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The liking gap in groups and teams☆,☆☆

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ABSTRACT

Every relationship begins with a conversation. Past research suggests that after initial conversations, there exists a *liking gap*: people underestimate how much their partners like them. We extend this finding by providing evidence that it arises in conversations among small groups (Study 1), continues to exist in engineering teams working on a project together (Study 2), and is linked to important consequences for teams' ability to work together in a sample of working adults (Study 3). Additional evidence suggests that the liking gap is largest for peer relationships and that it is determined in part by the extent to which people focus on negative aspects of the impressions they make on others. Group conversations and team interactions often leave people feeling uncertain about where they stand with others, but our studies suggest that people are liked more than they know.

1. Introduction

Many of the most important moments in people's lives revolve around the first conversations they have with each other. Nailing an interview might land you a dream job. Making a good first impression is the difference between making an acquaintance and making a friend. Finding common ground can turn a loose collection of people into a highly motivated team. Despite the fact that people will have many conversations like these over the course of their lives, initial conversations are often a source of anxiety, as people wonder and worry about the impressions they leave on others.

1.1. Early interactions shape relationships

People have good reason to be concerned. Since the earliest days of research on social perception, it has been clear that people's impressions of others form rapidly and, once formed, those impressions endure (Allport & Vernon, 1933). Indeed, within seconds of striking up a conversation, people have already gleaned from the faces of their conversation partners their kindness and competence (Todorov, Olivola, Dotsch, & Mende-Siedlecki, 2015), which in turn, can affect everything from attributions of legal responsibility to snap judgments of whether that person would make a good CEO (Berry & Zebrowitz-McArthur, 1988; Livingston & Pearce, 2009). People extract a similar wealth of information from their conversation partner's voice (Giles, Scherer, & Taylor, 1979). For example, people deduce a person's social class from their pronunciation (Labov, 2006), their personality from their use of emotion words (Berry, Pennebaker, Mueller, & Hiller, 1997) and their social status from prosodic features of speech (Gregory & Webster, 1996). Give people even more time to talk, and they will size up their conversation partners on important social dimensions, like how much they self-disclose and gossip (Collins & Miller, 1994; Dunbar, 1996). This, along with unconscious affiliative behaviors such as the tendency to mimic each other, is what determines whether conversation partners "click" and establish a rapport (Bernieri & Rosenthal, 1991; Bargh & Chartrand, 1999; Tickle-Degnen & Rosenthal, 1990). In short, by the end of the first conversation, people have already formed rich impressions of one another.

Those first impressions are not fleeting; rather, they set the tone for the rest of the relationship. Indeed, impressions formed in a brief initial interaction predict the quality of that relationship much later (Back, Schmukle, & Egloff, 2010; Berg, 1984; Hays, 1984, 1985; Human, Sandstrom, Biesanz, & Dunn, 2012; Selfhout, Denissen, Branje, & Meeus, 2009; Sunnafrank & Ramirez, 2004; Zerubavel, Hoffman, Reich,

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Ochsner, & Bearman, 2018). First impressions not only *correlate* with subsequent judgments (Ambady & Rosenthal, 1992) but may also *cause* them by setting expectations for future behavior that are self-fulfilling (Jones, 1990). For example, attractive people are more social because others expect them to be (Snyder, Tanke, & Berscheid, 1977); students who are treated as if they are on the cusp of an intellectual breakthrough can rise to the occasion (Jussim & Harber, 2005); and when members of stereotyped groups are expected to act out stereotyped behavior, they tend to follow the script (Nguyen & Ryan, 2008).

Given how quickly people form impressions that shape their future interactions, it is no surprise that early conversations have important implications for organizations and people's work lives. Indeed, early positive interactions with coworkers and supervisors predict subsequent job performance (Chen & Klimosk, 2003; Wayne & Liden, 1995). In salary negotiations, the interpersonal aspects of the interaction (e.g., how much the new hire felt the negotiation "built a good foundation for a future relationship") predict job satisfaction a year later, while the purely economic aspects (e.g., how much additional compensation was extracted in the negotiation) do not (Curhan, Elfenbein, & Kilduff, 2009). Moreover, two meta-analyses suggest that the expectations formed in early interactions not only predict later performance but cause it as well, as employees behave in line with the assumptions managers make about them (Kierein & Gold, 2000; McNatt, 2000).

In short, impressions form rapidly in early conversations and set expectations that shape people's future interactions. As such, initial interactions provide something of a template for the rest of a relationship, establishing interpersonal norms, identifying areas of common ground—or lack thereof—and orienting everyone involved to how they will interact in the future. Given all this, it makes sense that people are eagerly gathering information about their conversation partners in early encounters, and that people are anxious about the impressions that result.

1.2. First impressions and meta-perceptions

As people sift thought all the information that early conversations provide, the first and most obvious thing they are doing is trying to form an impression of their conversation partner—is this person a friend or foe, altruistic or selfish, hardworking or lazy? But importantly, these perceptions are not a one-way street: people also get information about how *others* feel about *them*. These so-called "meta-perceptions" are another important piece of information that people extract from early conversations—do *others* think that *I'm* a friend or foe, altruistic or selfish, hardworking or lazy (Carlson & Kenny, 2012; Carlson, Vazire, & Furr, 2011; Kenny & DePaulo, 1993; Levesque, 1997)? In short, while a person is deciding whether they like someone else, they may also be wondering, "does this person like *me*?"

Both judgments are important, but they are fundamentally different. Whereas perceptions of others feel effortless, knowable, and certain, meta-perceptions are more effortful, unknowable, and less certain. It's easy to judge whether you find someone boring; the answer seems to come to you instantly. Your answer is also indisputable, as your subjective experience is the final say on the matter. In contrast, how do you know if someone else finds *you* boring? Suddenly you must do some interpersonal sleuthing: are they yawning as you talk? Breaking eye contact? Trying to change the subject? What if they are trying to leave not because they find you boring, but because they have to run to a meeting? This perceptual detective work is both cognitively taxing and susceptible to bias (Gilbert, Pelham, & Krull, 1988; Ross, 1977; Mastroianni, Gilbert, Cooney, & Wilson, 2020).

Forming accurate meta-perceptions would be easier if people provided each other unambiguous feedback, but the norms of conversation often prevent that from happening. People often hide their true feelings in conversations out of politeness ("I just don't have the heart to tell this guy his story is boring") (Brown & Levinson, 1987; Cooney, Gilbert, & Wilson, 2018; Swann, Stein-Seroussi, & McNulty, 1992; Tesser, Rosen, & Batchelor, 1972), self-protection ("this story is really interesting, but if I say so, I might come off as desperate") (Beck & Clark, 2010), or the simple hope that the current conversation will continue smoothly ("maybe this story will get better if I let him keep talking") (Schegloff, Jefferson, & Sacks, 1977). Finally, people may not merely obfuscate their feelings in conversations but actively misrepresent them in attempts to ingratiate (Gordon, 1996), or even to manipulate (Geis & Christie, 2013) their partners.

Overall, the dynamics of conversation make it hard for people to know what others truly think of them, and as a result people's post-conversation thoughts are often marked by uncertainty ("Did she think I was boring?" "Did I talk too much?" "Was that joke off-color?"). Ultimately, this uncertainty opens up the possibility that people will make systematic mistakes when trying to imagine what others think of them.

1.3. The liking gap after initial conversations

Despite these challenges, meta-perceptions do tend to be correlated with reality, though they are still far from perfect (Carlson & Kenny, 2012; Funder, 1980; Kenny & DePaulo, 1993), and initial conversations might be a particularly challenging environment in which to gather accurate data. Making the task even more difficult, people's thoughts tend to be disproportionally self-focused and negative after social interactions (Brozovich & Heimberg, 2008; Nilly & Winquist, 2002; Savitsky, Epley, & Gilovich, 2001; Savitsky & Gilovich, 2003). One important result is a phenomenon called the *liking gap*: after initial dyadic conversations, people systematically underestimate how much their conversation partner likes them (Boothby, Cooney, Sandstrom, & Clark, 2018). Thus, it seems that people often walk away from their first conversations with a negative bias about the impression that they've made and how much their conversation partner enjoyed their company.

Could the liking gap also arise in group conversations, such as those among team members at work? So far, it has only been studied in dyadic conversations; however, the addition of another person fundamentally changes the structure and experience of a conversation (Cooney, Mastroianni, Abi-Esber, & Wood Brooks, 2020). For example, it is possible that group conversations create a shared sense of group identity that buoys self-esteem (Bergami & Bagozzi, 2000; Ellemers, Kortekaas, & Ouwerkerk, 1999) and prevents the liking gap from arising. Research also suggests that people disclose less in groups (Solano & Dunnam, 1985; Taylor, de Soto, & Lieb, 1979), and less self-disclosure might mean less uncertainty about having crossed the line ("Did I share too much?"). On the other hand, since individuals in group conversations must divide a finite amount of speaking time between them, perhaps group conversations also give each individual more non-speaking time in which negative thoughts about the self can arise. Group conversations may also involve greater interpersonal stakes, which could give rise to the negative self-focus that in turn drives the liking gap (Boothby et al., 2018). Lastly, in group conversations, people still have more access to negative thoughts about themselves ("I didn't tell that joke the way I meant to") than about their conversation partners, which is one of the proposed mechanisms underlying the liking gap (Boothby et al., 2018). Altogether, while the existing evidence suggests that the liking gap could arise in groups, it is not clear that it would.

Furthermore, if the liking gap does exist in groups, to what extent might it persist over time as groups continue to interact? Previous research found that the liking gap continued to exist between college roommates for the majority of the school year, but diminished in the final months (Boothby et al., 2018), which is consistent with research finding that meta-perceptions become more accurate over time (Carlson & Kenny, 2012). Work teams themselves often collaborate for prolonged and concentrated periods of time, providing ample opportunity for the liking gap to shrink. Moreover, many organizations provide formal opportunities for superiors, subordinates, and peers to evaluate each other, reflect on their work together, and discuss issues and their solutions.

These structured conversations may help defuse the misperceptions underlying the liking gap.

In sum, the current research is motivated by three unanswered questions regarding the liking gap. First, does the liking gap arise in group conversations? If so, does it persist in teams as members continue working together? Lastly, could the liking gap have consequences for how well teams function?

1.4. A note on metaperceptual "accuracy"

As we answer these questions, it is important to note that there are two ways of conceptualizing the accuracy of meta-perceptions. Imagine Emily is trying to estimate how much Rory, Lorelai, and Trix like her. First, one could ask whether Emily over- or underestimates how much she is liked overall: is the mean level of how much Emily *thinks* others like her different from the mean level of how much others *actually* like her? This has been referred to as *mean-level bias* (Fletcher & Kerr, 2010). On the other hand, one could set aside the question of whether Emily over- or underestimates how much people like her overall, and ask whether Emily knows who likes her the most, middle, and least. This has been referred to as *tracking accuracy* (Fletcher & Kerr, 2010). Importantly, these two types of accuracy can be orthogonal. For example, Emily may correctly perceive that Rory likes her the most, followed by Lorelai and then Trix, but she may simultaneously underestimate how much all three of them like her.

While both types of accuracy are important, the liking gap is an example of a mean-level bias, and so that will be our primary focus. In this way, our work expands on previous organizational research on meta-perception, which has generally focused on tracking accuracy and not mean-level bias (e.g. Adie & Jowett, 2010; Eisenkraft, Elfenbein, & Kopelman, 2017; Elfenbein, Eisenkraft, & Waverly, 2009; Hu, Kaplan, Wei, & Vega, 2014; Malloy & Janowski, 1992; Oltmanns, Gleason, Klonsky, & Turkheimer, 2005). Moreover, the research that has explored both mean level bias and tracking accuracy has focused on people's perceptions of status, not liking (e.g., (Anderson, Srivastava, Beer, Spataro, & Chatman, 2006)). Our analytical approach utilizes the truth and bias model (West & Kenny, 2011) as a complement to our primary analyses, as it allows us to simultaneously investigate tracking accuracy and mean-level bias.

1.5. The liking gap in groups and teams

The current research is of practical importance, because if the liking gap exists in group conversations and persists thereafter, it may have a significant impact on several important organizational outcomes: how relationships form, how teams perform, and how employees feel about their job and their workplace.

First, the liking gap may slow or prevent friendships from forming, which would be unfortunate since having friends at work leads to higher job satisfaction and lower turnover (Feeley, Hwang, & Barnett, 2008; Morrison, 2004, 2007, 2008; Riordan & Griffeth, 1995; Winstead, Derlega, Montgomery, & Pilkington, 1995). Research also suggests that people who are friends work better together; a meta-analysis of 26 studies found that groups of friends outperform groups of nonfriends on a wide variety of tasks, including problem solving and idea generation (Chung, Lount, Park, & Park, 2018). If people underestimate how much their colleagues like them, it may delay or dampen the development of friendships, and thus the interpersonal and organizational benefits that friendship affords.

The liking gap may also hamper team performance. Past research has shown that teams often fail to reach their potential in two ways: they may fail to optimally combine the contributions of individual members (*coordination loss*), and individuals may work less hard together than they would alone (*motivation loss*) (Kravitz & Martin, 1986; Latané, Williams, & Harkins, 1979; Shepperd, 1993; Steiner, 1972; Wittenbaum, Vaughan, & Stasser, 1998). If team members underestimate how positively they feel toward each other, it could contribute to both of these types of productivity loss. Team members who suffer from the liking gap may not coordinate as well (e.g., "I'm not sure our relationship is close enough for me to ask for advice"), and they may be less motivated (e.g., "I don't want to put in extra hours if my team doesn't value me"). Our studies begin to explore these possible links between meta-perception and team performance.

Finally, the liking gap may even sap the fundamental positivity of workplace relationships, which other research has shown predicts a host of positive organizational outcomes, including satisfaction and performance (Basford & Offermann, 2012; Everly & Falcione, 1976; Reich & Hershcovis, 2010; Robinson, Roth, & Brown, 1993; Van Der & Bunderson, 2011). Moreover, job embeddedness and "fit"—which captures aspects of relationship quality with other people at an organization—also predict satisfaction and performance (Felps et al., 2009; Kristof-Brown, Zimmerman, & Johnson, 2005; Mitchell, Holtom, Lee, Sablynski, & Erez, 2001). Naturally, positive relationships also go hand-in-hand with feeling supported, and two meta-analyses have found that perceived support from coworkers and supervisors is strongly linked to satisfaction, commitment, turnover, and performance (Chiaburu & Harrison, 2008; Ng & Sorensen, 2008). Positive workplace relationships even boost cardiovascular health and immune and endocrine functioning (Heaphy & Dutton, 2008). Simply put, people who like each other work better together and have a better time doing it. Unsurprisingly, then, managers strongly desire positive relationships between their employees and take active steps to promote them (Berman, West, & Richter, 2002), but the liking gap may hinder these efforts.

1.6. The present research

Considered together, this evidence suggests that negatively-biased meta-perceptions tend to arise in initial interactions, which may have an important impact on how relationships develop. Our goal was to study how these processes affect groups. Specifically, we investigated whether people would systematically underestimate how much others like them after group conversations and among teams. If those biased perceptions were to persist, we would expect that they would rob group members of the benefits that positive group relationships confer.

Accordingly, in Study 1 we investigated whether the liking gap existed following group conversations in a controlled laboratory environment. In Study 2, we explored whether the liking gap persisted in teams of engineers working together on group projects. Lastly, in Study 3 we surveyed work teams to see whether the liking gap persisted in real-world work environments, and to investigate what consequences this might have for relationship formation, team communication, and job satisfaction. Across these studies, we also explored whether the liking gap changes as relationships develop, whether it varied depending on people's relative status within their teams, and finally, whether the liking gap is in part determined by people disproportionately focusing on negative aspects of the impressions they make on others.

2. STUDY 1: Group conversations

We recruited people to have a conversation in groups of three. Following that conversation, we asked people how much they liked each of their conversation partners, and how much they believed each of their conversation partners liked them.

2.1. Method

2.1.1. Participants

One hundred and fifty-nine participants (93 female, 65 male, 1 other, M_{age} = 21.18 years, 40% White, 24% Asian, 13% multiracial, 11% Hispanic, 11% Black, 1% other) were recruited from the participant pools at the Harvard Department of Psychology and Harvard Decision Science Lab and compensated with either $15 or one unit of course

credit.

Our sample size was determined a priori based on two considerations. First, a power analysis indicated that we would need approximately 75 participants to obtain 99% power to detect the liking gap if it were similar in size to previous findings in dyads. However, we reasoned that the liking gap could be smaller in groups, and so we doubled our target sample and planned to recruit at least 150 participants. Second, we also determined beforehand that the study would run for two semesters, and we would collect additional participants beyond 150 if time permitted. These stopping rules were set before data collection, and no sample size decisions were based on analyzing the data during collection. We ultimately succeeded in recruiting 159 participants.

2.1.2. Procedure

All participants completed the study in groups of three. Participants were seated around a table in a private room. They were instructed to put away any cellphones for the duration of the study, and to remove any watches. They were then asked to write their first name on a name tag and put it on. The experimenter informed them that their conversation would be audio recorded, and that they could request that the experimenter stop or delete this recording at any time. In order to make sure that the recorder was picking up their voices, participants then read aloud a random six-digit string from a sheet of paper. The experimenter then read aloud the following instructions:

> "Now, please talk about whatever you like, for as little time or as much time as you like, as long as it is more than one minute and less than 45 min. We have additional tasks for you to complete if there is time left afterward, so you will participate for the full hour regardless of how long you choose to talk in the first part of the study. Whenever you're ready to move on to the next part of the study, please come get me. I'll be down the hall. Thanks!"

The experimenter then left the room and the conversation began. Participants proceeded to talk for as long as they wanted. If participants chose to end their conversation, they opened the door to inform the experimenter; if participants talked for the entire 45 mins, the experimenter returned to tell participants time was up. In either case, the experimenter led participants to separate rooms to complete the next part of the study.

Participants then answered a series of questions at their individual computers. First, they were shown the names of their conversation partners and asked whether they remembered which name belonged to each person. They then reported how much they enjoyed the conversation and how much they thought each of their partners enjoyed the conversation using 7-point Likert scales with endpoints *not very much* and *very much*.

Then participants answered our primary dependent measures: how much they liked each of their partners, and how much they thought each of their partners liked them. Participants used 7-point Likert scales with endpoints *not very much* and *very much* to answer the following questions: "How much do you like [name of partner 1]?", "How much do you like [name of partner 2]?", "How much do you think [name of partner 1] likes you?", "How much do you think [name of partner 2] likes you?", "How much do you think [name of partner 1] likes [name of partner 2]?", and "How much do you think [name of partner 2] likes [name of partner 1]?"

The questionnaire then continued on to other measures that were taken for a separate study (see Appendix). Finally, participants completed demographics, were thanked for their participation, compensated, debriefed, and dismissed.

2.2. Results

All data and code necessary to reproduce all analyses are available at https://osf.io/ndu3h/files/.

2.2.1. Exclusions

No participants were excluded from analyses.

2.2.2. Conversation duration

On average, conversations lasted 34.74 mins ($SD = 13.76$). Note that while participants talked for different amounts of time, conversation length did not interact with the liking gap analysis below, $b = 0.0009$, 95% CI = [−0.008, 0.009], $t(475) = 0.20$, $p = .84$.

2.2.3. Liking gap

Did participants accurately estimate how much their conversation partners liked them? To find out, we compared participants' ratings of how much they liked each of their conversation partners to their ratings of how much they thought each of their partners liked them. To make this comparison, we used a linear mixed effects model that included rating type (actual or perceived) as an independent variable and liking as the dependent variable. In order to account for the structure of the data, we entered rating type as a fixed effect and included random intercepts for participant ID nested within group ID (including random slopes or random intercepts for the target of each rating caused issues with model convergence, so for this and all subsequent models we omitted these terms). We fit the model using the lme4 package in R (Bates, Mächler, Bolker, & Walker, 2014); significance tests were derived using the lmerTest package (Kuznetsova, Brockhoff, & Christensen, 2017).

The analysis revealed a significant effect of rating type on liking, $b = -0.54$, 95% CI = [−0.66, −0.43], $t(476) = -9.22$, $p < .001$. In other words, participants liked their conversation partners more than they believed their partners liked them (actual: $M = 5.32$, 95% CI = [5.12, 5.53]; perceived: $M = 4.78$, 95% CI = [4.58, 4.98]). It is worth noting that this liking gap is a mistaken belief since, on average, everyone cannot like their conversation partners more than their conversation partners like them. In short, as shown in Fig. 1, people underestimated how much their conversation partners liked them after a group conversation.

Using an analogous model to the one described above, further analysis revealed that participants also estimated that their partners liked them less than their partners liked each other, $b = -0.36$, 95% CI = [−0.48, −0.25], $t(476) = -6.42$, $p < .001$. So not only did people underestimate how much their conversation partners liked them, they also perceived that the other two people in the conversation liked each other more. In other words, participants mistakenly thought they were the

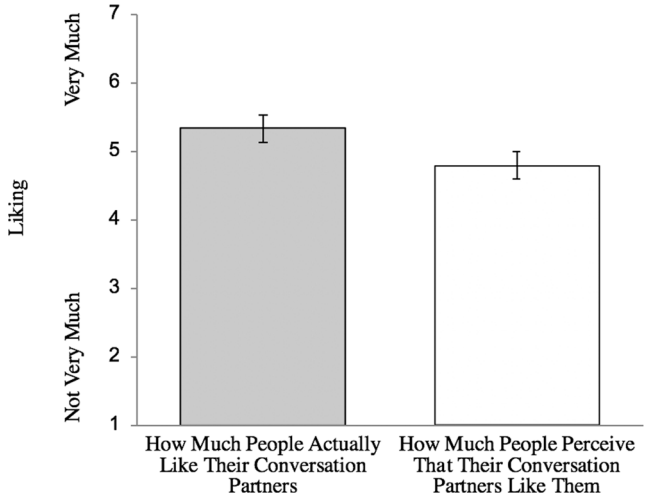

Fig. 1. Results of Study 1: mean ratings of how much people like their conversation partners, and how much people think their conversation partners like them, following a three-person conversation. Error bars show 95% confidence intervals.

least liked person in the conversation.

2.2.4. Enjoyment

Participants also reported enjoying the conversation significantly more than they thought their partners did, b = -0.18, 95% CI = [−0.31, −0.05], $t(317) = -2.77$, $p = .006$.

2.2.5. Truth and bias model

The above analyses provide evidence for one type of inaccuracy, a *mean level bias*: participants underestimated how much they were liked. As noted before, there is another form of accuracy: tracking accuracy. Even though participants underestimated how much group members liked them *on average*, to what extent were participants able to discern which group members liked them more and which group members liked them less? The truth and bias model (West & Kenny, 2011) allows us to answer this question.

The truth and bias model analyzes the extent to which a judgment of some value is related to the true value and to some biasing variable (West & Kenny, 2011). In this case, the judgment is how much participants thought their conversation partners liked them (meta--perceptions), and the truth is how much participants were actually liked by their partners. In a typical truth and bias model, the "biasing variable" is how much participants reported liking their partners. To avoid confusion between this form of bias and the mean-level bias that is the liking gap, we refer to this final variable as *self-projection.* It is important to consider self-projection in this type of model because when people estimate how much their partners like them, they may base their judgments on how much they like their partners.

Following West and Kenny's (2011) protocol, we first centered our variables (i.e., meta-perception, truth, and self-projection) on the mean of truth. We then entered these variables into a mixed linear effects model with participants' meta-perceptions as the outcome, and truth and self-projection as predictors. We also included a random intercept for each participant.

In a truth and bias analysis, the intercept is equivalent to the mean-level bias. The model indicated a significant intercept, $b = -0.54$, 95% CI = [−0.65, −0.44], $t(148) = -9.89$, $p < .001$; note that this is equivalent to the size of the liking gap reported in the main analysis above. The model also indicated a significant coefficient for truth, b = 0.12, 95% CI = [0.05, 0.19], $t(270) = 3.57$, $p < .001$. Together, these two results confirm that people underestimate how much their fellow group members like them (the liking gap), but also show that people display some amount of tracking accuracy in knowing who among their group members liked them more and who liked them less. Furthermore, the analysis also indicated a significant effect of self-projection, b = 0.55, 95% CI = [0.47, 0.63], $t(315) = 14.64$, $p < .001$. This suggests that people may use their own opinion of how much they like others to estimate how much they think others like them.

In sum, this analysis helps illuminate the accuracy and bias in participants' meta-perceptions. When participants estimated how much their partners liked them, their judgments were indeed significantly related to how much those partners actually liked them, demonstrating a modest amount of *tracking accuracy*. Moreover, participants' meta-perceptions were strongly related to how much they reported liking their partners, suggesting that participants may have used how much they liked others to form their estimates of how much others liked them. Finally, these two effects operated against the backdrop of a third effect, a significant *mean-level bias*—participants underestimated how much their partners liked them.

2.3. Discussion

These findings extend the liking gap from dyadic conversation to group conversation in important ways. Most fundamentally, we found that following an initial group conversation, people consistently underestimated how much their conversation partners liked them. Additionally, people thought their partners liked them less than they liked each other—as if their partners were forging a positive bond with one another while they remained on the outside. This evidence suggests that the liking gap is broader in scope than previously documented. In sum, from the earliest moments of a group's acquaintance, people think that the impressions they leave on others are more negative than they really are.

Given that the liking gap seems to exist in small groups when people are getting to know each other, might this have implications for real-world teams working on projects together? Studies 2 and 3 explored this important question.

Going forward, it is worth noting is that the structure of the data collected in Studies 2 and 3 is different from that of Study 1. Study 1 asked everyone in a group how much they liked each of their other group members and how much they thought they were liked in return. Because we had data from every person in every group, it is logically impossible that the participants in Study 1 could like the other participants, on average, more than they were liked by those same participants. As such, the liking gap we identified in Study 1 is necessarily an error. By contrast, we were limited in our data collection method for Studies 2 and 3 because we could not survey all members of every group, which means that we do not know how much each person was actually liked. However, unless our sampling method somehow identified a group of people who were truly liked less than they liked their partners (and who knew it), we can infer that any such liking gap is, in fact, an error. While systematic sampling bias is possible, it is unlikely, and it is also not a parsimonious account of the data, given prior research on the liking gap. Still, it is worth noting that the liking gap is demonstrably an error in meta-perception in Study 1, whereas in Studies 2 and 3 it is assumed to be so.

3. STUDY 2: Engineering teams

Study 2 sought to explore the liking gap in teams. To do so, we surveyed engineering teams at a large university in the northeast. These teams are composed of various engineering majors who often compete at national and international engineering design competitions. The teams tackle problems such as developing new technologies to ensure access to safe drinking water, creating medical devices to be used in low-resource communities, and constructing bridges and off-road vehicles. Because we were interested in teams that had frequent personal contact, we restricted our sample to teams that work in groups of 2–12. These teams had worked together for different amounts of time, which also allowed us to explore how the liking gap might change as relationships develop.

3.1. Method

3.1.1. Participants

One hundred and forty participants (87 female, 52 male, 1 other, M_{age} = 19.83 years, 51% Asian, 31% White, 8% multiracial, 6% Hispanic, 3% Black, 1% other) were recruited by email in exchange for $5.00 and a chance to win a $50.00 raffle prize.

We sought to obtain a sample similar in size to Study 1. Ultimately, our sample size was constrained by the response rate of the people we contacted, so we recruited as many participants as possible before the end of the semester. As in Study 1, no sample size decisions were made based on analyzing data during collection.

3.1.2. Procedure

People were recruited by an email containing a link to our survey. After consenting, participants indicated which team they were on. They also reported the number of people on their team and the first names of each of their fellow team members. Two team members were then selected at random, and participants answered our primary measures about those teammates only. Once participants had their two teammates in mind, they used 7-point Likert scales with endpoints labeled *not very*

much and *very much* to answer our primary dependent measures: how much they liked those teammates, how much they thought those teammates liked them, and how much they thought those teammates liked each other.

Participants then answered the following questions about their teammates using 7-point Likert scales with endpoints *not very comfortable* and *very comfortable*: "How comfortable do you feel asking [name of teammate] for help?", "How comfortable do you feel giving [name of teammate] open and honest feedback?" Participants also answered the following question using a 7-point Likert scale with endpoints *not very interested* and *very interested*: "Given the option, how interested would you be in working on another project with [name of teammate]?"

Next, participants reported how close they were with all their teammates, whether they had additional relationships to their teammates other than being on a team with them (e.g. friends, family members), and the gender of each teammate. Participants also reported how long they had been on their team, how much longer they intended to be on their team, how often their team meets as a group, as well as the main objective of their team. Finally, participants answered several additional questions for a separate study (see Appendix) as well as a suite of demographic measures.

3.2. Results

3.2.1. Exclusions

No participants were excluded from analysis.

3.2.2. Liking gap

On average, participants reported that they liked their partners significantly more than they estimated that their partners liked them (actual: $M = 5.77$, 95% CI = [5.60, 5.94]; perceived: $M = 5.31$, 95% CI = [5.14, 5.48]), as indicated by a linear mixed effects model fit with a fixed effect of rating type (actual or perceived) and random effect of participant ID, $b = -0.47$, 95% CI = [−0.62, −0.32], $t(415) = -6.07$, $p < .001$. In short, participants liked their partners more than they thought they were liked in return.

In contrast to Study 1, participants' estimates of how much their teammates liked them did not significantly differ from their estimates of how much their teammates liked each other, $b = -0.11$, 95% CI = [−0.25, −0.04], $t(414) = -1.43$, $p = .15$. In other words, while participants thought they liked their partners more than they were liked in return, they did not necessarily believe that they were the *least* liked out of their group of three randomly selected teammates.

3.2.3. How does the liking gap change as relationships develop?

While our data were collected at one point in time and so cannot provide conclusive evidence of how the liking gap may change as group members get to know each other, it does offer some insight into how the liking gap may persist over time. It may be the case that the liking gap simply shrinks as repeated interactions dispel some of the interpersonal uncertainty that drives the effect. Another possibility is that time alone is not enough to undo the liking gap. Perhaps more time together merely provides additional ambiguous information that solidifies the gap rather than shrinks it.

We tested the effect of time by coding the length of time participants reported being on a team together as either "0–1 semester" (N = 27) or ">1 semester" (N = 111). We chose these categories in order to compare teammates who had known each other for the least possible amount of time to participants who had known each other for longer. We entered this factor as a fixed effect along with type of rating (actual liking vs. perceived liking) and participant ID as a random effect. Consistent with our main findings, the analysis indicated a significant main effect of rating type: controlling for time spent together, participants still reported that they liked their teammates more than they estimated being liked by teammates in return, $b = -0.41$, 95% CI = [−0.58, −0.24], $t(408) = -4.75$, $p < .001$. The main effect of time was not significant, $b = 0.12$, 95% CI = [−0.32, 0.55], $t(206) = 0.53$, $p = .60$. The interaction effect between the liking gap and time was also not significant, $b = -0.31$, 95% CI = [−0.69, 0.07], $t(408) = -1.60$, $p = .11$. To determine whether the liking gap was still present at both time points, we then conducted post-estimation contrasts using the lsmeans package (Lenth, 2016), employing a Holm-Bonferroni correction to compensate for multiple comparisons. That analysis revealed a liking gap both before and after the one semester mark: participants who knew their teammates for 0–1 semester liked their teammates significantly more (actual: $M = 5.85$, 95% CI = [5.46, 6.24]) than they thought their teammates liked them (perceived: $M = 5.13$, 95% CI = [4.74, 5.52]), $t(407) = 4.14$, $p < .001$, estimated mean difference = 0.72, 95% CI = [0.38, 1.07]. Similarly, participants who knew their teammates for >1 semester also liked their teammates significantly more (actual: $M = 5.74$, 95% CI = [5.54, 5.93]) than they thought their teammates liked them (perceived: $M = 5.33$, 95% CI = [5.13, 5.52]), $t(407) = 4.75$, $p < .001$, estimated mean difference = 0.41, 95% CI = [0.24, 0.58]). In other words, as shown in Fig. 2, the liking gap was present no matter how long participants knew their teammates, and while the liking gap was larger when participants knew their teammates for one semester or less compared to participants who knew their teammates for longer than one semester, this interaction was not significant ($p = .11$).

3.2.4. Consequences

Could meta-perceptions of liking among teammates have consequences for how well teams work together? To investigate this, we tested whether participants' meta-perceptions of liking (how much they thought their teammates liked them) predicted three important measures of team functioning: willingness to ask for help, willingness to provide open and honest feedback, and interest in working on another project together in the future. One possibility, of course, is that participants' meta-perceptions merely correlate with how much they like their teammates, and the latter is actually what predicts each of the outcomes. To account for this possibility, we included participants' actual liking for their partners as a covariate in each of the following models. Unsurprisingly, controlling for how much participants estimated their partners liked them, how much participants liked their partners was related to how comfortable they felt asking their partners for help: $b = 0.56$, 95% CI = [0.39, 0.73], $t(262) = 6.63$, $p < .001$, how comfortable they felt giving their partners open and honest feedback: $b = 0.35$, 95% CI = [0.18, 0.51], $t(266) = 4.19$, $p < .001$, and how interested they were in working on another project together: $b = 0.83$, 95% CI = [0.68, 0.98], $t(263) = 10.91$, $p < .001$. However, how much participants perceived

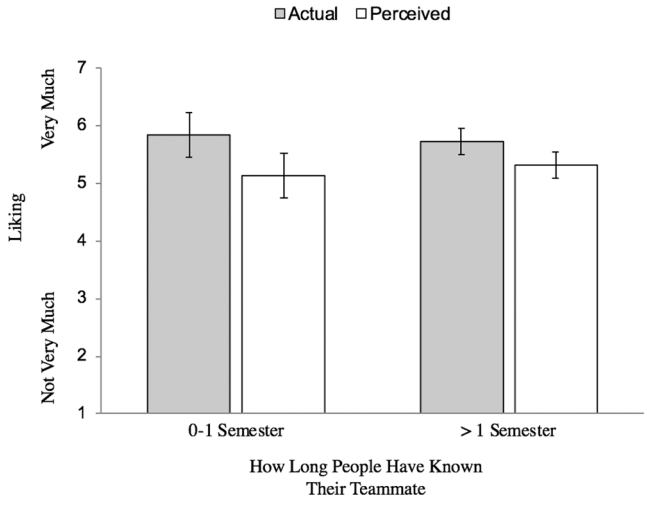

Fig. 2. Results of Study 2: mean ratings of how much people like their teammates and how much people perceive that their teammates like them. Error bars show 95% confidence intervals.

that their partners liked them significantly predicted each outcome as well, controlling for how much participants liked their partners: helping: $b = 0.29$, 95% CI = [0.13, 0.45], $t(230) = 3.47$, $p < .001$; feedback: $b = 0.34$, 95% CI = [0.18, 0.50], $t(238) = 4.15$, $p < .001$); work together again: $b = 0.20$, 95% CI = [0.06, 0.35], $t(232) = 2.72$, $p = .007$. Given that participants' meta-perceptions were consistently lower than their actual liking for their teammates, these results suggest that people's overly negative beliefs may have negative consequences for how teams work together.

3.3. Discussion

We designed Study 2 with two primary questions in mind: could the liking gap persist in teams even after an initial conversation, and if so, could it have consequences for how those teams work together? The answer to both questions appears to be yes. Participants liked their teammates more than they thought they were liked in return. Furthermore, how much participants perceived that their teammates liked them was strongly tied to participants' willingness to ask for help, their willingness to give their teammates honest feedback, and their desire to work on future projects together—three important indicators of teams' communication quality and overall functioning. Finally, Study 2 provided some evidence that the liking gap persists over time. Together, these findings suggest that the liking gap continues to exist even after a team's first interactions, that it may affect a team's ability to work well together.

4. STUDY 3: The workplace

Might the liking gap exist in a general sample of working adults? If so, the consequences may be even greater. As such, in Study 3 we aimed to examine the relationship between people's meta-perceptions of liking and important outcomes such as open communication, team effectiveness, and job satisfaction. The large sample we recruited also allowed us to examine whether the liking gap depends on people's relative status (e.g., peer-to-peer versus supervisor-supervisee relationships). Lastly, we asked employees to reflect on their workplace relationships, and analyzing the content of those reflections allowed us to explore one of the processes that we suspect causes the liking gap: how readily negative thoughts come to mind when people think about the impressions they make on others.

4.1. Method

4.1.1. Recruitment

We simultaneously posted two studies on Amazon Mechanical Turk in order to recruit a sample of participants who had worked on a small team for a shorter or longer period of time. One of these studies was available to people who had worked in a group of 3–5 people for 0–6 months, and one was available to people who had worked with a group of 3–5 people for more than six months. Respondents who attempted to access one study but were eligible for the other were redirected to the other study until that study had reached its maximum number of participants, at which point they were no longer redirected and were instead dismissed.

4.1.2. Screening

We implemented several layers of screening to ensure that we obtained our desired sample; as such, we began with a large number of potential participants and dismissed any who were not eligible. First, we used the screening tools provided on the TurkPrime platform (Litman, Robinson, & Abberbock, 2017) to block any users that had been previously associated with suspicious activity. Potential participants were advised ahead of time that we were looking for a specific type of participant and that the first two questions of the survey would indicate whether they were eligible or not. Four thousand eight-hundred and fifty-eight people responded to either version of the survey. First, they were asked to indicate their current employment status from a list of the following options: "I am not currently employed," "I am currently retired," "I have never been employed," "I am currently employed and I rarely work in groups," "I am currently employed and I most frequently work in groups of 2," "I am currently employed and I most frequently work in groups of 3–5," "I am currently employed and I most frequently work in groups of 6+." Two thousand nine hundred and eighty-one respondents did not report that they most frequently work in groups of 3–5 and were dismissed.

The 1877 remaining respondents then read the following question:

"Please think about a group that you work with. This should be a group that:

(1) Often completes projects or tasks together.

(2) Has frequent contact.

(3) Has 3–5 people in it total (including you).

How long have you worked with that group?"

Respondents could answer: "0–6 months," ">6 months," or "I do not work with a group like that." At this point, 21 respondents reported that they did not work in a group like that and were dismissed. Another 1302 respondents were either redirected from one study to the other, or excluded once the other study had reached its intended sample size. The remaining 554 respondents then completed a three-item test to assess their English skills as well as whether they resided in the United States. This test required them to know that children who are four or five years old attend kindergarten and not third grade or above, that an American ZIP code is a sequence of five numbers, and that eating turkey is not associated with Halloween. One hundred and thirty-eight respondents answered at least one of these items incorrectly and were dismissed. The remaining 416 respondents (185 female, 229 male, 2 other, M_{age} = 34.76 years, 65% White, 14% Black, 8% Asian, 8% Hispanic, 3% multiracial, 2% other) completed a consent form and became participants in our study in exchange for $1.50. To obtain a diverse sample of work sectors and relationship types, we recruited as many participants as our resources would allow. No decisions regarding sample size were made based on analysis of the data.

4.1.3. Main measures

Participants first reported whether they worked in a group of three, four, or five people. They then supplied the first names of each of each person in the group and wrote a short description of "what this group is and what it works on." They were then asked, "How much do you like [name of group member]?" Participants responded on a 7-point Likert scale with endpoints *not very much* and *very much*. Using the same Likert scale, participants then reported how much they thought each group member liked them, again in random order. If participants worked in a group of three, they answered this question for both of their group members, in random order. If they worked in a group of four or five, they answered this question for a random subset of two of their group members, in random order; this same random subset of their group was used for all further questions, except for demographics questions at the end of the study, where participants reported on everyone in their group.

4.1.4. Open-ended responses

Participants were then asked to write at least 50 words about "what comes to mind when you think of how much you like [name of group member]?" They then wrote at least 50 words about "what comes to mind when you think of how much [name of group member] likes you?" They completed this question for both group members, in random order.

4.1.5. Consequences

Participants then answered three further questions about the same two group members using 7-point Likert scales: "How comfortable would you feel asking [name of group member] for help?" (endpoints: *not very comfortable* and *very comfortable)*, "How comfortable would you feel having an honest conversation with [name of group member] about

their performance at work?" (endpoints: *not very comfortable* and *very comfortable)*, and "How much do you feel like [name of group member] values the work that you do?" (endpoints: *not very much* and *very much)*

Then participants answered two questions about their team: "How well do you feel like your group works together?" (endpoints: *not very well* and *very well)* and "To what extent do you feel included in your group?" (endpoints: *not very included* and *very included)*. They then answered the question, "How satisfied are you with your job overall?" (endpoints: *not very satisfied* and *very satisfied*).

Participants then reported on several aspects of their group members. First, they reported how well they knew each member (endpoints: *not very well* and *very well)*. Then they reported their work relationship to each person by selecting from among the options: "We are peers," "I am their superior," or "They are my superior." They reported how long they have known each person in the group using the following options: "0–1 month," "1–3 months," "3–6 months," "6–12 months," "1–2 years," "2–5 years," or "5+ years." They then indicated how long they had worked with their group, using the same options. Next, they answered the question, "Did [name of group member 1] and [name of group member 2] know each other before you met them?" The response options were: "Yes," "No," or "I'm not sure."

4.1.6. Demographics

Finally, participants answered a series of descriptive questions about their workplace, including how many days and hours per week they work, their personal income last year, whether they work for a non-profit or for-profit or governmental organization, the category of their work (from a provided list of 26 options), and the number of employees in their workplace. Participants then answered demographic questions (see Appendix), embedded in which was an attention check that required them to select the option "other" and write the word "tree." Participants were then dismissed and compensated.

4.2. Results

4.2.1. Exclusions

Fourteen participants failed the attention check at the end of the survey and were excluded from all analyses. As an additional check, we compared participants' initial report of how long they had worked with their group to the report they gave at the end of the study. Eighty-five participants' answers were inconsistent, and they were also excluded. Finally, five additional participants were excluded because their answers to the open-ended questions were copied and pasted from the question itself or elsewhere on the internet. These exclusions do not change the outcome of any of the analyses below. After exclusions, 312 participants remained (145 female, 165 male, 2 other, M_{age} = 35.34 years, 72% White, 9% Asian, 9% Hispanic, 6% Black, 3% multiracial, 1% other) and were included in all analyses.

4.2.2. Liking gap

A linear mixed effects model fit with the type of rating (actual or perceived) as a fixed effect and participant ID as a random effect indicated that participants reported liking their group members more than they estimated their group members liked them in return (actual: M = 5.45, 95% CI = [5.32, 5.58]; perceived: M = 5.28, 95% CI = [5.15, 5.41]), $b = -0.17$, 95% CI = [−0.29, −0.06], $t(935) = -2.99$, $p = .003$. These results again suggest that participants, on average, underestimated how much they were liked by their colleagues. Further analysis determined that there was no overall effect of how long participants had worked with their team (0–6 months versus > 6 months) on the size of the liking gap ($p = .97$), allowing us to collapse across time for the remainder of our analyses.

4.2.3. Consequences

Could there be consequences of underestimating group members' positive regard for oneself? We investigated this possibility by testing the relationship between participants' meta-perceptions of liking and their reports on the following variables: how comfortable they would feel asking their group members for help, how comfortable they would feel having an honest conversation with another group member about that person's performance at work, and how much they felt their group members valued their work. Our analyses controlled for how much participants liked their partners, meaning that these effects are not due to participants' overall liking of their fellow group members, but rather reflect the independent effect of how much participants *perceived* that their group members liked them. Controlling for meta-perceptions, liking was related to all outcomes (asking for help: $b = 0.45$, 95% CI = [0.35, 0.55], $t(608) = 8.55$, $p < .001$; honest conversation: $b = 0.44$, 95% CI = [0.32, 0.56], $t(529) = 7.26$, $p < .001$; valuing work: $b = 0.31$, 95% CI = [0.22, 0.39], $t(592) = 7.25$, $p < .001$). However, controlling for liking, meta-perceptions also significantly predicted all three outcomes (asking for help: $b = 0.36$, 95% CI = [0.26, 0.47], $t(621) = 6.63$, $p < .001$; honest conversation: $b = 0.35$, 95% CI = [0.22, 0.47], $t(571) = 5.40$, $p < .001$; valuing work: $b = 0.44$, 95% CI = [0.36, 0.53], $t(615) = 9.99$, $p < .001$. Therefore, participants' beliefs about what their group members thought of them were related to important measures of communication quality and how valued people felt in their workplace, even when controlling for how much participants liked their teammates.

Further analysis also indicated that participants' meta-perceptions were strongly related to team-level and job-level outcomes. We averaged participants' meta-perceptions for both of their teammates and used them to predict each of the following three outcomes: team effectiveness, feelings of team inclusion, and job satisfaction. We also included actual liking in the model to control for how much participants liked their teammates. Controlling for meta-perceptions, liking was significantly related to team effectiveness ($b = 0.34$, 95% CI = [0.20, 0.48], $t(309) = 4.94$, $p < .001$) and job satisfaction ($b = 0.33$, 95% CI = [0.13, 0.53], $t(309) = 3.20$, $p = .002$), but not to feeling included ($b = 0.07$, 95% CI = [−0.11, 0.25], $t(309) = 0.78$, $p = 0.44$). Controlling for liking, meta-perceptions significantly predicted all outcomes (team effectiveness: $b = 0.28$, 95% CI = [0.14, 0.41], $t(309) = 4.08$, $p < .001$; feeling included on the team: $b = 0.49$, 95% CI = [0.31, 0.66], $t(309) = 5.50$, $p < .001$; job satisfaction: $b = 0.21$, 95% CI = [0.01, 0.41], $t(309) = 2.08$, $p = .04$).

In short, participants liked their coworkers more than they thought their coworkers liked them, and these perceptions were strongly related to a range of important interpersonal, team, and job-level outcomes.

4.2.4. Relative status

These data also allow us to explore how different types of workplace relationships might affect the liking gap. To perform this exploratory analysis, we created a factor (relationship type) with three levels: peer, supervisor, and supervisee, reflecting the status of the group member that participants were reporting on. We explored the magnitude of the liking gap for each relationship type (peer perceived liking vs. peer actual liking, supervisor perceived liking vs. supervisee actual liking, and supervisee perceived liking vs. supervisor actual liking) using post-estimation contrasts with a Holm-Bonferroni correction to account for multiple comparisons. Interestingly, as shown in Fig. 3, the liking gap was significant when participants were reporting on their relationship with a peer (estimated mean difference = −0.23, 95% CI = [−0.40, −0.07], $t(931) = -3.35$, $p = .003$), but not when participants were reporting about a supervisor (estimated mean difference = −0.12, 95% CI = [−0.57, 0.33], $t(1224) = -0.62$, $p = 1$) or supervisee (estimated mean difference = 0.03, 95% CI = [−0.42, 0.48], $t(1224) = 0.15$, $p = 1$). This suggests people's relative organizational status might be an important moderator of the liking gap.

4.2.5. Sentiment analysis

In order to explore one psychological process that might play a role in the liking gap, we also analyzed the content of participants' open-ended text responses using sentiment analysis. Recall that each

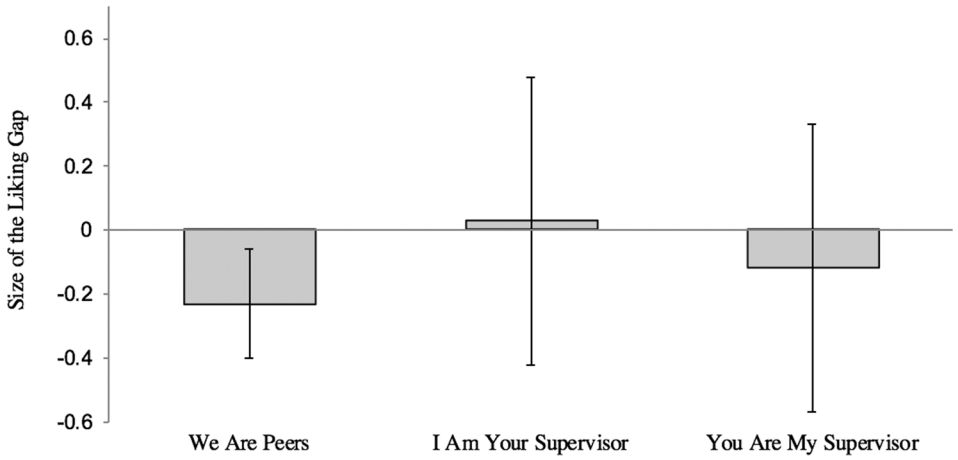

Fig. 3. Results of Study 3: size of the liking gap by type of relationship at work. Error bars show 95% confidence intervals.

participant provided two responses; we refer to participants' reflections about their coworkers as *actual sentiment*, and participants' reflections about what their coworkers thought of them as *perceived sentiment*. Before beginning analysis, we removed all names from the corpus in order to anonymize responses. The entire corpus of responses contained 68,712 words across 312 participants (mean word count per response, actual sentiment = 110.05, $SD = 12.46$; mean word count per response, perceived sentiment = 110.18, $SD = 11.76$). Individual words were scored for positive or negative sentiment on a scale from −5 to 5, using the tidytext R package and the AFINN sentiment dictionary (Nielsen, 2011; Silge & Robinson, 2016).

A sentiment score was assigned to each response by computing the average sentiment score across all its words. Words not listed in the dictionary were omitted from analysis. Omitted words included stop words (simple neutral words such as "and," "the," "at"), proper nouns, slang terms, and uncommon words. Due to the scope of the AFINN dictionary, only 5.19% (3569 words) of the text response corpus were assigned sentiment scores. The average response consisted of about 6 scored words ($M = 5.82$, $SD = 2.77$). Across the entire corpus, response sentiment scores ranged from −3.33 to 4.0, and skewed positive on average ($M = 1.23$, $SD = 1.22$).

To explore the relationship between sentiment scores and interpersonal liking, we (1) correlated participants' actual sentiment scores with participants' actual liking of their group members; (2) correlated participants' perceived sentiment scores with participants' perceptions of how much their group members liked them; and finally, (3) we correlated the gap between actual and perceived sentiment with the gap between actual and perceived liking. The goal of these analyses was to determine whether sentiment scores were related to liking, meta-perceptions of liking, and the liking gap. All three analyses were significant. Participants' actual sentiment scores correlated with how much participants liked their group members, $r = 0.33$, 95% CI = [0.26, 0.40], $t(574) = 8.36$, $p < .001$; (2) participants' perceived sentiment scores correlated with how much participants perceived that their group members liked them, $r = 0.31$, 95% CI = [0.23, 0.38], $t(589) = 7.76$, $p < .001$; and (3) the gap between actual and perceived sentiment correlated with the gap between actual and perceived liking, $r = 0.15$, 95% CI = [0.06, 0.23], $t(550) = 3.45$, $p < .001$. In other words, when participants were prompted to reflect on their workplace relationships, the sentiment scores of those reflections predicted how much they liked their group members, and how much they thought their group members liked them. Moreover, *the extent to which* participants tended to recall more negative information about themselves compared to the information they recalled about others predicted the magnitude of the liking gap. While correlational, these results are consistent with previous research (Boothby et al., 2018), suggesting that one of the psychological processes that drives the liking gap is the availability of overly negative thoughts when people try to imagine how they are perceived in the eyes of others.

4.2.6. Valence analysis

As a robustness check on the sentiment analysis, we also had each statement rated by three human judges who were blind to the hypothesis of the study. These three judges rated the valence of each open-ended statement using a Likert scale with endpoints −3 (*very negative*) and +3 (*very positive*). We calculated the interclass correlation among the judges using the "psych" package (Revelle, 2019) in R, which indicated high agreement, ICC = 0.92, $F(1248) = 12.70$, $p < .001$. This allowed us to average each of the three raters' judgments into a composite score. We created two kinds of scores for each participant: the valence of the statement they wrote reflecting on how they feel about their coworker (which we will call *actual valence*), and the valence of the statement they wrote reflecting on how their coworker feels about them (which we will call *perceived valence*).

As with the sentiment scores, we then (1) correlated participants' actual valence scores with participants' actual liking of people in their work group; (2) correlated participants' perceived valence scores with participants' perceptions of how much their group members liked them; and finally, (3) we correlated the gap between actual and perceived valence with the gap between actual and perceived liking. All three analyses were significant. Participants' actual valence scores correlated with how much participants liked their group members, $r = 0.71$, 95% CI = [0.67, 0.75], $t(619) = 25.26$, $p < .001$; (2) participants' perceived valence scores correlated with how much participants perceived that their group members liked them, $r = 0.71$, 95% CI = [0.67, 0.75], $t(615) = 24.95$, $p < .001$; and (3) the gap between actual and perceived valence correlated with the gap between actual and perceived liking, $r = 0.39$, 95% CI = [0.33, 0.46], $t(614) = 10.64$, $p < .001$.

In sum, both sentiment analysis and human judgement yielded similar results; namely, the positivity and negativity of people's thoughts were related to people's liking of others as well as people's perceptions of how much others liked them. Moreover, *the extent to which* people recalled more negative thoughts about themselves compared to their thoughts about others correlated with the magnitude of the liking gap. These analyses suggest that the availability of negative thoughts about the self may contribute to the liking gap. For instance, when thinking about how much they liked their coworker, one participant wrote, "A very straightforward guy with no false pretense." However, when writing about how much the same person likes them in turn, they wrote, "I think he thinks I can be annoying because I am way too concerned about performing well and accurately." To further explore the possibility that the asymmetric negativity of thoughts like these

could underly the liking gap, we conducted a mediation analysis.

4.2.7. Mediation analysis

Following the original demonstration of the liking gap (Boothby et al., 2018), we used the human-coded valence scores for the mediation analysis. To test for mediation, we fit three linear mixed effects models. The first model used rating type (actual vs. perceived) to predict valence. The second model used valence to predict liking, and the third model used rating type to predict liking, controlling for valence. Each model included random intercepts for each participant. We extracted the relevant coefficients and bootstrapped an estimate of the indirect effect of rating type on liking, which was significant, $b = 0.12$, SE = 0.03, 95% CI = [0.08, 0.19]. In short, participants' thoughts were more negative when they thought about how others viewed them compared to how they viewed others, and this asymmetric negativity mediated the size of the liking gap. This provides evidence that the liking gap may arise because people focus on negative thoughts when thinking about how much others like them ("I got a promotion recently, so she might feel jealous") more than they do when thinking about how much they like somebody else ("She got a promotion recently, and I feel happy for her").

4.3. Discussion

Study 3 extends the findings of Study 2 in three main ways: first by investigating the liking gap in a larger and more diverse sample of workers; second, by relating individuals' beliefs about how much their teammates like them to an even broader array of outcomes, and third, by providing evidence for a psychological process that supports the liking gap.

Once again, our results show that people tend to believe that they like their teammates more than they think they are liked in return. This misperception persisted over time and was strongest for peer relationships. What drives the liking gap? By analyzing the sentiment and valence of people's workplace reflections, we provided evidence that people perceived a larger liking gap when they spontaneously called to mind more positive impressions their teammates made on them in social interactions ("Joe's such a mensch—he always refills the watercooler"), but meanwhile called to mind more negative impressions they left on their teammates ("Last Friday, Alice seemed bored during my presentation"). This is consistent with previous research showing that people's thoughts about themselves can be remarkably negative, especially after social interactions (Boothby et al., 2018; Savitsky, Epley, & Gilovich, 2001).

The liking gap predicts important workplace outcomes. When people felt that their teammates perceived them less positively, they were less likely to ask for help, less willing to communicate openly and honestly, and felt less included on their team. Moreover, negative meta-perceptions were also related to decreased team effectiveness and decreased job satisfaction. If only people knew, then, how positively their teammates actually felt about them, they might communicate better, feel more included on their teams, and be happier overall with their jobs. In short, the liking gap appears in a broad sample of workers, is related to people's tendency to naturally call to mind negative information about how others perceive them, and plays a role in a range of important team and organizational outcomes.

5. General discussion

Our research sought to answer three questions. First, after an initial group conversation, do people know how much their partners liked them? The answer appears to be no: participants in Study 1 underestimated how much they were liked. Furthermore, they thought they were *uniquely* less liked: individuals thought their partners liked them less than they liked each other. From their very first conversation, then, people's group relationships began under a cloud of negatively-biased meta-perceptions—the liking gap.

Second, we sought to investigate whether the liking gap might persist as groups develop relationships over time. The answer seems to be yes: the liking gap was present both in engineering teams completing a project (Study 2) and in a general sample of employees (Study 3). While the liking gap was smaller, people's negative misperceptions continued to linger.

Finally, we investigated the possibility that this misperception has consequences for how teams work together (Studies 2 and 3). The answer again was yes: how much participants felt they were liked by their teammates was strongly related to how comfortable they felt asking those teammates for help, communicating with them honestly, and completing another project together in the future. Furthermore, meta-perceptions predicted how included participants felt, how effectively their team worked together, and how satisfied they felt with their jobs. These connections were significant even controlling for how much individuals liked their teammates, suggesting that these effects depend not only on how much people like others, but also depend on how much they think others like them. Our findings also point out that these meta-perceptions are negatively biased, meaning that teams may not work as well together as they could because they mistakenly believe that their teammates don't like them as much as they actually do.

Overall, these studies provide evidence that people underestimate how much others like them after an initial group conversation, that this negative perception still persists at least somewhat into the group's tenure, and that it likely has negative consequences for how group members relate to each other, work together, and feel about their jobs.

5.1. Theoretical implications

5.1.1. Formation of relationships and groups

These findings speak to the importance of investigating meta-perceptions in the domain of relationship formation. Previous work has shown that initial interactions predict the quality, closeness, and productivity of future relationships (Back et al., 2010; Berg, 1984; Hays, 1984, 1985; Human et al., 2012; Selfhout et al., 2009; Sunnafrank & Ramirez, 2004; Zerubavel et al., 2018). This work has primarily focused on how partners perceive each other, and has less consistently investigated how partners believe they are perceived by others; our work suggests that the latter also matters greatly. In early interactions, people are not only asking, "Do I like this person?" but also wondering, "Does this person like *me*?" and their answers to both questions have important implications for the path their relationship takes.

Since groups are built on connections between individuals, our results also speak to group formation. Mutual liking is a key ingredient of early interactions (Hogg & Turner, 1985), and our results suggest that while reciprocal liking may be present in initial conversations, people don't always know it. This may stymie group formation, as groups often don't recover after starting off on the wrong foot (Ericksen & Dyer, 2004; Ginnett, 1993).

These insights into early group interactions are especially important because many modern workplaces are characterized by transient groups (Hackman & Katz, 2010). Improved communications technology (O'Leary & Cummings, 2007) and more flexible structuring and operations decisions (Dess, Rasheed, McLaughlin, & Priem, 1995) mean that people join new teams regularly and often collaborate with a wide range of coworkers, sometimes at a distance. For example, over the course of a large-scale construction project or distributed software development, groups will add and lose members at different stages, depending on turnover and required expertise. People are constantly meeting new people and forming first impressions, and as a result, workplaces are filled with groups that spend less time in the adulthood of their tenure and more time in their adolescence—precisely where the data suggest that misperceptions of liking might be strongest, and the organizational consequences might be greatest.

5.1.2. Negative biases in social interaction

More generally, our research adds to a growing body of evidence that perceptions surrounding social interactions are often negatively biased. In contrast to well-known research documenting people's overly optimistic views about everything from one's likelihood of getting sick to one's likelihood of being involved in a traffic accident (Alicke, 1985; Kruger & Dunning, 1999; Weinstein, 1980), people seem uncharacteristically self-effacing prior to social interaction (Epley & Schroeder, 2014; Levine, Bitterly, Cohen, & Schweitzer, 2018) and disproportionally self-critical afterwards (Boothby et al. 2018; Savitsky, Epley, & Gilovich, 2001; Savitsky & Gilovich, 2003). Additional work is needed to understand why thoughts and beliefs surrounding social interaction seem to be an exception to a general self-enhancing tendency.

Our findings also highlight the importance of studying social interactions in contexts beyond the dyad, which has been the focus of much of the emerging work on conversation. Group interactions may differ from dyadic interactions in important ways (Cooney et al., 2020). For example, conversing in a group changes the basic mechanics of conversation, such as how speaking turns are allocated and how speaking time is divided. Being in a group also changes people's basic social orientation, such as how much people self-disclose, and the reputational risk of doing so (Cooney, Wilson, & Gilbert, 2014). Therefore, to fully understand the psychological processes underlying conversation, it is important to take the phenomena that have been largely studied in dyadic interactions and explore them in groups, with an eye toward building a deeper theoretical understanding of how adding more minds to a conversation can change it fundamentally. Our findings are a step in this direction, suggesting that dyadic and group conversations are similar in at least in one regard: people leave them believing they like their partners more than their partners like them.

5.2. Practical implications

5.2.1. Newcomer socialization

Our results add to the understanding of how newcomers are socialized to the norms, values, and practices of an organization, which has long been a focus of research and theory (Van Maanen & Schein, 1977). A meta-analysis of 70 unique samples found that successful socialization leads to increased job satisfaction, performance, and organizational commitment, and a key factor of successful socialization is subjective feelings of social acceptance (Bauer, Bodner, Erdogan, Truxillo, & Tucker, 2007). Our findings suggest that negatively biased meta-perceptions may hamper this process, and perhaps additional steps ought to be taken to overcome these mistaken beliefs early in newcomers' tenure.

5.2.2. Self-fulfilling prophecies

A key element of newcomers' transition into an organization is the set of expectations they bring and those that they encounter upon arrival. Past research has shown that these expectations can have important implications for organizational outcomes—so-called Pygmalion effects (Kierein & Gold, 2000; McNatt, 2000)—and the liking gap could play a role in those effects. Much as high expectations can improve performance, people's beliefs that others don't like them as much as they actually do may have the unfortunate effect of causing others to like them less. For example, perhaps people who experience a liking gap are a little less likely to invite a colleague to lunch, or hesitant to strike up a conversation in the elevator, or they might assume their partner doesn't want to work on another project together. In turn, their partners may interpret those avoidant behaviors as evidence that they aren't much liked by their coworker, thereby perpetuating the self-fulfilling cycle.

5.2.3. Team performance

Our findings have important implications not only for how people enter an organization and the expectations that they encounter, but also how they perform with their team once they settle in. For a team to function optimally, its members must be able to ask each other for help, speak honestly, and feel valued and included. The results of Studies 2 and 3 illustrate that these important ingredients for success are strongly tied to how people think that other people feel about them; accordingly, meta-perceptions were also related to team effectiveness. Managers seeking to create cohesive, effective teams should therefore think critically not only about how those teammates feel about each other, but also how each teammate *thinks* their teammates feel about each other.

5.2.4. Job satisfaction

Employees want jobs that they like, and organizations want their employees to like their jobs. As such, job satisfaction has been studied extensively and many of its determinants have been identified, including a sense of control over one's job (Bond & Bunce, 2003), the perceived fairness of the organization (McFarlin & Sweeney, 1992), harmony between work and family (Ernst Kossek & Ozeki, 1998), and personality traits like extraversion and agreeableness (Judge, Heller, & Mount, 2002). Our research identifies an additional ingredient of job satisfaction: how workers think others feel about them. This component of job satisfaction may be easier to change than many of the others, if only because the liking gap is a misperception, whereas one's perceptions of fairness or sense of control may simply reflect the realities of an organization.

5.3. Future directions

What processes drive changes in the liking gap over time? While our studies were cross-sectional and therefore cannot speak conclusively to how the liking gap changes over time, our data suggest that the liking gap is largest immediately after an initial conversation and smaller in groups that have known each other longer. How quickly does this occur, and why? Perhaps small doubts remain even later on in a relationship but the most egregious self-criticism that drives the liking gap early on cannot stand up to the weight of evidence of mutual liking. Future work could investigate how the liking gap and other meta-perceptual biases arise and fade as relationships develop—and what psychological processes sustain these effects.

Are there other mean-level biases in meta-perception? As future research comes to better understand the liking gap, it should also consider the possibility that other meta-perceptions may be more accurate or even positively biased. There are several reasons why meta-perceptions of liking may be distinct from others. Liking is closely related to interpersonal warmth, one of the two dimensions on which people instantly and effortlessly perceive each other when they first meet (Cuddy, Fiske, & Glick, 2008). This dimension is unique in that an individual can't assess their own warmth objectively. How does someone know if they're nice or not? The first question they would likely ask is, "Do other people think I'm nice?" Perhaps this uncertainty about what *others* think is precisely where self-doubt can creep in; needing to make an assumption invites assuming the worst.

Competence, the other fundamental dimension of person perception (Cuddy et al., 2008), may be less subjective, given that there are non-interpersonal benchmarks one can use. Anyone who can disassemble and reassemble a computer, audit a balance sheet, or win new clients by cold calling them knows that they are competent in at least one domain without relying on others' judgments to judge themselves. This suggests that meta-perceptions related to warmth may be more susceptible to negative bias than other kinds of meta-perceptions, such as competence.

Are there benefits to the liking gap? As future work investigates the genesis, development, and change of meta-perceptual biases, it is important to consider why these biases may exist in the first place. Our work is consistent with previous research showing that the liking gap arises in part because people are overly focused on negative self-directed thoughts following conversations (Boothby et al., 2018). So why do people leave their conversations kicking themselves for their *faux pas*

rather than patting themselves on the back for their *bon mots*? One possibility is that focusing on failures makes it easier to avoid them next time (Epstude & Roese, 2008). For example, perhaps people who experience negative meta-perceptions early on in relationships feel more motivated to improve those relationships, whether by putting in extra effort or working hard to fix social flaws they have noticed in their own behavior. Future research could investigate the possibility that the people who feel like they have made the worst impression are the ones who work hardest to improve it going forward.

6. Conclusion

Every relationship has a beginning. Strangers become coworkers, friends, and spouses by having a conversation, and then another, and then another. While conversation may be humans' most powerful tool for building relationships, it doesn't work perfectly. In particular, it seems to give rise to a systematic bias that emerges especially in initial interactions: people often feel uncertain about what their conversation partners *really* think of them, which can lead them to underestimate how much they are liked. Our research sheds new light on this liking gap, providing evidence that it arises in groups, affects how well teams work together, and has consequences for how people form and maintain new relationships.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.obhdp.2020.10.013.

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