# Individual-Level Predictors of Task-Related Teamwork Processes: The Role of Expertise and Self-Efficacy in Team Meetings

Sabine Sonnentag and Judith Volmer

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# Individual-Level Predictors of Task-Related Teamwork Processes

## The Role of Expertise and Self-Efficacy in Team Meetings

Sabine Sonnentag
*University of Konstanz*
Judith Volmer
*University of Erlangen-Nuremberg*

This study investigates expertise (i.e., high level of individual task performance) and self-efficacy as predictors of an individual's contribution to teamwork processes (problem analysis, goal specification) during team meetings. Multilevel, multisource data from a longitudinal field study in 22 professional software design teams reveal large within-team variability in individual contributions to teamwork processes. Expertise positively predicted a team member's contribution to meeting processes 1 year later, also when controlling for the initial level of contribution. Contrary to the hypothesis, self-efficacy was negatively related to problem analysis during team meetings.

***Keywords:*** *teams; expertise; self-efficacy; task performance; multilevel model*

Organizations put increasing emphasis on the implementation of teamwork (Cohen & Bailey, 1997; Kozlowski & Bell, 2003). This interest in teamwork has resulted in new insights based on empirical investigations (Gully, Incalcaterra, & Joshi, 2002; Stewart, 2006) and in the development of new theoretical and conceptual approaches. Two major theoretical and conceptual innovations are particularly noteworthy: a renewed focus on the

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concept of team processes (i.e., team members' acts that refer to the way team inputs are transformed into outcomes; Marks, Mathieu, & Zaccaro, 2001) and the conceptualization of teams as multilevel entities (Chen & Kanfer, 2006; Kozlowski & Klein, 2000). One aspect within this multilevel conceptualization of teams refers to individual-level processes that unfold within a team context. An increasing number of studies has not only considered team processes at the team level but also examined individual-level processes within the team context (Chen, Thomas, & Wallace, 2005; DeShon, Kozlowski, Schmidt, Milner, & Wiechman, 2004; Ng & Van Dyne, 2005).

In our article, we build on these theoretical and conceptual advancements and report findings from a longitudinal study that focuses on individual behavior in a knowledge-intensive team setting. In knowledge-intensive domains (e.g., product development, software and hardware design; Sawyer, 2004; Walz, Elam, & Curtis, 1993), requirements for social interaction and teamwork processes are high (Reus & Liu, 2004; Stempfle & Badke-Schaub, 2002), and mastery of these processes is crucial for high team performance (Brodbeck, 2001; Walz et al., 1993). We examine individual members' contributions to one specific type of team processes, namely, team*work* processes (i.e., processes within a team that direct, align, or monitor task accomplishment; Marks et al., 2001) during team meetings. Meetings are an important part of organizational life and are widely used in many organizations (Rogelberg, Leach, Warr, & Burnfield, 2006). Particularly in knowledge-intensive domains where the requirements for exchanging information are high (Cross & Cummings, 2004; Reus & Liu, 2004), team meetings play an important role for the team's progress. During such meetings, team members discuss problems, set goals, and make decisions on the team's further course of action (Walz et al., 1993).

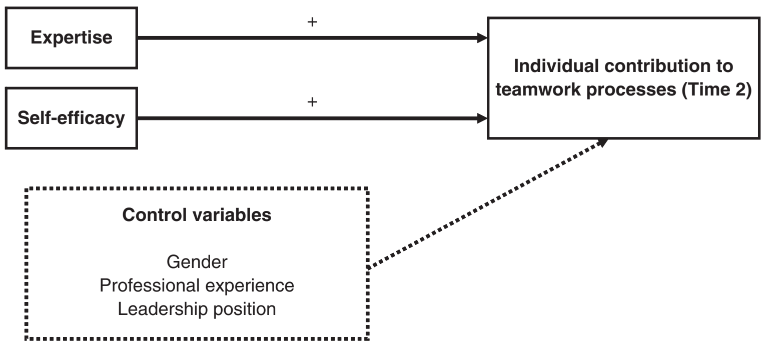
We argue that team members differ in the degree to which they engage in teamwork processes during meetings. For example, not all team members might equally contribute to the specification of the team's goals. Some members might be very involved in this activity, whereas others might largely refrain from it. Although many managers and others might share similar views based on their everyday experience, empirical research on the *predictors* of individual behavior in teams in general and individual contributions to team meetings in particular is scarce and mainly based on cross-sectional research (Franz & Larson, 2002). To advance the understanding of team processes as multilevel processes, it is important to examine how individuals behave within a team context and to identify predictors of individual-level variation of team-related behavior (DeShon et al., 2004).

Of course, part of the variation in individual members' contributions during meetings is because of the formal role within the team with team leaders being particularly engaged in directing the team's efforts and activities (Larson, Christensen, Franz, & Abbott, 1998). We are interested in team members' characteristics—beyond their formal role—that might account for within-team variation in contributions to teamwork processes. Recently, Tasa, Taggar, and Seijts (2007) suggested that individual task-relevant knowledge (i.e., expertise) and self-efficacy are the most important individual-level predictors of individual teamwork behaviors. Task-relevant knowledge is highly important for emergent states within the team (Marks et al., 2001) and for team performance (LePine, Hollenbeck, Ilgen, & Hedlund, 1997). According to social cognitive theory, self-efficacy is crucial for the behaviors individuals engage in (Bandura, 1997). We draw on this line of reasoning and examine if expertise and self-efficacy predict an individual's contribution to team meetings over time.

It might seem rather obvious that individuals' behavior in teams benefits from expertise and self-efficacy. However, research on expertise has mainly concentrated on experts' behavior in individual task settings (Ericsson & Lehmann, 1996) and largely neglected team-relevant behaviors. Moreover, it has even been argued that experts who possess elaborate task-relevant knowledge do not function well in teams and do not posses the necessary skills to contribute to the teamwork process (Shanteau, 1988; Stein, 1995). Therefore, it is worthwhile to put the assumed relationship between an individual's level of expertise and his or her contribution to teamwork behavior to an empirical test.

Our study contributes to the literature in several ways. First, we participate in moving research on teamwork processes to the individual level, offering a more detailed picture of teamwork processes, and provide evidence that individuals differ in their involvement in teamwork processes—beyond the variation that can be explained by formal role requirements. Second, we make a specific contribution to research on expertise that has largely focused on experts' knowledge and problem-solving skills observed in individual task settings but largely neglected experts' behavior unfolding in a team context (Ericsson & Lehmann, 1996). Third, by focusing on professionals working together in organizational settings over longer periods, we go beyond earlier research that has often included students working together in laboratory or simulation settings (Chen et al., 2005; DeShon et al., 2004; Tasa et al., 2007). Fourth, our longitudinal study overcomes limitations of previous studies that have examined the association between individual characteristics and contributions to teams with cross-sectional designs (Barry & Stewart, 1997; Morgeson, Reider, & Campion, 2005). More specifically, we go beyond earlier research (Tasa et al., 2007) and test if expertise and self-efficacy predict *change* in teamwork behaviors over

**Figure 1**
**Conceptual Model**




time; that is, we examine if team members high on expertise and self-efficacy increase their contribution to teamwork processes as teamwork proceeds. Figure 1 shows our conceptual model.

The findings of our study will matter for the management of teams. A finding that experts contribute more to teamwork processes than do nonexperts would put managers relatively at ease because they can expect that the content of experts' contributions to problem analysis and goal specification reflect a high level of skills and knowledge. However, if nonexperts are highly engaged in teamwork processes, managers and other team members should be worried—because low expertise members might influence important decision without possessing the necessary skills and knowledge. In such a situation, it would be important to find ways to encourage expert team members to engage more in team work processes.

## Task-Related Teamwork Processes During Meetings

### Meetings as Context for Teamwork Processes

Work in team settings is often performed in episodes (i.e., temporal cycles of goal-directed activities) characterized by distinct action and transition phases (Marks et al., 2001). During action phases, teams engage in activities that directly contribute to accomplishing the team's goal. For example, in an action phase, members of a product development team write text statements for the marketing campaign. During transition phases, teams engage in specific activities such as reflection about past performance, goal setting, and planning that in turn guide the team's future goal accomplishment. In other words, during transition phases, teams spend time and effort on activities that prepare, direct, and regulate activities executed later during action phases. During such transition phases, metatask processes take place that guide the daily work activities directly related to task accomplishment. For example, in a transition phase, members of the product development team will discuss the goal of the marketing campaign and decide about the specific features to be included in the brochures composed for the campaign. Research based on action regulation theory (Frese & Zapf, 1994; Hacker, 2003) has suggested that it is not the mere execution of a task (i.e., activities taking place during action phases) but the *regulation* of task execution (i.e., transition-phase activities such as problem analysis and goal development) that is crucial for team performance (cf. Tschan, 1995, 2002).

Within teams in knowledge-intensive domains, weekly or biweekly project meetings are a prototypical setting during which activities typical for transition phases occur (Marks et al., 2001). Usually, team members participate in meetings to evaluate the team's progress, to discuss remaining problems, and to set goals for the next action phases (Sonnentag, 2001; Walz et al., 1993). The way team members behave during meetings is related to meeting effectiveness (Nixon & Littlepage, 1992).

In our study, we focus on two specific teamwork processes occurring during transition phases in general and in team meetings in particular, namely, problem analysis (also called "mission analysis" in other taxonomies; e.g., Marks et al., 2001) and goal specification. We chose these activities because problem analysis and goal specification are crucial for success in knowledge-intensive teams (and beyond). For example, if a team does not thoroughly analyze the problem and does not come to an adequate representation of the problem and the requirements, product quality will suffer (Walz et al., 1993). Similarly, as tasks in knowledge-intensive domains are often complex, ill structured, and characterized by fluctuating and conflicting requirements (Cohen, Mohrman, & Mohrman, 1999; Curtis, Krasner, & Iscoe, 1988), it is difficult—if not impossible—for a team to arrive at high performance if it does not specify its goals in detail. Of course, other teamwork processes such as expression of empathy, confidence building, and affect management are relevant as well (Kellett, Humphrey, & Sleeth, 2002, 2006). We decided to focus on problem analysis and goal specification because theorizing within action theory (Frese & Zapf, 1994; Hacker, 2003) identified these two teamwork behaviors as particularly important.

## Problem Analysis

Teams engage in problem analysis to develop an adequate mental representation of the task and to understand situational factors associated with it. Problem analysis is essential as it helps in acquiring and exchanging information needed for task accomplishment. A thorough problem analysis clarifies core aspects of the task and enables the team to focus its attention and effort on these aspects (Rousseau, Aubé, & Savoie, 2006). Empirical evidence supports this view: Problem analysis and information acquisition within teams are associated with high team performance (Stout, Salas, & Carson, 1994).

## Goal Specification

Goal specification can be described as "the identification and prioritization of goals and subgoals" (Marks et al., 2001, p. 365). Goal specification at the team level implies that a team develops and decides about its overall goals and subgoals. For example, in a product development team, members will specify which core product features they will prioritize during the development process and by when they will start to test the first prototype.

Effective goal specification is crucial for high team performance. Experimental studies have shown that high and specific goals improve team performance (O'Leary Kelly, Martocchio, & Frink, 1994). In addition, research on multilevel processes in teams has demonstrated that goal-related processes are positively associated with team effort and team action processes that in turn are associated with team performance (DeShon et al., 2004). Goal specification is particularly relevant when teams start to work together. However, also later in the process, goal specification is important because higher-order goals must be decomposed into subgoals and because teams have to adapt to changes in task requirements. Moreover, teams may work on several projects or products over time, with each new project requiring goal specification.

## Individual Contribution to Teamwork Processes

Most studies on team processes have conceptualized teamwork processes as a team-level phenomenon. For example, it has been analyzed if the extent to which the team as a whole engages in team processes is related to team performance (Ilgen, Hollenbeck, Johnson, & Jundt, 2005; LePine, Piccolo, Jackson, Mathieu, & Saul, 2008). With respect to level issues in team research, we do not question that problem analysis or goal specification can be conceptualized at the team level. In our view, *individual contributions* to team processes such as team-level problem analysis and team-level goal specification can still be described as individual-level activities. Thus, individuals engage in specific cognitive activities and show specific overt behaviors including talking to each other, and these individual-level activities and behaviors combine into a team-level process. For example, within software design teams, gathering information on the hardware platform that influences a team's decisions about software design features is primarily an individual cognitive activity—although several team members might be engaged in this activity and might come up with a decision at the team level. Similarly, it is often an individual team member who makes a first suggestion about a desired future state that later other team members might take up and develop it further as their common team goal. Thus, team-level goal specification is built up of interrelated individual acts of proposing goals and elaborating on them. We suggest that team members differ in the degree to which they engage in these individual-level acts.

The notion that individual team members do not uniformly behave within a team but differ largely in their engagement in team-related processes is in line with classical (Bales & Strodtbeck, 1951) and more recent research on team roles (Stewart, Fulmer, & Barrick, 2005). Although the specific contents of teamwork processes such as problem analysis and goal specification differ from the team-related behaviors specified in team roles research, team members most likely also vary in the degree to which they contribute to the team's problem analysis and goal specification (cf. DeShon et al., 2004).

In this article, we use the term *individual contributions* to teamwork processes (i.e., problem analysis and goal specification during team meetings) to describe an individual-level phenomenon embedded in team-level processes. When speaking about an individual's contribution to problem analysis (or goal specification), we refer to the individual's degree of participation in the team's problem analysis (or goal specification) activities—and not to the quality of the individual's problem analysis (or goal specification) statements.

## Predictors of Individual Contributions to Teamwork Processes

### Expertise

We propose that expertise is a core predictor of an individual's contribution to problem analysis and goal specification in a team context. We conceptualize expertise as high domain-specific task performance demonstrated over time (Ericsson & Lehmann, 1996). This view implies that experts in a team are those members who show the highest level of task performance and not necessarily those with the most extended professional experience (i.e., time on the job). In domains where new products are developed, they often assume the role of technical innovators (Howell & Shea, 2006). Although specific skills and abilities of experts vary across domains, scholars agree that experts possess a large body of well-organized domain-specific knowledge and procedural skills (Ford & Kraiger, 1995; Green & Gilhooly, 1992).

Research in social and industrial–organizational psychology has suggested that experts play a specific role in teams and differ from other team members in team-related skills. Studies following the *hidden profile* paradigm (Stasser & Stewart, 1992) have demonstrated that experts and nonexperts differed in their overall individual contributions to team discussions. Experts participated more in the overall team process, mentioned and repeated more information, and put emphasis on specific aspects of knowledge, particularly when their expertise was known to the other team members (Franz & Larson, 2002; Larson, Christensen, Abbott, & Franz, 1996; Larson et al., 1998). Similarly, studies conducted in organizational contexts have reported that experts in software engineering teams spent a large amount of their working time on work-related communication with other team members and were perceived by their fellow team members as being highly socially skilled (Curtis et al., 1988; Sonnentag, 1995). Also, in other jobs, task-related performance levels were found to be positively related with social skills and knowledge about how to work together as a team (Hochwarter, Witt, Treadway, & Ferris, 2006; Morgeson et al., 2005).

To sum up, there is evidence—although not unequivocal (Shanteau, 1988; Stein, 1995)—that experts are socially skilled, engage in communication processes, and contribute to discussions in teams. However, it remains largely unclear if experts' higher overall involvement in team-related activities refers primarily to their involvement in task-work processes (i.e., processes directly related to task completion; cf. Marks et al., 2001) or teamwork processes—or both. We are aware of only one study that explicitly examined experts' engagement in teamwork processes. In an observational study in meetings of software design teams, Sonnentag (2001) found that experts participated more in the overall meeting and contributed more to teamwork processes, particularly when the meetings were ill structured. Thus, there is some first evidence that experts differ from nonexperts with respect to their individual contributions to teamwork processes.

We propose that expertise will be positively related to the individual's contribution to problem analysis and goal specification. One can think of both cognitive–motivational and social processes for why experts should contribute more to these teamwork processes. First, because experts have a well-organized domain-specific knowledge that is highly proceduralized (Ford & Kraiger, 1995; Green & Gilhooly, 1992), they are likely to know more about which aspects of the task and the problem domain should be covered during problem analysis. This knowledge will help them to pose more questions when trying to understand the problem. They will also have a better mental representation of potential appropriate task goals to be achieved. Therefore, experts will engage more in problem analysis and goal specification. Compared to team members with a lower level of expertise who might also have a high need for acquiring information to understand the problem, experts will be less reluctant to engage in public problem analysis because they do not have to worry that their questions convey lack of competence (cf. Ashford, Blatt, & VandeWalle, 2003).

Moreover, social processes might account for experts' high involvement in teamwork processes. Based on the status expectation theory, one can assume that team members develop perceptions and expectations of other team members' performance level (Berger, Cohen, & Zelditch, 1972). These perceptions and expectations influence how team members interact with each other. When team members expect that another member possesses a high level of expertise, they will signal to this person that they expect specific input from him or her. For example, they may pose specific questions or use nonverbal behavior that stimulates the expert to show specific behaviors (e.g., answering questions and making suggestions) that contribute to problem analysis or goal specification.

*Hypothesis 1:* Expertise positively predicts an individual's contribution to problem analysis in a team context.

*Hypothesis 2:* Expertise positively predicts an individual's contribution to goal specification in a team context.

## Self-Efficacy

We propose that not only expertise but also individual self-efficacy will be related to an individual's contribution to teamwork processes. Self-efficacy refers to an individual's confidence to be able to perform a specific course of action (Bandura, 1997). In our research context, self-efficacy refers to an individual's confidence in his or her ability to perform specific tasks such as designing a software product (for a different conceptualization of self-efficacy, see Tasa et al., 2007). Empirical evidence from studies using complex simulation scenarios where persons work individually on a task suggests that individuals high on self-efficacy show more information search (Seijts, Latham, Tasa, & Latham, 2004) and use analytic task strategies to a greater extent (Bandura & Jourden, 1991; Wood & Bandura, 1989). As information search and the use of analytic task strategies are important elements of problem analysis, one can assume that highly self-efficacious individuals are more inclined to engage in such behaviors relevant for problem analysis. In addition, there is broad empirical evidence that individuals' level of self-efficacy is positively related to the goal levels individuals set for themselves (Brown, Jones, & Leigh, 2005; Phillips & Gully, 1997; Wood & Bandura, 1989). These findings imply that individuals high on self-efficacy view high goals more positively and will not shrink away from such high goals. Therefore, one can assume that individuals high on self-efficacy will generally pay attention to goals and will engage in activities that help to specify the goal, for example, by suggesting particular goals.

We assume that self-efficacy also predicts individuals' behavior during team meetings. Research has shown that individuals high on self-efficacy have more positive social exchange relationships with other team members and supervisors (Chen & Klimoski, 2003). This more positive social exchange relationship will facilitate the expression of ideas related to problem analysis and goal specification. In addition, because self-efficacious individuals are confident about their ability to accomplish tasks successfully, they will also be more confident in contributing to teamwork processes. Specifically, team members high on self-efficacy will pose more questions and elicit information important for problem analysis because they will assume that their questions are important for team progress and will not just reflect their own lack of knowledge or understanding. Moreover, self-efficacious team members will be more confident that the goals they are suggesting are appropriate for the team. In other words, self-efficacy should help team members to express ideas and to be less timid and reluctant to suggest goals and identify questions relevant for problem analysis.

*Hypothesis 3:* Self-efficacy positively predicts an individual's contribution to problem analysis in a team context.

*Hypothesis 4:* Self-efficacy positively predicts an individual's contribution to goal specification in a team context.

## This Study

We use a field study approach to examine expertise and self-efficacy as predictors of an individual's contribution to teamwork processes. To move beyond the limitations of earlier cross-sectional studies analyzing the relationship between expertise and self-efficacy on one hand and team-related behavior on the other hand, we use a longitudinal design. When predicting an individual's contribution to problem analysis and goal specification at Time 2, we control for this individual's contribution to these processes at Time 1. This approach helps to rule out that team members demonstrate high expertise because they have gained from engaging in specific teamwork processes. In other words, our analysis tests if expertise and self-efficacy predict changes in contributions to teamwork processes over time.

An individual's contribution to teamwork processes might not depend only on his or her expertise and self-efficacy. Status expectation theory (Berger et al., 1972; Bunderson, 2003) suggests that status-related cues such as gender or task-related experience might also affect a person's (perceived) expertise and his or her involvement in teamwork processes. In addition, a person's formal role in the team might also influence contributions to teamwork processes. Particularly, a leadership position might be associated with a higher degree of contribution, whereas persons with purely administrative positions who have no knowledge and skills in the specific (technical) field might contribute less to problem analysis and goal specification. To rule out that associations between predictor and teamwork process variables are based on status cues or formal roles within the team, we control for gender, years of professional experience, leadership position, and administrative position.

## Method

### Sample

We conducted our study in 29 software development teams from 28 organizations in Germany. These organizations were involved in the development of a great variety of different software products (e.g., information and communication systems, systems for administrative and financial purposes). We approached the organizations directly by telephone or e-mail and by placing advertisements in appropriate newspapers and professional journals. Companies that expressed some interest in participation were provided with detailed information about the study and participation requirements, both on a written basis and during face-to-face meetings held in the organizations. Information about the study procedures was also accessible via the Internet throughout the course of data collection.

This study was part of a larger research project. Participating projects had to meet three requirements: (a) teams should have at least three members, (b) teams should conduct team meetings on a regular basis (i.e., at least once a month), and (c) teams should intend to work together for at least another 12 months. Participation in the study was voluntary. To motivate teams for participation, we offered them feedback sessions after data collection at Time 1 and Time 2. These sessions included presentations by the authors and discussions within the teams. Sessions covered general topics related to teamwork and did not include any information that could have influenced responses at Time 2.

At Time 1, a total of 224 self-report questionnaires was sent to a total of 29 teams. Of these questionnaires, 205 usable questionnaires from 29 teams were returned to the researchers in prestamped envelopes (response rate = 91.5%). For 185 of these 205 persons who sent back self-report questionnaires, peers provided data on problem analysis and goal specification (90.2%). For a total of 164 persons (80.0%), supervisory ratings on expertise were available (overlapping sample: $N = 149$ from 29 teams).

One year later, we approached the teams for the second round of data collection (Time 2). We chose a 1-year time lag to assess medium-term effects (as opposed to short-term effects that become obvious after some weeks) and to hold seasonal effects on business activities constant. Out of the 29 teams that constituted our sample at Time 1, 22 participated at Time 2. Two teams could not be included because they did not run business anymore, and 5 teams decided not to participate because of severe time constraints. Thus, 125 of the total of 149 participants from Time 1 were potential participants at Time 2. In all, 119 persons sent back self-report questionnaires at Time 2 (data not included in this study). Usable peer data on problem analysis and goal specification were available for 93 of these 119 persons (i.e., response rate for peer data = 78.2%). These 93 persons from 22 teams constituted our final sample. Regular contacts and follow-up reminders before and during data collection, face-to-face meetings, and team-specific feedback sessions resulted in response rates for self-report, peer, and supervisory data that were substantially higher than those normally observed in organizational surveys (Baruch, 1999).

In the final sample, most participants (82.8%) were male. Average age at Time 1 was 34.03 years ($SD = 7.19$), and average professional experience in the field was 8.23 years (*SD* = 7.42). About a quarter (24.7%) of our sample had a leadership position. Average team age was 3.76 (*SD* = 2.73) years. Average team size was 6.57 members (*SD* = 3.47).

We examined if our final sample of *N* = 93 differed from our sample of *N* = 149 at Time 1. We found no significant differences with respect to our study variables assessed at Time 1 (expertise, problem analysis, goal specification, self-efficacy, years of professional experience). Thus, although there was some attrition in our sample, it seems that it was not selective.

## Measures

To avoid problems associated with common-method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), we used multisource data. Specifically, we measured expertise by supervisory ratings and individual contribution to problem analysis and goal specification by peer ratings. For assessing self-efficacy and the control variables, we used self-reports. Table 1 shows means, standard deviations, and intercorrelations among the study variables.

*Expertise*. We assessed a person's level of expertise at Time 1 with supervisory performance ratings. Specifically, we used a measure developed for assessing task-related knowledge and skills in technical domains (Schuler, Funke, Moser, & Donat, 1995). For each focal study participant, supervisors rated this person's technical task performance on a 9-point scale ranging from 1 (*extremely below average*) to 9 (*extremely above average*). The five items referred to *scientific and technical knowledge, innovation, problem solving, theoretical work*, and *technical service*. Cronbach's alpha was .88. We decided to assess expertise with a continuous variable—as opposed to a dichotomous variable—to capture a broad variability of expertise levels.

*Self-efficacy*. We assessed self-efficacy at Time 1 with a total of 20 items developed according to the suggestions of Wood and Bandura (1989; cf. O'Neill & Mone, 1998). More specifically, participants reported their degree of confidence to successfully accomplish specific tasks such as (a) professional software design tasks, (b) tasks related to requirement specification, (c) tasks related to coding, (d) tasks related to testing of software, and (e) tasks related to debugging of software at various performance levels, using a scale ranging from 0 (*not at all confident*) to 9 (*fully confident*). Cronbach's alpha was .96.

**Table 1**
**Means, Standard Deviations, and Zero-Order Correlations Among Study Variables**

| | *M* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Gender[a] | 1.83 | 0.38 | | | | | | | | | |
| 2. Professional experience | 8.23 | 7.42 | –.15 | | | | | | | | |
| 3. Leadership position[b] | 1.75 | 0.43 | .14 | –.27 | | | | | | | |
| 4. Administrative position[c] | 0.05 | 0.23 | –.52 | .03 | –.08 | | | | | | |
| 5. Expertise | 6.13 | 1.55 | .17 | –.01 | –.12 | –.28 | | | | | |
| 6. Self-efficacy | 5.60 | 1.99 | .27 | –.03 | .16 | –.58 | .30 | | | | |
| 7. Goal specification (Time 1) | 3.43 | 0.55 | .24 | .29 | –.40 | –.17 | .40 | .14 | | | |
| 8. Goal specification (Time 2) | 3.51 | 0.55 | .02 | .13 | –.22 | –.07 | .47 | .00 | .50 | | |
| 9. Problem analysis (Time 1) | 3.90 | 0.43 | .11 | .23 | –.42 | –.09 | .25 | .03 | .67 | .26 | |
| 10. Problem analysis (Time 2) | 3.88 | 0.46 | –.07 | .16 | –.16 | .04 | .30 | –.15 | .27 | .73 | .24 |

Note: $N = 93$. All $r \geq |.21|$ are significant at $p < .05$; all $r \geq |.27|$ are significant at $p < .01$.
a. 1 = *female*, 2 = *male*.
b. 1 = *no leadership position*, 2 = *leadership position*.
c. 0 = *no administrative position*, 1 = *administrative position*.

*Individual contribution to teamwork processes*. We assessed team members' individual contribution to problem analysis and goal specification with peer assessments at Time 1 and Time 2. Measures from Time 1 were used as control variables; Time 2 measures were our outcome variables. Study participants were provided with a set of three peer rating surveys and were requested to hand these surveys to three of their peers (i.e., persons with whom they directly worked in their teams). In cases in which they had three or fewer peers, they were instructed to give the surveys to all of their peers. Peers were asked to send the completed survey in a sealed, prestamped return envelope directly back to the researchers. A specific coding algorithm allowed us to match focal participants' data with the peer data while at the same time keeping the anonymity of both the focal participants and the peers. Peers were requested to report focal participants' behavior during regular team meetings and to respond to all items on a 5-point Likert-type scale ranging from 1 (*not true at all*) to 5 = (*totally true*). At Time 1, an average of 2.59 peers ($SD$ = 0.77) provided problem analysis and goal specification ratings for each focal study participant. At Time 2, an average of 2.55 peers ($SD$ = 0.79) returned ratings on individual contribution to problem analysis and goal specification.

Specifically, we assessed individual contribution to problem analysis during team meetings with three items ("During meetings s/he directly addresses other participants in order to get information that is required"; "During meetings s/he speaks to other team members and requests the information s/he needs"; "During meeting s/he tries to be clear about what s/he does not know and then asks for the information"). Cronbach's alphas were .75 (Time 1) and .85 (Time 2). Peers demonstrated considerable agreement about focal participants' individual contribution to problem analysis at Time 1, average deviation ($AD$) = 0.37 (Burke & Dunlap, 2002), $\eta^2$ = .50, $F(90, 152)$ = 1.719, $p < .01$, intraclass correlation coefficient (ICC) (1) = .2173, and at Time 2, $AD$ = .43, $\eta^2$ = .46, $F(92, 152)$ = 1.318, $p$ = .069, ICC (1) = .1106, with the $AD$ agreement scores being far below the criterion of $AD$ = .80 that is regarded as the cutoff value for scales with five response categories (Burke & Dunlap, 2002).

Goal specification was measured with four items referring to an individual's involvement in specifying and prioritizing specific and high-level goals during team meetings ("During meetings s/he makes suggestions about which goals we should pursue as a team"; "During meetings s/he emphasizes that we reach our goals at a high performance level"; "During meetings s/he pleads that we as a team decide on specific goals"; "During meetings s/he gets to the heart of what we want to achieve"). Cronbach's alpha was .82 at Time 1 and at Time 2. Peers substantially agreed on focal participants' individual contribution to goal specification at Time 1, $AD$ = .48 (Burke & Dunlap, 2002), $\eta^2$ = .56, $F(90, 152)$ = 2.134, $p < .001$, ICC (1) = .3046, and at Time 2, $AD$ = .44, $\eta^2$ = .60, $F(92, 152)$ = 2.359, $p < .001$, ICC (1) = .3483. For further analyses, peers' assessments of individual contributions to problem analysis and goal specification were averaged per focal participant.

To examine whether individual contribution to problem analysis and goal specification represent distinct constructs, we conducted confirmatory factor analyses. For data from Time 1, results demonstrated that a two-factor solution with problem analysis items loading on a problem analysis factor and goal specification items loading an a goal specification factor showed a reasonable fit ($\chi^2$ = 56.65, *df* = 13, *p* < .001; goodness of fit index [GFI] = 93, comparative fit index [CFI] = 97, normed fit index [NFI] = .96, non-normed fit index [NNFI] = .95) and fit the data better than a one-factor model with all items loading on one common factor ($\Delta\chi^2$ = 176.09, *df* = 1, *p* < .001). Also, at Time 2 the two-factor model showed a good fit ($\chi^2$ = 36.36, *df* = 13, *p* = .00052; GFI = .96, CFI = .99, NFI = .98, NNFI = .98) and fit the data better than a one-factor model ($\Delta\chi^2$ = 164.96, *df* = 1, *p* < .001).

*Control variables*. As a person's gender, professional experience, and position in the team might influence his or her contribution to teamwork processes and also supervisors' performance ratings, we controlled for gender, years of professional experience, leadership position, and administrative job (i.e., job of project coordinator without knowledge or skills in software design) in our analyses. We assessed gender, professional experience, and position in the team with single-item measures.

## Data Analysis

Because we were interested in individual-level contributions to teamwork processes, and because team members' data might not be independent within the teams, we analyzed our data with a hierarchical linear modeling approach (Bryk & Raudenbush, 1992) using the MLwiN program (Rasbash et al., 2000; for a comparison between various software programs for hierarchical linear modeling, also see Kreft & de Leeuw, 1998). To overcome some of the problems of cross-sectional studies and to take advantage of our longitudinal data set, we controlled for Time 1 scores of contributions to problem analysis and goal specification when predicting Time 2 scores of contributions to problem analysis and goal specification, respectively.

# Results

## Variation Within Teams

We compared within-team and between-team variance in contribution to problem analysis and goal specification. At Time 1, the total variance of individual contribution to problem analysis was .185, with a between-team variance of .014 (7.6%) and a within-team variance of .171 (92.4%). The total variance of individual contribution to goal specification was .303.

Between-team variance was .031 (10.2%) and within-team variance was .272 (89.8%). At Time 2, the picture was similar. For individual contribution to problem analysis, between-team variance was .037 (17.5%) and within-team variance was .174 (82.5%), summing up to a total variance of .211. For individual contribution to goal specification between-team variance was .049 (16.3%) and within-team variance was .252 (83.7%), resulting in a total variance of .301. Thus, most of the variance in individual contribution to teamwork processes was within the teams, suggesting that team members differed largely in their involvement in problem analysis and goal specification. Therefore, it makes sense to use hierarchical linear modeling and to examine individual-difference variables that might explain within-team variability of individual contribution to teamwork processes.

## Test of Hypotheses

We tested the relationship between expertise and self-efficacy on one hand and individual contribution to problem analysis and goal specification on the other hand with a hierarchical linear modeling approach. Outcome variables in these analyses were individual contribution to problem analysis and goal specification at Time 2. For each of these two individual-level outcome variables, we compared four nested models, a Null Model, Model 1, Model 2, and Model 3. In the Null Model, the intercept was the only predictor. In Model 1, we entered gender, professional experience, leadership position, and administrative position as control variables. In Model 2, we entered the Time 1 scores of problem analysis and goal specification as additional control variables. In Model 3, we entered expertise and self-efficacy as our core predictor variables of interest. We tested the improvement of each model above the previous one with the difference between the respective likelihood ratios. This difference follows a chi-square distribution, with *df* equaling the number of new parameters added to the model.

Table 2 displays the results for individual contribution to problem analysis as outcome variable. Model 1 with the control variables gender, professional experience, leadership position, and administrative position did not show a better model fit than the Null Model (difference of –2*log = 7.997, $df = 4$, *ns*). Individual contribution to problem analysis at Time 1 added in Model 2 resulted in an improved model fit (difference of –2*log = 4.883, $df = 1$, $p < .05$). In Model 3, we entered expertise and self-efficacy as the core predictor variables. Again, model fit increased (difference of –2*log = 11.176, $df = 2$, $p < .01$). Expertise was a significant positive predictor for individual contribution to problem analysis at Time 2. Contrary to what we

**Table 2**
**Hierarchical Linear Modeling Results Predicting Problem Analysis at Time 2 From Expertise and Self-Efficacy**

| | Null Model | | | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | *SE* | *t* | Estimate | *SE* | *t* | Estimate | *SE* | *t* | Estimate | *SE* | *t* |
| Intercept | 3.890 | 0.061 | 63.770 | 3.866 | 0.071 | 54.451 | 3.869 | 0.070 | 55.271 | 4.213 | 0.165 | 25.533 |
| Gender | | | | 0.105 | 0.131 | 0.812 | 0.067 | 0.128 | 0.523 | 0.013 | 0.123 | 0.106 |
| Professional experience | | | | 0.018 | 0.007 | 2.571* | 0.016 | 0.007 | 2.286* | 0.016 | 0.006 | 2.667** |
| Leadership position | | | | –0.114 | 0.110 | –1.036 | –0.015 | 0.116 | –0.129 | 0.037 | 0.111 | 0.333 |
| Administrative position | | | | 0.193 | 0.227 | 0.850 | 0.196 | 0.221 | 0.887 | –0.002 | 0.251 | –0.008 |
| Problem analysis (Time 1) | | | | | | | 0.247 | 0.111 | 2.225* | 0.195 | 0.107 | 1.822 |
| Expertise (Time 1) | | | | | | | | | | 0.081 | 0.029 | 2.793** |
| Self-efficacy (Time 1) | | | | | | | | | | –0.059 | 0.026 | –2.269* |
| –2*log (lh) | 114.985 | | | 107.098 | | | 102.265 | | | 91.089 | | |
| Diff –2*log | | | | 7.997 | | | 4.833* | | | 11.176** | | |
| *df* | | | | 4 | | | 1 | | | 2 | | |
| Level 1 intercept variance (*SE*) | 0.174 | 0.029 | | 0.144 | 0.024 | | 0.135 | 0.023 | | 0.124 | 0.021 | |
| Level 2 intercept variance (*SE*) | 0.037 | 0.025 | | 0.070 | 0.032 | | 0.069 | 0.032 | | 0.050 | 0.025 | |

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

had hypothesized, self-efficacy was negatively related to a team member's individual contribution to problem analysis at Time 2.

The results for individual contribution to goal specification as outcome variable are shown in Table 3. Model 1 that included gender, professional experience, leadership position, and administrative position as control variables showed no significant improvement over the Null Model (difference of –2*log = 6.036, $df = 4$, *ns*). Model 2 that also included individual contribution to goal specification measured at Time 1 fit the data substantially better than Model 1 (difference of –2*log = 24.740, $df = 1$, $p < .001$). It is not surprising that individual contribution to goal specification at Time 1 was strongly associated with individual contribution to goal specification at Time 2. For Model 3, including expertise and self-efficacy as predictor variables, model fit further improved (difference of –2*log = 14.643, $df = 2$, $p < .01$). Expertise showed a positive relationship with individual contribution to goal specification at Time 2. Self-efficacy was negatively related to the goal specification variable at Time 2, although the respective $t$ value missed the conventional significance level.

To sum up, findings from hierarchical linear modeling provided support for Hypotheses 1 and 2 but not for Hypotheses 3 and 4. Expertise predicted an individual's contribution to problem analysis and goal specification positively, whereas self-efficacy tended to be a negative predictor.

## Additional Analyses

Research has shown that within teams the effects of expertise are not uniform for women and men (Thomas-Hunt & Phillips, 2004). Therefore, we tested whether gender moderates the relationship between expertise and change in individual contributions to problem analysis or goal specification over time. We computed an interaction term between expertise and gender and entered this interaction term into a Model 4. For individual contribution to problem analysis as outcome variable, Model 4 with the interaction term between expertise and gender showed a significantly better fit than Model 3 (difference of –2*log = 6.196, $df = 1$, $p < .05$, $\gamma = .155$, $SE = 0.060$, $t = 2.583$, $p < .05$). For individual contribution to goal specification as outcome variable, improvement of model fit was not significant (difference of –2*log = 2.009, $df = 1$, *ns*). To explore the pattern of this interaction effect for problem analysis, we ran separate analyses for males ($n = 77$) and females ($n = 16$). Because of the small size of the female subsample, we retained only the Time 1 score for individual contribution to problem analysis as control variable and expertise as predictor in the analyses. As

**Table 3**
**Hierarchical-Linear Modeling Results Predicting Goal Specification at Time 2 From Expertise and Self-Efficacy**

| | Null Model | | | Model 1 | | | Model 2 | | | Model 3 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Estimate | *SE* | *t* | Estimate | *SE* | *t* | Estimate | *SE* | *t* | Estimate | *SE* | *t* |
| Intercept | 3.523 | 0.072 | 48.931 | 3.517 | 0.073 | 48.178 | 3.522 | 0.066 | 53.364 | 3.812 | 0.176 | 21.659 |
| Gender | | | | 0.087 | 0.165 | 0.527 | –0.130 | 0.149 | –0.933 | –0.145 | 0.139 | –1.043 |
| Professional experience | | | | 0.009 | 0.008 | 1.125 | –0.001 | 0.008 | –0.125 | 0.002 | 0.007 | 0.286 |
| Leadership position | | | | –0.240 | 0.134 | –1.791 | 0.018 | 0.127 | 0.142 | 0.055 | 0.119 | 0.462 |
| Administrative position | | | | –0.169 | 0.282 | –0.599 | –0.124 | 0.246 | –0.504 | –0.209 | 0.273 | –0.766 |
| Goal specification (Time 1) | | | | | | | 0.546 | 0.103 | 5.301*** | 0.424 | 0.102 | 4.157*** |
| Expertise (Time 1) | | | | | | | | | | 0.123 | 0.033 | 3.727*** |
| Self-efficacy (Time 1) | | | | | | | | | | –0.051 | 0.028 | –1.821 |
| –2*log (lh) | 149.245 | | | 143.209 | | | 118.469 | | | 103.826 | | |
| Diff –2*log | | | | 6.036 | | | 24.740*** | | | 14.643** | | |
| *df* | | | | 4 | | | 1 | | | 2 | | |
| Level 1 Intercept Variance (*SE*) | 0.254 | 0.042 | | 0.235 | 0.034 | | 0.177 | 0.029 | | 0.154 | 0.022 | |
| Level 2 Intercept Variance (*SE*) | 0.049 | 0.035 | | 0.052 | 0.034 | | 0.046 | 0.028 | | 0.034 | 0.022 | |

$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$.

**Figure 2**
**Interaction Effect of Expertise × Gender on Individual Contributions to Problem Analysis**

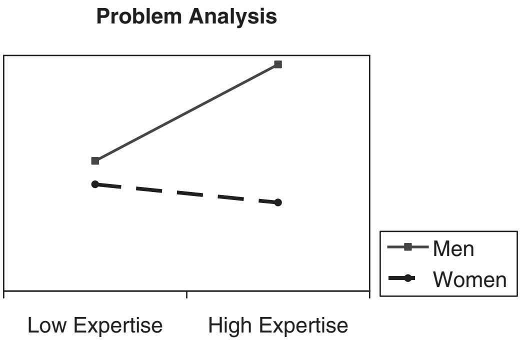



Figure 2 depicts, the relationship between expertise and contribution to problem analysis was positive for men ($\gamma = .116$, *SE* = 0.035, $t = 3.314$, $p < .01$), but for women it was not ($\gamma = -.022$, *SE* = 0.038, $t = -0.579$, *ns*).

## Discussion

Our study examined individuals' contribution to teamwork processes during team meetings. Analyses based on multisource data showed that team members differ largely in the extent to which they contribute to problem analysis and goal specification during team meetings. Expertise (i.e., high level of individual task performance) was a strong predictor of individual contributions to teamwork processes, with team members high on expertise being more involved in a team's problem analysis and goal specification. Self-efficacy was negatively related to individual contribution to problem analysis.

Because we used longitudinal data and controlled for the level of an individual's contribution to problem analysis and goal specification at Time 1, our study suggests that expertise predicts *change* in an individual's contribution to these processes. This finding implies that expert team members increase their individual contribution to problem analysis and goal specification over the course of one year. Thus, our study suggests not only that experts and nonexperts differ in their degree of individual contribution to problem analysis and goal specification (see Table 1 for correlations at Time 1) but also that over the course of time experts develop a prominent role within their teams where they guide teamwork processes. If one assumes that experts' individual contributions to problem analysis and goal specification are more relevant than the contributions of other team members (Bonner, Baumann, & Dalal, 2002), this development should be beneficial for team performance because the team can increasingly rely on experts' inputs.

Expertise turned out as a strong predictor of individual contributions to problem analysis and goal specification. This finding adds to expertise research in the field of cognitive psychology that has mainly focused on experts' superiority in knowledge and problem solving processes (Ericsson & Lehmann, 1996). Our results suggest that persons with a high level of expertise are at the same time highly involved in processes that guide and regulate the team's activities. In addition, our study contributes to research in the organizational field that has demonstrated with cross-sectional data that team-related skills are positively associated with task performance (Hochwarter et al., 2006; Morgeson et al., 2005). By using longitudinal data, our study has shown that task performance level is related to *change* in individual contribution to teamwork processes. Although—strictly speaking—causal inferences should not be drawn from our nonexperimental study, our findings might suggest that an individual's performance level influences this person's contribution to teamwork processes.

Contrary to what we expected, self-efficacy was a negative predictor of individual contribution to problem analysis. This finding is noteworthy as it seems to contradict findings from Tasa et al.'s (2007) study that reported positive relationships between self-efficacy and teamwork behavior. However, Tasa et al. assessed teamwork self-efficacy (i.e., confidence in performing specific teamwork behaviors), whereas our study assessed self-efficacy with respect to specific professional tasks such as software design or debugging. Recently, some studies have shown that self-efficacy may reduce individual performance, particularly when performance is analyzed at the within-person level (Richard, Diefendorff, & Martin, 2006; Vancouver, Thompson, Tischner, & Putka, 2002).

For the present research context, one can think of several reasons why highly self-efficacious team members reduce their contribution to problem analysis over time. First, highly self-efficacious team members might falsely *feel* that they have already understood the problems to be solved and might therefore reduce their willingness to contribute to problem analysis during team meetings. One might speculate that they are even overconfident in their interpretation of the problem (Stone, 1994) and therefore do not approach other team members. Second, self-efficacy might help to perform well on tasks early at the onset of a software project. For example, self-efficacious team members might find problem solutions and come up with very good ideas about how to design the software system already early in the design process. Therefore, later in the process there will be no real need for them to engage in activities that contribute to the team's problem analysis. Finally, team members high on self-efficacy might pursue problem analysis in general but not do so during team meetings. Taken together, our study showed that actual expertise (i.e., expertise as perceived by the team leader) is related to individual contributions to teamwork processes, whereas team members' self-reported confidence in the ability to perform the relevant tasks tends to be negatively related to individual contributions to teamwork processes.

Our analyses suggest that the relations between expertise and individual contribution to teamwork processes are dependent on gender. Although these results must be interpreted carefully because of sample size, our data might indicate that the positive relationship between expertise and individual contribution to problem analysis does not hold uniformly for males and females. It might be that in male-dominated domains such as software design, a high level of expertise does not help female team members to actively participate in the teamwork process. It might be that in such domains females are reluctant to openly refer to their expertise and to assume a steering role in the team (Thomas-Hunt & Phillips, 2004), maybe because some roles that imply direction and guidance are still gender typed (Atwater, Brett, Waldman, DiMare, & Hayden, 2004). However, the zero-order correlations among gender, expertise, and individual contributions to teamwork processes (particularly at Time 2) were rather small, suggesting that gender differences in contributions to team meetings in male-dominated domains do not exhibit simple gender-specific differences but seem to follow a more complex pattern. Here, future research is clearly needed with larger subsamples of both male and female team members.

## Limitations

As with any study, our study has some limitations. First, our study focused on just two aspects of teamwork processes typical for transition processes and neglected other ones such as explicit strategy formulation

(Marks et al., 2001) and processes related to the identification and expression of emotions (Kellett et al., 2006). We did not examine team members' overall individual contributions to the team meetings (i.e., amount of talking) but focused on their contribution to specific teamwork processes. Therefore, it might be that experts' contributions to problem analysis and goal specification are not specific for these teamwork processes but reflect a higher degree of overall degree of participation in team meetings. Our findings might imply that experts received higher coworker ratings on individual contributions to problem analysis and goal specification because they generally talked more during team meetings.

Second, we limited the investigation of teamwork processes to one specific setting, namely, formal team meetings. However, team members' contributions to the teamwork process might not be expressed just during meetings but can also occur at other occasions, for example, when members of a software design team meet informally to run a test for a specific module. Therefore, future research should extend the investigation of individuals' contribution to teamwork processes to settings other than formal team meetings. In the face of increasing use of video conferences and other virtual forms of collaborations (Bosch-Sijtsema, 2007; Hertel, Geister, & Konradt, 2005), it would be highly interesting to examine if our findings also hold for members working together in virtual teams.

Third, we conducted our study in software design teams. Although we are confident that our study findings generalize to other teams in knowledge-intensive domains where tasks are ill structured (making problem analysis a necessity) and where employees enjoy relatively high job autonomy (allowing for goal specification), the pattern of findings might look different in other types of teams where the need and opportunity for problem analysis and goal specification are more limited. Therefore, it would be an interesting question for future studies to examine if task and job characteristics moderate the relationship between expertise and individual contribution to problem analysis and goal specification. We would assume that in work situations with less complex tasks and a lower degree of job autonomy, the relationships found in this study would be attenuated.

## Implications for Future Research and Practice

Our finding that team members largely differ with respect to their individual contributions to problem analysis and goal specification suggests new avenues for future research. It would be highly interesting to test if our findings also hold for other team process variables (e.g., processes addressing emotions rather than task aspects; cf. Kellett et al., 2006) and to examine how individual-level contributions to teamwork processes combine into teamwork processes at the team level (cf. Kozlowski & Klein, 2000). Most probably, for advancing team-level problem analysis and goal specification, it is sufficient when one or two members pose questions to increase team-level problem comprehension or suggest specific goals to be pursued by the team. All team members, however, should then comprehend the problem and accept the goals specified.

A further important question to be addressed in future research refers to the processes underlying experts' contributions to teamwork processes. As we conducted our study in real teams where team members probably were aware of each other's performance levels, it is most likely that both cognitive–motivational and social processes played a role. Future studies should try to disentangle the effects of actual and perceived expertise. It would be particularly interesting to examine if persons who show a high level of individual task performance (i.e., experts) engage in behaviors relevant for teamwork processes also when their level of expertise is not known by the other team members, for example, in newly composed teams. Another option could be to independently manipulate actual and perceived expertise in an experimental setting.

Our findings have implications for the selection of team members and staffing of teams. To ensure that within teams a certain amount of teamwork processes are performed, our study suggests selecting team members with a high level of expertise. As it might be taken for granted to staff teams with highly domain-relevant knowledgeable members because their knowledge is indispensable for producing a superior product, staffing teams with members high in expertise to facilitate well-functioning teamwork is also highly important. Although we found that self-efficacy negatively predicted individual contribution to problem analysis, we do not recommend staffing teams with members low in self-efficacy, as low self-efficacy might have negative effects on performance. However, managers should be aware that selecting highly self-efficacious individuals as team members might not automatically improve teamwork processes.

Although our results on the interaction between expertise and gender should be considered preliminary, our study might indicate that female team members with high expertise might need specific encouragement to engage in teamwork behaviors during team meetings. For example, training interventions or mentoring might help women with high levels of individual task performance express their expertise in problem analysis or goal specification activities during meetings.

## Conclusion

To sum up, our study has demonstrated that team members differ in the extent to which they contribute to teamwork processes. This finding stresses the importance of including the assessment of processes operating at the individual level in team research. Moreover, expertise (i.e., a high level of individual task performance) was found to predict an individual's contribution to teamwork processes over time, pointing to a change in the role experts play for the team as teamwork proceeds. Overall, our study—along with earlier conceptualizations in team research (Hackman & Morris, 1975)—suggests that individual task performance should be considered not only as an outcome variable of individual and organizational processes but also as an important predictor variable that influences how individuals behave at their workplace in general and in teams in particular.

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**Sabine Sonnentag**, PhD, is a full professor of work and organizational psychology at the University of Konstanz, Germany. Her research centers around the question how employees can show sustainable high performance and remain healthy and engaged in their work.

**Judith Volmer**, PhD, is an assistant professor of social and organizational psychology at the Department of Psychology, University of Erlangen-Nuremberg, Germany. Her research interests include emotions in strategic settings and performance and learning at work.