Intragroup Conflict Under the Microscope: Micro-Conflicts in Naturalistic Team Discussions

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Abstract

We argue for the value of examining micro-conflicts, brief moment-by-moment disagreements in conversations, and present a test of a coding scheme for this construct. Conceptualized and measured as such, micro-conflicts are brief rather than long-lasting behaviors, observational rather than self-report, and do not rely on participant retrospection. Using video data from naturalistic multidisciplinary teams, we examined type of micro-conflicts, micro-conflict resolution, affect, and the effect of team characteristics. Logistic regression revealed that negative affect was uncommon for micro-conflicts but still negatively related to micro-conflict resolution. Process micro-conflicts were more prevalent early in teams' life cycles and in groups that experienced more obstacles and frustrations. Future research using this micro-behavioral construct can link immediate cognitive and affective consequences and antecedents to these micro-disagreements. It is possible that micro-conflicts, as minute behaviors, may be less emotionally intense and more easily resolved and thus have different implications, predictors, and correlates than macro-, self-reported conflicts.

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The advantages and disadvantages of conflict are an inherent aspect of collaboration (De Dreu & Gelfand, 2008a). The conditions under which intragroup conflict is useful to team performance seem to be limited and contingent on other factors (De Dreu, 2006, 2008; De Dreu & Weingart, 2003; DeChurch & Marks, 2001; Jehn & Bendersky, 2003; Simons & Peterson, 2000; Tekleab, Quigley, & Tesluk, 2009). Theory and over two decades of research on minority opinion dissent have argued that task conflict, under certain circumstances, can be beneficial, particularly for innovation (e.g., De Dreu & West, 2001; Jehn, 1997; Jehn & Mannix, 2001; Nemeth, 1986; Pelled, Eisenhardt, & Xin, 1999; West, 2002), whereas relationship and process conflict should hurt performance (Jehn, 1997). In a meta-analysis, however, both task and relationship conflict were negatively related to team performance (De Dreu & Weingart, 2003). Despite a plethora of excellent research, there is an important characteristic of intrateam conflict that remains under-explored and might further illuminate when and why conflict is beneficial. This aspect is the level of granularity of the conflict. We propose it is important to draw a distinction between macro-behaviors/perceptions and fine-grained micro-behaviors.

In this article, we present a conceptualization and measurement of a particular type of manifest (expressed, observable) conflict that we term *micro-conflict*. The goal of this study is to argue for the importance of examining conflict and disagreements at this level and then to test an initial coding scheme of micro-conflicts. We propose a distinction between micro-, meso-, and macro-conflicts. The micro-, meso-, and macro-conflict distinctions here refer to granularity of time, rather than level of analysis based on the number of participants or organizations as others have done (e.g., Fox, 2004; Korsgaard, Jeong, Mahony, & Pitariu, 2008). Micro-conflicts are fleeting, minute-by-minute disagreements; meso-conflicts are more drawn out, taking place over hours or several times over the course of a day, such as those captured using daily diary methods (e.g., Kurtzberg & Mueller, 2005); and macro-conflicts are long-standing disagreements, lasting (and ebbing and flowing) over at least a couple of days. For example, imagine a software development and design team discussing their project: One designer suggests that the new database should have a certain kind of search function, and another designer disagrees. If the disagreement is brief—whether because it is resolved quickly or because it is simply dropped and not raised again—that would be a micro-conflict; if the individuals debate this topic during the whole meeting, but it is not raised after that meeting, that would be a meso-conflict; and if the design team comes back to the issue again and again over the course of weeks, that disagreement has become a macro-conflict. Conflicts are thus conceptualized as disagreements about specific topics during the ebb and flow of conversation.

To clarify this construct, we offer an analogy. The water from rain can take many forms. Very small amounts of water can be drops, larger amounts combine to form puddles, and even larger amounts of water can become part of lakes and rivers. Although one can measure rainwater using specific fluid measurements (e.g., gallons), in nature, water comes as drops, puddles, lakes, and so on. Each of these bodies of water is conceptually distinct, even given within-type variability in size, and smaller types can make up the larger types. This analogy is relevant to conflict in three ways.

First, micro-conflicts can pool into larger (meso- or macro-) conflicts, much as many drops make up a puddle. Only through observing the greater context can one know whether a micro-conflict is part of a larger conflict or stands alone. Second, *exact* measurement based on time (or fluid volume) is not necessary for either conceptual distinction, although measurement can be used to answer specific questions. Drops and micro-conflicts are smaller than puddles and meso-conflicts, respectively, but each have substantial variability in size and are still considered within a same type. For example, water drops from rain are not all the same size (Villemaux & Bossa, 2009). In both cases, although the distinction between types does not rely on specific sizes, measuring the exact amount may be useful for other purposes. Similarly, micro-conflicts may vary in time length, and length can then be a measurement of conflict intensity (e.g., Karn & Cowling, 2008). Third, both rainwater and conflicts have distinct boundaries. In the case of water, air or other nonwater molecules surround a raindrop; in the case of micro-conflicts, in the context of a conversation, the micro-conflict is surrounded by nondisagreement, nonargument speech.

Conceptualized as such, micro-conflicts are brief and immediate. They are therefore best measured via observation, rather than how conflict is currently often measured, via retrospective self-report. To a degree, one can only judge a micro-conflict in retrospect and by its greater context: when it begins, it is possible it will last longer, becoming a meso- or macro-conflict. Many instances or iterations of the same micro-conflict topic can, in aggregate, make up a meso- or macro-conflict. We contend that micro-conflicts are likely to be less emotionally intense, more likely to be simple disagreements, and less likely to be recalled by those engaged in them. As a fleeting type of behavior, we argue below that micro-conflicts are difficult to perceive and remember. As brief exchanges, micro-conflicts are also more likely to include simple topics when compared to conflicts that are repeated and developed again and again. Finally, we argue for the distinction between emotionality and type of conflict (as do Jehn & Bendersky, 2003). Using process data of real-world, multidisciplinary problem-solving teams in an organizational setting, we demonstrate a method of operationalizing micro-conflicts and examine the prevalence of negative and positive emotionality in micro-conflicts.

Micro-conflicts may have slightly different characteristics and performance implications from macro-conflicts, providing an additional theoretical and methodological tool with which to parse out more precisely when, how, and why conflict can be helpful versus detrimental to teams. Specifically, micro-conflict measurement has the potential to uncover *immediate* antecedents and consequences of small disagreements. For example, while background knowledge diversity has been linked to conflict (e.g., Pelled et al., 1999), this relationship is likely distal, being mediated and moderated by other factors such as gaps in shared mental models (e.g., Cronin & Weingart, 2007), which can then be measured in relation to micro-conflicts. One can examine whether a specific micro-conflict event is sparked by, or spurs, immediate cognitive events such as analogy use and other types of creativity (e.g., Chiu, 2008a; Paletz & Schunn, 2010; Paletz, Schunn, & Kim, 2010). A connection between cognitive and social variables, as an instance of a brief, situational cause of a social process, is likely best unpacked through behavioral observation rather than self-report (Ericsson & Simon, 1993; Nisbett & Wilson, 1977).

Just as emotion has been conceptualized both as moods that stretch over hours or days and as fleeting expressions and feelings (e.g., Ekman & Davidson, 1994), so too can conflict be conceptualized along a dimension of the length of the event. Although rarely done, conflict has been teased apart at different levels before: Jehn and Bendersky (2003) distinguish between the individual reactions and intragroup (group level) interactions related to conflict, and Korsgaard et al. (2008) theorize about antecedents and consequences of individual-, dyadic-, and team-level conflict. Examining level differences of time rather than number of individuals, this study takes inspiration from previous research that examines small-scale behavior such as communication exchanges, particularly reactions (see Bales, 1950; Karn & Cowling, 2008; Millar & Rogers, 1976; Rogers & Farace, 1975), the examination of linguistic cues as predictive of outcomes (e.g., Olekalns, Brett, & Donohue, 2010) and the negotiation literature (Weingart, Hyder, & Prietula, 1996). Marriage and family research has made great strides in understanding the role of micro-behaviors in short conflict events (e.g., Gottman & Levenson, 2000; Gottman & Notarius, 2000; Vuchinich, 1987).

What has not been done clearly, however, is distinguish, conceptually and methodologically, intrateam conflict based on the time frame within which the conflict occurs. We contend that a great deal of research has confounded the construct of conflict with specific types of measurement: most cross-sectional research that involves global, retrospective self-reports of conflict will only capture macro-conflicts. Interviews involving critical incidents of conflicts (e.g., Jehn, 1997) may highlight meso- or macro-conflicts, depending on the length of time of the incident. Rather than making an ecological fallacy (Rousseau, 1985), we contend conflict theory should incorporate all lengths of conflict. Specifically, we take an isomorphic model perspective: while the functions of conflict may be similar as either micro- or macro-behaviors, it is possible that the specific processes and structures may be different (Klein, Tosi, & Cannella, 1999). This difference may be one reason for the disparity in findings between research showing that explicit disagreement by a minority opinion holder can spark original and divergent thinking in others (e.g., Nemeth, 1986; Nemeth & Kwan, 1985; Nemeth & Wachtler, 1983) and the meta-analysis suggesting that conflict is detrimental to performance (De Dreu & Weingart, 2003). While other moderators between conflict and performance exist (e.g., task type), the discrepancy between these two major research paradigms could be due to dramatic differences in how conflict is both conceptualized and measured.

The Construct of Conflict

Conflict has been defined and operationalized from disagreement to aggression, from argument to bullying to riots (e.g., De Dreu & Gelfand, 2008b; Jehn & Bendersky, 2003). Beyond organizational psychology, political scientists have described conflict in terms of national and ethnic disputes, impasses, and violence (e.g., Hamelink, 2010; Lovaglia, Mannix, Samuelson, Sell, & Wilson, 2005). The definition of conflict for this study originates from Jehn and Bendersky's (2003) broad definition as "perceived incompatibilities or discrepant views among the parties involved" (p. 189). One caveat

is that we focus on expression rather than perception (as do Korsgaard et al., 2008). We argue below that micro-conflicts, as opposed to longer conflicts, need not be, and may not be able to be, perceived easily. We focus specifically on intragroup conflict within interacting work groups.

The diversity of ways in which conflict has been conceptualized, measured, and theorized could help explain some of the inconsistencies in the literature on conflict and performance outcomes (Barki & Hartwick, 2004; Jehn & Bendersky, 2003; Mannes, 2008). Barki and Hartwick's (2004) review of the organizational literature organizes this complexity, dividing conflict into three properties: disagreement, negative affect, and interfering and obstructionist behavior. These three properties parallel distinctions between cognition, emotion, and behavior. From their review, disagreement ''exists when parties think that a divergence of values, needs, interests, opinions, goals, or objectives exists'' (p. 232). Disagreement is most like Jehn's (1995, 1997) concept of task conflict or Amason's (1996) concept of cognitive conflict (Barki & Hartwick, 2004). Task conflict revolves around the work itself; relationship conflict focuses on interpersonal incompatibility; and process conflict involves delegation and scheduling (Jehn, 1997). Negative affect states, including ''fear, jealousy, anger, anxiety, and frustration,'' figure prominently in Barki and Hartwick (2004), p. 232) dimension of relationship conflict (e.g., Jehn, 1997), affective conflict (e.g., Amason, 1996), and emotional conflict. Interfering and opposing behaviors may include ''debate, argumentation, competition, political maneuvering, back-stabbing, aggression, hostility, and destruction'' (p. 232).

Many researchers have studied conflict as some combination of these three properties (e.g., Jehn, 1995, 1997; examining task and relationship conflict; Amason, 1996; examining affective and cognitive conflict). Although some may argue that conflict must entail all three dimensions, this claim ignores the variety of research that has focused on only on one or two of these dimensions, such as research on the effects of dissent on creativity (e.g., Nemeth, 1986; Schulz-Hardt, Mojzisch, & Vogelgesang, 2008). We maintain that researchers should be explicit about what they are examining, given that each dimension may have different correlates and levels of intensity. In our framework, micro-conflicts are behavioral and at a lower level than typically examined. They are also disagreements, which put them ostensibly into the cognition category. They are expressed via communication, as cognition is often measured via expressed communication (e.g., Alibali, Bassok, Solomon, Syc, & Goldin-Meadow, 1999; Chi, Feltovich, & Glaser, 1981).

The current project is informed by three critiques. First, we agree with Jehn and colleagues (e.g., Jehn, 1997; Jehn & Bendersky, 2003; Jehn, Greer, Levine, & Szulanski, 2008) that task conflict is not as emotionless as Barki and Hartwick (2004) imply, nor that relationship conflict is without cognition. Although task and relationship conflict are considered distinct concepts (Jehn & Bendersky, 2003), De Dreu and Weingart's (2003) meta-analysis suggests that they are positively correlated. Jehn and Bendersky (2003) contend that the task/relationship distinction is different from the intellectual/emotional dimension, such that both task and relationship conflict may vary on the degree to which negative affect is present. We measure conflict as disagreement and then *assess* the level of emotionality, thus teasing the two constructs apart. Because we

might expect micro-conflicts to be less saturated with negative affect than higher-level types of conflict, the degree to which micro-conflicts are affect-laden becomes an empirical question.

Second, retrospective *perception* of conflict is a common focal element of the definition of intragroup conflict (e.g., De Dreu & Gelfand, 2008a); this definitional choice has been questioned recently (e.g., Barki & Hartwick, 2004). The focus on perceptions of conflict, while an important topic in its own right, may not encompass all of the dimensions that conflict researchers want to study. As implicit or lay assumptions, perceptions may also confound dimensions that should be examined separately when possible, such as emotionality, norms regarding conflict management, and team success in conflict management (Mannes, 2008). Much of the literature showing the positive benefits of dissent, in fact, manipulated only expressed conflict (e.g., Nemeth, 1986). Discussion intensity, a manifest behavior, apparently mediates the effects of dissent (Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2006), suggesting that important aspects of conflict are expressed in behavior. In fact, task disagreement might not be *perceived* as conflict (Barki & Hartwick, 2004; see parallel argument by Gottman & Notarius, 2000). When asked to rate the level of conflict in a team, laypeople might downplay lively debates that were well managed and lack negative affect, but those discounted or forgotten conflicts may have been very productive. Thus, our examination of micro-conflicts focuses on manifest behavior.

Third, it is important to make a distinction between macro- and micro-behaviors. The same behavior as discussed by theorists can be displayed, perceived, and reacted to differently as it occurs briefly versus over a longer period of time. For example, members of a school board could debate the appropriate computer-to-student ratio for a high school. If the debate is brief, that implies the disagreement is less emotional and/or easily resolved; if it is long and is raised again and again over the course of days, weeks, or months, that implies the same topic of disagreement has more underlying differences in assumptions or values and is more contentious, emotional, and/or important to the individuals involved. Conflict should also be measured as a *dynamic process that occurs between individuals* (see Barki & Hartwick, 2004, p. 218), just as negotiation strategies have been examined (e.g., Weingart et al., 1996). Yet, quantitative, organizational studies examining intrateam conflict as it unfolds over time are still rare (exceptions being Goncalo, Polman, & Maslach, 2010; Greer, Jehn, & Mannix, 2008; Jehn & Mannix, 2001; Kurtzberg & Mueller, 2005; Peterson & Behfar, 2003; Tekleab et al., 2009; etc.). Rarer still are studies that examine conflict as a moment-by-moment process (e.g., Chiu, 2008a,b; Karn & Cowling, 2008). Such a fine-grained, temporal examination enables researchers to unpack conflict processes with greater precision.

Micro- versus Macro-Conflicts: Interactions between Theory and Methods

Although conflict may be a mix of behavior, affect, and cognition, how researchers measure conflict limits how it can be conceptualized. For instance, if one conceptualizes conflict as perceived but does not measure perceptions, a mismatch exists; similarly, if

conflict is conceived as behaviors but is only measured as perceptions, findings and correlates will be based, *de facto*, on a perceptual construct. Thus, conceptual and measurement issues are linked. The overlapping methodological and theoretical differences between macro- and micro-conflicts in part motivate this research.

This study finds inspiration from previous observational, behavioral studies of conflict and negotiation events (e.g., Bendersky & Hayes, 2010; Olekalns et al., 2010; Weingart et al., 1996), the examination of *brief* conflict events in marriage and family research (e.g., Gottman & Levenson, 2000; Gottman & Notarius, 2000; Vuchinich, 1987), and cognitive and emotion research that examines micro-behaviors (e.g., Ekman, 1993). Micro-conflicts, as we define them, exist at the instant of an expressed disagreement between two or more people[1] and are thus in line with research on dissent and disagreement. In the following sections, we detail the many ways in which micro-conflicts may differ from macro-conflicts as typically measured and conceptualized.

Granularity of Behaviors

Different granularities can have different predictors, antecedents, and consequences. Some conflict researchers have distinguished between short and long time frames of the consequences of conflict, using as examples job satisfaction (short term) and turnover (long term, e.g., De Dreu, 2008). While turnover is likely to be a consequence of long-term conflict, it is not likely to be associated with individual micro-conflicts. We contend that the previously listed short- and long-term conflict consequences are all macro-behaviors, just as mood is different from emotions as measured by facial expressions (e.g., Ekman, 1993). For example, a long-term sad mood is different from a micro-expression of sadness: The former might indicate lasting depression, perhaps spurred by a family death months ago, whereas the latter might indicate a hidden emotional truth about a person being discussed. Micro-conflicts can be simple corrections (e.g., ''Professor Fernandez is in Building 10,'' ''No, she is in Building 15'') as well as the vocalization of longer-lasting disagreements (e.g., ''I still think our database should have a spell check function,'' ''But I think we don't have the resources to do it,'' etc.). Corrections are a valid type of micro-conflict because they are disagreements over facts, information, and/or reality (Deutsch, 1973; as cited in Karn & Cowling, 2008); corrections often represent critical disconnects between team members because the listener finds them important enough to correct. The main distinction between meso-conflict and micro-conflicts is that meso-conflicts are specific events that may occur during a day's work, whereas micro-conflicts are more moment-by-moment. Micro-conflicts are not at the level of long-standing tensions between team members (macro-) or specific instances of breakdowns in coordinated decision making (meso; Bearman, Paletz, Orasanu, & Thomas, 2010). Instead, many micro-conflicts can make up a meso-conflict, and several meso-conflicts can make up a macro-conflict.

[1]Another kind of micro-conflict is discussions of conflict, where individuals discuss conflicts they have with others who are not present (e.g., Jehn & Bendersky, 2003). We have also developed a coding guide for those types as well.

From a theoretical standpoint, conceiving of conflict as only long term obscures the possible predictive power of micro-conflicts in the context of creative or problem-solving conversations. The study of longer-duration conflict behaviors does have utility, such as Jehn's (1997) groundbreaking interviews and observations of team conflict. The examination of behavior at the micro-level is different, but also important. What occurs at, before, or after the instant of conflict? If one is interested in examining the *immediate* cognitive and behavioral consequences and antecedents of conflict, it is necessary to examine individual, minute conflict behaviors. For example, if one is interested in whether conflict spurs or is sparked by brief cognitive processes such as analogy or flashes of insight, examining micro-conflicts is necessary (e.g., Chiu, 2008a; Paletz & Schunn, 2010). As with the dissent literature (Nemeth, 1986), but contrasted with the self-reported conflict research (De Dreu & Weingart, 2003), Chiu (2008a) found that speech turns with disagreements yielded greater micro-creativity than agreements. Rude disagreements resulted in less micro-creativity, but if an incorrect idea was raised, rude rather than polite disagreements raised teammate creativity. Similarly, Chiu (2008b) found that polite disagreements led to correct contributions in problem solving, but rude disagreements and agreements reduced the likelihood of a correct contribution. Global assessments of higher-level conflict are likely to involve a mix of different individual conversation conflict events, including ones that may have different or contradictory effects at lower levels.

Similarly, the examination of micro-behaviors in conversations has greatly illuminated romantic relationships. Gottman and Levenson (2000) were able to predict divorce based on micro-behaviors observed between newlyweds: Specific negative affect behaviors (defensiveness, contempt, wives' criticism, and husbands' stonewalling) during a conflict conversation predicted early divorce, and later divorce was predicted by a lack of positive affect behaviors (e.g., affection, humor, curiosity, and joy) in conversations about conflict and daily events. Without examining micro-behaviors, they would not have been able to discover which types of behaviors were predictive of divorce, even fourteen years later. Informed by the person-perception literature, examining micro-behaviors has also spurred fruitful research on the predictive value of thin slices of behavior (e.g., Ambady & Rosenthal, 1992; Curhan & Pentland, 2007; Mason, Sbarra, & Mehl, 2010).

Methodologically, rather than requiring participants to make global assessments, researchers can aggregate the specific behaviors that are of interest, if it makes theoretical sense to do so (Rousseau, 1985). Aggregation of specific behaviors was used in the relationship research. However, we are interested in examining micro-behaviors for their immediate consequences and antecedents, as well. The marriage research suggests that it is not simply the existence of conflict, but how people engage in conflict and its resolution—the nature of their micro-behaviors—that makes a difference in terms of healthy marriages. By analogy, the nature of micro-behaviors should also reflect and predict healthy team functioning.

Behavior in the World versus Self-reported Perceptions

The focus on conflict as solely perceived by the actor confounds the methods and theory of conflict, limiting its study. Observation and measurement of expressed conflict behavior

in work groups is relatively rare, albeit quite informative when it occurs (e.g., Jehn, 1997). *Quantitative* research involving observation of conflict is also rare (e.g., Olekalns et al., 2010). As noted previously, when they have been studied, the observation of micro-behaviors has yielded remarkable advances in other areas of interpersonal research, such as facial expression and emotion (e.g., Ekman, 1993), negotiation (e.g., Weingart et al., 1996), relational communication (e.g., Rogers & Farace, 1975), and romantic relationships (e.g., Gottman & Levenson, 2000; Gottman & Notarius, 2000). Examining conflict in this manner may similarly uncover a number of conceptual issues and phenomena that have been neglected.

Self-report is currently an extremely common method for studying intragroup conflict (see De Dreu & Weingart, 2003; for a range of studies). Self-report is essential for measuring perceptions (Spector, 1994) and may be the best way, both conceptually and logistically, to represent perceived conflict or asymmetry in conflict perceptions (e.g., Jehn, Rupert, & Nauta, 2006). Self-report makes sense for measuring global, perceived macro-conflicts, which are necessarily conflicts that have occurred over days. It is also potentially a sensible method for meso-conflicts, which, by virtue of also being relatively longer in time, will be more easily perceived and remembered by respondents. However, self-report does not capture fine-grained behaviors. Self-report surveys, particularly in the context of cross-sectional designs, may actually measure lay assumptions of organizational performance and behavior rather than actual behavior (Mannes, 2008; Staw, 1975). Staw's (1975) study suggested that knowledge of a group's performance directly affected ratings on group dynamics, including in cases where that knowledge was experimentally manipulated. Repeated self-report measures are also prey to changes over time as the participants' understanding of the questionnaire changes.

Self-report is also inappropriate for many topics. Topics that entail socially desirable reporting or obvious self-consistency or self-enhancement biases (e.g., attitudes toward drug use) are inappropriate. Even beyond conscious or unconscious biases in reporting, certain behaviors may simply be difficult for an actor to perceive. For example, one does not use self-report to assess brief positive and negative facial expressions (e.g., Ekman, 1993). Micro-conflicts lend themselves naturally to behavioral coding (Weingart, 1997), given that they are explicitly a type of expressed behavior. As Gottman and Notarius (2000) argued with regards to marital interactions, ''observational methods can add predictive power and theoretical clarity….in part, from the power of observational data to reveal a replicable portrait of complex social interaction that lies beyond the natural awareness of even the most keenly sensitive spouse or partner, and thus lies beyond assessment with self-report instruments'' (p. 927).

Behavior versus Perceptions in Retrospection and Memory

An additional issue is the role of memory. A problem with focusing a construct on perception and then measuring it via self-report is that self-report is necessarily dependent on how well an actor can *recall* the perception or behavior. Brief behaviors in particular can be forgotten, making them unsuitable for study using surveys, especially if the behaviors occurred further back in time (Ericsson & Simon, 1993). From a theoretical

standpoint, conflict may have different frequencies and different effects at various points of time in a team's life cycle (Jehn & Bendersky, 2003; Jehn & Mannix, 2001; Kratzer, Leenders, & van Engelen, 2006). Only a few studies have examined conflicts as they occur, removing memory biases: for example, Jehn and Mannix (2001) examined perceived conflict at regular intervals in MBA teams, uncovering a number of changes and predictors over time. Another exception is a study of meso-conflicts: Kurtzberg and Mueller (2005) conducted a multilevel longitudinal study of conflict and creativity, where daily perceptions of creativity were correlated with perceptions of conflict. They discovered that while task conflict alone did not predict same-day self-rated creativity, it did predict next-day self-rated creativity. This analysis and Jehn and Mannix's study could not have been conducted, nor their results discovered, in most studies of conflict and team performance that rely on single-point and retrospective data collection.

The micro-, meso-, and macro-conflict distinction is different from the effects of different kinds of conflict over the life of the team (e.g., Jehn & Bendersky, 2003; Jehn & Mannix, 2001) or during critical events or as rhythmic patterns (Ballard, Tschan, & Waller, 2008). Being able to assess whether a particular micro-conflict turns into a meso- or macro-conflict does require using data with a long temporal span, however. In the case of Kurtzberg and Mueller (2005), the combination of meso-level behavior collection and longitudinal design increased knowledge of group dynamics over time. Thus, measuring and conceptualizing behavior at different levels of granularity, particularly combined with a longitudinal design, enables researchers to examine the temporal aspect with greater clarity. Notably, it is important to take into account biases because of memory, whether via using observational methods or via daily diary methods.

Hypotheses Based on Macro-Conflict Theory

At this point, we present a new coding scheme for micro-conflicts that can be used in the situations described earlier. For instance, micro-conflicts can be associated with immediately preceding or subsequent cognitive events (e.g., Paletz & Schunn, 2010). We attempt to show the coding scheme's basic utility via (a) examining its descriptive qualities and (b) testing hypotheses grounded in macro-conflict theory (see Figure 1 for a

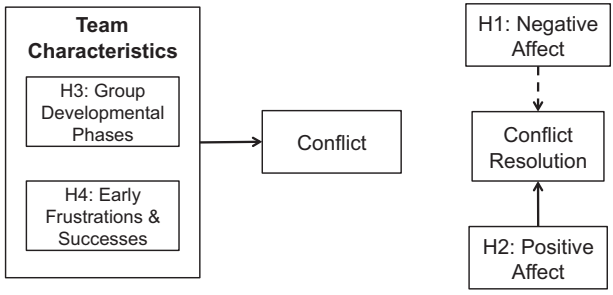

Figure 1. Broad theoretical model and hypotheses of team characteristics, conflict, affect, and conflict resolution.

broad, high-level model). By demonstrating the differences and similarities between micro-conflicts and other variables as argued by macro-conflict theory, we can both demonstrate that these are conflicts (and not some other type of construct) but also illuminate some key differences.

Descriptive Qualities of Micro-Conflicts

We first characterize the nature of typical micro-conflicts in one organizational setting. We categorize micro-conflicts by task, process, and relationship type (Jehn, 1995, 1997), as well as by negative and positive affect. We explicitly test the relationship between affect and these types of conflict at the micro-level, as well as the degree to which the length and complexity of the conflict are related to affect within micro-conflict events. We contend that micro-conflicts in general are likely to be low in emotional intensity, compared to past conceptualizations of macro-conflicts. Given the importance of conflict resolution at the macro-level, we also classify how micro-conflicts are resolved.

Affect and Conflict Resolution

Separating negative emotion from the cognitive aspects of conflict has helped explain why conflict under some circumstances may be relatively hurtful (Amason, 1996; Barki & Hartwick, 2004; Jehn & Bendersky, 2003). The presence of negative affect is considered an exacerbator of conflict, such that it makes the negative effects of conflict on team outcomes more prevalent and lessens the likelihood of its positive aspects (Jehn & Bendersky, 2003). Positive affect, on the other hand, is considered an ameliorator, lessening the negative effects of conflict and emphasizing the positive effects (Jehn & Bendersky, 2003). Positive affect is also an important predictor of marital outcomes (Gottman & Notarius, 2000).

Examining micro-conflicts provides an opportunity to test one reason why affect may have such effects. Barki and Hartwick (2004) suggest that pure disagreement situations are more likely to be easily resolved than situations with pure negative emotion. Similarly, Jehn and Bendersky (2003) note that negative affect such as anger can result in devaluing one's partner/adversary in a negotiation situation and lead negotiators to reject offers that are in their best interests. Thus, one possible reason for the exacerbating effects of conflict is that individual conflicts involving negative emotion are less likely to be resolved at the micro-level (see Figure 1). Jehn and Bendersky's (2003) contention is essentially a micro-argument: Moments of negativity can turn disagreements into more serious quarrels. We further suggest that conflicts with positive affect are more likely to be resolved.

H1: Micro-conflicts with negative affect are less likely to be resolved than neutral affect micro-conflicts.

H2: Micro-conflicts with positive affect are more likely to be resolved than neutral affect micro-conflicts.

Team/Context Characteristics: Group Development

Theorists have argued that the context, such as the history of the team together and the current situational complexity, can affect the prevalence of certain kinds of conflict. We explore whether such contextual effects are also revealed at the micro-level. At the macro-level, a variety of team characteristics lead to different kinds of conflict (Jehn & Bendersky, 2003). A well-known theory of group development with clear connections to conflict is Tuckman's five stages of group development: forming, storming, norming, performing, and adjourning (Tuckman, 1965; Tuckman & Jensen, 1977). This theory suggests a relatively early period of conflict, which is then resolved, followed by a period of less conflict (see Figure 1). This model was further refined and criticized. Morgan, Salas, and Glickman (1994) proposed an integrative model that takes into account the possibility of re-norming (punctuated equilibrium, Gersick, 1988), different teams developing in different ways, and that teams go through stages that are indistinct and overlapping rather than distinct. The Morgan et al. (1994) model also includes a relatively early phase of sorting out the norms and processes for the team, as well as the possibility that these processes will be revisited later. They did not, however, test their model in terms of the ebb and flow of conflict.

In a longitudinal study, Jehn and Mannix (2001) examined conflict over time for high- and lower-performing groups, arguing that high-performing teams would engage in more process conflict early in their life cycles and then increase as the project comes to a close and requires additional work. They found, however, that in high-performing teams, *self-reported* process conflict increased over time to peak at the end of the project; in low-performing teams, self-reported process conflict started moderate, lowered, and then was high at the end.

We propose that micro-conflicts over time will be in line with the Morgan et al. (1994) model and Tuckman's (1965) theory. We contend that micro-behaviors will match these theories to a greater degree than global self-reports for the methodological reasons noted earlier, including memory and salience of specific events and lay understandings of conflict and performance. In addition, taking the same survey multiple times may result in the development of different understandings of the concepts portrayed in the survey, as the team also develops. Actual behavior, we hypothesize, is likely to follow the model of storming/norming, followed by performing, followed by revisiting norms when it is necessary—be that at the end of a project or during midpoints that remind participants of the flaws in their current processes.

H3: Conversations later in a group's life cycle will have a lower prevalence of process micro-conflicts than in earlier days.

Team/Context Characteristics: Early Obstacles versus Early Success

Examining micro-conflicts over time can also be used to study the relationship between conflict and team success and frustration. Jehn and Mannix (2001) found that in general, all types of conflict were lower in high-performing groups compared to low-performing groups. Similarly, the literature on cohesion would suggest that early team performance success is positively related to later cohesion (Mullen & Copper, 1994).

Peterson and Behfar (2003) examined the dynamic relationship between performance feedback and conflict. Drawing on theories of negative performance-efficacy spirals and the threat rigidity hypothesis, they argued that negative performance feedback could actually cause conflict. In fact, they found that relationship and task conflict at time 2 were predicted by both poor performance at time 1 and conflict at time 1 (relationship conflict by relationship conflict, and task conflict by both relationship and task conflict). Furthermore, the relationship between task conflict at time 1 and relationship conflict at time 2 was moderated by intragroup trust—a finding in line with prior research suggesting that intragroup trust buffers against task conflict turning into relationship conflict (Simons & Peterson, 2000). Early successes should, then, have a similar effect to experiencing early high performance. Peterson and Behfar's (2003) study would suggest that early frustrations would lead to more conflict. Frustrations and successes may also occur concurrently with specific conflict behaviors, as conflict with others feeds frustrations, and successes lull individuals to thinking their work processes and tasks need not be questioned (as implied by Nemeth, 1986; Goncalo et al., 2010).

H4: Teams with early successes will have less task (H4a) and process (H4b) micro-conflict than teams with early frustrations.[2]

The Research Context: The MER Science Mission

The field setting for this project is the multidisciplinary Mars Exploration Rover (MER) science team (Squyres, 2005). The MER mission's goal was to discover whether there was evidence for a history of surface liquid water on Mars. To meet this goal, the mission involved landing two identical rovers on opposite sides of Mars and driving, photographing, and digging. In the first 90 Martian days of the mission (or sols),[3] the overall team discovered incontrovertible evidence for a history of water. This significant discovery was accomplished by a steady stream of modest but innovative ideas ranging from how to handle unexpected process and technical problems to interpreting complex, ambiguous information.

Day one represented when each rover landed on Mars. Prior to the first 90 Martian days (sols), the larger team had already been assembled and worked together on many tasks, but the early part of the first 90 sols represented a huge shift to an activity type that was new for most team members. The early part of these 90 sols was chaotic, as the scientists grew accustomed to working on a Martian time schedule, problem-solved in an intense, real-time, and colocated manner, and unexpected technical and logistical situations arose (Squyres, 2005). During those first 90 sols, data were downloaded daily from the rovers and daily plans were uploaded. The scientists were colocated at the Jet Propulsion Laboratory, spending most of their shifts in a large room with workstations and projectors for each disciplinary and multidisciplinary subteam. Communication was primarily conducted via face-to-face formal (structured) and informal meetings within and between subteams. Each working shift involved analyzing and interpreting the

[2]Relationship conflict ended up being too rare as micro-behaviors in this sample to test (see Table 2).

[3]Martian days are roughly 40 min longer than Earth days.

recent data and making short- and longer-term plans for the rovers. Thus, data analysis and plans occurred in an iterative real-time problem-solving manner.

The overall, multidisciplinary MER team was widely considered extremely high functioning, both from a technical and an interpersonal perspective. Thus, the overall team could be considered to have had high intragroup trust and to be extremely capable. However, the situation was fraught with stressors. Disciplinary differences were great, involving differences in disciplinary language and norms. The work of real-time Martian data analysis was fast-paced, novel for most participants, and intrinsically involved competition for scarce resources (i.e., rover time and energy). The mission had overwhelmingly high stakes: it was extremely expensive, involved years of preparation and work, and unforeseen technological glitches could easily end the mission (and careers). Furthermore, sleep patterns were disrupted because of complex shift schedules (Mishkin, Limonadi, Laubach, & Bass, 2006).

The greater 100+ person science team was broken into two large, minimally overlapping groups that followed each rover: MER A followed Spirit, and MER B followed Opportunity. The two rovers were on opposite sides of Mars, and the scientists' schedules matched them, so one group was working while the other slept. These teams knew of each other's work and occasionally swapped scientists and lessons learned, but day-by-day, they were generally separate. Each rover science team was further made up of disciplinary science and engineering subteams. Because of circumstances outside of the participants' control, MER A and MER B had very different early experiences. The Spirit Rover arrived on Mars first; it had some early technical problems, and scientists discovered evidence for water later in the first 90 Martian days of the mission. The Opportunity Rover, which landed three weeks later, discovered evidence for water relatively earlier simply owing to where it landed. By learning from Spirit's experience, Opportunity engineers were able to implement software changes before their rover suffered the same technical problems. Differences between MER A and MER B enable us to test differences in intragroup conflict associated with early frustrations (MER A) versus early success (MER B).

Methods

Data Collection Procedure

Five researchers collectively made 20 trips to visit the MER science operations. These trips involved a counterbalanced sampling design. Each researcher made one early and one late trip on each of the two rovers. Video cameras were set up on top of large shared screens and were left running during the scientists' shifts. These screens were located near different subgroups' workstation clusters and were used by the scientists themselves. The scientists quickly became habituated to the cameras, at times discussing personal information. A research trip consisted of 3 days at roughly 8 hr/day, resulting in almost 500 hr of video recorded from the mission, total. Roughly, half of the sampled conversations were chosen based on visual clarity for a separate study regarding gestures (Schunn, 2010); these conversations were mainly from the second half of the first 90 Martian days when the video quality was better. The other half of the data were chosen

by screening from the earliest parts of the mission and choosing conversations that were both on-topic and had sufficient audio quality to transcribe.

This study examines informal, task-relevant conversations during the first 90 Martian days of the MER mission. Structured, formal meetings were excluded because they involved a highly formal round-robin presentation style, they were composed of scores of individuals, and true group discussion was rare. Task-relevant talk included anything regarding the mission (e.g., anything from the rovers to issues regarding onsite parking). Off-topic talk was relatively rare: although not coded for conflict, these deliberately excluded conversations included, for example, discussions about iPods, family vacations and children, and detailed, confidential discussions of medical conditions, rather than personal arguments. Informed consent was obtained from the MER science team for videotaping and observation of their work process. We obscure key details in this article to keep individuals anonymous.

Participants, Clips, Blocks, and Events

The overall MER science team, including both MER A and B, had over 100 members during the first 90 Martian days of the mission, almost all of whom appeared at some point in the large video dataset. Although there are essentially two major subteams (A and B), we analyzed data at the level of the conversation, which occurred between 2 to 10 individuals. These informal meetings within a larger workgroup fall into the definition of the group: They include two or more members, are interdependent because of the nature of their work, are embedded in a social system, and affect others via their tasks (cf. Guzzo & Dickson, 1996).

We selected 11 hr and 25 min of informal conversation based on the audibleness of conversations and also when conversations naturally began and stopped. These stopping/starting points divided the video into a series of clips. The audio–video clips were then transcribed into 12,336 utterances (thought statements or clauses; Chi, 1997). To exclude irrelevant conversations, we coded whether each utterance was on-topic talk or not, broadly speaking (Cohen's kappa = .96).[4] We included MER-related process and relationship conversations, but not those truly unrelated (e.g., the medical conversations). The analyses were conducted on the remaining 11,856 utterances or roughly 11 hr. These 114 clips were from 8 to 760 utterances long (M = 104, *Median* = 67, SD = 122). Clips ranged from two to 10 participants. In terms of gender composition, 74% of those clips had only males present, and 26% were a mix of males and females.

Although conflicts were coded by each utterance, conflict utterances were clustered into conflict events based on topic. Analyses were conducted using either conflict events—as in the case of H1 and H2, where the dependent variable was whether the conflict event was resolved immediately or not—or a block structure. In testing Hypoth-

[4]Kappas from 0.40 to 0.59 are considered moderate, 0.60 to 0.79 substantial, and 0.80 and above outstanding (Landis & Koch, 1977). In addition, in some cases, when rating categories are used relatively frequently or infrequently, intercoder reliability may be lowered (Smith, 2000), such as in the case of journal submissions, where the data are skewed toward rejection categories (Whitehurst, 1984).

eses 3 and 4 (team characteristics), it was necessary to use segmented, roughly minute-long blocks rather than events as the level of analysis. Different clips came from either MER A or MER B, were early or late within each, and were different lengths, such that conversations changed topic during clips and there were potentially unequal amounts of time. Even more importantly, when testing for whether an event occurs more often during a certain context, it is important to examine not only the number of events during the different contexts but the nonevents during those contexts (i.e., conflict events and nonconflict events during different rover team informal meetings).

We created the blocks by first taking the conflict events and making them into blocks, and then selecting the 25 utterances before and after the conflict events as new blocks, continuing the pattern to make blocks occurring away from conflicts also 25 utterances long, as possible. Twenty-five utterances were chosen because this was roughly a minute in length, but standardized for the number of thought statements occurring (excited individuals may utter more thought statements in the same amount of time). At times, the nonconflict blocks were shorter than 25 utterances because of their proximity to the beginning/end of the clip and to conflict events. Conflict blocks themselves could be shorter or longer than 25 utterances, as conflict events ranged from 1 to 41 utterances long and conflict events could be nested inside each other. In total, there were 688 blocks ($M = 17.2$ utterances, $Median = 24$ utterances, $SD = 9.3$ utterances) within the 114 clips. Although the blocks were nested within clips, controlling for clip-level variance ended up not being necessary (see Analyses).

Participants were embedded in both analyses. Unlike in most laboratory experiments, because the conversations could include any combination of the over 100 MER scientists, conversations did not nest cleanly into stable small teams. Furthermore, given the anonymous nature of the study, the video quality, the fluid nature of the conversations (speakers could come and go during blocks), and the tendency for speakers to occasionally stand offscreen or not face the camera, it was often not possible to tell what combinations of specific individuals were present.

Measures

Two independent coders from a pool of five coders assessed *all* the utterances and/or micro-conflict events for the coded variables (see Table 1 for inter-coder reliability). Discrepancies were discussed until consensus was reached. At least one coder was blind to the hypotheses of this study.

Micro-Conflict

Coders identified conflicts at the utterance (thought statement) level (see Appendix). Micro-conflicts, grouped according to topic, often occurred across several utterances to make up a micro-conflict event. Because we wished to measure micro-conflict presence separately from its emotionality, conflict was coded simply as presence or absence for each utterance (see Appendix). Conflict was identified not only because the speaker took a (questionably) controversial viewpoint, but because the speaker was disagreeing with something said previously in the video clip. For example, in one micro-conflict, a speaker noted

Table 1
Coding Categories and Inter-Coder Reliability

Coding Category	Inter-Coder Reliability*
Coding by Utterance	
Identification of conflict	.62
Type of conflict	.48
Coding by Conflict Event	
Conflict resolved or not	.72
Type of conflict resolution	.23 (but direct agreement 91%)†
Type of conflict nonresolution	.69
Presence of positive affect	.69
Intensity of positive emotionality (0–5)	.79
Presence of negative affect	.71
Intensity of negative emotionality (0–5)	.81
Complexity/what sparked the conflict event	.71

*Reliability is determined via Cohen's kappa for categories and intraclass correlation for continuous codes (i.e., the affect intensity variables).
†Here, low reliability was because of a skewed distribution of category frequency. Thirty of the 33 resolved conflicts were considered by both coders as one partying agreeing with the other.

Table 2
Frequencies of Types of Conflict by Block and Event

	Total		Types of Conflict		
Micro-Conflicts	Conflict (%)	Science (%)	Rover Planning (%)	Process (%)	Relationship (%)
Micro-conflicts in blocks (N = 688)	17	4	7	7	0.4
Micro-conflict events* (N = 121)	100	21	38	39	3

*Percentages do not sum to 100% because of rounding.

that the scientists would not have time to do all of the instrument readings that they might like; another speaker directly disagreed, saying "There's a time for everything now," and then elaborated on his point (see Table A2 in the Appendix). Supporting arguments of disagreements were also counted as conflict. Just as with Vuchinich's (1987) naturalistic study of family verbal conflicts over dinner, we were conservative, such that "statements that were not clearly conflictual were not coded as conflict" (p. 584). If an individual asked a genuine question where the answer was "no," we did not count it as a conflict (see Tables A1 and A2, Example 6). Although conflict was initially identified from the written transcripts of the conversations, the coders referred to the audio–video recordings both when unsure of what to code and when discussing differences between coders' judgments. There, they were told to attend to voice, body language, and (as possible) facial expression.[5]

[5]Later iterations of this scheme involved coding the transcript while playing the video in order to capture these subtleties.

Coders also assessed on the utterance level whether conflicts were *task* (*science* and *rover planning*), (work) *process*, or *relationship* (see Appendix; Jehn, 1995, 1997).[6] In this context, the two main tasks for the science team were rover planning and scientific data analysis. In the MER context, science conflict included arguments over interpretations of data and images and about the nature of the rocks under analysis. In contrast, rover planning focused on what the rovers should be doing, how and when to deploy rover instruments, and what images to choose for scientific articles. These were both considered task conflict types because rover planning was one of the main mission tasks and the focus was on planning *science*. Work process conflict, by contrast, focused on prioritization, scheduling, communication, and the coordination of *people*, such as ''who is responsible for writing up the final report and who will make the presentation'' (Jehn & Bendersky, 2003, p. 201). Relationship conflict involved personal relationships, dislike of people, and personal attacks (Jehn, 1997).

Conflict Event Variables: Micro-Resolution

Conflict utterances were clustered into micro-conflict events according to topic ($N = 121$, $M = 4.7$ utterances long, *Median* = 3, $SD = 4.9$, ranged 1–41 utterances). Each conflict event was also coded for whether it was clearly resolved in the short run or not. Immediate (micro-) conflict resolution in this context was operationalized as what occurred in the 25 utterances after the conflict ended. This number was chosen because it was on average, a minute of conversation, the size of a block, and would thus match micro-conflicts with micro-resolutions. More long-term resolution of these conflicts was not consistently codable because we did not have a complete record of all the MER mission conversations; in addition, the resolution could have occurred weeks or even years later. Those resolved immediately were also assessed as to how they were resolved, and those not resolved were also assessed as to how not.

Conflict Event Variables: Expressed Emotionality and What Sparked the Conflict

We had two measures of conflict intensity: the number of utterances of the micro-conflict event (length, as done by Karn & Cowling, 2008) and the positive and negative emotional intensity of the event. Each conflict event was assessed for the expressed emotionality of the speakers by listening and watching the audio–videotape. Although the video was not clear enough for coding specific facial expressions and muscle changes, coders were encouraged to attend to the participants' body language, gross facial expressions, gestures, vocal tones, and the words they used to identify expressed positive and negative emotionality and their intensity. Negativity (for H1) and positivity (for H2) were assessed separately so as to identify positive/negative blends (e.g., sad laughter, affectionate sarcasm), and so we could capture possible emotional complexity

[6]More recent pilot work exploring this coding scheme with a different video participant sample and different coders asked coders to judge whether the conflict was task, process, and/or relationship conflict as three separate codes, with dominant type as a fourth code. Reliability was far higher with this method (0.60–1.0, with ''dominant type'' as 0.82) because even single utterances of conflict can involve combinations of conflict types.

(Spencer-Rodgers, Peng, & Wang, 2010). First, coders assessed the conflict events for the presence of positive and negative emotionality. Coders were told that positive emotionality could include happiness, affection, pleasant surprise, smiling, and laughter (humor). Negative emotionality could include irritation, anger, fear, disgust, sadness, fearful or angry surprise, contempt, regret, or negative sarcasm. The emotions detected followed the literature on positive and negative affect but did not include low-intensity emotions such as contentment (Watson, Clark, & Tellegen, 1988). Low-intensity emotions, such as serenity and calmness, are difficult to code from observation and to distinguish from neutrality, both in practice and conceptually. Then, following Barki and Hartwick's (2004) call for measuring magnitude, coders assessed the intensity of the expressed emotionality, both positivity and negativity, on a 0 (none, for those where the type of emotionality was coded as absent) to five (highest intensity) Likert scale. Although coders were encouraged to use the whole scale, the general professional demeanor of the scientists meant that high scores were very rare (see Table A2 for examples).

The conflicts varied in terms of what sparked them. To control for conflict complexity at the micro-event level, coders assessed what started the conflict: Was it a simple correction or something else? For example, some conflicts were simple, brief corrections about the distance a rover had traveled, whereas others were more complex and nuanced.

Team/Context Structure

We examined the effects of early/late in the first 90 sols of the mission on process conflict (H3). During the first half of the 90 days, we expected storming and norming activities to be prevalent as the group negotiated and solidified their work processes. As time went on, the team grew more expert, demonstrating great leaps in process efficacy (Tollinger, Schunn, & Vera, 2006). We also examined the two major subteams for differences in task and process conflict (H4a, H4b): Because MER A suffered early problems and frustrations, and MER B experienced early successes, we expected that MER B would endure fewer conflicts. Testing for these two structural variables was also important for determining generalizability of our findings, and so they were included in other analyses as well. At the clip level, 44% of the clips were from MER A and 56% from MER B; 65% were from before Martian day 50 of the mission versus 35% from sols 50–90.

Analyses

The data presented here were inherently multilevel, as blocks or events occurred within video clips. Using the program Hierarchical Linear Modeling 6 (HLM 6; Raudenbusch & Bryk, 2002), we were able to ascertain whether there was significant clip-level variance—in other words, whether the video clips contained significant Level 2 variance and nonindependence within clips. We tested the intercept's random effects using the base HLM model of the dependent variables for both blocks and events. Since the level-2 variance component was not significant (i.e., no violation of independence of blocks or events—no nesting effect), simple logistic regressions were performed to test our hypotheses. Because micro-conflicts are inherently interactions, our analyses embedded participants and group conversants within time blocks or events.

Our analyses of micro-conflicts were broken into two types: either at the event level, which while brief, occurred across utterances, or at the level of blocks nested within clips. For block-level analyses, each block was assessed as to whether a micro-conflict was present. Most variables were dichotomized (e.g., Did a block contain process conflict or not? Was the conflict event resolved or not?), requiring logistic analyses. First, we present the descriptive statistics of the micro-conflicts, both at the block and the event level: What kinds of conflict were most common in this multidisciplinary team setting, and how are the length and complexity of conflicts related to affect? At the event level, because of the categorical or non-normal nature of many of the variables, we used Spearman rho correlations and chi-square tests, as appropriate. Second, we examined at the event level variables predictive of immediate conflict resolution using logistic regression: How did negative (H1) and positive (H2) affect influence micro-conflict event resolution? Third, we tested for the effects of time during the mission (H3), and rover group on conflict (H4a, H4b) on the presence of micro-conflicts using logistic regression. For all logistic regression analyses, the assumption of no multicollinearity was met.

We initially tested for a number of possible covariates. For the conflict resolution analyses (H1, H2), we tested for the possible effects of the number of individuals arguing in the conflict, number of utterances per event, rover team, early versus late in the mission, and whether the conflict was sparked by a correction or something more complex. Only the last was significant, $B = 2.72$, $SE = .68$, Wald χ^2 (1) = 16.05, exp(B) = 15.13 (4.00, 57.16), $p < .001$, making this covariate logistic regression model significant, χ^2 (5, $N = 121$) = 28.28, $p < .001$, Negelkerke $R^2 = .28$. The Hosmer-Lemeshow test was not significant, indicating a model with good fit, χ^2 (8) = 4.81, $p = .78$. So, this covariate was included for testing the effects of affect on conflict resolution in our final logistic model. For the block-level analyses, where the presence of process or task micro-conflicts was the dependent variable, we tested the number of people present by block (as mode as appropriate, given the fluid teams, and as two vector variables) and gender composition. None of these potential covariates were significant for process or science (task) conflict. However, one of the group size vectors was significantly associated with rover planning conflict. In that case, the covariate model was significant, χ^2 (3, $N = 486$) = 8.10, $p = .04$, Negelkerke $R^2 = .05$, with Hosmer-Lemeshow nonsignificant, indicating a model with good fit, χ^2 (4) = 2.23, $p = .69$. Conversations of four or more people compared to those with two were about 280% more likely to have planning conflict, $B = 1.33$, $SE = .60$, Wald χ^2 (1) = .88, exp(B) = 3.80 (1.16, 12.39), $p = .027$. This covariate was thus included in the eventual hypothesis-testing logistic regression model.

Results

What Kinds of Conflict are Most Common in Informal Team Conversations?

Micro-conflicts occurred in many blocks, and micro-conflicts of different types sometimes appeared in the same block. Approximately 17% of the blocks had at least

one micro-conflict in them, resulting from 121 micro-conflict events (see Table 2). Relationship conflict was extremely rare in this sample, likely due to how we chose video clips, and should not be taken as representative of relationship conflict generally. Task and process micro-conflicts occurred more frequently in the blocks, and most of the micro-conflict events were task planning or process conflicts.

Affect in Micro-Conflict Events

Do micro-conflicts typically involve positive or negative affect, and if not, what factors are associated with whether a micro-conflict has affect? In contrast with macro-conflict theory (e.g., Barki & Hartwick, 2004), as well as with the potential for negative affect in such a complex, difficult mission, there was an overall absence of affectivity in the conflicts, indicating that the micro-conflict events can often be neutral and without high emotionality. Only 16% of the conflict events had positive emotion at all (intensity $M = 0.24$, $SD = .61$, range from 0 to 3), and only 24% had negative affect (intensity $M = 0.49$, $SD = .99$, range from 0 to 4). Keeping in mind that the coders were encouraged to use the entire scale (0–5), even when affect was noticeably present, it was usually in low levels. Positive and negative affectivity were not significantly correlated with each other (either as presence/absence, $r_s = -.08$, $p = .37$, $n = 121$; or including levels of intensity; $r_s = -.08$, $p = .36$, $n = 121$).

At the event level, the longer the micro-conflict event, the more negative affect it was likely to have, although the magnitude of the relationship was small (micro-conflict number of utterances and either negative affect strength or presence, $r_s = .22$, $p = .02$, $n = 121$). This finding is of note because simple length of micro-conflict event was not a significant covariate for whether the event was resolved. Positive affect was not related to the length of the conflict (positive affect presence, $r_s = .05$, $p = .62$, $n = 121$; positive affect strength, $r_s = .03$, $p = .71$, $n = 121$). Recall that conflict length was an operationalization of conflict intensity, suggesting that conflict intensity and negative affect had a small but significant correlation, whereas conflict intensity was not related to positive affect. Whether the conflict was complex or a simple correction was not significantly correlated with its level of either negative or positive affect (negative affect strength, $r_s = -.09$, $p = .31$, $n = 121$; positive affect strength, $r_s = -.05$, $p = .57$, $n = 121$).

We also examined whether the different types of conflicts were equal in negativity/positivity. We conducted this analysis in part to establish the generality of the low emotionality pattern in this micro-conflict and in part to assess whether connections between affect and other variables might be explained by confounds with type of conflict. Note that there were only three relationship micro-conflict events in the sample: all three, less surprisingly, contained no positive affect, but all contained negative affect (negative intensity $M = 3.67$, $SD = .29$). Because there were so few observations with relationship conflict (likely due to our sampling of the video), analyses both with and without relationship conflict are presented. There was no significant relationship between the type of micro-conflict and whether it entailed positive affect, regardless of whether relationship conflict was included in the analysis or not, χ^2 (3, $N = 121$) = 0.68, $p = .88$, Cramer's $V = .08$; without relationship conflict, χ^2 (2, $N = 118$) = 0.11, $p = .95$, Cramer's $V = .03$. Sixteen percent of science conflicts, 17% of

rover planning conflicts, 15% of process conflicts, and 0% of relationship conflicts had positive affect.

Turning to negative affect, when relationship conflict was included in the analysis, it was more likely to have negative affect (100%) than the other three types (all below 26%), χ^2 (3, N = 121) = 11.55, p = .009, Cramer's V = .31. However, without relationship conflict, there was no significant difference in the presence of negative affect between science conflict (12% had negative affect), rover planning conflict (24%), and work process conflict (26%), χ^2 (2, N = 118) = 1.89, p = .39, Cramer's V = .13.

In summary, affect of either kind was relatively rare in the micro-conflicts. In terms of type of conflict, task and process micro-conflicts shared similar, low frequencies of negative and positive affect. Longer micro-conflicts were more likely to be negative but no more likely to be positive. Removing the infrequent relationship micro-conflicts, there was no association between affect and type of conflict, nor between any affect and the complexity of the micro-conflict.

Conflict Event Resolutions and Causes

How are micro-conflicts resolved in the immediate term, and are micro-conflicts typically trivial (sparked by corrections, easily resolved) or more complex? Approximately half (49%) of the micro-conflicts were resolved within 25 utterances, obtaining a "micro-resolution." Of those conflicts that were *not* resolved, 3% were interrupted, 14.5% involved a topic change to a nonargument topic, 18% changed to a different micro-conflict, 10% were punted (stopped arguing deliberately), and 55% were dropped such that the topic did not change, but explicit disagreement did not continue. Of those conflicts that *were* resolved, the overwhelming majority (97%) did so because one of the parties engaged in the conflict agreed (or changed his/her mind to agree) with another. For example, one scientist argued with another that a certain set of rover instrument readings was possible, but only if done in a particular order. At first, the second scientist disagreed the set was possible, but then came to understand the first's point and agreed. Only 3% were resolved because of multiple parties compromising and changing their initial standpoints. The simple categorization of what sparked the conflict, not surprisingly, was dominated by the more complex type (79%), while 21% were sparked by a simple correction. In other words, only a minority of these micro-conflicts was of the very trivial correction type, even though micro-conflicts are quite brief.

Taken as a whole, these results suggest the form of micro-conflicts in a professional, science setting. Compared to other ways of conceptualizing conflict, micro-conflict immediate resolutions are different from longer conflict resolutions of macro-conflicts. About half of the micro-conflicts were resolved fairly quickly, mostly because one party accepted the other's perspective; those that were not resolved had a greater variety of nonresolutions.

H1 and H2: What Predicts Immediate Conflict Resolutions?

We hypothesized that micro-conflict resolutions would be more likely with positive affect (H2) and less likely with negative affect (H1). A standard logistic regression was

Table 3
Predictors of Micro-Conflict Event Resolution

Predictors	*B*	*SE*	Wald χ^{2*}	exp(*B*) (95% confidence interval)	*p*
Covariates					
Other conflict type vs. correction	2.55	.66	14.84	12.82 (3.50, 46.93)	<.001
Hypotheses					
Negative affect presence (H1)	−1.12	.52	4.65	0.33 (0.12, 0.90)	.03
Positive affect presence (H2)	0.54	.55	0.98	1.71 (0.59, 4.98)	.32

*All degrees of freedom for the Wald $\chi^2 = 1$.

performed at the micro-conflict event level on conflict resolution (49% were resolved). In addition to testing the effects of negative affect and positive affect, as noted earlier, we controlled for what sparked the conflict (simple correction versus something more complex).

There was a significant prediction of whether a conflict was resolved or not by the model of the three independent variables noted earlier, χ^2 (3, $N = 121$) = 29.60, $p < .001$, Negelkerke $R^2 = .29$ (see Table 3). The Hosmer–Lemeshow test was not significant, indicating a model with adequate fit, χ^2 (4) = 6.58, $p = .16$. The presence of positive affect was not significantly related to immediate resolutions, offering no support for H2. However, the presence of negative affectivity negatively impacted the probability that a conflict would be resolved (H1): Those conflicts with negative affectivity were about 33% as likely to be resolved as those without negative affectivity. In addition, simple corrections were almost 13 times more likely to be resolved compared to more complex micro-conflicts.

In sum, the findings provided support for the hypothesis that micro-conflicts with negative affect were less likely to be resolved (H1), but did not provide support that micro-conflicts with positive affect were more likely to be resolved (H2). In addition, simple corrections were far more likely to be resolved immediately than more complex conflicts.

H3, H4a, and H4b: Effects of Team/Context Structure on Conflict

We hypothesized that process conflicts would be more prevalent early in the mission (H3) and that both task and process conflicts would be more common in a team with early frustrations (H4a, H4b). The presence of process conflict was significantly predicted by early/late and rover team, although the magnitude of the effect was small, χ^2 (2, $N = 688$) = 16.36, $p < .001$, Negelkerke $R^2 = .06$ (see Table 4). The Hosmer–Lemeshow test was not significant, indicating a model with adequate fit, χ^2 (2) = 3.39, $p = .18$. Compared to earlier in the mission, only about 28% of the amount of process conflict appeared in conversations later in the mission, confirming Hypothesis 3. Similarly, MER B, which experienced early successes and fewer technical and scientific obstacles, had only about 37% as much process conflict as MER A, supporting Hypothesis

Table 4
Predictors of Process Conflict: Logistic Regression Analysis

Predictors	*B*	*SE*	Wald χ^{2*}	exp(*B*) (95% confidence interval)	*p*
Early vs. late (H3)	−1.26	.36	11.95	0.28 (0.14, 0.58)	.001
Rover team (A vs. B, H4)	−1.00	.34	8.77	0.37 (0.19, 0.71)	.003

*All degrees of freedom for the Wald $\chi^2 = 1$.

4b. However, rover team and time in mission did not make a difference for the two types of task conflicts. Thus, we did not find support for the hypothesis (4a) that task conflict would be higher for teams with difficulties. In summary, *process* micro-conflicts were particularly more likely to occur earlier in the mission and in the group that suffered early frustrations and obstacles.

Discussion

This project argues for conceptualizing conflict at a fine-grained interactional, behavioral level. By taking advantage of a rich, real-world dataset of science in action, we were able to explore many aspects of micro-conflicts. Because we conceptualized conflict as a micro-behavior and primarily as disagreement, we were able to test empirically, rather than presume, the associated levels of affect. This particular work group was known to have high levels of trust and competence, but also existed in a stressful, high-stakes environment. The low levels of affect, particularly negative affect, with regards to micro-conflicts were thus surprising and have implications for how these particular participants may have perceived their team's conflict at a macro-level. It is possible that the MER mission managers would estimate a lower amount of their time dealing with conflict, compared to those in the Thomas and Schmidt (1976) survey, even though the overall numbers were similar (21% prevalence in the survey).

Affect nonetheless made a difference: micro-resolutions were less likely to occur in direct micro-conflict events with negative affect. Whether brief negative affect is a cause or effect of lack of resolution is yet to be seen. Our finding suggests that negative affect, complex micro-conflicts, and lack of micro-resolutions may build, perhaps snowballing such that certain kinds of micro-conflicts become, or are brief expressions of, meso- or macro-conflicts. Although it is premature to tell precisely which micro-conflicts will become meso- or macro-conflicts, these three variables are likely to be related to continuing conflict.

In addition to examining emotional intensity, this study also enabled us to test whether the length of a micro-conflict (or conflict intensity) was important. Longer micro-conflicts were more likely to be negative, but micro-conflict length was not related to whether a micro-conflict was resolved. This latter finding is surprising, suggesting that it is simply that some conflicts, even micro-conflicts, take longer (or shorter) to resolve. What makes a micro-conflict resolvable is not the length, but other factors, such as their complexity. Further, the association between negative affect and

conflict length (intensity) was significant but small. Future research could also question whether length of conflict is the appropriate operationalization for conflict intensity in micro-conflicts.

On the other hand, positive affect was unrelated to whether a micro-conflict event was resolved, suggesting differences from Jehn and Bendersky's (2003) model when translated to micro-conflicts. The prevalence of positivity was extremely low in micro-conflicts. From a theoretical standpoint, this finding reveals not only possible differences between micro-resolutions and longer conflict resolutions (see longer discussion), but reminds us of differences between longer-lasting mood states and micro-emotional states. Our episodes of positive affect were coded mainly based on smiles and laughter. Emotion researchers have noted that there are conceptual and signaling differences between brief emotional states such as what we identified and other types of longer-lasting moods (e.g., Ekman & Davidson, 1994). Affect as discussed in macro-conflict theory (e.g., Jehn & Bendersky, 2003) may be referring to moods and longer-lasting affect states rather than brief emotions. Regardless, in general, these micro-conflicts lacked emotional intensity and were brief. We contend that these affective and intensity findings are core features of micro-conflicts that differentiate them from meso- or macro-conflicts, rather than incidental or accidental.

In terms of team and context characteristics, most of those findings were in line with macro-conflict theory, providing some assurance that we were measuring a type of conflict. As expected, process micro-conflicts were more prevalent in the earlier part of the mission. Although process micro-conflict occurred more often in the team that for reasons beyond their control experienced more frustrations and obstacles, this team did not encounter significantly more task micro-conflict, be it in terms of science conflict or rover planning conflict. This latter finding is significant because the other team experienced early task success. The theoretical implications for task conflict are discussed in more detail below.

This overall pattern of results suggests a mix of confirmation and limits to translating macro-level conflict theory to the micro-level. The insistence that conflict must entail negative affect may not apply to micro-conflicts, which are less likely to be negative the more fleeting they are (see analysis on length and negative affect). This finding does not imply that micro-conflicts are not a genuine type of conflict; on the contrary, behavioral disagreements at the level of micro-behavior represent an important area in conflict research. In terms of team characteristics, most of those hypotheses in line with macro-conflict theory were echoed using micro-conflicts. In the following section, we discuss several theoretical implications and future directions that can be sparked by this new conceptualization and measurement of conflict.

Future Directions and Theoretical Implications

While observed micro-conflicts are practically and theoretically inappropriate for types of research that require perceptions of conflict (e.g., asymmetries of conflict perceptions research), this measurement opens up future directions for conflict research and theory.

Immediate Relationships between Disagreement, Affect, and Creative Cognition

First, the micro-nature of the behavior has implications for examining the immediate interplay between creative cognition and disagreement between group members (Chiu, 2008a,b; Paletz & Schunn, 2010; Paletz et al., 2010). Although there has been a variety of theory regarding the antecedents, eventual consequences, and management of meso- and macro-conflict (e.g., Greer et al., 2008; Korsgaard et al., 2008), as noted in the introduction, research and theory on more immediate antecedents and consequences of micro-conflicts are extremely rare (e.g., Chiu, 2008a,b; Paletz & Schunn, 2010). Measured in this fashion, exact moments of disagreement can be associated immediately and directly with responses, cognition, emotion, or perceptions. Similarly, one could code for divergent or convergent statements and further code conflict for majority/minority source, testing and unpacking Nemeth's (1986) suggestion that dissent increases divergent thinking at a lower level. In addition, just as with Gottman and Levenson's (2000) study of specific behaviors and eventual divorce, measuring conflict at such a fine-grained level can enable a more precise understanding of what types of micro-conflicts are functional or dysfunctional, predictive of immediate or eventual creativity, and/or predictive of team performance at different points in the life of a team. Following Jehn and Bendersky's (2003) moderated model and Amason's (1996) suggestion to distinguish between cognitive versus affective conflict, it may well be that the level of negative affectivity of *micro*-conflicts is a predictor of team success or dysfunction. As with theory about types of conflict (e.g., task), it could be that the cumulative number of certain kinds of conflict, as well as their affectivity and resolution, is associated with team success and functionality. The relationship between disagreement, affect, and creative cognition can be more carefully unpacked at the micro-level.

Conflict Micro-Resolution

This study provides a unique exploration of immediate conflict resolutions and nonresolutions in work teams. Examined at this lower level, conflict resolution has a different meaning from how it is generally studied. Some of the conflict resolution categories found at the macro-level in previous research, such as rotating responsibilities and voting (Behfar, Peterson, Mannix, & Trochim, 2008), while important at the macro-level, may not be meaningful at the micro-level. Micro-resolutions and nonresolutions are immediate and thus may have different implications for short- and long-term team dynamics than macro-conflict resolutions. For instance, coming up with a third option (an integrative solution) is often considered the ideal way to resolve macro-conflicts, and previous research suggests that a collaborative conflict resolution style may make task conflict less likely to become relationship conflict (DeChurch, Hamilton, & Haas, 2007). Is this the case for micro-conflicts? In the MER sample, the majority of the micro-conflict resolutions were simply because of one party agreeing with the other, rather than both coming to a new agreement. The one-sided agreement resolution style may have been a perfectly healthy option for micro-conflicts, rather than indicating a competitive or accommodating conflict style. In a study of family conflicts over dinner, most conflicts that were resolved used this agreement style (59%) rather than

compromise (41%; Vuchinich, 1987). This resolution technique may be what a collaborative conflict resolution style looks like at the micro-level, as different individuals persuade each other about micro-conflicts but compromise over underlying issues. Future research could examine the degree to which one versus another individual's opinion holds sway within work teams and determine how it relates to perceived conflict resolution style, status, and perceived expertise.

Similarly, the wide variety of ways in which micro-conflicts were *not* resolved could have implications for, and reflect, different kinds of team dynamics. If individuals are more likely to punt on micro-conflicts in one team rather than another, this tendency may reflect a team with relatively greater power distance where the leader is not present. Alternately, punting could reflect a team that encounters greater ambiguity over tasks and processes where a shared vision is (not yet) held. In our study, many of the nonresolutions involved dropping the argument and moving on; at the micro-level, this does not necessarily reflect deliberate attempts to avoid or ignore conflict (as a style at the macro-level, Behfar et al., 2008). The conversation could simply have moved along, and the topic returned to later, depending on how strongly individuals felt. Thus, resolution at this different level of examination could be a slightly different construct, having different effects and implications.

Conflict Types: Relationship, Process, and Task Conflict

Extending current conflict theory, this study also suggests a modest conceptual reconsideration of the different types of conflict. First, while process and task micro-conflicts seemed to occur at normal rates, relationship micro-conflict in this sample was extremely rare. This lack is likely due to some combination of four factors: (a) this team was remarkably collegial, (b) relationship micro-conflict exists primarily as perceived, global assessments as would be captured by self-report rather than micro-behaviors, (c) relationship micro-conflict, when manifest, is rarely expressed directly at its target, and/or (d) by selecting for generally on-task talk and conversations that took place in a shared workplace, we missed relationship conflict that may have occurred at some other time and place. Each of these explanations has merit: although this sample *was* widely regarded as high functioning, expressed relationship conflict is likely to be relatively rare in professional settings, given workplace and politeness norms against stating outright one's personal problems with another coworker. The cost of such expression is high, particularly when working on a long-term task in a relatively stable team embedded in a small professional community. Other settings, such as family dinners, are likely to have relatively more relationship conflict (e.g., Vuchinich, 1987). Furthermore, the focus on task/process conflict could be related to sampling mission-focused conversations. On the other hand, the scientists' conversation that we sampled was not exclusively task-focused, even though it primarily pertained to the mission. Finally, it is possible that relationship conflict is more likely than other types to be quietly perceived than expressed. This is not to say that relationship conflict is not objectively real; rather, it may have a larger proportion of its experience in unspoken emotional reactions, subtext, and conversations with third parties rather than in direct disagreement. Still, because of our video sampling, the absolute amounts of relationship conflict should not be taken

as representative of all workplaces. Additional research can help understand differences in relationship conflict as perceived versus observed.

This study also implies a second look at process conflict: specifically, process micro-conflicts were not any more affectively laden than task conflicts. This finding insinuates that process macro-conflict's negative influence on performance (Jehn, 1997) may not be due to it being fully mediated by negative affectivity, as Greer and Jehn (2007) suggest, but due to process losses (Jehn & Bendersky, 2003). A lack of clarity involving roles and responsibilities is likely to lead to both poorer performance (Salas, 2010) *and* more process conflict, suggesting that process conflict is not simply a cause but may be an additional result of underlying problems. It is also possible that this sample was so high on respect and trust that the proposed relationship between process conflict and negative affect was moderated away (Greer & Jehn, 2007). There could also be genuine differences between process macro- and micro-conflicts, such that micro-conflicts in general simply involve less negative affectivity. Further analyses at the micro-level can unpack the nature of the process conflicts and determine which types are indeed related to negative outcomes directly.

Third, the examination of task micro-conflicts reveals areas for future theorizing and study. Our distinction between task planning and work processes may be relevant for other teams in aviation, science, and engineering. A team of biologists conducting experiments on animals could argue about interpretations of data (science), the design of the study and how to organize the animals (science planning), their own scheduling and meetings (work process), and personal relationships; similarly, air traffic controllers could disagree about (a) the interpretation of weather data, (b) planning the flow of air traffic, (c) their own scheduling, and (d) personal relationships.

Fourth, neither task conflict type was more prevalent in the team that experienced frustrations and obstacles, despite prior theorizing and findings. Prior theory suggests that frustrations lead to blame and subgroup competition (Peterson & Behfar, 2003). One simplistic explanation is that both teams were engaged in an all-encompassing, similar task that overwhelmed any team differences in externally caused successes or obstacles. Both teams were faced with shrinking resources and uncertainty. In addition, even though one team had greater difficulty in achieving the high-level goal of discovering evidence for liquid water, both teams had to grapple with low-level science and planning issues that were debated day-by-day. General levels of success and failure, particularly if caused by luck, may have caused the team experiencing failure to question and revisit their work processes but not necessarily their task. An alternative explanation is that perceptions of task conflict are not necessarily predictive of actual behavior at such a fine-grained level. A third explanation combining the two is that the prevalence of macro-conflicts may, in fact, have been greater in the team with more early difficulties, but the prevalence of micro-conflicts was the same. This result could occur if the team with difficulties experienced more micro-conflicts regarding the same issue again and again (e.g., whether to have the rover drive or stay), but the team with greater success had micro-conflicts about a greater variety of minor issues. Future research could examine directly the relationships between task micro-conflicts and specific self-reported macro-conflicts.

Methodological Limitations

As with any study, methodological limitations remain. The most obvious for this method is that it requires the availability of clear audio–video data and the resources to code and transcribe it. More importantly, these data are correlational, rather than experimental. Individuals were not randomly assigned to conditions. In particular, the findings for team characteristics may be due to factors not measured by this study. The two different rover groups, while both in the overall, successful MER science team, could have differed in other ways in addition to what they experienced during the mission. On the other hand, the relatively greater amount of process micro-conflict early in the first 90 sols was unlikely to be due to the presence of difficult individuals who left, as scientists were bound by contracts and career interests to stay through the first 90 sols. Future research should test the utility of this coding scheme in other samples, particularly those with a variety of dissimilar teams with dramatically different levels of success.

Conclusion

Some researchers might argue that conflict, by definition, must entail all three of Barki and Hartwick's (2004) dimensions. We contend that a "big tent" view of conflict is the most useful and practical, given that how it is studied varies widely across disciplines, but with the caveat that researchers take care to separate and define the different dimensions of conflict as well as possible. This study offers a specific method of examining, conceptualizing, and measuring conflict, quantitatively, as observed, immediate micro-behaviors. The focus on perception, retrospection, and self-report has brought the field of conflict far. However, drawing from the success and importance of research on other interpersonal processes (e.g., emotional expression, Ekman, 1993; Gottman & Levenson, 2000), we propose that conflict researchers additionally examine conflict micro-behaviors (Baumeister, Vohs, & Funder, 2007). The conceptualization and measurement of conflict as micro-behaviors can also push conflict theory in new directions and can help explain discrepancies in prior findings. Micro-level conflicts represent new opportunities to understand team dynamics in more detail. At the micro-level, the precise types of disagreements that lead to creativity and enhanced problem solving can be discovered.

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Appendix

Coding Guide for Identifying Conflict and Examples of Conflict.

Table A1
Coding Guide

Code	Key
Identifying Micro-Conflicts	
0 (No conflict) vs. 1 (Conflict)	(A) Conflict is here defined as disagreement between two or more people. For the purposes of this coding scheme, it's not a conflict if one person just makes an assertion or suggestion, even if it's an unpleasant one, and no one challenges him/her, or if folks agree with him/her. It IS a conflict if someone makes an assertion and another person disagrees with it. (B) START coding the conflict at the first sign of disagreement, specifically, NOT the first sign of an opinion, and mark in dark red what words clued you in initially. Be sure to mark as conflict (1) each utterance as the participants make arguments for and against until they change topic, stop disagreeing, or someone relents/agrees (basically, when they stop disagreeing with each other). IF you don't think a line is in disagreement anymore, stop coding as conflict. So, do include if people are going on for a long time explaining their perspectives, if they are still disagreeing. If any one utterance is no longer conflict, even in the midst of an argument, mark it as 0. (C) Consider that someone may be talking ABOUT a conflict or has a conflict with someone not present, in which case, code as a *discussion of conflict* [a topic of a separate paper]. (D) The simple existence of ''no'' does not constitute a conflict. Sometimes a ''no'' is a clarification or answer to a question. You can tell if it's a conflict based on context. Simply asking a question and receiving a ''no'' answer is not a conflict. (E) Contradicting someone else—substantively disagreeing with them—does count as conflict. However, adding/clarifying does not. Note that ''yeah, but'' is often the beginning of a conflict, but can also be suggesting an additional, noncontradictory idea. (F) A contradiction that is clearly not meant seriously is not disagreement/conflict; however, a jokingly-said true disagreement IS conflict. (G) A question is sometimes a conflict. It can be challenging or sarcastic, or it can be a genuine question. Be sure to listen and watch the video in these cases. (H) In any doubt, in disagreement with another coder, or if you are unsure and/or curious, be sure to watch/listen to the video. Watch for body language, gestures, facial expression; listen to vocal changes, tone, etc. This coding system, if applied widely, should take into account cultural differences in conflict expression (e.g., Morris et al., 1998).
(Write out)	Write in the NOTES section which lines the conflict includes, who is arguing with whom, and what the topic of the conflict is in your own words.
Types of Conflict	
Task science	Conflict is specifically about the science, engineering, etc. data and interpreting the data: What does this particular image/science data mean, is there water on Mars, what *is* this rock, etc.

Table A1
(continued)

Code	Key
Rover planning (task planning)	Conflict is about planning what the rovers should be/are doing; when and how to deploy instruments; what kinds of images to use in articles; etc. Content is still task/science based, but here it's about what/the content of what to plan for the science. Also involves arguments about order of doing instrument measurements, how best to use instruments, and what to name newly found rocks.
Process	Conflict is about work processes: how to allocate human/person resources; *who* should be on what task; human prioritization, scheduling, communication, etc.; how to write papers, problems with computers having nothing to do with Mars instrument planning, etc.; what to call a file or paper, peoples' emails, how to get on email lists, etc.; and disagreements as to what decisions were made (e.g., we decided X, no, we decided Y).
Relationship	Conflict is about personal relationships, personal values, dislike of people, personal attacks or things that someone responds to as if it was a personal attack, etc. Utterances where the meaning is essentially ''I think you are stupid'' are relationship conflict.

Table A2
Examples of Micro-Conflicts (Key Words in Bold)

Coded as	Utterance
Example 1: Science Conflict	
No conflict	S2*: …I'm afraid that this very low angle interior wall reflects that
No conflict	there is no bedrock there
Science conflict	S3: Well, Bereonies got a low slope also.
Science conflict	**It could be that the bedrock is just not very conical**
Example 2: Rover Planning Conflict	
No conflict	S3: Then the issue becomes we all, we may not have enough time to do any mineralogy or this spectral stuff
No conflict	if we're going to have a long look at the salt.
No conflict	S2: You think of this
No conflict	as we've only been there for 2 weeks
Rover planning conflict	**There's a time for everything now**
Rover planning conflict	How do we spend it such that
Rover planning conflict	maybe your stuff, half the peoples' stuff doesn't get done on one sol,
Rover planning conflict	but the other half can really get something that's good.
Rover planning conflict	S3: Right, **but I need to do the stuff I want to do, which is…**
Example 3: Process Conflict (with ''No'')	
No conflict	S2: You showed me that already.
Process conflict	S3: **No, I showed you a single frame.**
Example 4: Relationship Conflict	
Rover planning conflict	S1: Well, what I'm saying is common things occur commonly

Table A2
(Continued)

Coded as	Utterance
Rover planning conflict	and rare things occur rarely
Rover planning conflict	and to say that we landed on the rare thing rather than the common thing
Relationship conflict	is a totally subjective decision that we make **that goes against logic**.
Relationship conflict	That's all I'm saying.
Rover planning conflict	S2: No, I agree with that, but—[is cut off]
Example 5: Conflict with No Conflict Embedded	
Science Conflict	S6: **But to me** they look like each one of these things
No conflict	Even though they're really wide,
Science conflict	They do sort of look like single event types of features
Science conflict	Because the sides of each of them are sort of parallel to each other
Science conflict	**which you wouldn't get** if there was a swarm coming in from the same place.
Example 6: Use of ''No'' without Conflict	
No conflict	S3: Is there any change in the plan here?
No conflict	S1: No.
Example 7: Use of ''But'' without Conflict (Additions Rather than Disagreement)	
No conflict	S3: Let me ask.
No conflict	S2: Well, we need some,
No conflict	but I think we need to pick a number, you know,
No conflict	and I think we need to pick a number of rocks
No conflict	and there's certainly at least two types that I can think of.
No conflict	But we need to have…
Example 8: Conflicts with Positive Affect	
This rover planning conflict was rated 1.5 out of 5 due to joking and laughter, but it is only at certain points in the conflict, not throughout. This process conflict was rated 2.0 out of 5—milder intensity, but encompassing more of the brief conflict	
No conflict	S1:... who knows what we could find over a depth of, uh, over twenty meters of—
No conflict	Maybe it's ten meters—
Rover planning conflict	S2: **but I think you're gonna see—**
Rover planning conflict	I think **if it's there**
Rover planning conflict	You're gonna see it remotely anyway
Rover planning conflict	S1: Uh, **I think the uh—**
Rover planning conflict	I mean the scale of the detail—
Rover planning conflict	S2: **No, I think—**
Rover planning conflict	Because, up close, up close you're gonna see the broken, you know, jumble
Rover planning conflict	S1: **Nah, I think it's worse than that**
Rover planning conflict	S2: If you can get it
Rover planning conflict	S3: You're, you're <laughs> **I think you're both wrong,**
Rover planning conflict	The problem is from looking at it from just sort of across

Table A2
(Continued)

Coded as	Utterance
Rover planning conflict	**I don't think** you can see close enough to see the lamination—
No conflict	S1 (to S3, interjecting): So, you wanna, you wanna settle your beer win?
Rover planning conflict	S3: —**but, but** by the time we get close enough
Rover planning conflict	We'd have to be hanging onto the roof <laughingly, referring to the rover gripping a very steep incline>, onto the cliff looking at it.
No conflict [answering a question]	No, I want to see my beer!
No conflict	S1: You want to double your, your bet?
Process conflict [emphatic, but amused]	S3: **No!**
No conflict	S1: alright, then, eh, alright
No conflict	S3: No, I wanna see my beer.
No conflict	We can have a new bet if you want.
Example 9: Conflicts with Negative Affect (Example 4 Also Had Negative Affect)	
This relationship conflict was rated 3.5 out of 5 for negative affect due to irritated tone of the speaker; the process conflict was rated 1.25 out of 5 due to milder irritation	
No conflict	S1: But then—exactly,
No conflict	But the point is why then—
No conflict	It sounded like you have a bias toward RATting [doing a certain instrument reading]
No conflict	Versus getting [person #1] in a position where he can really analyze some rocks with a Mini-Tes [another instrument]
No conflict	S3: Hey, let me make a suggestion
Relationship conflict	S2: **It's not MY bias.** [irritated]
Relationship conflict	It's one that—it's what you're hearing from several people.
No conflict	S1: Well, it's what [person #2] just said.
Relationship conflict	S2: Yeah, that's my point. [defensively]
Process conflict	S1: But is that in general?
Process conflict	S2: **And [person #3] agrees with him.**
Process conflict	S1: **I don't know that he does.**
No conflict	S2: Well, maybe he's trying to be—

*S2, S1, etc. are speaker numbers. The first speaker in the clip is S1, etc. S2 in one clip may not be S2 in another clip.