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Why individuals in larger teams perform worse

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ABSTRACT

Research shows that individuals in larger teams perform worse than individuals in smaller teams; however, very little field research examines why. The current study of 212 knowledge workers within 26 teams, ranging from 3 to 19 members in size, employs multi-level modeling to examine the underlying mechanisms. The current investigation expands upon Steiner's (1972) model of individual performance in group contexts identifying one missing element of process loss, namely relational loss. Drawing from the literature on stress and coping, relational loss, a unique form of individual level process, loss occurs when an employee perceives that support is less available in the team as team size increases. In the current study, relational loss mediated the negative relationship between team size and individual performance even when controlling for extrinsic motivation and perceived coordination losses. This suggests that larger teams diminish perceptions of available support which would otherwise buffer stressful experiences and promote performance.

Introduction

As work-groups become more widespread within organizations (Hackman, 2002), interest has also grown in designing effective teams whose productivity can be linked to long term competitive advantage (Levine & Moreland, 1998). As prior research has found that team performance is some derivation of combined individual performance (Steiner, 1972), researchers have shown much interest in better understanding factors that can influence individual performance in team contexts. One set of factors involves the structural variants related to the team itself. For example, a large body of classical psychological research has shown that team size can have important consequences for individual performance (Thomas & Fink, 1963), revealing an intriguing paradox regarding individual behavior in the context of larger teams. Namely, while individuals in larger groups have access to more resources (Hare, 1952), including a higher likelihood that one person in the group will remember an important piece of information (Horowitz & Bordens, 2002), individuals on larger teams also expend less effort (Latane, Williams, & Harkins, 1979), engage in fewer differentiated tasks, assume less responsibility for the tasks (Wicker & Mehler, 1971), and generally perform worse than individuals on smaller teams (Liden, Wayne, Jaworski, & Bennett, 2004). In sum, although greater human resource capital is available in larger teams, research has unexpectedly shown that individuals in larger teams perform worse (Hackman, 2002; Thompson, 2003).

Most of the studies that inform our understanding regarding why individuals in larger teams perform worse were conducted in the laboratory. These studies tended to involve relatively simple tasks where members experienced temporary person-group relationships rendering the generalizability of these studies to teams of workers engaging in complex tasks over time somewhat questionable. The main body of field work that demonstrates a relationship between team size and performance has primarily focused on team (as opposed to individual level) performance (Stewart, 2006), and has examined team size as a control variable (Haleblian & Finkelstein, 1993), and with few exceptions (Liden et al., 2004), has generally not examined a cross-level perspective showing the processes through which team size might influence individual performance.

A cross-level focus in the domain of team size research is critical because the literature shows that team size often positively relates to *group* level performance (Stewart, 2006), but *negatively* relates to *individual* level performance (Kerr & Bruun, 1983; Liden et al., 2004; Mullen, 1983; Thomas & Fink, 1963). These findings mirror the Latane et al. (1979) observation that collective performance may increase as group size increases, but this collective increase is *less* than the sum of individual optimal efforts. In other words, the diminished performance in larger teams is often not observable at the team level and tends to occur at the individual level. Hackman (2002) suggests that one way to expand what we know about phenomenon involves exploring a level beneath, and bracketing where the bulk of unexplained variance operates. Hence, the current study brackets the cross-level of analysis (team size to individual level performance) where the bulk of unexplained variance associated with poor performance occurs in larger teams.

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This focus allows for the discovery of new and important types of individual level processes which may account for lower levels of performance in larger teams; processes which are obscured when focusing on the group level of analysis (House, Rousseau, & Thomas-Hunt, 1995; Klein & Kozlowski, 2000).

Building on a prominent theoretical perspective – Steiner's theory of process loss (1972) – I explore why individuals in larger teams in real-world work contexts perform worse than individuals in smaller teams. Steiner suggested that individuals in larger teams perform worse because they experience lower levels of coordination and motivation. However, Steiner's original theory was developed to explain the performance of individuals working in groups engaged in single time as opposed to repeated task interactions. As such, the classical conception of team task design is very different from the modern concept actually implemented in real-world organizations, where team members work together in some cases for years, and tend to spend a great deal of time together on a daily basis. Because research shows that interpersonal relationships commonly develop when people work interdependently over time (Reis, Collins, & Berscheid, 2000), and that supportive relationships have important implications for individual level performance (Madjar, Oldham, & Pratt, 2002), the questions remains whether in real world contexts, relationships play an important role in explaining individual level performance in larger teams. Specifically, there may be process losses due to relational losses-individuals in larger teams perceive that support is less available in the team. Hence, the current paper expands the theory of group size and performance by identifying that individuals in larger teams also experience relational loss, and this additional source of process loss contributes uniquely to poor individual performance.

Understanding which individual level experiences best explain the relationship between team size and individual level performance can add to our understanding of how individuals might better use the greater resources available in larger teams. Based on current theory and research, one might infer that in larger teams the best individual performers should simply minimize the amount of time spent coordinating and increase time spent working on individual tasks to avoid coordination and motivation losses (Hackman, 1987; Steiner, 1972). However, the current paper will suggest that even if a person were to follow these recommendations he still might perform worse in large group contexts. This can be attributed to individuals in larger teams also experiencing relational loss which has important consequences for individual performance.

Components of Steiner's process loss

Steiner (1972) developed a widely accepted theory regarding productivity loss. Steiner explained that performance losses occur primarily because of process losses, defined as the inefficiencies which detract from an individual's potential productivity. Process loss contains two general components: motivation loss and coordination loss. Steiner argued that for all task types, motivation loss occurs at the individual level when members are not optimally motivated to perform a task. For tasks that require coordination, coordination loss occurs when individual members fail to organize their efforts optimally as a group. Steiner argued that in order to understand the effect of group size on individual productivity, one needs to understand the effect of group size on the components of process loss. For tasks that require coordination, members in larger teams will experience more coordination loss or difficulty and inefficiency coordinating their activities with other teammates. Similarly, the larger the team, the more likely team members will experience motivation loss, a lower motivation to work hard on behalf of the team.

Steiner's inclusion of motivation loss as an important component of overall process loss comes from empirical evidence dating back to one of the first social psychological studies ever conducted. Specifically the "social loafing" paradigm finds that individuals working alone tend to exert more effort than individuals working in groups (Kravitz & Martin, 1986; Ringelmann, 1913). Empirical extensions of social loafing research demonstrate that an individual's propensity to loaf increases in the context of larger and larger groups (Ingham, Levinger, Graves, & Peckham, 1974; Latane et al., 1979; Liden et al., 2004). In his review of the literature, James Shepperd (1993) proposed that expectancy theory explained why individuals loafed. Shepperd stated that individual members experience declines in motivation when they perceive no contingency between their contributions to the group and achieving a desirable outcome (e.g., rewards or recognition). In the case of team size, theory suggests individuals in larger teams may feel their contribution is less identifiable (Olson, 1965), and therefore their perceived likelihood of receiving rewards and recognition for individual work and resulting motivation will decline as team size increases. This suggests that individual team members' motivation associated with extrinsic rewards and recognition should diminish as teams increase in size.

Steiner also proposed that for tasks requiring coordination, coordination losses will increase with the addition of each teammember. Steiner describes that individual members might themselves perceive greater coordination costs for two basic reasons: (1) matching a members' own and other members 'expertise to specific tasks or roles becomes increasingly difficult when more members are available to perform each role, (2) executing role assignments in an organized way requires a person to exert more time, effort, and understanding of who occupies every other role as the number of members increases. Indeed, in their classic book on "Work Redesign," Hackman and Oldham (1980) suggest that as team size increases, so does the complexity of role assignment and understanding how to gather information in an organized and efficient manner.

Relational loss

Relational loss is a type of individual level process loss whereby an employee perceives that support, help, and assistance are less available within the team as team size increases. Relational losses draw from theory of social support which attributes perceptions of social support to the quality of interpersonal relationships experienced in one's environment (Lakey & Cohen, 2000). Relational losses specifically involve perceptions about the extent to which teammates are likely to provide help, assistance, and support in the face of struggle or difficulty (Cohen & McKay, 1984; Cohen & Wills, 1985; Frese, 1999). Building upon House (1981) relational losses can involve the perceived availability of four types of support including: emotional support (the expression of trust and positive emotion to teammates in the context of setbacks or struggle), instrumental support (help and assistance from teammates), appraisal support (advice to help teammates overcome setbacks), and informational support (information to help members solve problems). Research in the domain of organizational behavior has also examined perceptions of support available from the team as a form of psychological supportive climate which reflects an employee's perception that teammates provide caring and help to one another (Amabile & Conti, 1999; Holahan & Moos, 1982).

In interdependent team contexts, research suggests that an individual's perception that support is available from the broader team is not often a function supportive behavior received from a single teammate or subset of teammates (Mueller & Cronin, 2009; Parris, 2003). Instead, a person's perception that support is available from the broader team denotes that the member believes

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that all team members could and would offer assistance if needed (Parris, 2003). Indeed, members of interdependent teams often expect (Parris, 2003) and require help and assistance from a range of members who have expertise in different aspects of the task (Anderson & Williams, 1996; Bachrach, Powell, Collins, & Richey, 2006; Van der Vegt & Van de Vliert, 2005).

Relational loss and team size

Although researchers have not explored the cross-level relationship between team size and perceptions that support is available from the team if needed, a resource allocation perspective (Becker, 1965) would propose that members of larger teams would be less likely to believe that support is readily available from the team. Resource allocation theory notes that there is a limit to the amount of time employees can spend on any activity (Becker, 1965), including pursuing social relationships (Oh, Chung, & Labianca, 2004). Building social relationships takes considerable time and effort (Kelley et al., 1983). For example, when building and maintaining social relationships individuals often seek help from others (Lee, 1997, 2002), give help to others (Blau, 1964; Clark & Mills, 1993) and express positive emotions (Reis et al., 2000), all behaviors that require a time investment (Bergeron, 2007; Nadler, Ellis, & Bar, 2003; Sutton & Rafaeli, 1988), and that, at high levels, can induce feelings of stress and burnout (Bolino & Turnley, 2005).

Individuals in larger teams may have the same number of work-week hours and tasks to complete as individuals on smaller teams; however, they also have a larger amount of work required to coordinate efforts with every other person, and also a greater amount of relational work to complete (e.g., help seeking and giving) to build relationships with other members on the team. Research has shown that unlike task related activities like coordination, relationship building activities like help seeking and giving are typically not formally rewarded in organizational contexts (Perlow, 1999; Perlow & Weeks, 2002), hence members of larger teams may focus even less time building relationships than attending to rewarded tasks. To conserve time, members may attempt to derive support from other sources (e.g., personal life) outside of the team (Halbesleben, 2006). Alternatively, members may build relationships with a small subset of teammates; however, sub-group formation harms perceptions that support is available from the entire team by promoting conflict between sub-groups (Lau & Murnighan, 2005; Parris, 2003; Thatcher, Jehn, & Zanutto, 2003), political coalitions (O'Leary and Mortensen, 2010), and feelings of isolation experienced by members who do not belong to a specific sub-group (Kahn, 1993). In sum, a given team member has limited time and motivation to spend on relational activity at work, so the addition of each person on a team may require each member to spread her time and efforts more thinly, develop relationships with a subset of teammates, or avoid building relationships within the team altogether. Consequently, a given member may experience relational loss because she perceives that gaining supportive help from the team is unlikely as teammates lack the time and resources required to provide individual members with assistance.

Hypothesis 1. Team size is positively related to relational loss – that is, to members' perception that support and assistance is less likely to be available in the team.

Relational loss and individual performance

People at work often experience setbacks, roadblocks, politics, downsizings, poorly performing teammates and other unexpected negative events which diminish performance and also promote stress (Cavanaugh, Boswell, Roehling, & Boudreau, 2000). Unexpected negative events may occur in interdependent team contexts where members interact more frequently with teammates and thus often experience interpersonal conflicts with teammates (Behfar, Peterson, Mannix, & Trochim, 2008; Bergeron, 2007; Peterson & Behfar, 2005). In addition, members in interdependent teams may experience conflicts of interest and trade-offs between maximizing individual and group goals (Barnes et al., 2008). When individuals work interdependently with others they often experience feelings of uncertainty and diminished control over many aspects of their own work (Stewart, 1996) as they depend upon teammates to execute a piece of the task (Wageman, 1995). This suggests that if one team-member is late delivering her piece of the project (e.g., when one co-author has to delay writing because another co-author "owns" the manuscript beyond the agreed upon deadline), or if the piece of the project delivered is of poor quality, this may threaten the quality of a target team-member's own work and may even result in the target feeling stress.

The unexpected negative events noted above may promote feelings of stress which can hinder performance (Lepine, Podsakoff, & Lepine, 2005). The job demands-resources model of stress and coping describes that stressors which deplete performance are likely to occur when employees perceive that the resources needed or demanded to achieve a goal exceed the actual resources they have at their disposal (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001). This suggests that unlike certain type of stressors which may push individuals to use more resources to achieve a demanding goal, other types of stressors indicate that goal attainment is obstructed or hindered because a person does not perceive they have the ability to obtain the resources needed to achieve the goal (Karasek, 1979).

The larger the perceived gap between resources employees have available and the resources employees need to achieve a goal, the higher the likelihood that employees will experience the type of stress which contributes to employee cognitive overload and depletion (Broadhurst, 1959; Schaufeli & Bakker, 2004). Cognitive overload can diminish performance by decreasing the sheer amount of working memory capacity a person can devote to any one task (Klein & Boals, 2001; Leroy, 2009). In addition, cognitive overload can include non-task related thoughts such as negative self-referent thoughts (e.g., "I can't do this, "I'm going to fail") which also impede working memory capacity and subsequent task performance (Sarason, 1984; Sarason, Sarason, Keefe, Hayes, & Shearin, 1986). Indeed, one meta-analysis found a direct negative relationship between stressors associated with hindrance and performance (Lepine et al., 2005).

One major lever which determines whether individuals in team contexts will experience the type of stress which diminishes performance is whether members appraise that support is accessible and available within their environment or team (Helgeson, 1993; Lazarus & Folkman, 1984; Vaux, 1988). Appraisals are defined as "a process through which the person evaluates whether a particular encounter with the environment is relevant to his or her well-being, and if so, in what ways." (Folkman, Lazarus, Gruen, & DeLongis, 1986, p. 572). Lazarus and Folkman (1984) describe that when people encounter a potential stress inducing problem they engage in two types of appraisals which jointly allow a person to assess the extent of stressful experience. Specifically, a person will appraise how threatening the problem is, and what available resources he might use to solve the problem. So if a person perceives that support is likely to be gained from his environment if needed, this perception is likely to factor into the appraisal process and buffer stress. The stress buffering hypothesis proposes that perceptions that support is readily available can diminish stress by contributing to a person's *perception* or evaluation that she will likely receive support if needed (e.g., increasing perceptions of

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available informational, instrumental, emotional or appraisal support) (Caspi, Bolger, & Eckenrode, 1987; Cohen, Gottlieb, & Underwood, 2004; Cohen & Wills, 1985; Greenberg, 2006; Lepore, 1992; Rook, 1987). If employees appraise that their environment contains the resources needed to solve a problem, this will immediately reduce the perceived gap between the resources needed and available to achieve a task which reduces feelings of stress and thereby promotes performance (Lazarus & Folkman, 1984).

While the mere perception that support is available from the group if needed can buffer stress by contributing to the appraisal process in positive ways (Folkman & Lazarus, 1985; Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986), this perception may also increase the likelihood that members engage in positive coping strategies such as seeking help (Lazarus & Folkman, 1987). Help seeking is a request for remedy that promotes perceptions of supportive help receipt (Bamberger, 2009; Flynn & Lake, 2008) as well as performance (Mueller & Kamdar, 2011). Research shows that seeking help from teammates in interdependent teams is particularly fruitful as teammates can provide members with information that is highly relevant to the interrelated task (Van Der Vegt, Bunderson, & Oosterhof, 2006). Even though help seeking results in performance benefits (Nadler et al., 2003), employees often refrain from seeking help to avoid the potential costs (DePaulo & Fisher, 1980; Lee, 1997, 2001, 2002). For example, seeking help can convey to others in the organization that the seeker lacks the competence to solve the problem alone (DePaulo & Fisher, 1980; Smith & DeWine, 1991). However, the perception that support is readily available in the team can promote help seeking by reassuring employees that the costs of seeking help are low (Anderson & Williams, 1996; Hofmann, Lei, & Grant, 2009), and the likelihood of receiving high quality help is high (Mueller & Kamdar, 2010).

In sum, while difficulties and resulting stressors may be experienced by members of large and small teams alike, large teams have features which promote relational loss by diminishing perceptions that support within the team is readily available which would otherwise directly buffer stress and/or encourage members to seek remedy to aid performance during times of unanticipated struggle (Ganster, Fusilier, & Mayes, 1986; Madjar et al., 2002; Shirom, 1976).

Hypothesis 2. Relational loss mediates the negative relationship between team size and individual performance.

Relational loss, coordination loss, and extrinsic motivation loss

Relational loss may diminish individual performance above and beyond coordination and extrinsic motivation losses. This perspective is novel, as one predominant view within the organizational literature to date is that coordinated exchange between members is the fundamental mechanism that explains poor *group* performance in larger teams (Haleblian & Finkelstein, 1993; Hoffer-Gittell, 2002; Quinn & Dutton, 2005; Smith et al., 1994; Wiersema & Bantel, 1992). Coordinated exchange at the group level should also promote individual level performance by enhancing the likelihood that individuals will obtain needed task related information from teammates (Reagans, Argote, & Brooks, 2005). However, research to date does not address whether coordinated exchange would help members overcome the stressful experience or obtain needed resources when unexpected negative events occur. Furthermore, research cannot speak to whether extrinsic rewards might help individuals overcome the type of stress which debilitates individual performance.

Stress buffering theory would propose that *perceptions* of group coordination would conceivably buffer a person's concern or worry that the group was poorly planned and disorganized (Janicik & Bartel, 2003). However, perceptions of coordination or feelings of extrinsic motivation may not buffer stress associated with unplanned and unexpected negative events, one major source of the type of stress which hinders performance (Mandler, 1984). Instead, research in the domain of stress and coping demonstrates that people cope with unexpected negative events by assessing support availability from informal relationships (DeLongis, Folkman, & Lazarus, 1988; Lazarus & Folkman, 1984). The psychological experience of support reflects employees' perceptions that caring and assistance is available from the broader environment – the primary lever through which perception of support availability link to appraisals and buffer stressful experience. In contrast, neither coordination nor motivation capture whether interpersonal interactions in the team are viewed as compassionate, indicating a willingness to help. Hence, coordination and motivation are less likely to govern how individuals cope when unexpected negative events occur.

Hypothesis 3. Relational loss mediates the negative relationship between team size and individual performance even when controlling for extrinsic motivation and perceived coordination loss.

Method

Overview

The present study was part of a larger longitudinal research program designed to examine the subjective work experience, process, and performance of 212 individuals in 26 teams, 7 companies and 3 industries (chemicals and pharmaceuticals, high tech, and manufacturing) located within the United States. I employed a convenience sample methodology as participants were not randomly selected. Instead, participants were selected based on several characteristics. First, participants were embedded within true cross-functional design teams requiring coordination – where members needed to organize efforts interdependently to achieve the group goal (Wageman, 1995). Second, all participants were knowledge workers who either developed products (e.g., ultra strong adhesive, home health care products, cut-resistant fiber), processes (e.g., maintaining and building a logistical tracking system, creating a customized information management system), and/or services (e.g., solving complex customer problems, integrating information systems). Third, all participants were primarily (80%) dedicated to the target project and available for study during the entire project or a discrete project phase. Because the projects and project phases varied in length, individual participation ranged from 9 to 38 weeks, with a mean of 19.04 weeks. The mean participant age was 38.17 years (range = 22–68), 77% of the participants were men, 82% were college graduates or had engaged in some post-graduate work.

Procedure and instruments

To assess team size all participants (including team leaders) completed a demographic questionnaire at the beginning of this study. Team size numbers were cross-checked against organizational charts. To triangulate results (Jick, 1979) and diminish same-method bias (Spector, 1987), I employed two measures of relational loss. One measure required participants to rate relational loss at the project midpoint; the response rate was 76%. The second measure of relational loss employed a questionnaire administered daily over email Monday through Friday continuously from the project midpoint until the project end. Response rate for the daily questionnaire was calculated by dividing the number of

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questionnaires completed by each participant by the total number of days (taking into account holidays, vacations and sick-days). Each participant should have completed the questionnaire; averaging all participant scores yielded a response rate of 75%. This second measure of relational loss involved aggregating each participant's daily support data from the project midpoint to end. Because extrinsic motivation loss is a state which is sensitive to daily fluctuations (Forgas, 1995), I measured extrinsic motivation loss by aggregating daily questionnaire scores from project midpoint until the project end. Perceived coordination loss was measured at the project midpoint (the response rate was 76%). Team members and team leaders completed a questionnaire at the end of the project or project phase measuring all other team members' performance; the response rate was 68%. Team ethnic heterogeneity was derived from the initial demographic questionnaire, and turnover was assessed by tracking team membership throughout data collection. Response rates within each team for each measure exceeded 60%.

Measures

Independent variable: team size

Team size, the total count of members on a team at the beginning of each project ranged from 3 to 19 members with an average of 9.27 members. A paired *t*-test revealed no significant difference between team size at the beginning ($M = 9.27$) and project midpoint ($M = 9.03$), ($t(25) = 1.66$, $p = ns$).

Mediators: relational loss

The relational loss scale was derived from a supportive work environment scale used in previous research (Amabile, Conti, Coon, Lazenby, & Herron, 1996). The work environment scale included four items that assessed all the different supportive resources identified by House (1981), including: *informational support* – providing information – assessed by the item "there is free and open communication within my work group;" *appraisal support* – providing constructive criticism – assessed by the item "within my work group, we challenge each other's ideas in a constructive way;" and, *instrumental support* – providing help – assessed by the item "in my work group, people are willing to help each other." In addition, one item "there is a feeling of trust among the people I work with most closely," assessed what James House (1981) identified as the content of an emotionally supportive act or affective transaction, thereby approximating *emotional support* (Cohen et al., 2004). Responses were anchored on a 4-point scale (1 = never or almost never; 4 = always, or almost always). The supportive work environment scale was reverse coded such that higher values indicate greater loss. Inter-item consistency was acceptably high ($\alpha = .84$).

Aggregated daily relational loss

An additional measure was developed from the daily questionnaire to capture each participant's perception that support is readily available in the team. The single item "supportive interactions within the team," was included in a section with the following header: "to what extent does each item describe the work environment of your project as you perceived it today?" I aggregated all daily data from the project mid-point to end creating a single perceived support availability score for each participant during the second half of the project. Again, I reverse coded scores such that higher values reflected more relational loss. Relational loss and the aggregated daily relational loss measures were significantly correlated ($r = .48$, $p < .01$).

Dependent variable: performance

Performance was obtained from two sources based on questionnaires administered at the end of the project or project phase. Specifically, team leaders were asked to rate every study participant on their "contribution to quality" over the prior month on a 7-point scale (1 = very low/very poor; 7 = very high/very good). Because team leaders rated subordinates using a single item measure of performance, calculating inter-rater reliability was not possible; hence, I also obtained peer ratings, whereby each study participant was asked to rate every other study participant who was a member of their team on the same single item scale. This performance score consisted of the mean of all team members' ratings of a teammate, not including self or team leader ratings. Research has shown that peer ratings are valid measures of performance (Beehr, Ivanitskaya, Hansen, Erofeev, & Gudanowski, 2001; Campion, Papper, & Medsker, 1996; Facteau & Craig, 2001; Furnham & Stringfield, 1998; Hoegl & Gemuenden, 2001). I calculated an intra-class correlation coefficient – ICC(1) assessing agreement of target teammate ratings yielding an overall score of .20. I also calculated an ICC(2) by applying the Spearman–Brown formula (Gulliksen, 1987) calculating an overall reliability score of .70 for all ratings in the sample – this justified aggregation of all peer-ratings to the target participant level. Team leader and peer ratings of each participant were highly correlated ($r = .35$, $p < .01$).

Individual level controls: perceived coordination loss

I employed a measure of perceived coordination developed to capture Steiner's original theory of perceived coordination loss at the individual level. Participants rated the following items to assess the degree to which team-members experienced coordination: "there are clear-cut roles for members of our team," "behavior in our team is orderly – it is clear what members are expected to do and they do it," and "what people in our team expect other team members to do seems to change every minute," on a seven point scale (1 = Not at all true; 7 = Very true). The perceived coordination scale was coded such that higher values represented more coordination loss, ($\alpha = .66$).

Extrinsic motivation loss

This scale was derived from a three item scale administered daily from the project mid-point to end. The questionnaire included two items from a section headed, "Today in my work on the target project, I felt. . ." The two items were as follows: "motivated by recognition I might earn," and "motivated by rewards I might earn." In addition, one item asked participants to describe the work environment of Project × as you perceived it "today", asking participants to rate "recognition and reward for creative work on the project." Each of the Daily Questionnaire scale-rated items had a 7-point response scale (1 = not at all, 7 = extremely). The scale contained acceptable inter-item reliability ($\alpha = .81$). I aggregated all daily data from the project mid-point to end creating a single mean extrinsic motivation score for each participant during the second half of the project. I then reverse coded each participant score; higher values reflected higher levels of extrinsic motivation loss.

Team level controls: turnover and ethnic heterogeneity

Because team heterogeneity tends to increase as team size increases (Bantel & Jackson, 1989; Jackson, Brett, Sessa, Cooper, et al., 1991), and racial heterogeneity influences performance (Jehn, Northcraft, & Neale, 1999), I controlled for the possibility that team size influenced performance because it increased diversity. I computed a team-level heterogeneity index for racial ethnicity (Blau, 1977), using the formula 1 – sigma(pi›) where pi was the proportion of the population in a given group. In addition, since turnover has been shown to decrease work-group supports (Amabile & Conti, 1999) and coordination (Lewis, Belliveau, Herndon, & Keller, 2007), I controlled for the possibility that change in team composition as opposed to team size predicted

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relational and coordination loss. The study administrators (research assistants) took detailed notes about the number of people who joined and left each team during the study, regardless of their participation in the study. I created turnover scores by dividing the number of members who left the team at the end of data collection by the team size at the beginning of data collection (Wagner, Pfeffer, & O'Reilly, 1984).

Data analysis

Validity of process measures

I used confirmatory factor analysis to establish the empirical distinctiveness of the two scales, perceived coordination loss and relational loss (both measured at the project-mid-point). This model provided a good fit to the data ($\chi^2(13) = 18.49$, $p = .14$; SRMR = .05; RMSEA = .06; CFI = .98). Because a Pearson correlation between the second-order relational loss and perceived coordination loss construct (each measured at the project mid-point using the same method) was positive and significant ($r = .48$, $p < .01$), I specified an alternative confirmatory factor analysis to test the possibility that the relational loss and perceived coordination loss items loaded on the same factor. The change in chi-square test ($\Delta\chi^2 = 21.74$, $\Delta df = 1$, $p < .01$) showed that the two factor model provided a significantly better fit to the observed data.

Analyses

All hypotheses are cross-level in that they involve relationships between the team level variables (level 2) as well as the individual level variables (level 1). Because multi-level modeling is an appropriate approach for testing cross-level models (Krull & MacKinnon, 1999, 2001) I used multi-level modeling with random effects via SAS PROC MIXED (Littell et al., 2002) to test all hypotheses. Multi-level modeling allows one to model individual and group level variance in a predictor and dependent variable. Multi-level modeling with random effects controls for random between-level variance (i.e., between-level variance not correlated with the level 1 or level 2 predictors), allowing the intercept and slope from the level 1 variable (e.g., performance) to act as a dependent variable in the level 2, or between-groups analysis. Controlling for random variance at the group level helps account for additional group level factors which are unrelated to between-level variance of any predictor in the model (e.g., compensation systems, downsizings). A significant parameter estimate for the level 2 predictor (e.g., team size) of a level 1 intercept indicated a group level effect, and a significant parameter estimate for the level 1 predictor of a level 1 dependent variable indicated an individual level effect (Hofmann, 1997). In order to reduce multi-collinearity between random intercepts (the grand-mean of each variable) and slopes (relationship between each predictor and dependent variable) I grand-mean centered all predictor variables in all major analyses (Hofmann & Gavin, 1998). In order to control for random variance between teams, I included team as a random variable in all analysis.[1]

To conduct mediation tests in a multi-level context, I employed the Baron and Kenny (1986) procedure which was adapted by Krull and MacKinnon (1999, 2001) to approximate the multi-level context. Specifically, Krull and MacKinnon identify four preconditions to test mediation, (1) show a relationship between the independent variable at level 2 (team size) and criterion variable at level 1 (performance), (2) establish a relationship between the predictor at level 2 (team size) and mediating variable at level 1 (relational loss), (3) establish a significant relationship between the mediator at level 1 (relational loss) and dependent variable at level 1 (performance) above and beyond the level 2 predictor (team size), (4) in this same model the fourth step involves showing the level 2 predictor (team size) no longer significantly relates to the level 1 outcome (performance). In addition to showing the 4 preconditions for mediation, I employ the methodology developed by MacKinnon, Lockwood, and Williams (2004) and adapted by Bauer et al. (2006) to a multi-level context to test the significance of the indirect effect using the bootstrapping procedure to produce a confidence interval; if the 95% confidence interval values do not include zero this supports a significant indirect effect (Preacher & Hayes, 2004); this method for assessing mediation is superior to the Sobel test (MacKinnon et al., 2004); and incorporates the stepwise procedure described by Baron and Kenny.

[1] I ran multi-level models including team, company and industry as random effects for each model to control for random level variance at the team, company and industry level. Controlling for each source of random variance did not alter any results; hence, I only controlled for random variance at the team level.

Results

Table 1 shows the descriptive statistics for all major variables in the analyses. The first hypothesis asserts that individuals in larger teams experience higher levels of relational loss. Because a level 2 variable (i.e., team size) can only explain differences between groups (Hofmann, 1997), I ran a null hierarchical model (a model with no level 2 explanatory variables) to show that significant between-group level differences exist for both relational loss variables. The results show significant between-group variance in relational loss ($\tau_{00team} = .06$, $df = 25$, $z = 2.27$, $p < .01$) and aggregated daily relational loss ($\tau_{00team} = .14$, $df = 25$, $z = 2.15$, $p < .05$). I also calculated an intra-class correlation coefficient to indicate the proportion of between-group variance relative to the total variance exhibited by both relational loss measures; this identifies the maximum amount of variance potentially explained by a level 2 predictor variable. An ICC(1) showed that 19% of the variance in relational loss existed between teams in this sample and 16% of the variance in aggregated daily relational loss existed between teams. Taken together these results justified further cross-level analyses.

To test this intercepts-as-outcomes model identifying whether team size positively relates to relational loss I ran a multi-level model controlling for ethic heterogeneity and turnover. Table 3 Models 1 and 3 both confirm that team size positively relates to relational loss ($\gamma = .042$, $t(163) = 3.85$, $p < .01$), as well as aggregated daily relational loss ($\gamma = .064$, $t(178) = 4.31$, $p < .01$) respectively. In addition, Table 3 Models 2 and 4 show that team size positively relates to relational loss ($\gamma = .020$, $t(150) = 1.98$, $p < .05$), and aggregated daily relational loss respectively ($\gamma = .043$, $t(149) = 2.09$, $p < .05$), when controlling for ethnic heterogeneity, turnover, extrinsic motivation loss and perceived coordination loss.

The amount of variance in relational loss explained by team size can be calculated by comparing the residual variance in the model with a level 2 predictor to the variance in the null model $((\sigma^2_{\text{null level 2}} - \sigma^2_{\text{level 2}})/\sigma^2_{\text{null level 2}})$. This reduction in variance calculation indicates that team size explained 49% of the between-level variance in relational loss, and 56% of the between-level variance in aggregated daily relational loss. Since 19% and 16% of the variance in relational loss and aggregated daily relational loss existed between groups, team size explains 10% and 9% of the total variance in relational loss and aggregated daily relational loss respectively. These results suggest strong support for Hypothesis 1.

Hypothesis 2 asserted that relational loss would mediate the relationship between team size and individual level performance. To justify this cross-level mediation, I ran a null model which showed that a significant amount of variance existed between teams for the peer-rated ($\tau_{00team} = .26$, $z = 2.48$, $p < .01$) and team-leader rated performance measures ($\tau_{00team} = .56$, $z = 2.54$, $p < .01$). ICC(1) calculations showed that 24% and 33% of the

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Table 1
Descriptives and Pearson correlation coefficients for all major variables, $N = 212$.[a]

Variables		Mean	*SD*	1	2	3	4	5	6	7	8
Team level variables											
1	Team size	9.27	4.48	–							
2	Turnover	.05	.07	.21**	–						
3	Ethnic heterogeneity	.29	.22	−.09	.28**	–					
4	Extrinsic motivation loss	5.37	1.24	.02	.07	−.26*	–				
5	Perceived coordination loss	3.19	1.02	.36**	−.04	.03	.01	–			
6	Relational loss	1.93	.53	.33**	−.02	.02	.18*	.48**	–		
7	Aggregated daily relational loss	3.57	.90	.33**	.10	−.08	.29**	.27**	.48**	–	
8	Team leader-rated performance	5.20	1.17	−.16*	.20**	.07	−.15*	−.27**	−.31**	−.23**	–
9	Peer-rated performance	4.94	.89	−.27**	.03	.14*	−.05	−.09	−.30**	−.28**	.35**

[a] Extrinsic motivation loss, perceived coordination loss, relational loss, and performance were collected at the individual level.
* $p < .05$.
** $p < .01$.

variance existed between teams in peer-rated and team leader rated individual performance respectively.

A multi-level model controlling for random team variance confirmed that team size does significantly and negatively relate to individual level peer-rated performance ($\gamma = -.057$, $t(185) = -2.34$, $p < .05$) as well as team-leader rated performance ($\gamma = -.069$, $t(158) = -2.07$, $p < .05$) when controlling for turnover and ethnic heterogeneity (see Table 2, Model 1, and Table 4, Model 1 respectively). The results testing Hypothesis 1 demonstrate that the second step for mediation has been met. Multi-level models were employed to test the third and fourth step towards mediation. Specifically, Table 2, Model 2 shows a multi-level model controlling for turnover, ethnic heterogeneity and random team level variance identifying that relational loss significantly and negatively related to peer-rated performance ($\gamma = -.360$, $t(162) = -2.95$, $p < .01$), and the relationship between team size and peer-rated performance was no longer significant ($\gamma = -.040$, $t(162) = -1.66$, $p > .10$). Using the method developed proposed by MacKinnon et al. (2004), and later adapted by Bauer et al. (2006), results indicated that the 95% confidence interval of the indirect effect did not include zero (LL = −.025, UL = −.005). This supports a significant indirect effect of team size on peer-rated performance via relational loss. In addition, Table 4, Model 2 shows a multi-level model controlling for turnover, ethnic heterogeneity and random

Table 2
Multi-level models for all major analyses predicting peer-rated performance at the individual level.

Variables	M1	M2	M3	M4	M5	M6
Controls – group level						
Turnover	2.575 (1.589)	1.829 (1.680)	2.464 (1.537)	2.269 (1.819)	2.075 (1.733)	2.175 (1.735)
Ethnic heterogeneity	.802 (.541)	.742 (.533)	.804 (.520)	.638 (.587)	.688 (.561)	.666 (.562)
Controls – individual level						
Extrinsic motivation loss				−.048 (.053)	−.020 (.054)	−.010 (.056)
Perceived coordination loss				−.021 (.067)	.064 (.073)	−.001 (.068)
Mediators – individual level						
Relational loss		−.360** (.122)			−.377* (.125)	
Aggregated daily relational loss			−.181** (.068)			−.168* (.065)
Predictor variable – group level						
Team size	−.057* (.024)	−.040+ (.024)	−.046+ (.024)	−.054* (.026)	−.045+ (.025)	−.046+ (.025)
n	212	189	205	178	178	177

Unstandardized coefficients are reported; two-tailed tests; standard errors are in parentheses.
+ $p < .10$.
* $p < .05$.
** $p < .01$.

Table 3
Multi-level models for all major analyses predicting relational loss at the individual level.

Variables	Relational loss		Daily aggregated relational loss	
	M1	M2	M3	M4
Controls – group level				
Turnover	−1.041 (.771)	−.384 (.707)	−.014 (1.310)	−.257 (1.412)
Ethnic heterogeneity	−.054 (.252)	.169 (.237)	−.139 (.440)	.144 (.465)
Controls – individual level				
Extrinsic motivation loss		.084** (.028)		.188** (.050)
Perceived coordination loss		.221** (.035)		.165** (.063)
Predictor variable – group level				
Team size	.042** (.011)	.020* (.010)	.064** (.019)	.043** (.018)
n	189	178	205	177

Unstandardized coefficients are reported; two-tailed tests; standard errors are in parentheses.
* $p < .05$.
** $p < .01$.

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Table 4
Multi-level models for all major analyses predicting team leader rated performance at the individual level.

Variables	M1	M2	M3	M4	M5	M6
Controls – group level						
Turnover	5.091* (2.157)	5.777* (2.236)	5.106* (2.135)	5.563* (2.330)	5.491* (2.248)	5.642* (2.316)
Ethnic heterogeneity	.803 (.743)	1.097 (.722)	.792 (.736)	.718 (.774)	.856 (.751)	.784 (.770)
Controls – individual level						
Extrinsic motivation loss				−.098 (.073)	−.056 (.074)	−.051 (.076)
Perceived coordination loss				−.183* (.093)	−.060 (.103)	−.138 (.095)
Mediators – individual level						
Relational loss		−.525** (.166)			−.507* (.161)	
Aggregated daily relational loss			−.263** (.093)			−.247** (.110)
Predictor variable – group level						
Team size	−.069* (.033)	−.052 (.032)	−.051 (.033)	−.054 (.034)	−.045 (.033)	−.043 (.034)
n	185	162	179	152	152	151

Unstandardized coefficients are reported; two-tailed tests; standard errors are in parentheses.
* $p < .05$.
** $p < .01$.

team level variance identifying that relational loss significantly and negatively related to team leader-rated performance ($\gamma = -.525$, $t(135) = -3.15$, $p < .01$), and the relationship between team size and team leader rated performance was no longer significant ($\gamma = -.052$, $t(135) = -1.61$, $p = ns$). The indirect effect of team size on team leader rated performance via relational loss was significant (95% confidence interval; LL = −.035, UL = −.008).

To triangulate results, I tested for mediation employing an additional measure of relational loss. Table 2, Model 3 shows a multi-level model controlling for turnover, ethnic heterogeneity and random team level variance identifying that aggregated daily relational loss also related to peer-rated performance ($\gamma = -.181$, $t(177) = -2.67$, $p < .01$), and the relationship between team size and peer-rated performance was no longer significant ($\gamma = -.046$, $t(177) = -1.92$, $p < .10$). The indirect effect of team size on peer rated performance via aggregated daily relational loss was significant (95% confidence interval; LL = −.025, UL = −.002). Table 4, Model 3 shows that aggregated daily relational loss significantly ($\gamma = -.263$, $t(151) = -2.82$, $p < .01$) and team size was no longer significantly related to team-leader rated performance ($\gamma = -.051$, $t(151) = -1.52$, $p = ns$). The indirect effect of team size on team leader rated performance via aggregated daily relational loss was significant (95% confidence interval; LL = −.034, UL = −.004).

Hypothesis 3 proposed that relational loss (a level 1 or individual level variable) mediated the relationship between team size (a level 2 variable) and performance (a level 1 or individual level variable), controlling for individual level extrinsic motivation loss and perceived coordination loss. To demonstrate the first step for testing mediation, I conducted a multi-level model controlling for random team variance, and Table 2, Model 4 shows that team size does significantly relate to peer-rated performance ($\gamma = -.054$, $t(150) = -1.98$, $p < .05$) when controlling for extrinsic motivation loss and perceived coordination loss. Table 4, Model 4 shows that team size does not significantly predict team leader rated performance ($\gamma = -.054$, $t(124) = -1.53$, $p = ns$) when controlling for extrinsic motivation loss and perceived coordination loss. Hence, the first step for mediation holds when controlling for perceived coordination loss and extrinsic motivation loss when predicting peer-rated, but not team leader rated performance. However, Baron and Kenny recently suggested that "step 1 is no longer essential in establishing mediation" (Kenny, Kashy, & Bolger, 1998, p. 260). Indeed other methodologists have argued that even if step 1 is not supported mediation may still occur; failing to test the significance of the indirect effect may spuriously mask true mediation (MacKinnon, Krull, & Lockwood, 2000; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Shrout & Bolger, 2002). Hence, I continued testing for mediation when predicting team-leader rated performance.

To test the third and fourth steps for mediation, I employed the use of multi-level modeling controlling for random team variance, perceived coordination loss, and extrinsic motivation loss while employing both measures of relational loss predicting peer-rated and team leader rated performance at the individual level.[2] Table 2, Model 5 shows that relational loss significantly and negatively predict peer rated performance ($\gamma = -.377$, $t(149) = -2.64$, $p < .05$), while size is no longer significant ($\gamma = -.045$, $t(149) = -1.78$, $p < .10$). The indirect effect of team size on peer rated performance via relational loss was significant (95% confidence interval; LL = −.020, UL = −.001). Table 2, Model 6 shows that aggregated daily relational loss ($\gamma = -.168$, $t(148) = -2.05$, $p < .05$) significantly and negatively predicts peer-rated performance, while team size does not ($\gamma = -.046$, $t(148) = -1.79$, $p < .10$). The indirect effect of team size on peer rated performance via aggregated daily relational loss was significant (95% confidence interval; LL = −.026, UL = −.001).

Table 4, Model 5 also shows that relational loss was significantly ($\gamma = -.507$, $t(123) = -2.59$, $p < .05$) and team size was not significantly related to team leader rated performance ($\gamma = -.045$, $t(123) = -1.35$, $p =$ ns). The indirect effect of team size on team leader rated performance via relational loss was significant (95% confidence interval; LL = −.023, UL = −.001). Table 4, Model 6 also shows that aggregated daily relational loss was significantly related team leader rated performance ($\gamma = -.247$, $t(122) = -2.21$, $p < .05$), and that team size was not significantly related to team leader rated performance ($\gamma = -.043$, $t(122) = -1.25$, $p = ns$). The 95% confidence interval of the indirect effect was significant in that it showed no overlap with zero; LL = −.017, UL = −.001. Hence, the results provide support for Hypothesis 3.

[2] Because perceived coordination loss significantly related to team-leader rated performance, I also tested the possibility that, without including relational loss in the model, perceived coordination loss might mediate the relationship between team size and team-leader rated performance. To test this association, I assessed the extent to which perceived coordination loss was related to team size, and a multi-level model controlling for random team variance, ethnic heterogeneity, turnover and motivation identified that size was significantly and positively related to coordination loss ($\gamma = .093$, $t(124) = 4.15$, $p < .01$). Table 4, Model 4 shows that perceived coordination loss was significantly related to team leader rated performance ($\gamma = -.189$, $t(123) = -2.00$, $p < .05$), while team size was no longer significantly related to team leader performance ($\gamma = -.054$, $t(123) = -1.53$, $p = ns$); the indirect effect was significantly different from zero (confidence interval – LL = −.040, UL = −.001). Hence, coordination did mediate the relationship between team size and team leader rated performance. It is important to note; however, that coordination does not mediate the relationship between team size and team leader rated performance when either measure of relational loss was included in the model (see Table 4, Models 5 and

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Supplementary analyses

The current results show that relational loss measured at the project midpoint relates to individual level performance at the project end. While these results do show some evidence of directionality, they cannot speak to whether earlier performance might significantly relate to relational loss. During the current study I also collected performance measures (using the same scale employed in the prior analysis) to assess peer and team leader rated performance subsequent to the first month of each project or project phase; this measure of performance was given prior to the measure of relational loss employed in the current study. Using multi-level models controlling for random team level variance as well as team size, turnover, ethnic heterogeneity, perceived coordination loss and extrinsic motivation loss, I tested to see if performance measured at time '$t-1$' related to relational loss measured at time 't.' A multi-level model identified that peer-rated performance measured at time '$t-1$' did not significantly relate to relational loss measured at time 't' ($\gamma = -.084$, $t(144) = -1.82$, $p = ns$). A second multi-level model identified that team leader rated performance measured at time '$t-1$' did not significantly relate to relational loss measured at time 't' ($\gamma = -.026$, $t(123) = -.82$, $p =$ ns).

If relational loss and group level support interact to predict individual performance, this would suggest that relational losses are not only an individual level process loss, but a complex interaction between individual and group level processes. To account for this possibility I collected measures of the supportive work environment assessed at the project end using the same scale I employed to capture relational loss. To justify aggregation to the team level, thereby creating a variable measuring team support, I assessed both between-team variability and within-team agreement for the supportive work environment measure assessed at the project end (Hofmann & Stetzer, 1996; Klein, Dansereau, & Hall, 1994; Seibert, Silver, & Randolph, 2004). A one-way ANOVA identified significant between-group variance ($F[25,153] = 2.45$, $p < .01$, $\eta^2 = .28$) and the ICC(1) calculated from the ANOVA was 16%, showing relatively high levels of within-group agreement in field research settings (Bliese, 2000). The median r_{wg} values across the 26 teams was .87, demonstrating that group member perceptions of supportive work environment were sufficiently homogeneous to justify group level aggregation (Zohar, 2000). Taken together, these statistics show acceptable levels of between-group variability and within-group agreement to justify aggregation to the team level.

I ran a multi-level model controlling for random team level variance as well as team size, turnover, ethnic heterogeneity, perceived coordination loss and extrinsic motivation loss, and included the main effects as well as interaction term of team support and relational loss to assess whether team support moderated the relationship between relational loss and team leader rated individual performance. This model identified that the interaction term (i.e., team level support $\times$ individual level relational loss) was not significantly related to team leader rated individual level performance ($\gamma = -.241$, $t(122) = -.48$, $p =$ ns). A second multi-level model controlling for random team level variance as well as team size, turnover, ethnic heterogeneity, perceived coordination loss and extrinsic motivation loss, which included the main effects as well as an interaction term including team support and relational loss identified that team support did not moderate the relationship between relational loss and peer-rated individual performance ($\gamma = .305$, $t(148) = .82$, $p = ns$).

Discussion

This study found support for the well-researched finding that individuals in larger teams perform worse. It examined two important and generally accepted theoretical reasons for why individuals in larger teams perform worse, namely extrinsic motivation loss and perceived coordination loss. However, there was only partial evidence that coordination loss mediated the negative relationship between team size and poor individual performance in this setting. Rather, the data supported the hypothesis that relational losses (i.e., individuals did not appraise that support was available within the team) mediated the relationship between team size and individual performance. The fact that the negative relationship between relational loss and individual performance held even when controlling for extrinsic motivation loss and perceived coordination loss is particularly telling in light of the finding that larger teams do show greater coordination loss and resulting performance loss (as evidenced by perceived coordination loss mediating the relationship between team size and team leader rated performance). This indicates that perceived coordination loss in and of itself does not completely mediate the relationship between team size and individual level performance, nor does it account for the negative influence of relational loss on individual performance. This finding confirms the importance of relational processes even above and beyond coordination and motivational issues in predicting individual performance in the context of large interdependent work-teams.

Theoretical implications

The current investigation provides evidence that perceptions of support available within a team – the theoretical basis of relational losses examined in the current study – is an important contributor to individual performance at work (Madjar et al., 2002). This finding suggests that future research should recognize perceptions of support from the team (e.g., supportive psychological climate) as a key determinant of individual functioning in teams at work. While much research in the organizational behavior realm has focused on the correlations between team functioning and a supportive context (Hackman, 2002), very little research examined the antecedents of support perceptions and resulting individual performance. The current study adds a unique contribution to the literature by providing evidence that individuals in larger teams may not perceive that support and caring is readily available in the broader team and thereby incur relational loss.

Participants in this study engaged in complex, meaningful, and non-redundant tasks which may also have contributed to the lack of association between extrinsic motivation loss and team size. Specifically, one meta-analysis of the social loafing literature by Karau and Williams (1993) found no evidence of social loafing for non-redundant and complex tasks. Erez and Somech (1996) found that "social loafing was the exception and not the rule" (p. 1529), since teams of managerial trainees only loafed when given vague instructions, no incentives, and when administrators disallowed any communication. A lab study entitled "working hard to get people to loaf" (Price, 1993) found that accountability did not relate to loafing, and instead participants only tended to loaf when told that their participation did not matter. Hence, performance losses due to extrinsic motivation losses may not be as relevant to employees in real world contexts (such as employees in the current study) where participants engaged in meaningful tasks.

Table 1 shows a positive correlation between relational loss and extrinsic motivation loss. Expectancy theory describes that, in larger teams, the perceived contingency between rewards/recognition and input to a task may decrease because individual contributions are less identifiable. However, this perspective does not consider that teammates also exchange rewards and recognition in the form of appreciation, acknowledgment, etc. Through decades of research on marital functioning, John Gottman identifies the acknowledgment of "credit" for the positive things another

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does in the context of a relationship as one hallmark of positive relational functioning (Gottman & Notarius, 2002). Future research should examine the interplay between relational loss and extrinsic motivation loss.

The current paper strove to identify a new form of process loss that would explain lower individual performance as the bulk of diminished performance in larger teams occurs at the individual and not the group level. The current study measured and conceptualized relational losses as a perception at the individual level. However, the possibility exists that relational losses may also occur at the team level. Specifically, research has shown that team support – often conceptualized as the average amount of helping or help exchange in a team – positively relates to group performance (Campion et al., 1996; Hargadon & Bechky, 2006; Hoegl & Gemuenden, 2001). A resource acquisition perspective suggests that group support or high levels of help exchange in a group will promote individual performance by increasing member help receipt (Ashford, 1986).

Theory from the domain of stress and coping would suggest that group level support measured as help exchange can promote processes which aid yet also *diminish* individual level performance. That is, group support can promote help exchange, yet the stress buffering theory would explain that the sheer amount of help received or exchanged does not distinguish between supportive help which enhances performance (Amabile & Conti, 1999; Madjar et al., 2002; Zhou & George, 2001), and unsupportive or imposed help which diminishes self-esteem and performance (Deelstra et al., 2003; Schneider, Major, Luhtanen, & Crocker, 1996). Perhaps this is why research has failed to find a significant relationship between the amount of help received and individual level performance (George & Zhou, 2001, 2007; Mueller & Kamdar, 2011) as well as help receipt and perceived support (Helgeson, 1993; Lakey & Heller, 1988; Sarason, Sarason, & Pierce, 1990; Wills & Shinar, 2000). In sum, there may be competing processes in supportive teams which promote supportive and unsupportive help which both aid and hinder individual performance respectively, and may theoretically cancel out the overall relationship between team support and individual level performance.

Furthermore, receiving help from teammates may not aid an individual's performance because some help is more costly than beneficial to obtain. Specifically, receiving help from others requires recipients to repay by giving something in kind (Blau, 1964; Emerson, 1976). Some forms of reciprocation are quite costly and require a significant time investment such as providing help in return (Bergeron, 2007), while other forms of reciprocation such as ingratiation (Baumeister, 1982) – appealing to the other persons' relatively greater expertise – may involve fewer time costs (Mueller & Kamdar, 2011). Supportive groups may require members to repay help using more costly means and reciprocating help. A resource allocation perspective suggests that because people have finite time (Becker, 1965), allocating time and energy towards reciprocating help may result in poor performance due to having less time and energy to spend on individual tasks (Bergeron, 2007). Empirical evidence confirms that giving help to teammates diminishes a person's own performance (Barnes et al., 2008; Mueller & Kamdar, 2011) and contributes to feelings of burnout and stress (Bolino & Turnley, 2005). Hence, supportive teams may allow members to receive help more easily, but the help received may not enhance individual performance simply because the help received was more costly than beneficial to obtain. In sum, theory suggests that group support, defined as the average amount of help exchange in a group, may not relate to individual performance; hence, group support is unlikely to account for poor individual performance in larger teams.

Managerial implications

Past team size research has primarily focused on coordination and motivation (Liden et al., 2004; Smith, Smith, Olian, Sims, et al., 1994). Building on their findings that larger teams had more coordination and motivation losses, researchers have often suggested that managers implement reward structures emphasizing individual contribution to increase accountability and thereby decrease social loafing commonly experience in larger teams (Karau & Williams, 1993). However, this recommendation may inadvertently also contribute to relational losses experienced in larger teams. For example, one study showed that relative to cooperative reward structures (i.e., rewarding group efforts), competitive reward structures (which emphasize individual achievements) decrease information sharing between group members (Johnson et al., 2006). This same study also showed that individuals have a tendency to asymmetrically adapt towards competitive behaviors (e.g., decreased information sharing) if competitive reward structures are introduced, even if groups have previously established norms for cooperative behavior. Perlow (1999) addressed how employees use their limited time at work, and identified a tendency for the software engineers in her sample to perceive social interactions as "disruptive," taking time away from focusing on valued individual tasks. Furthermore, helping other co-workers generally went unrecognized and unrewarded to the point of being subtly discouraged. These findings suggest that reward structures emphasizing individual contribution may disrupt employees from engaging in the types of behaviors (e.g., help giving) that promote perceptions that support is available in the broader environment. A negative association between individual reward structures and perceptions that team members will provide needed assistance might be stronger for larger teams whose individual members have even less time to devote to relational tasks.

Researchers have proposed that creating sub-groups within the larger team (Hoegl, 2005) and keeping team sizes small (Hackman, 2002) should reduce coordination and motivation costs. However, neither recommendation addresses how to promote good performance in *large* groups. Because individual level performance is one important input to group level performance, the current study suggests that one way managers may increase performance in larger groups is to provide more caring and support for individual members. One reason why relational losses occur in larger groups is because individuals in larger groups have less time to engage in relational behaviors and may even prioritize their time more towards enacting individual tasks and coordinating with others. Hence to diminish relational losses managers could assign formal roles to a range of team members tasked with helping and providing care to teammates. This may mitigate the extent to which members feel relational loss by making it easier to receive assistance and caring from the team in light of difficulty or setbacks. In addition, managers should also encourage and even reward seeking help from members in these formal roles to promote the view that support is readily available in the team.

Limitations and future research

The goal of the current investigation was to identify relational losses as an important process component when attempting to understand performance losses in larger teams. While the current paper does show that relational processes explain poor individual performance in larger teams above and beyond the classical processes, it is important to note that a host of processes not considered in the current investigation may influence individual functioning in larger team contexts. For example, this study examined one process related to relationship functioning – relational

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loss. This focus is an important first step in understanding expectations individuals in larger teams have about the relationships in their environment. While defining relational loss as an individual level process loss builds from a long tradition of relational sciences (Sarason, Sarason, & Pierce, 1995), it is reductionist in nature and represents one small part of a broader and complicated system of dyadic relationships situated in larger teams (Reis et al., 2000). Hence, future research should explore whether relational loss may also involve supportive processes at the dyad level. Furthermore, outside of controlling for various measures of diversity, the current investigation did not examine elements of team composition that might have influenced functioning in larger teams. Future research should examine the possibility that certain types of personalities (e.g., extroverts may better handle relational demands) may work better in larger teams than others. In addition, the current study did not focus on leadership activities that may help or hinder functioning in larger teams; an area of exploration for future research.

The coordination scale used in this study focuses on role clarity and organization of individual efforts, an operationalization which should be interpreted with caution as the scale reliability was slightly low, yet also provides some theoretical clarity relative to other scales which either combine aspects of coordination and relational processes (e.g., Hoffer-Gittell, 2001) or measure coordination as the "frequency" of communication. For example, one study showed that larger top management teams experienced lower frequency of informal communication which contributed to fewer corporate sales (Smith et al., 1994). Because Smith et al. employed "frequency of communication" as their measure of team process; it is difficult to determine whether the lower frequency of communication denoted poor organization of member efforts or lower levels of perceived support availability in the team. Future research examining coordination losses due to team size should focus on aspects of team coordination that distinguish coordinating activities from relational processes. Future research should interpret the findings involving the variable daily aggregated relational loss with caution as this variable was a single item measure and therefore does not allow for the calculation of inter-item consistency.

It is important to note that the current study limited its focus to interdependent teams where coordination was a desirable and important process. The current study did not focus on other types of tasks (e.g., disjunctive, additive, conjunctive) which do not necessarily require large amounts of coordination between members. Future research should explore the extent to which groups engaged in different types of tasks might experience relational loss. Additionally, it was outside the scope of the current investigation to hypothesize about how different team processes might relate to performance differently over time. It is possible that coordination loss, relational loss, and extrinsic motivation loss, may relate differently to one another and performance during different developmental phases of a project. Future research should address this limitation by considering this possibility. In addition, while the field design of the current investigation lends greater external validity to the team size research, it cannot inform causal relationships between variables. Future research should explore the causal interplay between performance, relational loss, coordination loss as well as motivation loss in larger teams.

The current study explored individual performance in the context of interdependent cross-functional teams. Even though the broader team context included an interdependent task, individual performance was still meaningful in this context because cross-functional team members had relatively little skill overlap and thus were each responsible for a unique piece of an interrelated task. However, because the current study focused on individual level performance in larger team contexts, it cannot speak to process losses which may diminish synergistic increases in group performance – emergent group level performance beyond combined individual inputs. That said, some research suggests that true team level synergy does not always occur even though teams are interdependent (Tziner & Eden, 1985). For example, theory and evidence support a new type of "fuzzy compositional model" of performance in interdependent teams whereby performance of a single member or a small set of members can account for the bulk of variance in group level performance (Pirola-Merlo & Mann, 2004). Hence, Pirola-Merlo and Mann (2004), as well as Tziner and Eden (1985), suggest that even when teams are interdependent, individual performance may be a very important predictor of group capability.

Relational loss is defined as an individual's own perception that support is less available within the team; hence, the level of individual perceptual agreement within a team is not relevant to the substantive definition of relational loss. Furthermore, according to the appraisal theory of stress and coping, that fact that group support perceptions are shared should not play a critical role in a person's own appraisal process – the process which buffers stress and promotes performance. The current study supports this point with supplementary analyses showing no significant interaction between group support and relational loss predicting individual level performance. Hence, the current study treats the group level variance in relational loss – which account for the indirect effect of team size on individual performance – as another way of representing relational loss as an individual level process. This is consistent with Chan (1998) and others (Chen, Bliese, & Mathieu, 2005; Glick, 1985), who proposed that if within group agreement is not relevant to the definition of a process, then group level aggregates of an individual level process measure as well as the individual level measure itself (especially referent-shift measures like the one used in the current study) can have a consistent conceptual meaning. That is, between-level and within-level variance in relational loss each serve the same function as both concern different ways of representing individual level perceptions of support availability in the team. However, one limitation of the current study is that it did not examine group level performance; hence, it was outside the scope of the current investigation to explore whether relational losses would have the same relationship with individual and group performance. Future research should assess the extent to which a model of relational loss in larger teams is homologous.

The measures of relational loss used in the current study captured each employee's perception that support was available in the broader group, but did not ask employees about the amount of support they themselves received from the broader group. The stress buffering theory of social support proposes that the receipt of supportive help and the perception that help is available from one's broader network are distinct processes that each serve to buffer stress (House, 1981). As men are less likely to seek support (Good, 1989) the major determinant of whether people receive support (Bamberger, 2009), appraisal processes are more likely to be operating in the current sample which includes roughly 80% men. Yet, it is possible that the measures of perceived support availability within the team employed in the current study also reflect perceived support receipt as participants are nested within each group, and their assessment of the group is likely to be highly influenced by their own experiences which are more salient during memory recall (Bower, 1981; Bradburn, Rips, & Shevell, 1987). However, because the current study did not measure both forms of relational loss, the personal receipt of supportive help, and perceptions that support is available within the team, it is not possible to distinguish between these two different forms of relational loss operating in the current study. As both types of relational loss are likely to operate in larger teams, future research might assess the

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possibility that each reflects different but equally important aspects of relational loss, or that one form of relational loss may relate to individual performance more than the other.

Conclusions

This study identifies that, in modern contexts, coordination losses and motivation losses provide an incomplete story in explaining why individuals in larger teams perform worse. Instead, the current study shows that relational losses play an important role in explaining why individuals experience performance losses in larger teams. Better understanding of process in larger teams moves the field past an obsession with finding the "optimal team size," a line of questioning which has yielded little understanding about performance in larger groups. Indeed, the optimal team size may be completely dependent upon the exact nature of the group task which may have as many variations as there are teams (Levine & Moreland, 1998). Focusing on process also moves the field past blanket recommendations to simply keep group sizes small. The reality is that managers tend to bias their team size towards overstaffing (Cini, Moreland, & Levine, 1993), and theory would suggest that larger teams have more potential productivity that can lead organizations to increased competitive advantage if managed correctly (Eisenhardt & Schoonhoven, 1990; West & Anderson, 1996).

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