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EFFECTS OF REWARD INTERDEPENDENCE ON TEAM PERFORMANCE: A PROCESS APPROACH

By

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ABSTRACT

EFFECTS OF REWARD INTERDEPENDENCE ON TEAM PERFORMANCE: A PROCESS APPROACH

By

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A lab study of 80 3-person teams was conducted to examine the process in which positive reward interdependence influenced team performance of interdependent tasks. At the individual level, positive reward interdependence was found to have a positive effect on members' cooperative orientation and a negative effect on their competitive orientation. In turn, cooperative orientation had a positive influence on individual teamwork effort, and competitive orientation had a positive effect on individual taskwork effort. At the team level, positive reward interdependence was found to have a positive effect on teamwork effort and a negative effect on taskwork effort. Teamwork effort and taskwork effort subsequently had independent positive influences on team performance. The effect of taskwork effort was, however, moderated by the level of task interdependence. Implications of the findings for how to reward teams were discussed.

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INTRODUCTION

Salience of Team Rewards

Teams are increasingly organized as primary work units within organizations (Guzzo & Dickson, 1996). One survey by Fortune magazine estimated that half of America's largest companies were experimenting with teams (Dumaine, 1990). Another survey by Lawler, Mohrman, and Ledford (1992) reported 51 percents of Fortune 1,000 companies had more than 20 percents of their employees in teams. The number increased to 68 percents in a follow-up survey (Lawler, Mohrman, & Ledford, 1995).

As the usage of teams as work units becomes more widespread, organizations find that individually based reward systems do not necessarily support a team-based approach to organizing work (Zingheim & Schuster, 1997). As a result, more organizations are moving toward using team-based pay systems, in which a portion of an individual's pay is contingent on the performance of his/her team. Lawler et al. (1995) reported that from 1990 to 1993 the percentage of organizations using team-based pay plans covering at least 20 percents of the workforce increased from 22 to 31 percents. The percentage covering over half of the workforce rose from 12 to 17 percents. Gross (1995) reported in another survey that 51 percents of companies had group-based rewards or were considering implementing them. The trend for group-based reward is continuing as many organizations adopt the practice (Zingheim & Schuster, 1997).

As team-based rewards become more prevalent, organizations face the challenge of determining how to pay individuals in a team-based environment (Guzzo & Dickson, 1996). Under team-based reward system, a team receives a reward or bonus contingent on its performance. Higher team performance is typically awarded with a higher reward.

The critical issue organizations are facing is how to distribute the team reward among team members. Two methods of reward distribution are often used. One is to distribute the reward equally, regardless of their individual contributions. The other is to divide the reward differentially, contingent on individual contributions. When team reward is divided differentially, the question then becomes how differentially the reward should be divided.

A Brief Review of Team Reward Literature

Research literature on team reward methods has relied heavily on the theory of cooperation and competition (Deutsch, 1949; Deutsch, 1985) and its conceptualizations of reward interdependence. According to this theory, positive reward interdependence exists when team members' rewards are positively correlated. With positive reward interdependence, team members sink or swim together. An example is the situation in which members of a basketball team share the prize equally when they win a tournament. Negative reward interdependence is present when team members' rewards are negatively correlated. As one member gains, other members lose in this type of reward distribution. An example is an arrangement in which only the best salesperson is given the team bonus when the sales team achieves its performance target. Reward independence exists when team members' rewards are only contingent on individual contributions and independent of other members' rewards.

The main finding of team reward research is that for interdependent tasks positive reward interdependence results in better team performance than reward independence and negative reward interdependence (Cotton & Cook, 1982; DeMatteo, Eby, & Sundstrom, 1998; Deutsch, 1949; Gordon, Welch, Offringa, & Katz , 2000; Johnson & Johnson,

1989; Johnson, Maruyama, Johnson, Nelson, & Skon, 1981; Miller & Hamblin, 1963; Slavin, 1982; Stanne, Johnson, & Johnson, 1999; Wageman & Baker, 1997). With a few exceptions (Gordon et al., 2000; Rosenbaum, Moore, Cotton, Cook, Heiser, Shovar, & Gray, 1980; Wageman & Baker, 1997), most studies operationalized positive reward interdependence as equal division of rewards among team members. Negative reward interdependence was studied as a winner-take-all or high-differential reward distribution in which members' rewards are negatively correlated (winner-take-all is often the case). Reward independence is operationalized as individual-based distribution (also called reward independence or individualistic reward distribution) in which members are rewarded in proportion to their performance independent of the team performance.

Most studies in the team reward literature explained the effect of reward interdependence through its impact on teamwork processes, defined as behaviors directed toward the team members (Ilgen & Sheppard, 1999). In a review of hundreds of studies, Johnson & Johnson (1989) reported that the main reason for the superior performance of positive reward interdependence is that it promotes helping behaviors, resource and information exchange, constructive feedback, constructive approach to conflicts, mutually supportive behaviors, acting in a trusting and trustworthy way, and positive mutual influence. With a few exceptions, the effect of reward interdependence on taskwork behaviors, defined as behaviors directed toward the task (Ilgen & Sheppard, 1999), has been ignored.

In our view, the finding that positive equal reward distribution is more effective than reward independence and negative reward interdependence is of limited significance. Negative reward interdependence such as winner-take-all distribution is at

the extreme end of the reward distribution spectrum. It is very competitive in nature and counter-productive in many situations. It is what Mischel (1973) called the strong situation. In the strong situation, individuals likely exhibit uniform behaviors in order to cope the demanding nature of the situation. Under a winner-take-all reward system, team members are likely extremely competitive and destructive to one another, leading to great decrement in the team performance of an interdependent task. Individualistic reward distribution is also highly competitive, though to a lesser extent. It was known as ineffective for rewarding teams early on in many organizations (Zingheim & Schuster, 1997; Hackman, 1998). With the finding that equal reward distribution is more effective than these two types of highly competitive reward distributions, the question of how to distribute team reward largely remains. The finding only indicates that equal reward distribution is superior to reward systems that focus only on individual performance. It does not necessarily say that equal reward distribution is the most effective and organizations should use it to reward team members.

For many interdependent tasks, team performance is likely influenced by both teamwork and taskwork behaviors (Salas, Dickinson, Converse, & Tannenbaum, 1992). It follows that an effective reward distribution should not only promote teamwork behaviors but also stimulates individual task performance. Because a mix reward system in which a portion of the reward is distributed equally and the rest is distributed proportionally has cooperative as well as competitive components, four studies (Gordon et al., 2000; Rosenbaum et al., 1980, Study 2 and 2a; Wageman & Baker, 1997) have attempted to study its effect.

Two lab studies conducted by Rosenbaum et al. (1980) examined the effects of mixed reward structures for a tower-building task. In one study, 60 3-member teams of college students were assigned to five reward conditions that varied in the portion of equally distributed team rewards (100%, 80%, 50%, 20%, and 0%, respectively) and the portion of proportionally-distributed team rewards (0%, 20%, 50%, 80%, and 100%, respectively). The results showed that the equal reward distribution (100% of team reward was distributed equally) led to higher team performance than all other reward distributions, which did not differ from one another. The second study was designed the same way as the first except that the competitive element of the mixed reward distribution was changed from proportional distribution to the distribution in which the highest performer of the team was rewarded proportionally for his/her contribution while other team members were not rewarded. The results indicated that equal reward distribution outperformed the 50-50 mixed reward distribution and the extremely competitive 0-100 reward distribution. However, it did not differ from the 80-20 and 20-80 mixed reward distributions.

In Gordon et al. (2000)'s study, 32 3-member teams of mostly college students worked under mixed and equal reward distributions on a simulation game in which team members interacted to manipulate garbage trucks to collect trash in a city. In the equal reward condition, the team reward was distributed equally. In the mixed reward condition, 50 percent of the team reward was distributed equally, and the rest was divided proportionally. The results showed that the reward conditions did not result in different levels of team performance.

Wageman and Baker (1997) examined 56 2-members teams' performance on an interdependent task of correcting technical writing syntax errors, using a 3 (reward interdependence) X 3 (task interdependence) design. Reward interdependence varied from high (an equal distribution) to medium (a mixed reward distribution in which half of the team reward was distributed proportionally and the rest was divided equally) to low (a proportional distribution). The task was designed so that a member of the team had to depend on the other's knowledge and assistance to complete his/her assigned team subtask. Task interdependence was manipulated by varying the portion of errors a team member could correct by his/her own knowledge from 50 percent (high interdependence) to 67 percent (medium interdependence) and to 100 percent (zero interdependence). The results showed that reward and task interdependence interacted to influence team performance. For the high-interdependent task, equal reward distribution was most effective. For the moderate interdependence task, the mixed reward distribution was most effective. For the independent task, the proportional distribution was most effective.

If different mixed-reward systems can be considered as representing different levels of positive reward interdependence, the results of the four studies reviewed above suggested that the effect of positive reward interdependence on team performance is rather complex. Rosenbaum et al.'s (1980) first study showed that team performance at the very high level of positive reward interdependence (100-0 mix) is higher than those of lower levels of positive reward interdependence, which did not differ statistically. Operationalizing positive reward interdependence differently, their second study indicated that team performance changed in a non-linear way across different levels of

positive reward interdependence. It was high at the very high level of positive reward interdependence (100-0 mix), and it was still high at the high level of positive reward interdependence (80-20 mix). However, it dropped at the moderate level of positive reward interdependence (50-50 mix). It then went back to high at the low level of positive reward interdependence (20-80 mix), and it dropped again at the very low level of positive reward interdependence (0-100 mix). Gordon's (2000) indicated that team performance at the very high (100-0 mix) and moderate (50-50 mix) levels of positive reward interdependence did not differ. Wageman and Baker's (1997) study added a new complexity to the relationship of positive reward interdependence and team performance by considering the levels of task interdependence. For high interdependence task, team performance decreased as positive reward interdependence changed from very high (100-0 mix) to moderate (50-50 mix) to very low (0-100 mix). For low interdependence task, team performance, however, increased when positive reward interdependence changed from very high level (100-0 mix) to moderate level (50-50 mix). It decreased when positive reward interdependence changed from moderate level to very low level (100-0 mix).

Taken together, these studies suggest that the effect of positive reward interdependence on team performance likely depends on the operationalization of positive reward interdependence and the level of task interdependence. Although this conclusion is based on a small number of studies, it is critical to ask why the effect of positive reward interdependence on team performance varies.

To date, our knowledge of the process in which positive reward interdependence affect team performance have been very limited. Wageman & Baker (1997) assumed that

equal reward distribution facilitates teamwork activities on the one hand, but it induces free-riding among team members on the other. These assumptions, however, were not tested in their study. Rosenbaum et al. (1980) and Gordon (2000) attempted to explain the effect of positive reward interdependence through teamwork behaviors. Like most studies in team reward research literature, their approach was to manipulate the reward distribution and then measured performance and teamwork behaviors at individual and/or team levels. The relationships of reward interdependence to team performance and teamwork behaviors were subsequently analyzed by comparing the aggregated means at the contextual (reward) level using ANOVA or linear regressions. Such an approach had a number of limitations. In term of the content, it has largely ignored the effect of positive reward interdependence on taskwork behaviors as important mediators. Because team performance of an interdependent task is likely influenced by both teamwork and taskwork behaviors (Salas, Dickinson, Converse, & Tannenbaum, 1992), failure to examine taskwork behaviors is a critical limitation in our view. In term of data analysis, the reward-level analysis treats team-level and individual-level variances as measurement errors that should be ignored. We think this is also a serious limitation because it is important to know how individuals and teams react differently under the influence of the reward system. By ignoring individual and team differences, researchers missed the opportunity to examine other factors that may interact with positive reward interdependence to influence team and/or individual-level behaviors.

Proposed Model of Team Reward Effects

Given the salience of the question of how to reward team members and the limited knowledge of team reward effect, the purpose of the current study is to examine

the mediating processes through which positive reward interdependence influences team performance on interdependent tasks at the multiple levels of analysis. The model explaining the process is depicted in Figure 1. To facilitate the reading of the model, contextual factors are depicted by the boxes with broken borders; the individual-level factors are represented by the boxes with regular borders; and the team-level factors are described by the boxes with bolded borders. According to the model in Figure 1, positive reward interdependence influences team performance through psychological and behavioral mechanisms. Specifically, positive reward interdependence affects team members' competitive and cooperative orientations. Member's orientations and task interdependence influence team members' expressed behaviors conceptualized as individual teamwork effort and taskwork effort. The individual-level behaviors are assumed to combine to give rise to the team-level teamwork effort and taskwork effort, which are also affected by task interdependence. Together, teamwork effort and taskwork effort influence team performance, but their effects are moderated by task interdependence. (From this point on, please note that team-level teamwork effort and taskwork effort would be simply referred as teamwork effort and taskwork effort, respectively; the analogous constructs at the individual level are referred as individual teamwork effort and individual taskwork effort).

The constructs in the model and their relationships, other than positive reward interdependence, are further elaborated in the remaining sections of the Introduction. Specifically, the constructs are going to be defined. The relevant literature is reviewed.

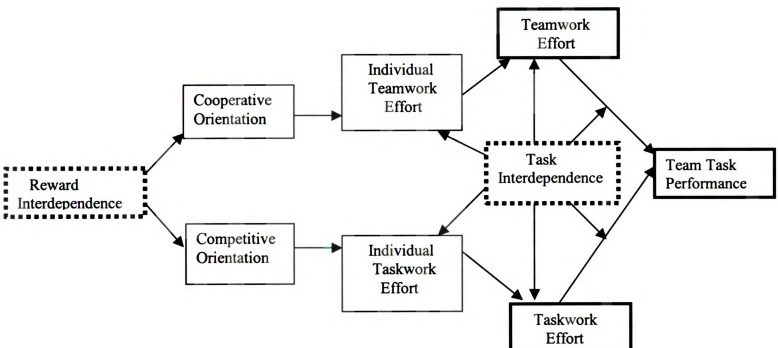

Figure 1: Effects of Reward Interdependence on Team Performance: A Process Approach

Because team behavior and function is a multilevel phenomenon (Kozlowski & Bell, 2003), we think it is important to first clarify the level of analysis in order to facilitate the discussions of the constructs that follow.

Multilevel Consideration

Team characteristics and processes must be regarded as a multilevel phenomenon (Kozlowski & Bell, 2003). Teams are composed of team members. They do not think, feel, or behave; team members do (Kozlowski & Bell, 2003). Teams live in a context and are influenced by the context's characteristics. Within such a context, team members interact and influence one another. Their interactions and mutual influence give rise to emergent properties of the team and can change the characteristics of the surrounding context. Because team characteristics and processes exist at individual and team levels within a context, it is critical that team research must have an explicit multilevel consideration. The level consideration suggests that the constructs, their measurements, and data analysis need to be aligned so that the conclusions about the constructs' relationships can be properly inferred (Kozlowski & Bell, 2003).

In our model, positive reward interdependence and task interdependence are contextual factors. Positive reward interdependence is expected to influence team members' psychological states, conceptualized as cooperative and competitive orientations. These psychological states and task interdependence were expected to influence team member behaviors as reflected in individual teamwork and taskwork effort constructs. The linkage between reward and task interdependence, team members' psychological states, and behaviors therefore could properly be analyzed at the individual

level nested within teams. HLM is an appropriate data analytic technique (Bliese, 2000; Hoffman, Griffin, & Gavin 2000; Bryk & Raudenbush, 1992).

As indicated in the model, individual teamwork effort and taskwork effort are assumed to give rise to teamwork and taskwork effort at the team level. Because the process of deriving team-level behaviors from team members' behaviors is largely guided by appropriate logics--not so much by empirical evidence--the relationship between individual-level teamwork effort and team-level teamwork effort as well as the relationship between individual-level taskwork effort and team-level taskwork effort would not be tested.

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At the team level, positive reward interdependence and task interdependence were hypothesized to influence teamwork effort and taskwork effort. In turn, teamwork effort and taskwork effort were expected to influence team task performance, but their effects were moderated by task interdependence. Because reward and task interdependence are contextual factors and because teamwork effort, taskwork effort, and team task performance are team-level constructs, analyses of the relationships among these constructs could properly done at the team level with multiple regressions.

Task and Task Interdependence

In team studies, it is important to specify the nature of the task to establish the necessary boundary conditions (Kozlowski & Bell, 2003). The task we addressed in this work has two distinguishing characteristics. First, the task can be broken down to relative independent components, which require specialized expertise to complete. Team members have specialized roles based on their expertise and are assigned the components that fit their expertise. Second, team members do not have the full knowledge and skills to complete all of their own component. They work on their own on the subcomponents that they have the knowledge for but need assistance from other team members for the components that they do not.

This form of task is common in many product planning and development teams. In order to speed the product to the market, the team task is broken down to relatively independent components so that they can be worked on in parallel in the interest of time. Components are assigned to team members who have the relevant expertise. Because a component often is too complex for one member to handle, he/she often needs assistance on the parts that he/she does not have the expertise. The components are brought together at regular intervals and configured into the team product. The team evaluates the product's progress and makes adjustment to the teamwork process. The cycle is repeated until the product meets certain criteria or the deadline they have to present it to the customers.

One important dimension of a task is task interdependence. Task interdependence is often defined as the extent to which team members must exchange information, resource, and expertise or actually work together to achieve their desired performance

(Cummings, 1978; Thompson, 1967; Van Der Vegt, Eman, Van De Vliert; 2001; Wageman & Baker, 1997). Many researchers (Bell & Kozlowski, 2002; Tesluk, Mathieu, Zaccaro, & Marks, 1998; Thompson, 1967) classified tasks by examining the workflow through which team members' inputs are combined to yield the team output. Tasks are frequently classified into four groups with increasingly complex workflows: pooled, sequential, reciprocal, and intensive interdependence (Bell & Kozlowski, 2002; Tesluk, Mathieu, Zaccaro, & Marks, 1998; Thompson, 1967). Pooled interdependence is a task in which subtasks are performed separately in any order. Sequential interdependence is a task in which subtasks are completed in pre-specified sequence. Reciprocal interdependence is different from sequential in that the reversals in the order of the workflow between any two team members are often required to complete the whole task. Intensive interdependence is the workflow in which team members have to interact with one another to get the task done.

Other researchers classified tasks by the manner in which team members' inputs are combined to yield the team output (Steiner, 1975). An additive task is a task in which members' inputs are added to form the team output. A disjunctive task is a task in which the input of the best team member is considered the team output. A conjunctive task is a task in which the input of the worst team member is evaluated as the team output. A complex task is the task that members' inputs are combined in a linear (regression weighting) or nonlinear way to form the team output.

In the current study, we define task interdependence as the degree to which team members must share materials, information, or expertise in order to achieve valued group outcome. Similar to Wageman and Baker (1997), this view of task interdependence

perceives task interdependence as the extent to which members have to depend on others for information, resource, and expertise for their task performance. Task interdependence increases when the task requires team members to depend more on one another's material, information, or expertise to complete the team task (Wageman & Baker, 1997). This conceptualization of task interdependence fits the intensive workflow described in Thompson's classification and the complex task described in Steiner's typology. It views tasks in terms of team members' resource interdependence. Further, it recognizes that the workflow and behavioral interactions within small teams tend to be complex and shifting and may not fit any pattern. With this view, task interdependence is a structural feature of work that constrains the level of behavioral interactions among team members. The behavioral interactions within team themselves are unspecified, and they likely change over time within teams and can be different between teams.

Cooperative and Competitive Orientations

According to theory of cooperation and competition (Deutsch, 1949, 1985; Johnson & Johnson, 1985), positive reward interdependence leads to cooperative orientation, whereas negative reward interdependence results in competitive orientation. Cooperative and competitive orientation are defined as situation-induced psychological states reflecting how team members perceive their outcomes are linked and how they likely respond to each other' behaviors (Deustch, 1985). Team members with a cooperative orientation perceive that their outcomes are positively linked, believing they swim or sink together. Effective actions by one member are expected to enhance other members' success while ineffective ones hinder it. They celebrate each other's success and commiserate each other's failure. Team members are cooperative and

psychologically open to the others' influences. On the other hands, team members with a competitive orientation perceive that their outcomes are negatively linked, believing one member' s win means others' losses. Effective actions by one member are expected to hinder other members' success while ineffective ones enhance it. They are distressed and at others' success and rejoice at other's failure. Team members are competitive and psychologically close to the others' influence.

Although Deustch considered cooperative and competitive orientations as two ends of a continuum (Deustch 1949, 1985), empirical evidence indicates that they are two separate dimensions. Based on Deustch's theory of cooperation and competition, the social interdependence scales (Johnson & Norem-Hebeisen, 1979) were developed to measure students' cooperative and competitive attitudes. Factor analyses of the data gathered from more than 6,000 students from kindergarten through college showed that cooperative and competitive attitudes were two orthogonal factors (Johnson & Norem-Hebeisen, 1979). Subsequent studies showed that the cooperative and competitive attitudes were unrelated (Onwueqbuzie & Daley, 1998; Bailey, Onwueqbuzie & Daley, 2000; Jones, Slate, & Marini, 1995).

While cooperative and competitive attitudes are less situation specific than Deustch's constructs of cooperative and competitive orientations, evidence gathered by more situation-specific measures also showed supports that cooperative and competitive orientations are two separate dimensions. Vegt, Emans, and Evert (1999) developed a measure of perception of goal interdependence, which we believe is a narrower measure of social orientation, to study the effect of goal interdependence on team performance.

Factor analysis of the data gathered with their measure resulted in two factors: negative and positive perceptions of goal interdependence.

As a result, in the present study we treated social orientation as two separate constructs: cooperative orientation and competitive orientation. We define cooperative orientation as a psychological state that predisposes an individual to cooperate and act mainly for the interest of his/her team. Competitive orientation refers to a psychological state that predisposes an individual to strive and act mainly to promote his/her own self-interest. According to our conceptualization, the competitive and cooperative orientations are relatively independent. In a given situation, one person can experience a high level of cooperative orientation and a high level of competitive orientation. Another person can be low on both dimensions. Another individual can experience a high level of cooperative orientation but a low level of competitive orientation. Still, another person can have a low level of cooperative orientation and a high level of competitive orientation. Consistent with theory of cooperation and competition, we predicted that

Hypothesis 1: Positive reward interdependence will have a positive effect on cooperative orientation.

Hypothesis 2: Positive reward interdependence will have a negative effect on competitive orientation.

Teamwork and Taskwork Effort

According to Bowers, Braun, and Morgan (1997) and Morgan, Salas, and Glickman (1994), team behaviors can be classified in two mutually exclusive and exhaustive categories of activities: teamwork and taskwork. Taskwork refers to a team member's activities directed toward the tasks and tools—the non-interpersonal

component of the task. It includes the behaviors traditionally associated with individual task performance. However, in an interdependent team, members must work together to perform the team task. Teamwork refers to interpersonal interactions among team members that are necessary for team goal setting, planning, exchanging information, coordinating actions, feedback, and work load balancing. Because of the interdependent nature of team tasks, team members often juggle the demands of teamwork with the needs to get their own task work done.

Teamwork Effort

Many taxonomies of teamwork have been proposed (Fleishman & Zaccaro, 1992; Hackman, 1987; Hackman & Morris, 1975; Marks, Mathieu, & Zaccaro, 2001; Prince & Salas, 1993; Weldon, Jehn, & Pradhan, 1991). For example, Hackman (1987) suggested six general categories of teamwork behaviors of an effective team. According to this classification, effective teams (1) minimize losses due to coordination and motivation (2) create a sense of team spirit, (3) consider the competency of individual team members, (4) encourage individual members to learn from one another, (5) maximize the efficiency of performance strategies, and (6) foster creative planning. Although these behavioral categories are descriptive, they do not provide detailed information concerning teamwork activities (Bowers et al., 1997). Based on their work in the TADMUS project, Smith-Jentsch, Johnston, and Payne (1997) identified four dimensions of teamwork behaviors: information exchange, communication, supporting behavior, and team initiative. They further specified dimensions at a more specific level of detail. For example, the information exchange dimension includes three specific behaviors: (1) seeking information from all available sources (2) passing information to the appropriate persons

before being asked and (3) providing overall situation updates. Although different teamwork taxonomies vary in content, specificity, and depth, they include behaviors and groups of behaviors that fall in three broad categories: coordination, cooperation, and communication (Kozlowski & Bell, 2003; Klimoski and Mohammed, 1994).

Empirical evidence shows that teamwork dimensions used in the team literature are highly correlated. For example, Marks, Sabella, Burke, and Zaccaro (2002) examined two important teamwork processes, coordination and backup behaviors, in a lab study. The correlation of these two dimensions was .65. In another lab study, Mathieu, Heffner, Goodwin, Salas, and Cannon-Bowers (2000) measured three dimensions of team process: coordination, cooperation, and communication. The mean correlations of the three dimensions over three measurement times were .49, .71, and .59, respectively. Factor analyses of the teamwork data in this study consistently showed the existence of a single underlying dimension for each of three measurements. As a result, the three dimensions were combined to form a single team process variable. Barrick, Stewart, Neubert, and Mount (1998) found similar results in a field study. The correlation of communication and team conflict was -.89. The correlation between communication and workload sharing was .67, and the correlation between workload sharing and team conflict was .78.

Because teamwork dimensions are highly correlated, we chose to treat teamwork as a unidimensional construct. Our purpose is to examine how different reward systems affect teamwork process as a whole. This treatment, we believe, is justified in light of the evidence of the high correlations of different teamwork dimensions.

Teamwork is often treated as a team-level construct (Ilgen & Sheppard, 2000). It emerges as a result of team members' interactions. The elements that give rise to

teamwork are team members' teamwork behaviors. Therefore, teamwork can exist at both team and individual levels. In this study, we define teamwork effort as the evaluation of the intensity of teamwork behaviors of a team against objective or subjective standards. Similarly, individual teamwork effort is the judgment of the intensity of a team member's teamwork behaviors against objective or subjective standards. Given the task we considered in this work, the team behaviors include the sharing of materials, information, and/or expertise by team members. The standard refers to the amount of material, information, and/or skills that members share. Although this variable can be considered as a team outcome variable, we treated it as process variable in this study because the acts of sharing material, information, and expertise contribute to team performance.

Taskwork Effort

For an interdependent task, a team needs both teamwork and taskwork to accomplish its task (Bowers et al., 1997; Morgan et al, 1994). Although taskwork is critical for task performance, it has been largely neglected in team research and especially in team reward literature. From a motivational perspective, taskwork can be distinguished conceptually by what the team chooses to do, how hard it works, and how long it persists. These three dimensions are parallel to direction, intensity, and persistence components of motivational outcomes (Kanfer, 1992). The direction dimension of taskwork refers to the types of task activities in which team members engage. The intensity dimension denotes how hard a team works at taskwork activities. The persistence dimension reflects a pattern of behaviors that a team exhibits over a long period of time (Kanfer, 1992). Because the intensity dimension refers to how hard a team

works and is likely be highly influenced by reward structures, it is the taskwork dimension of interest in our study. The direction and persistence of taskwork behaviors will be controlled in our study as teams are required to work for a prescribed period of time and their behavioral options are restricted.

We defined taskwork effort (the intensity dimension) as the evaluation of the intensity of task-relevant behaviors. It is typically referred as on-task behaviors and includes behaviors such as the usage of material, knowledge, and skill to work on the task. It does not include off-task behavior such as daydreaming or irrelevant web surfing. The standard of evaluation refers to the frequency or amount of such behaviors for a specific period of time. Taskwork effort is different from task performance, which is often used a proxy measure of task effort in many studies (Kanfer, 1992). Task performance is a measure of successful taskwork behaviors, whereas taskwork effort is a measure of task-relevant behaviors, which include both successful and failing attempts to do the tasks. Similar to teamwork, taskwork is often treated as a team-level construct (Ilgen & Sheppard, 2000). Taskwork effort at the team level emerges as a result of team members' task effort. Therefore, taskwork effort also exists at the individual level and can be defined as the evaluation of the intensity of a member's task-relevant behaviors according to a subjective or objective standard.

Determinants of Individual Teamwork and Taskwork

Theory of cooperation and competition (Deutsch, 1949; 1985) predicts positive reward interdependence leads to cooperative orientation and better teamwork processes than negative reward interdependence. Research evidence has largely supported these predictions. Johnson and Johnson (1989) reviewed hundreds of studies in a meta-

analysis. They found that positive reward interdependence led to more effective teamwork processes. The effect was attributed to the cooperative orientation of team members. It should be noted that most of team reward research examined individual-level data or aggregated data. They should be therefore considered as empirical evidence to evaluate individual-level relationships. Within the narrow range of positive reward interdependence, Rosenbaum et al. (1980) found that reward distributions that were approximately equal among team members led to more effective teamwork processes than different levels of mixed reward distributions. Therefore, we expected to replicate that cooperative orientation had a positive effect on individual teamwork effort and that positive reward interdependence had a positive effect on individual teamwork effort.

With a lower level of positive reward interdependence, reward distribution is likely more differential. Some team members receive higher levels of reward, whereas others get lower levels of reward. A high level of reward in terms of money is likely associated with higher valence than a low level of reward because of the instrumental and symbolic values of money (Stajkovic & Luthans, 2001). Money is instrumental in obtaining other goods and services that can fulfill physiological and psychological needs. Symbolically, because it is often associated with status in organizations, it can generate social comparisons about one's relative social standing (Stajkovic & Luthans, 2001). Thus, obtaining a high level of reward likely enhances the one's self-interest, whereas getting a low level of reward likely demotes one's self-interest. In a performing team, because more individual taskwork effort likely leads to better individual performance and a higher level of associated reward, we expected that competitive orientation had a

positive effect on individual taskwork effort and positive reward interdependence had a negative effect on individual taskwork effort.

Although these expectations are plausible, little research evidence exists to evaluate their validities. With a few exceptions, team reward research has not investigated the linkage of reward interdependence and taskwork effort for interdependent tasks. Our review of the literature showed that only three studies have examined the effect of reward interdependence on taskwork effort (Konovsky & Podsakoff, 1993; Newcomb, Brady, & Hartup, 1979; Rosenbaum et al, 1980). Using a tower-building task in which team members worked together to build a single tower out of wood blocks, Newcomb, Brady, and Hartup (1979) found that competitive reward distribution, whether operationalized as proportional distribution or winner-take-all, was associated with a higher number of handled blocks than equal reward structure among 88 two-person groups of preschool students. Similarly, Konovsky and Podsakoff (1993) found proportional distribution of team reward resulted in a higher number of blocks handled than equal distribution for 64 three-person teams of college students working on the same tower-building task.

Also using the tower-building task, Rosenbaum et al.'s (1980) Study 1 examined the performance of 36 three-person groups under equal reward structure and two competitive reward structures. One of competitive reward condition was operationalized as proportional distribution, and the other was operationalized as the distribution in which the high performer of the team was rewarded proportional to his performance while the other two team members were not rewarded. The results showed that both competitive reward conditions resulted in more numbers of block handled than the equal reward

condition, but the effects were only marginally significant ($p < .08$). The marginal significance of the effect happened probably because the study did not have enough power due to the small number of teams in each reward condition.

Because the number of blocks handled in the tower-building task can be a reasonable indicator of task effort, the results of the three studies (Newcomb, Brady, & Hartup, 1979; Rosenbaum et al, 1980; Konovsky & Podsakoff, 1993) showed that competitive reward leads to a higher level of task effort. However, the tower building task used by all three studies has been criticized as biased towards encouraging taskwork effort (Chertkoff & Mesch, 1997). In this task, the higher the tower, the higher the probability that it will fall. As a result, low performing members under the competitive reward structure can benefit by adding more blocks. If the tower still stands, their performance improves. If the tower falls, it is more beneficial for them because all team members have to start from scratch. Because of this bias, it is very plausible that team members in the competitive reward structure are motivated to handle more blocks as the tower falls more frequently. Team members in cooperative reward structure, on the other hand, are motivated to keep their tower tall and therefore handle the blocks with care, resulting in a smaller number of blocks handled.

Team reward research on independent tasks also suggests that competitive reward distribution leads to higher level of taskwork effort than equal reward distribution. Reviews of team reward studies by several researchers (Chertkoff & Mesch, 1997; DeMatteo et al, 1998; Miller & Hamblin, 1969) showed that competitive reward distribution has been found to result in more effective performance for independent tasks. Because teamwork can be considered not important for this type of task, the superior

performance can reasonably be attributed to the higher level of taskwork effort resulted from competitive reward system.

In sum, we made the following predictions:

Hypothesis 3: Cooperative orientation will have a positive effect on individual teamwork effort.

Hypothesis 4: Competitive orientation will have a positive effect on individual taskwork effort.

Hypothesis 5: Positive reward interdependence will have a positive effect on individual teamwork effort.

Hypothesis 6: Positive reward interdependence will have a negative effect on individual taskwork effort.

At the individual level, positive reward interdependence was expected to have a positive effect on individual teamwork effort. The effect could be explained by the mediating effect of cooperative orientation. However, we did not attempt to predict whether the mediation was full or partial. Similarly, our hypotheses suggested that positive reward interdependence had a negative effect on individual taskwork effort. The effect could be explained by the mediating effect of competitive orientation. However, we did not attempt to make any prediction regarding the nature of the mediation.

In the model in Figure 1, task interdependence is construed as the degree to which team members need to share materials, information, or expertise in order to achieve valued group outcome. It is a structural feature of work that constrains the level of behavioral interactions among team members. With high task interdependence, team members need to depend more on one another for material, information, or expertise to

complete the team task. A high level of task interdependence demands team members to engage in more teamwork behaviors. More social interactions likely reduce the amount of time members can work on the task, likely leading to a lower level of individual taskwork effort. Therefore, we expected that,

Hypothesis 7: Task interdependence will have a positive relationship with individual teamwork effort.

Hypothesis 8: Task interdependence will have a negative relationship with individual taskwork effort.

Determinants of Team-Level Teamwork Effort and Taskwork Effort

The model in Figure 1 predicted that higher individual-level teamwork effort and taskwork effort give rise to higher team-level teamwork effort and taskwork effort. As researchers become more aware of multilevel issues (Klein & Kozlowski, 2002), the logics for how individual behaviors are combined to form team-level behaviors needs to be explicated.

The team task in this study requires that a team member works on a relative independent component for which he/she has the expertise. He/she can work independently on the subcomponents for which he/she has the knowledge, but needs assistance from other team members for the subcomponents he/she does not have the expertise. When the minimum amount of individual reward is high enough to be desirable, any level of positive reward interdependence likely elicits a reasonable minimum amount of teamwork. Moreover, because the task components are relative independent and team members have the expertise for their assigned components, the lack of teamwork behaviors by one member is not likely to have the devastating effect on

team-level teamwork behavior. A high level of teamwork behavior by one team member is not likely to have the overwhelming impact on the team-level teamwork behavior, either. It is more likely that the lack of teamwork by one member is compensated by more teamwork by others. The total amount of team member teamwork is likely what determines team performance. Thus, we assumed that the sum of individual-level teamwork effort captured the majority of the variance of team-level teamwork effort. Because positive reward interdependence were hypothesized to have a positive effect on individual teamwork effort, we expected that

Hypothesis 9: Positive reward interdependence will have a positive effect on teamwork effort at the team level.

Similarly, when the minimum amount of individual reward is high enough to be desirable, any level of positive reward interdependence likely elicits a reasonable minimum amount of taskwork. Moreover, because the task components are relatively independent and team members have expertise for their assigned components, low taskwork effort by one team member unlikely have a catastrophic effect on the team-level taskwork effort. A high level of effort by one team member will not likely have an monumental effect on team-level taskwork effort, either. It is more likely that the lack of effort by one team member is compensated by more effort exerted by other members. The total amount of individual effort is likely what determines team performance. Thus, we assumed that the sum of individual-level taskwork effort captured the majority of the variance of team-level taskwork effort. Because positive reward interdependence were hypothesized to have a negative effect on individual taskwork effort, we expected that

Hypothesis 10: Positive reward interdependence will have a negative effect on taskwork effort at the team level.

For the present work, task interdependence is construed as the structural feature of work that constrains team members' interactions. High task interdependence requires team members to interact more often to accomplish the task. More interactions, however, likely lead to higher level of process loss (Steiner, 1975) and result in a lesser amount of time for performing the task. Therefore, we expected

Hypothesis 11: Task interdependence will have a positive effect on teamwork effort.

Hypothesis 12: Task interdependence will have a negative effect on taskwork effort.

Effects of Teamwork Effort and Taskwork Effort on Team Performance

The current team reward literature has largely focused on teamwork processes to explain the differential effects of reward structures on team task performance, which we defined as the quantity of products that a team produces over a specific period of time and meet certain subjective or objective quality criteria. Many team models (cf., Cohen & Bailey, 1997; Gladstein, 1984; Guzzo & Dickson, 1996) proposed teamwork processes as the main factors that mediate the relationship between reward structures (team input) and team task performance (team output). Review after review of team reward research (Deustch, 1985; Johnson & Johnson, 1989; Chertkoff & Mesch, 1997; DeMatteo et al., 1997) showed that teamwork had positive effect on team performance. For example, Johnson and Johnson (1989) concluded in a meta-analysis that cooperative reward system was superior because it encouraged helping, information and resource exchange,

constructive feedbacks, constructive approach to conflict resolution, and mutually influencing behaviors. Evidence from team training research also showed the same pattern of relationships (cf., Cannon-Bowers & Salas, 1998; Marks et al, 2002; Mathieu et al., 2000).

Because taskwork is an important dimension of team behaviors (Bowers et al., 1997; Jensth-Smith et al., 1998; Morgan et al., 1994), it is likely to have a significant effect on team task performance. In their models of team effectiveness, Hackman and Morris (1975) and Hackman (1983) proposed that taskwork effort is positively related to team performance. Although past team reward research did not directly examine the relationship between taskwork effort and team task performance, research on team goal setting showed that higher team goals led to increased taskwork effort, which explained the higher level of team performance (Weingart & Weldon, 1991; Weingart, 1992; Weldon et al., 1991). Therefore, we predicted that

Hypothesis 13: Teamwork effort will have a positive effect on team performance.

Hypothesis 14: Taskwork effort will have a positive effect on team performance.

Because task interdependence is a structural feature that specifies the amount of interactions needed to accomplish the team task, it likely moderates the effects of teamwork and taskwork on team performance. Empirically, Wageman and Baker (1997) found that task interdependence moderated the effect of reward interdependence on team performance. Several reviews reported that equal reward distribution resulted in better performance for interdependent task but inferior performance for independent tasks when comparing with proportional reward distribution. These finding suggest that perhaps team performance is more influenced by teamwork effort and less affected by taskwork

effort for high interdependent task. For low interdependent task, probably taskwork has a stronger effect and teamwork is less influential. Therefore, we expected that

Hypothesis 15: Task interdependence will moderate the relationship between teamwork effort and team performance.

Hypothesis 16: Task interdependence will moderate the relationship between taskwork effort and team performance.

METHODS

Participants were 111 male (42%) and 129 female (58%) undergraduate students enrolled in an introductory psychology courses at a large Mid-western university. The ethnic makeup of the sample was: 76% Caucasian American, 10% African American, 4% Hispanic American, 1% Indian American, and 9% Asian American. Their ages were from 18 to 24 years (M =19.5, SD =1.4). The subjects selected the study to fulfill their research participation requirements and were randomly assigned to 3-person teams. The teams were randomly assigned to four different experimental conditions (2 reward interdependence X 2 task interdependence). Two teams were eliminated from the study because a member of one team left the experiment due to illness and the experimenter failed to record the other team's work properly, leaving a total of 80 teams in the study.

Training of Team Members

Before working as a team, team members went through training to develop the necessary skills and knowledge for the team task. During the training, each team member learned how to program in HTML a unique, restricted set of symbols. Specifically, the first team member learned how to code all the Greek letters and became "Greek Letter Specialist". The second team member was trained to know how to program all the Latin letters and became "Latin Letter Specialist". The third team member learned how to write all the special signs and became "Sign Specialist."

The team member learned his/her part by following a training tutorial (See Appendix C) and an accompanying coding manual (See Appendix D) on the computer screen. The training tutorial provided step-by-step instructions on how to write the

underlying codes for the symbols in a text editor (Notepad) and then display the symbols on Internet Explorer. The coding manual contained a list of codes for 50 different symbols. To program a symbol, the team member would type in a unique set of five keystrokes including #, &, and three numbers. Team members were told that they did not have to memorize the specific codes for the symbols and that they could refer to the coding manual at any time during both the training and the subsequent team task sessions. A trainer was available to answer any questions that team members had during the training. Team members were allowed up to 20 minutes for the training, but most finished it within 15 minutes.

Task

The task required a 3-person team to fix 132 errors on a 3-page website. Each member of the team was assigned the responsibility of fixing one of the three pages for which he/she had the expertise. The underlying codes for the page were contained in an HTML file that the team member had opened on his/her computer screen prior to the start of team task (See Figure 2 for a portion of the first page).

Similar to Figure 2, each of the three web pages had the same structure and contained 44 errors. In the page, an error appeared as a pair of question marks (??). The text preceding the question marks described which specific symbols should be programmed. For example, one of the errors was "Greek small zeta and Greek small alpha: ??" To fix it, the team member would need to replace the two question marks with the codes "&#950 &#945" in the HTML file, which would be displayed as "ζ α" on Internet Explorer.

```
<html>
<head><title>This page is authored by the Greek Letter
Specialist</title></head>
<body>

This page is authored by the Greek Letter Specialist.
<br>
<br>
Two symbols can be combined to form a unit. Below are 44 units:
<br>
<br>
greek small  kappa and capital U circumflex: ??
<br>
greek capital  tau and inverted exclamation sign: ??
<br>
greek capital  delta and greek small  zeta: ??
<br>
greek capital  beta and greek capital  zeta: ??
<br>
greek small  omicron and capital A grave: ??
<br>
<br>
greek small  zeta and greek capital  kappa: ??
<br>
greek capital alpha and regular currency sign: ??
<br>
greek small  rho and small u grave: ??
<br>
.....
.....

</body>
</html>
```

Figure 2: Portion of the Web Page Assigned to the Greek Letter Specialist

The page was designed to have a mix of Greek letters, Latin letters, and special signs. As a result, the team member could fix some of the errors independently using the codes he/she had in the coding manual. However, the member needed to rely on the knowledge of other team members as well as his/her own to fix the rest. For example, Greek Letter Specialist could fix all the errors that contained only Greek letter symbols. He/she needed to ask Latin Letter Specialist for the Latin letter codes to fix errors that contained Latin letter symbols and Sign Specialist for special sign codes to fix errors that

had special sign symbols. The maximum amount of errors that the team member could fix independently varied depending on the task interdependence condition in which his/her team was assigned.

It should be noted team members could not copy and paste the entire codes for a symbol because the coding manual was set up as a read-only acrobat file. The experimenter explicitly told a few subjects who attempted to use the Acrobat Find function to locate the symbols in the coding manual that the search function was not permitted. These controlling actions ensured that each symbol would take approximately the same amount of effort to program by (1) visually searching the coding manual or asking other team members for the correct codes and (2) typing them in manually.

For this task, each member of the team was assigned the responsibility of fixing one of the three pages for which he/she had the expertise. They were told that they needed to work together as a team to fix the errors in their web pages. They might not know how to fix all the errors on their pages. For the errors they did not know how to fix, one of their team members had the knowledge. If they wanted to fix all the errors in their pages, they needed to work with one another. However, team members could work in any way they wanted, except they were not allowed to physically type the codes for their teammates. Team members had a total of 30 minutes to work on the task (Forty-four errors were the maximum amount of errors that a team member could fix in 30 minutes in a pilot study) with a short break after the first 15 minutes during which they were given feedbacks of their individual and team performance.

Team members worked in a common room, and each used a personal computer. The computer stations were set up so that the team members were in close proximity and

could easily talk to one another face to face. However, they were away far enough so that they could not see one another's work from their own workstations. The computers were not connected when team members worked on the task. As a result, team members could not share knowledge by emailing. Because of these restrictions, all team members shared their knowledge with one another verbally.

Task Interdependence

The task was designed so that in the low task interdependence condition, 22 errors (50%) in the web page could be corrected by the team member's own knowledge. The team member needed to rely on one teammate to fix the 11 errors (25%) and another teammate to fix the other 11 errors (25%). In the high task interdependence condition, the subject could fix 14 errors (33%) independently, and he/she needed to the assistance of one teammate to fix 15 errors (33%) and the other teammate to fix the other 15 errors (33%).

Reward Structure Manipulations

In the present study, a team would win a cash bonus of $90 if the team's performance was in the top 25 percent of all performing teams. In other words, a team had a 25% chance of getting the team reward. Two reward conditions were examined. In the high positive reward interdependence condition, team members were told that the team reward would be distributed equally among team members. Each team member would get $30 if the team won the bonus. In the low positive team reward interdependence, team members were told that the team reward would be divided differentially. The top performer of the team would receive $40; the middle performer, $30; and the bottom performer, $20.

Manipulation Checks

Team members were asked to respond to five questions (See Appendix H) by rating on a scale from 1 (strongly disagree) to 5 (strongly agree). The first question referred to their knowledge of what constituted a correct fix. The second and third questions regarded the team members' understanding of how individual and team performance were assessed. The fourth and fifth questions asked the subjects how teams and individuals would be rewarded.

Procedure

After being greeted and signing voluntary participation agreements, the subjects answered a questionnaire (See Appendix G) regarding their demographics (gender, age, ethnicity, and GPA). They then learned how to build simple web pages. Once they finished the training phase, the experimenter asked team members to gather in the center of the room and introduce themselves. To help the team members to become more comfortable with one another, team members were encouraged to chat about their major, classes, and college experiences for five minutes.

After their conversations, the team members were asked to work on a trial team task. The purpose of the trial task was to allow the team members to become familiar with the team task. The trial task was the same as the team task with two exceptions. The first is that each web page of the website had only 10 errors instead of 44. The second is that 4 of the errors could be fixed independently, and 6 errors required other members' assistance. For the trial task, team members were told to work together to fix all the errors in the web pages as a team. The experimenters introduced to the team members individually as having the expertise in different areas and assigned them to

work on the page for which they were the experts. They were told that they might not know how to fix all the errors on their pages. For the errors they did not know how to fix, one of their team members had the knowledge. If they wanted to fix all the errors in their pages, they need to work with one another. However, team members were then told that they could work in any way they wanted, except they were not allowed to physically type the codes for their teammates. Though there was no time restriction for this trial task, most team members took less than 15 minutes to complete their assignments.

Once the subjects finished the trial task, they were then asked to read the instruction on how to work on the next team task (See Appendix E). After they finished reading, the experimenter showed the full website that the team members needed to fix and repeated the same instruction verbally. The instructions described the team tasks, team members' roles, what was considered as a correct fix, the measurements of individual and team performance, and the contingencies of performance and reward at the team and individual levels. It also explained that team members needed to work together as a team to fix the errors in their web pages.

Subjects were then asked if they understood how they would be rewarded. The second survey (See Appendix H) was then administered to measure the subjects' understanding of the reward contingencies and their cooperative and competitive orientations. Following the survey, team members worked on the team task. Team members had a total of 30 minutes to work on the task. After the first 15 minutes, they were asked to stop their work so that the experimenters could upload and assemble the pages together. Once the pages were uploaded, team members could see the outputs of other members and the entire team. The experimenter counted the number of correct fixes

by individual members and the entire team and reported them to the team verbally. Team members then had another 15 minutes to complete the task.

Measures

Cooperative and Competitive Orientations

The cooperative and competitive orientation measures, adapted from Johnson & Norem-Hebeisen (1979), were used to assess individual cooperative and competitive orientations. Because the original measure was developed to gauge students' social orientation in the classroom, references to the class, students, and learning were changed to the team, team members, and performance, respectively. The measure contained 15 items (See Appendix H), and each item was rated on a scale from 1 to 7. Seven items in the measure tapped cooperative orientation. An example item was, "It is a good idea for team members to help one another perform." The other eight items were assumed to measure competitive orientation. An example item was, "I like to compete with other team members to see who can do the best work." The higher the score on each scale, the more cooperative or competitive the respondents considered themselves to be. Alphas were high in previous studies, ranging from .84 to .94 for cooperative scale and from .85 to .88 for competitive scale. Factor analysis of the data in the present study yielded a two-factor solution. Item 1 of the competitive orientation scale, however, had high loadings (larger than .4) on both factors and was therefore eliminated. The final scales contained 7-item cooperative orientation scale and 7-item competitive orientation scale. The alpha coefficient for cooperative orientation was .92, and the alpha coefficient for competitive orientation was .86.

Individual-Level Task Effort

Individual-level taskwork effort was measured objectively. The number of symbols, not errors, a subject attempted to fix in her assigned page was used as the indicator of individual-level taskwork effort. The symbols were the building blocks of the task, and each required 5 keystrokes (#, &, and 3 numerical digits) to program. Because the # and & were identical for all symbols and could be copied and pasted, we decided to count the symbol as a unit of taskwork effort instead of the keystroke itself. It turned out that only four subjects attempted to copy and pasted # and & in their work, the measure of effort in terms of symbols was considered an equivalent measure of keystrokes.

Individual-Level Teamwork Effort

Individual-level teamwork effort was also measured objectively. The piece of information (the five-digit code for a symbol) each team member shared with the rest of the team was recorded and assessed for its accuracy by the experimenter, who used an observation check list (See Appendix F). Because the amount of shared inaccurate information was very close to zero (only one subject shared two pieces of inaccurate information), we used the amount of shared accurate information as indicator of teamwork effort. The correlation between this measure and the measure of shared information obtained by examining the objective outputs was very high, at .95.

Teamwork Effort

Team-level teamwork effort was measured objectively. The total number of pieces of information (the five-digit code for a symbol) team members shared with one another was recorded by the experimenter and used as the indicator of teamwork effort.

The correlation between this measure and the measure of shared information obtained by examining the team's final outputs was very high, at .96.

Taskwork Effort

Team-level taskwork effort was measured objectively. A rater examined the team final output for the number of symbols the team attempted to fix in the website. The total number of attempts was the indicator of team-level taskwork effort.

Team Performance

Team performance was measured objectively. A rater examined each team 's final output for the number of errors that have been fixed. The total number of errors the entire team fixed was the measure of team performance.

RESULTS

Manipulation checks showed that subjects clearly understood how their performance was measured and the contingency between performance and reward. On the scale from 1 (strongly disagree) to 5 (strongly agree), the means of the subjects' understanding of what constituted a correct fix was 4.84 (SD = .37). The means of their understanding of how team and individual performances were evaluated was 4.89 (SD = .31) and 4.83 (SD = .38), respectively. The means of their understanding of how team and individual were rewarded was 4.95 (SD = .21) and 4.92 (SD = .26), respectively.

Analysis Strategies

Because the model in Figure 1 described the relationships among the constructs at both the team and individual levels, two different approaches were used to analyze the data. HLM was used to analyze the effects of reward and task interdependence on individual-level endogenous variables (individual-level analyses). Multiple regressions were applied to assess the effects of reward and task interdependence on team-level endogenous variables (team-level analyses).

Individual-Level Analyses

The means, standard deviation, ranges, and zero-ordered correlations for all variables for individual-level analyses were reported on Table 1. The relationships of reward interdependence with cooperation orientations and competitive orientations were both significant with respective correlation coefficients of 0.16 and –0.14. Hypotheses 1 and 2 were therefore supported.

Table 1

Summary Statistics for Individual-Level Variables

VARIABLE	Mean	SD	Range	Task	Reward	Cooperative Orientation	Competitive Orientation	Teamwork	Taskwork
Task									
Reward				0.00					
Cooperative Orientation	42.8	3.18	37-49	-0.08	0.16*				
Competitive Orientation	27.65	7.29	14-45	-0.09	-0.14*	0.04			
Teamwork	12.94	5.24	2-27	0.21**	0.20**	0.26**	0.02		
Taskwork	61.79	13.48	27-88	- 0.15*	-0.22**	0.11	0.24**	0.17**	
Performance	27.8	7.77	11-44	-0.18**	-0.15*	0.16*	0.23**	0.27**	0.89**

* $p < 0.05$ * * $p < 0.01$

At the individual level (See Figure 3), the mediation model of the effects of reward and interdependence on teamwork effort via cooperative orientation was tested first. The same set of tests was repeated to examine the effect of reward interdependence on the second dependent variable, taskwork effort.

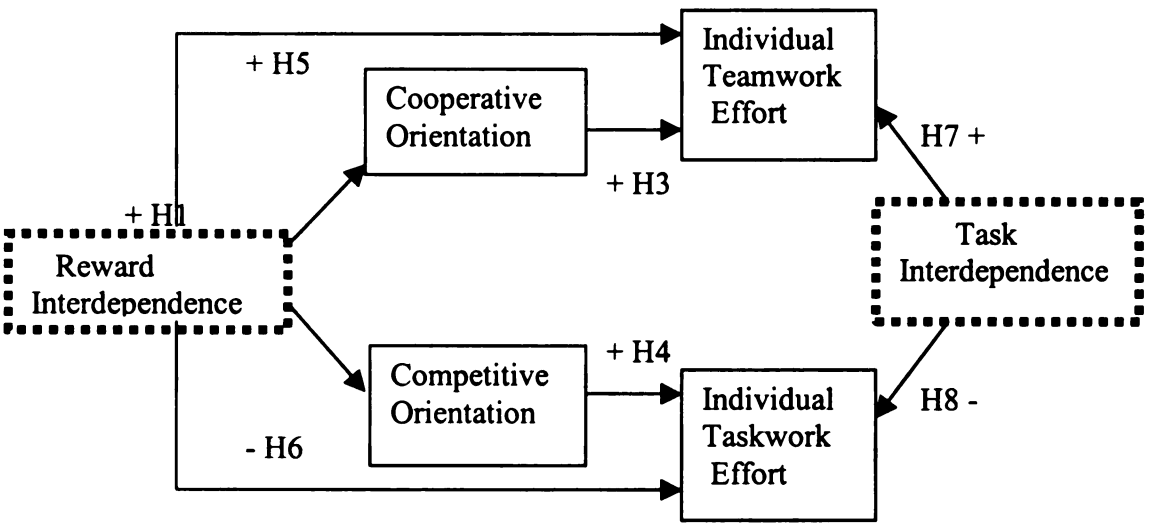


Figure 3: Individual-Level Model

Because individual-level teamwork effort and taskwork effort are nested within teams, the appropriate statistical technique is multilevel random coefficient analysis (Bryk & Raudenbush, 1992). Multilevel random coefficient analysis (Bryk & Raudenbush, 1992) can be considered a simultaneous two-stage procedure. In Stage 1, intercepts and slopes are estimated for each team at the individual level. The overall statistical significances of individual-level relationships are considered "pooled or averaged" parameter estimates from all teams.

In Stage 2, Stage 1 slopes and intercepts are used as the criteria to estimate the effects of team-level variables. If a team-level variable (reward interdependence) is related to the variability of the intercept, it is inferred to have a main effect on the

dependent variable. If a team-level variable is related to the variability of the slope, it is considered to have a moderating effect.

Five random coefficient models were estimated to test the hypotheses regarding each dependent variable. The first model (ANOVA Model) was a null model that had no predictors at either level. It was used to partition the variance in each dependent variable into between-team and within-team components. The proportion of between-group variance to the total variance was calculated and used as an intraclass correlation as in a one-way analysis of variance (Bryk & Raudenbush, 1992).

The second model (random coefficient model) added the mediator (e.g., cooperative orientation) as an individual-level predictor, but it does not have any the team-level predictor. The pooled value of the within-team parameter estimates provided the assessment of the averaged effect of the mediator on the dependable variable at the individual level across teams. The significant test of the parameter indicated that the mediator had an effect on the dependent variable. The effect size was determined by evaluating the differences between the variance components of this model and those of the null model.

The third model (intercept-as-outcomes model with task interdependence as the team-level predictor) included task interdependence as the team-level predictor (e.g., cooperative orientation) but did not have the individual-level predictor. The between-team parameter estimate provided as assessment of the effect of the task interdependence on the team-means of the dependent variable. The significant test of the parameter indicated that task interdependence had an effect on the dependent variable. The effect

size was determined by evaluating the differences between the between-team variance of this model and that of the null model.

The fourth model (intercept-as-outcomes model with task and reward interdependence as the team-level predictors) added reward interdependence to the third model as a team-level predictor. The team-level parameter estimate provided the assessment of the independent effect of the reward interdependence on the team-means of the dependent variable. The significant test of the parameter estimate indicated that reward interdependence had incremental effect on the dependent variable, over and above that of the task interdependence. The incremental effect size of reward interdependence was determined by evaluating the differences between the between-team variance of this model and that of the third model.

The fifth model (intercepts-as-outcomes model with social orientation as the individual-level predictor and task interdependence as the team-level predictor) added the task interdependence as a team-level predictor to the second model. It were used a compared model to examine the direct effect of reward interdependence in the sixth model.

The sixth model (intercepts-as-outcomes model with social orientation as the individual-level predictor, task and reward interdependence as the team-level predictors) added reward interdependence as individual-level predictors to the fifth model. The parameter estimate of reward interdependence and the deviation score provided the assessments of the reward's direct effect when the effects of task interdependence and social orientation were controlled.

The HLM analyses of antecedents of teamwork behaviors were shown in Table 2. In Model 1 (ANOVA model with no predictor), the level-2 intercept of level-1 intercepts was significantly different from zero (G00 = 12.94, t= 26, $p < .01$), meaning that the grand mean of teamwork effort across teams was 12.94. The variance of level-1 intercepts (between-team variance) was 16.3 and significantly different from zero (U0 = 16.3, X2(79) = 421.27, $p < .01$), showing that teamwork effort varied between teams. The within-team variance was 11.28. Accordingly, ICC was .59 (16.3 /{16.3+11.28}), indicating between-team variance made up 58% of total teamwork variance.

In Model 2 (random coefficient model with cooperative orientation as the individual-level predictor), the level-2 intercept of level-1 slopes (the pool slope) was significantly different from zero (G10 = .32, t = 2.31, $p < .01$), indicating that cooperative orientation, on average, likely led to higher level of teamwork effort. The change in deviation score was 13.39 (1393.39 – 1380) and significant, indicating model 2 fits the data better than model 1. As a result, hypothesis 3 was therefore supported. The within-team residual variance was reduced to 8.7. The between-team variance was decreased to 15.02. Therefore, the cooperative orientation accounted for .20 ({11.28 – 9.07}/11.28) of within-team teamwork variance, .08 ({16.3 – 15.02}/16.3) of between-team teamwork variance, and .12 (.20*.41 + .08*.59) of total teamwork variance.

Table 2:
HLM Results of Effects on Individual-Level Teamwork Effort

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Effect						
Constant	12.94** (26)	12.88**(26.78)	9.51**(5.94)	6.39**(3.49)	9.20**(5.80)	6.04**(3.26)
Cooperative Orientation		0.321**(3.34)			0.34**(3.44)	0.33**(3.37)
Task Interdependence			2.24*(2.31)	2.24*(2.39)	2.43**(2.60)	2.56**(2.81)
Reward Interdependence				2.08*(2.23)		1.99*(2.20)
Random Effect						
Intercept 1, UO	16.3**	15.02**	15.26**	14.38**	13.85**	13.48**
Chi-square	421.27	328.22	394.56	371.48	309.70	296.48
df	79	79	78	77	78	77
Cooperative Orientation Slope, U1		0.22**			0.21**	0.198**
Chi-square		114.65			114.59	113.58
df		79			79	79
Individual Level, R	11.28	9.07	11.28	11.28	9.17	9.17
Deviation Score	1393.39	1380	1388.26	1379.99	1371.25	1367.33
Estimated Parameter	3	5	4	5	6	7
ICC	0.59					
Reliability	0.81					

All values are unstandardized beta coefficients. T values are shown in the parentheses.

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

Model 1: ANOVA Model

Model 2: Random Effect Model with cooperative orientation as the individual-level predictor

Model 3: Intercept-as-outcomes Model with task interdependence as the team-level predictor

Model 4: Intercept-as-outcomes Model with task and reward interdependence as the team-level predictors

Model 5: Intercept-as-outcomes Model with cooperative orientation as the individual-level predictor and task interdependence as team-level predictor

Model 6: Intercept-as-outcomes Model with cooperative orientation as the individual-level predictor and task and reward interdependence as the team-level predictors

It should be noted that the variance of level-1 intercepts was significantly different from zero (U0 = 15.31, X2 (79) = 368.39, $p < .01$), showing that teamwork effort was still different between teams after cooperative orientation was controlled. The variance of level-1 slopes of cooperative orientation was also significantly different from zero (U1 = .23, X2 (79) = 118.36, $p < .01$), indicating that the effect of cooperative orientation on teamwork effort varied between teams.

In Model 3 (means-as-outcomes model with task interdependence as the team-level predictor), the level-2 slope of task interdependence that predicted level-1 intercepts was significantly different from zero (G01 = 2.24, t = 2.24, $p < .05$), indicating that task interdependence had an effect of team-level teamwork effort. The change in deviation score was 5.13 (1393.39 – 1388.26) and significant, indicating model 3 fits the data better than model 1. As a result, hypothesis 7 was supported. The variance of level-1 intercepts was decreased to 15.26. Therefore, task interdependence accounted for .06 ({16.3 – 15.26}/16.3) of between-team teamwork variance and .04 (.06*.59 + 0*.41) of total teamwork variance.

In Model 4 (means-as-outcomes model with both task and reward interdependence as the team-level predictors), the level-2 slope of task interdependence that predicted level-1 intercepts was still significantly different from zero (G01 = 2.24, t = 2.39, $p < .05$). The level-2 slope of reward interdependence that predicted level-1 intercepts was also significantly different from zero (G02 = 2.08, t = 2.23, $p < .05$). This indicated that reward interdependence had a positive effect on teamwork effort after the effect of task interdependence was controlled. The change in deviation score was 8.27 (1388.26 – 1379.99) and significant, indicating model 4 fits the data better than model 3.

Hypothesis 5 was therefore supported. The variance of level-1 intercept was reduced to 14.38. Therefore, task and reward interdependence accounted for .12 ({16.3 – 14.38}/16.3) of between-teamwork variance or .07 of total teamwork variance (.12*.59 + 0*.41). In other words, reward interdependence explained an additional .06 of between-team teamwork variance and .03 of total teamwork variance over and above the effect of task interdependence.

In Model 6 (intercepts-as-outcomes model with cooperative orientation as the individual-level predictor and task and reward interdependence as the team-level predictors) the level-2 slope of reward interdependence that predicted level-1 intercepts was significantly different from zero ($G02 = 1.99$, $t = 2.20$, $p < .05$). The change in deviation score was 3.99 (1371.24 – 1367.33) and significant, indicating model 6 fits the data better than model 5. This indicated that reward interdependence had an incremental effect on teamwork effort over and above the effects of task interdependence and cooperative orientation. Thus, the effect of reward interdependence on individual teamwork effort is partially mediated by cooperative orientation.

The HLM analyses of antecedents of taskwork behaviors were shown in Table 3. In Model 1 (ANOVA model with no predictor), the level-2 intercept of level-1 intercepts was significantly different from zero ($G00 = 61.67$, $t = 58.5$, $p < .01$), indicating that the grand mean of taskwork effort across teams was 61.67. The variance of level-1 intercepts (between-team variance) was 44.53 and significantly different from zero ($U0 = 44.53$, $X2(79) = 155.73$, $p < .01$), showing that taskwork effort varied between teams. The within-team taskwork variance was 137.54. Accordingly, ICC was .245

(44.53/{44.53+137.54}), indicating between-team variance made up 24.5 % of total taskwork effort variance.

In Model 2 (random coefficient model with competitive orientation as the individual-level predictor), the level-2 intercept of level-1 slopes (the pool slope) was significantly different from zero (G10=.42, $t = 3.50$, $p < .01$), indicating that competitive orientation, on average, likely led to higher level of taskwork effort. The change in deviation score was 10.40 (1914.03 – 1901.89) and statistically significant, indicating model 2 fits the data better than model 1. As a result, hypothesis 4 was supported. The within-team residual variance was reduced to 124.47. The between-team taskwork variance was decreased to 38.73. Therefore, competitive orientation accounted for .10 ({137.54 – 124.47}/137.54) of within-team taskwork variance, .13 ({44.53 – 38.73}/44.53) of between-team taskwork variance, and .11 (.10*.74 + .13*.26) of total taskwork variance. We noted that the variance of level-1 intercepts was significantly different from zero (U0 = 38.73, X2 (79) = 117.05, $p < .01$), indicating that taskwork effort was still different between teams after competitive orientation was controlled. The variance of level-1 slopes of competitive orientation was not significantly different from zero (U1 = 0.18, X2 (79) = 85.86, $p > .01$), showing that the effect of competitive orientation on taskwork effort did not vary between teams.

In Model 3 (means-as-outcomes model with task interdependence as the team-level predictor), the level-2 slope of task interdependence that predicted level-1 intercepts was significantly different from zero (G01 = -4.01, $t = -1.94$, $p < .05$), indicating that task interdependence had a negative effect of team-level taskwork effort.

Table 3
HLM Results of Effects on Individual-Level Taskwork Effort

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Fixed Effect						
Constant	61.79**(58.5)	61.84**(61.26)	67.92**(21)	76.90**(18.72)	66.76**(22.275)	74.92**(18.28)
Cooperative Orientation						
Competitive Orientation		0.422**(3.50)			0.41**(3.47)	0.362**(2.98)
Task Interdependence			-4.01*(-1.94)	-4.01*(-2.06)	-3.23[a](-1.94)	-3.40[a](-1.82)
Reward Interdependence				-5.99**(-3.06)		-5.21**(-2.66)
Random Effect						
Intercept 1, UO	44.53**	38.73**	41.57**	33.38**	37.17*	31.02*
Chi-square	155.73	117.05	148.72	133.06	115.98	105.79
df	79	79	78	77	78	77
Competitive Orientation Slope, U2		0.177			0.16	0.18
Chi-square		85.86			85.14	85.63
df		79			79	79
Individual Level, R	137.54	124.47	137.54	137.54	125.24	123.74
Deviation Score	1914.03	1901.89	1907.22	1893.49	1894.26	1886.81
Estimated Parameter	3	5	4	5	6	7
ICC	0.245					
Reliability	0.493					

All values are unstandardized beta coefficients. T values are shown in the parentheses.

* p < .05. **p < .01 [a] marginally significant (p < .10)

Model 1: ANOVA Model

Model 2: Random Effect Model with competitive orientation as the individual-level predictor

Model 3: Intercept-as-outcomes Model with task interdependence as the team-level predictor

Model 4: Intercept-as-outcomes Model with task and reward Interdependence as the team-level predictors

Model 5: Intercept-as-outcomes Model with competitive orientation as individual-level predictor and task interdependence as team-level predictor.

Model 6: Intercept-as-outcomes Model with competitive orientation as the individual-level predictor and task interdependence and reward interdependence as the team-level predictors

The change in deviation score was 6.81 (1914.03 – 1907.22) and significant, indicating model 3 fits the data better than model 1. As a result, hypothesis 8 was supported. The variance of level-1 intercepts was decreased to 41.57. Therefore, the effect size of task interdependence on between-team teamwork variance was .07 ({44.53 – 41.57}/44.53) of between-team taskwork variance and .02 (.07*.26 + 0*.74) of total taskwork variance.

In Model 4 (means-as-outcomes model with both task and reward interdependence as the team-level predictors), the level-2 slope of task interdependence that predicts level-1 intercepts was still significantly different from zero (G01 = -4.01, t = -2.06, $p < .05$). The level-2 slope of reward interdependence that predicted level-1 intercepts was also significant different from zero (G02 = -5.99, t = -3.06, $p < .01$). This indicated that reward interdependence had a negative effect on taskwork effort after the effect of task interdependence was controlled. The change in deviation score was 13.73 (1907.22 – 1893.49) and significant, indicating model 4 fits the data better than model 3. Hypothesis 6 was therefore supported. The variance of level-1 intercept was reduced to 33.38. Therefore, task and reward interdependence accounted for .20 ({41.57 – 33.38}/41.57) of between-team taskwork variance and .05 (.20*.25 + 0*75) of total taskwork variance. In other words, reward interdependence explained an additional .13 of between-team taskwork variance and .03 of total taskwork variance over and above the effect of task interdependence.

In Model 6 (intercepts-as-outcomes model with task and reward interdependence as the team-level predictors and competitive orientation as the individual-level predictor) the level-2 slope of reward interdependence that predicted level-1 intercepts was significantly different from zero (G02 = -5.21, t = -2.66, $p < .01$). The change in

deviation score was 7.45 (1894.26 – 1886.81) and significant, indicating model 6 fits the data better than model 5. This indicated that reward interdependence had an incremental effect on taskwork effort after the effects of task interdependence and competitive orientation was controlled. Thus, the effect of reward interdependence on individual teamwork effort was partially mediated by competitive orientation.

Team-Level Analyses

The means, standard deviation, ranges, and zero-ordered correlations for all variables for team-level analyses were reported on Table 4.

Table 4
Summary Statistics for Team-Level Variables

VARIABLE	MEAM	SD	RANGE	TASK	REWARD	TEAMWORK	TASKWORK
TASK							
REWARD				0.00			
TEAMWORK	38.96	13.65	12-75	0.23*	0.22*		
TASKWORK	185.86	28.39	125-244	-0.25*	-0.32**	0.39**	
TEAMPERF	83.43	14.42	56-115	-0.28*	-0.24*	0.58**	0.86**

* $p < 0.05$ ** $p < 0.01$.

At the team level (See Figure 4), a series of multiple regressions were run to assess the effects of task and reward interdependence on team performance via the mediating effects of teamwork effort and taskwork effort. We tested the relationships in the model through five sets of hierarchical regressions.

In Set 1, the effects of the predictor variables (task and reward interdependence) on the criterion variable (team performance) were assessed. Hierarchical regressions were used to evaluate the incremental effect of the predictors. Team performance was regressed on task interdependence in model 1. Reward interdependence and the

interaction term of reward and task interdependence were then added in model 2 and 3, respectively. R^2 in model 1 provided an assessment of the task interdependence effect on team performance. R^2 difference between model 2 and 1 provided the incremental effect of reward interdependence over and above that of the task interdependence. R^2 difference between model 3 and 2 allowed the examination of the interaction effect of task and reward interdependence.

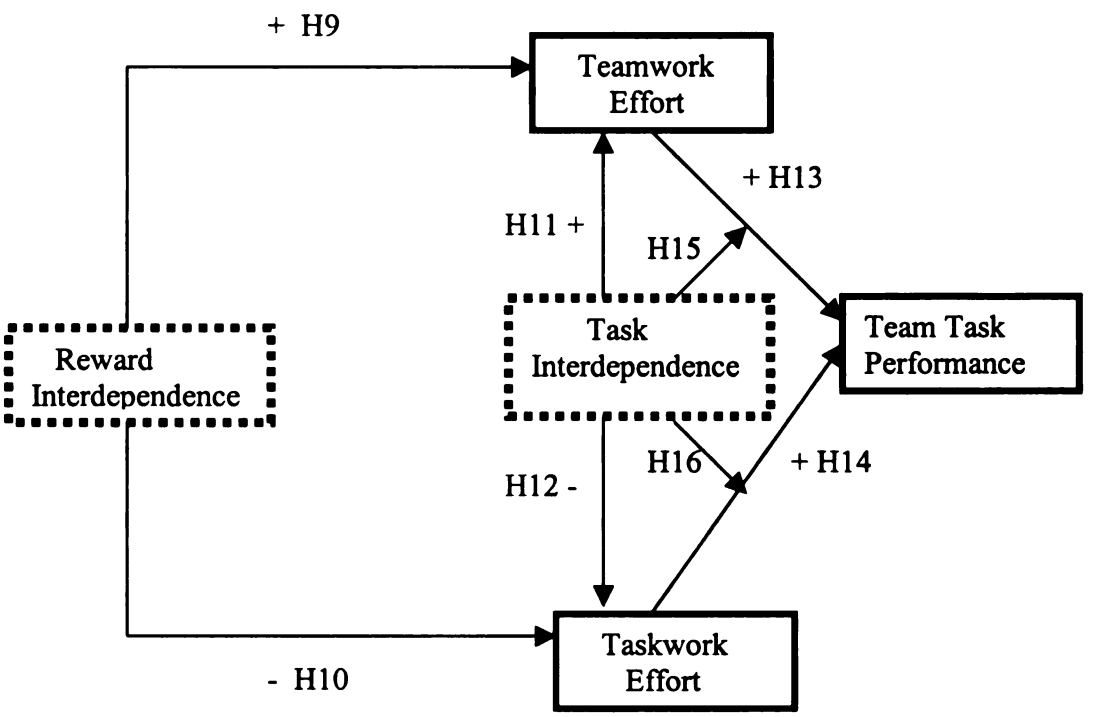


Figure 4: Team-Level Model

In set 2, the effects of the predictor variables (task and reward interdependence) on each of the two mediating variables (teamwork effort and taskwork effort) were assessed. Hierarchical regressions were used to evaluate the incremental effect of the predictors. The mediating variable was regressed on task interdependence in model 1 and then on both task and reward interdependence in model 2. R^2 in model 1 provided an assessment of task interdependence effect on team performance. R^2 difference between

model 2 and 1 provided the incremental effect of reward interdependence over and above that of task interdependence.

In Set 3, the effects of the mediators on team performance were assessed. Hierarchical regressions were used to evaluate the incremental effects of the mediators. Team performance was regressed on teamwork effort in model 1, on taskwork effort in model 2, and then on both teamwork effort and taskwork effort in model 3. R^2 difference between model 3 and 2 provided the incremental effect of teamwork effort over and above that of the taskwork effort. R^2 difference between model 3 and 1 provided the incremental effect of taskwork effort over and above that of the teamwork effort.

In Set 4, hierarchical regressions were used to assess the effects of task interdependence on the relationships of team performance to each of the mediators. Team performance was regressed on task interdependence and the mediator in model 1. The interaction term of task interdependence and the mediator were added in model 2. R^2 difference between model 2 and 1 provided the assessment of the incremental effect of the interactions on team performance over and above the main effects.

Table 5
Effects of Task and Reward Interdependence on Team Performance

Variable (N=80)	Model 1	Model 2	Model 3
Task Interdependence	-8.12**(-2.68)	-8.12**(-2.68)	-16.90 (-1.76)
Reward Interdependence		-6.77**(-2.23)	-15.55 (-1.62)
Task X Reward			5.85 (.96)
Model R Square	0.08**	0.136**	0.147**
Change in R Square		0.056*	0.011

All values are unstandardized beta coefficients. T values are shown in the parentheses.
* $p < 0.05$ ** $p < 0.01$

In Set 1 (See Table 5), task interdependence had a negative effect on team performance (B1= -8.12, t = -2.68, p < .001). High task interdependence led to lower level of performance than low task interdependence. The effect size was .008. Reward interdependence had a negative influence on task performance over and above task interdependence (B2 = -6.77, t = -2.23, p < 05). When the effect of task interdependence was controlled, high reward interdependence resulted in a lower level of performance than low reward interdependence. The incremental effect size was 0.056 and significantly different from zero. The interaction effect of reward and task interdependence, however, was not significant (B3 = 5.85, t = .96, p > .05).

The Effects of Task and Reward Interdependence on Teamwork and Taskwork Effort

In Set 2 (See Table 6), when teamwork effort was the criterion, task interdependence had a positive effect (B1 = 6.12, t = 2.45, p < .05). High task interdependence led to a higher level of teamwork effort than low task interdependence. Hypothesis 11 was supported. The effect size was .05. Reward interdependence had a negative incremental effect over and above task interdependence (B2 = 6.13, t = 2.09, p < .05). High reward interdependence resulted in higher level of teamwork effort than low reward interdependence over and above the effect of task interdependence. Hypothesis 9 was supported. The incremental effect size was .05 and significantly different from zero. When both task interdependence and taskwork effort were partialed out, the effect of reward interdependence was still significant (B2 = 11.32, t = 4.53, p < .01).

Table 6

The Effects of Task and Reward Interdependence on Teamwork and Taskwork

Variable (N=80)	Teamwork			Taskwork		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Task Interdependence	6.12*(2.45)	6.13*(2.09)	10.25**(4.19)	-13.8*(-2.24)	-13.8*(-2.35)	-21.16*(-4.35)
Reward Interdependence		6.03*(2.01)	11.32**(4.53)		-17.70**(-3.01)	-24.93**(-5.13)
Teamwork	--	--	--			1.20** (6.53)
Taskwork			.30**(6.53)	--	--	--
Model R Square	.05*	.10*	0.42**	0.06**	0.16**	.46**
Change in R Square		.05*	.32**		.10*	.30**

-- The variable listed as independent variable is the dependent variable in this set of analysis

All values are unstandardized beta coefficients. T values are shown in the parentheses.

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

When taskwork effort was the criterion, task interdependence had a negative effect (B1 = -13.8, t = -2.24, p < .05). High task interdependence led to a lower level of taskwork effort than low task interdependence. Hypothesis 12 is supported. The effect size is .06. Reward interdependence had a negative incremental effect over and above task interdependence (B2 = -17.70, t = -3.01, p < .05). High reward interdependence resulted in lower level of taskwork effort than low reward interdependence after the effect of task interdependence was controlled. Hypothesis 10 was supported. The incremental effect size was .10 and significantly different from zero. When both task interdependence and taskwork effort were partialed out, the effect of reward interdependence was still significant (B2 = -24.93, t = -5.93, p < .

The Effects of Teamwork Effort and Taskwork Effort on Team Performance

Table 7
The Effects of Teamwork Effort and Taskwork Effort on Team Performance

Variable (N=80)	Model 1	Model 2	Model 3
Teamwork	0.62** (6.37)		0.31** (5.34)
Taskwork		.44** (14.8)	0.38** (13.70)
Model R Square	0.34**	0.74**	0.81**

All values are unstandardized coefficients. T values are shown in the parentheses.
* p < .05. **p < .01

In Set 3 (See Table 7), teamwork effort had a positive effect on team performance (B1 = .62, t = 6.37, p < 01). Higher level of teamwork effort led to higher level of team performance. The effect size was .34. Taskwork effort also had a positive effect on team performance (B1 = .44, t = 14.8, p < 01). Higher level of taskwork effort led to

higher level of team performance. The effect size was .74. When team teamwork and taskwork efforts were entered as predictors of team performance, they both had independent effects. The effect size was .81. As a result, teamwork effort has incremental positive effect over and above taskwork effort. The incremental effect size was .07 and significantly different from zero. Similarly, taskwork effort had a incremental positive effect over and above teamwork effort. The incremental effect size was .47 and significantly different from zero. Thus, hypotheses 13 and 14 were supported.

Moderating Effects of Task Interdependence on Mediator-Performance Relationships

Table 8
Moderating Effects of Task Interdependence

Variable (N=80)	Team Performance		Team Performance	
	Model 1	Model 2	Model 1	Model 2
Task Interdependence	-12.55** (-5.42)	-16.93 (-2.39)	-2.22 (-1.30)	17.23 (1.52)
Reward Interdependence				
Teamwork	.72** (8.47)	.56* (.27)		
Taskwork			.43** (14.09)	.59** (6.07)
Task X Teamwork		.11 (.65)		
Task X Taskwork				-0.10[a] (-1.74)
Model R Square	0.52**	0.527**	.743**	.753**
Change in R Square		0.003		0.01[a]

All values are unstandardized beta coefficients. T values are shown in the parentheses.
* $p < 0.05$; **$p < .01$; $p < 0.01$
[a] $p = 0.087$

In Set 4 (See Table 8), the effect of the interaction of task interdependence and teamwork effort on team performance was not significant (B3 = .11, t = .65, p = .515). The effect of teamwork effort on team performance did not vary by the level of task interdependence. Hypothesis 15 was not supported. The effect of the interaction of task interdependence and taskwork effort on team performance was

marginally significant (B3 = -.10, t = -1.74, p = .087). The effect of taskwork effort on team performance was marginally different between tasks.

DISCUSSION

Theoretical Contributions

The goal of this study was to explicitly examine the process in which positive reward interdependence affected team performance of interdependent tasks. As we expected, at the individual level positive reward interdependence has a positive effect on cooperative orientation and a negative effect on competitive orientation. When the effect of task interdependence was controlled, positive reward interdependence had a positive effect on teamwork effort and a negative effect on taskwork effort. The effects reward interdependence on teamwork effort and taskwork effort could be explained in part through its effects on cooperative and competitive orientations, respectively. At the team-level, reward interdependence had a positive effect on teamwork effort and a negative effect on taskwork effort when the effect of task interdependence was controlled. Teamwork effort and taskwork effort in turn determined team performance. The effect of reward interdependence on team performance could mostly be explained through its effects on teamwork effort and taskwork effort.

The present study found that reward interdependence had a negative effect on taskwork effort with an effect size of .16 after the effect of task interdependence is controlled. Taskwork effort in turn had a positive influence on team performance over and above teamwork effort, with the large incremental effect size of .47. This finding is important because most studies in team reward literature have ignored the effect of team reward on this influential variable. It is also consistent with a few studies (Newcomb, Brady, & Hartup, 1979; Rosenbaum et al, 1980; Konovsky & Podsakoff, 1993) that have examined the effect of reward interdependence on taskwork effort. However, the present

study differs in two respects. One is that unlike the previous studies that examined the effect of a broader range of reward interdependence (positive reward interdependence, negative reward interdependence, and reward independence), the current study examined a narrow range (high and low positive reward interdependence). The other is that the task used in this study does address the bias inherent that the tower-building task.

Hypothesis 16 (Task interdependence moderates the effect of taskwork efforts on team performance) was only marginally supported because the p value for the interaction term was greater than .05 but smaller than .10. This marginal support occurred perhaps because of three reasons. First, the task interdependence manipulation was rather weak. The difference between the low- and high- interdependence tasks was the need to share or not to share 7 pieces of information that were needed to fix 44 errors. Second, the sample size was rather small, a total of 80 teams, for this study. Third, the interaction effect is hard to detect in most studies in general. As a result, many researchers recommend that the cutoff point for p value should be increased to .10 from .05. Because of these three reasons, we decided that hypothesis 16 was partially supported and concluded that task interdependence interacted with taskwork effort to influence team performance, instead of rejecting the hypothesis because of the p value of .087.

Unexpectedly, Hypothesis 15 was rejected. Although teamwork effort had a positive effect on team performance, its effect did not vary by the level of task interdependence. Because the p value of the interaction term was quite high, it unlikely occurred because of the small sample size. This result changed our view of the effect of teamwork effort. It showed that though teamwork has a positive effect on team performance, its effect did not vary for tasks that had moderate to high level of

interdependence. This interpretation is reasonable in hindsight. For our task, receiving one piece of information from another team member allowed the receiver to fix one error. Because the receiver could readily fix the error when having sufficient information, the ratio of shared pieces of information and additional fixes likely stayed 1:1 and unchanged. The more teamwork likely led to higher team performance. This effect occurred whether the task was high or low on task interdependence. Therefore, the interaction effect was not supported.

Previous work had also investigated the effect of positive reward interdependence on team performance. The results have been mixed. One possible explanation is the effect depends on the operationalization of positive reward interdependence. The other reason is that the effects probably vary by the level of task interdependence (Rausenbaum et al., 1980; Gordon et al., 2000). The nature of the fixed effect, however, made such explanations less certain. More importantly, the question why the effect of positive reward interdependence vary by the operationalization of positive reward interdependence and task interdependence remains unanswered as previous work has made prior assumptions (Rosenbaum et al., 1980; Wageman & Baker, 1997) about the underlying process or inferred the process retroactively (Gordon et al., 2000).

Our study made a contribution by explaining the underlying mechanism. The result of our study showed that positive reward interdependence had opposite effects on two behavioral processes, teamwork effort and taskwork effort, which in turn had positive effects on team performance. High positive reward interdependence likely led to higher level of teamwork effort but lower level of taskwork effort, whereas low positive reward interdependence likely resulted in lower level of teamwork effort but a higher

level of taskwork effort. The effects of reward interdependence on teamwork effort and taskwork effort could be explained in part through its effects on team members' cooperative and competitive orientations, respectively. The effect of taskwork effort likely varied by the level of task interdependence of the tasks.

Practical Implications

If the results of the present work are replicated in future studies, they have great implications for the practice of how to reward team members. According to our literature review, positive reward interdependence is more effective than negative reward interdependence or zero reward interdependence. Our study showed that within the narrow range of positive reward interdependence, higher interdependence did not necessarily led to higher performance (For our task, it actually led to lower performance). As Wageman and Baker (1997) suggested, the effect of positive reward interdependence perhaps was moderated by task interdependence. Given the nature of the task interdependence facing a team is relatively fixed and unchanged, the important question organization faces is how to change the level of positive reward interdependence to motivate high performance. Our study suggested that positive reward interdependence had opposite effects on teamwork effort and taskwork effort, and its effect could be explained by team members' cooperative and competitive orientations. This piece of knowledge can offer useful guidance on the direction one should follow in changing the level of positive reward interdependence to improve team performance. When team performance is unsatisfactory, one needs to examine whether teamwork effort or taskwork effort is the main cause. If teamwork effort is, one should make the reward system less differential and more positively correlated. On the other hand, if taskwork

effort is the main cause of low performance, one should make the reward system more differential and less positive correlated. However, one should proceed with caution because changing the level of reward interdependence involves trade-offs. Increasing teamwork behavior tends to decreasing taskwork behavior, and vice versa. When teamwork and taskwork behaviors are not available to guide reward intervention, one can assess team members' cooperative and competitive orientations and use them as diagnostic information. The same process can be followed to determine the direction of change in positive reward interdependence.

Limitations

There are several limitations of the study. First, the study was conducted in a lab setting with psychology undergraduate students using a relatively simple task. As many lab studies, the external validity of the present is questionable and needs to be tested in the field. Second, the studies used ad-hoc teams with a total lifespan of 1.5 hours, and members worked on the team task for a total of 45 minutes. This kind of team is temporary and may not represent typical teams that often share a history and prior experiences (Kozlowski & Bell, 2003). The results of study were therefore more reflective of the early stage of team development. Third, our study operationalized positive reward interdependence with only two levels of reward distributions. As such, the results of the study represented fixed effects, which may not generalize to other levels of positive reward interdependence.

Although the lab study has limitations, the high level of control of the lab setting is needed to address the research question raised in the present work. The issue here is how positive reward interdependence affects team performance. It requires the

examinations of team members' psychological and behavioral reactions in responding to different reward systems in a team environment. This type of question requires the manipulation of the reward system and a clear contingency between performance and reward. The effects of reward interdependence on cooperative and competitive orientations need to be isolated. Moreover, teamwork effort, taskwork effort, and team performance need to be distinguished and measured adequately. These requirements would be very hard to be fulfilled in the field setting because of low level of control. Typically, researchers do not have much control over pay manipulations for both teams and individuals in the field. The team performance-reward and individual performance-reward contingencies are often not clearly established. The cooperative or competitive orientation of a worker is likely a function of individual differences, reward interdependence, role interdependence, and goal interdependence embedded in the field setting. As a result, it would be very difficult to isolate the effects of reward interdependence on cooperative and competitive orientations. Furthermore, in the field, teamwork effort and taskwork effort are not easily distinguishable and captured. Experimental control is needed to differentiate and measure them. For these reasons, a lab study is needed because of its high level of control.

Despite the shortcomings of the lab setting, we believe, our present study addressed the research question reasonably. We manipulated the reward distribution in a moderate way. Subjects clearly understood the basis on which they would be rewarded. Their cooperative and competitive orientations were assessed right after the reward manipulation check and had significant group differences. Their teamwork and taskwork effort were measured rigorously. Therefore, the process through which positive reward

interdependence influenced team performance was adequately captured because of the psychological realism of the experiment.

Like many team reward research studies, the present work suffered the limitations of the fixed-effect study by having only two levels of positive reward interdependence. The results of the studies were fixed and specific to the particular levels of positive reward interdependence being studied. However, we believe the fixed effects in our study are generalizable to other levels of positive reward interdependence because there is a strong theoretical basis to assume that the relationships of positive reward interdependence and various criteria are monotonic functions (increasing or decreasing functions). The hypotheses that positive reward interdependence has a positive effect on cooperative orientation (Deustch, 1985) and a negative effect on competition are theoretically sound and plausible. Perhaps, most people would probably agree with such assertions, and it would be hard to imagine the relationships in the reverse direction. The same argument can be applied to the relationships of positive reward interdependence and teamwork effort and taskwork effort. Moreover, we have clear prior evidence that positive reward interdependence has a positive effect on teamwork behaviors (Johnson & Johnson, 1989). And we also had some collaborating evidence to suggest that it has a negative relationship with taskwork effort (Newcomb, Brady, & Hartup, 1979; Rosenbaum et al, 1980; Konovsky & Podsakoff, 1993).

New Research Directions

Because the effect of rewards on individual-level teamwork and taskwork were not fully mediated by cooperative and competitive orientation, future studies should examine additional psychological states. One of the potential mediators is state anxiety.

When positive reward interdependence is low, performance evaluation likely becomes more salient. Team members may then experience heightened state anxiety. Anxiety was known to affect individual effort and performance. State anxiety therefore can be potential mediator and should be examined at both the individual and team levels.

Another potential mediator is the perception of valence of the individual reward. Past research has clearly established that individuals tend to overestimate their ability and performance. It follows that they will expect to have higher averaged performance ranking within teams and receive higher level of rewards on average when team reward is distributed differentially. Thus, positive reward interdependence may have a negative relationship with aggregated perception of the valence of individual rewards.

Although individual differences were assumed to contribute to the variance of the social orientations in conjunction with reward interdependence, their effects were not examined in the present study. To further expand our knowledge, future research should examine individual difference factors that can affect social orientation. Two potential individual factors are collectivism and individualism. By definition, individualists tend to accord greater importance to their personal needs than the needs of the groups (Wagner, 1995). They likely look after themselves and ignore group interests if they conflict with their personal desires. Collectivists, on the other hand, tend to give higher priority to the interests of their groups than their personal needs (Wagner, 1995). They likely look out for the interest of the groups to which they belong, even if such actions require the sacrifice of personal interests. Therefore, it is likely that collectivism has a positive effect on cooperative orientation and teamwork effort, whereas individualism has a positive effect on competitive orientation and taskwork effort.The task we examined in

the present studies is relatively simple. For a more complex task, having high level of cooperative orientation does not necessarily translate into individual teamwork effort. Similarly, high level of competitive orientation may not lead to taskwork effort. Future research may need to examine factors that may moderate the relations of social orientation and team process behaviors. Perhaps, individual social skills moderate the relationship between cooperative orientation and teamwork effort. The current study only examines team performance during a short duration. Future research should examine the effect of positive reward interdependence over a long term. The effects of team feedback will probably become relevant over time. It will be informing to know how social orientation and process behaviors vary over time, and how they will vary when teams fail or succeed.

APPENDICES

Appendix A: Html Version of the Task

```
<html>
<head><title>This page is authored by the Greek Letter Specialist</title></head>

<body>

This page is authored by the Greek Letter Specialist.
<br>
<br>
Two symbols can be combined to form a unit. Below are 44 units:
<br>
<br>
greek small  kappa and capital U circumflex: ??
<br>
greek capital  tau and inverted exclamation sign: ??
<br>
greek capital  delta and greek small  zeta: ??
<br>
greek capital  beta and greek capital  zeta: ??
<br>
greek small  omicron and capital A grave: ??
<br>
<br>
greek small  zeta and greek capital  kappa: ??
<br>
greek capital alpha and regular currency sign: ??
<br>
greek small  rho and small u grave: ??
<br>
greek capital  rho and greek small  pi: ??
<br>
greek small  sigma and little eth sign: ??
<br>
<br>
greek capital  zeta and greek small  nu: ??
<br>
greek small  iota and capital A circumflex: ??
<br>
greek capital  upsilon and Japanese yen sign: ??
<br>
greek small  delta and small o acute: ??
<br>
greek capital  omicron and little ae sign: ??
<br>
<br>
```

greek small nu and greek capital chi: ??

greek capital lambda and capital A ring: ??

greek small theta and small cent sign: ??

greek capital nu and greek small omicron: ??

greek small beta and greek capital rho: ??

greek capital theta and greek small theta: ??

greek small pi and greek capital eta: ??

greek capital iota and small i circumflex: ??

greek small xi and greek capital tau: ??

greek capital mu and small function sign: ??

greek capital chi and greek small kappa: ??

greek capital psi and capital A dasis: ??

greek small epsilon and greek capital pi: ??

greek capital xi and large pound sign: ??

greek capital phi and greek small iota: ??

greek small upsilon and small o circumflex: ??

greek capital gamma and greek capital upsilon: ??

greek small psi and greek capital theta: ??

greek capital sigma and greek small xi: ??

greek small tau and small division sign: ??

greek capital pi and greek small mu: ??

greek small gamma and greek capital sigma: ??

greek capital omega and small o dasis: ??

greek small alpha and greek capital iota: ??

greek capital epsilon and n tilde sign: ??

greek capital kappa and greek small lambda: ??

greek small lambda and capital A acute: ??

greek capital eta and greek capital phi: ??

greek small mu and little thorn sign: ??
</body>
</html>

<html>
<head><title>This page is authored by the Latin Letter Specialist</title></head>

<body>

This page is authored by the Latin Letter Specialist

Two symbols can be combined to form a unit. Below are 44 units:

capital I grave and left gumet sign: ??

small u dasis and greek small alpha: ??

capital Y acute and small u acute: ??

small a grave and capital Y acute: ??

capital U acute and inverted question sign: ??

capital O dasis and small i acute: ??

small y dasis and and capital U grave: ??

capital O grave and greek capital epsilon: ??

small c cedilla and capital O stroke: ??

capital E grave and small degree sign: ??

small u circumflex and capital E grave: ??

capital O acute and small y acute: ??

small i circumflex and greek capital psi: ??

capital C cedilla and capital I grave: ??

small e acute and right gumet sign: ??

small i grave and greek capital gamma: ??

capital A grave and small e grave: ??

small e grave and capital C cedilla: ??

capital A ring and spacing macron sign: ??

small o circumflex and capital U acute: ??

capital A circumflex and greek small delta: ??

small a circumflex and capital E circumflex: ??

capital O stroke and three quarters sign: ??

small sharp s and greek capital beta: ??

capital U grave and small u circumflex: ??

capital E acute and small registered sign: ??

small i acute and small y dasis: ??

capital U dasis and greek small beta: ??

small u grave and one half sign: ??

capital A acute and small sharp s: ??

capital I dasis and small u dasis: ??

small o acute and capital O circumflex: ??

capital A dasis and greek capital delta: ??

small u acute and plus-minus sign: ??

capital O circumflex and small e acute: ??

small e circumflex and greek small gamma: ??

capital U circumflex and small i grave: ??

small a acute and capital O dasis: ??

capital E circumflex and one quarter sign: ??

small o dasis and greek capital alpha: ??

capital I acute and small e circumflex: ??

small a dasis and greek small epsilon: ??

capital I circumflex and capital E acute: ??

small y acute and circumflex accent sign: ??

</body>
</html>

<html>
<head><title>This page is authored by the Special Sign Specialist</title></head>

<body>

This page is authored by the Special Sign Specialist.

Two symbols can be combined to form a unit. Below are 44 units:

book section sign and greek capital lambda: ??

feminine indicator sign and capital I acute: ??

superscript two sign and large OE sign: ??

small function sign and feminine indicator sign: ??

small division sign and greek capital mu: ??

little ae sign and large caron sign: ??

inverted question sign and small c cedilla: ??

little tilde sign and large THORN sign: ??

small registered sign and greek small sigma: ??

large pound sign and capital O grave: ??

superscript three sign and greek small psi: ??

three quarters sign and large AE sign: ??

little thorn sign and capital I circumflex: ??

n tilde sign and spacing dasis sign: ??

odd square sign and greek capital omicron: ??

book paragraph sign and small a circumflex: ??

broken bar sign and greek capital xi: ??

a tilde sign and odd square sign: ??

inverted exclamation sign and capital O acute: ??

Japanese yen sign and small copyright sign: ??

superscript one sign and greek small rho: ??

little eth sign and O tilde sign: ??

little oe sign and small a acute: ??

spacing macron sign and little tilde sign: ??

large caron sign and greek capital nu: ??

large OE sign and book section sign: ??

small cent sign and capital I dasis: ??

left gumet sign and superscript two sign: ??

large ETH sign and greek small tau: ??

one half sign and little caron sign: ??

large dasis sign and small a dasis: ??

spacing dasis sign and A tilde sign: ??

small copyright sign and little oe sign: ??

large THORN sign and greek capital omega: ??

small micro sign and superscript one sign: ??

plus-minus sign and book paragraph sign: ??

one quarter sign and broken bar sign: ??

little caron sign and greek small upsilon: ??

right gumet sign and large dasis sign: ??

large AE sign and capital U dasis: ??

O tilde sign and large ETH sign: ??

circumflex accent sign and small a grave: ??

small degree sign and small micro sign: ??

regular currency sign and superscript three sign: ??

</body>
</html>

Appendix B: Web Version of the Task

This page is authored by the Greek Letter Specialist.

Two symbols can be combined to form a unit. Below are 44 units:

greek small kappa and capital U circumflex: ??
greek capital tau and inverted exclamation sign: ??
greek capital delta and greek small zeta: ??
greek capital beta and greek capital zeta: ??
greek small omicron and capital A grave: ??

greek small zeta and greek capital kappa: ??
greek capital alpha and regular currency sign: ??
greek small rho and small u grave: ??
greek capital rho and greek small pi: ??
greek small sigma and little eth sign: ??

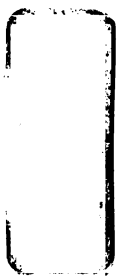
greek capital zeta and greek small nu: ??
greek small iota and capital A circumflex: ??
greek capital upsilon and Japanese yen sign: ??
greek small delta and small o acute: ??
greek capital omicron and little ae sign: ??

greek small nu and greek capital chi: ??
greek capital lambda and capital A ring: ??
greek small theta and small cent sign: ??
greek capital nu and greek small omicron: ??
greek small beta and greek capital rho: ??

greek capital theta and greek small theta: ??
greek small pi and greek capital eta: ??
greek capital iota and small i circumflex: ??
greek small xi and greek capital tau: ??
greek capital mu and small function sign: ??

greek capital chi and greek small kappa: ??
greek capital psi and capital A dasis: ??
greek small epsilon and greek capital pi: ??
greek capital xi and large pound sign: ??
greek capital phi and greek small iota: ??

greek small upsilon and small o circumflex: ??
greek capital gamma and greek capital upsilon: ??
greek small psi and greek capital theta: ??
greek capital sigma and greek small xi: ??



greek small tau and small division sign: ??

greek capital pi and greek small mu: ??
greek small gamma and greek capital sigma: ??
greek capital omega and small o dasis: ??
greek small alpha and greek capital iota: ??
greek capital epsilon and n tilde sign: ??

greek capital kappa and greek small lambda: ??
greek small lambda and capital A acute: ??
greek capital eta and greek capital phi: ??
greek small mu and little thorn sign: ??

This page is authored by the Latin Letter Specialist

Two symbols can be combined to form a unit. Below are 44 units:

capital I grave and left gumet sign: ??
small u dasis and greek small alpha: ??
capital Y acute and small u acute: ??
small a grave and capital Y acute: ??
capital U acute and inverted question sign: ??

capital O dasis and small i acute: ??
small y dasis and and capital U grave: ??
capital O grave and greek capital epsilon: ??
small c cedilla and capital O stroke: ??
capital E grave and small degree sign: ??

small u circumflex and capital E grave: ??
capital O acute and small y acute: ??
small i circumflex and greek capital psi: ??
capital C cedilla and capital I grave: ??
small e acute and right gumet sign: ??

small i grave and greek capital gamma: ??
capital A grave and small e grave: ??
small e grave and capital C cedilla: ??
capital A ring and spacing macron sign: ??
small o circumflex and capital U acute: ??

capital A circumflex and greek small delta: ??
small a circumflex and capital E circumflex: ??
capital O stroke and three quarters sign: ??
small sharp s and greek capital beta: ??
capital U grave and small u circumflex: ??

capital E acute and small registered sign: ??
small i acute and small y dasis: ??
capital U dasis and greek small beta: ??
small u grave and one half sign: ??
capital A acute and small sharp s: ??

capital I dasis and small u dasis: ??
small o acute and capital O circumflex: ??
capital A dasis and greek capital delta: ??
small u acute and plus-minus sign: ??
capital O circumflex and small e acute: ??

small e circumflex and greek small gamma: ??
capital U circumflex and small i grave: ??
small a acute and capital O dasis: ??
capital E circumflex and one quarter sign: ??
small o dasis and greek capital alpha: ??

capital I acute and small e circumflex: ??
small a dasis and greek small epsilon: ??
capital I circumflex and capital E acute: ??
small y acute and circumflex accent sign: ??

This page is authored by the Special Sign Specialist.

Two symbols can be combined to form a unit. Below are 44 units:

book section sign and greek capital lambda: ??
feminine indicator sign and capital I acute: ??
superscript two sign and large OE sign: ??
small function sign and feminine indicator sign: ??
small division sign and greek capital mu: ??

little ae sign and large caron sign: ??
inverted question sign and small c cedilla: ??
little tilde sign and large THORN sign: ??
small registered sign and greek small sigma: ??
large pound sign and capital O grave: ??

superscript three sign and greek small psi: ??
three quarters sign and large AE sign: ??
little thorn sign and capital I circumflex: ??
n tilde sign and spacing dasis sign: ??
odd square sign and greek capital omicron: ??

book paragraph sign and small a circumflex: ??
Broken bar sign and greek capital xi: ??
A tilde sign and odd square sign: ??
inverted exclamation sign and capital O acute: ??
Japanese yen sign and small copyright sign: ??

superscript one sign and greek small rho: ??
little eth sign and O tilde sign: ??
little oe sign and small a acute: ??
spacing macron sign and little tilde sign: ??
large caron sign and greek capital nu: ??

large OE sign and book section sign: ??
small cent sign and capital I dasis: ??
left gumet sign and superscript two sign: ??
large ETH sign and greek small tau: ??
one half sign and little caron sign: ??

large dasis sign and small a dasis: ??
spacing dasis sign and A tilde sign: ??
small copyright sign and little oe sign: ??
large THORN sign and greek capital omega: ??
small micro sign and superscript one sign: ??

plus-minus sign and book paragraph sign: ??
one quarter sign and broken bar sign: ??
little caron sign and greek small upsilon: ??
right gumet sign and large dasis sign: ??
large AE sign and capital U dasis: ??

O tilde sign and large ETH sign: ??
circumflex accent sign and small a grave: ??
small degree sign and small micro sign: ??
regular currency sign and superscript three sign: ??

Exhibit C: Training Manual

Learning to Write a Web Page (For Greek Letter Specialist)

Purpose: This tutorial will guide you on how to write a web page using html, the main Internet programming language. It focuses on teaching you how to write Greek Letter Symbols. Throughout the tutorial, you will see detailed instructions, sample html codes, and their actual appearance on Internet Explorer. You will also have opportunities to do some hands-on exercises.

HTML Document Structure

HTML files are just normal text files. They usually have the extension html. HTML documents have two parts: the head and the body. The body is the larger part of the document, as the body of a letter you would write to a friend would be. The head of the document only contains the document's title and similar information.

Example of basic HTML document structure:

<html>

<head><title>Title goes here</title></head>

<body>

The body goes here. The body text is written in html just as how it is written in Microsoft Word. You can just type your text on and on. When you want to start a new line, you need to insert the following break tag.

This sentence will start in a new line. Without the tag, the next sentence just follows the previous one until the end of the line where it wraps. When you want double space the next line, you can just enter two break tags as following.

Symbols, however, are coded by a series of unique numbers. For example, &#936 is a Greek capital psi.

A Greek capital phi is &#934.

</body>

</html>

Some Fundamentals: **Whatever appears between the TITLE tags will be the title of the document, which can be found in the title bar at the top of the screen of an Internet Explorer window.**
**Whatever you place between the BODY tags will appear in the major area of the document window. When you write a web page, you will write in the area between <body> and </body>. You can just ignore the text between <header> and </header>. If you want to start text in the new line, you need insert the break tag
. If you want extra space between two lines, just enter two break tags,

.**

Symbols: Symbols are special characters. Unlike a typical character we know such as "a", html language often requires a number of keystrokes to display a symbol. Typically, a symbol can be coded by using a series of number. For example, &#934 will display the Greek capital phi symbol, Φ. &#936 will display the Greek capital psi symbol, Ψ.

Try it yourself #1

Type the following HTML code in Notepad.
To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>

<body>

The body goes here. The body text is written in html just as how it is written in Microsoft Word.
You can just type your text on and on. When you want to start a new line, you need to insert
the following tag.
<br>
This sentence will start in a new line. Without the tag, the next sentence just follows the
previous one until the end of the line where it wraps. When you want double space the next
line, you can just enter two break tags as following.
<br>
<br>
```

Symbols are entered by a series of unique numbers. For example, &#936 is a Greek capital psi.

A Greek capital phi is &#934.

</body>

</html>

Save the file as ExampleOne.html in folder C:/AAA
To see how this files appears on the Internet,
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleOne.html

If you enter the right codes, you will see "Title go here" appear at the top of your Internet Explorer. In the main page, you will see:

The body goes here. The body text is written in html just as how it is written in Microsoft Word. You can just type your text on and on. When you want to start a new line, you need to insert the following tag.
This sentence will start in a new line. Without the tag, the next sentence just follows the previous one until the end of the line where it wraps. When you want double space the next line, you can just enter two break tags as following.

Symbols are entered by a series of unique numbers. For example, Ψ is a Greek capital psi.
A Greek capital phi is Φ.

In this tutorial, you will learn how to write Greek Letter Symbols and will become a Greek Letter Specialist. The html codes for 50 Greek Letter Symbols are in the file C:/AAA/GreekLetters.pdf. Please, double click on the preceding link to open the file and quickly read through its content. Remember you don't have to memorize the html codes for these symbols, as you can refer back to this reference file later any time you need.

Try it yourself #2

Type the following HTML code in Notepad. To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>

<body>

 This is a Greek capital upsilon ??.
<br>
This is a Greek Capital lambda ??.

</body>

</html>
```

Now replace the question marks with the html codes for Greek capital upsilon and Greek Capital lamba. You can find the html codes for these two symbols in file C:/AAA/GreekLetters.pdf you just read.

Save the file as ExampleTwo.html in folder C:/AAA
To see how this file appears on the Internet
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleTwo.html

The correct codes will show the following in the main page:

This is a Greek capital upsilon υ.
This is a Greek capital lambda Λ.

Try it yourself #3

Type the following HTML code in Notepad. To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>
<body>
```

This is a Greek capital chi ??.

This is a Greek capital pi ??.

</body>

</html>

Now replace the question marks with the html codes for Greek capital chi and Greek Capital pi. You can find the html codes for these two symbols in file C:/AAA/GreekLetters.pdf you just read.

Save the file as ExampleThree.html in folder C:/AAA
To see how this file appears on the Internet
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleThree.html

The correct codes will show the following in the main page:

This is a Greek capital chi Χ.
This is a Greek capital pi Π.

Learning to Write a Web Page (For Latin Letter Specialist)

Purpose: This tutorial will guide you on how to write a web page using html, the main Internet programming language. It focuses on teaching you how to write Latin Special Letters. Throughout the tutorial, you will see detailed instructions, sample html codes, and their actual appearance on Internet Explorer. You will also have opportunities to do some hands-on exercises.

HTML Document Structure

HTML files are just normal text files. They usually have the extension html. HTML documents have two parts: the head and the body. The body is the larger part of the document, as the body of a letter you would write to a friend would be. The head of the document only contains the document's title and similar information.

Example of basic HTML document structure:

<html>

<head><title>Title goes here</title></head>

<body>

The body goes here. The body text is written in html just as how it is written in Microsoft Word. You can just type your text on and on. When you want to start a new line, you need to insert the following break tag.

This sentence will start in a new line. Without the tag, the next sentence just follows the previous one until the end of the line where it wraps. When you want double space the next line, you can just enter two break tags as following.

Symbols, however, are coded by a series of unique numbers. For example, &#249 is a small u grave.

Capital A grave is &#192.

</body>

</html>

Some Fundamentals: Whatever appears between the TITLE tags will be the title of the document, which can be found in the title bar at the top of the screen of an Internet Explorer window.

**Whatever you place between the BODY tags will appear in the major area of the document window. When you write a web page, you will write in the area between <body> and </body>. You can just ignore the text between <header> and </header>. If you want to start text in the new line, you need insert the break tag
. If you want extra space between two lines, just enter two break tags,

.**

Symbols: Symbols are special characters. Unlike a typical character we know such as "a", html language often requires a number of keystrokes to display a symbol. Typically, a symbol can be coded by using a series of number. For example, &#249 will display the small u grave, ù. &#192 will display the capital A grave, À.

Try it yourself #1

Type the following HTML code in Notepad.
To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>

<body>

The body goes here. The body text is written in html just as how it is written in Microsoft Word.
You can just type your text on and on. When you want to start a new line, you need to insert
the following tag.
<br>
This sentence will start in a new line. Without the tag, the next sentence just follows the
previous one until the end of the line where it wraps. When you want double space the next
line, you can just enter two break tags as following.
<br>
<br>
Symbols are coded by a series of unique numbers. For example, &#249 is a small u grave.
<br>
Capital A grave is &#192.
```

```
</body>

</html>
```

Save the file as ExampleOne.html in folder C:/AAA
To see how this files appears on the Internet,
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleOne.html

If you enter the right codes, you will see "Title go here" appear at the top of your Internet Explorer. In the main page, you will see:

The body goes here. The body text is written in html just as how it is written in Microsoft Word. You can just type your text on and on. When you want to start a new line, you need to insert the following tag.
This sentence will start in a new line. Without the tag, the next sentence just follows the previous one until the end of the line where it wraps. When you want double space the next line, you can just enter two break tags as following.

Symbols are coded by a series of unique numbers. ù is a small u grave.

Capital A grave is À.

In this tutorial, you will learn how to write Latin Special Letters and will become a Latin Letter Specialist. The html codes for 50 Special Signs are in the file C:/AAA/LatinSpecials.pdf. Please, open this file (go to folder C:/AAA and double click on the file) and quickly read through its content. Remember you don't have to memorize the html codes for these symbols, as you can refer back to this reference file later any time you need.

Try it yourself #2

Type the following HTML code in Notepad. To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>

<body>

This is a capital E acute ??.
<br>
This is a small i acute ??.

</body>

</html>
```

Now replace the question marks with the html codes for capital E acute and small i acute. You can find the html codes for these two symbols in file C:/AAA/LatinSpecials.pdf you just read.

Save the file as ExampleTwo.html in folder C:/AAA
To see how this file appears on the Internet
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleTwo.html

The correct codes will show the following in the main page:

This is a capital E acute É.
This is a small I acute í.

Try it yourself #3

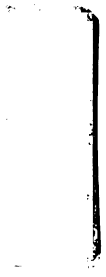
Type the following HTML code in Notepad. To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>
<body>

This is a capital U circumflex ??.
<br>
This is a small a circumflex ??.
```



</body>

</html>

Now replace the question marks with the html codes for capital U circumflex and small a circumflex. You can find the html codes for these two symbols in file C:/AAA/LatinSpecials.pdf you just read.

Save the file as ExampleThree.html in folder C:/AAA
To see how this file appears on the Internet
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleThree.html

The correct codes will show the following in the main page:

This is a capital U circumflex Û.
This is a small a circumflex â.

Learning to Write a Web Page (For Special Sign Specialist)

Purpose: This tutorial will guide you on how to write a web page using html, the main Internet programming language. It focuses on teaching you how to write Special Sign Symbols. Throughout the tutorial, you will see detailed instructions, sample html codes, and their actual appearance on Internet Explorer. You will also have opportunities to do some hands-on exercises.

HTML Document Structure

HTML files are just normal text files. They usually have the extension html. HTML documents have two parts: the head and the body. The body is the larger part of the document, as the body of a letter you would write to a friend would be. The head of the document only contains the document's title and similar information.

Example of basic HTML document structure:

```
<html>

<head><title>Title goes here</title></head>

<body>

The body goes here. The body text is written in html just as how it is written in Microsoft Word.
You can just type your text on and on. When you want to start a new line, you need to insert
the following break tag.
<br>
This sentence will start in a new line. Without the tag, the next sentence just follows the
previous one until the end of the line where it wraps. When you want double space the next
line, you can just enter two break tags as following.
<br>
<br>
Symbols, however, are coded by a series of unique numbers. For example, &#165 is a
Japanese Yen sing.
<br>
Book section sign is &#167.


</body>

</html>
```

Some Fundamentals: Whatever appears between the TITLE tags will be the title of the document, which can be found in the title bar at the top of the screen of an Internet Explorer window.

**Whatever you place between the BODY tags will appear in the major area of the document window. When you write a web page, you will write in the area between <body> and </body>. You can just ignore the text between <header> and </header>. If you want to start text in the new line, you need insert the break tag
. If you want extra space between two lines, just enter two break tags,

.**

Symbols: Symbols are special characters. Unlike a typical character we know such as "a", html language often requires a number of keystrokes to display a symbol. Typically, a symbol can be coded by using a series of number. For example, &#165 will display the Japanese Yen sign, ¥. &#167 will display the book section sign, §.

Try it yourself #1

Type the following HTML code in Notepad.
To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>

<body>

The body goes here. The body text is written in html just as how it is written in Microsoft Word.
You can just type your text on and on. When you want to start a new line, you need to insert
the following tag.
<br>
This sentence will start in a new line. Without the tag, the next sentence just follows the
previous one until the end of the line where it wraps. When you want double space the next
line, you can just enter two break tags as following.
<br>
<br>
Symbols are coded by a series of unique numbers. For example, &#165 is a Japanese Yen
sign.
<br>
Book section sign is &#167.
```

```
</body>

</html>
```

Save the file as ExampleOne.html in folder C:/AAA
To see how this files appears on the Internet,
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleOne.html

If you enter the right codes, you will see "Title go here" appear at the top of your Internet Explorer. In the main page, you will see:

The body goes here. The body text is written in html just as how it is written in Microsoft Word. You can just type your text on and on. When you want to start a new line, you need to insert the following tag.
This sentence will start in a new line. Without the tag, the next sentence just follows the previous one until the end of the line where it wraps. When you want double space the next line, you can just enter two break tags as following.

Symbols are coded by a series of unique numbers. ¥ is a Japanese Yen sign.

Book section sign is §.

In this tutorial, you will learn how to write Special Signs and will become a Special Sign Specialist. The html codes for 50 Special Signs are in the file C:/AAA/SpecialSigns.pdf. Please, open this file (go to folder C:/AAA and double click on the file) and quickly read through its content. Remember you don't have to memorize the html codes for these symbols, as you can refer back to this reference file later any time you need.

Try it yourself #2

Type the following HTML code in Notepad. To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>

<body>

This is a small copyright sign ??.
<br>
This is an n tilde sign ??.


</body>

</html>
```

Now replace the question marks with the html codes for small copyright sign and n tilde sign. You can find the html codes for these two symbols in file C:/AAA/SpecialSigns.pdf you just read.

Save the file as ExampleTwo.html in folder C:/AAA
To see how this file appears on the Internet
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleTwo.html

The correct codes will show the following in the main page:

This is a small copyright sign ©.
This is an n tilde sign ñ.

Try it yourself #3

Type the following HTML code in Notepad. To open Notepad, go to
Start
Programs
Accessories
Notepad

Note: Feel free to use COPY and PASTE if you feel comfortable with the code and don't want to type it all yourself.

```
<html>

<head><title>Title goes here</title></head>
<body>

This is a book paragraph sign ??.
<br>
```

This is a large OE sign ??.

</body>

</html>

Now replace the question marks with the html codes for book paragraph sign and large OE sign. You can find the html codes for these two symbols in file C:/AAA/SpecialSigns.pdf you just read.

Save the file as ExampleThree.html in folder C:/AAA
To see how this file appears on the Internet
Open the Internet Explorer
In the Address Box, type: C:/AAA/ExampleThree.html

The correct codes will show the following in the main page:

This is a book paragraph sign.
This is a large OE sign.

Exhibit D: Coding Manual

50 Greek Letters

&#927 greek capital omicron
&#965 greek small upsilon
&#913 greek capital alpha
&#963 greek small sigma
&#915 greek capital gamma

&#961 greek small rho
&#919 greek capital eta
&#959 greek small omicron
&#921 greek capital iota
&#957 greek small nu

&#914 greek capital beta
&#955 greek small lambda
&#926 greek capital xi
&#953 greek small iota
&#922 greek capital kappa

&#950 greek small zeta
&#928 greek capital pi
&#948 greek small delta
&#929 greek capital rho
&#946 greek small beta

&#931 greek capital sigma
&#932 greek capital tau
&#937 greek capital omega
&#945 greek small alpha
&#933 greek capital upsilon

&#935 greek capital chi
&#947 greek small gamma
&#936 greek capital psi
&#949 greek small epsilon
&#934 greek capital phi

&#952 greek small theta
&#923 greek capital lambda
&#954 greek small kappa
&#917 greek capital epsilon
&#956 greek small mu

&#924 greek capital mu
&#958 greek small xi
&#925 greek capital nu
&#960 greek small pi
&#920 greek capital theta

&#968 greek small psi
&#916 greek capital delta
&#964 greek small tau
&#918 greek capital zeta
&#966 greek small phi

&#967 greek small chi
&#962 greek final sigma
&#963 greek small sigma
&#998 greek pi square
&#978 greek hook upsilon

50 Latin Special Letters

&#233 small e acute
&#193 capital A acute
&#236 small i grave
&#196 capital A dasis
&#243 small o acute

&#192 capital A grave
&#225 small a acute
&#204 capital I grave
&#234 small e circumflex
&#221 capital Y acute

&#223 small sharp s
&#205 capital I acute
&#255 small y dasis
&#218 capital U acute
&#226 small a circumflex

&#201 capital E acute
&#228 small a dasis
&#214 capital O dasis
&#232 small e grave
&#207 capital I dasis

&#250 small u acute
&#206 capital I circumflex
&#253 small y acute
&#211 capital O acute
&#249 small u grave

&#210 capital O grave
&#251 small u circumflex
&#220 capital U dasis

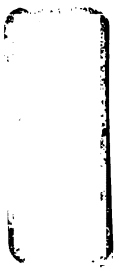
&#252 small u dasis
&#216 capital O stroke

&#237 small i acute
&#217 capital U grave
&#244 small o circumflex
&#194 capital A circumflex
&#231 small c cedilla

&#219 capital U circumflex
&#246 small o dasis
&#197 capital A ring
&#199 capital C cedilla
&#224 small a grave

&#200 capital E grave
&#202 capital E circumflex
&#238 small i circumflex
&#212 capital O circumflex
&#230 small ae diphthong

&#107 small k letter
&#100 lowercase d letter
&#114 small r cursy
&#122 lower z cursy
&#100 small n cursy



50 Special Signs

&#168 spacing dasis sign
&#732 little tilde sign
&#169 small copyright sign
&#978 odd square sign
&#222 large THORN sign

&#166 Broken bar sign
&#710 circumflex accent sign
&#167 Book section sign
&#254 little thorn sign
&#170 feminine indicator sign

&#402 small function sign
&#176 small degree sign
&#352 large caron sign
&#178 superscript two sign
&#240 little eth sign

&#338 large OE sign
&#177 plus-minus sign
&#339 little oe sign
&#189 one half sign
&#376 large dasis sign

&#188 one quarter sign
&#353 little caron sign
&#190 three quarters sign
&#187 right gumet sign
&#198 large AE sign

&#230 little ae sign
&#179 superscript three sign
&#208 large ETH sign

&#191 inverted question sign
&#247 small division sign

&#171 left gumet sign
&#162 small cent sign
&#175 spacing macron sign
&#165 Japanese yen sign
&#182 book paragraph sign

&#185 superscript one sign
&#241 n tilde sign
&#195 A tilde sign
&#213 O tilde sign
&#161 inverted exclamation sign

&#174 small registered sign
&#163 large pound sign
&#181 small micro sign
&#164 regular currency sign
&#130 left single quote

&#132 right single quote
&#093 right square bracket
&#092 left square bracket
&#125 right curly bracket
&#123 left curly bracket

Appendix E: Team Task Instruction

PLEASE, READ THE INSTRUCTION FOR THE NEXT TASK.

Your Team Task

You have been trained to become an expert in one area while your two other team members have learned to become specialists in two other areas. In the next team task, you will work with the other two members to fix a website. The website has 3 pages. Each page has 44 errors, so there are 132 errors in total. Your team will have a 25 % chance to win $90 cash bonus for this task.

Your Assignment

Each of you will be assigned to fix one page of the website for which you have the most expertise. The page is set up so that you don't have the knowledge to fix all the errors yourself. If you don't know how to fix an error, one of your team members does. So you need to communicate and work with your team members if you want to fix all the errors. You guys can work in any way you want. The only restriction is that you cannot physically type in the codes for your other team members.

Your Team and Your Own Performance

Your team performance will be the total number of errors that all three team members correctly fix. Your performance will be the total number of errors that you correctly fix in your assigned page. Remember that a fix should contain a unit of two correct symbols. If one of the symbols in the unit is not corrected, it is still considered an error.

If your team performance is in the top 25 % of all performing teams, your team will win $90.

The following lines are different for each condition

High positive reward interdependence:

If your team wins $90, each one of you will get $30.

Low positive reward interdependence:

If your team wins $90, the top performer of your team will get $45; the middle performer will get $30; and the bottom performer will get $20.

You are assigned to work on page C:/AAA/member#.html. Please, open this file in both Notepad and Internet Explorer.

PLEASE, DON'T START YET. LET THE EXPERIMENTER KNOW ONCE YOU HAVE THE FILE OPEN SO HE/SHE CAN START EVERYONE AT THE SAME TIME.

Appendix F: Information Exchange Checklist

Symbol	Codes	Latin Ask	Response	Sign ask	Response
greek capital beta	&#914				
greek capital chi	&#935				
greek capital delta	&#916				
greek capital epsilon	&#917				
greek capital eta	&#919				
greek capital gamma	&#915				
greek capital iota	&#921				
greek capital kappa	&#922				
greek capital lambda	&#923				
greek capital mu	&#924				
greek capital nu	&#925				
greek capital omega	&#937				
greek capital omicron	&#927				
greek capital phi	&#934				
greek capital pi	&#928				
greek capital psi	&#936				
greek capital rho	&#929				
greek capital sigma	&#931				
greek capital tau	&#932				
greek capital theta	&#920				
greek capital upsilon	&#933				
greek capital xi	&#926				
greek capital zeta	&#918				
greek capital alpha	&#913				
greek final sigma	&#962				
greek hook upsilon	&#978				
greek pi square	&#998				
greek small alpha	&#945				
greek small beta	&#946				
greek small delta	&#948				
greek small epsilon	&#949				
greek small gamma	&#947				
greek small iota	&#953				
greek small kappa	&#954				
greek small lambda	&#955				
greek small mu	&#956				
greek small nu	&#957				

greek small omicron	**&#959**				
greek small pi	**&#960**				
greek small rho	**&#961**				
greek small sigma	**&#963**				
greek small tau	**&#964**				
greek small theta	**&#952**				
greek small upsilon	**&#965**				
greek small xi	**&#958**				
greek small zeta	**&#950**				
greek small chi	**&#967**				
greek small phi	**&#966**				
greek small psi	**&#968**				
greek small sigma	**&#963**				

Appendix G

Questionnaire 1: Demographic Information

Demographic Information

What is your age? _____ Gender? _____ GPA? _____

SAT score? _____ Or ACT score? _____

What is your ethnicity? (Please check one):

- ☐ Caucasian American
- ☐ African American
- ☐ Hispanic American
- ☐ Native American
- ☐ Asian American

Appendix H

Questionnaire 2: Manipulation Checks and Social Orientation Scales

Manipulation Checks:
To what extent do you agree or disagree with the following statements

1. A correct fix will require the correct codes for two symbols. If one of the symbols of the unit is not the correct, it is still an error.
2. Your team performance will be the total number of errors all three members of the team correctly fix.
3. Your performance will be the total number of errors you correctly fix in your assigned page
4. Your team will win $90 if your team performance is in the top 25 % of the all performing teams.

For high reward interdependence condition

5. If you team wins $90, you will receive $30.

For low reward interdependence condition

5. If you team wins $90, top performer of the team will receive $40; middle performance will receive $30; and bottom performer will receive $20

Social Orientation Scales
To what extent do you agree or disagree with the following statements regarding your expectations and intentions for this task

Cooperative Orientation

1. I like to help other team members perform.
2. I like to share my knowledge and materials with other team members.
3. I like to cooperate with other team members.
4. I benefit greatly by working with other team members.
5. I try to shard my knowledge and materials with other team members when I think it will help them.
6. Team members can benefit greatly by working with one another.
7. It is a good idea to help other team member perform.

Competitive Orientation

8. I like to do better work than other team members.
9. I work to get better rewards than other team members do.
10. I like to be the best performer in the team.
11. I don't like to be second.
12. I like to compete with other team members to see who can do the best work.
13. I am happiest when I am competing with other team members.
14. I like the challenge of seeing who is best.
15. Competing with other team members is a good way to work.

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