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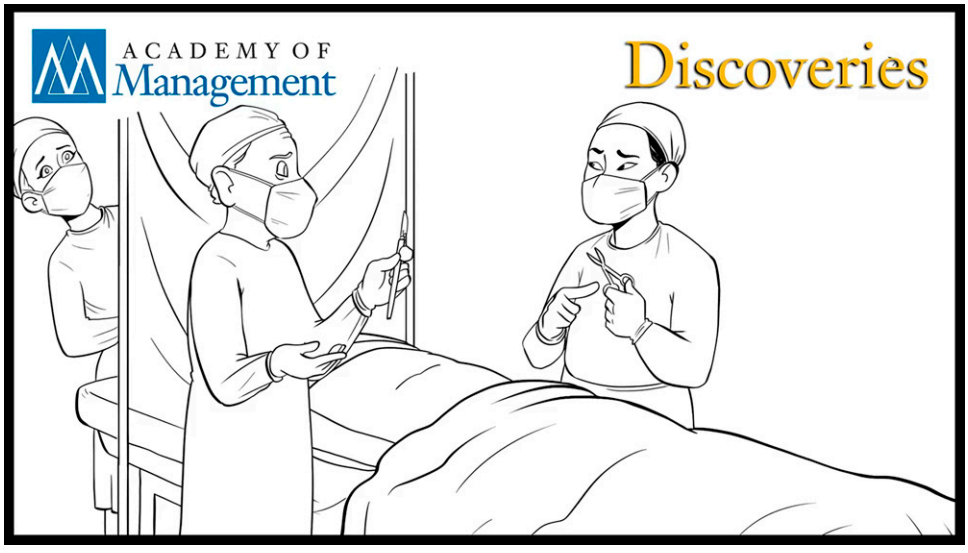
THE WAY WE MAKE EACH OTHER FEEL: RELATIONAL AFFECT AND JOINT TASK PERFORMANCE

TIZIANA CASCIARO
University of Toronto

MIGUEL SOUSA LOBO
INSEAD

HENDRIK WILHELM
Witten/Herdecke University

MICHAEL WITTLAND
University of Applied Sciences and Arts Hannover



When two people work closely together to perform a task interdependently, do the emotions they elicit in each other matter for their joint performance? If so, which emotions matter most, and does performance itself affect which emotions arise? Our study discovers the unique role of relational tension in dyads as an antecedent and an outcome of joint task performance. We analyzed longitudinal archival and survey data on surgeons working in dyads to execute visceral surgeries, with a sample including 1,315 surgeries conducted before the relational survey, and 475 surgeries afterward. Of all forms of relational affect we considered—how relaxed, excited, alert, nervous, tense, or lethargic surgeons felt when working with each other—we found that only relational tension predicted subsequent surgery performance. Regarding the antecedents of relational affect, the past performance of a surgeon dyad explained only relational tension. But not all forms of past performance mattered. Only having experienced performance peaks lowered relational tension, while performance valleys and averages had no effect. No form of positive relational affect had a discernible role as either an antecedent or an outcome of joint performance. These findings chart new territory on the affect–performance link, with implications for management theory and practice.

All authors contributed equally. Their names are listed in alphabetical order.

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Much of the work of organizations is carried out not by individuals working in isolation, but by people interacting with each other to share knowledge and resources, coordinate their activities, and thus jointly perform tasks that they could not execute alone (Lawrence & Lorsch, 1967; Thompson, 1967). These workplace relationships—wherein two people perform interdependent tasks together—are embedded in larger groups, work units, and networks in an organization (Venkataramani, Labianca, & Grosser, 2013). Think of a head chef and a sous chef assembling dishes together in a restaurant kitchen. The satisfaction of diners in the restaurant is a result of how well the entire team—including not only cooks but also managers, servers, dishwashers, hosts, and bartenders—operates at the individual and group levels; *and* it is also a result of how well the head chef and the sous chef, specifically, operate with each other at the dyadic level, because those two are ultimately responsible for delivering a key outcome for a restaurant: excellent dishes. The performance of a group or an organizational unit must therefore be understood partly as a function of how two people jointly performing work tasks relate to each other dyadically.

Dyadic workplace relationships such as the one linking head chef and sous chef in a restaurant kitchen have a disproportionate effect on the collective performance of the organizational units they are embedded in (Humphrey, Morgeson, & Mannor, 2009). These relationships can be thought of as "core dyads." Cockpit crews flying commercial airplanes are another example. Commercial aviation requires the work of many, including air traffic controllers and maintenance crews. But flying the aircraft is ultimately the job of a pilot and a copilot, so their capacity to work together as a dyad is particularly relevant to completing a safe and pleasant flight. Core dyads such as these can be found in many organizational contexts, as Figure 1 illustrates. They range from dyadic interactions between two executives making strategic decisions for their company to co-surgeons operating on a patient.

Understanding what allows individuals interacting in such dyads to achieve excellence in executing interdependent tasks is therefore critical to many collective endeavors in the workplace. In this paper, we deepen this understanding with an exploration of the interplay between affect and performance at the dyadic level of analysis. It is well established that affect and performance are linked at the individual (Fredrickson, 2001), group (Barsade & Knight, 2015), and organizational levels of analysis (Barsade & O'Neill, 2014; Huy, 1999). Two gaps in the literature, however, limit our understanding of the affect–performance link in core dyads. First, our current knowledge is insufficient to specify *which* affective responses that two individuals experience from interactions with each other influence their joint performance. Second, we have a limited understanding of *how* past performance elicits specific affective responses in a dyad.

To explore these questions, we follow Casciaro (2014) and define "relational affect" as the relatively stable affective states that an individual (ego) experiences from interactions with a given person (alter). Relational affect is therefore a dyadic construct that, at the individual level of analysis, captures how an individual tends to feel when interacting with a specific other. At the dyadic level of analysis, relational affect represents how ego and alter tend to make each other feel, irrespective of how reciprocated the feelings they experience from their interactions are. For instance, a sous chef can feel excited when working with a celebrity chef, who may or may not feel the same level of excitement; yet, the sous chef's excitement, even if partly or entirely unreciprocated, can still influence how the dyad performs together in the kitchen.

As in Casciaro (2014), we specify relational affect in terms of the "circumplex model" of affect (Larsen & Diener, 1992; Watson, Clark, & Tellegen, 1988; Watson & Tellegen, 1985), wherein the affective responses people experience in a work relationship range from positive low activation (e.g., relaxed) to positive high activation (e.g., excited and alert), negative high activation (e.g., tense and nervous) and negative low activation (e.g., lethargic), as Figure 2 illustrates. Conceptualizing relational affect in terms of the circumplex of the affective experience does not imply that other emotional responses cannot manifest themselves relationally. For example, social interactions also elicit discrete emotions—like anger, happiness, fear, sadness, pride, envy, or shame. A coworker can anger you, for example, or can make you feel jealous or proud. However, most discrete emotions can be plotted onto the circumplex model of affect based on their hedonic tone and level of activation (Cropanzano, Weiss, Hale, & Reb, 2003; Russell & Barrett, 1999). For this reason, the circumplex provides a more parsimonious theoretical basis for defining relational affect (Casciaro, 2014).

Next, we elaborate on how the interplay of relational affect and joint performance in core dyads matters for management theory and practice.

From Relational Affect to Joint Performance

Research on affect has documented the facilitating role of positive affect for task performance (Ashkanasy & Dorris, 2017; Barsade & Knight, 2015). As Barsade and Gibson (2007: 51) concluded in a comprehensive review: "The evidence is

FIGURE 1
Core Dyads Performing Joint Tasks in Organizations

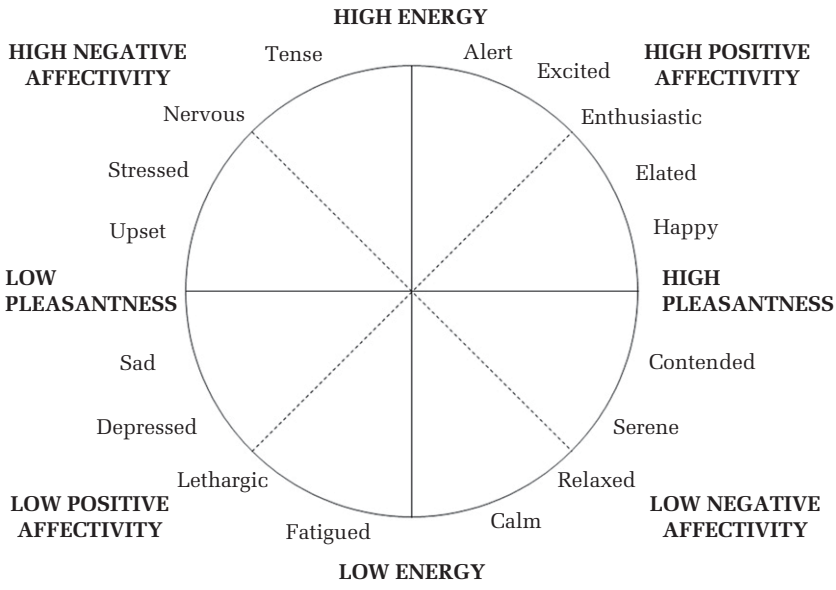
Photo credits (from top left to bottom right): Pexels/Rene Asmussen; Pixabay/Engin Akyurt; Getty Images; Pexels/Christina Morillo; © Lufthansa.

overwhelming that experiencing and expressing positive emotions and moods tends to enhance performance at individual, group, and organizational levels." Exceptions to this rule exist, however. For example, positive mood has been shown to facilitate an array of cognitive tasks, like categorization (Isen & Daubman, 1984), but impair working memory (Martin & Kerns, 2011), which could be detrimental to the error-free execution of complex tasks, like performing surgery or flying an aircraft. By contrast, negative affect can improve working memory (Gray, 2001).

Video:
You can click to watch a video that demonstrates an example of joint performance

At the same time, reducing the experience of negative affect when interacting with someone may be the key to removing barriers to joint performance. The negative affect triggered by adverse events elicits a threat–rigidity response, narrowing the range of cognitive and behavioral responses (Staw,

FIGURE 2
Conceptualizing Relational Affect Based on the Circumplex Model of the Affective Experience



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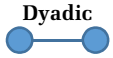
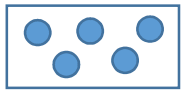
Sandelands, & Dutton, 1981), triggering heightened negative responses to loss more than they enhance positive responses to opportunity (Chattopadhyay, Glick, & Huber, 2001). What should dyads emphasize, then, when they wish to enhance their joint performance? Is it more important to enhance flow by boosting positive relational affect (e.g., excitement), or is decreasing the experience of negative relational affect (e.g., nervousness) key to removing barriers to joint performance?

Adding complexity to answering this question, generalized positive and negative affect encompass a great variety of emotional responses (Barsade & Gibson, 2007), each with distinctive motivational and behavioral consequences (Gooty, Gavin, & Ashkanasy, 2009). Although, in their meta-analysis, Shockley, Ispas, Rossi, and Levine (2012) showed that positive discrete emotions tend to benefit various aspects of performance, while negative discrete emotions tend to do the opposite, certain discrete emotions have more complex associations with performance. For example, in negotiations, anger can be both beneficial and detrimental to the concessions a negotiator obtains (Adam & Brett, 2018).

It is therefore necessary to specify which forms of relational affect develop in a dyad, because generalized positive and negative affect may be insufficient to discern what leads two people to successfully coordinate their work or to fail to do so (Shockley et al., 2012). Yet, a theoretical and empirical gap exists about the link between dyad-level affect and performance of joint tasks, as Table 1 illustrates. Fine-grained views of moods and emotions have almost exclusively been applied to the individual level. As Methot, Melwani, and Rothman (2017: 1790) noted, "existing perspectives on workplace relationships persistently characterize them as one dimensional, positioning them along a bipolar continuum from positive to negative," rarely contemplating how specific forms of relational affect between coworkers shape their joint performance. Similarly, studies of group performance have typically adopted a simpler view of positively and negatively valenced affect as enhancing and hindering, respectively, collective performance, without considering directly how distinct affective content develops within relationships between two individuals (Ashkanasy & Dorris, 2017; Barsade & Knight, 2015).

Moreover, the affect–performance link at the individual level hinges on mechanisms that may not readily apply to how relational affect that people experience in a dyad influences their joint performance of interdependent tasks. For example, feeling relaxed may dampen an individual's motivation and productivity when working alone, but at the dyadic

TABLE 1
Overview of Research on Affect and Task Performance at Different Levels of Analysis

		Level of analysis		
		Individual 	**Dyadic** 	**Collective** 
Form of affect	Discrete moods and emotions	Anger Fear Envy Guilt/shame Frustration Hostility Nervousness Sadness Shame/pride Tension Affection Enthusiasm Confidence Contentment Happiness (for a review, see Shockley et al., 2012) Affective events (for a review, see Ohly & Schmitt, 2015)	This study	Emotional cultures (Barsade & O'Neill, 2014) Shared emotions (Vuori & Huy, 2016)
	General positive and negative affective valence	State positive/negative affect (e.g., Isen & Daubman, 1984) Trait positive/negative affect (e.g., Staw & Barsade, 1993)	Positive/negative interpersonal affect (Methot et al., 2017) Emotional contagion (Barsade, 2002)	Group affective tone (e.g., Knight, 2015) Organizational affective tone (e.g., Knight, Menges, & Bruch, 2018) Group affective composition (e.g., Barsade, Ward, Turner, & Sonnenfeld, 2000)

level, it might lower barriers—such as competitiveness—to the knowledge sharing and the collaboration typically required for joint performance. The affect–performance link may therefore not be isomorphic across levels of analysis, preventing deductive analyses of the association between relational affect and collective performance.

From Performance Averages, Peaks, and Valleys to Relational Affect

An equally elusive puzzle concerns how, exactly, past performance influences the relational affect two people elicit in each other. Do past instances of performance excellence enhance positive relational affect, such as excitement? Do past instances of failure heighten negative relational affect, such as tension? Or is average past performance—the tendency to either do well or poorly over time—what really matters for the relational affect experienced in dyadic interactions?

A priori predictions in this respect are difficult to justify based on existing theory and data. Research on discrete emotions and performance has typically treated performance as the dependent variable, not the predictor (Shockley et al., 2012; Weiss & Cropanzano, 1996). In studies documenting performance as an antecedent of psychological responses—such as self-efficacy—the focus has typically been on single instances of past performance and performance trends, without analyses of the potential role of performance peaks and valleys in people's psychological experience (Sitzmann & Yeo, 2013). Yet, evidence suggests that extreme events loom large in people's minds (Thaler & Sunstein, 2008). For example, recall of acute pain is more accurate than recall of chronic pain (Erskine, Morley, & Pearce, 1990). This would suggest that instances of extreme negative performance may elicit heightened emotional responses in a dyad. These responses could be negative (e.g., by making people feel more tense or nervous about their future joint performance) or

positive (e.g., by making people more alert and excited about the possibility of improvement from low joint performance). We have little theory or evidence to predict whether performance averages, peaks, and valleys elicit relational affect in a dyad.

An Abductive Analysis of the Affect–Performance Interplay in Workplace Dyads

We explore the specific forms of relational affect that develop in core dyads in the workplace as both an antecedent and an outcome of collective performance. Shedding light on this interplay of affect and performance at the dyadic level matters in organizations, in two critical ways. First, determining whether collective performance results from enhancing flow (by infusing core dyadic interactions with positive relational affect) or from removing barriers (by decreasing negative relational affect) changes the type of work environment that an organization should strive to cultivate. Should organizations work to instill excitement between employees or rather help them feel less anxious when working together? Second, pinpointing how past performance elicits specific forms of relational affect in a core dyad is consequential for how an organization designs its work processes to cultivate peaks of excellence, avoid valleys of failure, or achieve good average levels of performance. Should the delivery of reliable performance over time and the prevention of performance dips be the overriding consideration for functional workplace relationships, or should an organization pursue extraordinary performance as a key to thriving work relationships, as positive organizational scholarship has emphasized (Kelly & Cameron, 2017)?

Our empirical exploration focuses on the relationship between co-surgeons—the core dyad of the surgery team (Humphrey & Aime, 2014: 445)—executing visceral surgeries for cancer treatment. We take an abductive approach because, as we have discussed, existing theory and empirical evidence do not allow for a priori predictions about how past performance influences relational affect, and which specific forms of relational affect emerge from and contribute to the performance of surgeons operating together. To corroborate the necessity of abductive inquiry in this context, we conducted polls of organizational scholars attending two research talks on this study. The first group comprised organizational behavior faculty members of a top business school in the United States, and featured prominent researchers on affect in organizations. The second group comprised attendees at a conference on intraorganizational networks, and featured experts in interpersonal relationships in organizations. We first provided these audiences with the theoretical background for this study, its empirical focus on co-surgeons executing visceral surgeries (detailed below), and the research design. We then asked them to select, using a Post-it note as their personal ballot, which of the six forms of relational affect we measured—nervous, tense, alert, excited, relaxed, and lethargic—they would hypothesize as influencing the performance of these surgeon dyads, and in which direction, based on their knowledge of the literature. A photograph of the vote tally at the intraorganizational networks conference is reported in Figure 3, and it faithfully represents the patterns we observed across both polls. This pattern is consistent with our claim that existing theory and evidence do not straightforwardly allow for deductive theorizing about which specific forms of relational affect come into play in the performance of surgeons operating jointly.

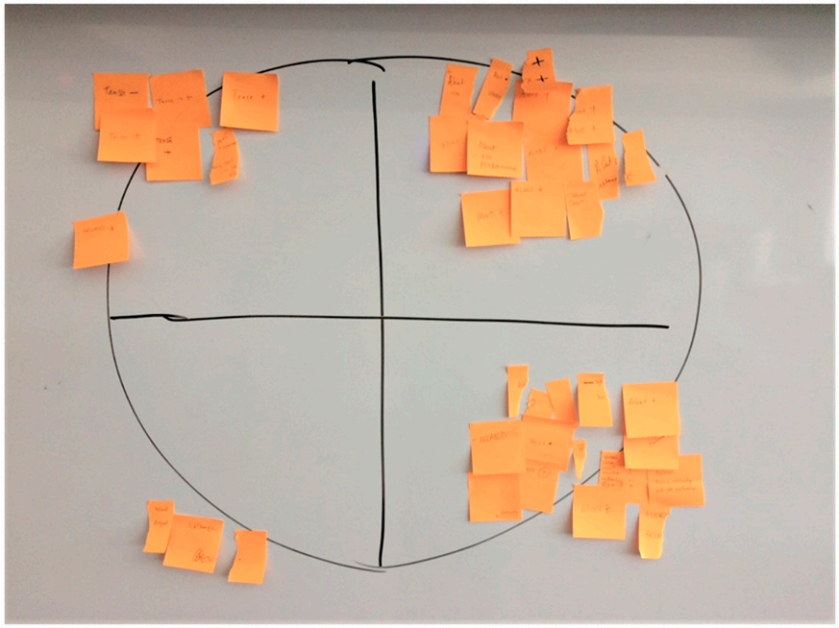
Video:
You can click to watch a video that shows this kind of joint performance during surgery
(note: this shows an actual surgery)

METHODOLOGY

Site and Procedure

We collected longitudinal archival and survey data on surgeon dyads executing visceral surgeries. Surgeries are an established setting to test management theory (e.g., Vashdi, Bamberger, & Erez, 2013). We collected these data from a surgery department in a German university hospital. The department is internationally renowned for its cancer operations. The surgeries we studied are carried out by surgical dyads comprised of a first (i.e., leading) surgeon and a second (i.e., assisting) surgeon, assisted by several scrub nurses. In line with past research on surgery performance (e.g., KC, Staats, & Gino, 2013), we did not study the scrub nurses, but instead focused on the surgeons executing the surgery. Executing complex fine motor tasks on a patient—such as the exquisitely precise removal of cancerous tissue—requires intense coordination between co-surgeons, placing them at the core of the surgery team (Humphrey & Aime, 2014) and making the largest impact on collective performance (Humphrey et al., 2009). As a result, in surgery research, it is commonplace to use dyadic data on the leading and assisting surgeon to explain variation in surgery performance (e.g., Finnesgard, Pandian, Kendrick, & Farley, 2018).

FIGURE 3
Responses to Poll on Most Likely Form of Relational Affect to Influence Surgical Performance



Note: The majority of scholars in attendance at both talks predicted that *positive* forms of relational affect would positively influence surgical performance, with predictions equally split between high activation ("excited" and "alert") and low activation ("relaxed") relational affect. Negative forms of relational affect were selected less often, with "anxious" and, especially, "lethargic" mentioned less often than "tense." A few scholars in attendance selected more than one form of relational affect, and their Post-it "ballots" were split accordingly.

The hospital's surgery manager assigned surgeons to surgeries according to availability and ability. Thus, surgeon dyads were formed exogenously—not based on the relational affect between them—allowing us to rule out selection effects. At the time of our study, the department employed 25 surgeons (10 senior, 15 junior) performing operations. The surgeons were predominantly male (88%) and on average 39 years old (SD = 8.98). Their mean tenure was 8.64 years (SD = 6.54). Junior surgeons usually were in the process of obtaining their specialist qualifications. The composition of surgery dyads varied considerably. We observed seniors operating with other seniors, juniors operating with other juniors, and seniors operating with juniors. We use multiple data sources collected within this department, including surgery archival data from patients' health records and the hospitals' information system, as well as a cross-sectional questionnaire completed by the department's surgeons. Following discussions with the head surgeons of the department, we included the four most frequent surgery types carried out by these surgeons. Type 1 is cholecystectomy, the surgical removal of the gallbladder. This procedure is commonly performed when a patient suffers from carcinoma of the gallbladder. Thyroidectomy (type 2) focuses on the surgical removal of the thyroid gland to treat thyroid cancer. Gastrectomy (type 3) is performed to treat stomach cancer and it entails the surgical removal of stomach sections. Finally, our data covers esophagectomy (type 4), the surgical removal of all or part of the esophagus and replacement of the removed sections with parts of the stomach. This procedure is commonly executed on patients with esophageal cancer (for an introduction to these procedures, see Roses, Paulson, Kanchwala, & Morris, 2009).

We also asked all surgeons who had consented to participate to complete a survey on their self-reported affective responses to each of their 24 colleagues in the department. To compensate surgeons for the time, those who returned a completed questionnaire received a 25 euro cafeteria voucher. We obtained clearances from the university hospital's ethics board, the staff council, the data protection officer, and informed consent from the surgeons to access the data. The consent form stated that participation was voluntary, and all data were confidential and would only be accessed by the research team.

Author's Voice:
How did you get access to your data?

Sample and Data

Data are available for surgeries that were conducted both before and after the survey was administered to the surgeons. This enabled us to explore how pre-survey surgery performance of a surgeon dyad shapes specific forms of relational affect between surgeons, and how these forms of relational affect impacted subsequent surgery performance.

Ideally, the survey data collection should have been concentrated in a single day. However, because the surgeons we sampled are elite medical professionals with very tight schedules, and because our survey required approximately one hour to complete, our only option to collect these data was to allow for a longer timeframe for the survey data collection. As a result, the surgeons filled out the survey online at their leisure over a two-month period. The university's data protection unit that collected all surveys on our behalf to safeguard surgeons' confidentiality did not provide us with survey time stamps.

To ensure conservative and transparent analyses, we classified surgeries as "pre-survey" if they were executed prior to April 1, 2015—the date the survey data collection started. For "post-survey" surgeries, we faced a trade-off between loss of information and added noise. We ran models with the cutoff at 0 days, at 30 days, and at 60 days after April 1, 2015, and the results were nearly identical across the three cases. These additional analyses demonstrate that even the most conservative cutoff (60 days)—that is, an operationalization that incurs a loss of information by waiting until the very last survey was returned—does not alter the findings reported below.

All 25 surgeons agreed to participate in the study. Four surgeons did not fill out the survey, however. Data are available for 1,315 pre-survey surgeries, and for another 475 post-survey surgeries (with the cutoff at 30 days). The sample size is the number of dyads for which the variables relevant for a particular analysis are available. At a minimum, this must include at least one jointly performed surgery and at least one survey response within the dyad. For simple regression involving only two variables, sample sizes ranged from 43 to 107.

Variables and Measures

Surgical performance. To measure surgical performance, we followed past research (e.g., Hull, Arora, Aggarwal, Darzi, Vincent, & Sevdalis, 2012; Vashdi et al., 2013; Xu, Carty, Orgill, Lipsitz, & Duclos, 2013) and used the hospital's archival data on the surgeon dyad's *cut–seam time*—that is, the time the surgeon dyad required to perform the surgery. In surgery research, it is well established that a shorter cut–seam time, normalized by type of surgical procedure, objectively reflects higher surgical performance (Ball, Pitt, Kilbane, Dixon, Sutherland, & Lillemoe, 2010; Daley, Cecil, Clarke, Cofer, & Guillamondegui, 2015; Procter, Davenport, Bernard, & Zwischenberger, 2010), as we detail in Appendix A.

To ensure comparability across surgeries, in particular for the calculation of the minimum and maximum cut-seam time, we normalized the cut–seam time by the *type* of surgery (zero mean and unit standard deviation based on an indicator variable from hospital archival data), by whether the surgery was an *emergency* (based on an indicator variable for whether the surgery's starting time was outside of the units' regular hours, 8:00 to 18:00),[1] and by whether an *additional procedure* was performed (based on an indicator variable for whether one or more procedures were performed in addition to the main procedure under which the surgery was classified). For each surgeon dyad, we constructed four measures to summarize the surgery history before and after the relational survey: (1) the *average cut–seam time pre-survey*, (2) the *minimum cut–seam time pre-survey*, (3) the *maximum cut–seam time pre-survey*, and (4) the *average cut–seam time post-survey*.[2]

Relational affect. We measured the relational affect each surgeon experienced from interactions with each other surgeon in their department (i.e., 24 alters) along six points of the affective circumplex (Figure 2), following conceptual work on relational affect in workplace dyads (Casciaro, 2014). To that end, each surgeon answered the question "When I

Author's Voice:
Why does cleaning data matter?

[1] While the surgery start time is an imperfect indicator of whether a procedure was scheduled in advance or conducted on an emergency basis, exact information about advance scheduling was not available. Further, this indicator is effective in reducing weight in the tail of the empirical distribution of cut-seam times, suggesting that the way the surgeons approach a procedure is impacted by whether it was conducted outside of regular hours, whether it was prescheduled or not.

[2] We specified only average performance post-survey because, theoretically, extreme events can have downstream consequences on people's psychological experience (i.e., peaks and valleys of performance can influence relational affect) but relational affect does not influence single downstream performance events above and beyond its effects on subsequent average performance.

TABLE 2
Summary Statistics for *Relational Affect*

	Sample mean	Sample standard deviation	Number of respondents	Retained number of respondents	Number of responses	Retained number of responses
Relaxed	5.29	1.73	21	16	504	384
Alert	5.30	1.71	21	9	504	216
Excited	4.55	1.70	21	16	504	384
Tense	2.54	1.62	21	17	504	408
Nervous	1.90	1.28	21	11	504	264
Lethargic	1.56	1.02	21	5	504	120

Survey items used a 7-point Likert scale.

work with this person, I feel … " on a 7-point Likert scale, followed by six adjectives: *nervous*, *tense*, *alert*, *excited*, *relaxed*, and *lethargic*. We selected adjectives from the circumplex model to prevent respondent fatigue, since surgeons had to rate 24 colleagues along each form of relational affect. We chose these adjectives based on discussions with the surgeons, who indicated that high activation emotions were more relevant to their experiences when operating with co-surgeons than low activation emotions. For this reason, we over-selected on high activation relational affect, with two positive emotions (alert and excited) and two negative ones (tense and nervous), and selected two low activation forms of relational affect, one positive (relaxed) and one neg-ative (lethargic).

For each surgeon dyad, we calculated the average over two responses, if both were available, or set the value equal to a single response if only one was available. This approach implies that relational affect, while a dyadic construct, is not necessarily shared in a dyad. The affective responses that two people elicit in each other can vary in intensity for each of the two individuals in the relationship. What we are interested in is the average level of each form of relational affect in the relationship, whether each person in the dyad feels that emotional response equally intensely or not. This is because relational affect need not be shared for it to influence joint performance. For example, if feeling relaxed leads an individual to collaborate with a coworker (instead of competing with him or her), their joint performance may increase even if the coworker does not feel equally relaxed. We therefore measured relational affect as a configural property of the dyad, without assuming convergence between members of the dyad, and allowing instead unit-level variability (Kozlowski & Klein, 2000). In doing so, we also explored using minimum and maximum relational affect within a dyad, as well as the difference in relational affect scores in a surgeon dyad, but missing responses from one of the two surgeons in a dyad reduced the available sample of observations, depriving these alternative approaches of the required statistical power. Table 2 presents summary statistics for the relational affect survey items.

Surgeon dyad experience. A dyadic variable relevant to joint surgical performance is the number of surgeries that a surgeon dyad performed together historically—that is, how experienced they were in working together. We thus controlled for this variable in our analyses. Because the number of surgeries performed together by each dyad (mean = 11.05, SD = 15.80, max. = 108) is very long-tailed, we used its logarithm, which results in a compact distribution (mean = 1.66, SD = 1.24, max. = 4.68).

Modeling Strategy

Analytical approach. The small sample size suggested a conservative approach to modeling. In particular, in order to prevent inadvertent "p-hacking," we committed to running and presenting our first linear regression model without further iterations on either the data normalization procedure or the model structure. Setting up complex models—such as hierarchical linear models (Raudenbush & Bryk, 2001)—inevitably requires iteration, making the process vulnerable to p-hacking, even if involuntary. Our approach was to normalize the data to allow for a valid, simple, linear least squares regression model. Given this commitment to running and presenting our first model, extensive effort was expended to validate the data, returning to the hospital unit as needed, including to identify and delete duplicate records and to investigate and resolve outliers (see Appendix B for details). Subsequent to running the first regression models, we engaged in extensive data exploration and robustness checks to validate a number of decisions about data handling (including the choices of cutoff point for classifying surgeries as pre-survey and post-survey, and the use of nonlinear transformation for the surgeon dyad experience). These robustness checks did not result in any changes of note in the results.

Modeling of relational data. From the relational affect ratings that surgeons provided about each of their 24 colleagues, we isolated the dyad-level "relationship effect." This is the component of the rating that is unique to two specific people beyond the biases associated with the survey item ("item effect") and beyond the way an individual rates others ("source effect") and is rated by others ("target effect," which Eisenkraft and Elfenbein, 2010, labeled "affective presence"). This approach is consistent with Kenny's (1994) social relations model and Casciaro and Lobo's (2008) approach to modeling interpersonal ratings from surveys. In simple terms, we are enforcing a zero mean across rows and across columns of the sociomatrix. The resulting estimates of the relationship terms—after parsing out source, target, and item effects—are then modeled in the regression analyses.

By definition, the *relationship effects* of interpersonal ratings are *statistically independent* of any ego-level (source effects) and alter-level (target effects) variables or any linear combination of the two—such as the average (or difference in) experience (or in tenure) within each pair of surgeons (Kenny, 1994). Consequently, with this methodology, individual-level characteristics of a surgeon (e.g., a surgeon's tenure, experience with a specific type of surgery, personality traits, or demographics) *cannot* impact the results of our dyadic analyses, because they have been parsed out of the statistical model, given our theoretical and empirical focus on the relational affect that two specific people in a dyad elicit in each other.[3] As in similar studies conducted in surgery settings (KC et al., 2013), unmeasured characteristics of the rest of the surgical team (e.g., scrub nurse experience and relationships within the team) constitute unexplained variance in our model.

To avoid biased estimates, the responses from surgeons whose ratings were identical across all alters were discarded.[4] Beyond constant responses, the same applies to low variance responses if the variance of responses is not controlled for or normalized. For most survey items, the number of respondents excluded for this reason ranged from three to five. The single exception was *lethargic*, for which most surgeons selected the lowest value in the response scale, presumably because of the strong negative connotation of the word. Due to the extremely low variance on this item, *lethargic* was excluded from the analyses.

RESULTS

Table 3 provides the summary statistics for the sampled surgeries before normalization. Table 4 shows the correlations between average, minimum, and maximum pre-survey cut-seam time. Table 5 shows the correlations between the specific forms of relational affect after accounting for the issues described above. We detected no unexpected patterns in these descriptive statistics.

From Historical Surgery Performance to Relational Affect

We used the three variables summarizing the pre-survey surgery performance history of each dyad—*maximum*, *minimum*, and *average cut–seam time*—as predictors of the average relationship effect in the dyad for each item, using five forms of relational affect: *nervous*, *tense*, *alert*, *excited*, and *relaxed*. Across the 15 models estimated (Table 6), we found that only one form of relational affect was associated with historical surgery performance in a dyad: *tension*. Specifically, the lower the minimum cut–seam time that two surgeons achieved together in the past, the lower the tension they experienced with each other ($b = 0.29$, $p < .0001$). This indicates that having experienced instances of peak performance in the past decreases relational tension in the surgeon dyad. By contrast, having avoided surgical failures (i.e., a low maximum cut-seam time) or having achieved good average surgical performance (i.e., a low average cut-seam time) had no discernible effects on relational tension.

Lower tension may be a consequence of increased joint experience and therefore comfort in working together. At the same time, as a dyad performs more surgeries together, the probability of extreme events increases along with the sample

[3] Analyses performed at the individual surgeon level are available from the corresponding author upon request.

[4] First, our subjective determination is that these responses do not have validity comparable to other responses and are not substantively different from the case in which the respondent declines to answer. We are concerned with dyad-level effects and, since identical responses across all alters do not discriminate across dyads, discarding them results in *no* loss of information. Second, if these responses are included—and if we do not control for the different variance in responses across respondents—the resulting model mismatch will result in invalid results. In a dyad that includes one of these constant responses, after controlling for the target effect, the estimated relationship effect will simply be the negative of the target effect. The estimates of the relationship effects will then become negatively correlated with the target effects. If there is a correlation between ego-level characteristics and cut–seam time (potentially even a spurious one, given the comparatively small number of surgeons), a spurious inverse finding will then result in the dyad-level analysis—incorrectly and because of a model mismatch.

TABLE 3
Summary Statistics for Surgeries in the Sample before Normalization

Number of sampled surgeries by type

Emergency	Add. Proc.	Type 1	Type 2	Type 3	Type 4	*Total*
No	No	325	212	212	641	*1,390*
No	Yes	128	158	6	29	*321*
Yes	No	47	1	37	14	*99*
Yes	Yes	5	0	1	1	*7*
Total		*505*	*371*	*256*	*685*	*1,817*

Mean of cut-seam time (in hours) by surgery type

Emergency	Add. Proc.	Type 1	Type 2	Type 3	Type 4
No	No	2.17	2.19	3.82	5.49
No	Yes	3.56	2.51	3.45	5.23
Yes	No	2.15		2.52	3.08
Yes	Yes	1.79			

Sample standard deviation of cut-seam time (in hours) by surgery type

Emergency	Add. Proc.	Type 1	Type 2	Type 3	Type 4
No	No	1.20	1.10	1.44	1.68
No	Yes	1.80	1.06	1.15	1.78
Yes	No	0.91		1.50	1.55
Yes	Yes	0.25			

Notes: "Add. Proc." captures whether additional procedures next to the main procedure (indicated by surgery type) were performed. Surgery types are as follows: cholecystectomy (type 1), thyroidectomy (type 2), gastrectomy (type 3), and esophagectomy (type 4). For an introduction to these procedures, see Roses et al. (2009). Empty cells in the table indicate an insufficient number of surgeries in that condition to calculate summary statistics. The difference between the total number of surgeries reported here and the number of surgeries used in the analyses is due to the normalization procedure.

TABLE 4
Correlations for Normalized Pre-survey *Cut-Seam Time*

	Minimum	Maximum
Average	.61***	.55***
Minimum		−.17*

n = 116 dyads
* $p < .05$
** $p < .01$
*** $p < .001$

TABLE 5
Correlations for *Relational Affect*

	Alert	Excited	Tense	Nervous
Relaxed	.06	.34***	−.53***	−.58***
Alert		.16*	−.05	−.26***
Excited			−.28***	.19**
Tense				.52***

n ranges from 192 to 384 dyads
* $p < .05$
** $p < .01$
*** $p < .001$

size.[5] For these reasons, it is essential to validate these results controlling for the number of surgeries performed by each dyad. A regression with the logarithm of *surgeon dyad experience* as a control variable, in addition to the minimum cut–seam time, results in a coefficient for *surgeon-dyad experience* that is not significant ($b = -0.10$, $p = .22$) and a coefficient for the minimum time (i.e., peak performance) that is still marginally significant ($b = 0.19$, $p = .06$).[6]

The only other form of relational affect that approached statistical significance—absent the

[5] If the samples are independent and identically distributed, the minimum and maximum can be expected to be decreasing and increasing with sample size, with means according to the corresponding order statistic.

[6] As robustness checks, we ran two models with variations on the control variables: (1) the untransformed number of surgeries, and (2) using a different nonlinear transformation in alternative to the logarithm. This alternative transformation is the expected value of the maximum of n_{ij} independent normal variables, where n_{ij} is the number of surgeries performed together by surgeon pair (i,j). The raw number of surgeries is never significant and does not change the coefficient or significance of the minimum cut–seam time (any significant result here would, in any case, be of questionable validity, on account of the long upper tail of the distribution of n_{ij} over all surgeon pairs). When using the alternative transformation, the mean of the n^{th} order statistic, the results are nearly identical to the results obtained using the logarithmic transformation.

TABLE 6
Simple Regressions with Pre-Survey *Cut-Seam Time* Explaining *Relational Affect*

	Relaxed	Alert	Excited	Tense	Nervous
Average time	−0.04	−0.17	0.03	0.19	0.18
p	.72	.18	.81	.14	.14
n	103	67	103	104	73
R^2	.00	.03	.00	.02	.03
Min. time	−0.14	−0.07	0.03	**0.29**	0.07
p	.07	.40	.73	**.00**	.45
n	106	69	106	**107**	74
R^2	.03	.01	.00	**.12**	.01
Max. time	0.11	−0.02	0.01	−0.07	0.03
p	.06	.76	.91	.27	.66
n	106	69	106	107	74
R^2	.03	.00	.00	.01	.00

Author's Voice:
What is the social relevance of your research?

TABLE 7
Simple Regressions with *Relational Affect* Explaining Post-Survey *Cut-Seam Time*

	Avg. time	*p*	*n*	R^2
Relaxed	−0.07	.65	68	.00
Alert	−0.15	.35	43	.02
Excited	−0.20	.17	68	.03
Tense	**0.30**	**.03**	**71**	**.07**
Nervous	−0.18	.31	55	.02

control for surgeon dyad experience—was the survey item *relaxed*, suggesting that previous experiences of peak performance (i.e., lower minimum cut–seam time) made surgeon dyads more relaxed subsequently ($b = -0.14$, $p = .07$), while previous experiences of performance dips (i.e., higher maximum cut–seam time) made co-surgeons less relaxed subsequently ($b = 0.11$, $p = .06$). The marginal statistical significance of the coefficients for *relaxed* is consistent with the clearer effects for *tense*, since *relaxed* is almost diametrically opposite *tense* in the affective circumplex.

From Relational Affect in Surgeon Dyads to Post-Survey Surgery Performance

With respect to the performance outcomes of relational affect, tension was the only form of relational affect with a statistically significant association with subsequent cut–seam time of a dyad (Table 7). The within-dyad average of the normalized relationship effects in the *tense* survey item was positively associated with the post-survey average cut–seam time ($b = 0.30$, $p = .03$); that is, the higher the level of tension in the surgeon dyad, the lower its subsequent surgery performance.[7]

Further corroboration of the distinctive role of relational tension in the joint performance of surgeon dyads emerges from the supplemental interview data presented in Appendix C. The picture emerging from this qualitative evidence is entirely consistent with the findings from the quantitative data while offering useful insights into them. In particular, these interviews unspool the intricate associations between relational tension, relational coordination between surgeons, and their psychomotor abilities during surgery.

DISCUSSION

The results of this exploratory study suggest that peaks of performance and high activation negative relational affect—specifically, tension experienced when working with a colleague—may be more consequential for collective performance in organizations than previously understood. Of all the forms of negative relational affective responses that we considered—how nervous, tense, or lethargic surgeons felt when working with each other—we found that only *tension* predicted subsequent surgery performance. The lower the tension experienced in the dyad, the higher the subsequent performance. Likewise, in explaining the antecedents of specific forms of relational affect, we found that the past performance of a surgeon dyad explained only relational tension, and none of the other forms of relational affect. But not all forms of past performance

[7] Controlling for pre-survey cut–seam time is very challenging with these data because it further reduces sample size. For a dyad to be retained, there must be (a) at least one surgery before the survey; (b) at least one response, either from *i* to *j* or from *j* to *i*, in the relational survey item of interest; and (c) at least one surgery after the survey. In the case of *tense*, this reduces the sample size to 47. Given the reduction in sample size and statistical power, adding variables to the regressions quickly leads to loss of significance in all variables. Yet, the pattern of results is broadly consistent with the findings obtained with a larger sample (all coefficients with $p < .20$ retain the same sign; the magnitude of the coefficient for *tense* changes from $b = 0.30$ to $b = 0.22$, with $p = .13$).

mattered. Only having experienced exceptionally good performance lowered relational tension.

Two aspects of these findings are particularly striking and generative for future research. The first is the irrelevance of positive forms of relational affect (e.g., excitement) as either an outcome or an antecedent of joint performance, other than weak effects of past surgical performance for how relaxed a surgeon dyad feels subsequently. While aware of the pitfalls of interpreting null results, the lack of detectable effects of positive affect—despite the statistical power of "relaxed" and "excited" being comparable to that of "tension"—runs counter to much of the literature on the psychology of affect and its role in organizations, which often emphasizes how positive emotions aid performance (Barsade & Gibson, 2007; Barsade & Knight, 2015).

The unique role of relational tension emerging from our exploration highlights the importance of theorizing about and measuring relational affect along the entire circumplex of the affective experience. It also introduces the possibility that characteristics of tasks such as surgery may give tension an outsize role that other tasks may not. The potential for such differences requires a theory of relational affect and joint performance contingent on the type of interdependent task that a dyad carries out.

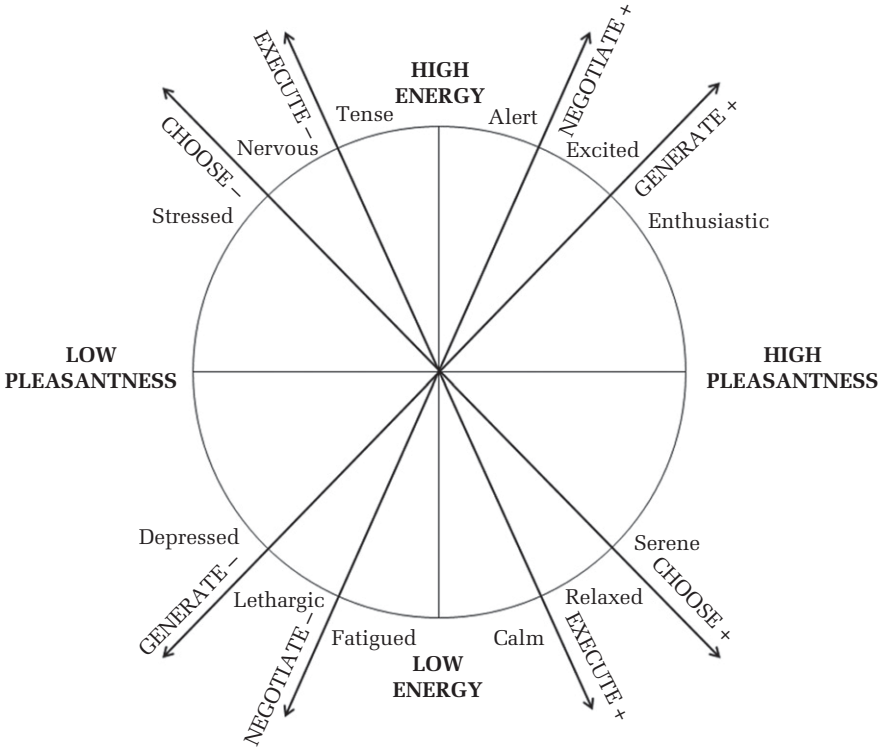
McGrath's (1984) "task taxonomy" provides guiding principles for such a contingency theory. McGrath identified two dimensions of task characteristics that define joint tasks along four quadrants: generating ideas or plans, choosing a solution, negotiating a solution to a conflict, executing a task. The surgeries we focused on entail executing psychomotor tasks that require intense coordination and accuracy to adhere to strict standards of excellence and thus prevent costly errors. Minimizing the tension that may arise from the imperative of precise, error-free execution may therefore be most conducive to excelling at these tasks, as our findings indicate. Our interviewees suggested that, in surgical practice, relational tension may interfere with performance *inter*-personally, by decreasing communication and coordination, and *intra*-personally, by inducing tentativeness and inhibiting psychomotor abilities (see Appendix C).

Other task types, however, entail demands that are likely to be best served by different forms of relational affect than tension. Namely, generating ideas and plans requires creativity and divergent thinking, which are likely to be supported by task interactions that elicit not simply pleasant positive moods, as previously documented (Amabile, Barsade, Mueller, & Staw, 2005; Fredrickson & Branigan, 2005), but especially positive affect with high activation, such as excitement and enthusiasm, as one might extrapolate from our findings; conversely, low activation negative relational affect, such as lethargy, might dampen creative output. In turn, choosing a solution in decision-making tasks requires unbiased, purposeful, and systematic information processing (Kahneman, 2011). Such deliberate, controlled reasoning can be impaired by stress (Staw et al., 1981), raising the possibility that having an interaction partner who makes one feel stressed or nervous may hamper joint performance in decision-making tasks, while relaxed or serene relational affect may be conducive to it. Finally, negotiating a solution to a conflict may be emotionally draining (Carneiro, Novais, & Neves, 2014), increasing the chance that social interactions that heighten alertness and dampen fatigue may yield higher joint performance in these tasks. Figure 4 summarizes these directions for future research.

The second notable finding from our study is that average historical surgery performance or past low points in performance do not appear to be as consequential to the relational affect that people experience when working together. A tentative explanation for these results is that peak past performance may be a proxy for self-efficacy, which may in turn be a precondition for lowered tension. Building on strong evidence that self-efficacy is a product of past performance (Sitzmann & Yeo, 2013), we have shown distinctive and previously unexplored effects of peak performance—versus just average performance—on subsequent easing of relational tension, which in turn enhances future performance. Our interviews support this argument, with surgeons specifically mentioning that having performed a surgery "in a super time" makes them feel that "yes, we both can do it very well."

This suggests that relational affect is more sensitive to joint experiences of success than failure. This is especially remarkable in a context like surgery, where error-free execution is paramount. The evidence that, even in environments that emphasize high reliability, it is the experience of outstanding performance (and not the avoidance of performance lapses) that decreases negative forms of relational affect supports the contention of positive organizational scholarship that extraordinary performance is key to people's thriving in organizations (Kelly & Cameron, 2017). It also suggests a criterion for organizing; for example, a way to improve patient outcomes in surgical practice is to over-select on surgeon dyads that, at any point in their joint history of surgical practice, have experienced at least one instance of exceptionally high performance. Future research should pinpoint the mechanisms responsible for the distinctive effects of performance peaks—versus performance averages and valleys—on subsequent relational affect.

FIGURE 4
Toward a Theory of Relational Affect and Joint Performance



As future research puts these fledgling predictions and mechanisms to the test, it must address four limitations of the current study. First, different work contexts should be investigated, using measures of performance that capture aspects of the joint execution of interdependent tasks that cut-seam time cannot measure, despite it being a preeminent measure of surgery performance. Second, future studies should strive to increase statistical power with larger samples of fine-grained relational data to test the impact of forms of relational affect that may have more subtle effects than those of tension. Third, although our measures of relational affect captured the four main quadrants of the affective circumplex, the distinctive impact of feeling tense even as compared to related emotional responses—like feeling anxious and relaxed—calls for fully capturing the nuances of the emotional experience in workplace relationships along the entire circumplex. Fourth, in the organization that we analyzed, the context that surrounds core dyads necessarily amounted to unexplained variance, but future work should measure it precisely at the group and network levels of analysis, because the performance of core dyads is not entirely independent of the larger network of relationships in which they are situated.

Although tentative and requiring deeper development, these guiding principles for theory building promise to advance scholarly and managerial understanding of the interplay of relational affect and performance, with the potential to improve the joint execution of a variety of interdependent tasks in organizations.

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Tiziana Casciaro (Tiziana.Casciaro@rotman.utoronto.ca) is a professor of organizational behavior and the Marcel Desautels Chair in Integrative Thinking at the Rotman School of Management of the University of Toronto. Her research explores how structural and psychological forces jointly shape behavior in organizations.

Miguel Sousa Lobo (Miguel.Lobo@insead.edu) is associate professor and Chair of the Decision Sciences area at INSEAD. His research interests include sequential decision-making and social network analysis methods, with interdisciplinary applications including the role of affect in intraorganizational networks.

Hendrik Wilhelm (Hendrik.Wilhelm@uni-wh.de) is the RMI Professor of Strategic Organization at Witten/Herdecke University, Germany. His research focuses on innovation, change, and learning within and across individual, team, and organizational levels in industrial and health care settings.

Michael Wittland (Michael.Wittland@hs-hannover.de) is a professor of healthcare management at the University of Applied Sciences and Arts Hannover. In his research, he mainly works on topics that help to explain how management can increase quality and efficiency in health care organizations.

APPENDIX A

MEASURING SURGICAL PERFORMANCE

In surgery, much empirical evidence supports the principle "the quicker the better." First, a longer cut–seam time increases the patient's risk of a wide range of complications—such as post-surgical deep vein thrombosis and sepsis, as well as surgical site infections (Daley et al., 2015; Kim, Hsu, De Oliveira, Saha, & Kim, 2014; Leong, Wilson, & Charlett, 2006; Procter et al., 2010; Singh, Swarer, & Resnick, 2017)—and prolonged hospital stay (Daley et al., 2015; Procter et al., 2010). This evidence results in a clear mandate in surgery to reduce cut–seam time to improve patient outcomes. Second, a shorter cut–seam time is a relevant performance indicator to surgeons, because saving surgery time allows them to operate on (and, thus, help) more patients within the same time frame (Fong, Smith, & Langerman, 2016). Third, hospitals consider a shorter cut–seam time to be an indicator of higher surgical performance because shorter surgeries improve hospital efficiency (Fong et al., 2016).

Alternative surgery performance measures, such as intraoperative patient mortality or postoperative mortality rate (e.g., Desai, 2015; KC et al., 2013), would have provided less reliable indicators of surgical performance in our setting. In the surgeries we studied, patients usually did not die (e.g., between April 1, 2015, and March 31, 2016, one patient died). Furthermore, cancer treatment usually covers a combination of surgery, chemotherapy, and radiation therapy. Therefore, postoperative mortality provides an unreliable indicator of surgery performance because it lacks a straightforward relation to the surgery dyad's behavior in our sample. Using cut–seam time as a performance indicator for the surgery types we studied was explicitly supported by the surgeons—who themselves are experienced researchers with world-class publication track records—from the department under consideration.

APPENDIX B

DATA CLEANING

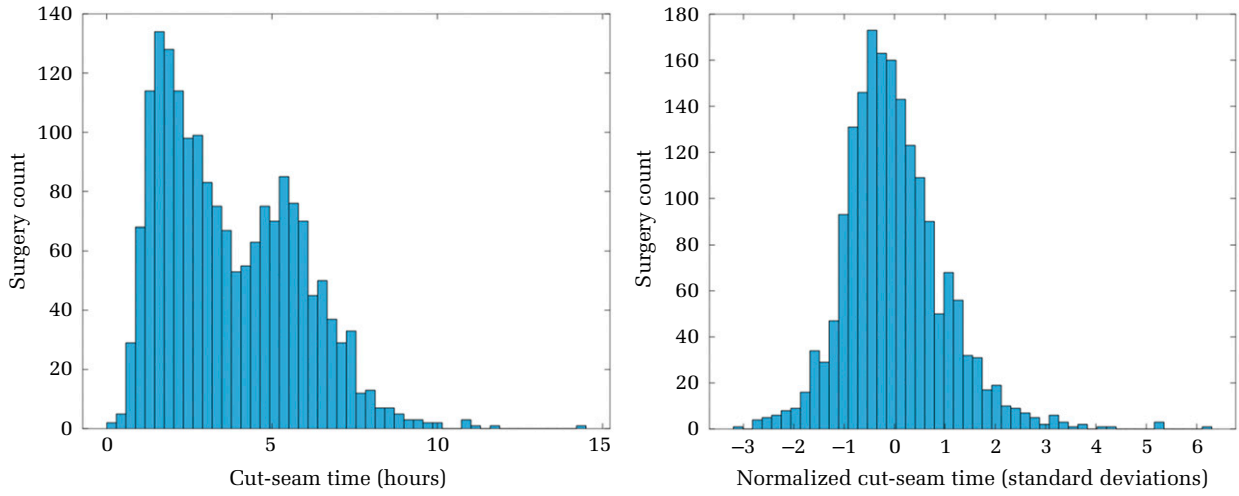
Given our commitment to running and presenting our first model, prior to any modeling work, extensive effort was expended to clean and validate the data, going back to the hospital unit as needed, including to identify and delete duplicate records and to investigate and resolve outliers.

Surgical Performance

As seen in Figure B1 (left-side plot), the distribution of cut–seam time is bimodal, on account of the different surgery types. To address heterogeneity in the data that could be problematic for least squares regression, we constructed 16 surgery categories based on the four surgery *types*, the *emergency* indicator variable, and the *additional procedures* indicator variable. Summary statistics by category are given in Table 3 in the main text of the paper, which shows that surgeries in different categories have different mean times and different variances ($p < 10^{-10}$). We then normalized the cut–seam time within each category, discarding the surgeries in the categories with a small sample size. Figure B1 shows the histogram of cut–seam time before and after the normalization.

The alternative approach to addressing surgery heterogeneity with control variables for surgery type, emergency status, and additional procedure is not feasible, because the average, minimum,

FIGURE B1
Distribution of Raw and Normalized *Cut-Seam Time*



and maximum cut–seam time we used in our models cannot be identified without first normalizing cut–seam time to make it comparable across different surgery types.

Figure B2 shows the evolution of the normalized cut–seam time as the number of surgeries performed by a surgeon dyad increases, averaged over all surgeon pairs with a sufficiently long history of joint surgeries. The left-side plot is the average cut–seam time over all dyads with a history of 10 or more surgeries (n = 42). The right-side plot is the average cut–seam time over all dyads with a history of five or more surgeries (n = 68). Despite the small sample size and consequently noisy measurement, the improvement of surgeon dyad performance with experience is consistent with the literature (Xu et al., 2013), further validating our use of the normalized cut–seam time as a proxy for surgery performance.

Relational Affect

We needed to account for differences in the variance of responses across individuals in our sample. Consistent with research on interpersonal ratings (Casciaro & Lobo, 2008; Kenny, 1994), the survey

FIGURE B2
Average *Cut-Seam Time* over Successive Surgeries by Surgeon Dyad

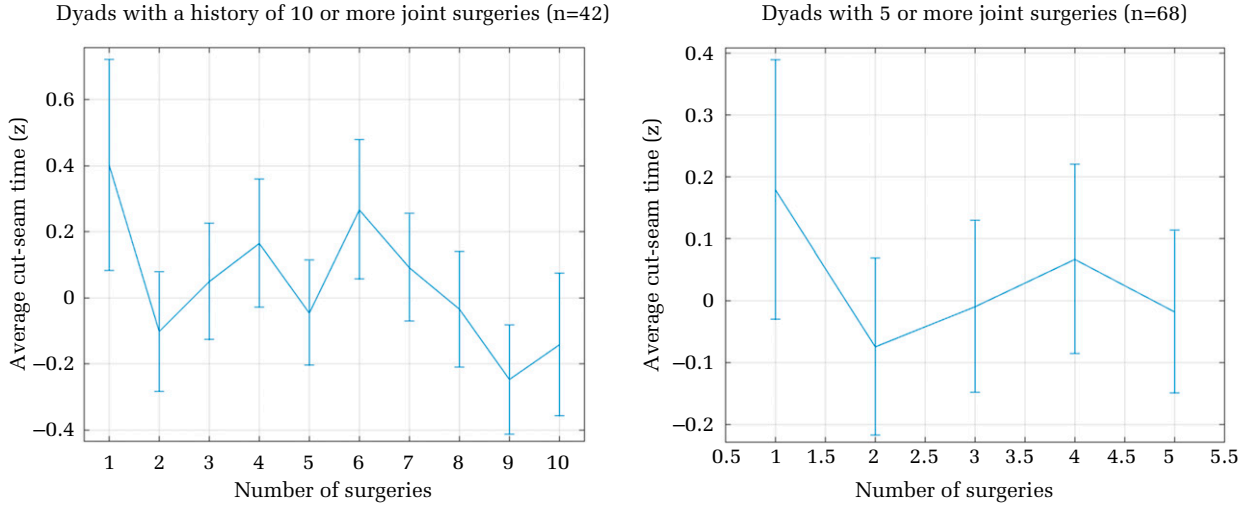
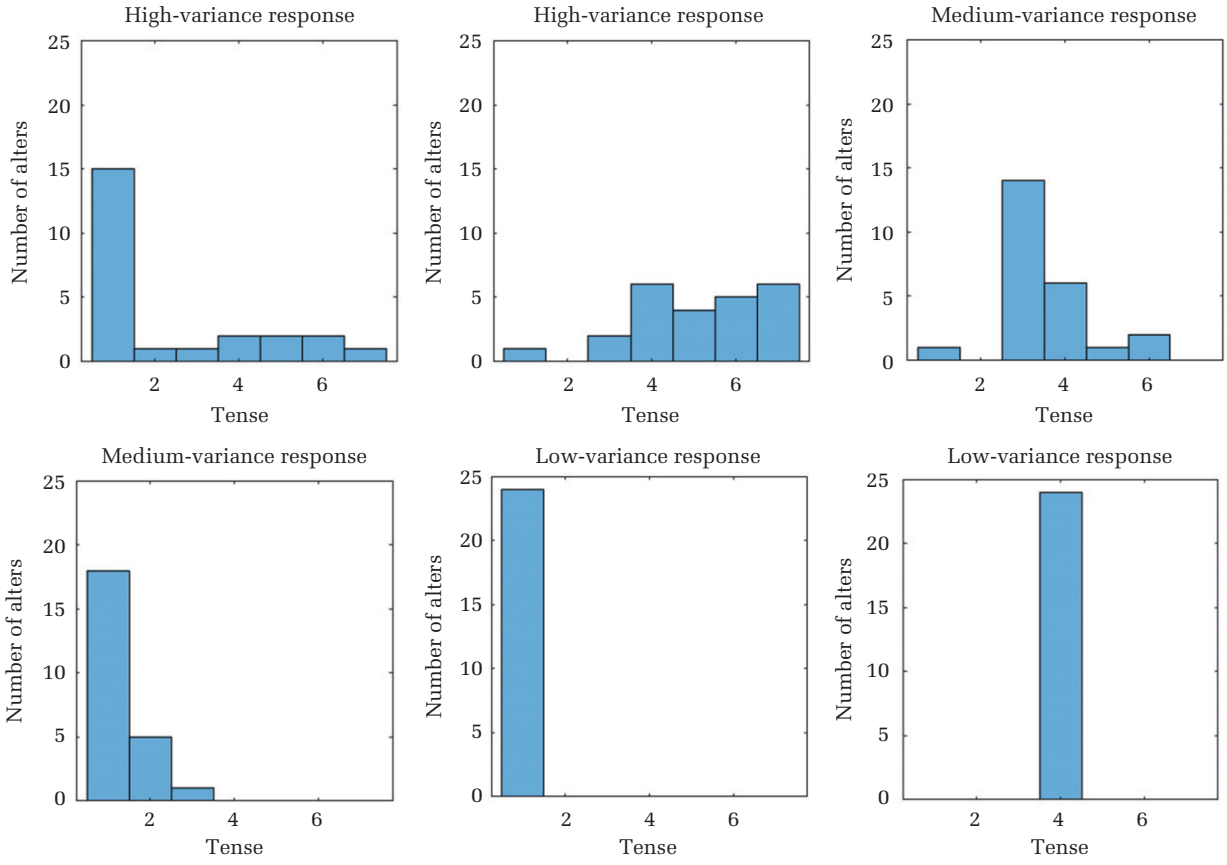


FIGURE B3
Illustrative Raw Responses by Six Respondents on Item "Tense"



Note: Each plot illustrates all the responses of an ego concerning 24 alters. Starting from the upper-left plot, the first two are sets of high variance responses, one medium variance, one low variance, and two with zero variance.

responses in our study offer clear evidence that different respondents use the response scale differently, in mean as well as in range and variance. For the same item, some respondents use the scale, say, from 6 to 7 and others from 2 to 6. To give a sense of the magnitude and nature of these differences, Figure B3 shows, for the relational survey item *tense*, the distribution for six selected respondents.

The standard deviation in responses ranges from 0 to 2, and, even after discarding the zero variance responses, any number of simple tests show that there is significant heteroscedasticity in the responses ($p < .0001$). This heterogeneity in how the response scale is used, and the associated heteroscedasticity in the data, would require a very complex and non-standard hierarchical model, but, given the modest sample size and our desire to avoid false positive results, we account for this issue by normalizing the responses from each surgeon to have zero mean and unit variance. This increases comparability across respondents and eliminates this significant source of heteroscedasticity that would invalidate the results if not controlled for.

APPENDIX C

SUPPLEMENTAL DATA COLLECTION AND EXPLORATION

The emergence of tension as the single critical form of relational affect in surgical performance prompted us to collect additional data to further explore this phenomenon and shed light on our findings. To that end, we returned to the hospital and conducted interviews with 12 surgeons. Our goal with the interviews was to either validate or challenge the unique role of tension in the performance of surgeon dyads, better understand how tension emerges between surgeons operating together, and consider potential alternative explanations. The picture emerging from the interviews is entirely consistent with the

findings from the quantitative data while offering useful insights into them. In particular, the interviews unspool the intricate associations between relational tension, relational coordination between surgeons, and their performance during surgery.

In response to an initial open-ended question on which emotions came to mind when reflecting on the experience of operating with a specific co-surgeon, positively and negatively valenced affect—such as like and dislike, and pleasantness and unpleasantness—received a few mentions, as in this quote:

> It can be joy—where you say [to yourself] "I am operating with him now!" It can be an inner dislike—where you say [to yourself] "Oh, you have to operate with him now." And, essentially, these two emotions. "Wow, pleasant surgery, this will be fun." Or, "Oh, okay, again together with this one."

Tension, however, was the form of relational affect that interviewees singled out without our prompting. In the words of three surgeons:

> Tension—for sure—is something that you feel. It always depends on whom you are working with and what the relationship between individuals is like.
>
> Tension. No fear, but tension.
>
> I do believe that I feel tenser—in a very basic way—with different people. Then you automatically act differently.

Another surgeon also mentioned tension as the emotion most likely to be triggered by a co-surgeon, and further elaborated on what caused him to experience tension:

> For example, "tense." When operating with my boss, then I do feel a little tenser. This certainly also relates to my character, in a way. I feel less tense when operating with a doctor at my level or with the younger [colleagues].

In response to a question on what leads these emotions to surface, the interviewees repeatedly pointed to how expectations about and reactions to how a surgical procedure unfolds affect the tension level with a co-surgeon:

> One of them wants you to hold the suction device in one way. Another one wants you to hold it another way. Another one wants a lot of suction, yet another wants little. And, if you do it a little wrong, then one guy freaks out. Then you will say—okay, I am a bit tense, and a tad more reserved.
>
> And, of course, if you have operated with someone together, you probably have a prejudice about how [they] will behave in the next operation.
>
> In the end, these feelings come from the past, from existing interactions, where you know that there are certain patterns of behavior, where you have to be a little more careful so that the other does not get upset in any way.
>
> For me, this usually has to do with surgical procedures; of course, emotions become more obvious when you have stress in the operating theatre because something doesn't work as you want it to. It is clear that it then acquires a different meaning than when everything simply happens. Or, if you are under time pressure, then you certainly perceive it more.

The flip side also came through in the interviews, where the experience of a particularly high level of surgical performance changes subsequent relational affect and self-efficacy for the better, as alluded to in these quotes:

> […] so, when I do an operation with a colleague in a super time, it's of course the case that, from a surgical point of view, you say, "Yes, we both can do it very well."
>
> If you operate and the operation works well in the end, the result is good that it works as you imagined it; a really good operation ensures that you had a positive experience with the other. This can then be transferred to the next operation.

These quotes corroborate the quantitative findings about the unique importance of having experienced peak performance for loosening the tension subsequently experienced with a co-surgeon. Also consistent with our quantitative analyses, one surgeon phrased this experience in terms of feeling relaxed:

> If it was very nice the last time, I think you go in a bit more relaxed, you think it will be nice again.

Two themes emerge clearly from the interviewees. First, the surgeons singled out tension as the form of relational affect most relevant to their relationship with a co-surgeon, for better or worse. By contrast, other forms of relational affect were rarely mentioned, if ever, with the one exception of "relaxed." Second, the surgeons identified the origin of feeling tension in the surgeries themselves. How surgeries unfolded in the past and how co-surgeons reacted to the events in the operating room were the only sources of relational tension, or lack thereof, that the surgeons mentioned. By contrast, surgeons never raised events or factors outside of the operating room as sources of tension with their colleagues during surgery. This validates our focus on past performance as the key antecedent of relational affect in this context.

In elaborating on the consequences of these emotions for the working relationship with a co-surgeon, the interviewees shed light on our finding that increased tension is associated with lower surgical performance, as these quotes illustrate:

> Tension, nervousness definitely affects surgery. For example, with regard to how you communicate during surgery. That you eventually restrain yourself because you are afraid of getting negative attention or that you further increase the tension during surgery or that you distract the [other] surgeon.

> [Tension] makes me more cautious about my own activities, so that I do not do things I would do spontaneously; for example, certain movements or activities. I don't do it because I don't want the decision to be misunderstood or because the other person thinks that they are doing things on their own that they do not want me to do.

These surgeons thus see tension affecting surgical performance by changing how surgeons communicate with one another, and by becoming less forthcoming and more withdrawn and reserved. In these accounts of the effects of relational affect on the work with co-surgeons, *calm* was also mentioned as the opposite of *tension*, as in this quote:

> If you have a sense of well-being, you are calmer and can operate more composedly. And maybe better in the end. If you feel tense, you react more fidgety in critical situations.

After asking open-ended questions that allowed surgeons to focus on specific forms of affect unprompted, we listed specific affective responses—nervous, tense, alert, excited, and relaxed—to probe the possibility that forms of relational affect other than tension might be important, too, although they may not come to the surgeons' mind without specific prompting. That was not the case, and responses to this specific question still led most to focus on tension. This quote is representative:

> Tenseness and nervousness, as I said before, can lead to you holding back a little and perhaps not communicating as well as you should during an operation.

An affective state that received commentary was "alert," which one surgeon characterized as essentially invariant because it is indispensable in the operating room:

> I personally feel alert, [but] it should also not depend on a person [you operate with]. You have to be alert per se, and I'm trying to. I'm most likely to feel tense. I feel more or less tense. Not nervous.

Finally, we asked surgeons specifically about tension and their perspective on why it emerged from the quantitative data as the primary correlate of surgical performance. Several interviewees provided insights:

> When you are tense, you are more restrained when it comes to communication; you ask fewer questions, for example, or you have less technical and factual conversations in the operating theatre on the subject. I become a little quieter myself.

> That is also in the term "tension." I am tense, so, in some way, I feel anxious, I am afraid, and, in a certain way, that leads to a motoric inability to calm down a little. Okay, I am more careful now and have a feeling of uncertainty.

> Maybe it is part of the fact that you talk less.

> You make sure, before you do something, whether it should be like this. But you also become more cautious and ponderous and then again mistakes tend to multiply. It creates uncertainty. At least that is how I function.

> If you have someone with whom you feel tension, you let them do less during the operation, you let them participate less practically in the operation, you could say that. About several parts of the operation itself. You do fewer handovers.

> It is non-verbal communication. You do not hand the thread over to the person, no instruments that are relevant for operating, and you communicate less.

In these accounts, increased tension affects subsequent performance through both interpersonal mechanisms, including decreased communication and task delegation, and intrapersonal mechanisms, including greater psychomotor inhibition.