Annu. Rev. Psychol. 2005. 56:517–43
doi: 10.1146/annurev.psych.56.091103.070250

First published online as a Review in Advance on October 5, 2004

# TEAMS IN ORGANIZATIONS: From Input-Process-Output Models to IMOI Models

Daniel R. Ilgen,[1] John R. Hollenbeck,[2] Michael Johnson,[2] and Dustin Jundt[1]

*[1]Department of Psychology, [2]Department of Management, Michigan State University, East Lansing, Michigan 48824; email: Ilgen@msu.edu, jrh@msu.edu, John1781@msu.edu, jundtdus@msu.edu*



**Key Words** teamwork, workgroup, groups, coordination, cooperation

■ **Abstract** This review examines research and theory relevant to work groups and teams typically embedded in organizations and existing over time, although many studies reviewed were conducted in other settings, including the laboratory. Research was organized around a two-dimensional system based on time and the nature of explanatory mechanisms that mediated between team inputs and outcomes. These mechanisms were affective, behavioral, cognitive, or some combination of the three. Recent theoretical and methodological work is discussed that has advanced our understanding of teams as complex, multilevel systems that function over time, tasks, and contexts. The state of both the empirical and theoretical work is compared as to its impact on present knowledge and future directions.

CONTENTS

## INTRODUCTION

Over a decade ago, Levine & Moreland's (1990) *Annual Review of Psychology* chapter concluded that small groups/teams research was "alive and well, but living elsewhere" (p. 620)—in organizational, not social, psychology. Guzzo & Dickson (1996) made a similar observation, and Sanna & Parks (1997) documented this empirically with an analysis of the top three organizational psychology journals. Between 1996 and 2004 the trend continued.

The organizational domain has shown some shift from questions of *what* predicts team effectiveness and viability to more complex questions regarding *why* some groups are more effective than others. We review what has been learned over the past seven years by categorizing findings in terms of their relevance to the formation, functioning, and final stages of teams' existence. From the outset we note that whereas there seems to be consensus on the need to study affective, cognitive, and behavioral mediational processes, this effort has been somewhat fragmented and noncumulative due to a proliferation of constructs with indistinct boundaries at the conceptual level and item overlap between measures of constructs at the level of individual studies.

As is often the case for Annual Review authors, we struggled with the boundaries of our domain. One aspect of this struggle is the recognition that there have been a number of both methodological and substantive achievements over the last seven years, but in the limited amount of space we have here, we focused primarily on substantive studies. This should not obscure the fact that during the period covered by the review, several important methodological developments took place, including major shifts toward (*a*) multilevel theoretic and analytic techniques (see Klein & Kozlowski 2000), (*b*) complex computer-generated task environments that simulate real-world phenomena while objectively capturing and time-stamping team behaviors (Schiflett et al. 2004), (*c*) the appearance of computational and mathematical models that provide potential for means of addressing the dynamic complexity of teams (Coovert & Thompson 2000, Losada 1999), and (*d*) the use of social network analysis to investigate the effects of larger social patterns on between-team and within-team behavior (e.g., Baldwin et al. 1997, Burt 2000, Hinds et al. 2000).

In terms of content, two recent *Annual Review of Psychology* chapters (Guzzo & Dickson 1996, Kerr & Tindale 2004) were instrumental in establishing boundaries. Guzzo & Dickson's (1996) chapter provided a clear beginning date for our review. It also provided excellent guidance for content inclusion with its focus on work teams, particularly teams embedded in ongoing organizations with pasts and futures. We share the concern for teams in similar contexts, but unlike Guzzo & Dickson, we did not limit the research setting to field research if we felt the empirical observations were relevant to work teams. Kerr & Tindale's (2004) *Annual Review of Psychology* chapter reviewed the social psychological literature on small group performance and decision making, which provides an up-to-date source for that content and allows us to ignore work addressed by them.

## STRUCTURING THE CURRENT REVIEW: BEYOND THE INPUT-PROCESS-OUTPUT FRAMEWORK

Conceptually, team researchers have converged on a view of teams as complex, adaptive, dynamic systems (McGrath et al. 2000). They exist in context as they perform across time. Over time and contexts, teams and their members continually cycle and recycle. They interact among themselves and with other persons in contexts. These interactions change the teams, team members, and their environments in ways more complex than is captured by simple cause and effect perspectives.

A number of excellent theoretical models of teams have appeared recently. McGrath et al. (2000) describe three levels of dynamic causal interactions (local, global, and contextual). Kozlowski and colleagues' (Kozlowski et al. 1999) theory of compilation and performance describes inputs, processes, and outcomes that develop over time as teams interact in contexts that are both external environments of the team and are shaped by actions of the teams in a reciprocal causal fashion. Knowledge, attitudes, and behaviors are both inputs and processes in a developmental sequence that impacts team performance. Team performance, while an output at time $t_n$, is an input and a part of the process leading to performance output at time $t_{n+1}$. A similar metatheoretical position, with processes unfolding over time, served as an underpinning for Marks et al.'s (2001) taxonomy of team processes and DeShon et al.'s (2004) multigoal study. Although these models contain differences in specific details regarding the nature of teams, all reflect the underlying notion that teams are complex, dynamic systems, existing in larger systemic contexts of people, tasks, technologies, and settings.

The empirical research on teams in organizational contexts is also moving in the direction of increased complexity, but this work still has a way to go to match developments in the conceptual domain. However, the empirical literature in the past six years does differ from that which preceded it. Prior to 1996, much of the empirical research on teams was focused on the outcomes of team performance and viability. This research was guided by practical issues: The search was for answers to the generic question of what makes some teams more effective or more viable relative to others, and it emphasized inputs such as composition, structures, or reward allocations. Over the past six years, more attention was paid to mediating processes that explain why certain inputs affect team effectiveness and viability.

In one sense, this search for mediators was well informed by previous attention to process as the link between inputs and outputs. Classic works of Steiner (1972), McGrath (1984), and Hackman (1987) expressed the nature of team performance in classic systems model ways in which inputs lead to processes that in turn lead to outcomes (the input-processes-output, or I-P-O, model). This framework has had a powerful influence on recent empirical research, much of which either explicitly or implicitly invokes the I-P-O model. In another sense, however, the convergence on consensus regarding the utility of I-P-O models as a guide to empirical research fails to capture the emerging consensus about teams as complex,

adaptive systems. Indeed, the I-P-O framework is insufficient for characterizing teams (Moreland 1996), and the most recent team literature, in at least three specific ways.

First, many of the mediational factors that intervene and transmit the influence of inputs to outcomes are not processes. Marks et al. (2001) developed a temporally based framework and taxonomy of team processes and correctly noted that many constructs presented by researchers trying to invoke the I-P-O model as process are not really process at all, but emergent cognitive or affective states. Their solution to the imprecision in the use of the term team process was to exclude from their review of team process all constructs that fit their emergent state definition rather than process definition as they developed their team process taxonomy. This strategy, while useful for their purpose of isolating a subset of conceptually pure behavioral processes, was not sufficient for our task of reviewing the broader teams literature, a domain including both behavioral processes and emergent cognitive and affective states.

Second, an I-P-O framework limits research by implying a single-cycle linear path from inputs through outcomes, even though the authors of the classic works clearly stipulated the potential for feedback loops, and some (e.g., Hackman 1987, McGrath et al. 2000) explicitly recognized limits of I-P-O thinking. Yet, failure to identify the feedback loop in the I-P-O sequence is likely to have limited the development of I-P-O-focused team research more than would have resulted with the use of a different model. Indeed, research that is more recent has examined traditional "outputs" like team performance and treated them as inputs to future team process and emergent states.

Finally, the I-P-O framework tends to suggest a linear progression of main effect influences proceeding from one category (I, P, or O) to the next. However, much of the recent research has moved beyond this. Interactions have been documented between various inputs and processes (I x P), between various processes (P x P), and between inputs or processes and emergent states (ES) (Colquitt et al. 2002, De Dreu & Weingart 2003, Dirks 1999, Janz et al. 1997, LePine et al. 1997, Simons et al. 1999, Simons & Peterson 2000, Stewart & Barrick 2000, Taggar 2002, Witt et al. 2001). Emergent states are constructs that develop over the life of the team and impact team outcomes. The broader focus beyond simply inputs and process places attention on boundary conditions of the traditional I-P-O framework and highlights when, where, and with whom various processes and emergent states become relevant.

Thus, the I-P-O framework is deficient for summarizing the recent research and constrains thinking about teams. As an alternative model, we use the term IMOI (input-mediator-output-input). Substituting "M" for "P" reflects the broader range of variables that are important mediational influences with explanatory power for explaining variability in team performance and viability. Adding the extra "I" at the end of the model explicitly invokes the notion of cyclical causal feedback. Elimination of the hyphen between letters merely signifies that the causal linkages may not be linear or additive, but rather nonlinear or conditional.

In keeping with the temporal features of many recent approaches, we initially organized the review around studies that focus on the early stages of team development (i.e., the IM phase), labeled the Forming Stage, followed by those examining issues that we see as the team develops more experience working together (i.e., the MO phase), labeled the Functioning Stage, and finally the Finishing Stage (i.e., the OI phase), where the team completes one episode in the developmental cycle and begins a new cycle. The paucity of literature directed at decline led us to collapse over the three in the finishing phase. Our use of the verb form throughout the review is intentional, to emphasize how these processes and states extend through time and involve change (Weick 1969). Within the three-way temporal classification, we added another three-way categorization scheme that reflects whether the primary interest of the study deals with affective, behavioral, or cognitive aspects of team development. In the formation phase, the topic of trusting focused on affective mediators, planning behavioral ones, and structuring cognitive ones. In the functioning phase, affect, behavior, and cognition were discussed under bonding, adapting, and learning, respectively. We emphasize that use of these categorical labels, while reflective of the dominating affective, behavioral, or cognitive process, was not meant to imply that other processes were excluded. Often all processes were present in any one category. For example, trusting involves not only affect but also cognitions and behavioral intentions. In sum, we present here a $3 \times 3$ framework in an effort to capture the domain or research on teams, not to suggest that the organizing model is a theory of team behavior.

## FORMING

### Trusting

For team members to trust in the team, they must feel that (*a*) the team is competent enough to accomplish their task (in the literature we reviewed, this is expressed in terms of constructs such as potency, collective efficacy, group efficacy, and team confidence), and (*b*) that the team will not harm the individual or his or her interests, which we refer to as safety.

POTENCY Potency is the team member's collective belief that they can be effective (Guzzo et al. 1993). Campion et al. (1996) found potency was positively related to employee self-ratings of effectiveness, manager judgments of team performance, and group performance appraisals conducted by their organization. Similarly, Hyatt & Ruddy (1997) found that work group confidence was positively related to managerial ratings of group performance on a number of different objective measures. Little & Madigan (1997) found that collective efficacy was positively related to a number of different group performance behaviors as well. Finally, Seijts et al. (2000) examined how group-referenced individual ratings of group efficacy differed from individually aggregated ratings of self-efficacy for multiple trials on a mixed motive task.

Many studies took a more complex approach to examining the relationship between potency-related constructs and team effectiveness. Hecht et al. (2002) found potency predicted performance over and above group member ability, and group goal commitment did not predict variance in performance over potency. Jung and colleagues (Jung & Sosik 1999, Jung et al. 2002) tested a reciprocal model in which group heterogeneity, preference for group work, outcome expectation, and potency were suggested to be unique predictors of group performance. Group performance at Time 1 predicted each of these constructs and predicted performance at Time 2. The major findings suggested a unique reciprocal relationship between potency and group performance.

Using both a lab and a field sample, Chen et al. (2002) examined the relationships between team expertise, "team drive" (the team level analogue of achievement motivation), collective efficacy, and team performance. They found that "team drive" positively and uniquely related to collective efficacy beliefs, whereas team expertise did not. Collective efficacy predicted unique variance in team performance and team drive in the lab, but not in the field. Durham et al. (2000) found that initial task performance related to group efficacy, and indirectly to group performance through the influence on goals and information seeking. Gibson (1999) supported a contingency view in which collective efficacy exerted a positive influence on performance under conditions of low uncertainty, high task interdependence, and high collectivism.

For Gonzalez et al. (2003), task cohesion mediated the relationship between collective efficacy and group effectiveness. Marks (1999) found that collective efficacy was positively related to team performance in a routine task environment, but not in a novel one. High levels of communication partially mediated the positive relationship between collective efficacy and team performance when the task environment was controlled. Sivasubramaniam et al. (2002) found a reciprocal relationship between transformational leadership and potency: Potency influenced later performance where collective efficacy was referenced to the team's specific tasks and potency to more generalized settings past, present, and future. Lee et al. (2002) made a conscious distinction between potency and collective efficacy. Controlling for group size and initial performance, group norm strength predicted potency but not collective efficacy, and potency predicted Time 2 performance on a novel task whereas collective efficacy did not. The data supported potency and efficacy as different constructs. Finally, Gully et al. (2002) conducted a meta-analysis that examined the effects of both team efficacy and potency on performance. Their findings suggest that both team efficacy and potency are meaningful predictors of team performance, and that the relationship between team efficacy—but not potency—and performance was stronger when task interdependence was high.

SAFETY In addition to trusting the team's competence, individuals must also trust the member's intentions. Jones & George (1998) distinguished between several different kinds of trust and suggested that levels of trust (or distrust) can be

shaped by people's values, attitudes, and moods/emotions, as well as by previous experience. In turn, they suggested that unconditional trust, the kind most valuable to teams, should have a strong direct, positive effect on interpersonal cooperation and teamwork. Few studies have examined the impact of interpersonal trust-related constructs on team effectiveness, and none have gone into the level of detail that Jones & George supply in their theoretical piece. Edmondson (1999), however, examined both collective efficacy and a trust-related variable she called psychological safety as they related to two structural variables (team leader coaching and organizational contextual support), team learning behaviors, and team performance. She defined psychological safety as "a shared belief that the team is safe for interpersonal risk taking" (p. 354). Her model suggested a causal sequence in which the two structural variables led to higher psychological safety and team efficacy and, in turn, to greater team learning and performance. Psychological safety and team efficacy mediated the relationships between the structural variables and team learning, learning behaviors mediated the relationship between psychological safety and team performance, and team efficacy did not predict unique variance in learning behaviors.

In a follow-up qualitative study, Edmondson et al. (2001) examined several hospitals implementing new cardiac surgery technology. A key characteristic of successful innovators was their ability to design preparatory practice sessions and early trials that created a sense of psychological safety. In hospitals low in psychological safety, people were less likely to engage in risk taking, and they exhibited more behaviors consistent with the status quo. Looking at both psychological and physical safety, Hofmann & Stetzer (1996) found that feelings of psychological safety led indirectly to actual physical safety through the mediating influence of communication regarding unsafe acts.

## Planning

Moving from the affective to the behavioral realm, at the early stages of team development one key mediating variable that explains success and viability is the degree to which the team arrives at an effective initial plan of behavioral action. Effective planning has two related, and yet distinct, components. First, the team needs to gather information that is available to the group members and/or their constituencies. The group then must evaluate and use this information to arrive at a strategy for accomplishing its mission.

GATHERING INFORMATION The studies pertaining to gathering information have focused on information sharing, information seeking, and communicating. Two cross-sectional survey studies documented the importance of effective information gathering for team performance. Barry & Stewart (1997) correlated member personality measures with open communication and team performance on student projects. Although these authors failed to find the relationship they hypothesized between group extraversion and open communication, they did report a significant

relationship between open communication and team performance, as did Hyatt & Ruddy (1997).

Drach-Zahavy & Somech (2001) examined the influence of functional diversity on information exchange and innovativeness. Functional heterogeneity predicted information exchange, and information exchange, in turn, was positively correlated with team innovation. Bunderson & Sutcliffe (2002) distinguished between within-member and between-member diversity. Within-person diversity reflects the fact that each group member has had experience in different functional areas, and between-person diversity means that each team member has a different functional background. Information sharing was more effective in the teams that contained within-person diversity, relative to between-person diversity, and this, in turn, was related to higher team performance.

Two studies examined group voice, operationalized in this research as the extent to which people speak up within their group (Erez et al. 2002, LePine & Van Dyne 1998). LePine & Van Dyne found participation rates were higher for group members who were (*a*) high in self-esteem, (*b*) male, (*c*) Caucasian, (*d*) high status, (*e*) highly educated, (*f*) highly satisfied with their group, and (*g*) in smaller, self-managed teams. Those with low self-esteem exhibited especially low levels of participation behavior in large groups and self-managed groups. Erez et al. (2002) examined the role of participative behavior in a quasi-experiment where leaders either rotated in or emerged and were evaluated either by peers or by external sources. Rotation of the leader's role and the provision of peer feedback promoted higher participation levels and positively impacted performance.

Durham et al. (2000) examined the effects of group goals and time pressure on information seeking and performance on a team decision-making task. These authors found that group efficacy indirectly influenced information sharing through group-set goal difficulty, which in turn had an indirect positive effect on group performance through information-seeking behaviors.



DEVELOPING STRATEGY Stout et al. (1999) examined the relationships between strategy development, communicating, shared mental models (a construct that we review in more detail below), and coordinated team performance on a helicopter defense/surveillance simulation. Better strategy development led to greater levels of unsolicited information sharing, more well developed team mental models, and higher performance during high workload situations. Tesluk & Mathieu (1999) investigated teams that faced roadblocks or obstacles to goal accomplishment. Teams that were most likely to overcome problems were those that anticipated problems in advance and had contingency plans in place from the very beginning. Further, crews with higher levels of coordination, potency, and familiarity (which they refer to as teamwork processes) were more likely to develop effective strategies.

Effective strategy development is enhanced by unambiguous and well-prioritized goals and agreement on the best means of goal accomplishment. Pritchard (1995) and his colleagues have developed and implemented a team-based performance management system called ProMES (productivity measurement and

enhancement system) that focuses on identifying objective team outputs, as well as the level of these outputs required to reach various levels of effectiveness for the team. Teams receive feedback referenced to these outputs, and are encouraged to develop plans that would help them achieve internally or externally set goals. ProMES has been used in a wide variety of contexts to help improve team planning and performance (Pritchard et al. 2001).

## Structuring

Structuring refers to the development and maintenance of norms, roles, and interaction patterns in the teams. Two cognitive structuring constructs have dominated the recent literature on teams. One is a shared mental model, which emphasizes common cognitive elements among group members. The second set of studies deals with transactive memory systems and emphasizes the unique and distinctive cognitive elements among group members. Ironically, one of these literatures suggests that high performance results when group members share cognitive elements, whereas the other suggests groups perform best when members compartmentalize and specialize in different aspects of the cognitive space that the team is required to cover.



SHARED MENTAL MODELS Mohammed & Dumville (2001) defined shared mental models as "organized understanding of relevant knowledge that is shared by team members" (p. 89). The focus is on collective knowledge regarding what individual team members hold in common. Whereas Mohammed & Dumville's (2001) work was conceptual in addressing the nature of the construct, others were concerned with measuring it and treating its development as part of something that could be addressed through training (e.g., Langan-Fox et al. 2000). Much of this work grew out of the TADMUS (Tactical Decision Making Under Stress) project, which was a response to the tragic shooting down of Iran Air Flight 655 by the *USS Vincennes* over the Persian Gulf in 1988. The TADMUS project represented a convergence of operational, scientific, and bureaucratic efforts (Collyer & Malecki 1998) to create a partnership between behavioral scientists and operational naval personnel. The result was the development of a process that embedded team training within the dynamic task environment (Cannon-Bowers & Salas 1998). A number of principles emerged from this and related work, particularly in connection to team training (Kozlowski 1998, Kozlowski et al. 1999). The most important principle is that of treating teams, rather than individuals, as the basic unit of analysis, and viewing team members as active participants in a continuous learning process.

Marks et al. (2002) examined the role of shared mental models as a factor that mediates the relationship between cross-training and team effectiveness. Cross-trained teams on a helicopter simulation were more likely to develop shared mental models, and teams with shared mental models performed better. Better performance resulted because the teams were more likely to display effective coordination and team backup behaviors. Mathieu et al. (2000) found similar results

with dyads performing a flight combat simulation. Again, coordination and communication mediated the relationship between the team mental model and team performance.

TRANSACTIVE MEMORY Consistent with Wegner's (1986) work, Austin (2003) defined transactive memory as "a combination of the knowledge possessed by each individual and a collective awareness of who knows what" (p. 866). In contrast to shared mental models, transactive memory focuses on who knows what rather than on overlapping task- or team-relevant knowledge. Austin (2003) studied field groups in charge of launching different types of new products in a sporting goods/clothing company, and broke transactive memory into four elements: knowledge stock (amount of knowledge), consensus (agreement on who knows what), knowledge specialization (amount of redundancy), and accuracy (correctness of knowledge about what others know). Each facet was then examined for its ability to predict unique variance in group goal attainment and both external and internal evaluations of performance. Task transactive memory accuracy was related positively and uniquely to all three performance criteria, and task knowledge specialization was related uniquely to both external and internal evaluations of team performance. Similarly, Lewis (2003), with different subdimensions, found transactive memory positively related to performance.

Two studies did not use the term transactive memory but did capture similar constructs. Druskat & Kayes (2000) assessed teams of MBA students on interpersonal understanding—accurate understanding of the spoken and unspoken preferences, concerns, and strengths of other members. Hyatt & Ruddy (1997) defined roles in terms of knowledge structures to include both (*a*) common expectations regarding work group behavior, and (*b*) knowledge about what members knew. Both studies found their constructs related to team performance.

Finally, Hollenbeck et al. (2002) examined the impact of different role structures on team performance via shared cognition. In divisional structures, team members had broad roles and resources and were grouped by region, whereas team members in a functional structure each had very narrow, specific roles, and were grouped by resource or task. Results suggested that different types of role structures are better suited for different types of environments. Divisional structures were thought to promote the development of team mental models that were more complete, and these models in turn led to better performance in random environments. On the other hand, functional structures should promote the development of transactive memory, thus leading to higher performance in predictable environments.



## FUNCTIONING

### Bonding

Bonding reflects affective feelings that team members hold toward each other and the team. Whereas trust represents a willingness to work together on the task,

bonding goes beyond trust and reflects a strong sense of rapport and a desire to stay together, perhaps extending beyond the current task context. We placed studies that examined constructs such as group cohesiveness, team viability, social integration, satisfaction with the group, person-group fit, and team commitment under this heading because they share a common core that deals with the strength of the member's emotional and affective attachment to the larger collective (Bishop & Scott 2000, Kristof-Brown et al. 2002). Because it takes time for team bonding to occur, its effects typically are observed not in the early formative phase but in the more mature functioning stage.

This is an important category of studies for three reasons. First, although past research has suggested that bonding is not all that necessary for high levels of team performance, more recent meta-analytic evidence suggests otherwise, particularly when work-flow interdependence is high (Beal et al. 2003). Second, as noted in a recent edited volume by Hinds & Kiesler (2002), organizations are increasingly employing virtual teams whose members rarely meet face-to-face. Despite the rise in their prevalence, the cumulative evidence from a recent meta-analysis of 27 studies questions the degree to which members of virtual teams ever bond with one another in the traditional sense, and suggests that as a result, they are both slower and less accurate than face-to-face teams (Baltes et al. 2002). A number of elaborate interventions have been offered to help overcome this problem (Kraut et al. 2002, Nardi & Whittaker 2002, Olson et al. 2002). Finally, even in contexts that allow face-to-face interactions, attempts to implement team-based structures meet resistance due to fears among leaders or members that they will not be able to manage the conflict that arises from their differences (Kirkman & Shapiro 1997). Conflict often starts small, but then spirals out of control, and in some cases even results in violent reactions (Robinson & O'Leary-Kelly 1998) and withdrawal behaviors (Duffy et al. 2000).



MANAGING DIVERSITY OF MEMBERSHIP Although past research on composition has generally conceived of teams as existing on a single continuum ranging from demographically homogeneous to demographically heterogeneous, more recent research has focused on specific aspects of demography. Riordan & Shore (1997) showed that some demographic differences, such as race/ethnicity, were much more important relative to age or gender when it came to predicting satisfaction with the team, a finding later replicated by Pelled et al. (1999), who employed emotional conflict as a criterion. Even within the race/ethnicity categories, it was critical to distinguish among different minority groups (African American versus Hispanic); without differentiation, a great deal of predictability is lost (Riordan & Shore 1997). All of this suggests that the simple, nondelineated construct of diversity that does not reflect the specific aspect of diversity embodied in the group has little predictive or explanatory power.

Others have challenged the notion that diversity is a meaningful continuum, and proposed that the opposite ends of the scale are qualitatively, not quantitatively, different. Earley & Mosakowski (2000) showed that the key to team bonding

was developing a single culture within the team, and this was promoted by either homogeneous compositions or highly heterogeneous compositions. Worst were moderately heterogeneous compositions that created subgroups or token members. Polzer et al. (2002) also found that high levels of heterogeneity could be conducive to developing cohesive teams.

Harrison and colleagues (1998, 2002) distinguished between surface-level diversity, which deals with demographic differences, and deep-level diversity, which deals with differences in attitudes and values, and showed that the importance of each varied with time. Surface-level diversity was more critical early, but its influence gave way to deep-level influence at later stages of the group's development. Jehn et al. (1999) distinguished between social category (demographic), value, and informational diversity, and reported similar results. Over the course of team's development, value diversity had a much more deleterious effect on commitment to the team relative to social category diversity.

Other research on bonding has examined diversity operationalized by differences in personality traits among team members. Barrick et al. (1998) found that social cohesion was highest when teams were high on agreeableness, extraversion, and high emotional stability. However, variance in agreeableness harmed cohesion, variance in extraversion promoted cohesion, and variance in emotional stability was unrelated to cohesion. Clearly, one must go beyond both demographic characteristics and simple, continuum-based hypotheses regarding homogeneity when it comes to understanding the complexities of when and why teams bond.

Although Barrick et al. did not explicitly show why teams high on agreeableness, emotional stability, and extraversion (and variance in extraversion) were better able to bond, Keller (2001) showed that cross-functional teams create stress, which in turn lowers cohesiveness. Teams high on emotional stability may weather this stress better than teams that are low in this trait. Simons et al. (1999) showed that another key to managing cross-functional teams is producing effective debate, which is likely to be difficult to achieve in introverted teams or teams in which all members are high in extraversion and thus fight for "airtime." Finally, Chatman & Flynn (2001) found that the speed with which demographically heterogeneous teams developed cooperative norms was the best predictor of their eventual viability, and this probably is related closely to the level and variability of agreeableness.

MANAGING CONFLICT AMONG TEAM MEMBERS Several recent studies have examined interventions that might be used to minimize social conflict among team members. Druskat & Wolff (1999) showed that face-to-face developmental feedback from peers could drastically reduce conflict, especially if this feedback is delivered at the appropriate time (at the project's midpoint). Naumann & Bennett (2000) found that leaders who promote procedural justice and apply rules consistently were able to minimize relationship conflict. De Cremer & van Knippenberg (2002) replicated and extended these findings regarding the leader's role in minimizing relationship conflict. van der Vegt et al. (2001) showed that group satisfaction is also promoted by adopting group-level rewards that do not make fine

distinctions among team members; the value of this, however, may be offset by the fact that cooperative rewards sometimes are associated with higher levels of social loafing (Beersma et al. 2003).

Although consensus exists regarding the deleterious effects of relationship conflict, this is not true with respect to task conflict. Jehn (1994) showed that there was a +0.44 correlation between task conflict and team performance and a –0.45 correlation between relationship conflict and team performance. Unfortunately, subsequent research failed to replicate the Jehn (1994) results. A recent meta-analysis, based upon 26 effect sizes, found the 95% confidence interval for the relationship between task conflict and performance to be –0.13 to –0.26, making the Jehn (1994) result an extreme outlier (De Dreu & Weingart 2003). Indeed, this same meta-analysis estimated the correlation between task and relationship conflict at over 0.50. The emerging consensus is that task conflict is generally unhelpful for teams. Instead of task conflict, teams require (*a*) rich, unemotional debate in a context marked by trust (Simons & Peterson 2000), (*b*) a context where team members feel free to express their doubts and change their minds (Lovelace et al. 2001), and (*c*) an ability to resist pressures to compromise quickly (Montoya-Weiss et al. 2001) or to reach a premature consensus (Choi & Kim 1999).



## Adapting

Most of the recent literature we reviewed dealing with behavioral processes of adapting falls under two distinct subcategories, one of which deals with performance in routine versus novel contexts, and the second dealing more narrowly with one specific aspect of adaptability—workload sharing in the form of either helping behaviors or backing up behaviors.

PERFORMANCE IN ROUTINE VERSUS NOVEL CONDITIONS In a controlled laboratory setting, LePine (2003) extended research from the individual level to teams and found teams with higher mean levels of cognitive ability and openness to experience did better when the task environment changed. Documenting differences between variables that predict team performance under routine versus novel conditions was also the goal of a study by Marks et al. (2000), but this study examined aspects of team training rather than team composition. Using a laboratory study simulation, Marks et al. found that training aimed at increasing the team's ability to communicate and interact, as well as expanding communication from leaders, improved team adaptability.

In a study by Waller (1999), the speed with which teams recognized that the environment has changed was also shown to be critically important for improving adaptability. This study employed airline crews that were observed on a realistic flight simulator performing after a hydraulic failure caused an unexpected change in the flight plan. Although previous research had documented that adaptability was contingent on the team's ability to reprioritize goals and redistribute tasks, Waller (1999) found that it was the speed—not necessarily the frequency—with which

teams engaged in these behaviors that was critical for adaptability. Methodologically, observing teams over time was critical; adapting would have been missed with retrospective self-reports. It was the timing of the behaviors, not the behaviors themselves, that was critical.

Subsequent research showed that the speed with which teams recognized the need for change was related to the number of "interruptions" that caused them to "stop and think" about their processes while engaged in the task (Okhuysen & Waller 2002). In addition, specific instructions to team members to raise questions helped adaptation (Okhuysen & Waller 2002), but did so less when teams members had a previous history of working together (Okhuysen 2001). In familiar teams, imposition of an external intervention disrupted established roles that already contained provisions for task interruptions. This effect is similar to that observed by Arrow (1997), who showed that feedback about deteriorating performance was not sufficient to get teams, entrained in their behavioral routines, to radically change their processes. Harrison et al. (2003) revealed entrainment on repeated trials of a task persisted even when a different type of task "interrupted" those repeated trials.

Moon et al. (2004) showed that teams whose initial task experience took place in a functional structure that created simple tasks with high interdependency requirements were fully able to switch to a divisional structure characterized by increased task complexity and less interdependence when the situation demanded such a change (Hollenbeck et al. 2002). However, teams that started out in divisional structure were not able to successfully execute a change to a functional structure, even when changes in the task environment demanded such a reconfiguration. In this context, the norms of high communication and support behavior of the formerly functional teams persisted into the future and promoted their adaptation to their new divisional structure. In contrast, the norms for concentration and independence associated with the formerly divisional teams also persisted into the future, destroying their ability to adapt to the new requirements of the functional structure. This research implies that rather than conceptualizing adaptation as an all-or-nothing phenomenon (teams are either adaptable or not), a more appropriate conceptualization would propose that adaptation is a directional phenomenon that needs to consider what the team is adapting from and what it is adapting to.

HELPING AND WORKLOAD SHARING One specific aspect of adaptation that has received a great deal of attention recently is the degree to which team members actively share their workload, help, or back up each other when faced with high demands. The virtues of workload sharing are one of the critical reasons behind adopting team-based structures (McIntyre & Salas 1995). Recent research supports this position, but also qualifies it, suggesting that helping behavior is a double-edged sword.

On the positive side, Podsakoff et al. (1997) examined the separate facets of organizational citizenship, and found that the amount of helping behavior exhibited

in the team was the only facet that had a positive impact on both the quality and quantity of team performance. This facet of citizenship was more important than facets such as civic virtue or sportsmanship.

Barrick et al. (1998) linked helping to team composition in a study of a large number of manufacturing teams where they found teams that were high on conscientiousness, agreeableness, extraversion, and emotional stability provided more help to one another relative to teams characterized in the opposite fashion. Moreover, on all four of these attributes, the score of the member lowest on the variable provided better predictive value for helping behavior than the average- or highest-scoring member for all four traits. This suggests that team members may only help each other in a reciprocal fashion, making the team as a whole look more like its worst member than its best member on this aspect of group process.

Another finding that emerged from the Barrick et al. (1998) study was that both helping behavior and flexibility were negatively related to variance in the team member's levels of general cognitive ability, suggesting that when high-ability members are teamed up with low-ability members, workload sharing is restricted and perhaps unidirectional. Other studies employing very different samples and methods have found that the frequency of helping behavior is negatively associated with team performance (Baldwin et al. 1997, Podsakoff & MacKenzie 1997). Shedding light on this, Porter et al. (2003) directly tested this speculation in a study that separated helping behaviors into two kinds—high-legitimacy helping behavior that eliminated a true workload distribution problem, and low-legitimacy helping behavior that simply reflected codependent enabling of "needy" team members. Extraversion displayed both a main and an interactive effect on backing up behavior, indicating that those who were high in extraversion sought and received much more help across all conditions, but especially when legitimacy was high. Yet, there was no main effect whatsoever for people who were high in conscientiousness, those who were the most discriminating team members when it came to helping. People who were high in conscientiousness were more likely to seek help in the high-legitimacy condition, but less likely to seek help in the low-legitimacy condition relative to those who were low in conscientiousness (thus showing no main effect).

Although low legitimacy in the Porter et al. (2003) study was operationalized in terms of a factor external to the team (objective workload distribution), a help request might also be low in legitimacy if it originates from someone who is not giving his or her best effort to the team. Research on social loafing continues to demonstrate how sensitive team members are to suspected "shirking" on the part of their teammates (Plaks & Higgins 2000). Indeed, LePine et al. (2002) found that potential providers of helping behavior respond very differently to team members who seem to need help because of a lack of ability, relative to team members who seem to need help due to lack of effort. LePine & Van Dyne (1998) developed a more comprehensive model of how teams react to their weakest link, noting how characteristics of the low performer influence peers, and in turn determine the form of helping intended to benefit the group.

## Learning

Learning is often a cognitive precursor to adaptation. The studies reviewed here focus primarily on changes in the team's knowledge base, rather than behavioral changes that may or may not flow from such learning. Within this category, most of the recent literature we reviewed falls under two distinct subcategories: (*a*) learning from team members who are minorities (defined in many different ways) and (*b*) learning who is the best team member for specific tasks and capitalizing on this knowledge.



LEARNING FROM MINORITY AND DISSENTING TEAM MEMBERS Arguments for team-based organizational structures are often predicated on the belief that different team members can broaden the team's initial knowledge base and set the stage for expanding that base as members learn from one another. Historically, however, the scientific literature has documented repeatedly that teams often fail to benefit from minority dissent when it is offered (Esser 1998, Janis 1982, Turner & Pratkanis 1998) or fail to access unique information possessed by members (Wittenbaum et al. 1999). Thus, it is not surprising that much of the current literature has been devoted to this issue.

Gibson & Vermeulen (2003), in a field study of teams working in the pharmaceutical industry, showed how learning could be accomplished by managing the team's composition. Extending prior research by Lau & Murnighan (1998) on group fault lines, Gibson & Vermeulen argued that diversity in the team's demographic characteristics is conceptually and empirically distinguishable from the degree to which there are identifiable subgroups in the team. A four-person team composed of two women and two men, two African Americans and two Caucasians, and two people from operations and two from marketing is diverse, but may or may not contain subgroups depending upon whether the differences are crossed. Thus, if both African Americans are also both women and also both in marketing, this creates two very strong subgroups in the team, which would not be the case if one of the African Americans was a man, and one of the men was in marketing, and one of the marketing representatives was an African American. Gibson & Vermeulen (2003) showed that unless one controls for the degree of subgroup formation, the level of the team's diversity does not predict team learning. Teams learned best when there were a moderate number of weak subgroups.

The importance of avoiding minority opinions was also documented in a study by Ellis et al. (2003) using a "connecting the dots" paradigm. In this paradigm, no one team member could learn based solely on his or her own personal experience. Unlike Gibson & Vermeulen's (2003) compositional approach, Ellis et al. took a structural approach to this same problem. Based upon past research on collective induction and the "truth supported wins" models (Laughlin 1999), this study showed that teams learned best when their resource allocations and task structures created "role partners" who could replicate, confirm, and support each other's personal experiences. Structures that created specialized loners failed to learn because

of the noncommensurate nature of their experiences, and teams structured in terms of overly broad generalists failed to learn because of information overload. The presence of weak subgroups seems to afford each team member some degree of "psychological safety" (Edmondson 1999, Edmondson et al. 2001) when sharing their experiences or expressing their doubts, and this seems to be essential to promote the level (De Dreu & West 2001) and nature (Lovelace et al. 2001) of group participation that creates team-level learning.

In terms of composition, Ng & Van Dyne (2001) found that value differences in terms of collectivism and individualism on the part of both dissenters and the team as a whole were critical determinants of group dynamics when there are opportunities for minority influence. Teams that were, on average, high on horizontal collectivism—a value emphasizing interdependence, sociability, and equality of in-group members—and low on horizontal individualism—a value stressing independence, self-reliance and equality—benefited more from the expression of minority dissent in their groups relative to other groups. Groups that were high on vertical collectivism—a value orientation that emphasizes interdependence but recognizes status inequalities—only obtained benefits from minority dissent when the dissenter was high in status. With respect to the dissenters themselves, the results indicated that vertical individualists were least stressed when placed in a position where they had to espouse a minority viewpoint, and this in turn led to greater social influence for these individuals. Thus, composition affected team's ability to benefit from minority dissent, but ironically, the very people most likely to express dissent (individualists) were least likely to be influenced by it.

McLeod et al. (1997) revealed a similar irony in a study that examined a more structural approach to minority dissent. Using the widely employed "hidden profile" paradigm, McLeod et al. found people were more likely to dissent when interacting in a context that was not face-to-face. Minority dissent, however, was less likely to have an impact on team members in this condition, relative to face-to-face conditions. Groups that encounter a minority dissenter in face-to-face contexts seem to admire the person's courage, and in line with norms for politeness, are more likely to work to incorporate this person's input into the group's discussion, whereas anonymous, electronically submitted dissent tended to be ignored.

LEARNING FROM THE TEAM'S BEST MEMBER In addition to learning from minority members, teams also need to learn from their members under different circumstances, and then use this knowledge to improve performance and expand the knowledge of other team members. Indeed, although much has been written about the value of information sharing and group discussion for promoting performance, two separate recent studies showed the value of learning who is the most knowledgeable member for making decisions based on discussions (Lavery et al. 1999, Littlepage et al. 1997). The ability of the team to learn from the most knowledgeable and to perform well is greater when task difficulty is higher (Bonner et al. 2002).

Research that examines how teams or team leaders develop differential weighting systems for aggregating individual member judgments into a single judgment

for the team can be found under many different headings. The Team Lens Model (Brehmer & Hagafors 1986), Judge-Advisor Systems (Sniezek & Buckley 1995; Sniezek & Henry 1989, 1990) and the Multilevel Theory of Team Decision-making (Hollenbeck et al. 1995; Phillips 2001, 2002) all examined this issue from slightly different perspectives. A detailed description of all of the research conducted under this heading is beyond our scope (see Humphrey et al. 2002 for a recent review of this literature), but the general patterns that emerge from this literature are worth noting, especially as they relate to team-level learning. Left to their own devices, most teams fail to learn the optimal schemes for integrating diverse opinions (Humphrey et al. 2002).

Finally, although this section has generally conceptualized team learning as a beneficial process that organizations might want to support, it needs to be noted that some of the factors that are known to promote learning and flexibility often do so at the expense of efficiency. Indeed, research by Bunderson & Sutcliffe (2003) found an inverted-U relationship between learning orientation and long-term performance in teams, and that the downward slope of the curve comes sooner for previously high-performing teams relative to teams that have struggled.

All of this suggests the need to balance the team's need to experiment and grow with the need to execute and survive, and nowhere is this duality more difficult to manage than in what some have referred to as "high-reliability organizations" (HROs). Weick et al. (1999) defined HROs as those that operate in an unforgiving competitive, social, and political environment that is rich for potential for error, and where the scale of consequences associated with error precludes learning through experimentation. This would include operations in nuclear power plants, air traffic control, naval aircraft carriers, and space shuttle operations. In these contexts, the team's first error may be its last, and thus the standard approaches to learning through experimentation or trial-and-error processes cannot be employed (Weick et al. 1999).

Weick et al. documented that successful HROs balance the need to learn and improve with the need for flawless execution by inducing in their members a high state of mindfulness. They identify five specific processes that organizations use to induce this state, including (*a*) a preoccupation with small failures or near misses that may be diagnostic for larger problems; (*b*) reluctance to simplify, explain away, or cover-up near misses, but a tendency instead to reward people for reporting them and studying them; (*c*) a high degree of sensitivity to operations at the tactical level, where team members create collective situational awareness via story-building techniques; (*d*) resilience, or the ability to bounce back or recover from small errors via contingency planning and containment systems; and finally (*e*) underspecifying structures and operations in order to prevent tight coupling of systems, thus preventing errors in one component of the system to trigger a cascading set of errors quickly down the chain. All of these processes are institutionalized by "after-action reviews," and, although not all organizations may be classified as HROs, Weick et al. argued that many would be better off in the long term if they acted as if they were. Indeed, unlike in HROs, teams often never look

back, thus precluding the opportunity to learn. Too little attention has been paid to processes that allow some teams to benefit more from their experiences than others.

## FINISHING

Groups and teams in organizational contexts disband for many reasons. The ending may be planned, as is the case for task forces or crews, or unplanned, as in the collapse due to interpersonal tensions, task failure, or many other reasons including member loss of interest in remaining together (Arrow et al. 2000). Of the three phases of teams in our framework, however, finishing processes are conspicuous in their absence from the empirical teams literature. This is somewhat surprising given the multiple theoretical statements emphasizing this phase in the life of a team. Several stage models of team development have addressed finishing processes, calling the end-stage adjourning (Tuckman & Jensen 1977), decay (Worchel 1994), or termination (van Steenberg LaFarge 1995). Although other team models have eschewed the notion of teams progressing predictably through stages, they also have dealt theoretically with finishing processes, referring to the phase as completion (Gersick 1988), transition (Marks et al. 2001), and metamorphosis (Arrow et al. 2000). Clearly, because many view the decline and eventual disbanding of members to be an important phase in the life cycle of teams, much more empirical work is needed on this final phase.

## CONCLUSION

We are left with two general impressions of the recent teams literature, one more positive than the other. The most striking development is a convergence on common perspective of teams along with theories and methods to address the complexities of the perspective. Teams are viewed as complex, adaptive, dynamic systems, and they are embedded in organizations and contexts and performing tasks over time (Ilgen 1999). Theories directed at teams/small groups in general (Arrow et al. 2000), adaptive teams (Kozlowski et al. 1999), team process (Marks et al. 2001), or focused on issues of training (Cannon-Bowers & Salas 1998, DeShon et al. 2004), provide excellent frameworks for addressing team behavior. Methodological and computational developments also are appearing to handle more effectively the complexities of multilevel problems (e.g., Klein & Kozlowski 2000). In addition, mathematical (Losada 1999) and computational models are being strongly advocated (Arrow et al. 2000, Hulin & Ilgen 2000) for aiding the understanding of organizational behavior in teams and other settings. A recent National Research Council study panel (Pew & Mavor 1998) shows that these models have been extremely helpful in application to military simulations. In many respects, theories and methods that have recently emerged provide a firm foundation on which to build into the future.

The domain of empirical studies, although possessing a number of interesting and important studies (as we have pointed out in our review), is far less cohesive or coherent in its entirety than is theory and method. In part, this may be because the research is more problem-driven than theory-driven. Demands of rapidly changing markets, the need for command and control, stressful military settings, and the existence of virtual organizations spanning national borders cry for the design of organizational systems incorporating teams and research to address each specific problem. Problems and the time urgency that often accompanies them direct attention away from programmatic research directed toward the development of overarching theories. It also leads to unsystematic sampling of the theory space as is evidenced by the paucity of work on teams as they decline. It has also led to a proliferation of processes that often are not very well articulated, as Marks et al. (2001) noticed in their review of team process where the differentiation between team process and resulting states of these processes (emergent states) were often blurred. Finally, although the importance of dynamic conditions experienced over time are accepted by all, the empirical work is only beginning to consider the implications of time in research designs. Thus, the empirical research lags behind the theoretical and methodological work at this time. However, given the strength of the latter and the level of activity in all domains of the study of teams, we are optimistic that the next *Annual Review of Psychology* chapter on teams will see even greater progress than we witnessed.



## ACKNOWLEDGMENTS

We thank the Office of Naval Research (N00014-00–1-0398) for support to prepare this review and for the many opportunities given to J. R. Hollenbeck, D. R. Ilgen, and their students to study and participate in many kinds of teams. While we gratefully acknowledge the support, we also acknowledge that the ideas are ours and the support does not imply endorsement by the Office of Naval Research.

**The *Annual Review of Psychology* is online at http://psych.annualreviews.org**

## LITERATURE CITED

Arrow H. 1997. Stability, bistability, and instability in small group influence patterns. *J. Personal. Soc. Psychol.* 72:75–85

Arrow H, McGrath JE, Berdahl JL. 2000. *Small Groups as Complex Systems: Formation, Coordination, Development, and Adaptation*. Thousand Oaks, CA: Sage

Austin JR. 2003. Transactive memory in organizational groups: the effects of content, consensus, specialization, and accuracy on group performance. *J. Appl. Psychol.* 88:866–78

Baldwin TT, Bedell MD, Johnson JL. 1997. The social fabric of a team-based MBA program: network effects on student satisfaction and performance. *Acad. Manage. J.* 40:1369–97

Baltes BB, Dickson MW, Sherman MP, Bauer CC, LaGanke JS. 2002. Computer-mediated communication and group decision making: a meta-analysis. *Organ. Behav. Hum. Decis. Process.* 87:156–79

Barrick MR, Stewart GL, Neubert MJ, Mount MK. 1998. Relating member ability and

personality to work-team processes and team effectiveness. *J. Appl. Psychol.* 83:377–91

Barry B, Stewart GL. 1997. Composition, process, and performance in self-managed groups: the role of personality. *J. Appl. Psychol.* 82:62–78

Beal DJ, Cohen RR, Burke MJ, McLendon CL. 2003. Cohesion and performance in groups: a meta-analytic clarification of construct relations. *J. Appl. Psychol.* 88:989–1004

Beersma B, Hollenbeck JR, Humphrey SE, Moon H, Conlon DE. 2003. Cooperation, competition, and team performance: toward a contingency approach. *Acad. Manage. J.* 46:572–90

Bishop JW, Scott KD. 2000. An examination of organizational and team commitment in a self-directed team environment. *J. Appl. Psychol.* 85:439–50

Bonner BL, Baumann MR, Dalal RS. 2002. The effects of member expertise on group decision-making and performance. *Organ. Behav. Hum. Decis. Process.* 88:719–36

Brehmer B, Hagafors R. 1986. Use of experts in complex decision-making: a paradigm for the study of staff work. *Organ. Behav. Hum. Decis. Process.* 38:181–95

Bunderson JS, Sutcliffe KM. 2002. Comparing alternative conceptualizations of functional diversity in management teams: process and performance effects. *Acad. Manage. J.* 45:875–93

Bunderson JS, Sutcliffe KA. 2003. Management team learning orientation and business unit performance. *J. Appl. Psychol.* 88:552–60

Burt RS. 2000. The network structure of social capital. *Res. Organ. Behav.* 22:345–423

Campion MA, Papper EM, Medsker GJ. 1996. Relations between work team characteristics and effectiveness: a replication and extension. *Pers. Psychol.* 49:429–52

Cannon-Bowers JA, Salas E, eds. 1998. *Making Decisions Under Stress: Implications for Individual and Team Training*. Washington, DC: Am. Psychol. Assoc. 447 pp.

Chatman JA, Flynn FJ. 2001. The influence of demographic heterogeneity on the emergence and consequences of cooperative norms in work teams. *Acad. Manage. J.* 44:956–74

Chen G, Webber SS, Bliese PD, Mathieu JE, Payne SC, et al. 2002. Simultaneous examination of the antecedents and consequences of efficacy beliefs at multiple levels of analysis. *Hum. Perform.* 15:381–409

Choi JN, Kim MU. 1999. The organizational application of groupthink and its limitations in organizations. *J. Appl. Psychol.* 84:297–306

Collyer SC, Malecki GS. 1998. Tactical decision making under stress: history and overview. See Cannon-Bowers & Salas 1998, pp. 3–16

Colquitt JA, Noe RA, Jackson CL. 2002. Justice in teams: antecedents and consequences of procedural justice climate. *Pers. Psychol.* 55:83–109

Coovert MD, Thompson LF. 2000. *Computer Supported Cooperative Work: Issues and Implications for Workers, Organizations, and Human Resource Management.* Thousand Oaks, CA: Sage

De Cremer D, van Knippenberg D. 2002. How do leaders promote cooperation? The effects of charisma and procedural fairness. *J. Appl. Psychol.* 87:858–66

De Dreu CKW, Weingart LR. 2003. Task versus relationship conflict, team performance, and team member satisfaction: a meta-analysis. *J. Appl. Psychol.* 88:741–49

De Dreu CKW, West MA. 2001. Minority dissent and team innovation: the importance of participation in decision making. *J. Appl. Psychol.* 86:1191–201

DeShon RP, Kozlowski SWJ, Schmidt AM. 2004. A multiple goal, multilevel model of feedback effects on the regulation of individual and team performance in training. *J. Appl. Psychol.* In press

Dirks KT. 1999. The effects of interpersonal trust on work group performance. *J. Appl. Psychol.* 84:445–55

Drach-Zahavy A, Somech A. 2001. Understanding team innovation: the role of team

processes and structures. *Group Dyn.* 5:111–23

Druskat VU, Kayes DC. 2000. Learning versus performance in short-term project teams. *Small Group Res.* 31:328–53

Druskat VU, Wolff SB. 1999. Effects and timing of developmental peer appraisals in self-managing work groups. *J. Appl. Psychol.* 84:58–74

Duffy MK, Shaw JD, Stark EM. 2000. Performance and satisfaction in conflicted interdependent groups: When and how does self-esteem make a difference? *Acad. Manage. J.* 43:772–82

Durham CC, Locke EA, Poon JML, McLeod PL. 2000. Effects of group goals and time pressure on group efficacy, information-seeking strategy, and performance. *Hum. Perform.* 13:115–38

Earley PC, Mosakowski E. 2000. Creating hybrid team cultures: an empirical test of transnational team functioning. *Acad. Manage. J.* 43:26–49

Edmondson AC. 1999. Psychological safety and learning behavior in work teams. *Admin. Sci. Q.* 44:350–83

Edmondson AC, Bohmer RM, Pisano GP. 2001. Disrupted routines: team learning and new technology implementation in hospitals. *Admin. Sci. Q.* 46:685–716

Ellis APJ, Hollenbeck JR, Ilgen DR, Porter COLH, West BJ, Moon H. 2003. Team learning: collectively connecting the dots. *J. Appl. Psychol.* 88:821–35

Erez A, Lepine JA, Elms H. 2002. Effects of rotated leadership and peer evaluation on the functioning and effectiveness of self-managed teams: a quasi-experiment. *Pers. Psychol.* 55:929–48

Esser JK. 1998. Alive and well after 25 years: a review of groupthink research. *Organ. Behav. Hum. Decis. Process.* 73:116–41

Gersick CJG. 1988. Time and transition in work teams toward a new model of group development. *Acad. Manage. J.* 31:9–41

Gibson CB. 1999. Do they do what they believe they can? Group efficacy and group effectiveness across tasks and cultures. *Acad. Manage. J.* 42:138–52

Gibson CB, Vermeulen F. 2003. A healthy divide: subgroups as a stimulus for team learning behavior. *Admin. Sci. Q.* 48:202–39

Gonzalez MG, Burke MJ, Santuzzi AM, Bradley JC. 2003. The impact of group process variables on the effectiveness of distance collaboration groups. *Comput. Hum. Behav.* 19:629–48

Gully SM, Incalcaterra KA, Joshi A, Beaubian JM. 2002. A meta-analysis of team-efficacy, potency, and performance: interdependence and level of analysis as moderators of observed relationships. *J. Appl. Psychol.* 87:819–32

Guzzo RA, Dickson MW. 1996. Teams in organizations: recent research on performance and effectiveness. *Annu. Rev. Psychol.* 47:307–38

Guzzo RA, Yost PR, Campbell RJ, Shea GP. 1993. Potency in groups: articulating a construct. *Br. J. Soc. Psychol.* 32:87–106

Hackman JR. 1987. The design of work teams. In *Handbook of Organizational Behavior*, ed. JW Lorsch, pp. 315–42. Englewood Cliffs, NJ: Prentice-Hall

Harrison DA, Mohammed S, McGrath JE, Florey AT, Vanderstoep SW. 2003. Time matters in team performance: effects of member familiarity, entrainment, and task discontinuity on speed and quality. *Pers. Psychol.* 56:633–69

Harrison DA, Price KH, Bell MP. 1998. Beyond relational demography: time and the effects of surface- and deep-level diversity on work group cohesion. *Acad. Manage. J.* 41:96–107

Harrison DA, Price KH, Gavin JH, Florey AT. 2002. Time, teams, and task performance: changing effects of surface- and deep-level diversity on group functioning. *Acad. Manage. J.* 45:1029–45

Hecht TD, Allen NJ, Klammer JD, Kelly EC. 2002. Group beliefs, ability, and performance: the potency of group potency. *Group Dyn.* 6:143–52

Hinds PJ, Carley KM, Krackhardt D, Wholey D. 2000. Choosing work group members:

balancing similarity, competence, and familiarity. *Organ. Behav. Hum. Decis. Process.* 81:226–51

Hinds PJ, Kiesler S, eds . 2002. *Distributed Work*. Cambridge, MA: MIT Press. 475 pp.

Hofmann DA, Stetzer A. 1996. A cross-level investigation of factors influencing unsafe behaviors and accidents. *Pers. Psychol.* 49:307–39

Hollenbeck JR, Ilgen DR, Sego DJ, Hedlund J, Major DA, et al. 1995. Multilevel theory of team decision-making: decision performance in teams incorporating distributed expertise. *J. Appl. Psychol.* 80:292–316

Hollenbeck JR, Moon H, Ellis APJ, West BJ, Ilgen DR, et al. 2002. Structural contingency theory and individual differences: examination of external and internal person-team fit. *J. Appl. Psychol.* 87:599–606

Hulin CL, Ilgen DR. 2000. Introduction to computational modeling in organizations: the good that modeling does. In *Computational Modeling of Behavior in Organizations: The Third Scientific Discipline*, ed. DR Ilgen, CL Hulin, pp. 3–18. Washington, DC: Am. Psychol. Assoc.

Humphrey SE, Hollenbeck JR, Meyer CJ, Ilgen DR. 2002. Hierarchical team decision making. In *Research in Personnel and Human Resources Management*, ed. GR Ferris, JJ Martocchio, pp. 175–214. New York: Elsevier/JAI Press

Hyatt DE, Ruddy TM. 1997. An examination of the relationship between work group characteristics and performance: once more into the breech. *Pers. Psychol.* 50:553–85

Ilgen DR. 1999. Teams embedded in organizations. *Am. Psychol.* 54:129–39

Janis IL, ed. 1982. *Groupthink: A Study of Foreign Policy Decisions and Fiascoes*. Boston: Houghton Mifflin. 2nd ed.

Janz BD, Colquitt JA, Noe RA. 1997. Knowledge worker team effectiveness: the role of autonomy, interdependence, team development, and contextual support variables. *Pers. Psychol.* 50:877–904

Jehn KA. 1994. Enhancing effectiveness: an investigation of advantages and disadvantages of value-based intragroup conflict. *Int. J. Confl. Manage.* 5:223–38

Jehn KA, Northcraft GB, Neale MA. 1999. Why differences make a difference: a field study of diversity, conflict, and performance in workgroups. *Admin. Sci. Q.* 44:741–63

Jones GR, George JM. 1998. The experience and evolution of trust: implications for cooperation and teamwork. *Acad. Manage. Rev.* 23:531–46

Jung DI, Sosik JJ. 1999. Effects of group characteristics on work group performance: a longitudinal investigation. *Group Dyn.* 3:279–90

Jung DI, Sosik JJ, Baik KB. 2002. Investigating work group characteristics and performance over time: A replication and cross-cultural extension. *Group Dyn.* 6:153–71

Keller RT. 2001. Cross-functional project groups in research and new product development: diversity, communications, job stress, and outcomes. *Acad. Manage. J.* 44:547–59

Kerr NL, Tindale RS. 2004. Group performance and decision making. *Annu. Rev. Psychol.* 55:623–55

Kirkman BL, Shapiro DL. 1997. The impact of cultural values on employee resistance to teams: toward a model of globalized self-managing work team effectiveness. *Acad. Manage. Rev.* 22:730–57

Klein KJ, Kozlowski SWJ, eds. 2000. *Multilevel Theory, Research, and Methods in Organizations: Foundations, Extensions, and New Directions*. San Francisco, CA: Jossey-Bass. 605 pp.

Kozlowski SWJ. 1998. Training and developing adaptive teams: theory, principles, and research. See Cannon-Bowers & Salas 1998, pp. 115–53

Kozlowski SWJ, Gully SM, Nason ER, Smith EM. 1999. Developing adaptive teams: a theory of compilation and performance across levels and time. In *The Changing Nature of Performance*, ed. DR Ilgen, ED Pulakos, pp. 240–92. San Fransisco, CA: Jossey-Bass

Kraut RE, Fussell SR, Brennan SE, Siegel J. 2002. Understanding effects of proximity on collaboration: implications for technologies

to support remote collaborative work. See Hinds & Kiesler 2002, pp. 137–62

Kristof-Brown AL, Jansen KJ, Colbert AE. 2002. A policy-capturing study of the simultaneous effects of fit with jobs, groups, and organizations. *J. Appl. Psychol.* 87:985–93

Langan-Fox J, Code S, Langfield-Smith K. 2000. Team mental models: techniques, methods, and analytic approaches. *Hum. Factors* 42:242–71

Lau DC, Murnighan JK. 1998. Demographic diversity and faultlines: the compositional dynamics of organizational groups. *Acad. Manage. Rev.* 23:325–40

Laughlin PR. 1999. Collective induction: twelve postulates. *Organ. Behav. Hum. Decis. Process.* 80:50–69

Lavery TA, Franz TM, Winquist JR, Larson JR. 1999. The role of information exchange in predicting group accuracy on a multiple judgment task. *Basic Appl. Soc. Psychol.* 21:281–89

Lee C, Tinsley CH, Bobko P. 2002. An investigation of the antecedents and consequences of group-level confidence. *J. Appl. Soc. Psychol.* 32:1628–52

LePine JA. 2003. Team adaptation and postchange performance: effects of team composition in terms of members' cognitive ability and personality. *J. Appl. Psychol.* 88:27–39

LePine JA, Hollenbeck JR, Ilgen DR, Colquitt JA, Ellis A. 2002. Gender composition, situational strength, and team decision-making accuracy: a criterion decomposition approach. *Organ. Behav. Hum. Decis. Process.* 88:445–75

LePine JA, Hollenbeck JR, Ilgen DR, Hedlund J. 1997. Effects of individual differences on the performance of hierarchical decision-making teams: much more than g. *J. Appl. Psychol.* 82:803–11

LePine JA, Van Dyne L. 1998. Predicting voice behavior in work groups. *J. Appl. Psychol.* 83:853–68

Levine JM, Moreland RL. 1990. Progress in small group research. *Annu. Rev. Psychol.* 41:585–634

Lewis K. 2003. Measuring transactive memory systems in the field: scale development and validation. *J. Appl. Psychol.* 88:587–604

Little BL, Madigan RM. 1997. The relationship between collective efficacy and performance in manufacturing work teams. *Small Group Res.* 28:517–34

Littlepage G, Robison W, Reddington K. 1997. Effects of task experience and group experience on group performance, member ability, and recognition of expertise. *Organ. Behav. Hum. Decis. Process.* 69:133–47

Losada M. 1999. The complex dynamics of high performing teams. *Math. Comput. Model.* 30:179–92

Lovelace K, Shapiro DL, Weingart LR. 2001. Maximizing cross-functional new product teams' innovativeness and constraint adherence: a conflict communications perspective. *Acad. Manage. J.* 44:779–93

Marks MA. 1999. A test of the impact of collective efficacy in routine and novel performance environments. *Hum. Perform.* 12:295–309

Marks MA, Mathieu JE, Zaccaro SJ. 2001. A temporally based framework and taxonomy of team processes. *Acad. Manage. Rev.* 26:356–76

Marks MA, Sabella MJ, Burke CS, Zaccaro SJ. 2002. The impact of cross-training on team effectiveness. *J. Appl. Psychol.* 87:3–13

Marks MA, Zaccaro SJ, Mathieu JE. 2000. Performance implications of leader briefings and team-interaction training for team adaptation to novel environments. *J. Appl. Psychol.* 85:971–86

Mathieu JE, Heffner TS, Goodwin GF, Salas E, Cannon-Bowers JA. 2000. The influence of shared mental models on team process and performance. *J. Appl. Psychol.* 85:273–83

McGrath JE. 1984. *Groups: Interaction and Performance*. Englewood Cliffs, NJ: Prentice-Hall

McGrath JE, Arrow H, Berdahl JL. 2000. The study of groups: past, present, and future. *Personal. Soc. Psychol. Rev.* 4:95–105

McIntyre RM, Salas E. 1995. Measuring and managing for team performance: lessons

from complex environments. In *Team Effectiveness and Decision-making in Organizations*, ed. RA Guzzo, E Salas, pp. 9–45. San Francisco, CA: Jossey-Bass

McLeod PL, Baron RS, Marti MW, Yoon K. 1997. The eyes have it: minority influence in face-to-face and computer-mediated group discussion. *J. Appl. Psychol.* 82:706–18

Mohammed S, Dumville BC. 2001. Team mental models in a team knowledge framework: expanding theory and measurement across disciplinary boundaries. *J. Organ. Behav.* 22:89–106

Montoya-Weiss MM, Massey AP, Song M. 2001. Getting it together: temporal coordination and conflict management in global virtual teams. *Acad. Manage. J.* 44:1251–62

Moon H, Hollenbeck JR, Humphrey SE, Ilgen DR, West BJ, et al. 2004. Asymmetric adaptability: dynamic team structures as one-way streets. *Acad. Manage. J.* In press

Moreland RL. 1996. Lewin's legacy for small-groups research. *Systems Pract.* 9:7–26

Nardi BA, Whittaker S. 2002. The place of face-to-face communication in distributed work. See Hinds & Kiesler 2002, pp. 83–110

Naumann SE, Bennett N. 2000. A case for procedural justice climate: development and test of a multilevel model. *Acad. Manage. J.* 43:881–89

Ng KY, Van Dyne L. 2001. Individualism-collectivism as a boundary condition for effectiveness of minority influence in decision making. *Organ. Behav. Hum. Decis. Process.* 84:198–225

Okhuysen GA. 2001. Structuring change: familiarity and formal interventions in problem-solving groups. *Acad. Manage. J.* 44:794–808

Okhuysen GA, Waller MJ. 2002. Focusing on midpoint transitions: an analysis of boundary conditions. *Acad. Manage. J.* 45:1056–65

Olson JS, Teasley S, Covi L, Olson G. 2002. The (currently) unique advantages of collocated work. See Hinds & Kiesler 2002, pp. 113–35

Pelled LH, Eisenhardt KM, Xin KR. 1999. Exploring the black box: an analysis of work group diversity, conflict, and performance. *Admin. Sci. Q.* 44:1–28

Pew RW, Mavor AS, eds. 1998. *Modeling Human and Organizational Behavior: Applications to Military Simulations*. Washington, DC: Natl. Acad. Press

Phillips JM. 2001. The role of decision influence and team performance in member self-efficacy, withdrawal, satisfaction with the leader, and willingness to return. *Organ. Behav. Hum. Decis. Process.* 84:122–47

Phillips JM. 2002. Antecedents and consequences of procedural justice perceptions in hierarchical decision-making teams. *Small Group Res.* 33:32–64

Plaks JE, Higgins ET. 2000. Pragmatic use of stereotyping in teamwork: social loafing and compensation as a function of inferred partner-situation fit. *J. Personal. Soc. Psychol.* 79:962–74

Podsakoff PM, Ahearne M, MacKenzie SB. 1997. Organizational citizenship behavior and the quantity and quality of work group performance. *J. Appl. Psychol.* 82:262–70

Podsakoff PM, MacKenzie SB. 1997. Impact of organizational citizenship behavior on organizational performance: a review and suggestions for future research. *Hum. Perform.* 10:133–51

Polzer JT, Milton LP, Swann WBJR. 2002. Capitalizing on diversity: interpersonal congruence in small work groups. *Admin. Sci. Q.* 47:296–324

Porter COLH, Hollenbeck JR, Ilgen DR, Ellis APJ, West BJ, et al. 2003. Backing up behaviors in teams: the role of personality and legitimacy of need. *J. Appl. Psychol.* 88:391–403

Pritchard RD, ed. 1995. *Productivity Measurement and Improvement: Organizational Case Studies*. Westport, CT: Praeger/Greenwood. 380 pp.

Pritchard RD, Holling H, Lammers BD, Clark BD, eds. 2001. Improving organizational performance with the productivity measurement and enhancement system: an interactional collaboration. Huntington, NY: Nova Science

Riordan CM, Shore LM. 1997. Demographic diversity and employee attitudes: an empirical examination of relational demography within work units. *J. Appl. Psychol.* 82:342–58

Robinson SL, O'Leary-Kelly AM. 1998. Monkey see, monkey do: the influence of work groups on the antisocial behavior of employees. *Acad. Manage. J.* 41:658–72

Sanna LJ, Parks CD. 1997. Group research trends in social and organizational psychology: Whatever happened to intragroup research? *Psychol. Sci.* 8:261–67

Schiflett S, Elliott LR, Salas E, Coovert MD, eds. 2004. *Scaled Worlds: Development, Validation and Applications*. Andershel, UK: Ashgate. In press

Seijts GH, Latham GP, Whyte G. 2000. Effect of self- and group efficacy on group performance in a mixed-motive situation. *Hum. Perform.* 13:279–98

Simons TL, Pelled LH, Smith KA. 1999. Making use of difference: diversity, debate, and decision comprehensiveness in top management teams. *Acad. Manage. J.* 42:662–73

Simons TL, Peterson RS. 2000. Task conflict and relationship conflict in top management teams: the pivotal role of intragroup trust. *J. Appl. Psychol.* 85:102–11

Sivasubramaniam N, Murry WD, Avolio BJ, Jung DI. 2002. A longitudinal model of the effects of team leadership and group potency on group performance. *Group Organ. Manage.* 27:66–96

Sniezek JA, Buckley T. 1995. Cueing and cognitive conflict in judge-adviser decision-making. *Organ. Behav. Hum. Decis. Process.* 62:159–74

Sniezek JA, Henry RA. 1989. Accuracy and confidence in group judgment. *Organ. Behav. Hum. Decis. Process.* 43:1–28

Sniezek JA, Henry RA. 1990. Revision, weighting, and commitment in consensus group judgment. *Organ. Behav. Hum. Decis. Process.* 45:66–84

Steiner ID. 1972. *Group Process and Productivity*. New York: Academic

Stewart GL, Barrick MR. 2000. Team structure and performance: assessing the mediating role of intrateam process and the moderating role of task type. *Acad. Manage. J.* 43:135–48

Stout RJ, Cannon-Bowers JA, Salas E, Milanovich DM. 1999. Planning, shared mental models, and coordinated performance: an empirical link is established. *Hum. Factors* 41:61–71

Taggar S. 2002. Individual creativity and group ability to utilize individual creative resources: a multilevel model. *Acad. Manage. J.* 45:315–30

Tesluk PE, Mathieu JE. 1999. Overcoming roadblocks to effectiveness: incorporating management of performance barriers into models of work group effectiveness. *J. Appl. Psychol.* 84:200–17

Tuckman BW, Jensen MA. 1977. Stages of small-group development revisited. *Group Organ. Stud.* 2:419–27

Turner ME, Pratkanis AR. 1998. A social identity maintenance model of groupthink. *Organ. Behav. Hum. Decis. Process.* 73:210–35

van der Vegt GS, Emans BJM, van de Vliert E. 2001. Patterns of interdependence in work teams: a two-level investigation of the relations with job and team satisfaction. *Pers. Psychol.* 54:51–69

van Steenberg LaFarge V. 1995. Termination in groups. In *Groups in Context: A New Perspective on Group Dynamics*, ed. J Gillette, M McCollum, pp. 82–103. Lanham, MD: Univ. Press Am.

Waller MJ. 1999. The timing of adaptive group responses to nonroutine events. *Acad. Manage. J.* 42:127–37

Wegner DM. 1986. Transactive memory: a contemporary analysis of the group mind. In *Theories of Group Behavior*, ed. B Mullen, GR Goethals, pp. 185–205. New York: Springer-Verlag

Weick KE. 1969. *The Social Psychology of Organizing*. New York: McGraw-Hill

Weick KE, Sutcliffe KM, Obstfeld D. 1999. Organizing for high reliability: processes of collective mindfulness. *Res. Organ. Behav.* 21:81–123

Witt LA, Hilton TF, Hockwarter WA. 2001. Addressing politics in matrix teams. *Group Organ. Manage.* 26:230–47

Wittenbaum GM, Hubbell AP, Zuckerman C. 1999. Mutual enhancement: toward an understanding of the collective preference for shared information. *J. Personal. Soc. Psychol.* 77:967–78

Worchel S. 1994. You can go home again: returning group research to the group context with an eye on developmental issues. *Small Group Res.* 25:205–23

*Annual Review of Psychology*
*Volume 56, 2005*

# CONTENTS