

# Collective Behavior and Team Performance

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Modern complex systems require effective team performance, yet the question of which factors determine effective teams remains to be answered. Group researchers suggest that collective or interdependent behavior is a critical component of team interaction. Furthermore, anecdotal evidence suggests that some team members are less collectively oriented than others and that the tendency to ignore task inputs from others is one factor that contributes to poor team performance. In this study we develop a procedure for differentiating collectively oriented versus egocentric team members. Experimental results confirm that collectively oriented team members were more likely to attend to the task inputs of other team members and to improve their performance during team interaction than were egocentric team members.

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## INTRODUCTION

Modern complex systems, such as military combat information centers, space shuttles, and commercial airliners, require effective team interaction and coordination. Traditionally, however, selection, training, and human factors efforts have focused almost exclusively on individual skills and technical proficiency. More recently, Foushee (1984), Foushee and Helmreich (1988), Driskell and Salas (1991), and others noted an increased recognition of the importance of team performance. In fact, a review of worldwide jet transport accidents from 1968 to 1970 documented more than 60 in which breakdown of crew coordination played a significant part (Cooper, White, and Lauber, 1979). Neverthe-

less, group researchers such as Hoffman (1965), Hackman and Morris (1975), and Driskell, Hogan, and Salas (1987) have lamented the fact that despite decades of research, very little is known about the factors that determine effective team performance.

One of the most obvious advantages of teams is that they offer a greater amount and variety of knowledge and skills on which to draw. Perhaps more important to team success, however, is the interdependent nature of team dynamics: team members are able to pool information, share resources, and check errors in accomplishing a task. One of the earliest studies of group performance attributed the effectiveness of groups to the ability of group members to exchange and coordinate information (Shaw, 1932). Lanzetta and Roby (1960) also recognized the importance of coordination in team performance, observing that the way in which skills were utilized was as important to team success as whether

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those skills were present or absent. These and other studies suggest that the ability of team members to exchange information in an interdependent manner is critical to effective group performance. Indeed, many have argued that the interdependence or collective behavior of group members—what Allport (1962) called *reciprocal give-and-take behaviors*—is the critical essence that constitutes a functioning group (see Lewin, 1948; McGrath, 1984; Steiner, 1986).

Furthermore, a lack of collective behavior is often evident in real-world descriptions of poor team performance. Foushee (1982) reported one flight crew incident in which, after ignoring repeated flight advisories from a copilot, the captain responded "just look out the damn window" (p. 1063). Other studies of real-world teams have shown that the failure to exchange information and coordinate interaction is one factor that differentiates good teams from bad ones (Foushee, Lauber, Baetge, and Acomb, 1986; Foushee and Manos, 1981). We argue that the tendency to attend to task inputs from others in an interdependent manner, which we term *collective behavior*, is a critical factor in effective team performance. We conducted an empirical study to distinguish collectively oriented team members from egocentric ones and to examine the effect of collective behavior on team task performance.

#### *Team Coordination and Collective Behavior*

One of the central features of a team (and usually one of the most obvious in terms of applied work groups) is that it is a group of people working together. Although group tasks differ in the degree of cooperation required (see Shaw, 1981), an essential feature that differentiates a group from an aggregate of individuals is that they interact—that is, one person's behavior forms the basis for the other's response. In fact, McGrath (1984) concluded that "the central feature, the 'essence'

of a group lies in the interaction of its members—the *behaving together* . . . of two or more people" (p. 12).

Well-functioning teams are often described intuitively in terms of coordinated behavior; We distinguish between the well-coordinated and interdependent behavior of a set of individuals who embody the team concept and that of a set of disparate individuals in a group context who are perhaps more properly termed an aggregate. Sports that require high levels of teamwork, such as basketball, illustrate this concept vividly: the top teams that end up competing for the national championship usually display a high level of team coordination, whereas teams that fare more poorly often contain one or more equally talented but self-centered ballplayers who are usually tagged as "poor team players." A more critical example of the need for effective team member coordination is aircrew performance. In 1982, an Air Florida B-737 rolled on takeoff and crashed at Washington National Airport. The National Transportation Safety Board recovered cockpit transcripts that clearly showed that the first officer advised the captain several times of his concerns over instrument readouts but that the captain ignored this input and continued to take off (National Transportation Safety Board, 1982).

This concept of behavioral interdependence, which we term *collective behavior*, refers to the tendency to coordinate, evaluate, and utilize task inputs from other group members in an interdependent manner in performing a group task. Collective behavior is in fact one of the criteria that define group performance; Golembiewski (1962) defined a group as a system of "coordinated behavior" (p. 97), Shaw (1981) defined a group as requiring "mutual influence" (p. 8), McGrath and Kravitz (1982) defined a group as including members who are "mutually aware and take one another into account" (p. 199), and

Steiner (1986) referred to a group's "mutual responsiveness" (p. 257).

There is some empirical evidence that collective behavior makes a difference in how well teams perform. Davis (1969) found that the preference for working alone versus working with a group was related to both the amount of group discussion and group effectiveness. In examining problem-solving groups composed of those who preferred to work without a partner or those who preferred teamwork, he found that the team preference groups interacted more, solved problems faster, and were more accurate. Thomas (1957) found that groups whose members performed a task interdependently (i.e., behavior was structured so that subjects had to work together in an interactive manner to solve the task) were more productive. In fact, Thomas found that group performance was affected more by behavioral interdependence than by whether the task was structured by competitive or cooperative goals. Even those who worked interactively but were told to strive for individual goals said that they worked harder for the group than for themselves. Finally, studies of flight crew interaction have found that ineffective crews are characterized by a relative lack of communication and failure to exchange information effectively (Foushee et al., 1986; Foushee and Manos, 1981).

In sum, the concept of mutual interdependence pervades the literature on team interaction. Furthermore, research suggests that some team members are more collectively oriented than are others—that is, they exhibit more interdependent behavior in task groups—and this may affect team performance. Specifically, we argue that collectively oriented team members benefit from group interaction: they are able to enhance their own performance (and that of the team) by attending to others' task inputs. In effect, they benefit from the opportunity to pool in-

formation, share resources, and check errors that is afforded by the team environment. We also argue that egocentric team members, who tend to reject task input from others, will not benefit from being in a team setting.

The following research examines the influence of collective behavior on team performance. The research was carried out in two phases. Phase 1 was conducted to identify collectively oriented team players and egocentric or nonteam players. In Phase 2 teams were composed of either collectively oriented or egocentric members, and data were gathered to examine the effects of collective behavior on team task performance.

#### PHASE 1

##### *Overview*

Consider a prototype team situation in which two persons are engaged in a collective task and must make a series of task decisions. For each decision, each person makes an initial decision, the two exchange this information, and then each offers a final team decision. Furthermore, they are in a *no-information* task environment—that is, they know nothing about their partner, the task, or their relative abilities at the task. The team members know only that they are to work together as a team. In such a situation, when team members initially disagree, we may expect them to resolve the disagreement according to an approximate 50/50 decision rule. In other words, half the time I may be right, so I will reject my partner's input; half the time my partner may be right, so I will accept my partner's input. This behavior reflects a mutual interdependence, or collective behavior, in this idealized two-person team environment.

However, some members may exhibit less team behavior—that is, they are less likely to attend to their partner's task inputs during group decision making. This type of behavior is evident in what Foushee and Helmreich

(1988) call the *wrong stuff* for flight crew members: a tendency toward self-sufficiency and rejection of influence from others. For example, a team member may exhibit a more egocentric decision style by not attending to the partner's input and resolving most disagreements in his or her own favor. The first type of behavior we term *collective behavior*, and the second we term *egocentric*. The purpose of the Phase 1 study was to isolate these types of behaviors.

#### Method

*Subjects.* Participants in this study were 60 male naval technical school students who volunteered to take part in a study examining team performance. (Because some were undoubtedly "volunteered" by their commanding officer, all were given the opportunity to decline privately and anonymously when they arrived to take part in the study. One did, but the rest seemed to view this as an interesting break from normal activities.)

*Procedure.* Subjects were seated alone in separate laboratory rooms, where they were told that the nature of the study concerned team problem solving and that they would be working together as a team making a series of task decisions. Subjects worked in two-person teams on a task developed to operationalize relevant aspects of the group decision-making process. Each team was confronted with a series of binary choice problems: a series of slides was shown depicting two checkerboard patterns, and the subjects' task was to choose which of the two patterns in each slide contained the greater area of white. For each slide, each team member made an initial choice as to the correct answer (either the top or the bottom pattern). The two then exchanged this information (after making an initial choice, each subject saw his partner's choice), and then, after restudying the task and considering his partner's choice, each member made a final choice. The

subjects were told that only final choices would be counted in determining final team scores. Initial scores were only for exchanging information, and the subjects were to take their partner's initial choice as their own final choice if they thought this would help them make a correct final team decision. To reinforce the team nature of the task, subjects were told that their final team score would be compared with that of other teams.

Initial choice feedback was controlled by computer, so that for 20 of 25 trials, subjects were faced with initial choice disagreements (that is, if they chose the top checkerboard, they saw that their partner chose the bottom one). Therefore, when initial choices disagreed, a team member could either accept his partner's initial choice as his own final choice (accepting his partner's influence) or keep his own initial choice as his final choice (rejecting his partner's input). The measure  $P(s)$  is the proportion of resolutions resolved in favor of self, a measure of rejection of the partner's task input.

Phase 1 constituted a baseline, no-information task condition. This was achieved through several means. First, each subject was seated alone in a laboratory room and had no direct contact with his partner; this was done to ensure that subjects did not form initial task expectations based on their partner's status, which could have been communicated by nonverbal or other social cues. Team members were linked and communicated task choices via a computer network. Second, the subjects were told the task was unrelated to traditional skills such as math or reading, in order to dissociate performance on this task from their previous experience. Third, the task was ambiguous. Pretesting ensured that the probability of choosing either answer on any one problem trial was approximately 0.50; therefore there was no objective basis for making a decision. In this type of no-information team environment,  $P(s)$  re-

flects a baseline propensity to reject others' influence.

Data from Driskell (1982) and others show that in such an idealized task situation, when one has no information on the task or on one's partner,  $P(s)$  approximates 0.60 (this reflects a slight baseline tendency to stay with one's own choices when resolving task disagreements). Thus in an ambiguous task situation, knowing only that they are working together with a partner as a team, group members tend to reject their partners' task inputs about 60% of the time. However, in any particular subject population, this figure will range from 0.0 (representing a team member who accepts his or her partner's initial task decisions on every trial) to 1.0 (representing a team member who rejects information provided by the partner on every trial).

The purpose of Phase 1 was to establish this  $P(s)$  metric for the subject population and to trisect this population into three subgroups based on  $P(s)$  scores: (a) those in the highest range who constituted the egocentric group, rejecting their partners' opinions most of the time; (b) the group around the mean who constituted the collectively oriented group, and (c) those in the lowest tripartition who represented the altercentric group, accepting their partners' decisions on most all occasions.

### Results

Sixty subjects took part in the baseline study. Data for four subjects were excluded from analysis because of equipment failure ( $n = 2$ ) and failure to follow instructions ( $n = 2$ ). The  $P(s)$  measure for the subjects ranged from 0.0 to 1.0, with a mean of 0.66. On the basis of the  $P(s)$  score, subjects were partitioned into three groups: (1) egocentric—19 subjects with the highest  $P(s)$  (range = 1.0–0.75, mean = 0.82); (2) collectively oriented—the 21 subjects in a median  $P(s)$  group (range = 0.70–0.60, mean = 0.65); and (3) altercentric—the group of 16 subjects with a lower

$P(s)$  (range = 0.55–0.0, mean = 0.43). Because the purpose of this study was to identify and examine the effects of collectively oriented versus egocentric team members on team performance, the altercentric group members were dropped from further analysis. The question of how to deal with the altercentric team member, who abdicates almost every decision to other team members, was not examined in this study.

## PHASE 2

### Overview

In Phase 2, egocentric teams, collectively oriented teams, and a control group of individuals who had not participated in Phase 1 performed a team task similar to that in Phase 1. However, there were two critical differences on this task: (a) it was not ambiguous but contained items that had correct answers, so that performance on the task could be evaluated; and (b) team members received actual rather than controlled initial choice feedback from their partners. Because team members made initial choices, received team member input, and then made final choices, Phase 2 allowed us to examine the gain in performance from initial choice to final choice for each team and to test the hypothesis that collectively oriented team members are more likely than egocentric team members to improve their performance by attending to their team member's task inputs.

### Method

*Subjects.* Participants in Phase 2 were those subjects identified in Phase 1 as either collectively oriented or egocentric, in addition to a separate group of new participants from the same initial subject pool, who were selected to perform the Phase 2 task as individuals.

*Procedure.* In Phase 2 new two-person teams were composed according to  $P(s)$  scores from Phase 1. Condition 1 comprised egocentric teams, Condition 2 comprised col-

lectively oriented teams, and Condition 3 comprised the group of subjects who worked on the task as individuals, making initial and final choices as in Conditions 1 and 2 but without another team member's input.

As in Phase 1, team members were seated alone in laboratory rooms. They again performed a team task, making initial choices, receiving their partner's initial choice feedback, and then making final choices on a series of checkerboard-patterned problems. However, in Phase 2 there were two changes in procedure as previously noted. First, the problems contained correct answers; slides were chosen on the basis of pretesting that yielded an average correct response of 66%, representing a task of intermediate difficulty. Second, each subject received information on his partner's initial choice prior to making a final choice.

Initial and final choices and response latency were recorded for each subject over 25 trials. At the conclusion of this task, subjects completed a questionnaire, which contained items assessing subjects' preference for working as a team member and general satisfaction with the group. After completing the questionnaire, each subject was interviewed individually, fully debriefed, and thanked for his participation.

### Results

Table 1 presents task performance data for each of the three conditions for the 25 task trials.

*Performance scores.* Performance scores (the number of correct responses out of the 25 trials) were derived for both initial choices and final choices for each subject in each of the three conditions. The primary analysis applied to the performance scores was a 3 (Condition)  $\times$  2 (Scores: initial and final) repeated-measures analysis of variance (ANOVA). This analysis revealed no significant main effect for condition,  $F(2,60) = 0.38$ ,  $p = 0.69$ . There was a significant main effect for scores,  $F(1,60) = 20.25$ ,  $p < 0.0001$ . Finally, there was a significant Condition  $\times$  Scores interaction,  $F(2,60) = 5.92$ ,  $p < 0.005$ .

An analysis of simple effects was carried out using a priori contrasts within the complete design (Kirk, 1982). First, results indicate that there was no significant change from initial score to final score for the egocentric team members of Condition 1,  $F(1,60) = 1.17$ ,  $p > 0.1$ ; the mean gain in performance score from initial to final choice for the 25 trials was 0.36.

Second, for the collectively oriented team members (Condition 2), there was a significant gain in performance from initial to final score,  $F(1,60) = 29.20$ ,  $p < 0.001$ , with a mean performance gain of 1.71. The improvement in performance for collectively oriented team members was almost five times that of the egocentric team members.

Third, there was no significant performance gain for the individual performers (Condition 3),  $F(1,60) = 1.66$ ,  $p > 0.1$ ; the mean gain in performance scores for this con-

TABLE 1  
Performance Scores by Condition

Condition	n	P(s) Phase 2	Mean Initial Score (SD)	Mean Final Score (SD)	Mean Gain
1. Egocentric	19	0.84	16.32 (2.68)	16.68 (2.21)	0.36
2. Collectively oriented	21	0.60	15.62 (2.31)	17.33 (2.18)	1.71
3. Individuals	23	—	15.78 (2.35)	16.17 (2.37)	0.39

dition was 0.39. Furthermore, the mean gain score for the individual task performers did not differ from that of the egocentric teams,  $F(1,40) = 0.002, p = 0.96$ . This indicates that the egocentric teams, given the opportunity to work in a team setting, benefited no more than did those who performed the task alone (see Appendix).

Finally, analysis of the  $P(s)$  data for Phase 2 reveals that the subjects retained their pattern of attending or not attending to partners' input demonstrated in Phase 1. The egocentric team members rejected their partners' input when initial choices disagreed an average of 84% of the time, compared with 60% for the collectively oriented performers. A simple ANOVA indicates that this difference is statistically significant,  $F(1,38) = 18.59, p = 0.0001$ .

*Response latency.* Coordinated team behavior involves the pooling of information—an information-processing function whereby team members evaluate others' input, reevaluate their own choice, and gather all available information to make a task decision. Indeed, one of the factors that allow teams to outperform individuals in certain instances is this ability to pool information and check errors (see Hill, 1982; Shaw, 1981). To assess this process, data were gathered on the latency or interval between initial and final choices for both agreement trials and disagreement trials. Following an initial choice, each subject was presented with his partner's initial choice. Subjects were instructed to look at their partner's choice, look again at the slide, and then make a final choice. Response latency was computed as the interval between initial choice and final choice.

A repeated-measures ANOVA produced a significant main effect for agreement/disagreement trials on response latency,  $F(1,38) = 8.08, p = 0.007$ , with disagreement trials resulting in a longer response latency than agreement trials. Thus, in general it

takes longer to make a task decision when team members disagree than when they agree. Of more interest is that the data also indicate a marginally significant interaction between type of group (collectively oriented vs. egocentric) and type of trial (agreement vs. disagreement),  $F(1,38) = 3.56, p = 0.07$ . The collectively oriented team members took significantly more time to make a final choice on a disagreement trial ( $M = 6.04$  s) than on a trial in which initial choices agreed ( $M = 5.40$ ),  $F(1,20) = 8.83, p = 0.008$ , reflecting the additional cognitive processing necessary to evaluate contradictory team member information and make a task resolution.

For the egocentric team members, there was no difference in response latency between agreement ( $M = 5.56$ ) and disagreement trials ( $M = 5.69$ ),  $F(1,18) = 0.69, p = 0.42$ . In other words, when team members' initial choices agreed, no task resolution was necessary. However, when initial choices disagreed, subjects faced the cognitive task of pooling discrepant information, evaluating partners' input, and making a team decision. These data suggest that only the collectively oriented team members were making this effort.

The latency data suggest that the egocentric team members were ignoring their partner's input—or, perhaps more specifically, simply ignoring the disagreements. This possibility can be evaluated by examining performance scores for both egocentric and collective groups on agreement trials versus disagreement trials. For collectively oriented team members, the improvement in performance from initial score to final score on disagreement trials ( $M = 1.67$ ) was significantly greater than the improvement on agreement trials ( $M = 0.05$ );  $F(1,20) = 28.26, p < 0.001$ . In other words, the response of collectively oriented team members to disagreement was different from their response to agreement. This suggests that collectively oriented team

members were attending to their partner's inputs and were more likely to reevaluate their initial choices when they found that they disagreed.

For egocentric team members, the improvement in performance on disagreement trials was much smaller ( $M = 0.4$ ) but still significantly greater than the improvement on agreement trials ( $M = -0.05$ );  $F(1,18) = 7.15$ ,  $p = 0.015$ . If egocentric team members were simply ignoring their partners, we would expect no difference in performance improvement between disagreement trials and agreement trials. However, these results suggest that the egocentric team members at least distinguished between when their partner disagreed with them and when they agreed, and thus they were not completely oblivious to their partner's actions.

These data provide a bit more insight into egocentric behavior. Although egocentric team members do not show a reliable *overall* improvement in performance during team interaction, they do show more of an improvement on disagreement trials than on agreement trials. This analysis suggests that egocentric team members do not completely ignore their partners, but they may be less likely to use or act on the information provided by their partners when they disagree. The critical difference seems to be *not* that egocentric individuals ignore their partners and collectively oriented team members don't but that when collectively oriented team members disagree, they attend to that information and improve their performance, and when egocentric members disagree, they do not.

One further analysis of these data supports this general profile. There was no difference in the extent of initial choice disagreements between the egocentric teams ( $M = 10.4$ ) and the collectively oriented teams ( $M = 9.4$ );  $F(1,38) = 1.50$ ,  $p > 0.1$ . However, there was a significant difference on final choice dis-

agreements between egocentric teams ( $M = 8.2$ ) and collectively oriented teams ( $M = 5.1$ );  $F(1,38) = 26.32$ ,  $p < 0.001$ . In other words, the collectively oriented teams were more likely to agree or converge on final choices than were egocentric teams.

*Questionnaire data.* The postexperimental questionnaire included two items presented on a 6-point scale that asked each subject how valuable he felt his partner's input was on the task (where 1 = *extremely valuable* and 6 = *not at all valuable*) and how useful he thought it was to work on the task as a team (1 = *extremely useful*, 6 = *not at all useful*). A simple ANOVA was performed to examine differences between egocentric and collectively oriented team member responses to these items. The implication that egocentric team members are poor team players is bolstered by the fact that egocentric team members saw their partners' input as less valuable ( $M = 3.84$ ) than did collectively oriented team members ( $M = 3.15$ ),  $F(1,37) = 4.29$ ,  $p < 0.05$ . Furthermore, egocentric team members believed that it was less useful to work as a team ( $M = 3.63$ ) than did collectively oriented team members ( $M = 2.65$ ),  $F(1,37) = 7.4$ ,  $p = 0.01$ .

Finally, subjects were asked how satisfied they were with the group (this was assessed on a 7-point scale, where 1 = *extremely satisfied* and 7 = *extremely dissatisfied*). There was no significant difference between egocentric ( $M = 2.6$ ) and collectively oriented team members ( $M = 2.6$ ),  $F(1,38) = 0.002$ ,  $p > 0.1$ . This suggests that the collective behavior construct is distinct from cohesiveness and other affective measures that assess attraction to the group.

## DISCUSSION

The pattern of decision behavior in egocentric teams reflected what Meeker (1983) has termed *mutual noncooperation* (p. 228). Results indicated that the performance of ego-



centric teams could be no more accurate than the initial individual inputs. In other words, egocentric team members showed no improvement in performance through the opportunity to work as a team. Further analysis suggested that egocentric team members were less likely to use the information provided by their partner and that they viewed the opportunity to work as a team, as well as their partner's input, as less valuable than did collectively oriented team members.

By contrast, collectively oriented teams were shown to outperform the initial individual scores of their members. In collectively oriented teams group members benefit from the advantages of teamwork, such as the opportunity to pool resources and correct errors—factors that make teamwork effective. In this sense these teams were more than simply an aggregate of two individual performers, and the increase in team scores reflects this fact. The increase in performance in collectively oriented teams is a measure of this *process gain*—that is, performance stemming from team interaction beyond that expected on the basis of individual input or initial ability alone.

The present results indicate that collective behavior is one factor that determines performance in a team setting. However, it is likely that the effects of collective orientation on group effectiveness will vary according to the task at hand. Tasks differ in the degree to which they require interdependence among group members, a fact recognized in the task typologies of Shaw (1973), Steiner (1972), and Herold (1978). Tasks that can be accomplished with little exchange of resources are likely to be unaffected by the collective behavior of group members. It is also likely that collective behavior is less relevant to tasks with simple technical and social demands (see Herold, 1978). However, for tasks that require interdependency of team members, transfer of information, and coordination of

member activities to achieve a group product, the interdependent behavior of group members should be a significant determinant of group success. Therefore we would expect to find a greater effect of collective behavior on difficult tasks and on tasks that require a high level of interdependence.

A second factor that may moderate the effect of collective behavior on group performance is the ambiguity of the task. Van de Ven, Delbecq, and Koenig (1976) argued that one way in which groups coordinate activities to accomplish a task is through mutual adjustments among members in response to new task information. In a study of organizational work groups, they found that as task uncertainty increased, a greater amount of mutual adjustments, or coordination among group members, was required. Therefore it is likely that collective behavior is particularly important for tasks marked by high levels of uncertainty or unpredictability, such as those encountered by teams performing under stressful conditions.

Third, whereas the egocentric group member is shown to be a bad team player, he or she is likely to be an even worse team leader. When the egocentric individual is placed in the position of coordinating group activities, the group is less likely to capitalize on the heterogeneous skills and viewpoints available to the group to accomplish tasks.

Finally, it is important to note limitations of the present research, which was conducted in an experimental laboratory setting. This setting was chosen because of increased control and precision in isolating collective behavior and in testing the effects of collective behavior on team member performance. However, this setting was devoid of factors that may affect collective behavior in more natural settings. Certainly these real-world factors, such as experience with one's teammates or confidence in one's own ability, will affect the degree of mutual interdependence

in decision making. Further research is required to examine the effects of collective behavior in real-world settings.

Goldstein (1986) noted the scarcity of information of a prescriptive nature to offer for training effective teams. The present research suggests that collective behavior is one critical factor in effective team performance. However, in order to propose interventions to enhance collective behavior in teams, one must first consider the nature of egocentric behavior. What impelled the egocentric individuals in this study to disregard the experimenter's instructions to work together as a team and to interact more as individuals than as team members?

Foushee and Helmreich (1988) noted that pilot selection has traditionally been based on the "wrong stuff" as far as group performance is concerned: the selected individuals are self-sufficient, somewhat egotistic, and less prone to sharing responsibility with others. This may have been the "right stuff" for a single-seat test pilot, but this approach is less likely to produce the good team players required by modern multipiloted aircraft. Furthermore, they noted that most pilots, who were selected on the basis of individual proficiency, have little real experience in situations that require teamwork. This supports our supposition that egocentric team members may have little experience as effective team players. Sampson (1977) noted that although humans are socialized from birth to be autonomous and self-sufficient, they receive little training at any time in interdependence. Indeed, team researchers have noted that when teams receive training, they invariably receive training in individual skills to the neglect of team skills (Swezey and Salas, 1992). Therefore it is likely that egocentric team members have not developed the proper schema for effective team interaction. Simulations that emphasize team coordination may be one effective means for building col-

lective team behavior. Further research is needed examining whether relatively simple interventions focused on training team members to coordinate task inputs in a more effective manner will be successful in promoting collective behavior in teams.

#### APPENDIX

It should be noted that the collectively oriented group differed significantly from the other two groups in final score performance,  $F(1,60) = 10.89, p = 0.0008$ . However, it should also be recognized that the collectively oriented group was marginally significantly different from the other two groups in initial score performance,  $F(1,60) = 2.46, p = 0.061$ . This suggests the possibility that the improvement in performance reported for the collectively oriented group is attributable to the fact that they were, by happenstance, lower on initial scores. If this argument were true, then when we remove the lower-scoring performers in Condition 2, there should no longer be a significant improvement in performance from initial to final score. However, this plausibility receives no support from additional analyses.

To assess this possibility, we first derived a frequency ranking of all scores within Condition 2, from low to high. We then eliminated the data for the three subjects who performed most poorly on initial score in Condition 2 (approximately 15% of this sample). This resulted in an overall mean initial score for Condition 2 of 16.28 and a mean final score of 17.78. Results of a repeated-measures  $3 \times 2$  ANOVA indicate no main effect for condition,  $F(2,57) = 1.22, p = 0.304$ , a significant main effect for scores,  $F(1,57) = 15.35, p = 0.0002$ , and a significant Condition  $\times$  Scores interaction,  $F(2,57) = 3.93, p = 0.025$ .

Next, an a priori comparison of initial scores for Condition 2 (the collectively oriented group) versus the combined egocentric and individual groups indicates that Condi-

tion 2 is equivalent to the other two conditions on initial score performance,  $F(1,57) = 0.67$ ,  $p = 0.21$ . Finally, an a priori comparison of initial and final scores for the collectively oriented group shows that the improvement in performance for this group is still significant,  $F(1,57) = 20.25$ ,  $p < 0.0001$ . Therefore this more fine-grained analysis, eliminating the extreme low performers so that the collectively oriented group was in fact equivalent to the other two groups in initial score performance, still shows a significant improvement in performance for the collectively oriented group. Therefore the overall improvement from initial to final score, and the significant difference from the other two conditions at the final measurement, cannot be attributed to the fact that collectively oriented subjects were lower in initial performance.

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