Journal of Nonverbal Behavior (2023) 47:19–56
https://doi.org/10.1007/s10919-022-00418-1

ORIGINAL PAPER

Perceiving Assertiveness and Anger from Gesturing Speed in Different Contexts

Michael Conway[1] · Despina Bolanis[1] · Jonathan Leclerc[1] · Sophia Chiovitti[1] · Sylvain Serey Tran[1] · Charlotte Roddick[1] · Kevin McLaughlin[1] · Heather Woods-Fry[1] · Constantina Giannopoulos[1]

Accepted: 25 August 2022 / Published online: 13 September 2022
© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2022

Abstract
More frequent gesturing, talking faster, and talking louder are aspects of nonverbal behavior often associated with being perceived as more dominant, assertive, influential, or as leader. The causal hypothesis in Study 1 was that people perceive an individual who gestures faster as more assertive and angrier in the context of a work or task-based interaction such as between coworkers. In the between-subject design of all six studies, participants observed at different speeds a cropped silent video of a dyadic interaction. Only hands, arms, and torsos could be seen, and one individual gestured throughout while the other hardly moved. In Studies 1–6, participants perceived the individual as more assertive and less anxious with faster gesturing, which were small effects across the workplace and other contexts. Findings as a function of context consistently emerged for perceived anger and warmth. In Studies 1, 3, and 4, participants perceived more anger and less warmth at slow and fast relative to moderate speed for the workplace and similar contexts. In Studies 5 and 6, there were no differences for perceived anger and warmth for the context of a one-time meeting between unacquainted students. To a varying degree across studies, participants who perceived the individual as more assertive and angrier rated the individual's gesturing speed as faster, which contributed to these speed ratings being inflated in the slow video speed condition in Studies 1–4. Findings are discussed in terms of the cropped silent video methodology, context, and the identity of the gesturing individual.

Keywords Person perception · Assertiveness · Anger · Warmth · Anxiety · Gestures · Nonverbal behavior

More frequent gesturing, talking faster, and talking louder are aspects of nonverbal behavior often associated with being perceived as more dominant, assertive, influential, or as leader (Hall et al., 2005). These are interrelated findings, as people often gesture when they speak, and may speak louder when talking faster. All these findings identify an association between, on the one hand, the intensity of nonverbal behavior and, on the other,

✉ Michael Conway
michael.conway@concordia.ca

Extended author information available on the last page of the article

perceptions of dominance, assertiveness, and related constructs. Our goal was to address causality: Does such intense nonverbal behavior cause such perceptions? The challenge was to address intensity while avoiding confounds. Our novel methodology was to present at different speeds the same cropped video of a dyadic interaction with the soundtrack removed. Participants are told that the video is of an individual talking to another, and since only hands, arms, and torsos are visible—and there is no sound—the only information available is the individual's gesturing. Participants who see faster gesturing because they are watching the video at a faster playback speed will likely assume that the individual is talking faster and perhaps louder.

The hypothesis in Study 1 was that people perceive an individual who gestures faster as more assertive and angrier in the context of a work or task-based interaction such as between coworkers. For this context, people likely perceive the individual's primary motive as being to get things done. Participants will then perceive the individual as primarily assertive as well as angry. Anger was included in the hypothesis, given its links to assertiveness and influence. People may perceive more assertiveness and anger with faster gesturing for two related reasons: property transmission (White, 2009) and learned associations. Property transmission is the general tendency to attribute an effect of a certain magnitude (in this case, faster gesturing) to an underlying cause of similar magnitude (in this case, greater assertiveness and anger). Learned associations, compatible with property transmission, may have been formed from observing assertive and angry individuals engaging in intense nonverbal behavior such as faster gesturing.

In general, people need to be assertive and possibly express anger in work or task-based interactions such as between coworkers. This context is important to study as it is both familiar and relevant to people, since many adults are employed outside the home. The hypothesis is formulated with this context. For another context, people may perceive gesturing as communicating primarily warmth and positive excitement. Consider, for example, two friends catching up on their activities and adventures. People might then consider faster gesturing as more immediacy behavior (Mehrabian, 1972)—occurring with exuberant, faster speech between individuals who like each other and are close.

Gesturing, Speech Speed, and Speech Loudness and Perceptions of Dominance, Assertiveness, or Influence in Interactions

Gesturing in prior studies in this area has been measured in terms of counts, duration, or general ratings by observers. Individuals who gestured more in group discussions were perceived as more ambitious and dominant, as being the leader, or as having more influence (Baird, 1977; Gifford, 1994; O'Connor, 1971; see Maricchiolo et al., 2011 for a possible limiting condition). Similar findings were obtained for various dyadic interactions: between a participant and a confederate working on a task (Burgoon & Le Poire, 1999), between participants having a conversation (Palmer, 1990), and between partners in heterosexual couples completing a decision-making task (Dunbar & Burgoon, 2005)—although only for observers' ratings of male partners. All this research on groups and dyads considered not only gesturing frequency, but other behaviors as well. Gesturing is likely to co-occur with some of these other behaviors, in particular speech, as noted above. One can ask whether gesturing frequency remains associated with perceptions of dominance, influence, or related constructs when controlling for speech duration. Indeed, speech duration is reliably associated with perceptions of dominance, leadership, and related constructs (Mast,

2002). Most of the studies cited above did not examine the association between gesturing frequency and social perceptions while controlling for speech duration. O'Connor (1971) did and found that more gesturing remained associated with greater perceived influence. Maricchiolo et al. (2011) found that gesturing frequency was associated with perceived influence for individuals who spoke relatively little (as indicated by turn taking frequency), and not for those who spoke more

Prior research on speech speed and loudness is relevant since faster gesturing implies faster (Bavelas & Chovil, 2006; McNeill, 1992) and perhaps louder speech (e.g., Burgoon & Le Poire, 1999; Schucker & Jacobs, 1977; Tusing & Dillard, 2000). The effects of speech speed and of speech loudness were examined separately in dyadic interaction studies. In one study, participants who spoke faster in conversations were perceived as more dominant and influential (Palmer, 1990). In another study, physicians were rated as more dominant if they spoke more quickly, and more loudly, when asking parents questions about their child's symptoms (Harrigan et al., 1989). In still another study, individuals who spoke louder when challenging another person were judged as more assertive (Rose & Tryon, 1979). Note, however, that Tusing and Dillard (2000) obtained results opposite to this overall trend for the association between talking speed and perceived dominance.

These overall trends for gesturing frequency, speech speed, and speech loudness remain evident when all prior research, across various contexts (e.g., solitary targets), is considered (Hall et al., 2005; Koppensteiner et al., 2016). Note that Hall and her colleagues focused on perceived verticality in their meta-analysis, which is a broad construct that includes SES, for example, but most findings (88%) concerned perceived dominance, assertiveness, influence, or leadership.

Assessing Perceived Anger

The expression of anger is linked to both assertiveness and influence. Expressing anger communicates dissatisfaction because the appraisal for anger is that things are not as they ought to be (Shaver et al., 1987). Expressing anger to those who caused the problem is being assertive, as the others may not readily acknowledge either the problem or their responsibility for it. Expressing anger is often an attempt to influence others, to have them change their problematic attitudes or behaviors (Averill, 1982). These links of anger to assertiveness and influence highlight the importance of assessing perceived anger. With no such assessment, participants might rate an individual as more assertive with faster gesturing even when they actually perceive more anger. That is, assertiveness ratings could serve as proxy for anger ratings.

People recognize very well the florid expression of subjectively intense, high arousal (hot) anger expressed by individuals from visual, audio (of pseudospeech), or both types of information (Bänziger et al., 2009, 2012). Individuals floridly expressing hot anger do so with a great deal of rapid gesturing (which implies rapid pseudospeech), gaze, as well as reduced interpersonal distance and less postural relaxation (both due to forward lean and movement; Dael et al., 2012, 2013).[1,2] Even without facial and vocal information, people

[1] Similarly, people who gaze more, show reduced interpersonal distance, and less postural relaxation are perceived as higher in verticality (Hall et al., 2005).

[2] All this research has focused on the florid expression of hot anger. There were apparently no portrayals of individuals expressing hot anger with low intensity behavior, even though this combination of experience

reliably identify such expressions of hot anger (Visch et al., 2014; Atkinson et al., 2004; but see Reynolds et al., 2019 for extremely intense portrayals). In contrast to hot anger, people less reliably recognize low subjective intensity, low arousal (cold) anger from individuals' low intensity expressions (Bänziger et al., 2009, 2012), although these expressions are sometimes perceived as hot anger, indicating that some observers assumed that intense anger was being expressed with low intensity behavior.

The Present Studies

We began with a Speed Pre-Test to identify the range of speed that people consider plausible and normal for the gestures in the cropped silent dyadic interaction video that we developed for the present research. We then proceeded to Study 1 in which the hypothesis was that people perceive an individual who gestures faster as more assertive and angrier in the context of a work or task-based interaction such as between coworkers. Participants in Study 1 were informed that the video was of an interaction between coworkers who knew each other and worked together in a company. In a between-subjects design, participants were presented four different speed versions of the video and then reported on their perceptions of the gesturing individual's (hereafter referred to as the *actor*) assertiveness, anger, and on an exploratory basis warmth and anxiety. Other measures in Study 1 included participants rating the actor's gesturing speed and expansiveness, as well as rating the plausibility and normalcy of the actor's behavior and of the interaction. Participants in Study 1 were expected to rate the actor's gesturing as faster and more expansive when having seen faster speed versions of the video. Both perceived gesturing speed and expansiveness were expected to reflect participants' general perceptions of the actor's nonverbal intensity (more on this below). No differences in plausibility and normalcy ratings were expected across video speed conditions.

The cropped silent video methodology used in Study 1 and the subsequent studies builds on prior research. Prior studies on people's perceptions of nonverbal behavior have excluded information on facial expressions and have shown that people do not need this information to draw coherent interpretations (Atkinson et al., 2004; Bente et al., 2001; Volkova et al., 2014). Excluding all facial and head information is advantageous as it eliminates specific influences of facial expression, head angle, and head motion (Atkinson et al., 2004; Livingstone & Palmer, 2016). Interaction videos have also been presented with no sound in prior research (cf. Burgoon et al., 1984; Gifford, 1994; Hall et al., 2002), which is necessary to eliminate the influence of speech.

Since participants are told, as part of this methodology, that the actor is talking, they will likely assume that the actor's speech rate is similar to that of the actor's gesturing rate because the gestures in the video meet the McNeill (1992) criteria for paths and types of motion for beat gestures, which are gestures that mark the rhythm and intonation of speech. In general, gesturing and speech are synchronous, and their frequency and speed are usually consistent with each other (Bavelas & Chovil, 2006; McNeill, 1992). Faster speech has also been linked to louder speech in some prior studies (e.g., Burgoon & Le Poire, 1999; Schucker & Jacobs, 1977; Tusing & Dillard, 2000), although it is unclear how consistently

Footnote 2 (continued)
and expression is likely in certain situations. People may not always be able to, or wish to, openly express intense feelings of anger.

this association is observed. In any case, the cropped silent video methodology reflects our assumption that participants do not need to hear the actor speak. Based on the cropped silent video, we expected participants to have coherent, general perceptions of the actor's nonverbal intensity, including the actor's gesturing speed and expansiveness, as well as speech speed and loudness.

Methodology of the Present Studies

The summary description of the methodology of Study 1 provided above is a rough guide to all the studies, given that they are all of similar design. Details now follow.

The Video

The video was created by two of the authors (MC and HWF) working with two male undergraduate research assistants. The original recording was made in a social sciences laboratory, under standard office fluorescent lighting conditions with a Sony Cyber-shot DSC-W125 7.2 megapixels digital video camera. The two men were seated at a table, facing each other. The actor performed eight beat gestures generally neutral in tone, of a type that a person might exhibit while speaking with another. See Fig. 1 for screenshots. The actor performed the gestures at a consistent speed. In addition to having the features of beat gestures, the gesture in panel (b) of Fig. 1 might also be a metaphoric representation (McNeill, 1992)—in terms of size—of some issue (e.g., a problem). The gesture in panel (h) might also be an emblem (Ekman & Friesen, 1969), being part of a shrug—which communicates aloofness, indifference, or uncertainty (*Merriam-Webster's collegiate dictionary* 2006). While the actor gestured, the other man hardly moved: He unclasped his hands once to move his left hand to the armrest, and then moved his hand back. The original recording was 38.13 s in duration and was used as the moderate–slow speed video in the studies. Different speed versions of the video were created with Adobe Elements (AdobeSystems, 2011).

A task-based context was implied by the video itself—apart from anything in the instructions on who the individuals were and what was transpiring in the video. Neutral-colored blank walls and an empty nondescript tabletop were bathed in uniform lighting. The two individuals were dressed in neutral and uniform tones, sat upright at the table, and hardly moved their torsos. The two individuals were male, and men are generally perceived as more assertive and less interpersonally warm than women, given status differences and gender roles (Conway et al., 1996; Eagly, 1987). People expect men to express anger more than women (Fabes & Martin, 1991; Plant et al., 2000; Smith et al., 2015; see Durik et al., 2006 for the importance of ethnicity), and consider angry men as competent and leader-like (Tiedens, 2001)—which may not be the case for how people perceive women (Brescoll & Uhlmann, 2008; Livingston et al., 2012). The gender of the individuals in the video was likely salient, given the little information provided about the individuals (Deaux & Major, 1987).

Common Study Features

There are many common features to the studies. Participants were undergraduate students at Concordia University, in Montreal, Canada. An experimenter approached individual female and male students in approximately equal numbers in public locations on campus

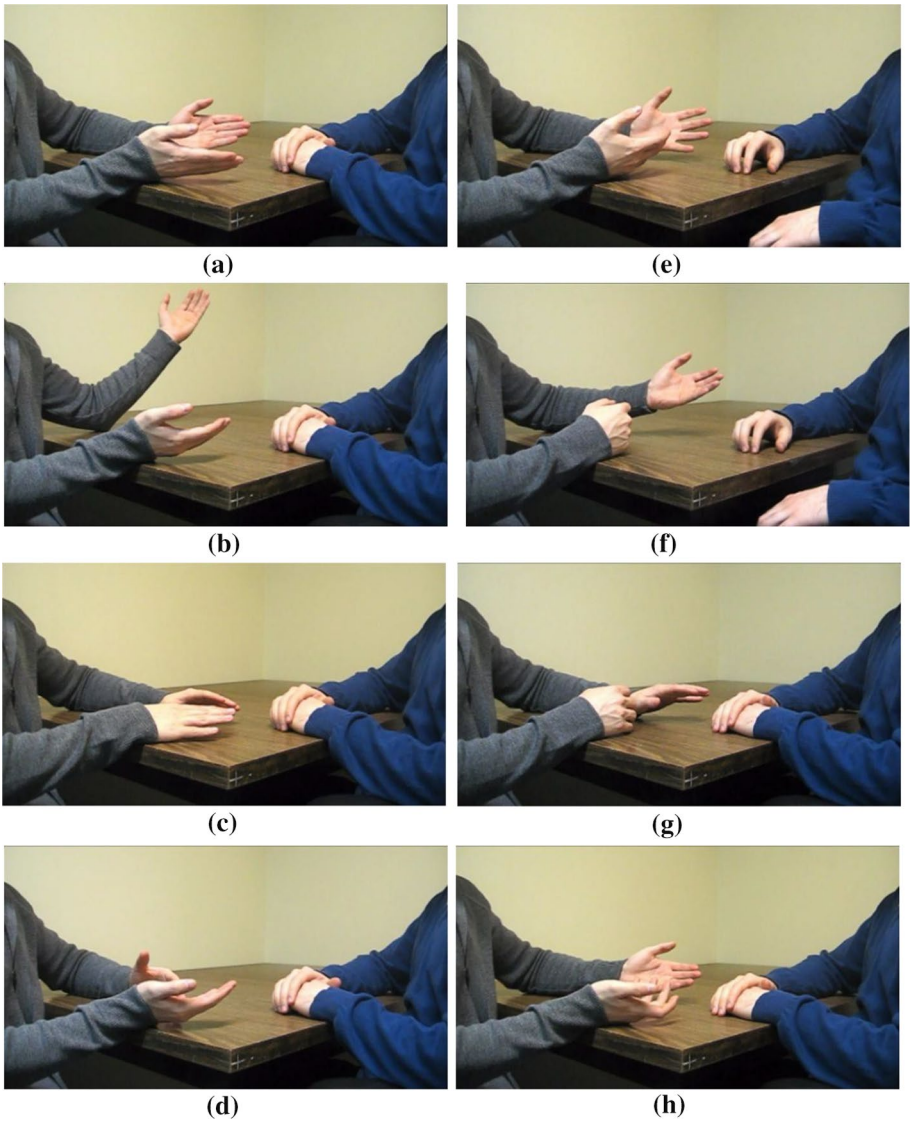

Fig. 1 Screenshots showing the apex of the actor's gestures in the video. The sequence from **a**–**h** is in chronological order

and invited them to immediately participate (except in Study 2). The experimenter was blind to speed condition and ran through the procedure with one participant at a time. Participants were informed that the study concerned people's perceptions of others' nonverbal behaviors and that they will watch a cropped silent video on a computer. As well, participants were informed that the video was of one individual talking to another person. In a between-subjects design, participants were randomly assigned to watch different speed versions of the cropped silent dyadic interaction video, played with either DirectRT (Jarvis, 2008) or Microsoft Media Player. There were four speed conditions in each study: slow

Table 1 Context information and measures in each study

Study	Stated context	Measures				
		Perceived context	Perceptions of the actor			Plausibility and normalcy
			Interpersonal orientation	Nonverbal behavior	Psychological engagement	
Speed Pre-Test	Coworkers					1, 2
Study 1	Coworkers		1, 2, 3, 4	1, 2		1, 2
Study 2	Coworkers		1, 3, 4, 5	1, 3		1
Study 3	None	X	1, 2, 3, 4	1, 2, 3, 4		
Study 4	None		1, 2, 3, 4	1, 2, 3, 4	X	
Study 5	Unacquainted students		1, 2, 3, 4	1, 2, 3		1, 2
Study 6	Unacquainted students		1, 2, 3, 4	1, 2, 3		1, 2

The *Coworkers* context refers to the video described as a meeting between two individuals who know each other and work together in the same department of a company. *None* refers to the video being described only as part of a conversation where one person was doing most of the talking. The *Unacquainted students* context refers to the video described as unacquainted students having a first and only meeting as part of a university project. For Interpersonal Orientation: 1 = assertiveness, 2 = anger, 3 = warmth, 4 = anxiety, 5 = competence. For Nonverbal Behavior: 1 = gesturing speed, 2 = gesturing expansiveness, 3 = talking speed, 4 = loudness. For plausibility and normalcy: 1 = Plausibility, 2 = Normalcy

(51 s), moderate–slow (38.13 s), moderate–fast (26 s), and fast (15.33 s). The exception was the Speed Pre-Test, in which there were also very-slow and very-fast speed conditions. Across studies, the video was centered on the computer screen and varied somewhat in size. For example, in the Speed Pre-Test the video image was 20.8 cm wide and 11.3 cm high on a laptop computer screen 35.8 cm in diagonal. Participants in each study watched the video twice to ensure familiarity.

Context Information

Context refers to who the men were and what they talked about. There was a statement about context provided to participants in some studies, but not in others. The statement about context, if there was one, varied across studies. See Table 1. The context in the Speed Pre-Test and Studies 1 and 2 was of a workplace interaction: The two men knew each other, worked together in a department of a company, and in the video one individual was "expressing concerns" to the other. We confirmed in a questionnaire pre-test (distinct from the Speed Pre-Test) that these concerns are perceived as work-related. Participants ($N = 83$) were recruited as in the studies and ran through the procedure one at a time. They read a questionnaire with the same workplace and "expressing concerns" information and with a screenshot of the apex of one of the actor's gestures. They reported their perceptions of the concerns on 5-point scales with endpoints 1 (*not at all*) and 5 (*very much*). Participants made higher ratings for "work problems that have to be dealt with", "what the other man should do", and "interpersonal issues between employees" than for "his own or the other man's private life (e.g., health, family)" and "his own or the other man's feelings and

well-being." The mean for the first three items, $M = 3.21$, 95% CI [3.07, 3.35], was higher than for the last two, $M = 2.39$, 95% CI [2.15, 2.62], $t(82) = 5.89$, $p < 0.001$, $r = 0.54$.

There was no statement about context in Studies 3 and 4. Participants were told only that "the video is of two men talking…you will view part of the conversation where the man on the left is doing most of the talking." The instructions in Studies 5 and 6 included a statement on context different from that of Studies 1 and 2. The context was that the two individuals were unacquainted students, both in second year and in similar programs. As part of a university initiative, they were invited to discuss concerns about their university experience. In the video, one individual was "expressing concerns." The rationale for these changes in whether context was stated in the instructions and, if so, what context was given is presented below.

General Measures

The main measures in Studies 1–6 were participants' impressions of the actor, usually for assertiveness, anger, warmth, and anxiety. See Table 1. Participants rated the extent to which provided words applied to the actor. Perceived assertiveness was assessed in any one study with three of *assertive*, *confident*, *determined*, *dominant*, and *self-confident* (the latter was not used in conjunction with *confident*). Perceived anger was assessed with *angry*, *annoyed*, and *frustrated*. Perceived warmth was assessed with *affectionate*, *caring*, and *warm*. Perceived anxiety was assessed with *anxious*, *fearful*, and *nervous*. Ratings were on 7-point scales with endpoints 1 (*not at all*) and 7 (*extremely*). Items were in counterbalanced order.

Measures in Studies 1–6 of secondary interest were participants' ratings of the actor's nonverbal behavior in response to "How fast do you think the person on the left was moving his hands and arms?" and other questions in counterbalanced order. Responses for the gesturing speed question were on a 7-point scale with endpoints 1 (*extremely slow*) and 7 (*extremely fast*). Other questions varied across studies, as noted in Table 1, and were also followed by 7-point scales. The gesturing expansiveness question was "How large and expansive were the hand and arm movements of the person on the left?", with scale endpoints 1 (*not at all expansive*) and 7 (*extremely expansive*). The talking speed question was "How fast to you think the person on the left was talking?", with the response scale being the same as for gesturing speed. The loudness question was "There was no sound, but in your opinion, how quietly was he talking?" (reversed), with scale endpoints *not at all* (1) and *completely* (7).

Checks on mundane realism followed the impression and behavior ratings. Participants in Studies 1, 2, 5, and 6 reported on the plausibility and normalcy of the actor's behavior and of the interaction, as noted in Table 1, with the questions not referring specifically to motion speed (which was the case in the Speed Pre-Test). Plausibility questions in Studies 1, 5, and 6 were "How plausible and realistic were the types of hand and arm movements of the person on the left?," "How plausible and realistic was the behavior of the person on the left?," and "Overall, how plausible and realistic was the interaction in the video?" Endpoints for the 7-point response scales were 1 (*extremely implausible*) and 7 (*extremely plausible*). The two normalcy questions in Studies 1, 5, and 6 were phrased as "In the context of …, do you consider…as normal and natural?" In Study 1, the first insert in both normalcy questions was "two people meeting at work." In Studies 5 and 6, the first insert in both normalcy questions was "two students meeting for the first time." In Studies 1, 5, and 6, the second insert was "the behavior of the person on the left" in one normalcy

question and "this interaction" in the other normalcy question. Endpoints for the 7-point response scales were 1 (*not at all normal*) and 7 (*completely normal*). Questions were in counterbalanced order. Ratings were different in Study 2, as described below. Plausibility and normalcy ratings were not included in Studies 3 and 4 to keep the studies short given the addition of other measures, as noted in Table 1. There was also a probe question regarding possible suspicion regarding our focus on gesturing speed in Studies 5 and 6. Finally, participants reported on their age, gender, ethnic or cultural identity, languages spoken, and domain of study, and were paid between CA$2.00 and $3.00 (except in Study 2).

Data Analyses and Reporting of Results for Studies 1–6

The analyses of participants' impressions of the actor (e.g., of his assertiveness) are reported in the *Results* section for each of Studies 1–6. Linear and quadratic trend analyses on mean impression indices were conducted across the four video speed conditions, with contrast coefficients based on the time intervals between speed conditions (Keppel & Wickens, 2004). Mean indices were derived by averaging ratings across each a priori set of items. Cronbach alphas were equal to or greater than 0.70, except for the anxiety index in Study 4 ($\alpha = 0.67$). Measures were adjusted for skew as necessary. The assertiveness index was negatively skewed in Studies 2 and 4. The anger index was positively skewed in Studies 1, 3, 4, and 6. The anxiety index was always positively skewed. Descriptive statistics are reported for raw scores. Also reported in each *Results* section are the analyses of participants' gesturing speed ratings most relevant to the impression ratings. Linear and quadratic trend analyses are reported, conducted as for the impression ratings, as are regression analyses of participants' gesturing speed ratings with predictors being video speed condition and participants' own impression ratings.

These study-by-study results for impressions and gesturing speed ratings were subjected to meta-analyses (Goh et al., 2016) which are reported in separate sections below. These internal "mini" meta-analyses provide a clear summary identification of findings and allow for comparisons across subgroups of studies. A fixed effects approach was used where the mean effect size (e.g., mean r) was weighted by sample size. This approach was adopted given that the studies were very similar methodologically and our goal was to summarize the results of the studies (Goh et al., 2016). Contrast analyses comparing findings across subgroups of studies were also with fixed effects. The Fisher's z transformation was applied to all coefficients (rs or standardized betas) for analyses. Results are reported in terms of rs or standardized betas, as applicable. All p values are two-tailed. All the meta-analyses reported below were conducted in this manner.

Analyses on how participants' ratings of the actor's gesturing speed related to their ratings of other aspects of the actor's nonverbal behavior are reported in another separate section below. We expected participants to hold coherent, general perceptions of the actor's nonverbal intensity. As such, we expected significant positive correlations between participants' gesturing speed ratings and their ratings of other aspects of the actor's nonverbal behavior, with higher ratings on all measures reflecting greater nonverbal intensity. We also expected one-component solutions for the principal components analyses (PCA) of behavior ratings (which were conducted when there were three or more behavior ratings in a study). Another set of analyses was on plausibility and normalcy ratings, and these are reported in still another separate section below. Linear and quadratic trend analyses were conducted on mean indices (there was only one normalcy item in the Speed Pre-Test).

Table 2 Sample characteristics in each study

Study	N	Female (%)	Age (*M*)	White (%)	English (%)	Refusal rate (%)
Speed pre-test	123	46.34	22.35	54.5	51.2	22.15
Study 1	93	54.84	22.54	49.5	52.7	20
Study 2	106	53.77	23.25	–	–	–
Study 3	134	50.00	22.88	51.5	50.4	25.82
Study 4	122	51.64	21.95	58.8	54.1	18.00
Study 5	121	55.37	23.08	43.8	40.5	22.93
Study 6	124	50.00	21.81	54.8	56.5	36.57

The heading *English* refers to only English being spoken at home. The refusal rate is for individuals who were approached to immediately participate in a study. Ethnicity and language information was not collected in Study 2, and there was no refusal rate given the nature of recruitment

Reliability was acceptable ($\alpha s > 0.68$). The normalcy rating was adjusted for positive skew in the Speed Pre-Test, and the plausibility index was adjusted for negative skew in Study 6. Meta-analyses for the plausibility and normalcy results are also reported. No differences were expected for perceived plausibility and normalcy across video speed conditions.

Speed Pre-test

The goal was to identify the range of plausible and normal speed for the gestures in the dyadic interaction video. We began with four speeds that we considered plausible and normal: slow, moderate–slow, moderate–fast, and fast. We then created two more speed versions: very-slow and very-fast. We expected participants to rate the very-slow and very-fast videos as less plausible and normal than the other four speeds. The Speed Pre-Test was distinctive relative to the other studies. Participants were informed that video speed was manipulated and that we were interested in their impressions of the plausibility and normalcy of the actor's behavior at the speed they saw it. Participants made only plausibility and normalcy ratings of the actor's nonverbal behavior, as noted in Table 1, and the plausibility and normalcy questions made explicit reference to speed.

Method

Stated context and measures are in Table 1, participant information is in Table 2, and the procedure is described in the *Methodology of the Present Studies* section above, with the following specifics. There were 21, 22, 20, 19, 22, and 19 participants in the very-slow to very-fast conditions, respectively. The six video speed versions were very-slow (63.87 s), slow to fast, and very-fast (4.66 s). The only questions were on plausibility and normalcy. Questions began with "For the person on the left" and responses were on 7-point scales. The two plausibility questions continued with "how plausible and realistic were the hand and arm movements, including their speed?" and "would a person having a conversation in real life move his hands and arms at the speed you saw?" Scale endpoints were *extremely implausible* (1) and *extremely plausible* (7) for the first question, and *absolutely not* (1) and *extremely likely* (7) for the second. The normalcy question continued with "can the hand and arm movements—including their speed—be considered normal for a person talking

to someone else?" Scale endpoints were *not at all normal* (1) and *completely normal* (7). Questions were in counterbalanced order.

Results and Discussion

The trend analysis with coefficients −2, 1, 1, 1, 1, and −2 for the plausibility index was statistically significant, $t(117) = 4.03$, $p < 0.001$, $r = 0.35$. As expected, the lowest mean ratings were in the very-slow and very-fast conditions, *M*s = 2.98 and 2.87, 95% CIs [2.51, 3.44] and [2.21, 3.53], respectively. The same trend analysis of the normalcy ratings had similar results, $t(116) = 3.69$, $p < 0.001$, $r = 0.32$; lowest means were in the very-slow and very-fast conditions, *M*s = 2.14 and 2.42, 95% CIs [1.68, 2.60] and [1.61, 3.23], respectively. Degrees of freedom are lower due to missing data. See Table 3 for descriptive statistics for plausibility and normalcy ratings for the slow to fast conditions (the trend analyses for the slow to fast conditions for plausibility and normalcy ratings are addressed below). In sum, the very-slow and very-fast videos were judged as less plausible and less normal than the other four speeds. Overall, the plausibility and normalcy ratings for the slow to fast conditions were moderate, which is consistent with other research: Participants rated beat gestures that were spontaneously generated by similar-aged peers as moderately natural (Dimitrova et al., 2016).

Study 1

The hypothesis and expected findings for Study 1 are presented at the beginning of *The Present Studies* section above.

Method

Stated context and measures are noted in Table 1, participant information is in Table 2, and the procedure is described in the *Methodology of the Present Studies* section above, with the following specifics.[3] There were 22, 22, 24, and 25 participants in the slow to fast conditions, respectively. Impression ratings preceded behavior ratings.

Results

Impressions

See Fig. 2 for descriptive statistics and Table 4 for inferential statistics. Contrary to the hypothesis, the linear trend was not significant for perceived assertiveness. Nor was the quadratic trend (*p*s > 0.25). As well, there was no indication of the expected positive linear trend for perceived anger—there was a nonsignificant negative linear trend ($p = 0.116$). What emerged for perceived anger was an unexpected U-shaped pattern of means, with the

[3] Study 1 originally had four other experimental conditions in which the video was presented at slow to fast speeds with a different context. We realized after the fact that this other context was ambiguous. There were no significant impression results across speed conditions for this other context, and these are not discussed further.

Table 3 Descriptive statistics by speed condition and trend analyses across the four speed conditions for plausibility and normalcy ratings in each study

Ratings	Speed condition								Trend analyses				
	Slow		Moderate−slow		Moderate−fast		Fast		Linear		Quadratic		df
	M	95% CI	*M*	95% CI	*M*	95% CI	*M*	95% CI	*t*	*r*	*t*	*r*	
Plausibility													
Pre-test	3.73	[3.21, 4.24]	3.30	[2.60, 4.00]	4.26	[3.66, 4.86]	4.25	[3.75, 4.75]	2.14*	.23	.54	.06	79
Study 1	4.59	[3.96, 5.22]	5.33	[4.88, 5.77]	4.93	[4.43, 5.43]	4.69	[4.30, 5.07]	− .19	− .02	− 1.98†	− .20	89
Study 2	5.26	[4.92, 5.60]	4.21	[3.56, 4.86]	4.28	[3.76, 4.79]	5.00	[4.49, 5.51]	− .55	− .07	3.58**	.35	102
Study 5	5.02	[4.59, 5.46]	4.83	[4.39, 5.27]	4.63	[4.21, 5.06]	4.47	[3.95, 4.99]	− 1.85†	− .17	.14	.01	117
Study 6	4.76	[4.30, 5.23]	4.51	[4.10, 4.93]	4.74	[4.36, 5.13]	4.42	[3.96, 4.89]	− .82	− .07	− .20	− .02	120
Normalcy													
Pre-test	3.18	[2.44, 3.93]	3.00	[2.18, 3.82]	3.53	[2.86, 4.20]	3.38	[2.71, 4.05]	.93	.10	− .08	− .01	78[a]
Study 1	3.98	[3.07, 4.88]	4.61	[3.98, 5.25]	3.67	[3.00, 4.33]	4.20	[3.57, 4.83]	− .20	− .02	− .01	.00	89
Study 5	3.52	[2.93, 4.11]	4.14	[3.60, 4.68]	3.27	[2.68, 3.85]	2.75	[2.20, 3.29]	− 2.65**	− .24	− 1.86†	− .17	117
Study 6	3.35	[2.81, 3.90]	3.34	[2.86, 3.81]	3.25	[2.74, 3.76]	3.40	[2.77, 4.02]	.04	.00	.32	.03	120

A positive *t* statistic for the linear trend indicates higher ratings with greater gesturing speed and indicates for the quadratic trend a U-shaped pattern of means. A negative *t* for the quadratic trend indicates an inverted-U shaped pattern of means

[a]Degrees of freedom are lower due to missing data

†$p < .10$.; *$p < .05$.; **$p < .01$

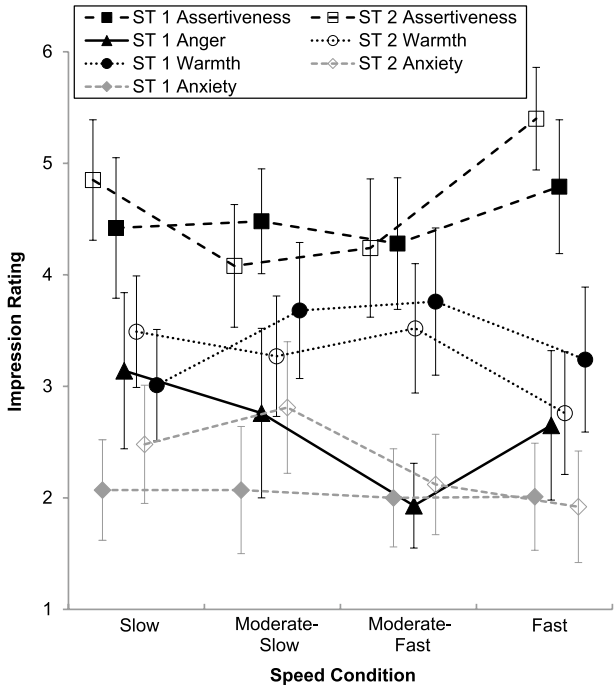

Fig. 2 Impression ratings in Studies 1 and 2. Higher numbers indicate more of the characteristic. Descriptive statistics are for raw scores. Error bars represent the 95% CIs of the mean. Points are offset horizontally so that error bars are visible

quadratic trend marginally significant ($p = 0.053$). The results for perceived anger remained virtually unchanged when controlling for assertiveness ratings, which were not significantly correlated with anger ratings, $r(91) = 0.17$, $p = 0.105$. For perceived warmth, there was an *inverted*-U pattern of means: The quadratic trend was significant ($p = 0.046$) and the linear trend was not ($p > 0.25$). No differences emerged across speed condition for perceived anxiety (ps > 0.25).

Gesturing Speed Ratings

See Fig. 3 for descriptive statistics and Table 5 for inferential statistics. The expected positive linear trend for gesturing speed ratings was significant ($p = 0.002$). However, a J-shaped quadratic effect was also significant ($p = 0.023$) as participants in the slow condition made higher ratings than expected. The regression of participants' gesturing speed ratings was significant ($p = 0.009$), with speed condition as a significant predictor ($p = 0.001$) and participants' anger ratings as a marginally significant predictor ($p = 0.057$). Speed was rated higher with faster video speed and higher anger ratings.

Discussion

The expected positive linear effect for perceived assertiveness was not significant in Study 1. Rather, participants made similar assertiveness ratings across speed conditions. Nor did the positive linear effect for anger emerge. Rather, there was a marginally significant quadratic trend for perceived anger: Participants tended to perceive the actor as angrier at slow

Table 4 Trend analyses for impressions in each study

Study	Assertiveness				Anger				Warmth				Anxiety				df
	Linear		Quadratic		Linear		Quadratic		Linear		Quadratic		Linear		Quadratic		
	t	*r*	*t*	*r*	*t*	*r*	*t*	*r*	*t*	*r*	*t*	*r*	*t*	*r*	*t*	*r*	
1	.74	.08	.83	.09	− 1.59	− .17	1.96†	.20	.49	.05	− 2.02*	− .21	− .37	− .04	.00	.00	89
2	1.77†	.17	3.58**	.33	–	–	–	–	− 1.65	− .16	− 1.02	− .10	− 2.20*	− .21	− .91	− .09	102
3	1.06	.09	.37	.03	.73	.06	2.54*	.22	− .83	− .07	− 2.25*	− .19	− 1.51	− .13	2.00*	.17	130
4	.86	.08	.34	.03	− 1.79†	− .16	2.15*	.19	− .72	− .07	− 2.83**	− .25	− 2.03*	− .18	1.64	.15	118
5	1.02	.09	− .71	− .06	.55	.05	− .77	− .07	1.19	.11	− 1.32	− .12	− .08	− .01	− .11	− .01	117
6	2.03*	.18	− .66	− .06	.43	.04	− .92	− .08	− .79	− .07	2.36*	.21	− 1.06	− .10	.49	.04	120

A positive *t* for a linear trend indicates that ratings for the construct were higher with greater gesturing speed and for a quadratic trend indicates a U-shaped pattern of means. A negative *t* indicates for a quadratic trend an inverted-U shaped pattern of means. Perceived anger was not assessed in Study 2

†$p < .10$; *$p < .05$; **$p < .01$

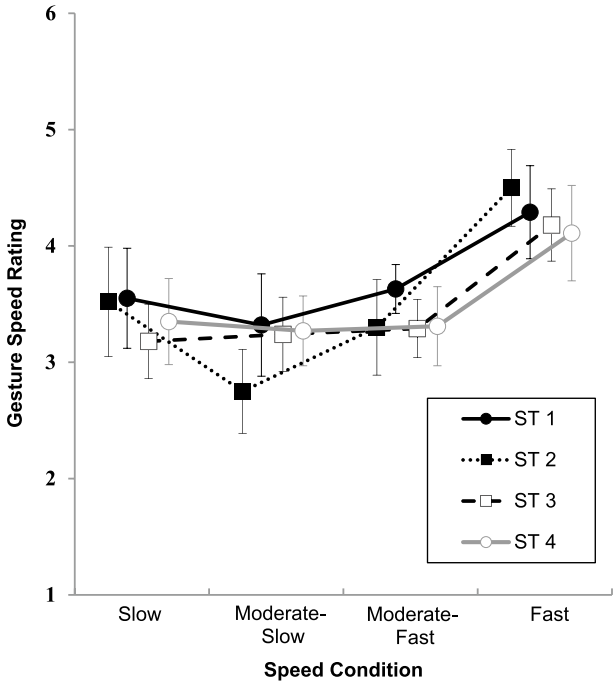

Fig. 3 Gesturing speed ratings in Studies 1, 2, 3, and 4. Higher numbers indicate higher speed ratings. Descriptive statistics are for raw scores. Error bars represent the 95% CIs of the mean. Points are offset horizontally so that error bars are visible

and fast relative to moderate speeds. In a complementary fashion to their anger ratings, participants perceived the actor as less warm at slow and fast relative to moderate speeds. Averaging across speed conditions, participants rated the actor as assertive, warm, angry, and anxious, in descending order. As such, the actor was seen as primarily assertive, as was expected, as well as angry to a lower extent.

Participants generally rated the actor's gesturing speed as faster when having viewed a faster video, but the pattern of means across speed conditions was not linear but J-shaped which resulted in a significant quadratic trend. In a regression, participants' speed ratings were predicted both by video speed as well as by their impressions of the actor's anger (the latter with marginal statistical significance). Perhaps perceiving anger led participants to rate the actor's gesturing as faster.[4] This bias may emerge because people generally perceive anger as an emotion that is intense and strong (Shaver et al., 1987). In sum, many findings for participants' impressions of the actor and for their ratings of the actor's gesturing speed were unexpected.

[4] It is less plausible to argue that participants' biased ratings of the actor's gesturing speed influenced their impressions of his anger, as the bias in speed ratings is left unexplained.

Table 5 Trend analyses across video speed conditions and regression analyses for gesturing speed ratings in each study

Study	Trend analyses					Regression analyses						
	Linear		Quadratic		df	*F*	dfs	Standardized beta coefficients				
	t	*r*	*t*	*r*				Speed condition	Assertiveness	Anger	Warmth	Anxiety
1	3.23**	.33	2.31*	.24	88[a]	3.27**	5,86[a]	.36**	− .07	.24[†]	.00	.03
2	4.16**	.38	4.85**	.43	102	3.59**	5,100	.31**	.26*	–	− .04	.14
3	4.72**	.38	2.66**	.23	128[a]	7.08**	5,126[a]	.33**	.19*	.21*	− .04	− .01
4	3.01**	.27	2.45*	.22	117[a]	4.87**	5,115[a]	.25**	.27**	.10	− .12	.03
5	4.29**	.37	2.14*	.20	117	4.60**	5,115	.34**	.09	.08	.04	.18[†]
6	3.45**	.30	− .36	.00	120	5.47**	5,118	.24**	.35**	.01	− .14	.15

For the trend analyses, a positive *t* for the linear trend indicates higher speed ratings with greater gesturing speed. A positive *t* for the quadratic trend indicates either a J-shaped pattern of means or similarly lower ratings for the slow to moderate–fast conditions and higher speed ratings for the fast speed condition. In the regression analyses, higher values for the speed condition variable indicate faster speed, and higher numbers for assertiveness, anger, warmth, and anxiety indicate more of each characteristic

[a]Degrees of freedom are lower due to missing data

[†]$p < .10$; *$p < .05$; **$p < .01$

Study 2

Study 2 was a replication of Study 1. One possible outcome was that the hypothesis of Study 1 will be supported, and findings will emerge as originally expected (as described at the beginning of *The Present Studies* section). Another possible outcome was that the unexpected findings of Study 1 will replicate.

Method

Stated context and measures are in Table 1, participant information is in Table 2, and the methodology is described in the *Methodology of the Present Studies* section above, with the following exceptions and specifics. Participants were recruited from a booth on campus and completed the study in a laboratory after first completing an unrelated study. There were 27, 28, 27, and 24 participants in the slow to fast conditions, respectively. As noted in Table 1, competence items (*capable*, *competent*, and *efficient*) were added to the impressions questionnaire, with the same response scales as for other impression items. Competence is associated with dominance in social perception (Anderson & Kilduff, 2009) and findings similar to perceived assertiveness were expected. Anger items were mistakenly omitted from the impressions questionnaire. Impression ratings preceded behavior ratings. Plausibility questions were "How realistic or plausible was the behavior of the person on the left?" and "Overall, how realistic or plausible was the interaction in the video?" Responses were on 7-point scales with endpoints 1 (*extremely implausible*) and 7 (*extremely plausible*). Participants were paid CA$10 for the two studies.

Results

Impressions

See Fig. 2 for descriptive statistics and Table 4 for inferential statistics. The hypothesis of Study 1 received some support with the marginally significant positive linear trend for perceived assertiveness ($p = 0.08$), but the more evident U-shaped quadratic trend ($p = 0.001$) was in line with the findings for perceived anger in Study 1. For perceived competence, linear and quadratic trends were nonsignificant, $ts < 1.13$, $ps > 0.25$; the overall mean was 4.51, 95% CI [4.29, 4.73]. In contrast to Study 1, the quadratic trend for perceived warmth was not significant ($p = 0.311$), and nor was the linear trend ($p = 0.103$). In contrast to Study 1, there was a significant negative linear trend for perceived anxiety ($p = 0.03$); the quadratic trend was not significant ($p > 0.25$).

Gesturing speed ratings

See Fig. 3 for descriptive statistics and Table 5 for inferential statistics. Findings were generally consistent with Study 1. The positive linear trend was significant ($p < 0.001$), as was a J-shaped quadratic trend ($p < 0.001$). The regression of the speed ratings was significant ($p = 0.005$). Speed condition was a significant predictor ($p = 0.001$), as were participants'

assertiveness ratings ($p = 0.034$). Other impression ratings were not significant predictors ($ps > 0.17$).

Discussion

Study 2 was conducted to determine whether the hypothesis of Study 1 is supported or whether the unexpected findings of Study 1 replicate. The marginally significant positive linear trend for perceived assertiveness in Study 2 provided some support for the hypothesis of Study 1. Yet the more evident U-shaped pattern of means for perceived assertiveness was not consistent with the hypothesis of Study 1 but with the anger findings of Study 1. Given that anger ratings were mistakenly omitted in Study 2, clear conclusions cannot be drawn from any of the findings for perceived assertiveness in Study 2. One possibility is that participants used their assertiveness ratings as proxy to communicate their impressions of the actor's anger. In any case, what is clear is that U-shaped nonlinear effects emerged in both Studies 1 and 2, and this pattern is at odds with the hypothesis of Study 1. Other findings in Study 2 did not clarify matters. There were no significant trends for perceived warmth in Study 2, in contrast to Study 1. Anxiety was generally rated lower with greater speed in Study 2, in contrast to the absence of differences in Study 1.

Participants in Study 2 rated the actor's gesturing speed as in Study 1, with the same J-shaped pattern of means emerging across speed conditions. As in Study 1, participants' impressions of the actor, in this case of his assertiveness, seemed to influence their ratings of the actor's gesturing speed. In sum, there was sufficient consistency in the impressions and gesturing speed findings of Studies 1 and 2 to warrant further investigation.

Studies 3 and 4

Studies 3 and 4, like Study 2, were modified replications of Study 1. One goal was to determine whether reliable findings emerge across multiple replications. Results were not always consistent in Studies 1 and 2, some results were of marginal statistical significance, some effects were not large, and there were problems of interpretation given that anger ratings were mistakenly omitted in Study 2. The hypothesis in Studies 3 and 4, based on the anger findings of Study 1, was that people perceive an individual who gestures at slow and fast relative to moderate gesturing speed are angrier in the context of a work or task-based interaction such as between coworkers. We also expected, as observed in Studies 1 and 2, a nonlinear J-shaped pattern in participants' ratings of the actor's gesturing speed, and that participants' ratings of gesturing speed will be associated with their impressions of the actor's anger or assertiveness or both.

Studies 3 and 4 also allowed us to address a question regarding Studies 1 and 2: Do the impression results—particularly participants' responses to the anger and assertiveness items—depend on the actor being described as expressing concerns? Would similar results emerge if there was no explicit reference to the actor expressing concerns and participants were informed only that the video was of a conversation? To address this question, participants in Studies 3 and 4 were not told who the men were or what that actor was talking about in the video. We assumed that the video itself (see *The video* section above) provided sufficient cues to be seen as a work or task-based interaction such as between coworkers.

There were other questions that needed to be addressed, specifically about the associations in Studies 1 and 2 between participants' impressions of the actor's anger or

assertiveness on the one hand, and their ratings of his gesturing speed on the other. Do these associations depend on participants reporting their impressions before rating gesturing speed? This question cannot be addressed in Studies 1 and 2 as impressions were always reported first. To address this, the order of impressions and speed ratings was changed in Studies 3 and 4. The other question was whether participants actually reported on their perceptions of the actor's gesturing speed when answering the gesturing speed question. Perhaps their ratings communicated their impressions of the actor's psychological engagement (e.g., motivation). Indeed, there were no psychological engagement items to report their views.

The measures required to address these questions could not all be included in one study, given the need to keep the procedure short (because the video is short, especially at faster speeds). Participants in Study 3 reported on their perceptions of context: Who do you think the individuals were and what did the actor talk about? These measures allowed us to verify our assumption that participants will see the video as a work or task-based interaction such as between coworkers in a company. Participants in Study 4 reported on the actor's psychological engagement in addition to reporting on the actor's gesturing speed. We expected a moderate but not high positive correlation between participants' ratings of the actor's psychological engagement and gesturing speed, and that their impressions of the actor's assertiveness or anger, or both will remain associated with their ratings of gesturing speed.

Method

Stated context and measures are in Table 1, participant information is in Table 2, and the methodology was as in the *Methodology of the Present Studies* section above, with the following specifics. There were 34, 34, 33, and 33 participants in the slow to fast conditions in Study 3; the corresponding numbers were 31, 33, 29, and 29, respectively, in Study 4. Participants in Study 3 completed behavior and impression ratings in counterbalanced order. They then reported on who the men were, how long they had known each other, and what they discussed, in counterbalanced order and with response options in counterbalanced order. The identity question was "Who are they?" and response options were (a) "they work together at a company," (b) "they are friends who don't study or work together," (c) "the person on the left is being interviewed by the other," (d) "they are students at a university," and (e) "other." If they chose (e), participants wrote who they thought the men were. The time question was "How long have they known each other?" and response options were (a) "they have known each other for some time" and (b) "the video is of their first meeting." The topic question was "The person on the left talked to the other person about…" and response options were (a) "something the other person said or did," (b) "something happening to the two of them," and (c) "something else."

In Study 4, the psychological engagement questions were "How strong are his feelings?", "How motivated is he?", "How bored is he?", and "How distracted is he?". Ratings were on 7-point scales with endpoints *not at all* (1) and *extremely* (7). The latter two questions showed floor effects and are not considered further. Participants rated the actor's behavior and psychological engagement in counterbalanced order, and then were given the impressions questionnaire.

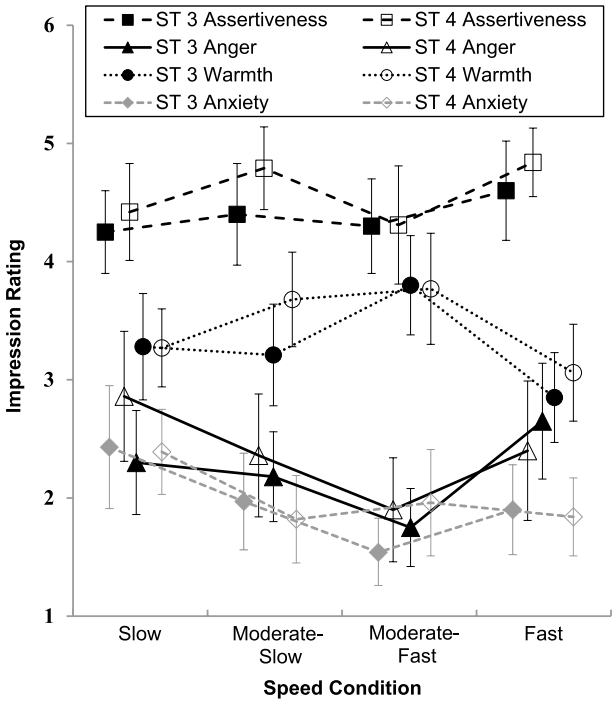

Fig. 4 Impression ratings in Studies 3 and 4. Higher numbers indicate more of the characteristic. Descriptive statistics are for raw scores. Error bars represent the 95% CIs of the mean. Points are offset horizontally so that error bars are visible

Results and Discussion

Impressions in Studies 3 and 4

See Fig. 4 for descriptive statistics and Table 4 for inferential statistics. The results were very similar in the two studies. The expected U-shaped quadratic effect for anger was significant in Studies 3 and 4 ($ps = 0.012$ and 0.034, respectively). There was no linear effect for anger in Study 3 ($p > 0.25$) and a marginally significant negative linear trend in Study 4 ($p = 0.076$). As in Study 1, linear and quadratic trends for perceived assertiveness were not significant in both studies ($ps > 0.25$). Anger and assertiveness ratings were not correlated in Study 3, $r = 0.04$, were in Study 4, $r(120) = 0.18$, $p = 0.046$, and introducing assertiveness ratings as a covariate in the analyses of anger ratings left results essentially unchanged in both studies. As such, the expected findings for perceived anger emerged in Studies 3 and 4 with participants being informed only that the two men were having a conversation. The explicit reference made in Studies 1 and 2 to the actor expressing concerns was not necessary for the anger results in Studies 3 and 4 to emerge.

No prediction was made for perceived warmth. Findings were as in Study 1: An inverted-U shaped quadratic effect emerged in Studies 3 and 4 ($ps = 0.026$ and 0.005, respectively) and linear effects were not significant ($ps > 0.25$). The patterns for perceived warmth and anger are complementary, and seem to indicate that participants considered warmth to be at odds with anger. For perceived anxiety, no prediction was made, and

patterns of means were generally similar across the two studies. The negative linear trend was not significant in Study 3 but was in Study 4 ($ps = 0.134$ and 0.044, respectively). A U-shaped quadratic trend was significant in Study 3 but not in Study 4 ($ps = 0.048$ and 0.104, respectively). The negative linear pattern for perceived anxiety is consistent with what was observed in Study 2.

Gesturing Speed Ratings in Study 3

See Fig. 3 for descriptive statistics and Table 5 for inferential statistics. As expected, the positive linear and the quadratic trends were significant ($p < 0.001$ and $p = 0.009$, respectively). The pattern of means was expected to be J-shaped but what emerged was slightly different: Speed ratings were similar from the slow to the moderate–fast conditions, and higher in the fast condition. Consistent with expectations, the regression of participants' speed ratings was significant ($p < 0.001$), with speed condition ($p < 0.001$), assertiveness ratings ($p = 0.034$), and anger ratings ($p = 0.033$) as significant predictors. These results emerged with speed and impression ratings being completed in counterbalanced order. Participants' impressions of the actor's assertiveness and anger seemed to have influenced their ratings of the actor's gesturing speed, similar to what was observed in Studies 1 and 2.

Perceptions of Context in Study 3

As expected, most participants perceived the video as a work or task-based interaction such as between coworkers in a company. Participants indicated that the men worked together at a company (48.5%), were in an interview (12.7%), or were students (6.7%)—presumably working on a task since participants did not choose the *Friends* option. Of the 20 participants (14.9%) who selected the *Other* category, nine wrote that the interaction was between a professor and a student, or between a superior and a subordinate. Three more responses were also task-oriented: the person on the left was negotiating a sale, was a consultant, or was interviewing the other. Four other responses for the *Other* category may also have been work or task-based, as they referred to giving an explanation, advice, or a presentation. Agreement rate across two independent coders for the *Other* categories was 85%. In sum, by the question on who the men were, most participants perceived the interaction as a work or task-based interaction such as between coworkers. Nevertheless, some participants (17.2%) perceived the video as an interaction between friends who do not study or work together. There was a significant difference across conditions in how participants identified the men, Fisher's exact test = 20.38, $p = 0.044$, which was due to the Friends category. Excluding participants who selected the Friends category left results for the impression and behavior ratings virtually unchanged, except that the p-value for the quadratic effect for anxiety ratings in Study 3 was now 0.093, due to the lower n. The effect size hardly changed.

Most participants perceived the men as having known each other for some time (72.4%), and these were evenly distributed across conditions, $\chi^2(3) = 4.34$, $p = 0.227$. Of the 37 participants (27.6%) who saw the video as a first meeting, seventeen reported that the men worked together at a company, one reported they were friends, and two selected the *Other* category ("left is negotiating a sale" and "the person on the left…is in a position of authority").

Most participants saw the actor as talking to the other about something the other said or did (59%), or something that was happening to the two of them (13.4%). As such, most

participants perceived the interaction in the video in a broader context of prior behavior or of a shared environment. There were no differences across speed conditions in participants' choice of topic, Fisher's exact test = 4.94, $p = 0.558$.

Gesturing Speed Ratings and Perceptions of the Actor's Psychological Engagement in Study 4

See Fig. 3 for descriptive statistics and Table 5 for inferential statistics. As expected, the positive linear and the quadratic trends for gesturing speed ratings were significant (ps = 0.003 and 0.016, respectively) with results very similar to those of Study 3. Also consistent with Study 3, the regression of the speed ratings was significant ($p < 0.001$), with speed condition ($p = 0.005$) and assertiveness ratings ($p = 0.004$) as significant predictors. Anger ratings were not a significant predictor in Study 4, however, contrary to Study 3. As such, participants' gesturing speed ratings in Study 4 remained associated with their impressions of the actor's assertiveness even when they rated gesturing speed before even seeing the impressions questionnaire. As well, gesturing speed ratings remained associated with assertiveness ratings even when there was a separate measure of psychological engagement—participants did not need to use speed ratings to report on actor engagement. There was only a moderate positive correlation between participants' gesturing speed and psychological engagement ratings, $r(119) = 0.37$, $p < 0.001$. The correlation was between speed ratings and a mean engagement index calculated for the motivation and strength of feelings ratings ($\alpha = 0.73$). Degrees of freedom are lower due to a missing value.[5]

Meta-analysis of Impressions and Gesturing Speed Ratings in Studies 1–4

We conducted meta-analyses on the findings for the impressions and gesturing speed ratings in Studies 1–4. See Table 6 for mean effect sizes. The meta-analysis for perceived assertiveness did not include the results of Study 2, given the ambiguity in those findings caused by the absence of anger ratings. For perceived assertiveness, mean effect sizes for linear ($p = 0.121$) and quadratic ($p > 0.25$) trends were not significant. For perceived anger, the mean effect size for the linear trend was not significant, and for the U-shaped quadratic trend was significant ($p < 0.001$). In a complementary fashion to the anger findings, the mean effect size for the inverted-U shaped quadratic trend for perceived warmth was significant ($p < 0.001$). As to perceived anxiety, the mean effect size for the negative linear trend was significant ($p = 0.002$).

Mean effect sizes for the linear and quadratic trends for gesturing speed ratings were significant. See Table 6. For the predictors in the regression of gesturing speed ratings, the mean beta weights for speed condition, $\beta = 0.31$, assertiveness ratings, $\beta = 0.17$, and

[5] A more comprehensive indicator that participants distinguished between the actor's psychological engagement and his nonverbal intensity is found in the results of a PCA conducted on participants' ratings for the two psychological engagement items adjusted for negative skew, and the four behavior items (including gesturing speed). With direct oblimin rotation, the PCA indicated a two-component solution with eigenvalues greater than 1, accounting for 58.29% of variance. The behavior items loaded on one component and the psychological engagement items loaded on another (> .51 on their respective components and < .12 on the other). The overall KMO value was .69 and individual KMO values were all above .63.

Table 6 Mean effect sizes for trends for impressions and gesturing speed ratings and contrast coefficients across contexts: work or task-based interaction such as between coworkers (studies 1, 2, and mostly in 3 and 4) and unacquainted students meeting (studies 5 and 6)

Impressions	Linear	Quadratic
	Mean *r* by Set of Studies	
Set 1: Studies 1 to 4		
Assertiveness	.08[a]	.05[a]
Anger	-.08[b]	.20[b]***
Warmth	-.07	-.19***
Anxiety	-.15**	.07
Speed rating	.34***	.28***
Set 2: Studies 5 and 6		
Assertiveness	.14*	-.06
Anger	.04	-.08
Warmth	.02	.05
Anxiety	-.05	.02
Speed rating	.33***	.11[†]
	Contrast *Z* across Sets 1 and 2	
Assertiveness	-.66	1.33
Anger	1.57	3.33***
Warmth	-1.01	-2.93**
Anxiety	-1.11	.51
Speed rating	.08	2.15*
	Mean *r* for all Studies	
Studies 1 to 6		
Assertiveness	.11[a]**	.00[a]
Anger	-.03[b]	.09[b]*
Warmth	-.04	-.11**
Anxiety	-.11**	.05
Speed rating	.34***	.22***

[a]Calculations for mean effect sizes for perceived assertiveness excluded the findings of Study 2

[b]Perceived anger was not measured in Study 2

[†]$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$

anger ratings, $\beta = 0.18$, were significant, ps < 0.001, but not for warmth or anxiety ratings, $|\beta|$s < 0.07.

Discussion for Studies 1–4

The meta-analyses for impressions in Studies 1–4 provided a summary identification of significant findings. There were no significant positive linear effects for perceived assertiveness or anger, and so the hypothesis of Study 1 was not supported. The strongest support for that hypothesis was in the significant mean effect size for the negative linear trend for perceived anxiety, since expressing anxiety (being fearful and nervous) is at odds with being assertive (e.g., being confident and determined). Other findings were clearly at odds with the hypothesis of Study 1. The mean effect size for the quadratic *U-shaped* pattern of

means for perceived anger was significant, just as was the mean effect size for a complementary *inverted-U* shaped quadratic trend for perceived warmth.

The nonlinear effects for perceived anger and warmth may have emerged because of how participants perceived the video. Participants watched a worker expressing concerns to another in Studies 1 and 2, which included concerns about what the other should do (see the concerns pre-test). Similarly, most participants in Studies 3 assumed—and the same likely held true in Study 4—that the actor was talking to the other about something the other said or did. As such, most participants in Studies 1–4 perceived the actor as raising concerns about the other's behavior even as the other showed little sign in the video of interrupting or objecting. Participants in Studies 1–4 may have seen the actor as having the right—in the other's eyes—to raise issues about the other's behavior. Participants also perceived the actor and the other as having known each other for some time, as was explicitly stated in Studies 1 and 2 and as most participants assumed in Study 3 (and probably in Study 4 as well). Participants in Studies 1–4 also generally perceived the actor and the other as interacting within the confines of work or task-based roles. The actor and the other were described as coworkers focused on work-related issues in Studies 1 and 2, and most participants in Studies 3 (and probably in Study 4 as well) assumed that the individuals in the video were interacting within work or task-based roles.

Participants in Studies 1 and 2, and most participants in Studies 3 and 4 seemed to perceive the situation as the actor having rights within the interaction with the other, and that the interaction was defined by enduring work or task-based roles. These conditions of rights within roles can be understood in terms of the relationship construct advanced in Fiske's model of human sociality (Fiske, 1991), which is a model that has been empirically supported (Haslam & Fiske, 1992, 1999; Fiske et al., 1991). Fiske's definition of relationships is a more specific version of the definition of a relationship being "a state of affairs existing between those having relations or dealings" (*Merriam-Webster's collegiate dictionary*, 2006). Of relevance here is that in Fiske's model a relationship defines each person's rights and responsibilities. People can assert themselves and express anger if others misbehave (Rai & Fiske, 2011)—without needing to impose themselves with intense verbal and nonverbal behavior. According to Fiske's model, people who interact within the enduring work or task-based roles typically found in the workplace have relationships. Of course, people have relationships with many others, including friends, family, and romantic partners, and these relationships vary in nature even as they are all based on the same four basic forms of human sociality.[6]

Our assumption that participants in Studies 1–4 generally perceived a relationship between the actor and the other person in the video is a theoretical stance consistent with prior research. Participants' impressions of the actor's greater anger at slow and

[6] In Fiske's model, a relationship consists of some combination of four basic forms of human sociality: authority ranking, communal sharing, equality matching, and market pricing. For authority ranking, legitimate differences in status define the relationship. With communal sharing, people "treat each other as all the same, focusing on commonalities" (Fiske 1992, p. 690). Equality matching supports balanced in-kind reciprocity, as well as equal treatment and contributions. Market pricing supports "Pay (or exchange) for commodities in proportion to what is received, as a function of market prices" (A. P. Fiske 1991, p. 43). As such, coworkers have relationships that can include authority ranking (e.g., based on recognized differences in seniority), communal sharing (e.g., sharing personal information), equality matching (e.g., helping each other out in a reciprocal manner), and market pricing (e.g., making exchanges for different types or times of work). Fiske's model does not postulate that the individuals involved consider themselves as "being in a relationship" or that observers label the interaction as being part of a "relationship.".

fast relative to moderate gesturing speed in Studies 1–4 seem to be the social perception counterpart of earlier research on anger expressed in relationships. People have reported that they express anger in their relationships with coworkers, friends, and romantic partners with either low- or high-intensity behavior (Diefendorff et al., 2010; Fehr et al., 1999; Kuppens et al., 2004; von Salisch & Vogelgesang, 2005). People report calmly talking to others or smiling when angry, just as they report more intense behavior such as flying off the handle. These self-reports seem to reflect people's sensitivity to the consequences of expressing anger. Overt expressions may be harmful in close relationships (Fitness, 2015) and may breach workplace norms (Gibson & Callister, 2010).

That the relationship context in Studies 1–4 may be important for the results that emerged led us to reconsider the studies cited in the Introduction on gesturing, speech speed, and loudness that formed the basis of the hypothesis of Study 1. We found that in many studies, participants interacted in a context that we label *open novel* (Baird, 1977; Burgoon & Le Poire, 1999; Gifford, 1994; O'Connor, 1971; Palmer, 1990). Open novel contexts have not to our knowledge been formally defined, and the definition we propose is that people (a) of similar status, (b) of no prior acquaintance, (c) whose prior behaviors have not affected each other, (d) are asked by a third-party, (e) on one occasion to a novel setting (f) to have a discussion, work on an assigned task, have a conversation, or get acquainted. As well, (g) individuals are not assigned roles, (h) there is no expectation of subsequent meetings, (i) there is no stated consequence for the individuals beyond the current meeting, and (j) the individuals interact only amongst themselves. These are the many conditions, and a researcher can readily create an open novel context when inviting undergraduate students into a research laboratory.

A distinctive feature of an open novel context is that it is devoid of relationships, as these are defined in Fiske's model (1991). People do not have rights and responsibilities as these exist in relationships. As such, there is a clear distinction between the contexts in Studies 1–4 and the open novel contexts instituted in many of the studies cited in the Introduction. Perhaps it is for open novel contexts that people are most likely to perceive an individual with more intense nonverbal behavior as more assertive and angrier. This possibility led us to conduct Study 5 and the exact replication Study 6 in which participants watched the same dyadic interaction video as in Studies 1–4 and were informed that the context was open novel.

Studies 5 and 6

Studies 5 and 6 were identical. Conducting two studies better allowed us to identify reliable findings for an open novel context. The hypothesis was that people perceive an individual who gestures faster as more assertive and angrier in an open novel context. We also expected a positive linear effect for participants' gesturing speed ratings, given the prediction for perceived assertiveness and anger. As in prior studies, we also expected that speed ratings will be related to participants' impressions of the actor's assertiveness, anger, or both. Finally, we introduced a probe question to assess whether participants suspected a focus on gesturing speed.

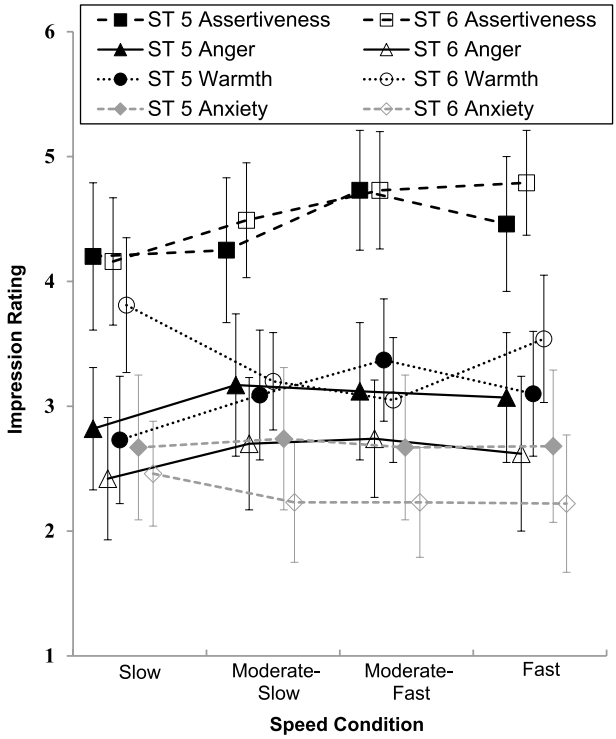

Fig. 5 Impression ratings in Studies 5 and 6. Higher numbers indicate more of the characteristic. Descriptive statistics are for raw scores. Error bars represent the 95% CIs of the mean. Points are offset horizontally so that error bars are visible

Method

Methodology was the same in Studies 5 and 6. Stated context and measures are in Table 1, participant information is in Table 2, and the methodology was as in the *Methodology of the Present Studies* section above, with the following specifics. There were 30, 31, 30, and 30 participants in the slow to fast conditions in Study 5, respectively; the corresponding numbers were 31, 34, 30, and 29, respectively, in Study 6. Participants reported their impressions, then rated the actor's behavior. The probe question on suspicion, which came last, was "At the beginning, I gave you a general idea of what this study is about. Do you have any thoughts about specific issues that I might be interested in?".

Results

Results for each study and meta-analyses across the two studies are reported together for each set of measures.

Impressions

See Table 4 for inferential statistics and Fig. 5 for descriptive statistics for each study, and see Table 6 for mean effect sizes across the two studies. The expected positive linear trend for perceived assertiveness was not significant in Study 5 ($p = 0.309$), was in Study

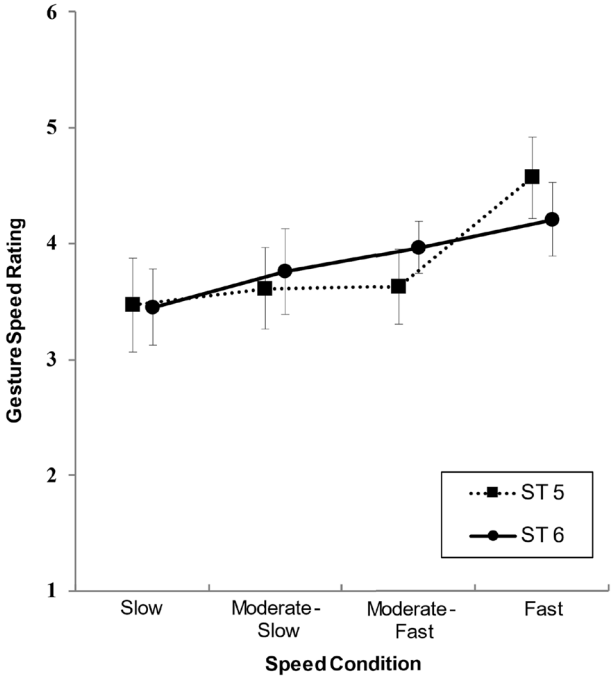

Fig. 6 Gesturing speed ratings in Studies 5 and 6. Higher numbers indicate higher speed ratings. Descriptive statistics are for raw scores. Error bars represent the 95% CIs of the mean. Points are offset horizontally so that error bars are visible

6 ($p = 0.044$), and the mean effect size across the two studies was significant ($p = 0.030$). No quadratic trend was expected, and it was not significant in Studies 5 and 6 ($ps > 0.47$) or across the two studies ($p = 0.165$). A positive linear trend was also expected for anger, but no significant linear or quadratic effects emerged in Studies 5 and 6 ($ps > 0.35$), or for the mean effect sizes across the two studies ($ps > 0.22$). No predictions were made for perceived warmth and anxiety, and no consistent findings emerged across the two studies for either measure. There was a U-shaped quadratic trend for perceived warmth in Study 6 ($p = 0.020$), but the quadratic trend in Study 5 was opposite and not significant ($p = 0.189$). Across the two studies, mean effect sizes for linear and quadratic trends for perceived warmth and anxiety were all nonsignificant ($ps > 0.41$).[7]

[7] Exploratory analyses indicated differences across male and female participants. A contrast analysis indicated that the mean effect size for male relative to female participants in Studies 5 and 6 was greater for the linear trend for perceived assertiveness, $Z = 2.36$, $p = 0.02$. Essentially, male participants' perceptions were as predicted, but female participants did not show any differences across speed condition. There were no other significant differences between male and female participants' linear and quadratic effect sizes for impression ratings in Studies 5 and 6. See Supplementary Material online for descriptive and inferential statistics by participant gender. Note that there was no such gender difference in Studies 1–4. Contrast analyses for the effect sizes for linear and quadratic trends for each of assertiveness, anger, warmth, and anxiety indices for Studies 1–4 (not Study 2 for anger) across male and female participants showed only one significant gender difference, which was that the quadratic trend for anxiety was greater for female than male participants, $Z = 2.04$, $p = 0.04$. This difference is not considered further.

Gesturing Speed Ratings

See Fig. 6 for descriptive statistics and Table 5 for trend and regression inferential statistics. See Table 6 for mean effect sizes for linear and quadratic trends. The expected positive linear trend for gesturing speed ratings was significant in Study 5 ($p < 0.001$) and 6 ($p = 0.001$). No quadratic effect was expected, and it was not significant in Study 6, $|t| < 1$, but was in Study 5 ($p = 0.034$), with ratings in the low to moderate speed conditions being similar and the ratings in the fast condition being higher. Across the two studies, the mean effect size for the positive linear trend was significant, and for the quadratic trend was marginally significant ($p = 0.078$). For the regression of gesturing speed ratings, speed condition was a significant predictor in Study 5 ($p < 0.001$) and 6 ($p = 0.006$). Contrary to expectations, assertiveness and anger ratings were not significant predictors, except for assertiveness ($p < 0.001$) in Study 6. Across the two studies, the mean standardized beta weights for the regression of gesturing speed ratings were significant for speed condition, $\beta = 0.29$, assertiveness ratings, $\beta = 0.22$, and anxiety ratings, $\beta = 0.16$, $ps < 0.05$, but not for anger or warmth ratings, $\beta s = -0.04$ and -0.05, respectively.

Probe Question

Most participants in Studies 5 (64.46%) and 6 (81.45%) wrote a response to the probe. In total, only four participants mentioned speed.

Discussion

As expected, participants in Studies 5 and 6, perceived the actor with faster gesturing as more assertive, as indicated by the small significant mean effect size for the positive linear trend. A positive linear effect was also expected for perceived anger, but no significant differences emerged across speed condition. No predictions were made for perceived warmth and anxiety, and no reliable effects emerged. As noted in Footnote 7, the expected effects for perceived assertiveness emerged for male but not female participants across Studies 5 and 6, and we return to this difference below. Participants also rated the actor's gesturing as faster when having seen faster videos; the quadratic effect that had been observed in Studies 1–4 was not expected, but the mean effect size for the quadratic effect in Studies 5 and 6 was marginally significant.

The next step was to conduct meta-analytic contrasts for the differences in the results of Studies 1–4 as compared to the results of Studies 5 and 6 for impressions and speed ratings, as well as to examine overall mean effect sizes across all studies.

Meta-analytic Contrasts for Impressions Between Studies 1–4 and Studies 5 and 6, and Mean Effect Sizes Across All Studies

The main findings in the present research are for participants' impressions of the actor's assertiveness, anger, warmth, and anxiety. Contrasts were conducted across the different contexts: the work or task- based roles (Studies 1, 2, and mostly in Studies 3 and 4) and unacquainted students meeting (Studies 5 and 6). See Table 6 for statistics and Fig. 7 for a schematic summary. For anger, the contrast for the quadratic trend was significant ($p < 0.001$): The significant U-shaped pattern in the work or task-based roles

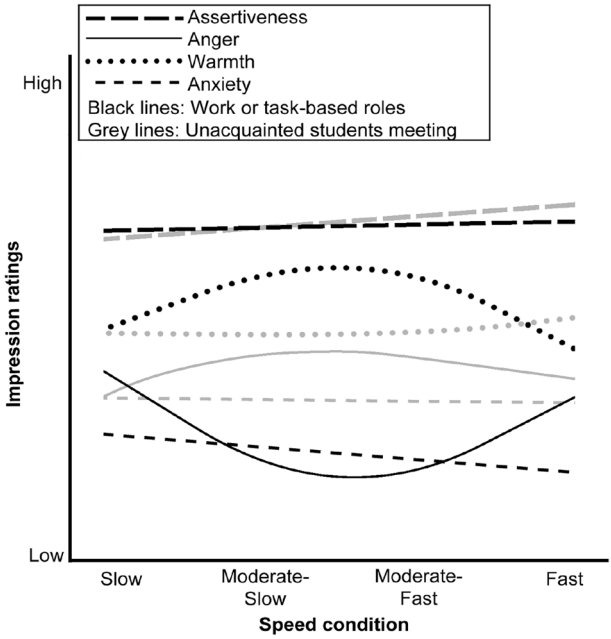

Fig. 7 Schematic for the contrasts across contexts: work or task-based roles (Studies 1, 2, and mostly in 3 and 4) and unacquainted students meeting (Studies 5 and 6). The straight lines for assertiveness and anxiety represent linear effects. Curved lines for anger and warmth represent quadratic effects

context differed from the slight inverted-U pattern in the unacquainted students context. For warmth, the contrast for the quadratic trend was significant ($p = 0.003$): The inverted-U pattern in the work or task-based roles context contrasted with the slight U-shaped pattern in the unacquainted students context. There were no other significant contrasts for impressions.

Across all studies except Study 2 (which was excluded because of the ambiguity caused by the omission of anger ratings), the mean effect size for the positive linear trend for perceived assertiveness was significant ($p = 0.010$); the quadratic trend was not ($p > 0.25$). See Table 6. In a complementary fashion, the mean effect size across all six studies for the negative linear trend for perceived anxiety was also significant ($p = 0.003$), and the quadratic trend was not ($p = 0.172$). Regarding perceived anger, the mean effect size for the linear trend was not significant ($p > 0.25$). Although the mean effect size across all studies for the U-shaped quadratic trend for perceived anger (except Study 2) was significant ($p = 0.030$), it is not representative of the findings in all contexts, given the contrast results. The same can be said for perceived warmth. The mean effect size across all studies for the linear trend was not significant ($p > 0.25$), and the mean effect size for the inverted-U shaped quadratic trend was significant ($p = 0.004$) but not representative of the findings in all contexts.

Meta-analytic Contrasts for Gesturing Speed Ratings Between Studies 1–4 and Studies 5 and 6, and Mean Effect Sizes Across All Studies

Across the studies, participants' ratings of the actor's gesturing speed varied in how much they detracted from the linear pattern that can be expected from the actual speeds of the videos and varied in their associations with participants' impressions of the actor. Contrasts were calculated across the work or task-based roles (Studies 1, 2, and mostly in Studies 3

and 4) and unacquainted students contexts (Studies 5 and 6). See Table 6. The contrast for the linear trend was not significant, $Z = 0.08$, whereas the contrast for the quadratic trend was significant, $Z = 2.15$, $p = 0.031$. The quadratic trend was more pronounced in the first set than the second set of studies. Other contrast analyses were conducted for the predictors in the regression analyses of gesturing speed ratings. None of the contrasts across contexts for the standardized beta weights were significant, be it for speed condition or the impression indices.

Across all studies, the mean effect size for the positive linear trend was significant, as was the mean effect size for the U- or J-shaped quadratic trend (see Table 6), although the latter trend is not representative of the findings in all contexts, given the contrast results. The next analyses were to determine patterns of findings across all six studies for how participants' gesturing speed ratings related to their other behavior ratings, as well as to determine the overall results for plausibility and normalcy ratings.

Gesturing Speed Ratings and Other Behavior Ratings in Studies 1–6

We expected participants to have coherent general perceptions of the actor's nonverbal intensity based on the actor's gesturing. Results for correlations and PCAs are reported here for Studies 1–6. See Table 1 for which behavior ratings were made in each study. The largest correlations were between participants' gesturing and talking speed ratings, rs > 0.44, ps < 0.001. Gesturing speed ratings were also significantly correlated with expansiveness and loudness ratings, rs > 0.21 and 0.26, ps < 0.05, respectively. PCAs with direct-oblimin rotation were conducted on the behavior ratings in each of Studies 3–6. As expected, a one component solution with an eigenvalue greater than one emerged in each study. Across the four PCAs, the mean overall KMO value was 0.59 (range 0.52–0.65). The mean for the lowest individual KMO value was 0.56 (range 0.51–0.61), the mean lowest loading was 0.51 (range 0.44–0.61), and the mean percentage variance accounted for was 53.21% (range 47.59–60.94). These correlational and PCA findings are consistent with the view that participants held coherent general perceptions of the actor's nonverbal intensity. Nevertheless, many correlations were small, and the PCA results were weak. Much variance remained unaccounted for. What was clearest was the moderate correlation between participants' gesturing and talking speed ratings.

Plausibility and Normalcy Ratings

Participants were expected to rate the four speed versions of the video similarly in terms of plausibility and normalcy. See Table 3 for descriptive and inferential statistics for plausibility and normalcy ratings. For plausibility ratings in the Speed Pre-Test, the positive linear trend across the slow to fast speed conditions was significant ($p = 0.036$), and the quadratic trend was not, $|t| < 1$. For normalcy ratings in the Speed Pre-Test, linear and quadratic trends were not significant, $|t|$s < 1. In Studies 1 and 2, linear trends for the plausibility index were not significant, $|t|$s < 1, and inconsistent quadratic trends emerged. An inverted-U shaped quadratic trend was marginally significant ($p = 0.051$) in Study 1 and a U-shaped quadratic effect was significant ($p = 0.001$) in Study 2 for the plausibility index. For normalcy ratings in Studies 1 and 2, linear and quadratic trends were not significant, $|t|$s < 1. In Studies 5 and 6, linear and quadratic trends for plausibility and normalcy ratings were generally not

significant, except for a significant negative linear trend ($p = 0.009$) for normalcy ratings in Study 5.

Meta-analyses for plausibility and normalcy ratings were conducted for the effect sizes for linear and quadratic trends across the studies. Mean effect sizes were not significant for either set of ratings, $|r|$s < 0.05, ps > 0.15. Overall, participants in the studies rated the actor's behavior and the interaction on the *plausible* side of the plausibility scale—slightly below *somewhat plausible*—and rated normalcy slightly above *somewhat normal*.

General Discussion

The hypothesis in Study 1 was that people perceive an individual with faster gesturing as more assertive and angrier in the context of a work or task-based interaction such as between coworkers. There were many unexpected findings in Study 1, and we conducted five replications with various modifications to determine what were reliable findings, to understand the nature of these findings, and to understand the importance of context in determining participants' perceptions. Changes in context were introduced across the studies. Meta-analyses indicated that participants perceived the actor with faster gesturing as more assertive across the different contexts. In a complementary fashion, participants perceived the actor with faster gesturing as less anxious. These effects were small and were usually not statistically significant on a study-by-study basis. These findings are consistent with a modified version of the hypothesis of Study 1, one that is narrower—by excluding anger—as well as being broader—by not referring to the specific context of a work or task-based interaction such as between coworkers. As suggested at the outset, the findings might be due to participants relying on property transmission (White, 2009) and learned associations. Property transmission refers to people attributing the cause of some behavior (e.g., intense nonverbal behavior such as faster gesturing) to an underlying factor of a similar nature (e.g., an intense interpersonal orientation such as higher assertiveness). As well, people may have learned from experience that more assertive individuals often engage in more intense nonverbal and verbal behavior.

It was the unexpected findings in Study 1 for perceived anger and warmth that led us to conduct modified replications. Participants in Study 1 perceived the actor as angrier at slow and fast relative to moderate gesturing speed (with marginal statistical significance). In a complementary fashion, participants in Study 1 perceived the actor as less warm at slow and fast relative to moderate gesturing speed. These findings were unexpected in Study 1 but emerged as consistent and reliable with subsequent studies. We understood these results as due to context: Participants perceived the individuals in the video as interacting within the confines of work or task-based roles. This context information was provided in Studies 1 and 2, and it was what most participants in Study 3 (and probably Study 4) assumed, based on what they saw in the video (instructions in Studies 3 and 4 did not provide any information on who the individuals were or what they talked about, and participants in Study 3 reported on who they thought the men were and what was talked about). Instructions in Studies 1 and 2 also referred to the actor expressing concerns to the other, and similarly in Study 3 (and probably Study 4) most participants perceived the actor as talking to the other about something that the other said or did. As well, it is not only the actor's gesturing that is important, but how the other individual behaved in the video. While the actor gestured, the other individual sat there, apparently listening and giving no sign of interrupting or objecting.

This may have led participants to perceive the actor as having the right—in the other's eyes—to raise concerns about the other's behavior. This situation of the actor having rights in an interaction anchored in enduring work or task-based roles can be understood as the actor and the other having a relationship, as defined in Fiske's (1992) model of human sociality (see Footnote 6). Relationships entail rights and responsibilities for those involved, and the actor does not need to impose himself with intense verbal and nonverbal behavior to express anger. As such, participants in Studies 1–4 likely perceived a relationship between the two individuals in the video (see Footnote 6). That is why participants in Studies 1, 3, and 4 (anger was not measured in Study 2) perceived the actor as angrier and less warm when gesturing at slow and fast relative to moderate speed. Such perceptions are similar to people's self-reports on their own anger expression in their relationships with coworkers, friends, and romantic partners.

This explanation of the anger and warmth findings in Studies 1–4 was put to the test in Studies 5 and 6. In these two studies, participants were presented the same dyadic interaction video but now the context was devoid of any relationship between the two individuals. The context was open novel, which is a context that has been implemented in many prior studies, even as it has not been formally defined (see the *Discussion for Studies 1–4* section for a proposed definition). In essence, an open novel context is one with no history and no future: unacquainted individuals of similar status are brought together on one occasion in a novel setting by a third party. In Studies 5 and 6, the open novel context was that two unacquainted students were meeting, as part of a university initiative, to discuss their concerns about their university experience. The mean effect size for the positive linear trend for perceived assertiveness was significant in Studies 5 and 6, with no other impression effects emerging. There nevertheless was a consistent gender difference in Studies 5 and 6, with male but not female participants perceiving more assertiveness with greater gesturing speed (see Footnote 7). This type of gender difference was not consistently found in the few studies in the Hall et al. (2005) meta-analysis that examined male and female participants' ratings separately for open novel contexts; rather, findings were mixed or ambiguous (Farley, 2000; Forden, 1981; Burgoon et al., 1992).

Across the four speed conditions in the six studies, participants generally perceived the actor as assertive, warm, angry, and anxious, in descending order. That ratings were higher for assertiveness and warmth than for anger and anxiety is consistent with people's reports of their own and others' workplace behavior (Moskowitz et al., 1994, 2007). The high assertiveness ratings also likely reflect the influence of many features of the actor's behavior, including his erect posture and direct orientation toward the other. Participants watching the video also likely assumed that the actor gazed at the other. All these nonverbal behaviors have been associated with more perceived dominance (Hall et al., 2005). Overall, participants perceived the actor as much more assertive than angry, and the lower anger ratings indicate that participants perceived cold (low subjective intensity and arousal) as opposed to hot (high subjective intensity and arousal) anger.

Effect sizes for perceived assertiveness and anger in the present research were smaller than that for gesturing frequency ($r = 0.37$) in the meta-analysis by Hall et al. (2005) on perceived verticality (which consisted mostly of perceived assertiveness, dominance, influence, and leadership). However, the 0.37 effect size includes the influence of co-occurring behaviors, such as the sheer amount (Mast, 2002) as well as the content of speech, paralinguistic features of speech such as loudness, and facial expressiveness.

External Validity

Participants only saw the actor's gestures but, on that basis, formed general coherent perceptions of the actor's nonverbal intensity, just as they likely do in everyday settings. As well, participants judged the videos as somewhat plausible and normal to a similar degree across speed conditions, which indicates that the variations in speed are all similarly in line with people's everyday experience. Admittedly, the plausibility and normalcy ratings may have been lowered slightly by the actor's gestures being of consistent speed with each other. Gestures may vary more in speed in everyday interactions. There was also no facial information in the video. Yet there may be little to be seen in the facial expressions of angry individuals (Durán et al., 2017; Motley & Camden, 1988). Finally, it is unclear whether the present findings will replicate when the gesturing individual is a young adult woman or an older adult. A woman might be stereotyped with a primary motive of interpersonal warmth as opposed to assertiveness—even in a workplace context. An older adult may be stereotyped in the same way (Fiske et al., 2002) and slow gesturing might be seen as a sign of age (Mussweiler, 2006).

Participants' Impressions of the Actor and Their Ratings of his Gesturing Speed

Overall, participants who perceived the actor as more assertive and angrier in Studies 1–4 rated the actor's gesturing speed as faster, which contributed to the overall J-shaped pattern of means for speed ratings across the slow to fast speed conditions. That is, speed ratings were higher in the slow condition than one would expect from actual video speed alone. To a lesser degree, similar results were obtained in Studies 5 and 6. Our theoretical account for these findings is that participants drew intentional inferences (e.g., *he is assertive*; Uleman, 1999) while watching the video, which influenced their information processing (Ferreira et al., 2012) when subsequently rating the actor's gesturing speed. That is, participants were influenced by self-generated descriptive words such as *assertive* and *angry* just as participants in the classic Loftus and Palmer (1974) research were influenced by provided descriptive words (*smashed* vs. *hit*) when recalling the speed of a car. Perceiving the actor as assertive and angry led to recalling his gesturing as faster because assertiveness is construed as high in activity (Williams & Best, 1990) and anger is construed as an intense and strong emotion (Shaver et al., 1987). It nevertheless remains unclear why perceived anger was associated with speed ratings only in the work or task-based roles context of Studies 1, 3, and 4, but not in the open novel context of Studies 5 and 6.

Implications

- Property transmission and learned associations may underlie a general tendency for people to perceive others with more intense nonverbal behavior, such as faster gesturing, as more assertive and less anxious, but the effect is small.
- Participants perceived the same nonverbal behavior differently depending on context, particularly for impressions of anger and warmth. The extent to which the context is a relationship—in the sense of Fiske's (1992) model of human sociality—may be generally important for how people perceive others' nonverbal behavior.

- Whether there are gender differences in how people perceive others' assertiveness may depend on context, and specifically whether the context is a relationship.
- People may be biased in how they recall others' nonverbal behavior, based on their impressions of the others' assertiveness and anger. These biases could help maintain people's general view that individuals who are assertive or express anger do so with intense verbal and nonverbal behavior.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10919-022-00418-1.

Author Contributions M.C. directed all aspects of the project and took the lead in writing the manuscript. H.W.-F. assisted in creating the video used in the studies. C.G. assisted in directing the project and writing the manuscript. All other co-authors were involved in designing and conducting the studies. J.L. conducted Study 1 and coordinated Study 6. D.B., S.S.T., and K.M. designed and conducted Study 3. C.R. and S.C. conducted the Speed Pre-Test and Studies 4 and 5. All co-authors provided feedback on drafts of the manuscript, and all co-authors have approved the manuscript.

Declarations

Conflict of interest The authors declare that they have no conflict of interest.

Human and Animal Rights All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee (University Human Research Ethics Committee, Concordia University, Certificate number 30001762) and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the studies.

References

AdobeSystems. (2011). Adobe Elements (Version 11) [Computer software]. San Jose, CA.

Anderson, C., & Kilduff, G. J. (2009). Why do dominant personalities attain influence in face-to-face groups? The competence-signaling effects of trait dominance. *Journal of Personality and Social Psychology, 96*, 491–503. https://doi.org/10.1037/a0014201

Atkinson, A. P., Dittrich, W. H., Gemmell, A. J., & Young, A. W. (2004). Emotion perception from dynamic and static body expressions in point-light and full-light displays. *Perception, 33*, 717–746. https://doi.org/10.1068/p5096

Averill, J. R. (1982). *Anger and aggression: An essay on emotion (Springer series in social psychology)*. Springer.

Baird, J. E. (1977). Some nonverbal elements of leadership emergence. *The Southern Speech Communication Journal, 42*, 352–361.

Bänziger, T., Grandjean, D., & Scherer, K. R. (2009). Emotion recognition from expressions in face, voice, and body: The Multimodal Emotion Recognition Test (MERT). *Emotion, 9*, 691–704. https://doi.org/10.1037/a0017088

Bänziger, T., Mortillaro, M., & Scherer, K. R. (2012). Introducing the Geneva Multimodal expression corpus for experimental research on emotion perception. *Emotion, 12*, 1161–1179. https://doi.org/10.1037/a0025827

Bavelas, J. B., & Chovil, N. (2006). Nonverbal and verbal communication: Hand gestures and facial displays as part of language use in face-to-face dialogue. In V. Manusov & M. L. Patterson (Eds.), *The Sage handbook of nonverbal communication* (pp. 97–115). Sage Publications Inc.

Bente, G., Krämer, N. C., Petersen, A., & de Ruiter, J. P. (2001). Computer animated movement and person perception: Methodological advances in nonverbal behavior research. *Journal of Nonverbal Behavior, 25*, 151–166. https://doi.org/10.1023/A:1010690525717

Brescoll, V. L., & Uhlmann, E. L. (2008). Can an angry woman get ahead? Status conferral, gender, and expression of emotion in the workplace. *Psychological Science, 19*, 268–275. https://doi.org/10.1111/j.1467-9280.2008.02079.x

Burgoon, J. K., Buller, D. B., Hale, J. L., & DeTurck, M. A. (1984). Relational messages associated with nonverbal behaviors. *Human Communication Research, 10*, 351–378. https://doi.org/10.1111/j.1468-2958.1984.tb00023.x

Burgoon, J. K., & Le Poire, B. A. (1999). Nonverbal cues and interpersonal judgments: Participant and observer perceptions of intimacy, dominance, composure, and formality. *Communication Monographs, 66*(2), 105–124.

Burgoon, J. K., Walther, J. B., & Baesler, E. J. (1992). Interpretations, evaluations, and consequences of interpersonal touch. *Human Communication Research*, *19*(2), 237–263. https://doi.org/10.1111/j.1468-2958.1992.tb00301.x

Conway, M., Pizzamiglio, M. T., & Mount, L. (1996). Status, communality, and agency: Implications for stereotypes of gender and other groups. *Journal of Personality and Social Psychology, 71*, 25–38. https://doi.org/10.1037/0022-3514.71.1.25

Dael, N., Goudbeek, M., & Scherer, K. R. (2013). Perceived gesture dynamics in nonverbal expression of emotion. *Perception, 42*(6), 642–657. https://doi.org/10.1068/p7364

Dael, N., Mortillaro, M., & Scherer, K. R. (2012). Emotion expression in body action and posture. *Emotion, 12*, 1085–1101. https://doi.org/10.1037/a0025737

Deaux, K., & Major, B. (1987). Putting gender into context: An interactive model of gender-related behavior. *Psychological Review, 94*, 369–389.

Diefendorff, J., Morehart, J., & Gabriel, A. (2010). The influence of power and solidarity on emotional display rules at work. *Motivation and Emotion, 34*, 120–132. https://doi.org/10.1007/s11031-010-9167-8

Dimitrova, D., Chu, M., Wang, L., Özyürek, A., & Hagoort, P. (2016). Beat that word: How listeners integrate beat gesture and focus in multimodal speech discourse. *Journal of Cognitive Neuroscience, 28*, 1255–1269. https://doi.org/10.1162/jocn_a_00963

Dunbar, N. E., & Burgoon, J. K. (2005). Perceptions of power and interactional dominance in interpersonal relationships. *Journal of Social and Personal Relationships, 22*, 207–233. https://doi.org/10.1177/0265407505050944

Durán, J. I., Reisenzein, R., & Fernández-Dols, J.-M. (2017). Coherence between emotions and facial expressions: A research synthesis. In *The science of facial expression* (Oxford series in social cognition and social neuroscience, pp. 107–129). New York, NY: Oxford University Press.

Durik, A. M., Hyde, J. S., Marks, A. C., Roy, A. L., Anaya, D., & Schultz, G. (2006). Ethnicity and gender stereotypes of emotion. *Sex Roles: A Journal of Research, 54*, 429–445. https://doi.org/10.1007/s11199-006-9020-4

Eagly, A. H. (1987). *Sex differences in social behavior: A social-role interpretation*. Erlbaum.

Ekman, P., & Friesen, W. (1969). The repertoire of non-verbal behavior: Categories, origins, usage, and coding. *Semiotica, 1*, 49–98. https://doi.org/10.1515/semi.1969.1.1.49

Fabes, R. A., & Martin, C. L. (1991). Gender and age stereotypes of emotionality. *Personality and Social Psychology Bulletin, 17*, 532–540.

Farley, S. D. (2000). *Attaining status at the expense of likability: Pilfering power through interruptive behavior*. Unpublished doctoral dissertation, Virginia Commonwealth University.

Fehr, B., Baldwin, M., Collins, L., Patterson, S., & Benditt, R. (1999). Anger in close relationships: An interpersonal script analysis. *Personality and Social Psychology Bulletin, 25*, 299–312. https://doi.org/10.1177/0146167299025003003

Ferreira, M. B., Garcia-Marques, L., Hamilton, D., Ramos, T., Uleman, J. S., & Jerónimo, R. (2012). On the relation between spontaneous trait inferences and intentional inferences: An inference monitoring hypothesis. *Journal of Experimental Social Psychology, 48*(1), 1–12. https://doi.org/10.1016/j.jesp.2011.06.013

Fiske, A. P. (1991). *Structures of social life: The four elementary forms of human relations: Communal sharing, authority ranking, equality matching, market pricing*. Free Press.

Fiske, A. P. (1992). The four elementary forms of sociality: Framework for a unified theory of social relations. *Psychological Review, 99*, 689–723. https://doi.org/10.1037/0033-295x.99.4.689

Fiske, A. P., Haslam, N., & Fiske, S. T. (1991). Confusing one person with another: What errors reveal about the elementary forms of social relations. *Journal of Personality and Social Psychology, 60*, 656–674. https://doi.org/10.1037/0022-3514.60.5.656

Fiske, S. T., Cuddy, A. J. C., Glick, P., & Xu, J. (2002). A model of (often mixed) stereotype content: Competence and warmth respectively follow from perceived status and competition. *Journal of Personality and Social Psychology, 82*, 878–902. https://doi.org/10.1037/0022-3514.82.6.878

Fitness, J. (2015). Emotions in relationships. In M. Mikulincer, P. R. Shaver, J. A. Simpson, & J. F. Dovidio (Eds.), *APA handbook of personality and social psychology, Volume 3: Interpersonal relations.* (APA handbooks in psychology, pp. 297–318, Vol. Interpersonal relations). Washington, DC: American Psychological Association.

Forden, C. (1981). The influence of sex-role expectancies on the perception of touch. *Sex Roles*, *7*, 889–894.

Gibson, D. E., & Callister, R. R. (2010). Anger in organizations: Review and integration. *Journal of Management, 36*, 66–93. https://doi.org/10.1177/0149206309348060

Gifford, R. (1994). A lens-mapping framework for understanding the encoding and decoding of interpersonal dispositions in nonverbal behavior. *Journal of Personality and Social Psychology, 66*, 398–412. https://doi.org/10.1037/0022-3514.66.2.398

Goh, J. X., Hall, J. A., & Rosenthal, R. (2016). Mini meta-analysis of your own studies: Some arguments on why and a primer on how. *Social and Personality Psychology Compass, 10*(10), 535–549. https://doi.org/10.1111/spc3.12267

Hall, J. A., Coats, E. J., & Smith LeBeau, L. (2005). Nonverbal behavior and the vertical dimension of social relations: A meta-analysis. *Psychological Bulletin, 131*, 898–924. https://doi.org/10.1037/0033-2909.131.6.898

Hall, J. A., Horgan, T. G., & Carter, J. D. (2002). Assigned and felt status in relation to observer-coded and participant-reported smiling. *Journal of Nonverbal Behavior, 26*, 63–81. https://doi.org/10.1023/A:1015683720462

Harrigan, J. A., Gramata, J. F., Lucic, K. S., & Margolis, C. (1989). It's how you say it: Physicians' vocal behavior. *Social Science & Medicine, 28*(1), 87–92. https://doi.org/10.1016/0277-9536(89)90310-9

Haslam, N., & Fiske, A. P. (1992). Implicit relationship prototypes: Investigating five theories of the cognitive organization of social relationships. *Journal of Experimental Social Psychology, 28*, 441–474. https://doi.org/10.1016/0022-1031(92)90041-H

Haslam, N., & Fiske, A. P. (1999). Relational models theory: A confirmatory factor analysis. *Personal Relationships, 6*(2), 241–250. https://doi.org/10.1111/j.1475-6811.1999.tb00190.x

Jarvis, B. G. (2008). *DirectRT (v2008) [Computer software]*. Empirisoft Corporation.

Keppel, G., & Wickens, T. D. (2004). *Design and analysis: A researcher's handbook* (4th ed.). Pearson Prentice Hall.

Koppensteiner, M., Stephan, P., & Jäschke, J. P. M. (2016). Moving speeches: Dominance, trustworthiness and competence in body motion. *Personality and Individual Differences, 94*, 101–106. https://doi.org/10.1016/j.paid.2016.01.013

Kuppens, P., Van Mechelen, I., & Meulders, M. (2004). Every cloud has a silver lining: Interpersonal and individual differences determinants of anger-related behavior. *Personality and Social Psychology Bulletin, 30*, 1550–1564. https://doi.org/10.1177/0146167204271176

Livingston, R. W., Rosette, A. S., & Washington, E. F. (2012). Can an agentic Black woman get ahead? The impact of race and interpersonal dominance on perceptions of female leaders. *Psychological Science, 23*, 354–358. https://doi.org/10.1177/0956797611428079

Livingstone, S. R., & Palmer, C. (2016). Head movements encode emotions during speech and song. *Emotion, 16*, 365–380. https://doi.org/10.1037/emo0000106

Loftus, E. F., & Palmer, J. C. (1974). Reconstruction of automobile destruction: An example of the interaction between language and memory. *Journal of Verbal Learning & Verbal Behavior, 13*, 585–589. https://doi.org/10.1016/S0022-5371(74)80011-3

Maricchiolo, F., Livi, S., Bonaiuto, M., & Gnisci, A. (2011). Hand gestures and perceived influence in small group interaction. *The Spanish Journal of Psychology, 14*, 755–764. https://doi.org/10.5209/rev_SJOP.2011.v14.n2.23

Mast, M. S. (2002). Dominance as expressed and inferred through speaking time: A meta-analysis. *Human Communication Research*, *28*(3), 420–450. https://doi.org/10.1093/hcr/28.3.420

McNeill, D. (1992). *Hand and mind: What gestures reveal about thought*. University of Chicago Press.

Mehrabian, A. (1972). *Nonverbal communication*. Aldine Atherton.

Merriam-Webster's collegiate dictionary (2006). (11th ed.). Springfield, MA: Merriam Webster.

Moskowitz, D. S., Ho, M. R., & Turcotte-Tremblay, A. (2007). Contextual influences on interpersonal complementarity. *Personality and Social Psychology Bulletin, 33*, 1051–1063. https://doi.org/10.1177/0146167207303024

Moskowitz, D. S., Suh, E.-J., & Desaulniers, J. (1994). Situational influences on gender differences in agency and communion. *Journal of Personality and Social Psychology, 66*, 753–761. https://doi.org/10.1037/0022-3514.66.4.753

Motley, M. T., & Camden, C. T. (1988). Facial expression of emotion: A comparison of posed expressions versus spontaneous expressions in an interpersonal communication setting. *Western Journal of Speech Communication, 52*, 1–22. https://doi.org/10.1080/10570318809389622

Mussweiler, T. (2006). Doing is for thinking! Stereotype activation by stereotypic movements. *Psychological Science, 17*, 17–21. https://doi.org/10.1111/j.1467-9280.2005.01659.x

O'Connor, J. R. (1971). *The relationship of kinesic and verbal communication to leadership perception in small group discussion*. Dissertation Abstracts International Section A: Humanities and Social Sciences, 32(11-A), 6589.

Palmer, M. T. (1990). *Mapping relational inferences onto conversational behaviors: Cross-sectional and time series analyses*. Dissertation Abstracts International Section A: Humanities and Social Sciences, 50(10-A), 3106.

Plant, E. A., Hyde, J. S., Keltner, D., & Devine, P. G. (2000). The gender stereotyping of emotions. *Psychology of Women Quarterly, 24*, 81–92. https://doi.org/10.1111/j.1471-6402.2000.tb01024.x

Rai, T. S., & Fiske, A. P. (2011). Moral psychology is relationship regulation: Moral motives for unity, hierarchy, equality, and proportionality. *Psychological Review, 118*, 57–75. https://doi.org/10.1037/a0021867

Reynolds, R. M., Novotny, E., Lee, J., Roth, D., & Bente, G. (2019). Ambiguous bodies: The role of displayed arousal in emotion [mis]perception. *Journal of Nonverbal Behavior*. https://doi.org/10.1007/s10919-019-00312-3

Rose, Y. J., & Tryon, W. W. (1979). Judgments of assertive behavior as a function of speech loudness, latency, content, gestures, inflection, and sex. *Behavior Modification, 3*, 112–123. https://doi.org/10.1177/014544557931008

Schucker, B., & Jacobs, D. R. (1977). Assessment of behavioral risk for coronary disease by voice characteristics. *Psychosomatic Medicine, 39*, 219–228. https://doi.org/10.1097/00006842-197707000-00003

Shaver, P., Schwartz, J., Kirson, D., & O'Connor, C. (1987). Emotion knowledge: Further exploration of a prototype approach. *Journal of Personality and Social Psychology, 52*, 1061–1086. https://doi.org/10.1037/0022-3514.52.6.1061

Smith, J. S., LaFrance, M., Knol, K. H., Tellinghuisen, D. J., & Moes, P. (2015). Surprising smiles and unanticipated frowns: How emotion and status influence gender categorization. *Journal of Nonverbal Behavior, 39*, 115–130. https://doi.org/10.1007/s10919-014-0202-4

Tiedens, L. Z. (2001). Anger and advancement versus sadness and subjugation: The effect of negative emotion expressions on social status conferral. *Journal of Personality and Social Psychology, 80*, 86–94. https://doi.org/10.1037/0022-3514.80.1.86

Tusing, K. J., & Dillard, J. P. (2000). The sounds of dominance: Vocal precursors of perceived dominance during interpersonal influence. *Human Communication Research, 26*, 148–171. https://doi.org/10.1093/hcr/26.1.148

Uleman, J. S. (1999). Spontaneous versus intentional inferences in impression formation. In S. Chaiken & Y. Trope (Eds.), *Dual-process theories in social psychology* (pp. 141–160). Guilford Press.

Visch, V. T., Goudbeek, M. B., & Mortillaro, M. (2014). Robust anger: Recognition of deteriorated dynamic bodily emotion expressions. *Cognition and Emotion, 28*, 936–946. https://doi.org/10.1080/02699931.2013.865595

Volkova, E. P., Mohler, B. J., Dodds, T. J., Tesch, J., & Bülthoff, H. H. (2014). Emotion categorization of body expressions in narrative scenarios. *Frontiers in Psychology, 5*(623), 1–11. https://doi.org/10.3389/fpsyg.2014.00623

von Salisch, M., & Vogelgesang, J. (2005). Anger regulation among friends: Assessment and development from childhood to adolescence. *Journal of Social and Personal Relationships, 22*, 837–855. https://doi.org/10.1177/0265407505058702

White, P. A. (2009). Property transmission: An explanatory account of the role of similarity information in causal inference. *Psychological Bulletin, 135*, 774–793. https://doi.org/10.1037/a0016970

Williams, J. E., & Best, D. L. (1990). *Measuring sex stereotypes: A multination study* (Rev). Sage Publications.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.

Authors and Affiliations

Michael Conway[1] · Despina Bolanis[1] · Jonathan Leclerc[1] · Sophia Chiovitti[1] · Sylvain Serey Tran[1] · Charlotte Roddick[1] · Kevin McLaughlin[1] · Heather Woods-Fry[1] · Constantina Giannopoulos[1]

Despina Bolanis
bolanisdespina@gmail.com

Jonathan Leclerc
jonathan-leclerc@hotmail.com

Sophia Chiovitti
s.chiovitti@hotmail.com

Sylvain Serey Tran
sylvain.serey.tran@protonmail.com

Charlotte Roddick
roddickc@mail.ubc.ca

Kevin McLaughlin
mclaughlinkp1227@gmail.com

Heather Woods-Fry
tirf@tirf.ca

Constantina Giannopoulos
dina.giannopoulos@concordia.ca

[1] Department of Psychology, Concordia University, Montreal, Canada