the criteria of productivity, or the structure of the particular task, high cohesive groups should (within specified limits) be more successful at overcoming forces with direction opposite to group-induced direction. (83:161)

These forces which move in a direction contrary to the group-induced direction represent barriers which might prevent the group from achieving its goals. The group members work together to overcome their problems. A more recent definition of group cohesion, which embodies this concept, was advanced by Carron who wrote that, "cohesion should be viewed as a dynamic process that is reflected in the group's tendency to stick together while pursuing its goals and objectives" (14:341).

Is group cohesion always a positive attribute to be strived for? Kellerman wrote that, "high cohesion is not a universal cultural attribute that should be valued for its inherent goodness" (14:344). The positive or negative results which occur because of high cohesion occur as an output of what the group's behaviors, attitudes, norms, goals, and objectives are (14:344).

> Individuals who join together to campaign for the United Way, for instance, as well as members of religious orders, juvenile gangs, and even the participants in events such as the Jonestown tragedy and the Charles Manson-orchestrated slayings also exhibited group cohesion. (14:340)

In the work place, there could be a group goal not to exceed a certain amount of productivity in a day, so that all of the members of that group would not have to work as hard each day. A new member to this group might become of this "norm" rather quickly. Every group that comes together will have cohesion to some degree, or else there would be no reason for being part of the group (14:343). This emphasizes how important it is for managers to monitor and influence their members in a positive direction.

Group cohesion, although possessed by all groups, should not be viewed as a static commodity. Carron conducted a literature review and concluded "that cohesion is dynamic and that it interacts in a circular fashion with other group variables" (14:347). If a team or group pulls together and wins a game or achieves a goal, then this influences the members' sense of pride and satisfaction about themselves and with their other group members. This in turn reinforces the team's positive feelings about one another which makes the team or group more cohesive (14:347).

Fisher came to the conclusion that there is a curvilinear relationship that exists between productivity and cohesion. He noted the difficulties present in trying

to define productivity. In some instances, it is easy to define productivity in situations where something is being produced. Widgits produced per hour and baskets per game are two examples. Productivity is more difficult to define when trying to evaluate a group's decisions.

Quantity of decisions made is not always an accurate metric for determining the quality of a group's decisions. As noted earlier, a group's effective decisions were evaluated according to the degree that the decision met the group's objectives and met group approval. However the quality of decisions is determined, Fisher maintained that, "productivity and cohesiveness may be considered the outputs of the task dimension and social dimension respectively" (26:42). The curvilinear relationship between productivity and cohesion is presented in Figure 2. The numbers on either axis have no other meaning than to indicate that productivity and cohesion are increasing in the same direction as the number scales. Fisher concludes that moderately high levels of cohesion are required for optimal group productivity, and "that the outputs of the two dimensions of group process affect each other reciprocally" (26:34). This conclusion is consistent with Carron's conclusion about the reciprocal nature of group cohesion from above.

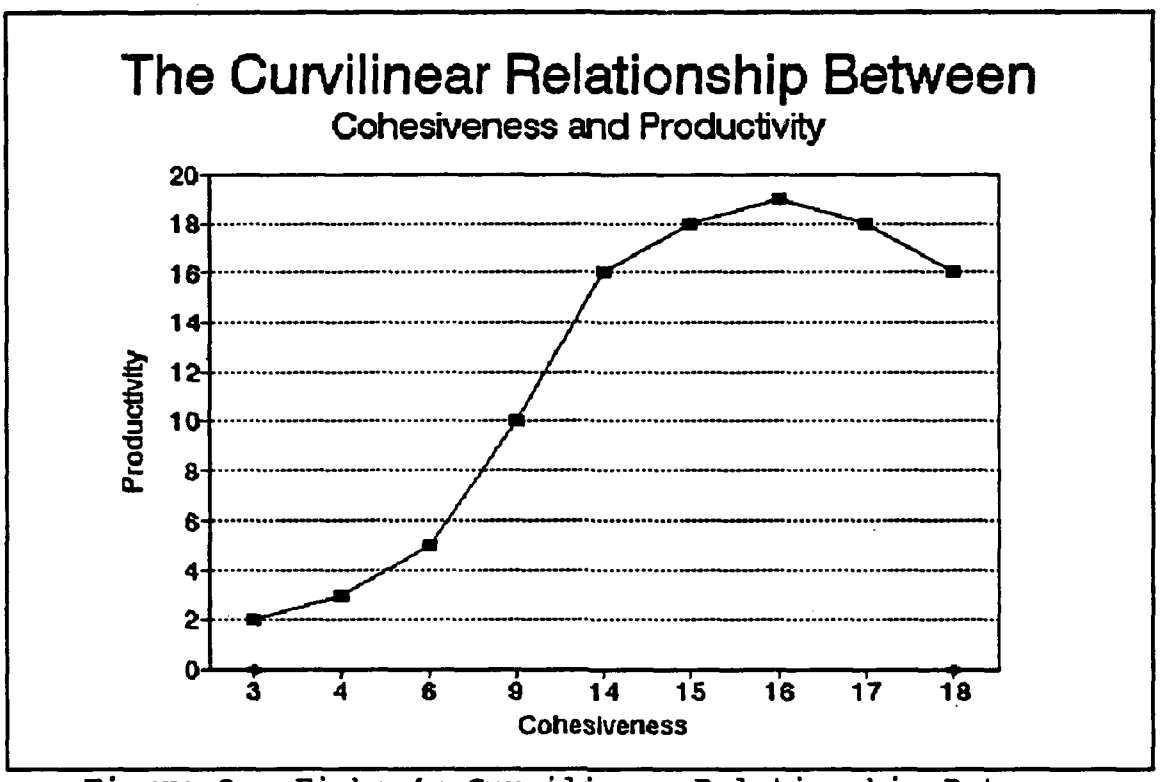

Figure 2. Fisher's Curvilinear Relationship Between Cohesiveness and Productivity (26:33)

Group Productivity

Group productivity can have a plethora of different meanings depending on the perspective of who's defining it. Economists, engineers, accountants, and managers would all define productivity differently depending on their area of expertise. Economists, engineers, and accountants all commonly define productivity in terms of inputs to outputs. Management tends to view productivity in a much more encompassing manner (94:481). Tuttle summarized a survey of chief executive officers and reported that:

> 8 out of 10 respondents would include efficiency, effectiveness, and quality in their productivity

> definitions. Seven out of 10 would also include disruption, sabotage, absenteeism, and turnover as well as output-oriented factors, even if these are difficult to measure. (94:481)

It should be no surprise that if one cannot adequately define something, it is going to be very difficult to measure. A major problem is how to measure and define productivity in today's arena of information and service-based industries. With manufacturing firms, it is easy to see an input-output relationship between the number of people who worked on a specific number of units (94:481). Hyde summarized the concerns of a recent Citibank CEO:

> Productivity, in the crudest sense, means output per man hour. That's a useful enough concept in manufacturing, but what does it tell us in an information-intensive age when the vast majority of our workers are employed in the service sector? Take the financial service industry. Once you get past counting the number of checks cleared per hour or the number of insurance claims paid, you move into the realm of subjectivity. How do you measure a loan officer's productivity? By the number of loans he makes? By the size of the loans? By the quantity of bad debt he creates? (32:322)

With all of the confusion surrounding the term "productivity," one must be careful in defining exactly what one means when using the term.

Productivity is a part of group effectiveness (43:482; 18:198). Tuttle came to the conclusion that:

> Literature has three main concepts in common: (a) productivity is a dimension of the broader concept of effectiveness, (b) productivity is a broad concept which encompasses both efficiency and effectiveness, and (c) productivity and effectiveness are separate but related concepts. (43:482)

Hackman presents a more detailed definition of group effectiveness. Hackman defines effectiveness as the sum of three different components:

> 1. Productive output. The productive output of the group must meet or exceed standards of quantity and quality as defined by the organization. 2. Personal need satisfaction. The experience of individuals in the group serves to satisfy personal needs. That is, groups are effective if they facilitate long-range individual growth and development. 3. Capacity for future cooperation. Finally, the social processes employed to complete the tasks should maintain or enhance the capacity of members to work together on subsequent tasks. If a group becomes divisive or destructive in completing its assigned tasks, its future productivity is in doubt. Hence, the effective work group avoids destructive social processes in its efforts to complete tasks. (18:198-199)

Efficiency is usually viewed as a ratio (input to output) which connects productivity to effectiveness (43:482). Drucker views the relationship between effectiveness and efficiency as effectiveness being deciding on the correct actions to accomplish in order to meet your objectives, while efficiency is viewed as implementing the decisions in the right way (22:45-46).

Though it may seem paradoxical, group productivity needs to be judged by the quality of the decisions that the group makes, and not the group's utilization of time.

> Hoffman, Harburg, and Maier (1962) discovered that conflict over ideas causes groups to search for more alternatives and thereby improve the quality of their group decisions. Conflict, then, serves as a stimulus to critical thinking and stimulates members to test their ideas. It logically follows that the issues which precipitate social conflict exert the greatest influence on the decisions which eventually achieve group consensus. And since those issues have survived the critical tests of ideational conflict, the decisions are probably of higher quality. (26:112)

Jung's Psychological Type Theory

Jung developed his behavioral and decision making theory in the early 1900's, but the underlying theme of his theory dates back over twenty five centuries ago to Hippocrates (46:3). For Hippocrates, people's behavior sprang from their tendencies towards four temperaments which were either "choleric, phlegmatic, melancholic or sanguine" (46:3). Thus, the idea that people could be explained according to different sets of characteristics has been around quite some time.

According to Jung's theory, the myriad of differences between people's personalities can actually be explained by the way people prefer to perceive the world around them and then how they judge and act upon those perceptions. Jung explained this more succinctly by writing:

> people are different in fundamental ways even though they all have the same multitude of instincts (archetypes) to drive them from within. One instinct is no more important than another. What is important is our preference for how we "function". Our preference for a given "function" is characteristic, and so we may be "typed" by this preference". (46:3).

His theory maintains that people are born predisposed with these innate preferences. Jung's theory is not intended to provide a means for stereotyping people; rather, the theory was designed to measure how people prefer to perceive and judge information about their environment. This theory is also non-judgmental in the sense that no one type is recognized as being superior to any other personality type.

Within Jung's theory, there are dichotomous ways of perceiving and judging the world. Sensing and intuition are the two mental processes by which an individual can perceive the environment. The person who prefers sensing will perceive the world in a concrete manner through the five physical senses. The person who prefers intuition will instead focus his attention on implied meanings and possibilities which are suggested by what he perceives through his senses. Thinking and feeling are the two mental functions that people use in their judgement process. People who prefer the thinking preference tend to arrive at decisions in a logical, objective, and impersonal basis. People with a feeling preference will base their decisions on a personal and value oriented basis. Myers and McCaulley define perception and judgement as follows:

> Perception includes the many ways of becoming aware of things, people, events, or ideas. It includes information gathering, the seeking of sensation or of inspiration, and the selection of the stimulus to be attended to. Judgement includes all the ways of coming to conclusions about what has been perceived. It includes decision making, evaluation, choice, and the selection of the response after perceiving the stimulus. (66:12)

There are two attitudes within Jung's theory. They are introversion and extraversion. These attitudes define a person's orientation towards the world. An extravert is focused towards the external environment such as people, activities, and things. Conversely, the introvert is characterized by having an inward focus and being more

comfortable in the inner world of ideas and thoughts (66:1-4). Finally, judging and perceiving are the two styles that people can adopt to interact with the world. These two functions are not explicitly defined in Jung's work; however, these two functions were drawn implicitly from his work by Briggs and Myers. A person who favors the judging attitude will order his world and prefer "closure over open options" (46:22). Whereas, the person who prefers perceiving will prefer to go with the flow and leave his options open and wait until the last possible chance to make his decision. Table 4 contains further descriptions of the different types, and the dominant, auxiliary and inferior processes will be described later.

Jung's psychological type theory maintains that people have all of these functions and attitudes, but that each person will have a particular preference which makes it stronger than the other. Keirsey wrote, "one can be extraverted in some degree as well as introverted in some degree, thinking in some degree and feeling in some degree, and so on" (46:14). Edinger points out that the attitudes, functions, and styles are usually not exhibited as clearly by people as they have been presented. The reason for this is that one will have a stronger preference for one function, but he will still possess the other functions as well which serve to counterbalance the characteristics of the dominant preference (24:3). People have all of the preferences available to them (46:3). Indeed, Jung thought

that all of functions "should be available to the individual in order for him to have a complete response to the life experience" (24:3). There is still debate among psychologists whether one is born with one's disposition towards these preferences or if they develop as one grows older (46:14; 68:11). In either case, Jung believed that the preferred function would grow stronger with use and that the less used function would become weaker with disuse (46:14).

The Myers-Briggs Type Indicator

History The Myers-Briggs Type Indicator (MBTI) is a psychometric test, which was developed by a mother and daughter team. The mother was Katharine Cook Briggs and her daughter was Isabel Briggs Myers. Katharine had reached the conclusion that people approached life in different ways and had been trying to classify people based on these differences since the early 1900's. When Jung's work was published in 1923, Katharine devoted herself to Jung's works and in tandem with her daughter began trying to discover ways to measure the differences they observed in people (48:8; 36:4). They "set out to design a psychological instrument that would explain, in scientifically rigorous and reliable terms differences according to Jung's Theory of Personality Preferences" (48:8). The results of their work culminated in the creation of the MBTI. The inventors hoped that it, "could be used to establish individual preferences

Table 4

Words to Help Understanding of Type Concepts (49:24-26)

Sensing Perception:
When using my sensing I am...
- Perceiving with the five senses
- Attending to practical and factual details
- In touch with the physical realities
- Attending to the present moment
- Confining attention to what is said and done
- Seeing "little things" in everyday life
- Attending to step-by-step experience
- Letting "the eyes tell the mind"

Intuitive Perception:
When using my intuition I am...
- Perceiving with memory and associations
- Seeing patterns and meanings
- Seeing possibilities
- Projecting possibilities for the future
- Imagining; "reading between the lines"
- Looking for the big picture
- Having hunches; "ideas out of nowhere"
- Letting "the mind tell the eyes"

Thinking Judgment:
When reasoning with thinking, I am...
- Using logical analysis
- Using objective and impersonal criteria
- Drawing cause and effect relationships
- Being firm-minded
- Prizing logical order
- Being skeptical

Feeling Judgment:
When reasoning with feeling, I am...
- Applying personal priorities
- Weighing human values and motives, my own and others
- Appreciating
- Valuing warmth in relationships
- Prizing harmony
- Trusting

Extraversion:
When extraverting, I am...
- Oriented to the outer world
- Focusing on people and things
- Active
- Using trial and error with confidence
- Scanning the environment for stimulation

Introversion:
When introverting, I am...
- Oriented to the inner world
- Focusing on ideas, concepts, inner impressions
- Reflective
- Considering deeply before acting
- Probing inwardly for stimulation

Judgment:
When I take a judging attitude, I am...
- Using thinking or feeling judgment outwardly
- Deciding and planning
- Organizing and scheduling
- Controlling and regulating
- Goal oriented
- Wanting closure, even when data are incomplete

Perception:
When I take a perceiving attitude, I am...
- Using sensing or intuitive perception outwardly
- Taking in information
- Adapting and changing
- Curious and interested
- Open-minded
- Resisting closure to obtain more data

Dominant Process
- Favorite among **S, N, T** or **F**
- Governing force
- Unifies one's life
- Best developed and most used process
- "The ship's captain"

Auxiliary Process
- Second favorite among **S, N, T** or **F**
- A perceptive (**S** or **N**) process if the dominant is judgment (**T** or **F**)
- A judging (**T** or **F** process if the dominant is perception (**S** or **N**)
- Used in the outer world if the dominant is introverted
- Used in the inner world if the dominant is extraverted
- "The ship's first mate"

Inferior Process (Sometimes called the shadow)
- The opposite of the dominant (As **S** is opposite **N**, **T** is opposite **F**)
- The least developed process
- Our relatively childish and primitive perception or judgment
- An escape from the conscious personality
- Is in charge when "You don't act yourself"
- A source of much undiscovered personal energy

and then to promote a more constructive use of the differences between people" (48:8).

The MBTI measures people's preferences on four dichotomous pairs and indicates one of sixteen possible personality types via a four letter identifier (46:26). The four bi-polar pairs are extraversion/introversion, sensing/intuition, thinking/feeling, and judging/perceiving. Table 5 illustrates each preference's influence on the sixteen different personality types. Each of the sixteen personality types has its own unique characteristics, strengths, and weaknesses (36:70; 48:43). The characteristics Myers associated with each type are summarized in Table 6. Because of the overlap of preferences in the matrix, one will notice that there are similar characteristics displayed in the different personality types. For example, if three of the four letter identifiers are the same then there will likely be similar characteristics between the two personality types (36:70). An additional summary of the characteristics associated with the sixteen types is provided by Lawrence in Table 7.

The MBTI Form G consists of 126 questions which measure the person's strength of each preference (48:45). Reference Figure 3 which illustrates how the various strengths of the preferences are charted.

By measuring the relative strengths of a person's preference for the different functions, the MBTI gives a four letter identifier which characterizes a person's type.

Table 5

Contributions Made by Each Preference to Each Type (62:448)

		Sensing Types		Intuitive Types	
		With Thinking	With Feeling	With Feeling	With Thinking
Introverts	Judging Types	**ISTJ** I Depth of concentration S Reliance on facts T Logic and analysis J Organization	**ISFJ** I Depth of concentration S Reliance on facts F Warmth and sympathy J Organization	**INFJ** I Depth of concentration N Grasp of possibilities F Warmth and sympathy J Organization	**INTJ** I Depth of concentration N Grasp of possibilities T Logic and analysis J Organization
	Perceptive Types	**ISTP** I Depth of concentration S Reliance on facts T Logic and analysis P Adaptability	**ISFP** I Depth of concentration S Reliance on facts F Warmth and sympathy P Adaptability	**INFP** I Depth of concentration N Grasp of possibilities F Warmth and sympathy P Adaptability	**INTP** I Depth of concentration N Grasp of possibilities T Logic and analysis P Adaptability
Extroverts	Perceptive Types	**ESTP** E Breadth of interests S Reliance on facts T Logic and analysis P Adaptability	**ESFP** E Breadth of interests S Reliance on facts F Warmth and sympathy P Adaptability	**ENFP** E Breadth of interests N Grasp of possibilities F Warmth and sympathy P Adaptability	**ENTP** E Breadth of interests N Grasp of possibilities T Logic and analysis P Adaptability
	Judging Types	**ESTJ** E Breadth of interests S Reliance on facts T Logic and analysis J Organization	**ESFJ** E Breadth of interests S Reliance on facts F Warmth and sympathy J Organization	**ENFJ** E Breadth of interests N Grasp of possibilities F Warmth and sympathy J Organization	**ENTJ** E Breadth of interests N Grasp of possibilities T Logic and analysis J Organization

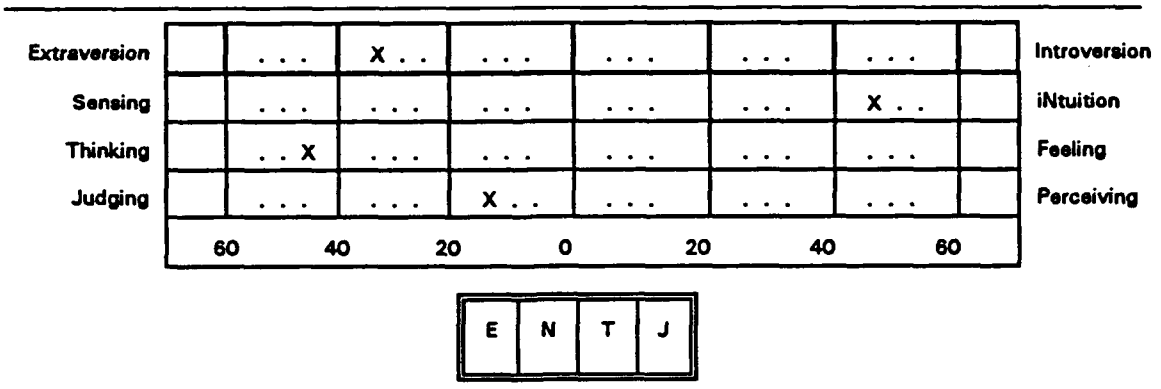

Figure 3. MBTI Chart (48:46)

Figure 3 shows that this person is an ENTJ. Just because this person is an ENTJ does not mean that he is identical to all of the other ENTJs in the world. The reason for this, in addition to other factors, is that another ENTJ may have different strengths of preferences and thus would be a different person (48:45). If a person has a slight score for one of the preferences, then that person will likely display characteristics of both functions in an intermixed fashion to the world and to themselves (48:45-46).

> According to the Myers-Briggs Type Indicator Manual (Consulting Psychologists Press, 1985), preference strengths (the numbers plotted on the graph of the report form) of 1-9 are considered to be 'slight', 11-19 are 'moderate', 21-31 are 'clear', and 33+ are 'very clear'. (48:45)

Thus, the higher an individual's score is, the stronger the characteristics associated with that preference will be manifested.

Table 6

Characteristics Frequently Associated With Each Type (63:20-21)

	SENSING TYPES	
INTROVERTS JUDGING	**ISTJ** Serious, quiet, earn success by concentration and thoroughness. Practical, orderly, matter-of-fact, logical, realistic and dependable. See to it that everything is well organized. Take responsibility. Make up their own minds as to what should be accomplished and work toward it steadily, regardless of protests or distractions. Live their outer life more with thinking, inner more with sensing.	**ISFJ** Quiet, friendly, responsible and conscientious. Work devotedly to meet their obligations and serve their friends and school. Thorough, painstaking, accurate. May need time to master technical subjects, as their interests are not often technical. Patient with detail and routine. Loyal, considerate, concerned with how other people feel. Live their outer life more with feeling, inner more with sensing.
INTROVERTS PERCEPTIVE	**ISTP** Cool onlookers, quiet, reserved, observing and analyzing life with detached curiosity and unexpected flashes of original humor. Usually interested in impersonal principles, cause and effect, or how and why mechanical things work. Exert themselves no more than they think necessary, because any waste of energy would be inefficient. Live their outer life more with sensing, inner more with thinking.	**ISFP** Retiring, quietly friendly, sensitive, modest about their abilities. Shun disagreements, do not force their opinions or values on others. Usually do not care to lead but are often loyal followers. May be rather relaxed about assignments or getting thins done, because they enjoy the present moment and do not want to spoil it by undue haste or exertion. Live their outer life more with sensing, inner more with feeling.
EXTRAVERTS PERCEPTIVE	**ESTP** Matter-of-fact, do not worry or hurry, enjoy whatever comes along. Tend to like mechanical things and sports, with friends on the side. May be a bit blunt or insensitive. Can do math or science when they see the need. Dislike long explanations. Are best with real things that can be worked, handled, taken apart or put back together. Live their outer life more with sensing, inner more with thinking.	**ESFP** Outgoing, easygoing, accepting, friendly, fond of a good time. Like sports and making things. Know what's going on and join in eagerly. Find remembering facts easier than mastering theories. Are best in situations that need sound common sense and practical ability with people as well as with things. Live their outer life more with sensing, inner more with feeling.
EXTRAVERTS JUDGING	**ESTJ** Practical realists, matter-of-fact, with a natural head for business or mechanics. Not interested in subjects they see no use for, but can apply themselves when necessary. Like to organize and run activities. Tend to run things well, especially if they remember to consider other people's feelings and points of view when making their decisions. Live their outer life more with thinking, inner more with sensing.	**ESFJ** Warm-hearted, talkative, popular, conscientious, born cooperators, active committee members. Always doing something nice for someone. Work best with plenty of encouragement and praise. Little interest in abstract thinking or technical subjects. Main interest is in things that directly and visibly affect people's lives. Live their outer life more with feeling, inner more with sensing.

INTUITIVE TYPES

INFJ Succeed by perseverance, originality and desire to do whatever is needed or wanted. Put their best efforts into their work. Quietly forceful, conscientious, concerned for others. Respected for their firm principles. Likely to be honored and followed for their clear convictions as to how best to serve the common good. Live their outer life more with feeling, inner more with intuition.	**INTJ** Have original minds and great drive which they use only for their own purposes. In fields that appeal to them they have a fine power to organize a job and carry it through with or without help. Skeptical, critical, independent, determined, often stubborn. Must learn to yield less important points in order to win the most important. Live their outer life more with thinking, inner more with intuition.
INFP Full of enthusiasms and loyalties, but seldom talk of these until they know you well. Care about learning, ideas, language, and independent projects of their own. Apt to be on yearbook staff, perhaps as editor. Tend to undertake too much, then somehow get it done. Friendly, but often too absorbed in what they are doing to be sociable or notice much. Live their outer life more with intuition, inner more with feeling.	**INTP** Quiet, reserved, brilliant in exams, especially in theoretical or scientific subjects. Logical to the point of hair-splitting. Interested mainly in ideas, with little liking for parties or small talk. Tend to have very sharply defined interests. Need to choose careers where some strong interest of theirs can be used and useful. Live their outer life more with intuition, inner more with thinking.
ENFP Warmly enthusiastic, high-spirited, ingenious, imaginative. Able to do almost anything that interests them. Quick with a solution for any difficulty and ready to help anyone with a problem. Often rely on their ability to improvise instead of preparing in advance. Can always find compelling reasons for whatever they want. Live their outer life more with intuition, inner more with feeling.	**ENTP** Quick, ingenious, good at many things. Stimulating company, alert and outspoken, argue for fun on either side of a question. Resourceful in solving new and challenging problems, but may neglect routine assignments. Turn to one new interest after another. Can always find logical reasons for whatever they want. Live their outer life more with intuition, inner more with thinking.
ENFJ Responsive and responsible. Feel real concern for what others think and want, and try to handle things with due regard for other people's feelings. Can present a proposal or lead a group discussion with ease and tact. Sociable, popular, active in school affairs, but put time enough on their studies to do good work. Live their outer life more with feeling, inner more with intuition.	**ENTJ** Hearty, frank, able in studies, leaders in activities. Usually good in anything that requires reasoning and intelligent talk, such as public speaking. Are well-informed and keep adding to their fund of knowledge. May sometimes be more positive and confident than their experience in an area warrants. Live their outer life more with thinking, inner more with intuition.

INTROVERTS JUDGING PERCEPTIVE

EXTRAVERTS PERCEPTIVE JUDGING

Table 7

Brief Descriptions of the Sixteen Types (49:15)

E N T J
Intuitive, Innovative ORGANIZER; aggressive, analytic, systematic; more tuned to new ideas and possibilities that to people's feelings.

E S F J
Fact-minded, practical ORGANIZER; aggressive, analytic, systematic; more interested in getting the job done than in people's feelings.

I N T P
Inquisitive ANALYZER; reflective, independent, curious; more interested in organizing ideas than situations or people.

I S T P
Practical ANALYZER; values exactness, more interested in organizing data than situations or people; reflective, a cool and curious observer of life.

E S T P
REALISTIC ADAPTER in the world of material things; good natured, tolerant, easy going; oriented to practical, first hand experience; highly observant of details of things.

E S F P
REALISTIC ADAPTER in human relationships; friendly and easy with people, highly observant of their feelings and needs; oriented to practical, first hand experience.

I S T J
Analytical MANAGER OF FACTS AND DETAILS; dependable, decisive, painstaking and systematic; concerned with systems and organization; stable and conservative.

I S F J
Sympathetic MANAGER OF FACTS AND DETAILS; concerned with peoples' welfare; dependable, painstaking and systematic; stable and conservative.

I S F P
Observant, loyal HELPER; reflective, realistic, empathic; patient with details, gentle and retiring; shuns disagreements; enjoys the moment.

I N F P
Imaginative, independent HELPER; reflective, inquisitive, empathic, loyal to ideals; more interested in possibilities than practicalities.

E S F J
Practical HARMONIZER and worker-with-people; sociable, expressive, orderly, opinionated, conscientious; curious about new ideas and possibilities.

E N F J
Imaginative HARMONIZER and worker-with-people; sociable, expressive, orderly, opinionated, conscientious; curious about new ideas and possibilities.

I N F J
People-oriented INNOVATOR of ideas; serious, quietly forceful and persevering; concerned with the common good, with helping others develop.

I N T J
Logical, critical, decisive INNOVATOR of ideas; serious, intent, highly independent, concerned with organization, determined and often stubborn.

E N F P
Warmly enthusiastic PLANNER OF CHANGE; imaginative, individualistic; pursues inspiration with impulsive energy; seeks to understand and inspire others.

E N T P
Inventive, analytical PLANNER OF CHANGE; enthusiastic and independent; pursues inspiration with impulsive energy; seeks to understand and inspire others.

The MBTI has been in use for over twenty years and has been proven to be both a reliable and valid instrument (13:461; 95:225). Because of the ability of the MBTI to accurately distinguish personality types, it has become the most popular and widely used personality indicator in the United States, and it is used for many purposes throughout private business and the government (13:461; 16:20). For example, the MBTI has been applied to such diverse areas as

> career development, academic advising, leadership training, counseling, roommate matching, para-professional training, understanding learning and teaching styles, conflict resolution, and development of retention strategies. (75:3)

The usefulness of this test has not been lost on the business world. Businesses such as IBM, Westinghouse, DuPont, Allied-Signal, Apple, AT&T, Citicorp, Exxon, GE, Honeywell, and 3M have all been using the MBTI in teambuilding interventions and leadership seminars (17:20; 62:74).

The Dynamic Nature of Preferences

It is important to understand how the person's preferences interact to create a given personality type. To begin, "Everyone regularly uses all four mental processes - sensing, intuition, thinking, and feeling - but we do not use them equally well" (49:8). Implicit in Myers and Briggs' interpretation of Jung's theory is that one of the mental processes will be the dominant function for an individual (49:9). From an early age, each person will rely

on one of the mental processes more than the others with the end result being that the favored mental process "becomes more mature and reliable" (49:8). Myers drew an analogy between one's personality and a ship at sea. She wrote that the "dominant function serves as the 'captain' of the personality. It determines what is the desired direction and keeps the ship on course. The other functions are important, but are subordinate to and serve the goals of the dominant function" (57:13).

To overcome a tendency to become "one-dimensional" (49:9) through the use of one of the four mental processes, a person develops a "helping or auxiliary process to balance the dominant process" (49:10). The mental processes of perception, (sensing and intuition) and judgement, (thinking and feeling) are polar opposites (49:9). This means, for example, that a person who favors sensing will not develop his intuition. The auxiliary process which serves to counterbalance the "captain," "is always formed in the dimension that the dominant is not in" (49:10). The eight sets of dominant and auxiliary processes are summarized in Table 7.

Table 8 presents the effects of the combinations of perception and judgement (65:3). Table 8 summarizes how the different combinations of perception and judgement will operate in general. When the functions are viewed from a dominant and auxiliary perspective, there may be a small

Table 8

Combinations of Dominant and Auxiliary Processes (49:10)

Dominant	Auxiliary	Dominant	Auxiliary
Sensing	with Thinking	Intuition	with Thinking
Sensing	with Feeling	Intuition	with Feeling
Thinking	with Sensing	Thinking	with Intuition
Feeling	with Sensing	Feeling	with Intuition

variance in personality depending on which process is dominant or auxiliary. Lawrence wrote that "The differences suggested here are subtle but not superficial" (49:10). For example, if a person is intuitive dominant with thinking auxiliary he will use both functions; however, if there is a conflict between them the intuitive side will ultimately win out over the auxiliary side (49:10).

Jung's third personality dimension, which multiplies the eight combinations of perception, and judgement into sixteen, "is extraversion-introversion" (49:10). The attitudes of extraversion and introversion determine which function will be used in public and in their inner world (66:16; 57:301). McCaulley wrote that,

> For each type, the dominant function is used in the preferred attitude and the auxiliary function in the less preferred attitude; that is, extroverts use the dominant function in the extraverted attitude and the auxiliary in the introverted attitude; introverts use the dominant in the introverted attitude and the auxiliary in the extraverted attitude. (57:301)

Table 9

Combinations of Perception and Judgement (65:3)

People who prefer:	ST SENSING + THINKING	SF SENSING + FEELING	NF INTUITION + FEELING	NT INTUITION + THINKING
focus their attention on:	Facts	Facts	Possibilities	Possibilities
and handle these with:	Impersonal analysis	Personal warmth	Personal warmth	Impersonal analysis
Thus they tend to become:	Practical and matter-of-fact	Sympathetic and friendly	Enthusiastic & insightful	Logical and ingenious
and find scope for their abilities in:	Technical skills with facts and objects	Practical help and services for people	Understanding & communicating with people	Theoretical and technical developments
for example:	Applied science Business Production Construction Etc.	Patient care Community service Sales Teaching Etc.	Behavioral science Research Literature & art Teaching Etc.	Physical science Research Management Forecasts & analysis Etc.

Extroverts will show their best developed function to the outer world and that introverts will show their second hand function to the outer world. Thus, it is logical "that introverts are more likely to be underestimated in casual contacts, since they show their second-best, not their best function" (66:16). Finally, the fourth dimension of Jung's theory, which was interpreted by Myers and Briggs, is "the attitude taken toward the outer world" (49:12). This attitude is, of course, either judgement or perception which were both covered earlier. The judgement or perception preference indicates which function will be "used in the

extraverted attitude for both extroverts and introverts" (66:16). If an MBTI type ends in (P), then the dominant function is the second letter, and if it ends in (J), then the dominant function is the third letter. Table 9 shows the interaction between judgement, perception, dominant and auxiliary processes.

The inferior process is defined as the opposite of the dominant process. So, if sensing is dominant, then intuition will be inferior and vice-versa. The same is true of the judgement processes (49:17). Some people call the inferior process the "shadow," but one must be careful of one's terminology because when Jung used the term "shadow," he attached more significance to it than just an inferior process (49:17). This process is the least developed amongst the four, and when used it appears to be childish (49:17). Lawrence writes that, "It is the process we have the least control of, and is the one that has taken over when we say 'I wasn't being myself just then'" (49:17).

Cognitive Styles

Effective problem solving and decision making depend on one's ability to think critically (11:39). Some people rely on objective, logical, reasoning while others, "emphasize people's sentiments, personal values, testimony of the senses, personal stores of facts, emergent possibilities, and inspiration" (68:2). The manner in which people gather

Table 10

Type Table (65:19)

		WITH THINKING	WITH FEELING	WITH FEELING	WITH THINKING
	JUDGING	ISTJ Introverted Sensing with thinking	ISFJ Introverted Sensing with feeling	INFJ Introverted Intuition with feeling	INTJ Introverted Intuition with thinking
INTROVERTS	PERCEPTIVE	ISTP Introverted Thinking with sensing	ISFP Introverted Feeling with sensing	INFP Introverted Feeling with intuition	INTP Introverted Thinking with intuition
EXTROVERTS	PERCEPTIVE	ESTP Extraverted Sensing with thinking	ESFP Extraverted Sensing with feeling	ENFP Extraverted Intuition with feeling	ENTP Extraverted Intuition with thinking
	JUDGING	ESTJ Extraverted Thinking with sensing	ESFJ Extraverted Feeling with sensing	ENFJ Extraverted Feeling with intuition	ENTJ Extraverted Thinking with intuition

their information and process that information to arrive at a decision is based upon their cognitive style (68:3).

> Cognition is defined as the action of the intellect - the ability to learn and to reason, a capacity for knowledge and understanding. It is comprised of a number of distinct aspects such as accrual of stimuli, sorting, memory, language, thinking, reasoning, and numerous other discrete mental functions. (11:45)

The MBTI provides an avenue to "view the cognitive make up of decision makers" (68:2).

Researchers have come to the conclusion that a person's preferences for gathering and processing information are defined by four different cognitive or decision styles for making decisions: ST (Sensation-Thinking), NT (Intuition-Thinking), SF (Sensation-Feeling), and NF (Intuition-Feeling) (68:4; 11:46; 64:1; 88:1311). These combinations are, "preferred modes of perception and judgement" (88:1312). Myers original definitions for how the preferences of sensing, intuition, thinking, and feeling interact in combination were summarized in Table 8 (65:3). Myer's categorizations are broader than Nutt's; however, both categorizations are consistent in their conceptualizations of the different combinations of cognitive styles.

Table 10 summarizes the facts and warrants which form the basis for understanding the different decision styles from the MBTI choice frames. According to Nutt, the ST is overall a "systematic" decision maker (68:4). The ST prefers hard facts which can be verified directly via the

senses (such as mathematical data), and decisions are reached through impersonal step-by-step analysis (68:4; 66:33). The NT is categorized as a "speculative" decision maker. He also stresses analysis but will want not only hard data but subjective data as well. The NT will analyze data and try to infer relationships which may not be apparent on the surface (68:4). "The NT would regard future possibilities, expressed as data-assumption linkages, as key facts which suggest a warrant of assumptional flux" (68:4). The NT will tend to make decisions on an impersonal basis.

Table 11

Decision Styles and Warrants (68:1)

Decision Style	Information Used	Illustrative Warrants
Choice Frame		
1. ST (Systematic)	hard data	statistical significance or representation by a mathematical model
2. SF (Judicial)	perceptions of interested parties	acceptance and compromise
3. NT (Speculative)	data assumption linkages	assumptional flux and stochastic parameters
4. NF (Heuristic)	views and beliefs of power brokers	experience and judgment
Action Frame		
1. IJ (Influencer)	degrees of freedom to maneuver	ends justify means understanding the imperatives to act
2. EJ (Persuader)	merits of the case	
3. IP (Tuner)	hidden meanings	mutual understanding
4. EP (Broker)	sanctioning mechanisms	negotiation and bargaining

Table 12

The Action Frame (68:42)

	Preferred Type of Action		
Dominant Focus When Action Taking		Judging	Perceiving
	Internal	Influencers (IJ)	Tuners (IP)
	External	Persuaders (EJ)	Brokers (EP)

Table 13

Perceptions of Action Taking (68:43)

	Observing Style			
	Influencer (IJ)	Persuader (EJ)	Broker (EP)	Tuner (IP)
Influencer (IJ)	Lost opportunities to manage the situation.	devious	Violating rules of conduct.	Taking unnecessary risks.
Persuader (EJ)	Naive	Critique quality of argument.	Acting without means.	Insensitive to necessity of compromise.
Broker (EP)	Limited by their focus on means.	Acting without rationale.	Bargaining leverage exploited.	Unable to learn.
Tuner (IP)	Limited by what others want.	Prone to inaction.	Reflecting when means must be cultured.	Values and feelings surfaced

Table 14

Constructing Decision Styles (68:44)

CONSTRUCTING DECISION STYLES							
Dominant Consideration	Action Focus	Dominant Process	Secondary Process (consideration brought out by action type)	Decision Style	Decision Style Code *	Action Style	Action Style Code
Thinking (T)	External (E)	Externally (ET) focused thinking	Data (S) with judgment (J)	PROCEDURAL	ES<u>T</u>J	PERSUASION	EJ
			Possibilities (N) with judgment (J)	EVALUATIVE	EN<u>T</u>J	PERSUASION	EJ
	Internal (I)	Internally (IT) focused thinking	Data (S) with perception (J)	ORDERED	IS<u>T</u>P	TUNING	IP
			Possibilities (N) with perception (P)	INTELLECTUAL	IN<u>T</u>P	TUNING	IP
Feeling (F)	External (E)	Externally (EF) focused feeling	Data (S) with judgment (J)	POLITICAL	ES<u>F</u>J	PERSUASION	EJ
			Possibilities (N) with judgment (J)	MEDIATOR	EN<u>F</u>J	PERSUASION	EJ
	Internal (I)	Internally (IF) focused feeling	Data (S) with perception (P)	FLEXIBLE	IS<u>F</u>P	TUNING	IJ
			Possibilities (N) with perception (P)	COMMITTED	IN<u>F</u>P	TUNING	IJ
Sensation (S)	External (E)	Externally (ES) focused sensing	Thinking (T) with perception (J)	TRADITIONAL	E<u>S</u>TP	TUNING	IJ
			Feeling (F) with perception (P)	RELATIONAL	E<u>S</u>FP	BROKERING	EP
	Internal (I)	Internally (IS) focused sensing	Thinking (T) with judgment (J)	EMPIRICAL	I<u>S</u>TJ	INFLUENCING	EJ
			Feeling (F) with judgment (J)	ANECDOTAL	I<u>S</u>FJ	INFLUENCING	EJ
Intuition (N)	External (E)	Externally (EN) focused intuition	Thinking (T) with perception (P)	VISIONARY	E<u>N</u>TP	BROKERING	EP
			Feeling (F) with perception	PROSELYTIZER	E<u>N</u>FP	BROKERING	EP
	Internal (I)	Internally (IN) focused intuition	Thinking (T) with judgment (J)	ICONOCLAST	I<u>N</u>TJ	INFLUENCING	IJ
			Feeling (F) with judgment (J)	COOPERATIVE	I<u>N</u>FJ	INFLUENCING	IJ

* underlined code letter indicates dominate consideration in decision making

Table 15

Decision Style in the Meta Frame (68:45)

Decision Style in the Meta Frame							
Dominant Process	Warrant Applied	Decision Style & Code	Secondary Process	Key Consideration	Key Traits	Weakness	Action Style
Externally Focused T hinkers	Reasoning and analysis	PROCEDURAL (ESTJ)	Support thinking by: 1) judgment using data	Factually described realities	Cautious; rule adherence	Conservatism	PERSUASION
		EVALUATIVE (ENTJ)	2) judgment using intuition	The consequences of possibilities	Quick study of implications	Ignore fact-based advice	PERSUASION
Internally Focused T hinkers	Operant principals	ORDERED (ISTP)	1) perception using data	Data that gives order and meaning	Realism	Economy of effort	TUNING
		INTELLECTUAL (INTP)	2) perception using intuition	Unique and ingenious options	All possible qualifications developed	Failure to deal with implementation problems	TUNING
Externally Focused F eelers	People's sentiments	POLITICAL (ESFJ)	Focus feeling by: 1) judgment using data	Tangible views of key people	Reconciliation of opposing views	Act on wrong assumptions	PERSUASION
		MEDIATOR (ENFJ)	2) judgment using intuition	Ways to harmonize	Human relation skills	Preoccupied with approval	PERSUASION
Internally Focused F eelers	Personal values	FLEXIBLE (ISFP)	1) perception using data	Peoples values	Creating flexible arrangements	Committed to needs of the moment	TUNING
		COMMITTED (INFP)	2) perception using intuition	What's right	Developing personal views and beliefs	Slow to act	TUNING

Externally Focused Sensors	Testimony of the senses	TRADITIONAL (ESTP)	Support data with: 1) Perception using thinking	Practical action	Concentrate on variations of what is known	Possibilities	BROKERING
		RELATIONAL (ESFP)	2) Perception using feeling	Tact	Maintenance of good relations	Tough choices	BROKERING
Internally Focused Sensors	Personal store of facts	EMPIRICAL (ISTJ)	1) Judgment using thinking	Facts that contain inferences	Use of experiment and observation	Wary of change	INFLUENCING
		ANECDOTAL (ISFJ)	2) Judgment using feeling	Personal experience	Recall of incidents and anecdotes	Finding an appropriate president	INFLUENCING
Externally Focused Intuitives	Emerging Possibilities	VISIONARY (ENTP)	Consider Possibilities using: 1) Perception using thinking	New ideas	Unpredictability, independence	Finding best ideas	BROKERING
		PROSELYTIZING (ENFP)	2) Perception using feeling	Making converts	Many projects	Squander emerges	BROKERING
Internally Focused Intuitives	Inspiration about what could be	ICONOCLAST (INTJ)	1) Judgment using thinking	New arrangements	Individualistic	Commitment to constant change	INFLUENCING
		COOPERATIVE (INFJ)	2) Judgment using feeling	Elicit cooperation toward goal	Get peers to understand and approve	The internal compromise of innovation	INFLUENCING

The SF is considered a "Judicial" decision maker. For the SF, "Decisions are treated as unique and each is considered on its merits, described by objective data" (68:4). SFs rely on feeling so they will tend to treat their own feelings and those of the people around them as facts (64:1; 68:4). Thus, SFs will have a tendency to resolve issues and make decisions through group consensus. Finally, "Action taking becomes feasible for an SF when people find a proposal acceptable" (68:4). The NF is called a "Heuristic" decision maker (68:4). The heuristic decision maker tries to balance and reconcile the diverse interests of people and their organizations. "Politics and bargaining, through mutual adjustment (Lindblom, 1963), are preferred approaches" (68:5). The NFs link personal views and issues when significant decisions need to be made. The NF will usually not act until the values and beliefs of significant people are addressed (68:5).

For Nutt, the cognitive styles of Jung and Myers were a starting point from which to explore the behavioral differences among different decision makers. Specifically, Nutt examined not only perception and judgment, but he also examined how introversion, extraversion, judging, and perceiving affected the cognitive styles of decision makers. A result of his investigation is that there are sixteen different decision making styles-one associated with each of the sixteen personality types as defined by Myers. Tables 12, 13, 14, and 15 briefly summarize the results of Nutt's

work. These tables explain the decision makers' decision styles, action styles, key considerations, key traits, and weaknesses. Nutt summarized his ideas on the applications of these cognitive styles in his working paper, Decision Style and Its Impact On Managers and Management.

> Using decision style the paper explains differences in the preferences and approaches of managers and ways to understand and deal with the conflicts that flow from their style differences. Between style comparisons identify distinctions in how managers choose and take action. Analysis of these distinctions identifies conflict in interpersonal relations and offers new insights into why organizational leaders advocate certain types of strategic plans and processes as well as use certain tactics for control, implementation, and decision making tactics. A deeper understanding of these style-based preferences, and their strengths and weaknesses, suggests steps that can be taken to build on the strength and manage weaknesses inherent in each style. The ideas in this paper have applications in team building, conflict management, self appraisal and awareness, leadership and followership, approach to decision making. (68:3)

Mitroff took the four different cognitive styles and identified organizational behaviors associated with each. In this manner, he effectively linked Jung's theory of psychological type to the organizational world. For each cognitive style, there is a corresponding ideal organization that the cognitive style would like to work in. Thus, there will be a tendency for an organization to attract people of a similar cognitive style (61:48-64). Figure 4 summarizes the types of organizational personalities and ideal organizations which Mitroff associates with each cognitive style. For example, the type one or ST ideal organization can be described as one that has a fanatical attention to

details as opposed to the type 2 or NT ideal organization which values working with "broad, global issues" (61:51). The type 3 or NF ideal organization is one where interest is paid to global issues and people abhor dealing with specific details. Finally, the type 4 or SF ideal organization is one which allows people to just deal in the specific details of other people in their organization. Mitroff's view of problem solving and decision making with regards to the different cognitive styles was that,

> As real-world problems (as opposed to exercises) have become so complex, it is important to appreciate that all four styles or attitudes have a fundamental role to play in defining and resolving important issues. No one style or attitude is capable of recognizing or dealing with all of the significant features of "reality". (61:60)

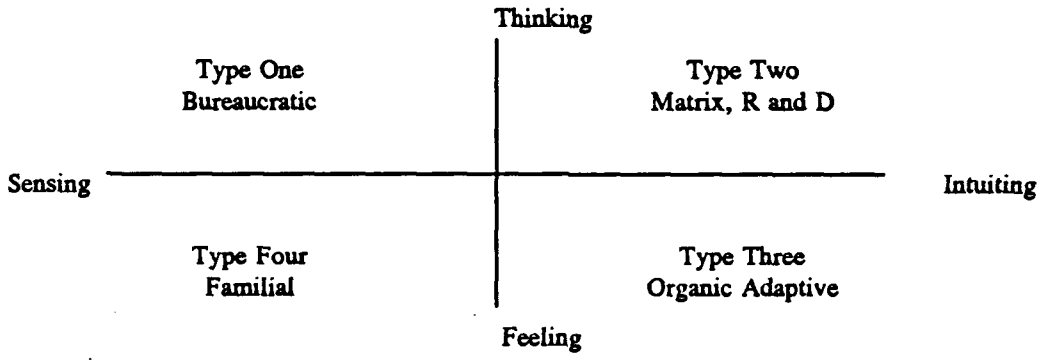

Figure 4. Cognitive Style vs Organizational Behavior (61:51)

The summary of the effects of type on perception and judgement was not included as a review of previously covered material, but it was included to highlight the manner in which the different types will interact. The main point is that all people attach salience to different data in the environment. Myers said that, "A sensing person and an intuitive person can go through the same experience, side by side, and come out with very different impressions as to what happened and was said was worth remembering" (64:1). Just as there are different ways in which to perceive one's environment, there are also many ways in which to judge or reach a decision on that data (64:1). "A thinking person and a feeling person can be faced with the same problem and resort to very different techniques for solving it" (64:1). Overall, "The ST and NF and the SF and NT have been called opposites because each of these pairs use totally different information and processing tactics (e.g., Taggert and Robey, 1981)" (68:5). Each one of these pairs of preferences will bring different insights to bear on the same problem (64:3).

Relevance of Type in Groups

Just as the theory of type is applicable to individuals, it is also applicable to group behavior. Schemel calls the sum of the individual types that comprise a given group as the "corporate person" (84:17). Thus, each group characterized as a corporate person will have different strengths and weaknesses associated with it.

Schemel tempers his definition of the corporate person to be applicable to work groups and families and not huge crowds, although he adds that there may be some general insights which could be gained (84:17).

> Just as numbers indicate the strength of preference of an individual for a particular function or attitude, so a group will demonstrate a stronger preference for those functions and attitudes for which it has a higher collective score. (84:17)

The analysis of type to group settings should be able to provide valuable information as to a particular group's strengths and weaknesses (84:1).

For example, suppose there is a group comprised of two ENFJs, one ENTJ, one ENTP, and two ISFJs. The group profile would be ENFJ. This group would have a very good flow of information and be very organized. This group would have a tendency to rely on how things had been done before, and it would be sensitive to the feelings of the group members and the people they interact with. This group will not have "attention to detail" and will also tend to make judgements too quickly. Overall, this group will have to learn to give the introverts time to share their thoughts since they are the "source of S data and detail" (84:17).

Finally, this group should devote more time to thinking and looking for other possibilities, "which they can easily see" (84:17). As this example illustrates, it is possible to apply type theory to groups to gain insights into a group's strengths and weaknesses.

Type and Teams

> The clearest vision of the future comes only from an intuitive, the most practical realism only from a sensing type, the most incisive analysis only from a thinking type, and the most skillful handling of people only from a feeling type. Success for any enterprise demands a variety of types, each in the right place. (64:7)

People have different preferences with regards to how they acquire and process information. They also have different preferences with regards to how they reach decisions and then act upon them. Some people like orderly routines, while others prefer to be flexible and spontaneous. Myers writes that, "The great value of these differences is that they fit people to do and enjoy widely different segments of the world's work" (64:2). One person may be in a job that he finds to be boring while someone else can step in that same job and find it stimulating. Thinking types would tend to enjoy working with things which behave in a logical manner, while feeling types would enjoy interacting with people. Sensing types would enjoy working with established facts and procedures, while the intuitive would enjoy churning out new ideas and possibilities (64:2-3). Each person contributes something different to the team. A summary of the contributions to teams and organizations by personality type is presented in Table 15, and a summary of what each preference brings to their work is presented in Table 17 (65:17-18).

Table 16

Contributions to Teams and Organizations
by Personality Types (12)

CONTRIBUTIONS TO TEAMS AND ORGANIZATIONS BY PERSONALITY TYPES			
ISTJ	ISFJ	INFJ	INTJ
Security and stability Critique of information Dedication to task Logic	Empathic negotiations Duty-bound traditions Gentle loyalists Fun and enjoyment	Develop alternatives In touch with people Strengthened relationships Inspirational views/support	Organized optimization Futuristic viewpoints Analytical reasoning High achievement
ISTP	ISFP	INFP	INTP
Problem identification Playful and energetic Spontaneous & instinctive Personal freedom	Nurturing & support Creative influence Reward emphasis Personal development	Subjective interpretation Easy-going idealists Personal warmth Integrity & sensitivity	Conceptualizing Corporate consciousness Data analysis Intellectual challenges
ESTP	ESFP	ENFP	ENTP
Action-oriented Flexibility Common sense approach Guidance, not control	Harmony & pleasure Conflict avoidance Non-conformist Enjoyment of activity	Need for affirmation Development of people Self expression Playful work	Inventive enthusiasm Catalyst & activity Variety of alternatives Reconstruction
ESTJ	ESFJ	ENFJ	ENTJ
Structured administrators Strong organizationalists Decisive realists Critique of flaws	Goodwill & happiness Appropriate schedules Sensitivity to others Cooperation	Persuasiveness Supportive relationships Ordered harmony Charisma & sympathy	Robust control Confrontation & debate Systematic planning Long-range achievement

Table 17

Effects of Each Preference in Work Situations (65:17-18)

EXTROVERTS	INTROVERTS
Like variety and action. Tend to be faster; dislike complicated procedures. Are often good at greeting people. Are often impatient with long slow jobs. Are interested in the results of their job, in getting it done and in how other people do it. Often don't mind the interruption of answering the telephone. Often act quickly, sometimes without thinking. Like to have people around. Usually communicate freely.	Like quiet for concentration. Tend to be careful with details; dislike sweeping statements. Have trouble remembering names and faces. Tend not to mind working on one project for a long time without interruption. Are interested in the idea behind their job. Dislike telephone intrusions and interruptions. Like to think a lot before they act, sometimes without acting. Work contentedly alone. Have some problems communicating.
SENSING TYPES	**INTUITIVE TYPES**
Dislike new problems unless there are standard ways to solve them. Like an established way of doing thins. Enjoy using skills already learned more than learning new ones. Work more steadily, with realistic idea of how long it will take. Usually reach a conclusion step by step. Are patient with routine details. Are impatient when the details get complicated. Don't often get inspired, and rarely trust the inspiration when they do. Seldom make errors of fact. Tend to be good at precise work.	Like solving new problems Dislike doing the same thing over and over again. Enjoy learning a new skill more than using it. Work in bursts of energy powered by enthusiasm, with slack periods in between. Put two and two together quickly. Are impatient with routine details. Are patient with complicated situations. Follow their inspirations, good or bad. Often get their facts a bit wrong. Dislike taking time for precision.

THINKING TYPES	FEELING TYPES
Are relatively unemotional and uninterested in people's feelings. May hurt people's feelings without knowing it. Like analysis and putting things into logical order. Can get along without harmony. Tend to decide impersonally, sometimes ignoring people's wishes. Need to be treated fairly. Are able to reprimand people or fire them when necessary. Tend to relate well only to other thinking types. May seem hard-hearted.	Tend to be very aware of other people and their feelings. Enjoy pleasing people, even in unimportant things. Like harmony. Efficiency may be badly disturbed by office feuds. Often let decisions be influenced by their own or other people's likes and wishes. Need occasional praise. Dislike telling people unpleasant things. Relate well to most people. Tend to be sympathetic.
JUDGING TYPES	**PERCEPTIVE TYPES**
Best when they can plan their work and follow the plan. Like to get things settled and wrapped up. Made decide things too quickly. May dislike to interrupt the project they are on for a more urgent one. May not notice new things that need to be done. Want only the essentials needed to get on with a job. Tend to be satisfied once they reach a judgment on a thing, situation or person.	Tend to be good at adapting to changing situations. Don't mind leaving things open for alterations. May have trouble making decisions. May start too many projects and have difficulty in finishing them. May postpone unpleasant jobs. Want to know all about a new job. Tend to be curious and welcome new light on a thing, situation, or person.

Type theory can aid in developing mutual respect and help to foster improved communication between team members (64:3-4). During the forming and storming periods of team development, it is not unusual to have disagreements within a team. Myers writes that cooperation between opposite types is difficult because, "they so often disagree on what should be done, or how, or whether anything needs to be done at all" (64:3). It is important to resolve this dissention

in a constructive manner so that further team development is not hampered (64:3). Myers thinks that a way to preserve the team's mutual respect, morale, and effectiveness is to stress to the team that both kinds of perception and judgement are necessary to effectively solve a problem (64:3).

The team should realize the problem solving process requires all

> four processes in succession: sensing to establish all the facts, intuition to suggest all the various possible solutions, thinking to determine the probable consequences of each course of action, and feeling to weigh the desirability of each outcome in human terms. (64:3)

Each individual alone will have some shortcomings at some point in this process, because his less preferred perception and judgement functions will be less developed than his preferred functions. Thus, a well-balanced team should include a representative from each of these functions to arrive at the best possible solution or decision (64:3). The MBTI can help to illustrate these differences amongst the team members by showing each person where his strengths and weaknesses are. "A healthy respect for one's opposite makes for peaceful and effective co-existence" (64:3).

Myers maintains that communication problems all stem from type differences. "A statement that seems perfectly clear and reasonable to one type may sound meaningless or preposterous to another" (64:3-4). In order for communication to be effective, it must be: "(a) listened

to, (b) understood and (c) considered without hostility" (64:4). It is natural for anyone not to listen if he believes that what is being said is not important to him.

To be effective then, a communication should begin with a leading statement or idea which will capture the interest of the listener. The problem is, that what is considered to be relevant and important varies across the spectrum of types. Thus, one will need to tailor his initial comments to elicit further interest in the communication based upon the type of person one is addressing. A sensing person will be more attuned to facts, and an intuitive person will be more interested by possibilities when being addressed. A thinking type person will be more interested if there is a logical flow of presentation, and a feeling type will be most interested if what is being discussed revolves around people (64:4-7). Communication difficulties can be further alleviated when each type is familiar with his co-workers and their type. Table 16 (64:7) summarizes how the different types can help the other to augment their natural weaknesses.

Jung's Psychological Theory and Team Building

Team building is a process that many organizations are currently using to increase the productivity and effectiveness of their teams. Team building is defined as the process of getting each team member to better understand himself and then to facilitate his awareness of the

Table 18

Mutual Usefulness of Opposite Types (64:7)

INTUITIVE NEEDS A SENSING TYPE:	SENSING TYPE NEEDS AN INTUITIVE:
To bring up pertinent facts	To bring up new possibilities
To apply experience to problems	To supply ingenuity on problems
To read the fine print in a contract to notice what needs attention now	To read the signs of coming change
	To see how to prepare for the future
To have patience	To have enthusiasm
To keep track of essential detail	To watch for new essentials
To face difficulties with realism	To tackle difficulties with zest
To remind that the joys of the present are important	To show that the joys of the future are worth working for
FEELING TYPE NEEDS A THINKER:	**THINKER NEEDS A FEELING TYPE:**
To analyze	To persuade
To organize	To conciliate
To find the flaws in advance	To forecast how others will feel
To reform what needs reforming	To arouse enthusiasm
To hold consistently to a policy	To teach
To weigh "the law and the evidence"	To sell
To fire people when necessary	To advertise
To stand firm against opposition	To appreciate the thinker

personalities of his co-workers so that the team will be able to function both more effectively and productively (80:529-530; 10:306; 71:27). Penderghast has defined team building as a two step process which is:

> To show participants how their personal style characteristics differ from those of the other members of their group and once this is done, how they can make use of this information to develop a stronger and more effective team. (71:22)

Hanson defines team building as,

> an effort in which a team studies its own process, how they work together, and takes some action steps to create a climate in which team members' energies are directed toward problem solving and maximizing the use of all team members' resources in this process. (32:28)

He further adds that the interpersonal atmosphere must be open with all members contributing or else there will be undercurrents which are "counter productive to effective team functioning" (32:28). The essence of team building is to facilitate the development of those interpersonal characteristics and attributes which well-functioning teams possess.

The MBTI is a widely used personality style indicator which has been used to improve interpersonal relationships during team building interventions (32:22). At the beginning of the team building intervention, the MBTI is given to each member of the team. When it is completed, the facilitator reviews type theory with the team so that each team member gains an appreciation for his own personality style. Also during this period, each team member discloses his own personality type to the other members of the team so that the team can appreciate the variety of personalities present in the team. Penderghast wrote that, "Recognizing their strengths and limitations, participants should leave the team building exercise better able to integrate their most effective contributions with those of their co-workers" (32:22; 80:529). After this initial phase there is, depending on the team building model, a group activity which allows the participants to learn the different strengths of themselves and their co-workers in operation. There is then a follow-up phase where team members review what they have learned and clear up any questions about type theory and its

application (32:22-23; 80:532). The MBTI is a valuable tool to use in improving group members' interpersonal relationships.

> Leadership that supports, appreciates, and encourages differences and provides an environment for mutual respect can only enhance the effectiveness of teams. An environment can be created whereby differences are appreciated and nurtured; there can be creative choices an decisions, with an outcome of excellence, for both individuals and agencies. (80:532)

Decision Making and Group Composition

Good teamwork calls for recognition and the use of certain valuable differences between members of the team (64:1). Type theory predicts that the more homogeneous that a group is, the quicker it will reach an understanding, and the quicker it will make decisions; however, the homogeneous group's decisions may tend to be flawed because of gaps in their reasoning due to their common least preferred and developed function. Heterogeneous groups will arrive at decisions more slowly due to the number of different types, but they will reach better decisions because more perspectives have been examined. (64:3-7; 57:3; 82:155-156). The logical question which flows from this theory is which group, the group composed of homogeneous types or the group which is composed of heterogeneous types, will perform better?

The question of what group composition is best suited to tackle a job is a question which has been around almost as long as there have been personality style theories (86:275). Schutz wrote that,

> Interest arises in part because prediction of group outcomes from a knowledge of the characteristics of the individuals and of the laws of interaction constitute an empirical test of the ancient problem of 'emergents' - whether or not a whole can be predicted form a knowledge of its parts. Also, group composition presents an ultimate challenge to any theory of human interaction. (86:275)

Jung's theory has been no exception. There have been many team experiments to try to prove or disprove the theory's claims (7:58-59; 55:1; 76; 86; 39; 38). Thus far, the results have been split between which group composition is truly optimal.

Blaylock conducted an experiment in 1984 to determine if "in a simulated production environment, do compatible or complementary groups perform the best" (7:59). He used sixty-nine students, which formed seventeen MBTI constructed teams, to compete in the PROSIM production simulation. Each team's decisions were reached independently of the other teams, and the simulation lasted four weeks (7:59-60). The simulation was judged to create, "identical situations for all teams and provides a realistic decision setting" (7:59). Four of the seventeen teams were constructed with mixed types and the rest were constructed of similar types. At the end of the experiment, three of the four mixed teams finished in the top five and all of the mixed teams finished

in the top half (7:61). Overwhelmingly, the complementary teams "significantly outperformed compatible groups" (7:67). Another interesting aspect of this research was that the expected conflict which was predicted to exist with the complementary teams never materialized (7:65).

On the other side, Dr. George McAleer conducted an MBTI formed team experiment in a simulated missile program office environment. The exercise lasted five weeks and simulated the acquisition of a surface-to-surface missile system. There were fifty teams which participated in the exercise and the teams were constructed with homogeneous, heterogeneous, and random type teams. The students who had actual acquisition experience were spread evenly throughout the groups. Dr. McAleer hypothesized before the exercise that the heterogeneous groups would outperform the other groups; however, it turned out that the homogeneous groups actually outperformed the heterogeneous groups (55:1-4).

Overall, most of the research efforts have concluded that complementary groups outperform compatible groups because of the different perspectives which are brought to bear on problem solving (57:2; 7:58; 56:46). Even though there is evidence that complementary groups outperform compatible groups, there is also evidence to support that compatible groups are best. This issue is not settled.

Barriers exist in the small group decision making process. The main barriers are poor communication, group think, dysfunctional behaviors, and personality conflicts. For small groups to be productive, they must be both effective and efficient. If a group is efficiently carrying out ineffective decisions, then the group is clearly not productive. The MBTI may improve both of these dimensions of productivity. Efficiency may be improved by using the MBTI in a teambuilding function. This may improve team member communication, show how dysfunctional behaviors should be avoided, and decrease personality conflicts by having the team realize that all types of people are necessary to do the job right. As Keirsy said, "Good teams aren't made in heaven. People who may be psychologically very different must learn to work together "without irritating the hell out of one another" (17:19).

The MBTI will help increase the likelihood of that a group will produce qualitatively better decisions through group personality composition. First the group will have a wider spectrum of diverse cognitive windows through which to view the decision of problem. The different opinions and perspectives which are brought together during the decision making process should create more conflict which enables a team to produce the best solutions to problems. When this conflict is cooperatively undertaken the team should be able to produce some creative and innovative solutions. The philosopher John Dewey stated:

> Conflict is the gadfly of thought. It stirs us to observation and memory. It instigates to invention. It shocks us out of sheeplike passivity, and sets us at noting and contriving. ...Conflict is a sine qua non of reflection and ingenuity. (82:155)

The conflict which may ensue with dissimilar personality groups will also decrease the chances of a groupthink type scenario developing. Groups which pursue using the MBTI for both teambuilding and designing team composition should therefore be able to maximize the productive capacity of a small group or team.

The experimental research into the effects of group composition on decision making appear to have mixed results. However, the majority of the results indicate that dissimilar type formed groups have produced qualitatively superior decisions than groups of similar type.

The methodology will be presented in the next chapter, along with the experimental design, and test hypothesis. It will explain how the research question and subsidiary research questions of this thesis will be analyzed.

III. Methodology

Introduction to the Chapter

This chapter introduces the experimental and survey methodology used to accomplish the objectives of this research. It covers the experimental design and acquaints the reader with how the data will be collected and analyzed. The chapter concludes with the statistical analysis techniques, a few statistical details, and a brief summary.

Test Hypothesis

This test hypothesis is based on the research hypothesis in Chapter I and is as follows:

Ho: Teams formed with dissimilar MBTI personality preferences will be no more effective than teams which are not formed with the use of the MBTI.

Ha: Teams formed with dissimilar MBTI personality preferences will be more effective than teams which are not formed with the use of the MBTI.

The Experimental Design

The research question, subsidiary questions, and test hypothesis were answered through both the analysis of game performance data and the post-game surveys gathered from the students who attended the Advanced Program Management course at the Air Force Institute of Technology. The data for this research were collected from the courses taught at AFIT

between April 1990 and April 1991. All of the subjects who participated in this experiment were given the Myers Briggs Type Indicator (Form G) within the first few days of their course. The subjects played the game simulation within the first or second week of their course. The game involved group problem solving and decision making to formulate overall team strategies and subsequent play decisions. The game yielded quantitative results which indicate how well the teams performed on the simulation. The game will be explained in greater detail later in this chapter.

There were approximately thirty subjects in each course and they were divided into teams of five or six subjects per team. This yielded four to six teams playing each game per course. The composition of each experimental team was formed based on the personality type of the subjects, as determined by the MBTI, so that all of the teams were as dissimilar as possible. The control teams were assembled with no regards to subjects' MBTI personality types. The TEMPO game took a day to complete.

The experimental design for this research was actually a quasiexperimental design, because equivalent experimental and control groups could not be guaranteed through random assignment. This design is diagrammed in Table 17.

O_1 represents the experimental group before the treatment X. O_2 represents the experimental group after the treatment X. O_3 represents the control group which did not receive the experimental treatment, and O_4 represents the

Table 19

The Nonequivalent Control Group Design (25:126)

O_1	X	O_2
O_3		O_4

control group after the simulation exercise. Final game scores were collected from O_2 and O_4. Usually, this quasiexperimental design includes a pre-test which is given to the groups in O_1 and O_3 to determine the equivalency of the groups. There was no pretest given to any of the groups involved in this experiment, because the intact equivalent design variation was chosen. This design is one "in which the membership of the experimental and control groups is naturally assembled. For example, one may use different classes in a school, membership in similar clubs, customers from similar stores, and the like" (25:126). The optimal experimental design would have two groups which were identical (25:126). It was assumed for this research that the control and experimental groups were similar enough to avoid any problems with internal validity.

The Variables

The independent variable is the variable manipulated during the experimental treatment of the teams. The independent variable is:

Team composition based on dissimilar personality preferences.

The dependent variable is the variable measured in both the experimental and control teams. For this research, the dependent variable is:

Team effectiveness.

The experiment was designed to determine if there was a causal relationship between the independent and dependent variables. Team effectiveness was measured by the team performance exhibited on the simulation games.

Population

The population studied included all of the students who attended the Advanced Program Management course offered at AFIT from April 1990 through April 1991. There were a total of 97 students who attended the Advanced Program Management courses during the time frame of this study. The student composition of this course included both civil servants and military personnel. The ranks of the military officers included senior company grade officers and field grade officers. The rank distribution of the military officers and their total population percentages will be summarized in Chapter 4. The pay grades of the civil servants included GS-11s through GM-14s. The civil servants exact pay grade distribution and percentage of the total population are also summarized in Chapter 4. The subjects from the Advanced

Program Management courses all had undergraduate degrees and most had graduate degrees.

All of the subjects involved in this experiment completed the MBTI (Form G), and the subjects personality types are summarized in Chapter 4. All of the subjects involved in the experimental treatment groups completed the post-game survey.

The Control and Treatment Groups

A requirement of the Advanced Program Management course is an introduction to the MBTI. Subjects of both groups completed the MBTI Form G, and before the exercises were played, the facilitator Dr. Dennis Campbell, spent approximately four hours instructing the subjects about Jung's psychological type theory and how it is operationalized by the MBTI. The facilitator covered the personality characteristics associated with each of the sixteen personality types and provided handouts to the subjects with the same information. Some of the information addressed pertained to personality type differences and ways in which these differences could be used constructively to improve the functioning of the teams.

Near the end of each session, the facilitator returned everyone's MBTI scores and explained their significance. The sessions ended with a question and answer period to insure that everyone felt comfortable with their MBTI personality types, understood the concepts presented, and

resolved any questions about the process. The subjects were also given the opportunity to decide whether their MBTI scores matched their own self-perceived "true type." If there was a difference, the subjects were encouraged to use that type instead. The subjects were also encouraged to disclose their MBTI personality types to their other team members. The games were played within two or three days of the MBTI review. After the games were finished, subjects were asked to complete a post-game survey which assessed the status of interpersonal relations during the exercise and the perceived impact of the MBTI on those characteristics.

The Treatment Group

The treatment group received the experimental treatment for this research. The subjects' MBTI types and scores were used as the basis to form the simulation game teams. Each team was constructed so that its composition would be as dissimilar as possible with regards to the MBTI personality types available.

The Control Group

One control group was required for this experiment. The control teams were formed haphazardly with no regard to the subject's personality types. For the TEMPO exercise, the control group consisted of four control teams. The control groups' members were not aware of their own individual types or their team member's personality types.

The course had historical data from previous years available. These data were used to augment the control groups' data because none of these courses had formed their teams based upon the dissimilarity of their students' MBTI personality types.

Justification of the Methodology

The use of game simulations in group research is well established as a valid research methodology (55:1; 8:9; 59:325). Though it is an established research method, other difficulties exist when attempting to monitor actual decision processes in the field, and laboratory experiments create artificial decision making environments (8:59). Blaylock suggests that, "A simulated decision environment where each participant (or group) fulfills a role offers an alternative to these methods. Such an approach creates identical situations for all teams and provides a realistic decision setting" (8:59). The game simulation methodology offered the most realistic methodology available to investigate this research's objectives, questions, and hypothesis.

The Time-by-Event-by Member-Pattern-Observation (TEMPO) Military Planning Game

The TEMPO game was originally developed by H. Hatry, F. Jackson, and P. Lever of TEMPO's Economic Analysis Section. The game is a part of the requirements the students must

fulfill during the Advanced Program Management course at AFIT. The TEMPO game requires that teams interact and create their own overall strategies and arrive at group decisions for each play. At least two teams are required to play, and each Advanced Program Management course had four teams with two games being played at the same time.

At the beginning of the game, each team begins with the same level of inventory and money to invest in new offensive and/or defensive weapon systems. Teams have the opportunity to purchase new systems at the beginning of each year, and each weapon system is worth a certain number of utils. The higher number of utils that a system is worth reflects the relative effectiveness of that weapon system. Teams may also purchase intelligence on what their adversary is up to, or they may purchase research and development information on future weapon systems. The purpose of each team is to maximize net offensive utils (35:1-10).

There is a facilitator who provides rule clarification and game status information to each team. The game is played over a simulated 10 year period. The teams have a chance to make their inputs at one year intervals for the first five years with planning periods in between, and then the teams get one more planning period to plan out the last five years of play. This last input, after year five, covers the whole five year time period. This creates time pressure on the game subjects because as the playing time goes on, there is less and less time available to make

decisions. Each year there is an unknown probability that the two teams could go to war. Should a war occur, the losing team would be penalized some utils. Each years' play is cumulative and each teams' decisions are dependent on what the other team's actions are. Each game requires approximately one day to play. The TEMPO instruction book which is given to all students is located in Appendix B.

The Myers-Briggs Type Indicator

The MBTI is a psychometric instrument which operationalizes Carl C. Jung's theory of psychological type, and it has been in use since the 1960s. The MBTI Form G was used for this research, and it is the standard form of the MBTI. It uses 95 questions of a personality inventory to measure a person's preferences on four dichotomous scales, and it yields one of sixteen possible personality types based upon these preferences (63:7). The MBTI is easy to administer and easy to score by hand or with the use of an optical scanner.

The MBTI was chosen to be the psychometric instrument for this research because of its widely recognized reliability and validity (13:461; 63:164-226; 95:255; 47:134). The MBTI has been proven to be a very accurate psychometric instrument in identifying a person's cognitive style or decision making style. This fact has made the MBTI the instrument of choice among researchers investigating

cognitive styles, decision making, and problem solving (81:285; 8:58).

The Post-Game Survey

The post-game survey was given to the subjects after they finished their game simulations. A copy of the survey can be found in Appendix A. The survey was designed to measure individual perceptions about the attributes of team cohesion, communication, interpersonal relations, interpersonal conflict, team atmosphere, and decision making styles present among the subjects during the game simulations. The attributes measured were all characteristics of effective teams (32:28). The survey was also designed to measure the impact that Jung's psychological type theory had on these attributes.

The survey consisted of twenty-one questions which were scored on a seven-point Likert scale. The following seven-point Likert scale was provided to the subjects:

7 = Strongly Agree
6 = Agree
5 = Mildly Agree
4 = Neither Agree or Disagree
3 = Mildly Disagree
2 = Disagree
1 = Strongly Disagree

A score between 1 and 3.5 will be interpreted to mean that the subject disagreed with the question. A response between 3.5 and 4.5 will be interpreted to mean that the subject neither agreed or disagreed with the question, and a

response between 4.5 and 7 will be interpreted to mean that the subject agreed with the question.

Each characteristic measured had a set of three questions associated with it. The first question in each set determined how critical each characteristic was to the subject for effective team functioning. The second question determined how much of that characteristic was perceived by the subject to have existed during the game simulation. Finally, the third question in each set asked the subject how he or she perceived the impact of MBTI on that characteristic.

Following the twenty-one questions were seven questions which the subjects were asked to respond to in written format on the back of the answer sheet. These questions were designed to elicit each subject's impression of how the MBTI helped or hindered the team process.

Data Collection and Analysis

The MBTI. The MBTI Form G was administered to the subjects during the beginning of their AFIT courses. There was no time limit to complete the test given to the subjects. The MBTI was administered according to the guidelines established in the Manual: A Guide to the Levelopment and Use of the Myers-Briggs Type Indicator (63:7-8). The answer sheets were both hand and computer scored using the procedures outlined by the Manual. The subjects' personality types were determined based upon the strength of

their preferences among the four dichotomous scales. The resulting four letter identifier indicated the subjects' personality types from sixteen possible personality types. The raw MBTI scores were input into a data file base for further analysis.

Scores from TEMPO Play-by-play records, along with the team's final scores were gathered from the team facilitator at the end of each exercise. These figures were also input into a data file base for further statistical analysis.

Post-Game Surveys. A survey was given to each subject at the conclusion of each exercise. The subjects were allowed to take as much time as they needed to complete the survey instrument. The surveys were hand scored and input into a data file base for further analysis. The qualitative data gathered from the surveys was tabulated and analyzed accordingly using statistical methods where appropriate. The data files were analyzed using the Statistix 3.1 statistical analysis software package on a personal computer (1).

The Statistical Analysis Techniques and Details

The following statistical analysis techniques were used on the data collected from both the simulation games and the post-game surveys. The analysis techniques in Table 17 were used to analyze the data and answer the research question, hypothesis, and subsidiary research questions.

Table 20

Data Analysis Techniques

Research Questions		Data Analysis Technique
1.	Do teams formed with dissimilar MBTI personality preferences make more effective decisions than teams which are formed without the use of the MBTI?	Two Sample T-Test (Parametric) Frequency Distribution
Subsidiary Research Questions		
1.	How valuable did the subjects perceive the MBTI to be in relation to team process?	Two Sample T-Test Frequency Distribution
2.	What attributes of group process were perceived to be important by the subjects?	Two Sample T-Test Frequency Distribution Valence Analysis
3.	What attributes of group process were perceived to be present by the subjects?	Two Sample T-Test Frequency Distribution Valence Analysis
4.	Were there any differences of opinion about the MBTI or attributes of group process between the different MBTI types?	Two Sample T-Test Frequency Distribution Valence Analysis
5.	Were there any differences of opinion on the post-game survey between the Male and Female subjects?	Two Sample T-Test Frequency Distribution Valence Analysis

The T-Test The t test is a parametric statistical analysis tool which is used for comparing the means of independent groups. The fact that one is analyzing two different means implies by definition that the data is at least interval or ratio level data. The data examined by this research were all interval level unless otherwise noted. There are four requirements which must be met in order to competently apply the t test. The first requirement for using the t test is that the two groups being compared must be independent from each other. Groups are considered independent when each group consists of a different set of people (21:254). Both the control and treatment groups met this criteria and were therefore independent groups.

The second requirement for using the t test is that both sample groups must be normally distributed (20:334). Normality can be determined from the data via the Wilk-Shapiro normality statistic. If this statistic is close to a .9 value then one can be reasonably assured that the data is normally distributed. This statistic was examined for each data set. The third requirement for the t test is that both sample sizes must be 12 or larger. The t test is usually used when the number of samples in the data set are less than thirty (20:334). Drew suggests that "because the t test is more flexible in terms of the number of subjects (e.g., n = 12-30 or above), it is almost universally used in comparisons of two means" (21:255).

The final requirement for using the t test is that both population variances must be equal, even though they are unknown. Devore states that one "approach is simply to "eyeball" the two sample variance; if they are roughly the same order of magnitude, then one can be comfortable in using this test" (20:334). The game simulation data and survey data used in this research conforms to all of the stated requirements and assumptions unless otherwise noted (78).

Level of Significance

All statistical tests will be conducted at an alpha level of .1. This level is generally accepted as indicating statistical significance (78).

Parametric and Nonparametric Tests

Parametric testing will be conducted on those statistics which meet the necessary assumptions (21:250-270; 25:350-373). When those assumptions are not met, nonparametric statistical tests will be used. The Wilk-Shapiro normality test will be used to determine if the data is normally distributed.

Summary

This chapter presented the experimental and survey methodology. It covered the areas of the test hypothesis, experimental design, selection of the instrument, the

population of interest, the survey, the data collection, statistical analysis techniques, and statistical analysis details. The next chapter will summarize the results of the data analysis.

IV. Findings and Analysis

The purpose of this chapter is to determine if teams formed by dissimilar MBTI personality types will outperform teams assembled without the MBTI. It begins with an introduction and then examines the composition of the subjects. The research question and subsidiary research questions are examined in order. For each question, the experimental or post-game survey data are presented, followed by discussion and analysis. The chapter ends with the valence analysis and a short summary.

Introduction

When this research began, there were many Advanced Program Management courses planned for 1991. However, due to budget reductions, some of these courses were canceled. Fortunately, historical data on the Advanced Program Management's version of the TEMPO game were available for analysis to augment this research effort.

Subject Composition

Demographic Background There were a total of 165 students who attended the Advanced Program Management courses during the time frame of this study. The student composition of these courses included both civil servants and military personnel. The military personnel included senior company grade officers and field grade officers. The rank

distribution of the military officers, the civil servants' pay grades, and sample percentages are summarized Figure 5. The pay grades of the civil servants ranged from GS-11s through GM-14s. The "other" category included the O-6, GS-11, and GM-14 pay grades. All the subjects from the Advanced Program Management courses had college degrees and most had graduate degrees as well. The TEMPO subjects' educational background is presented in Figure 6.

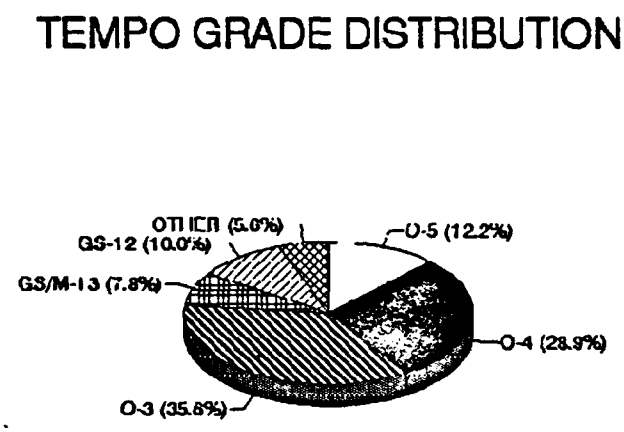

Figure 5. Tempo Grade Distribution

The MBTI Population Distribution All of the subjects involved in this experiment completed the MBTI (Form G), and the subjects' MBTI personality type preferences and percentages of the sample are summarized in Table 21. The sample's largest MBTI type concentrations were found in the

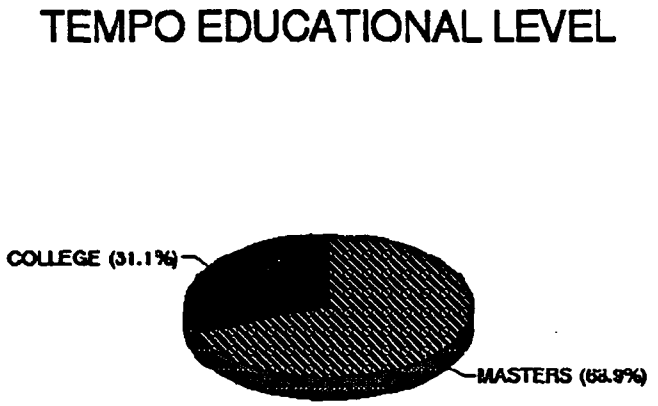

Figure 6. Tempo Educational Level

ISTJ, ESTJ, and ENTJ categories. The majority of the sample had a preference for introversion, sensing, thinking, and judging. The sensing-thinking decision style was the most preferred decision style.

The TEMPO Experimental Population

The population examined for the TEMPO research included six Advanced Program Management courses divided into two groups: the experimental treatment group (1991: January, February, and March) and the control group (1990: April, May, and September). The experimental TEMPO teams were organized by dissimilar personality types and introduced to the MBTI. As a part of the MBTI introduction, each team member self-disclosed their MBTI personality types to each member of their team. With one exception, the control TEMPO

teams were organized without knowledge of individual personality types or backgrounds. The exception was that the TEMPO coordinator intentionally distributed the military and civilian ranks evenly throughout the teams. All of the subjects on the experimental teams completed a post-game survey.

TEMPO Success Parameters

The overall objective of the TEMPO game is to maximize each team's net offensive utils (35:7; 54). Net offensive utils are equal to the sum of each teams' utils minus the opposing team's defensive utils. This dependence between the two teams scores makes this parameter suspect as the basis for comparison between games from different classes because each score is relative to how the other team performed, and does not give an absolute measure of performance for the team. Because of this dependence, other parameters of the TEMPO game were examined to provide more meaningful insight into the TEMPO performance parameters.

The first parameter examined was the total amount of offensive utils that each team accumulated from TEMPO years one through ten. This parameter was thought to reflect the quality of the decision making by reflecting the offensive nature of the game. Each team's successive util score throughout the ten plays of TEMPO are cumulative in nature, and the more offensive utils accumulated by the end of the game, the better. Thus, the second parameter which was

Table 21

The Control and Treatment Team Members' MBTI Preference Distribution and Each Preferences' Percentage of the Total Population N=165

SENSING TYPES with THINKING	SENSING TYPES with FEELING	INTUITIVE TYPES with FEELING	INTUITIVE TYPES with THINKING				
ISTJ	ISFJ	INFJ	INTJ	JUDGING	INTROVERTS	E=70	42.4%
						I=95	57.5%
N = 43	N = 10	N = 4	N = 11			S=108	65.4%
						N=57	34.5%
% = 26.06	% = 6.06	% = 2.42	% = 6.67			T=132	80.0%
						F=33	20.0%
ISTP	ISFP	INFP	INTP	PERCEPTIVE		J=119	72.1%
						P=46	27.8%
N = 8	N = 5	N = 4	N = 10				
% = 4.85	% = 3.03	% = 2.42	% = 6.06				
ESTP	ESFP	ENFP	ENTP	PERCEPTIVE	EXTROVERTS	ST=89	53.9%
						SF=19	11.5%
						NF=14	8.4%
						NT=43	26.0%
N = 9	N = 1	N = 5	N = 4				
% = 5.45	% = .61	% = 3.03	% = 2.42				
ESTJ	ESFJ	ENFJ	ENTJ	JUDGING			
N = 29	N = 3	N = 1	N = 18				
% = 17.58	% = 1.82	% = .61	% = 10.91				

investigated was the total amount of offensive and defensive utils accumulated over the course of the game. This parameter was thought to capture the effectiveness of the team's decision making by showing the total utils accumulated by the end of each game.

The other parameter which was examined was the offensive to defensive util ratio of each team. This ratio was selected because the overall objective of the game is to maximize net offensive utils. Therefore, any team which had a ratio of sixty, seventy, eighty, or ninety percent was judged to indicate that efficient decision making was occurring on the team. According to Dr Mauer, the Dean of the AFIT School of Systems and Logistics, who has been working with the TEMPO game since the 1960s, the offensive to defensive util ratio is the most insightful parameter into a team's decision making and problem solving processes (54). Any team which has an offensive to defensive ratio less than sixty percent has not focused on the correct objective of the game. This parameter was examined at each play of the TEMPO game to see if any trends developed over the course of the game.

Analysis of Research Question 1

Do teams formed with dissimilar MBTI personality preferences make more effective decisions than teams which are formed without the use of the MBTI?

Research hypothesis:

Ho: Teams formed with dissimilar MBTI personality preferences will be no more effective than teams which are not formed with the use of the MBTI.

Ha: Teams formed with dissimilar MBTI personality preferences will be more effective than teams which are not formed with the use of the MBTI.

The Offensive Utils

The following is the modified research hypothesis for the TEMPO parameter of offensive utils:

Ho: Teams formed with dissimilar MBTI personality preferences will have no more offensive utils than teams which are not formed with the use of the MBTI.

Ha: Teams formed with dissimilar MBTI personality preferences will have more offensive utils than teams which are not formed with the use of the MBTI.

The offensive util data set met the requirements of the t test. The data was interval level and both the control and treatment groups were independent. The data set for each TEMPO play was verified to be normal via the Wilk-Shapiro normality statistic. The Wilk-Shapiro normality statistic ranged from .8022 to .9826, so the data sets were judged to be normally distributed. Each sample size was equal to twelve which meets the t test size requirement.

A t test was conducted for each TEMPO play with alpha equal to .1. The t test results are summarized in Table 22. The means of both the control and treatment groups at each

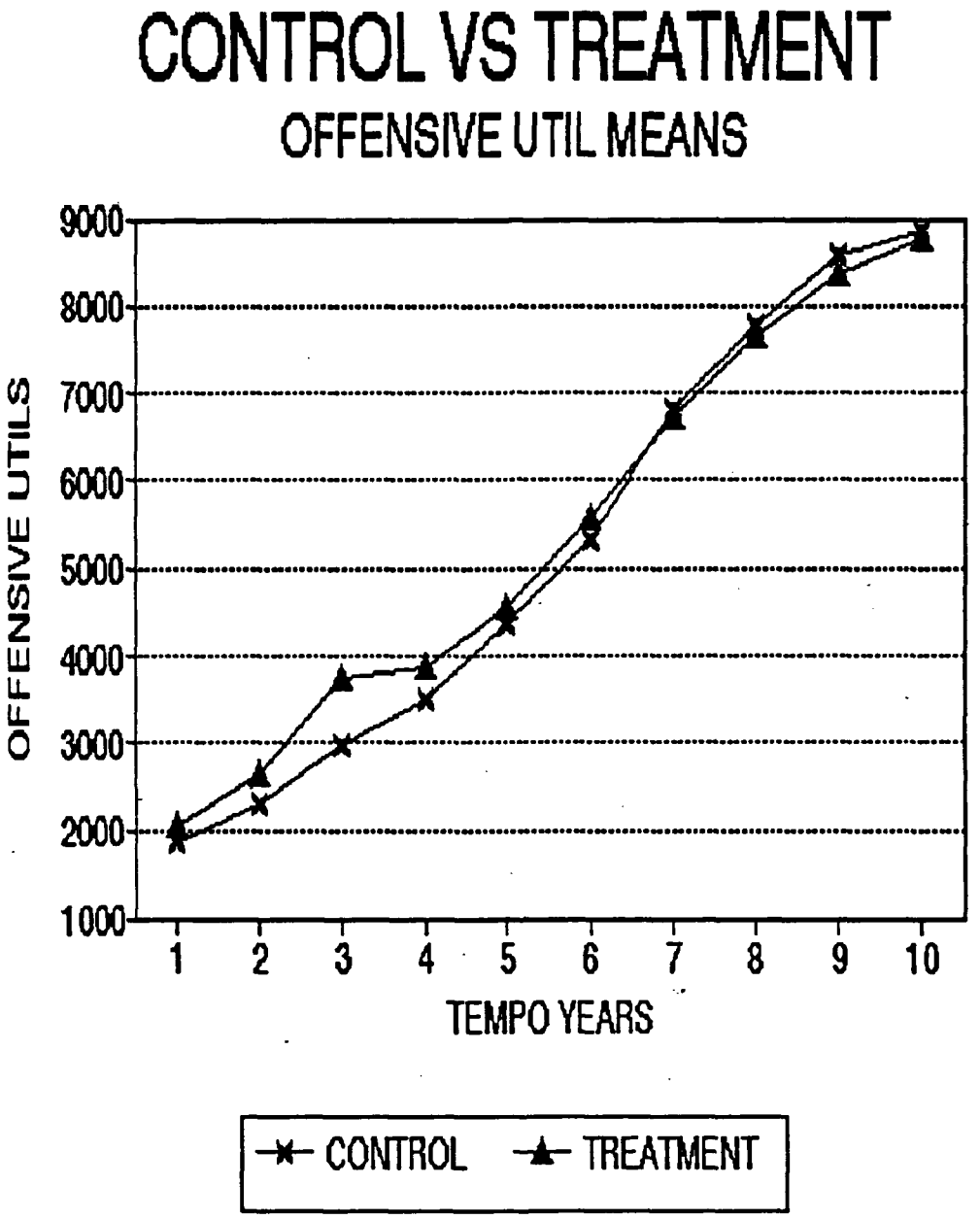

Figure 7. Control vs Treatment Offensive Util Means

TEMPO year are presented in Figure 7. As the figure illustrates, there was no overall statistical difference between the control and treatment groups with the exception of TEMPO year three.

Table 22

The Offensive Util Means, Standard Deviations, t-Statistics, and P-Values between the Control and Treatment Groups N=165

TEMPO Years	Mean	SD	T	P
X1 Y1	1,883 2,057	768.4 989.1	-.48	.3171
X2 Y2	2,323 2,651	980 814.8	-.89	.1911
X3 Y3	2,977 3,756	1,173 1,376	-1.49	.0750 *
X4 Y4	3,496 3,889	1,643 1,262	-.66	.2590
X5 Y5	4,397 4,563	1,807 1,317	-.26	.3996
X6 Y6	5,328 5,591	1,793 1,954	-.34	.3671
X7 Y7	6,827 6,738	2,125 2,169	.10	.4603
X8 Y8	7,780 7,667	2,199 2,152	.13	.4499
X9 Y9	8,585 8,349	2,479 2,217	.25	.4039
X10 Y10	8,870 8,782	2,678 2,426	.08	.4666

X = Control Teams
Y = Treatment Teams

p < .1 *
p < .05 **
p < .01 ***

The decision rule for determining when to reject the null hypothesis is that if the p value is less than the alpha level, then the null hypothesis is rejected. Conversely, if the p value is greater than the alpha level then do not reject the null hypothesis. The p values are

also summarized in Table 22. The null hypothesis was accepted at every TEMPO year of play except for year three. In year three, the p value was equal to .0750, and alpha was equal to .1; therefore, because the p value was less than the alpha level, the null hypothesis was rejected for year three. This implies that there is a statistical difference between the means with the control group mean equal to 2,977 utils and the treatment mean equal to 3,756 utils at a level of .1 significance.

The Total Offensive and Defensive Utils Parameter

The following is the modified research hypothesis for the TEMPO parameter of total offensive and defensive utils:

Ho: Teams formed with dissimilar MBTI personality preferences will have no more total utils than teams which are not formed with the use of the MBTI.

Ha: Teams formed with dissimilar MBTI personality preferences will have more total utils than teams which are not formed with the use of the MBTI.

The total utils data set fulfilled the requirements and assumptions of the t test. The data is interval level and both the control and treatment groups were independent. The data set for each TEMPO play was verified to be normal via the Wilk-Shapiro normality statistic. The Wilk-Shapiro normality statistic ranged from .8022 to .9826, so the data sets were judged to be normally distributed. Each sample size was equal to twelve which meets the t test size

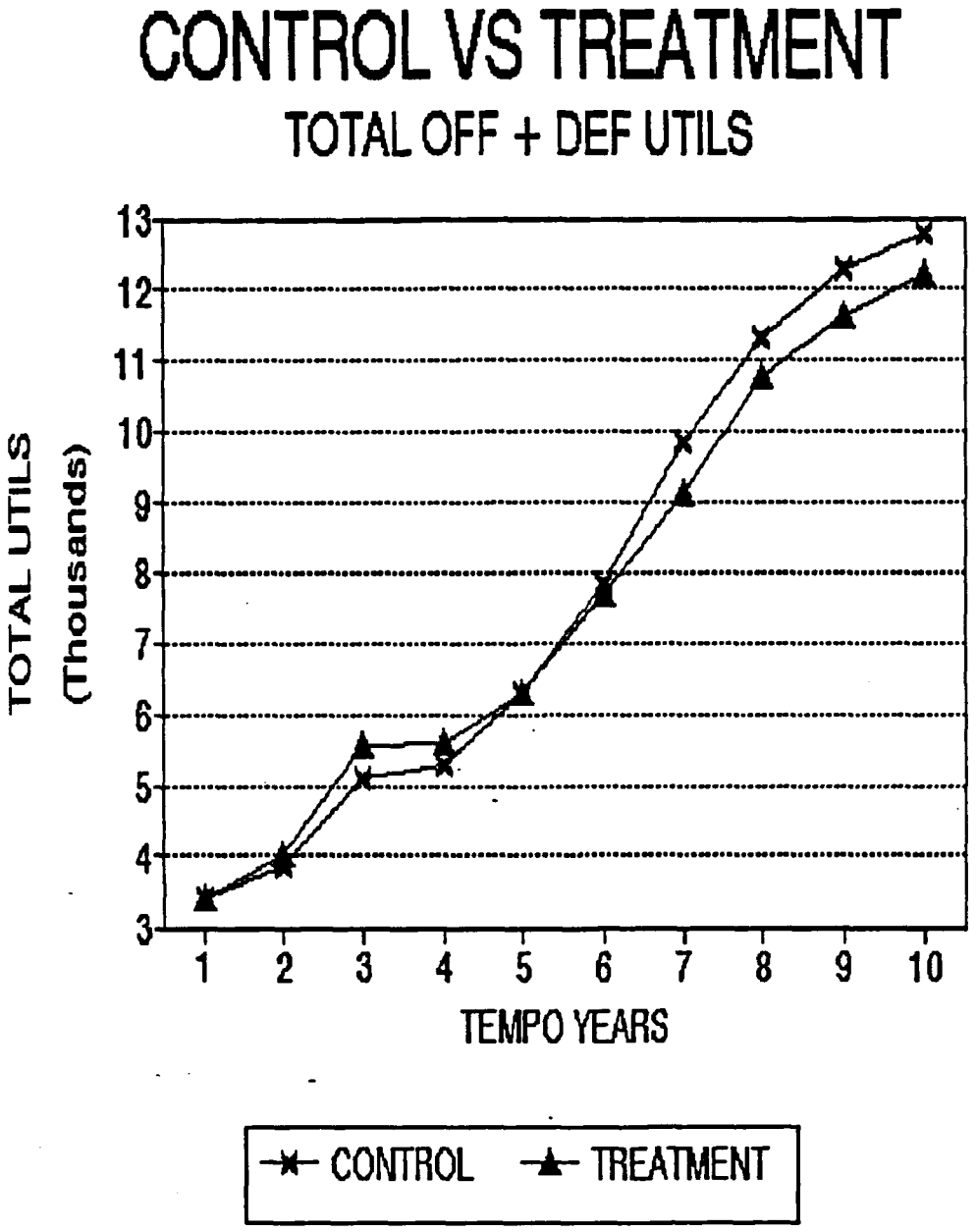

Figure 8. Control vs Treatment Total Offensive and Defensive Utils

requirement.

A t test was conducted for each TEMPO play with alpha equal to .1. The t test results are summarized in Table 23. The means of both the control and treatment groups at each

TEMPO year are presented in Figure 8. As the figure illustrates, there was no overall statistical difference between the control and treatment groups.

The decision rule is if the p value is less than the alpha level, then the null hypothesis is rejected. Conversely, if the p value is greater than the alpha level, then do not reject the null hypothesis. The p values are also summarized in Table 23. With this decision rule, the null hypothesis was accepted at every TEMPO year of play.

The Offensive to Defensive Utils Ratio Parameter

The following is the modified research hypothesis for the TEMPO parameter of offensive to defensive utils ratio:

Ho: Teams formed with dissimilar MBTI personality preferences will not have a higher offensive to defensive utils ratio than teams which are not formed with the use of the MBTI.

Ha: Teams formed with dissimilar MBTI personality preferences will have a higher offensive to defensive utils ratio than teams which are not formed with the use of the MBTI.

The offensive to defensive utils ratio was examined both from a total utils ratio perspective and a play by play perspective. The total utils ratio approach compared the mean of all of the control ratios to the mean of all of the treatment ratios over all of the TEMPO years. The offensive to defensive utils ratio data set met the requirements and

Table 23

The Total Offensive + Defensive Utils' Means, Standard Deviations, t-Statistics, and P-Values Between the Contro and Treatment Groups N=165

TEMPO Years	Mean	SD	T	P
X1 Y1	3,396 3,389	776.1 1,166	.02	.4925
X2 Y2	3,888 4,025	1,138 694.8	-.36	.3628
X3 Y3	5,087 5,590	1,354 1,104	-1.0	.1647
X4 Y4	5,285 5,603	1,846 1,363	-.48	.3182
X5 Y5	6,299 6,300	1,873 1,171	-.00	.4996
X6 Y6	7,861 7,690	2,220 1,509	-22	.4138
X7 Y7	9,852 9,114	1,987 1,982	22.0	.1863
X8 Y8	11,300 10,760	2,052 2,410	22	.2834
X9 Y9	12,260 11,630	2,133 2,650	22	.2634
X10 Y10	12,770 12,190	2,310 2,763	.55	.2925

X = Control Teams
Y = Treatment Teams

p < .1 *
p < .05 **
p < .01 ***

assumptions for the t test. The data is interval level and both the control and treatment groups are independent. The data was verified to be normal via the Wilk-Shapiro normality statistic, which ranged from .9751 to .9783. Each sample size is at least equal to twelve which meets the minimum t test size requirement.

The Total Ratio t Test The results of the t test are presented in Table 24 along with the p values. The control mean was 65.11 and the treatment mean was 69.32. The p value was .0364 which was less than an alpha of .05. This indicates that the null hypothesis is rejected in favor of the alternative hypothesis, and that the control mean is statistically less than the treatment mean. However, this result was not determined to be conclusive because the combining of all ten ratios at each year of play does not take into consideration that there may have been differently proportioned ratios over the ten plays. Additionally, the greater number of ratios used to determine the means statistically reduced their variance; thus, the tighter variances made the difference between the two means more significant than it was (78). Therefore, this test did not provide conclusive evidence of a significant difference between the overall means.

The Play By Play Perspective A t test was conducted for each TEMPO play with an alpha equal to .1. The t test results, means, and p values are summarized in Table 25. The means of both the control and treatment groups at each TEMPO year are presented in Figure 9. This graphically displays that the mean of the treatment group at each TEMPO year exceeds the mean of the control group.

Table 24

The Total Offensive to Defensive Util Ratio Means, Standard Deviations, t-Statistic, and P- Value Between the Control and Treatment Groups N=165

Variable	Mean	SD	T	P
CONTROL	65.11	19.43		
TREATMENT	69.32	16.63	-1.80	.0364 *

p < .1 *
p < .05 **
p < .01 ***

The p value decision rule for determining whether to accept or reject the null hypothesis was used at each TEMPO year. As can be verified by Table 25, the p values in every TEMPO year are greater than alpha at .1. Thus, the null hypothesis was accepted at every TEMPO play. Overall, the t test results indicate that the null hypothesis was not rejected at each TEMPO year of play and that the means of the control group are not statistically different than the means of the treatment group.

Additional Subsidiary Research Question

During the course of the data analysis, a subsidiary question to question one developed. The subsidiary question which was investigated was: Is there a positive correlation between better team scores and a higher degree of personality type dissimilarity on the teams? If the answer

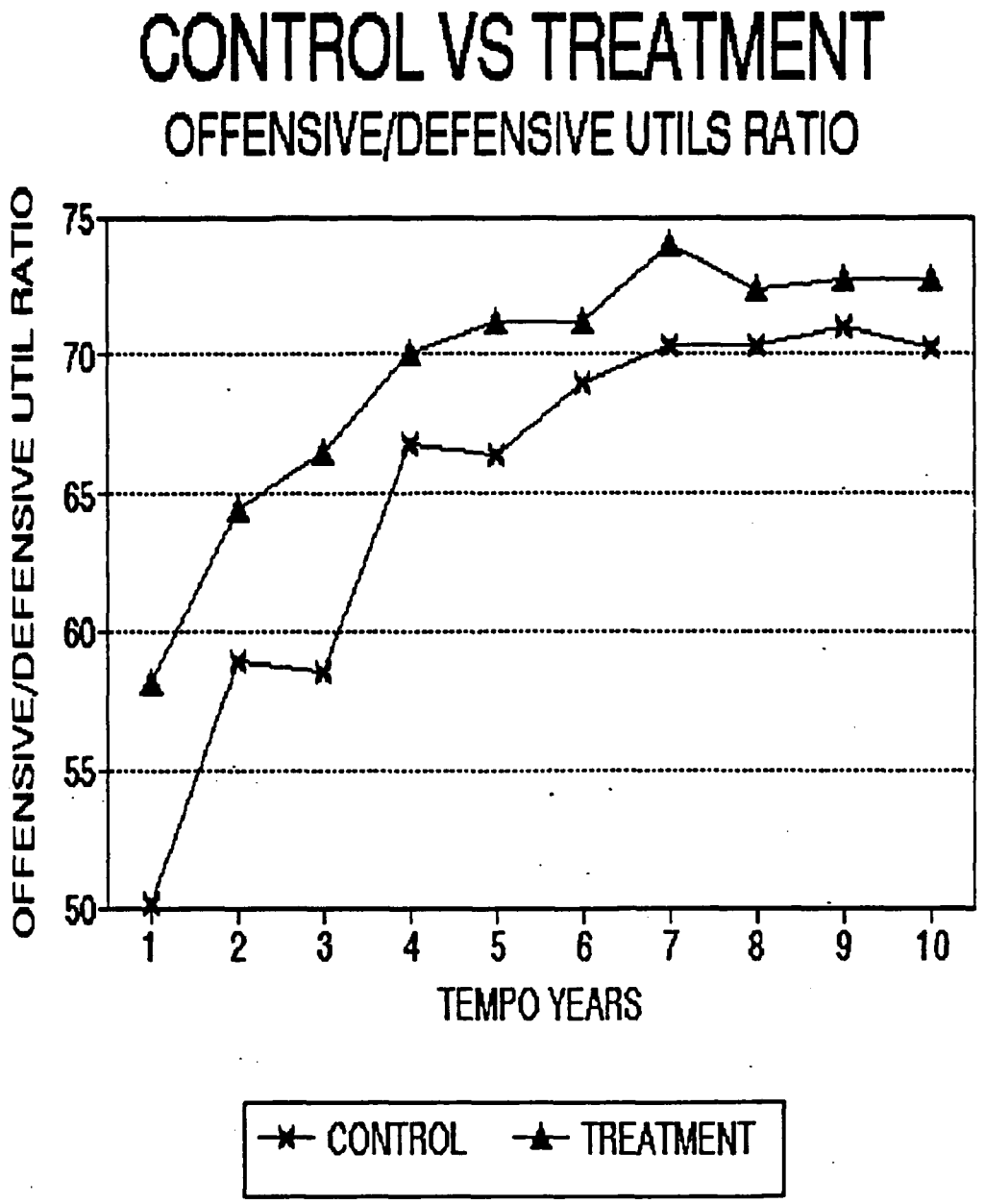

Figure 9. Control vs Treatment Offensive/Defensive Util Ratios

to this question was that there was a high positive association between teams constructed in a diverse manner and higher team performance, then this would have provided

Table 25

The Offensive to Defensive Util ratio Means, Standard Deviations, t-Statistics, and P-Values Between the Control and Treatment Groups N=12

Variable	Mean	SD	T	P
X1	50.12	16.08		
Y1	58.20	15.31	-1.26	.1102
X2	58.91	17.42		
Y2	64.44	19.06	-.74	.2328
X3	58.47	21.02		
Y3	66.42	15.34	-1.06	.1509
X4	66.71	22.38		
Y4	70.04	16.69	-.41	.3416
X5	66.33	19.61		
Y5	71.16	14.46	-.70	.2468
X6	68.93	16.86		
Y6	71.16	17.01	-.32	.3753
X7	70.25	18.93		
Y7	73.99	17.49	-.50	.3100
X8	70.33	20.06		
Y8	72.35	17.22	-.27	.3966
X9	71.00	19.10		
Y9	72.66	16.70	-.23	.4115
X10	70.02	18.05		
Y10	72.73	16.28	-.39	.3516

X = Control Teams
Y = Treatment Teams

$p < .1$ *
$p < .05$ **
$p < .01$ ***

additional evidence that teams formed with dissimilar MBTI personality preferences did make more effective decisions than teams which were formed with the use of the MBTI.

To answer this subsidiary question, an index of MBTI type dissimilarity was constructed to give a parameter to indicate the degree of a given team's MBTI dissimilarity.

This number was developed for each team and correlated to the TEMPO offensive to defensive util ratio performance parameter. The Rank (Spearman) Correlation was utilized to investigate the presence of any association between the variables. Due to the slight positive associations which were discovered and the assumptions which were made to conduct the analysis, the overall results were inconclusive that there was a correlation between the index of dissimilarity and the offensive to defensive utils. The methodology, results and analysis for this subsidiary question are summarized in Appendix C.

Introduction to the Post-Game Data Analysis

The following section addresses the data which was gathered from the post-game surveys. The post-game surveys were given to the subjects to determine their perceptions in several different areas. First, the survey was designed to determine how valuable the subjects perceived the MBTI to be in relation to improving team processes. Next, the survey sought to ascertain which group process attributes the subjects perceived to be important and present during the game exercises. Finally, the survey data were used to determine if any differences of opinion between the major MBTI types and the Males and Females existed. This research assumed that the data gathered from the Likert scale were interval level data. This was assumed to provide more

insight and depth to the analysis than was possible from an ordinal approach.

The Treatment MBTI Distribution

The treatment team subjects' MBTI personality type preferences and percentages of the sample are summarized in Table 26. The treatment team subjects' MBTI personality preferences are similar to the total TEMPO sample. The treatment subjects' largest MBTI concentrations were found in the ISTJ, ESTJ, and ENTJ categories. The majority of the treatment sample also had a preference for introversion, sensing, thinking, and judging, and the sensing-thinking decision style preference was the largest. These results are consistent with the total TEMPO sample distribution.

Analysis of Subsidiary Research Question 1

How valuable did the subjects perceive the MBTI to be in relation to team process?

Total Post-Game Survey Analysis

There were seventy-six subjects who took the post-game survey. The questions which related to the MBTI included the following:

3. The MBTI helped me to be a team member during the exercise.

6. The MBTI helped me communicate effectively with other members of my team.

9. The MBTI helped me to know the personality characteristics of the other members.

12. The MBTI helped me to be considerate of the members of my team.

15. The MBTI helped me to hear the opinions and views of all team members.

18. The MBTI helped me to reduce the amount of interpersonal conflict.

21. The MBTI helped me to understand my team members' decision making styles.

These questions, the subject's median scores, mean scores, and standard deviations are summarized in Table 27. Median and mean scores greater than 4.5 indicate that the subject agreed with the statement. From the medians of the survey scores, it can be seen that the only question which the median score was greater than 4.5 was question number nine. The mean and the median both indicate that the MBTI helped the majority of the respondents to know the personality characteristics of the other team members.

The rest of the group process attributes of team cohesion, communication, consideration of team members, open team atmosphere, interpersonal conflict, and knowledge of team members' decision making styles were not interpreted, from the means and medians, as being either helped or hindered by the MBTI. The overall mean scores and standard deviations indicate that the subjects were consistent with regards to the perceived benefits to be gained or not gained from the MBTI.

Table 26

TEMPO Subjects MBTI Preference Distribution and each Preferences' Percentage of the Sample N=76

SENSING TYPES		INTUITIVE TYPES				
with THINKING	with FEELING	with FEELING	with THINKING			
ISTJ	ISFJ	INFJ	INTJ	JUDGING	INTROVERTS	E=37 48.6% I=39 51.3%
N = 22	N = 5	N = 1	N = 3			S=53 69.7% N=23 30.2%
% = 28.95	% = 6.59	% = 1.32	% = 3.95			T=61 80.2% F=15 19.7%
ISTP	ISFP	INFP	INTP	PERCEPTIVE		J=58 76.3% P=18 23.6%
N = 3	N = 1	N = 2	N = 2			
% = 3.95	% = 1.32	% = 2.63	% = 2.63			
ESTP	ESFP	ENFP	ENTP	PERCEPTIVE	EXTROVERTS	ST=46 60.5% SF=7 9.2% NF=8 10.5% NT=15 19.7%
N = 5	N = 0	N = 4	N = 1			
% = 6.59	% = 0	% = 5.26	% = 1.32			
ESTJ	ESFJ	ENFJ	ENTJ	JUDGING		
N = 16	N = 1	N = 1	N = 9			
% = 21.05	% = 1.32	% = 1.32	% = 11.84			

Table 27

The Total Surveys' Means, Standard Deviations, and Medians on the MBTI Questions N=76

MBTI Question	Mean	SD	Median
3 Team Number	3.553	(1.660)	4.0
6 Communicate	3.579	1.585	4.0
9 Know Others	4.461	1.724	5.0
12 Considerate	3.868	1.739	4.0
15 Hear Opinions	3.855	1.679	4.0
18 Reduce Conflict	3.737	1.535	4.0
21 DM Styles	3.724	1.511	4.0

Analysis of Qualitative Post-Game Survey Questions for Subsidiary Research Question 1

There were seven qualitative questions for the subjects to answer on the back of their surveys. Questions one, two, four, five, six, and seven all sought to ascertain the usefulness of the MBTI in relation to team processes, so the following analysis was completed to determine the answer to subsidiary research question number one. On the first four qualitative questions, it was possible to discern general responses from the subjects. These data are ordinal at best, so the techniques of analysis used were descriptive in nature. The MBTI questions and the subjects' responses are:

Qualitative Survey Question 1: Do you feel the MBTI was useful to help you be more comfortable while getting to know the other members of the team?

n = 76	Responses	Number	Percentages
	Yes	26	34.21%
	Somewhat	7	9.21%
	No	27	35.53%
	Not Really	11	14.47%
	Not Used	2	2.63%
	Don't Know	3	3.95%

Qualitative Survey Question 2: Did the MBTI help to make other team members more aware of your personality characteristics?

n = 76	Responses	Number	Percentages
	Yes	19	25.00%
	Some	4	5.26%
	Possibly	14	18.42%
	No	15	19.74%
	Doubt it	7	9.21%
	Not Considered	2	2.63%
	Don't Know	15	19.74%

Qualitative Survey Question 4: Do you feel that the MBTI facilitated a better team atmosphere?

n = 76	Responses	Number	Percentages
	Yes	24	31.58%
	Probably	7	9.21%
	No	31	40.79%
	Not Really	5	6.58%
	Could not Determine	9	11.84%

These results are consistent with the earlier portions of the survey. Forty-three percent of the subjects indicated that the MBTI was useful to help them be more comfortable while they got to know the other members of the team. Conversely, fifty percent of the subjects either disagreed or neither agreed or disagreed that the MBTI helped them to be more comfortable while they got to know the other members of their teams. Forty-eight percent of the subjects responded that the MBTI helped to make other team members more aware of their personality types, and twenty-nine percent of the subjects indicated that the MBTI did not help them. Forty percent of the subjects indicated that the MBTI facilitated a better team atmosphere during the simulation games, and forty-seven percent of the subjects answered that the MBTI did not facilitate a better team atmosphere. In summary, less than half of the subjects reported that the MBTI helped the team processes in question.

Open-Ended Questions Qualitative questions five, six, and seven were open ended questions which encouraged the subjects to make written comments about their MBTI experiences; thus, it was only possible to provide a summary of their written responses to these questions. In addition, not all of the subjects provided a response to these questions making it difficult to determine any trends from this data.

Qualitative Survey Question 5: How did your MBTI type help serve your team?

This question was answered in a variety of ways. Several subjects responded that they did not think that the MBTI was a factor at all. A common response was that the MBTI was a good ice breaker and helped to get the team acquainted when they first got together. The ISTJs responded frequently that they helped the team by providing methodical, analytical, and detailed analysis during the exercise.

Qualitative Survey Question 6: How did your MBTI type detract from your team?

The largest category of response to this question was that "my MBTI type did not detract!." The next most common response was that the Introverts thought that they were too introverted and did not contribute enough to the team. Also, the introverts thought that they were too cautious and not assertive enough during the exercise. Conversely, the

extraverts thought that they were too extraverted and dominated too much of the team discussion.

Qualitative Survey Question 7: Are there other comments about the MBTI or the exercise you would like to offer?

There were a great variety of responses that were made by all of the types on this question. There were both positive and negative comments about the MBTI. The negative remarks ranged from subjects who thought that the MBTI block should be canceled all together, to subjects who thought that the MBTI was enjoyable but had no applicability in the real world. Some subjects thought the MBTI was too complicated to use without further instruction on how to apply the concepts. Several subjects were worried that the MBTI would lead to labeling and stereotyping of people. Other subjects noticed that as the time pressure increased during the game, that people switched to other types.

The positive remarks ranged from subjects thinking that the MBTI was an enjoyable exercise to subjects who thought that everyone in their work place should take it. A frequently reported comment was that the MBTI had helped people to gain greater insight into themselves and other people and that because of this they were able to interact better with their other team members.

It was difficult to determine type related comments on this question because of the wide range of responses which were made. The introverts, extraverts, and perceptive were the only preferences which had any discernable common

responses. The extraverts responded that the MBTI helped them to understand that others may perceive them to dominate discussions, and that because of this they tried to let other people participate more during discussions. Conversely, the introverts reported that they tried to be more extraverted than normal in order to contribute more to group discussions. A few subjects with the introverted preference indicated that the explanation of the MBTI was the first one that did not make them feel that introverts were subservient to those with the extraverted preference. Finally, the perceptive were generally more positive about the MBTI than the rest of the subjects who took the survey.

Analysis of Subsidiary Research Question 2

What attributes of group process were perceived to be important by the subjects?

Total Post-Game Survey Analysis

The questions which pertained to the importance of group process on the post-game survey are summarized below:

1. It is important to feel like a member of the team.
4. Effective communication among team members is essential to team performance.
7. In order for a team to be effective, it is important to know the personality characteristics of other team members.
10. It is important to be considerate of the needs of other team members.

13. When teams make decisions, it is important to hear the opinions and views of other team members.

16. For effective team decision making, it is important to reduce interpersonal conflict.

19. It is important to understand all team members' decision making styles so that more effective decisions may be made.

The subjects' median and mean scores, along with their standard deviations, are summarized in Table 28. Median and mean scores greater than five indicate that the subject agrees with the statement. In general, the subjects agreed that all of the attributes were important to have on a team. Effective communication was listed as the most important of the team attributes with median scores of seven. Understanding team members' decision making styles and knowing the personality characteristics of team members were both tied for the lowest ranking on the Likert scale with an overall median value of five.

Analysis of Subsidiary Research Question 3

What attributes of group process were actually perceived to be present by the subjects?

The questions which investigated the presence of group attributes in the survey were:

2. "Feeling as a team member" was present among my team.

5. Effective communication was present among my team during the exercise.

8. My team knew the personality characteristics of the other members.

Table 28

The Total Surveys' Means, Standard Deviations, and Medians on the Importance of Group Process Attributes N=76

Importance of Group Process Questions	Mean	SD	Median
1 Cohesion	6.289	1.017	6.5
4 Communication	6.474	1.039	7.0
7 Know Others	4.5	1.536	5.0
10 Considerate	6.027	1.107	6.0
13 Hear Opinions	6.145	1.251	6.0
16 Reduce Conflict	5.658	1.292	6.0
19 Understanding Decision Making Styles	4.645	1.334	5.0

11. My team members were considerate of each other.

14. My team made sure the opinions and views of each team member were heard.

17. My team made sure the amount of interpersonal conflict was reduced.

20. My team understood all members' decision making styles.

Total Survey Response Analysis Results

The subjects' median and mean scores, along with their standard deviations, are summarized in Table 29. Median and mean scores greater than 4.5 indicate that the subject agrees with the statement. In general, the subjects agreed the attributes of group process were all present on their teams. Being knowledgeable about the personality characteristics of the other team members, and understanding other team members' decision making styles were the lowest ranked of all the attributes. The attribute of knowing the personality characteristics of the other team members rated at a median value of five, so the respondents only mildly agreed that this was important. Knowledge of team members' decision making styles was ranked the lowest on the Likert scale with a median value of four. Thus, the majority of respondents neither agreed or disagreed that this was present on the teams.

Analysis of Qualitative Post-Game Question for Subsidiary Research Question 3

There were several qualitative open ended questions on the back of the survey. On the first four qualitative questions, it was possible to discern general responses from the subjects' surveys. These data are ordinal level data, which precludes many statistical tests from being performed on it. The presence of group process attribute question and the subjects' responses were:

Table 29

The Total Surveys' Means, Standard Deviations, and Medians on the Presence of Group Process Attributes N=76

Presence of Group Process Questions	Mean	SD	Median
2 Cohesion	6.053	1.082	6.0
5 Communication	5.908	1.073	6.0
8 Know Others	4.882	1.649	5.0
11 Considerate	6.118	1.032	6.0
14 Hear Opinions	5.553	1.237	6.0
17 Reduce Conflict	5.355	1.251	6.0
20 Understood Decision Making Styles	3.987	1.371	4.0

Qualitative Survey Question 3: Do you feel good about the manner in which team decisions and strategies were reached?

n = 76 Responses	Number	Percentages
Yes	65	85.53%
Somewhat	8	10.53%
No	3	3.95%

By far the majority of the subjects were satisfied with the way that their team decisions were reached.

Analysis of Subsidiary Research Question 4

Were there any differences of opinion about the MBTI or attributes of group process between the different MBTI types?

The Jungian Types

The Jungian Types Compared to the Survey The Jungian types' survey response means were compared to the means of the total survey responses to determine if there were any significant differences. The sixteen Jungian types would all have been examined except that several of them consisted of very small sample sizes. All of the types were examined if their sample size was at least equal to three. It is recognized that a sample size of three is a small sample size; however, these samples were included to investigate the possibility that there might have been major differences of opinion between the subjects.

There was only one statistical difference between the means of the Jungian types and the means from the total survey. On question number six, the ESTP mean was 4.800 and the total survey mean was 3.579. The ESTP mean was found to be statistically different via the t test with the resulting p value equal to .0999. The ESTPs felt that the MBTI helped them to communicate more effectively with the other members of their teams than the total survey subjects did. There were no other statistically significant differences between the means of the Jungian types and the means of the total survey subjects.

The Jungian Types Compared to Each Other Each of the Jungian types mean scores were then compared to the other Jungian types' mean scores to determine if there were any statistically significant differences between the types mean survey question scores.

The Type's Perceptions of the MBTI Differences The Jungian types' MBTI survey question means were compared to each other via the t-test to determine if there were any significant differences between them. The results of the t-tests are presented in Table 30. The first significant difference was between the ISTJs and the ESTPs. The ISTJs responded that they did not agree that the MBTI helped to increase communication among their teams as compared to the ESTPs who did agree. Also, the ISTJs did not agree that the

MBTI helped them to reduce interpersonal conflict on their teams as compared to the ENTJs who neither agreed or disagreed that the MBTI helped.

The ISFJs were more critical of the MBTI than the ENTJs and the ESTPs. First, the ISFJs did not agree that the MBTI

Table 30

The Significantly Different MBTI Types' Means, Standard Deviations, and P-Values to the MBTI Post-Game Survey Questions

MBTI Type/Question	Mean	SD	P
ISTJ/Q6 ESTP/Q6 Communication	3.304 4.800	1.460 1.634	.0521 *
ESTP/Q6 ISFJ/Q6 Communication	4.800 2.750	1.643 1.500	.0949 *
ISFJ/Q12 ENTJ/Q12 Considerate	2.750 4.667	1.500 1.658	.0742 *
ISTJ/Q18 ENTJ/Q18 Reduce Conflict	3.348 4.444	1.369 1.810	.0727 *

P<.1 * ISTJ n=22
P<.05 ** ESTP n=5
P<.01 *** ISFJ n=5
ENTJ n=9

helped to improve effective communications on their teams as compared to the ESTPs who did agree. Additionally, the

ISFJs did not agree that the MBTI helped them to be more considerate of other team members as compared to the ENTJs who agreed that the MBTI did help them to be more considerate.

The MBTI types' mean scores from the MBTI post-game survey questions are presented in Table D1 found in Appendix D. Overall, the ISFJs and the ISTJs were the most critical of the MBTI helping the group process attributes investigated. The ESTPs and ENTJs were the most favorably disposed towards the MBTI helping the group process attributes investigated.

Importance of Group Process Attributes The statistically significant differences between type mean survey scores of the importance of group process attribute questions are presented in Table 31. The ISFJs did not agree that it was important to know the personality characteristics of the other team members, in order to have an effective team, as compared to the ENTJs and the ENFPs who both agreed that it was important. The ESTJs neither agreed or disagreed that to have an effective team it is important to know the personality characteristics of the other team members, as compared to the ENFPs who agreed that it was important. The ESTPs agreed more than the ENTJs that it was important to hear tne opinions and views of other team members during decision making.

The mean scores from the importance of group process attributes post-game survey questions are presented in Table D2 in Appendix D. Overall, all of the MBTI types agreed that all of the group process attributes investigated were important, but that agreement also varied among specific types.

The Presence of Group Process Attributes The ESTPs agreed more significantly than the ENFPs that effective communication was present on their teams. The ESTPs neither agreed or disagreed that their team members knew the personality characteristics of the other team members, as compared to the ENTJs who agreed that this attribute was present. The ESTPs agreed more significantly that interpersonal conflict on their teams was reduced more than the ISTJs reported.

The mean scores from the presence of group process attributes post-game survey questions are presented in Table D3 in Appendix D. In general, the MBTI types agreed that all of the group process attributes investigated were present. The ESTPs and the ENFPs neither agreed or disagreed that their teams knew the personality characteristics of the other members on their teams. The ESTPs neither agreed or disagreed that their teams understood all their team members' decision making styles.

Table 31

Comparison of MBTI Types' Means, Standard Deviations, and P Values for the Presence and Importance of Group Process Attributes post-game survey questions

Variable/Question	Mean	SD	P
ESTJ/Q7 ENFP/Q7 Important to Know Personality Characteristics	4.500 5.750	1.243 .957	.0897*
ISFJ/Q7 ENTJ/Q7 Important to Know Personality Characteristics	3.750 5.000	1.500 .7071	.0592*
ISFJ/Q7 ENFP/Q7 Important to Know Personality Characteristics	3.750 5.750	1.500 .957	.0656*
ESTP/Q13 ENTJ/Q13 Important to Hear Opinions and Views	6.800 6.111	.4472 .7817	.0981*
ESTP/Q5 ENFP/Q5 Effective Communication was Present	6.600 5.500	.5477 .5774	.0222** *
ESTP/Q8 ENTJ/Q8 Team Knew Personality Characteristics	4.200 5.556	1.483 1.130	.0775*
ISTJ/Q17 ESTP/Q17 Interpersonal Conflict	4.913 6.200	1.535 .8367	.0836*

P<.1 * ESTJ n=16 ENTJ n=3
P<.05 ** ESTP n=5 ENFP n=4
P<.01 *** ISTJ n=22 ISFJ n=5

The ISFJs disagreed that their teams understood their team members' decision making styles.

The Attitudes and Processes

The survey respondents' results were further divided by their different attitudes and processes, or into E, I, S, N, T, F, J, and P. After this was done, their means were each compared to each of the total survey question means. From this entire comparison of means, there were only two questions which were significantly different from the overall survey. Subjects with the perceptive style, differed from the overall subjects on questions number three and six. The means, standard deviations, and p value are presented in Table 32.

The perceptives neither agreed or disagreed that the MBTI helped them to communicate more effectively with their team members, and helped them more to be team members. However, the perceptives mean scores were greater on these two questions than the rest of the survey. The total surveys' mean scores also indicate that they neither agreed or disagreed that the MBTI helped them in these areas.

The Preferences Compared To Each Other.

The preferences of each index were compared to each other, to determine if the opposing preferences' survey means would differ in a statistically significant manner. Table 33 outlines all of the statistically significant

Table 32

The Post-Game Survey Questions' Means, Standard Deviations, and P-Values Between the MBTI Functions and the Total Survey that were Statistically Significant

MBTI Function/Question	Mean	SD	P
Perceptive/Q3 Total Survey/Q3 Cohesion	4.316 3.553	1.204 1.660	.0632
Perception/Q6 Total Survey/Q6 Communication	4.368 3.579	1.212 1.585	.0458 **

P<.1 * Perceptives n=18
P<.05 ** Survey n=76
P<.01 ***

findings' questions, means, standard deviations, and p values. The decision rule was that if the p value exceeded the alpha value then the null hypothesis was rejected. These were all two tailed tests conducted at an alpha value of .1.

The subjects with a perceptive preference had significantly higher means on questions one, two, three and six. This indicates that the perceptive's perceived that It was important to feel like a member of a team, that feeling like a team member was present on their teams, and that the

MBTI helped them both to be a team member during the exercise and to communicate more effectively than the judging subjects did.

The subjects with the feeling preference had a statistically higher mean than the subjects with the thinking preference on question number two. Those with a feeling preference indicated through their higher mean that feeling like a team member was more present on their teams than those with the judging preference.

Those with the extraverted preference scored higher means on question eighteen and twenty than their introverted counterparts. The extraverts indicated that the MBTI helped them to reduce the amount of interpersonal conflict on their teams more than the introverts did. The extraverts felt that they understood their team members' decision making styles more than the introverts did.

Finally, those with a intuitive preference had a higher mean than the subjects with the sensing preference on question 2. The subjects with the intuitive preference indicated they believed that feeling like a team member was more present on their teams than those with the sensing preference believed. There were no other statistically significant findings from this portion of the analysis.

Table 33

The Post-Game Survey Questions' Means, Standard Deviations, and P-Values Between the MBTI Attitudes and Processes that were Statistically Significant

Preference/Question	Mean	SD	P
P/Q1 J/Q1 Important to Feel Like Team Member	6.632 6.175	.4956 1.120	.0907*
P/Q2 J/Q2 Team Member Presence	6.421 5.930	.6070 1.178	.0866*
P/Q3 J/Q3 MBTI Helped Team Member	4.316 3.298	1.204 1.721	.0197**
P/Q6 J/Q6 MBTI Helped Communication	4.368 3.316	1.212 1.616	.0112**
T/Q2 F/Q2 Team Member Presence	5.951 6.467	1.161 .5164	.0983*
E/Q18 I/Q18 MBTI Helped Reduce Conflict	4.162 3.333	1.482 1.493	.0176**
E/Q20 I/Q20 Understood Decision Making Styles	4.270 3.718	1.367 1.337	.0791*
S/Q2 N/Q2 Team Member Presence	5.906 6.391	1.213 .5830	.0720*

P=Perceptive	n=22	P<.1	*
J=Judging	n=5	P<.05	**
T=Thinking	n=5	P<.01	***
F=Feeling	n=15		
E=Extraversion	n=37		
I=Introversion	n=39		
S=Sensing	n=53		
N=iNtuitive	n=23		

The Decision Styles

The four decision styles' means were compared by the t test to each other. The results of these t tests are presented in Table 34 along with the questions, means, standard deviations and p values. There were no statistically significant differences between the means of the STs and the NFs.

With regards to question fourteen, the subjects with the NT preferences did not agree as strongly as the subjects with the SF preferences. The mean score of the SFs was almost a full point higher than the NTs. The SFs thought that their teams made sure the opinions and views of each member were heard more than the NTs. The null was rejected in this case with a p value which was equal to .0170. The SFs also indicated that during their teams decision making, it was more important to hear the opinions and views of their team members than the NTs did. Both of the mean scores for the NTs and the SFs indicated that these were important.

The subjects with the SF preferences overall felt that the attributes of team process were more important than the STs. The SFs mean indicates that it is more important for them to feel like a team member than the STs - even though they both agree that it is important. The SFs felt more than the STs that the opinions and views of each member were heard.

Table 34

The Post-Game Survey Questions' Means, Standard Deviations, and P-Values Between the MBTI Decision Styles that were Statistically Significant

Decision Style/Question	Mean	SD	P
ST/Q1 SF/Q1 Important to Feel Like Team Member	6.109 6.857	1.140 .3780	.0932 *
ST/Q14 SF/Q14 Team Heard Opinions	5.478 6.571	1.225 .5345	.0248 **
SF/Q13 NT/Q13 Important to Hear Opinions	6.714 6.067	.4880 .5936	.0208 **
SF/Q14 NT/Q14 Team Heard Opinions	6.571 5.400	.5345 1.121	.0170 **
ST/Q2 NT/Q2 Team Member Presence	5.804 6.400	1.258 .6325	.0844 *
SF/Q14 NF/Q14 Team Heard Opinions	6.571 5.375	.5345 1.685	.0961 *
ST=Sensor-Thinker SF=Sensor-Feeler NT=iNtuitive-Thinker NF=iNtuitive-Feeler	n=46 n=7 n=8 n=15	P<.1 * P<.05 ** P<.01 ***	

The subjects with the NT preference indicated that they thought that feeling like a team member was more present on their teams than those with the ST preference, and both agreed that it was present.

The last statistically significant difference among the different decision styles occurred on question fourteen between the NFs and the SFs. The mean score of the SFs was significantly higher than the mean score of the NFs. The SFs felt that their teams made sure that the opinions and views of each team member were heard more than the NTs did.

Subsidiary Research Question 5

Were there any differences of opinion on the post-game survey between the male and female subjects?

To answer this question, the mean scores of the responses for males and females who participated in the exercise were compared. The statistically significant differences between the means are presented in Table 35. The females means indicate that they felt that it was more important for effective decision making to be considerate of the needs of other team members, to hear the opinions and views of other team members, and to reduce interpersonal conflict than the males indicated.

The females also indicated that they felt the presence of feeling like as a team member and effective communication more than the males reported. The results also indicate that the females agree more strongly than the males that the MBTI improves the group process attributes of cohesion, communication, each members' knowledge of other team

Table 35

The Post-Game Survey Questions' Means, Standard Deviations, and P-Values Between the Males and Females that were Statistically Significant

Gender/Question	Mean	SD	P
Male/Q10 Female/Q10 Importance Consideration	5.919 6.500	1.178 .5189	.0762*
Male/Q13 Female/Q13 Importance Hear Opinions	6.032 6.643	1.342 .4972	.0994*
Male/Q16 Female/Q16 Importance Reduce Conflict	5.532 6.214	1.352 .8018	.0741*
Male/Q2 Female/Q2 Presence Team Member	5.935 6.571	1.143 .5136	.0462**
Male/Q5 Female/Q5 Presence Communication	5.806 6.357	1.114 .7449	.0828*
Male/Q3 Female/Q3 MBTI Helped Team Member	3.355 4.429	1.600 1.697	.0279**
Male/Q6 Female/Q6 MBTI Helped Communication	3.387 4.429	1.530 1.604	.0254**
Male/Q9 Female/Q9 MBTI Helped Know Others	4.226 5.500	1.731 1.286	.0115**
Male/Q12 Female/Q12 MBTI Helped Consideration	3.661 4.786	1.679 1.762	.0278**
Male/Q21 Female/Q21 MBTI Helped Decision Styles	3.581 4.357	1.466 1.598	.0824*
Male n=62 Female n=14	P<.1 * P<.05 ** P<.01 ***		

members' personality characteristics, consideration and understanding team members' decision making styles. There were no other statistically significant findings from this comparison.

The Valence Analysis

A major concern of this research was the investigation of the benefits of using personality characteristics to improve team decision making. So far, this research has analyzed team performance in the simulation game exercise, perceptions about certain attributes relative to team interactions, and the degree which a personality profile aided these interactions. This research now turns to the investigation of the relationships between the importance of the team attributes and the degree to which those attributes were perceived to be present during team interaction. This relationship, or valence, should provide further insight toward meeting interactive needs to improve team effectiveness.

Valence is defined as the difference between how important an attribute is perceived to be for team effectiveness and how much the subjects perceived the attribute to be present during team interaction. The calculation for valence was:

$$\text{Valence} = x_P - x_I$$

Where x_P = mean score of presence for an attribute

x_I = mean score of importance for an attribute

A negative valence represents an attribute whose presence in team interaction was perceived as less than its relative importance. Negative valences provide insight for improving team effectiveness. The mean scores for importance, presence, valence scores, and rank orders for each attribute are presented in Table 36. In general, the valence table consists of ordinal ranking of the mean data and their resulting valences. A valence which is negative indicates that the subjects perceived that group process to be of some importance, and the presence of that attribute was perceived less. If the valence is positive, that indicates that the subjects' perceived a greater presence of that attribute than its scored importance.

Importance of Attributes

Table 36 presents the results of the total sample population. Effective communication (1), the importance of feeling like a member of the team (2), hearing the opinions and views of the other team members (3), being considerate of other team members (4), and reducing the amount of interpersonal conflict among team members (5) were ranked as the top five for importance by the total sample population. Knowing the personality characteristics of the other team members (7) and of understanding team members' decision making styles (6), were ranked as sixth and seventh in importance by the sample population. In contrast, the attribute know personality characteristics of other team

members ranked last among the seven attributes. However, the amount of presence for this attribute was perceived as higher than its importance. Thus, among the seven attributes, the subjects perceived a higher level of knowing team members' personality characteristics than they felt as relatively important for team effectiveness.

Presence of Attributes

Being considerate of other team members (1), feeling like a team member (2), effective communication (3), hearing the views and opinions of the other team members (4), and reducing the amount of interpersonal conflict among team members (5) were ranked as the top five according to their amount of perceived presence on the teams. Knowing the personality characteristics of the other team members (6) and understanding the decision making styles of others (7) were ranked as sixth and seventh in perceived presence by the sample population.

The Valences

The attribute of understanding team members' decision making styles had the most negative valence which implies that there was less of this attribute present than the rated level of importance. This is meaningful; however, the subjects rated the attribute sixth in importance out of the

Table 36

The Total Surveys' Means and Rank Orders of the Importance, Presence, and Valence of Group Process Attributes N=76

Team Process Attributes	X Group Process	Rank Order of Importance	Rank Order of Presence	X Presence	Valence X_f-X_i	Rank Order
Effective Communication	6.474	1	3	5.908	-.566	3
Hear Opinions & Views of Others	6.145	3	4	5.553	-.592	2
Reduce Interpersonal Conflict	5.658	5	5	5.355	-.303	4
Feeling Like a Team Member	6.289	2	2	6.053	-.236	5
Consideration of Needs of Others	6.026	4	1	6.118	+.092	6
Understand Decision Making Styles of Others	4.645	6	7	3.987	-.658	1
Know Personality Characteristics of Other Team Members	4.500	7	6	4.882	+.382	7

other group process attributes. This indicates that though the attribute was ranked relatively low among all seven attributes, the subjects felt the least amount of presence existed. The other negative valences indicate that the team members felt that the attributes of hearing the views and opinions, and effective communication present less than their relative importance for team effectiveness.. These were rated third and first in importance respectively, and the valences may be seen as more significant than understanding team members' decision styles. The valences of being considerate of the other team members (6) and

knowing the personality characteristics of other team members (7) both had positive valence values, which possibly indicates that the team members felt that there was more of these group process attributes present than was needed or necessary for team effectiveness.

Summary

The data collected from the simulation games and post-game surveys was used to answer the research question, subsidiary research questions, and hypothesis set forth in Chapter III (Table 20). Statistical differences, and relationships were presented and highlighted when significant. The next chapter will elaborate on these findings and draw specific conclusions from them.

V. Conclusions and Recommendations

This final chapter is divided into two sections. The first section will present the conclusions of this research effort. The second section will present recommendations based upon the results of those conclusions. As the reader progresses through this chapter, it should be kept in mind that this research effort was conducted on a small sample and that the statistical tests were applied at the .1 level of significance. This level of significance does not allow for strong levels of statistical significance to be attached to the results; thus, the conclusions reached as a result of this research are to be considered general in nature and broadly indicative of the population.

Research Objective 1

The first research objective was to conduct an experiment which would determine if teams formed with dissimilar MBTI personality preferences would make more effective decisions than teams formed without the use of the MBTI.

Conclusion 1: Research Question 1

Do teams formed with dissimilar MBTI personality preferences make more effective decisions than teams which are formed without the use of the MBTI?

The statistical conclusion for question one, based on the results in Chapter IV, is that the null hypothesis cannot be rejected.

H_o: Teams formed with dissimilar MBTI personality preferences were no more effective than teams not formed with the use of the MBTI.

The scores from the TEMPO game were cumulative in nature. Therefore, rather than just comparing the means of the final end scores, the game performance parameters were evaluated at each simulated TEMPO year. From all of the t tests between the means of the treatment and control groups on the performance parameters, there were no statistically significant results with one exception. The treatment teams' offensive utils score significantly exceeded the control teams' score at TEMPO year number three. Except for this anomaly, the overwhelming conclusion was not to reject the null hypothesis for any of the game parameters; thus, teams formed with dissimilar MBTI personality preferences and teams which were not formed with the MBTI had no statistically significant different scores on the TEMPO simulation game.

There were no statistically significant differences between the means of the treatment and control teams; however, there was a discernable trend with regards to the offensive utils and the sum of offensive and defensive utils TEMPO parameters. The treatment groups' scores were higher than the control populations' scores during the first five

TEMPO years of play. This trend was only statistically significant at TEMPO year three with the offensive utils parameter.

This trend was also visible with the offensive to defensive util ratio, but in this case the treatment teams' ratios exceeded the control teams ratios at every TEMPO year of play. It is a fact, as seen in the data, that teams formed based upon MBTI dimensions did achieve higher performance levels, these levels though, were not statistically significant. This suggests that forming teams based upon MBTI dimensions still has potential and the technique should receive further investigation.

Discussion of Research Question's Results

There are many possible reasons why the teams' effectiveness did not improve due to the experimental treatment given to them. The following discussion will explore some of the reasons why there was not more of a statistically significant difference between the scores of the treatment and control teams. Also, possible explanations are presented to explain why the treatment teams scores were higher than the control teams' scores.

The TEMPO Play One difficulty present in trying to discern trends from the TEMPO scores was that the performance indicators used from the TEMPO games were not in themselves conclusive. The problem with the score, which is in fact used to determine the winner of a game's play, is that the

net offensive utils are computed at each year of play by taking one team's offensive utils and subtracting the opposing team's defensive utils from it. This score is fine for determining which team won the game, but it is not independent, nor is it suited for comparison to other team scores from other classes. The offensive util score is not independent because each score is dependent on the actions of the other team. This also results in the inability to compare scores across different teams because each team's score is relative to how well the opposing team played; thus, making it difficult to compare team performance from game to game.

The TEMPO performance parameters which were used for the purposes of this research attempted to overcome the problems with the net offensive utils mentioned above. The parameters of the offensive utils, the sum of offensive and defensive utils, and the offensive to defensive utils ratio all define a portion of the team's success, but they do not provide an absolute measure of the teams' success (54). The parameter which provided the most insight into the TEMPO teams' decision making process was the offensive to defensive utils ratio (54). Because the performance metrics analyzed were not fully indicative of a teams' performance level, it might be difficult to detect an increase in performance.

Sample Size There might be a more detectable difference between the control and treatment teams if the sample size

of the experiment was increased. It is difficult to draw specific conclusions about the TEMPO scores because of the relatively small sample size. If the sample size was increased, it would be possible to draw more specific conclusions from this data.

The Hawthorne Effect There is a possibility that the treatment teams' increased scores were caused by the Hawthorne effect. The control teams did not receive the MBTI introduction prior to playing the game, while the treatment teams did. Drew and Hardman suggest that it is difficult to design an experiment so that the Hawthorne effect does not influence the results (21:138). When one group receives a "treatment" while the other "control" group does not, then

> the members of group 1 might perform better because they feel 'special' whereas the members of group 2 might not have the 'special' feeling and might not perform as well because of this. (21:138)

Group 1 in this case would be equivalent to the treatment group, and group 2 would be equivalent to the control group. Thus, it is possible that the higher scores in the treatment group could be attributable to the MBTI introduction and not team formation by dissimilar MBTI personality types.

In addition to the Hawthorne effect, there is a possibility that the treatment teams' higher scores were due to the team building qualities that were present during the MBTI introduction. The MBTI introduction consisted of a four hour lesson which introduced the subjects to Jung's

psychological type theory and how it is operationalized by the MBT At the end of this session the subjects MBTI scores were given to each subject. The subjects were then encouraged to disclose their MBTI type preferences to the other subjects on their TEMPO teams. The MBTI introduction and the self disclosure which the subjects participated in share some characteristics in common with team building.

The MBTI introduction that the teams received had some team building qualities. Team building has been defined as the process of getting each team member to better understand himself and then to facilitate his awareness of the personalities of his co-workers so that the team will be able to function more effectively and productively (10:529-530; 71:27). Because of these team building characteristics, it is possible that the MBTI introduction and not the forming of teams by dissimilar type was responsible for the higher scores among the treatment teams.

A stronger experimental design which would account for the Hawthorne effect and the teambuilding qualities of the MBTI introduction would be to give the MBTI introduction to both the control and treatment teams so that they would be as equivalent as possible. Therefore, the only difference between the two groups would be that the treatment teams were formed by dissimilar MBTI types. With this design, there would be no question that the forming of the teams by dissimilar MBTI personality types was the cause for whatever differences might exist between the two groups.

Team Cohesion It takes a long time and considerable effort from each member for a team to develop a high level of effectiveness (32:28). The subjects involved in the AFIT short courses were only in school for three weeks, and in their TEMPO teams for a day. The subjects also knew that their participation in the TEMPO game was for the most part ungraded. Because the subjects did not have the time to go through the natural stages of team development, they may not have been as inclined to develop effective team processes as they would have in their work environments.

Stages of Team Development The simulation game teams may have been in several stages of team development at the same time (98). The initial stages of team development are some of the most difficult stages for teams to work through. In the forming stage, it is not uncommon for a team to accomplish very little towards their goals. And during storming, conflicts arise over team leadership, goals, norms, roles, and task assignments. Even if the diverse MBTI personality types on the teams were contributing to a more effective decision making process, it is possible that this effect might be lost in the confusion resulting from the initial stages of team development. Other research has concluded that

> one-shot studies with ad hoc groups produce results relevant to newly forming groups (Tuckman, 1965), not to groups which have developed some modest social structure, much less those with a highly developed set of norms. (37:387)

For the TEMPO game in this research effort, the forming of teams by dissimilar personality types did not have a significant impact on the performance of the teams. It is possible that because of the limited time duration of the TEMPO game and the course, the subjects were not as motivated to perform as they would have been in their work environments. The TEMPO game simulation may not have stimulated the same levels of emotional involvement or motivation found in a natural work environment (37:386-387). Thus, the increase in performance due to the forming of groups by dissimilar types might have been inhibited by the experimental environment. In a work environment, the subjects may likely be more inclined to be critical in the problem solving and decision making process and have more motivation to succeed because of the higher stakes involved. The subjects would then be more likely to make inputs into the decision making and problem solving process, thus maximizing the potential contributions that dissimilar perspectives and opinions could offer to the process and increasing the overall performance of the team.

Team Interactions Another factor which may have constrained the benefit of having diverse personalities and perspectives to draw upon during the TEMPO problem solving and decision making process was a desire on the part of the subjects to withhold different points of view that might have adversely impacted the friendly atmosphere. Feeling like a team member was ranked number two in importance by the subjects

who took the post-game survey. Thus, if the subjects attached this much importance to team cohesion, it is possible that they may have withheld points of view which were counter to the team's popular views. If this was the case, then compromises on decisions may have been accommodated by team members in order to maintain a friendly atmosphere (18:446; 37:383-384).

Personality Characteristics There may not have been a significant difference between the teams because of the nature of the TEMPO game and the personality characteristics which made up a significant portion of the sample population. The TEMPO game's objective is to maximize net offensive utils. Beyond this, there are several distractions present in the game such as different offensive and defensive weapons which may be purchased and intelligence on the other team's activities. The rules and distractions tend to influence teams into analyzing the expected benefits of each weapon system in an analytical fashion. Overall, the skills used during the playing of the game involve impartial analysis of the team's objectives and a systematic manner of making decisions. The game is geared more towards people that are inclined to be analytical, logical, systematic, and pay attention to details.

The TEMPO games' atmosphere is very conducive to the majority of the MBTI personality types found in the sample population. The ISTJs, ENTJs, and ESTJs made up 54.55% of the total sample population. The personality traits they

all have in common are that they are predisposed to be both analytical and systematic (49:15; 63:20-21). The subjects with the ST and NT preferences made up 79.94% of the sample. Subjects with these preferences are inclined to impersonal analysis and to be both practical and logical (65:3). The other 20% of the population consists of subjects with the SF and NF preferences. Subjects with these preferences tend to have more interest in interpersonal relationships and be more sympathetic and enthusiastic towards other people (65:3). The implication here is that the majority of the subjects' personality preferences were more inclined to the nature of the TEMPO game than were the personality characteristics of the rest of the population.

With the TEMPO simulation game, and with the given sample population, there may not have been an improved problem solving and decision making process because the contributions that the minority of the sample population made may not have been the type of contributions which would increase a team's performance on this type of game simulation.

Variability of Personalities Another possibility as to why the dissimilarly formed teams did not perform significantly better than the control teams is that there was not much variability present within the sample to have a high degree of dissimilarity among the experimental teams. Even though the teams were formed as dissimilarly as possible, they were still quite similar in overall composition. This

explanation is consistent with the results because there were not significantly dissimilar personality types on the teams, and there was not a significant difference in performance shown by the treatment and control teams. Perhaps with a more diverse sample there would have been more improved problem solving and decision making as was theorized to exist.

There are two other reasons why the improved performance did not accrue to the treatment teams. First, the skeptical nature of most of the subjects towards the MBTI could have affected the teams' performance. Second, enough time may not have been given for the subjects to assimilate and effectively learn how to use their new MBTI information while they were participating in the game simulations. Perhaps if the subjects had more training in the MBTI they would be able to more effectively capitalize on the diversity present within their teams and in the workplace.

Another possible reason to explain the statistically insignificant results is that the MBTI in itself may not account for enough of the facets of human nature which determine an individual's behavior. Or at least not to the extent that it is possible to predict a group's performance based upon the additive effect of the personalities of the group's members. This is what Shutz referred to as the "ancient problem of 'emergents'- whether or not a whole can be predicted from a knowledge of its parts" (86:275).

A final comment on this research question is that because the treatment teams were constructed of dissimilar MBTI personality types, it was expected that there would be more conflict present in the initial stages of team development, than on the control teams (7:65). This conflict was not observed. This could be due to the fact that there was not a high degree of dissimilarity among the team members. Or, it could be that the conflict did not arise because the subjects all had similar educational experiences, work backgrounds, and ethics.

The Second Research Objective

The following subsidiary research questions were investigated in order to fulfill the second research objective: To investigate the test subjects' perceptions of the group process during the experiment and the influence of the MBTI.

Conclusion 2: Subsidiary Research Question 1

How valuable did the subjects perceive the MBTI to be in relation to team process?

The means and median scores from the sample are inconclusive in determining how the MBTI aids or detracts team members from contributing toward their team process. Responses about the indicator's utility were mixed between valuable to not valuable. Some indication emerged that the responses were type-related, allowing one to note that a

larger sample with more type diversity might provide a greater distinction of value.

Conclusion 3: Subsidiary Research Question 2

What attributes of group process were perceived to be important by the subjects?

By a large majority, the subjects mean scores indicated that they perceived all of the group process attributes to be important to group process. The subjects reported that (1) effective communication, (2) feeling like a team member, (3) and hearing the opinions and views of the other team members were the most important group process attributes needed to make effective decisions. The subjects' perceptions of the importance of these attributes are consistent with characteristics of effective teams.

Conclusion 4: Subsidiary Research Question 3

What attributes of group process were perceived to be present by the subjects?

The mean and median scores indicate that all of the attributes were perceived to be present by the majority of the subjects in the sample, except for the attribute of understanding team members' decision styles. It was inconclusive that the subjects perceived the attribute of understanding team members' decision making styles as being present during their game exercise. The fact that the subjects perceived this attribute to be important, and that

its presence was questionable, indicates that this may be an area for team process improvement. The subjects' mean scores indicated that (1) being considerate of the needs of others, (2) feeling like a team member, (3) effective communication, and (4) hearing the opinions and views of other team members were the group process attributes which the subjects perceived to be most present during their TEMPO games. The majority of the subjects were satisfied with the manner in which decisions were reached on their teams.

Conclusion 5: Valence Conclusions

The valence analysis provided more insight into the importance that the subjects attached to the group process attributes and the perceived presence of those attributes. Team members felt that the attributes of hearing the views and opinions, effective communication, and understanding the decision making styles of others present less than their relative importance for team effectiveness. These findings point towards areas which need to be worked on to improve group effectiveness. The subjects also reported that the attributes of being considerate of the other team members and knowing the personality characteristics of other team members were present more than their relative importance for team effectiveness. Possibly these group process attributes were present more than was needed or necessary for team effectiveness.

Conclusion 6: Subsidiary Research Question 4

Were there any differences of opinion about the MBTI or attributes of group process between the different MBTI types?

It is important to note that these findings were drawn from a relatively small sample and that the level of significance for the t-tests was equal to .1; thus, the following conclusions are general in nature.

The results from the t-tests in Chapter 4 indicate that the ISTJs and the ISFJs were the most critical Jungian types towards the MBTI aiding their team processes. The ENTJs and the ESTPs were the Jungian types most favorably disposed towards the MBTI improving their team processes. In general, the extraverts perceived the MBTI to help their group processes more than the introverts did. Further research is necessary, however these results point to the fact that the ISTJs and those subjects with the introverted preference were generally more skeptical of the MBTI and that this should be taken into consideration when introducing them to the MBTI.

The t-tests of the mean post-game survey scores between the different Jungian types and preferences indicated that there were some type-related differences of perceived importance and presence of the group process attributes. These differences allow one to conclude that a larger sample with more types would lead to more specific insights into each types perceptions of team processes.

The Decision Styles

The decision style comparison provided some insight into the differences between the decision styles. Overall, the mean scores from the SFs indicated that they were more concerned with the interpersonal relationship aspects of team process than the other decision styles. Conversely, the mean scores of the STs and the NTs reflected their more impersonal perspective towards interpersonal relationships in regards to team processes.

Conclusion 7: Subsidiary Question 5

Were there any differences of opinion on the post-game survey between the male and female subjects?

There were many statistically significant differences between the mean scores of the male and female subjects. In this case, the differences found do not appear to be due to type-related differences between the subjects. The most frequently reported female MBTI personality preferences were extraversion, sensing, thinking, and judging, and the males most frequently reported MBTI personality preferences were introversion, sensing, thinking, and judging. Thus, the preferences between the male and female subjects are almost the same. The differences in opinion between the male and female subjects may be due to the relatively small sample investigated.

Recommendations

The recommendations which follow denote the fact that more research is needed in this area before any firm conclusions as to the utility of forming teams by dissimilar MBTI personality types can be made. Recommendations are first made to improve both the experimental design and the post-game survey. Further recommendations are made for the possible applications of this research and further follow up research in this area.

Recommendation One: The Experimental Design

Overall, the experiment could have benefitted from a larger sample size so that more precise determinations could be made as to the utility of using the MBTI to form teams. This research was accomplished at the alpha of .1. Completing further research with a larger sample size and using an alpha level equal to .05 would contribute to more specific results.

It is also recommended that for future research the following adjustments be made:

A. There would be more visible results if the TEMPO teams were constructed so that there were similar personality types on one team and dissimilar types on the other team. If the dissimilar type teams scored significantly higher than the similar type teams, then appropriate conclusions could be made.

B. There should be another control team to account for all of the treatment variables of dissimilar personality types and the MBTI introduction. The MBTI introduction and self disclosure of the subjects may have had some team building characteristics which may have effected the teams.

C. Research should be conducted with a game simulation which has independent scores for each team. Problems associated with determining scores from the TEMPO game may be avoided. Also, a different simulation game should be used which requires many different contributions from the team members so that no personality type is favored over any other.

Recommendation Two: The Survey

A. The control teams should take the survey to determine how group process attributes' importance and presence are related to allow for more meaningful comparison between the control and treatment groups.

B. The surveys should be tracked to each team, so that responses may be examined in light of team performance.

Recommendation Three: Suggestions for Future Research

The offensive to defensive util ratio and the other TEMPO performance parameters indicate that the treatment teams had higher scores during the first five TEMPO years of play than the control teams did, even though the results were not statistically significant. Another point which

should not be omitted, is that the control and treatment teams both had the same amount of time in which to make their decisions for each TEMPO year of play.

There are a couple of possible explanations for this trend. First, several of the survey respondents reported that the MBTI introduction had served as a good ice breaker for the teams when they first got together. It is possible that the MBTI introduction and disclosure of MBTI personality types allowed the teams to move more efficiently through the first stages of their teams' development, thus allowing them to initially make better decisions than the control teams. Then as the initial stages of team development were completed, the control teams caught up to the level of team development that the treatment teams had achieved and made equally good decisions for the rest of the game.

Another plausible explanation for these results is that as the time pressure increased during the course of the game, the treatment groups began to forget about type concepts and reverted back to their old ways. That may give reason as to why the control teams caught up with the treatment teams in the middle of the game.

Because the treatment teams had higher scores than the control teams and in light of the above explanations the following are possible areas for future research:

A. It is recommended that units or teams be formed at SOS, OTS, and the Air University by dissimilar MBTI

personality types to see what influence this has on the unit or team's performance as they progress through the schools.

B. It is also recommended that the Air Force Wargaming Center form teams for its game simulations based upon dissimilar personality types to see if any improvements take place during their war gaming exercises.

C. It is recommended that future researchers experiment with having a more intensive lesson on the MBTI for their game participants to see what effect this might have on team decision making. Several TEMPO participants expressed the desire to have more instruction on the MBTI to make the knowledge useable.

Recommendation Four: Applications of the Research

A. The Air Force spends large sums of money each year on consultants who work to improve team processes. The group process attributes which this research identified as possibly being deficient could provide areas of team process which the consultants could focus on. It is recommended that the results of this research and future research in this area be provided to team building consultants to increase the effectiveness of teams throughout the Air Force.

Summary

This chapter presented the conclusions based upon the results from Chapter IV and recommendations to improve the

experimental design and post-game survey. Further recommendations were made for future research and applications of the conclusions of this research.

Appendix A. The Survey Instrument

MBTI EXERCISE SURVEY

This is a survey about your perception of how the MBTI contributes to the team process. Your responses will be used for research purposes. Your participation will be appreciated.

DIRECTIONS

On the accompanying answer sheet, enter your four letter MBTI designation (i.e.; ENTJ, ISTP, etc.) in the first four blocks of the Last Name column. Enter the first letter of your sex in the Middle Initial column.

Please indicate your reaction to the following statements using the following alternatives.

Strongly Agree 7	Agree 6	Mildly Agree 5	Neither Agree or Disagree 4	Mildly Disagree 3	Disagree 2	Strongly Disagree 1

1. It is important to feel like a member of a team.

2. "Feeling as a team member" was present among my team.

3. The MBTI helped me to be a team member during the exercise.

4. Effective communication among team members is essential to team performance.

5. Effective communication was present among my team during the exercise.

6. The MBTI helped me communicate effectively with other members of my team.

7. In order for a team to be effective, it is important to know the personality characteristics of other team members.

8. My team knew the personality characteristics of the other members.

9. The MBTI helped me to know the personality characteristics of the other team members.

10. It is important to be considerate of the needs of other team members.

11. My team members were considerate of each other.

12. The MBTI helped me to be considerate of the members of my team.

13. When teams make decisions, it is important to hear the opinions and views of other team members.

14. My team made sure the opinions and views of each member were heard.

15. The MBTI helped me to hear the opinions and views of all team members.

16. For effective team decision making, it is important to reduce interpersonal conflict.

17. My team made sure the amount of interpersonal conflict was reduced.

18. The MBTI helped me to reduce the amount of interpersonal conflict.

19. It is important to understand all team members' decision making styles so that more effective decisions may be made.

20. My team understood all members' decision making styles.

21. The MBTI helped me to understand my team members' decision making styles.

Please write and number your comments to the following questions on the back of the answer sheet.

1. Do you feel the MBTI was useful to help you be more comfortable while getting to know the other members of your team?

2. Did the MBTI help to make other team members more aware of your personality characteristics?

3. Do you feel good about the manner in which team decisions and strategies were reached?

4. Do you feel that the MBTI facilitated a better team atmosphere?

5. How did your MBTI type help serve your team?

6. How did your MBTI type detract from your team?

7. Are there other comments about the MBTI or the exercise you would like to offer?

Thank you for your time and effort in completing this survey. An Executive Summary of this research will be prepared sometime in late 1991. If you want to receive a copy of the summary, print your name and address on the back of the answer sheet.

Appendix B: The TEMPO Instructions

TEMPO MILITARY PLANNING GAME*

Rules and Suggestions for Players

*The TEMPO Game was developed by H. Hatry, F. Jackson, and P. Lever of TEMPO's Economic Analysis Section and is fully described in SP-174, May 1962, TEMPO, General Electric Company, Santa Barbara, California

GENERAL DESCRIPTION

Two teams are required for a play of the game. Teams start with identical forces and budget. The budget can be spent on (1) operation of existing forces; (2) procurement of additional forces; (3) research and development; (4) intelligence and counter-intelligence.

All weapon systems are divided into four classes: Offensive A, Offensive B, Defensive A, Defensive B.

Each weapon system is worth a certain number of "utils" per unit. The "util" is a measure of effectiveness which has been assigned to each system in order to simplify game play.[1].

In simple terms, the aim of the game is to maximize your team's net offensive utils.[2] A sample calculation is shown on page 2.

Utils are received only for forces currently being operated.

Defensive A can only defend against Offensive A and similarly for "B" weapons. However, any Defensive A system counts against any Offensive A weapon, and likewise for B systems. Thus, defensive utils in DB2 are counted as defensive against OB1, OB2, etc.

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[1] Although determining the "effectiveness" of weapons is often the most difficult part of military planning, this gross simplification permits the players to concentrate on budget allocation problems.

[2] In reality, the objective is more complex than this statement suggests. The game is played for an undetermined number of periods and maximizing utils for any one year will conflict with maximizing utils in other years. In addition, the game is an educational device, and therefore, the real aim is to learn something about military planning and limited budgets. Other complications will become apparent during the play of the game.

DETAILED RULES

1. Starting the game. At the start of play each team will be given:

   a. A number of Force Information Sheets (FIS). The first set of FIS provides a current inventory of four systems plus estimates of R&D costs and utils of new systems. [See Enclosure 1.]

   b. Two copies of a Budget Allocation Form [see Enclosure 2]. One copy will be returned to the umpire at the end of the first period and one copy will be retained by the team.

2. Research and Development

   a. Each team will receive a "first FIS" on all new systems or modifications of old systems during various years of play. This first sheet will provide expected R&D, procurement and operating costs, and expected utils per unit. Note that all values are estimated and may change as R&D progresses.

   b. Additional R&D sheets will be provided only when a team completes the previous R&D.

   c. R&D may be discontinued at any time and resumed at a later date with a penalty payment of $300 or one-half of the last current year R&D cost, whichever is the smaller.

   d. Information on costs and utils pertaining to the last year of R&D can be treated as certain. Note that for one-year R&D programs the first year is the last. Therefore, no further R&D sheets or changes in information are to be expected.

3. Modifications. Some FIS will provide information about the possibility of modifying existing systems. A modification involves the following special rules:

   a. During the year of modification R&D, existing force units may be modified at the cost given in the FIS.

b. The old units may be operated at their old costs and values during the modification year or moth-balled during modification.

c. After modification R&D is completed, additional units of the modified system can be procured at a time cost equal to the procurement cost of the old system plus the modification costs for the modified version.

4. Procurement. A team may procure units of any system which is in inventory and any new system during the last year of R&D and thereafter at any rate not exceeding the maximum acquisition rate stated on the FIS.

5. Operation

a. A team may operate any or all forces in inventory at the start of a year. Units procured during one year are available the next year.

b. A team may operate units undergoing modification during the year of modification at the old costs and utils.

c. Force units not operated in any one year will be assumed to have been scrapped. (You cannot "moth-ball" old units.) However, those units being modified in any year may be withdrawn from operation for that one year if desired.

6. Intelligence. Each team may procure intelligence about the posture of the opposing team in four categories at a cost of $100 per category. The categories are:

a. Current changes in force structure of offensive forces.

b. Current changes in force structure of defensive forces.

c. Current changes in R&D programs of offensive forces.

d. Current changes in R&D programs of defensive forces.

No credit is given for over-defending, i.e., defensive utils in excess of the offensive utils of the enemy.[3]

After a total of 2000 utils in any force unit type, such as OA2, is obtained, further utils are discounted in a sliding scale. Thus, if team "X" has 3500 utils in OA2, their actual util credit for that weapon is 3300.

New weapon systems do not displace or devaluate old systems. All units have the same util value throughout the play.

[3] However, 20% of defensive utils in one system over the number necessary to "neutralize" the opposing team's offensive utils will be credited to the defensive posture of the other systems when deciding the result of the war.

A Sample Calculation

Total net offensive utils for each team are calculated as follows:

Total Offensive A utils minus opposing team's Total Defensive A utils

PLUS

Total Offensive B utils minus opposing team's Total Defensive B utils

EXAMPLE:

OAx	2000	OAy	1500
DAy	2500	DAx	1000
(OAx - DAy)	-500	(OAy - DAx)	+500
DBy overdefense (if any)	0	DBx overdefense (if any)	0
Difference[1]	-500	Difference	+500
Net OAx	0	Net OAy	+500
OBx	1000	OBy	1500
DBy	500	DBx	1200
(OBx - DBy)	+500	(OBy - DBx)	+300
DAy overdefense (if any)	-100	DAx overdefense (if any)	0
Difference	+400	Difference	+300
Net OBx	+400	Net OBy	+300

Total net offensive utils for Team X = Net OAx + Net OBx = 0 + 400 = 400

Total net offensive utils for Team Y = Net OAy = Net OBy = 500 + 300 = 800

[1] Net offensive utils are zero if difference is negative

In addition counterintelligence may be purchased at a cost of $200. When purchased this results in less accurate intelligence being given to the opposing team on force structure, offensive and defensive, if they purchased intelligence that year.

7. War. During each and every period of play there will be a probability of war. If war occurs, the results in terms of net offensive utils will be announced by the umpires.

8. Penalties.

   a. If war occurs, each team will have $400 cut back from its next year's budget.

   b. The loser's budget will be cut by an additional amount equal to the difference between the two teams' net offensive utils. (see GENERAL DESCRIPTION).

   c. If a budget allocation sheet is not submitted exactly on time, the late team will be penalized at the rate of $50 per minute for the first five minutes, $100 per minute over five minutes. The penalty will be subtracted from the next budget.

   d. A team that overexpends its budget will have its following budget cut by twice the amount of the overexpenditure.

   e. Funds not expended in any one year are lost.

Appendix C. Subsidiary Research Question One

The Index of Dissimilarity

The index of dissimilarity was designed to reflect the degree of dissimilarity or similarity of MBTI personality types present on a team. This index was computed for all of the teams that had type information available. Table C1 will provide a reference for the explanation of the index's formulation.

Table C.1

The Index of Dissimilarity

Team 1X From 8 January TEMPO Game						
TYPE	TYPE DIFFERENCES					
1ENTJ						
2ESTJ	1					
3ISTJ	2	1				
4ESTP	2	1	2			
5ISFJ	3	2	1	2		
6ENFP	2	3	4	3	3	
	10 +	7 +	5 +	5 +	3	= 32

This index was arrived at by comparing the first subject's MBTI type preferences (ENTJ) with the type preferences of the second member of the team (ESTJ). In this example, the first team member prefers intuition and the second member prefers Sensing, therefore the difference

between the two types is one. The one to the right of the ESTJ reflects this difference. Each type is compared to the other types on the team and the sum of the differences is computed for each. For this team, the index of dissimilarity is equal to 32. The higher the index of dissimilarity, the more heterogeneous the team's personalities are, and the lower the index, the more homogeneous the team's personalities are. This index was created for this research effort and has not been used before to the author's knowledge.

The index of dissimilarity is only ordinal level data (78). Drew characterizes ordinal measurement as "the ability to rank order events on the basis of an underlying continuum" (21:214). Because this data is ordinal level, the statistical tests conducted on it were limited to nonparametric methods of analysis. The nonparametric assumptions were not as stringent as the parametric assumptions.

The Rank (Spearman) Correlation

The Rank (Spearman) Correlation coefficient (R) is a descriptive statistic which indicates the "degree of association between the sample pairs of observations" (29:274). When R is equal to one there is perfect direct agreement between the two variables, and when R is equal to minus one there is perfect inverse disagreement between the two variables. Gibbons explained that:

> Perfect agreement means that large values of one variable are associated with large values of the other, and small values are likewise associated. Such an association might be called direct since the variables are moving in the same direction. In an inverse relationship the variables move in opposite directions; that is, large values of one variable are associated with small values of the other, approaching perfect disagreement. (29:277)

When R is equal to zero this indicates that there is no agreement or disagreement between the two variables and that consequently there is no association between the two variables. The Rank (Spearman) Correlation is a nonparametric method for determining the degree of correlation between two variables.

Procedure

The index of dissimilarity was computed for all of the teams which met the following two criteria: (1) Each team had exactly six people on the team, and (2) each team member's personality types were available for analysis. The index was computed for both control and treatment teams. First, the Rank (Spearman) Correlation coefficients were calculated for all three TEMPO performance parameters. The results of these tests are summarized in Table C2. The offensive to defensive util ratios exhibited the greatest direct association, so the Rank (Spearman) Correlation coefficient was calculated for each TEMPO year of play to see if there were any trends.

Table C.2

Rank (Spearman) Correlation Coefficients for TEMPO Performance Parameters

Performance Parameter	R
Offensive / Defensive Util Ratio	.1947
Offensive Utils	-.0863
Total Offensive and Defensive Utils	-.3673

Offensive/Defensive Util Ratio The coefficient was calculated to be equal to .1947, which indicates that there is a very slight direct association between the index of dissimilarity and the offensive to defensive util ratio. There is a small degree of correlation between the two variables.

Offensive Utils The coefficient was calculated to be equal to -.0863, which indicates a very minor inverse association between the index of dissimilarity and the teams offensive util scores. For all practical purposes this R value is so small that it indicates no relationship.

Total Offensive and Defensive Utils The coefficient was calculated to be equal to -.3673, which indicates a small inverse relationship between the index of dissimilarity and the teams total offensive and defensive util scores.

Play by Play Offensive to Defensive Util Ratio The results of the Rank (Spearman) Correlation coefficients for the TEMPO play by play offensive to defensive util ratios and the index of dissimilarity are summarized in Table C3. The results indicate that there are no strong association relationships between the ratio and the index. However, there is a slight direct association present after year five which increases through year ten.

Table C.3

The Rank (Spearman) Coefficient Correlations for Play by Play Offensive to Defensive Util Ratios and the Index of Dissimilarity

Tempo Year	R
1	-.1372
2	.3761
3	.0265
4	-.6955
5	.0774
6	.3363
7	.1018
8	.2810
9	.2699
10	.2494

Appendix D. Survey Mean Scores By Type

Table D.1

The MBTI Types' Means for the Importance of Group Process Attribute Questions on the Post-Game Survey

Survey Mean And Importance Group Process Attribute Questions	ISTJ	ESTP	ESTJ	ISFJ	ENFP	ENTJ
1 6.289 Team Member	6.087	6.600	6.000	6.750	6.750	6.222
4 6.474 Communication	6.565	7.000	6.067	6.750	6.500	6.556
7 4.5 Know Others	4.261	4.400	4.333	3.750	5.750	5.000
10 6.026 Considerate	6.000	6.400	5.733	6.500	6.500	6.000
13 6.145 Hear Opinions	5.957	6.800	6.200	6.500	5.750	6.111
16 5.658 Reduce Conflict	5.522	6.000	5.533	5.500	5.500	5.889
19 4.645 Decision Styles	4.435	4.800	4.733	5.000	5.250	4.667

Table D.2

The MBTI Types' Means for the Presence of Group Process Attribute Questions on the Post-Game Survey

Survey Mean And Presence of Group Process Attribute Questions	ISTJ	ESTP	ESTJ	ISFJ	ENFP	ENTJ
2 6.053 Team Member	5.696	6.200	5.800	6.250	6.500	6.222
5 5.908 Communication	5.826	6.600	5.533	5.750	5.500	6.889
8 4.882 Know Others	4.565	4.200	5.067	5.500	4.500	5.556
11 6.118 Considerate	6.130	6.400	5.800	6.500	6.500	6.222
14 5.553 Hear Others	5.391	5.800	5.400	6.250	5.250	5.667
17 5.355 Reduce Conflict	4.913	6.200	5.333	6.000	5.000	5.444
20 3.987 Decision Styles	3.913	4.200	4.133	3.000	4.250	4.111

Table D.3

The MBTI Types' Means for the MBTI Questions on the Post-Game Survey

Survey Mean And MBTI Questions	ISTJ	ESTP	ESTJ	ISFJ	ENFP	ENTJ
3 3.553 Team Member	3.261	4.400	3.400	2.750	4.000	3.556
6 3.579 Communication	3.304	4.8	3.333	2.75	3.75	4.0
9 4.461 Know Others	4.043	4.2	4.667	3.5	4.0	5.111
12 3.868 Considerate	3.826	4.2	3.6	2.75	3.75	4.667
15 3.855 Hear Opinions	4.0	4.4	3.4	3.0	4.25	4.444
18 3.737 Reduce Conflict	3.348	4.2	3.8	3.25	4.0	4.444
21 3.724 Decision Styles	3.565	4.2	3.933	2.75	4.25	3.556

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13. ABSTRACT *(Maximum 200 words)*

This experimental study attempted to prove that teams formed with dissimilar personality types would have better decision making than teams which were not formed by dissimilar types.. The Myers-Briggs Type Indicator, based on Jung's Theory of Psychological Type, was used to determine the subject's personality type preferences. Subjects' perceptions of team processes were also investigated. The sample population consisted of military officers and civil servants who attended the Advanced Program Management course at the Air Force Institute of Technology. Decision making effectiveness was determined from team performance on the Time-by-Event-by-Member-Pattern-Observation system (TEMPO). The design for this research consisted of comparing the scores from teams formed by dissimilar MBTI personality types to scores from teams which were not formed by dissimilar MBTI personality types. The T-test was used to determine the differences between the teams' mean scores at an alpha equal to .1. The research concluded that teams formed by dissimilar MBTI personality types were statistically no more effective than teams formed without the MBTI; however, the teams formed by dissimilar MBTI personality types did score higher than the teams that were not formed with the MBTI.

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