Language Use in Group Discourse and Its Relationship to Group Processes

Lyn M. Van Swol1, Paul Hangsan Ahn1, Andrew Prahl2, and Zhenxing Gong3

Abstract
The study examined the relationship between language use and perception of group processes. In an experiment, participants discussed their views about climate change in a group chat. Afterward, participants (n = 239) filled out their perception of themselves and group processes. Participants who perceived more similarity among group members used less complex language (cognitive processes language) and more assenting language. As participants felt more knowledgeable and credible about the topic, their use of “we” pronouns and word count increased and use of “I” pronouns decreased. Replicating past research, participants with more extreme opinions used more “you” pronouns, and participants who reported engaging in more perspective-taking used more complex language and “we” pronouns. Results are integrated within an input–process–output model of group processes and suggest that language is reflective of individual inputs and perception of group processes.

Keywords
group processes, perspective-taking, language, LIWC, group similarity

Conceptual Framework
Group Similarity

If a group member perceives other group members as similar to oneself, this can be reflected in the language used during

1University of Wisconsin–Madison, USA
2Nanyang Technological University, Singapore
3Liaocheng University, China

Corresponding Author:
Lyn M. Van Swol, Department of Communication Arts, University of Wisconsin-Madison, 821 University Avenue, Vilas Hall, Madison, WI 53706, USA.
Email: vanswol@wisc.edu

Creative Commons CC BY: This article is distributed under the terms of the Creative Commons Attribution 4.0 License (https://creativecommons.org/licenses/by/4.0/) which permits any use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE and Open Access pages (https://us.sagepub.com/en-us/nam/open-access-at-sage).
interaction. Similarity can be based on having similar opinions, discussing similar information, or other factors such as interaction style (Good & Nelson, 1973); for example, groups that perceive they have more homogeneous personality traits have higher perceptions of similarity among members (Civettini, 2007). Groups with similar members tend to have a higher level of cohesiveness and attraction to the group and stronger group identity (Good & Nelson, 1973; Hogg et al., 1995; Hogg & Williams, 2000). For example, research has found that a perception of ingroup homogeneity is linked to stronger group identity (Brewer & Gardner, 1996; Simon & Pettigrew, 1990), and group members from groups with homogeneous members tend to retain a stronger identity to their group than more heterogeneous groups (Deffa, 2016).

In terms of language use, use of collective (e.g., we) versus singular pronouns (e.g., I) indicates differences in where a speaker is focusing attention and in a speaker’s psychological state (Brewer & Gardner, 1996; Chung & Pennebaker, 2007). Group members with a stronger sense of group identity and cohesion may have a more group focus rather than inward and self-focus, and therefore use more collective pronouns (Pennebaker, 2011). For example, research has found a positive relationship between use of “we” pronouns and perception of cohesiveness in a group (Lieberman et al., 2005; Matthews et al., 2015), although Gonzales et al. (2010) found that more cohesive groups used fewer “we” pronouns. Furthermore, newcomers can encounter more social acceptance in a group using collective pronouns because these pronouns serve a social integration function (Kane & Rink, 2015). Brewer and Gardner (1996) found that exposure to “we” pronouns increased perceptions of collective identification and facilitated judgments of similarity to ambiguous statements more than exposure to “they” or “it” pronouns. This research suggests there could be a relationship between use of “we” pronouns and perceptions of greater similarity. Participants who perceive themselves as similar to their group members will likely use more “we” pronouns during discussion, as people use more “we” pronouns with stronger group identity (Pennebaker, 2011; Van Swol & Kane, 2019). For example, research has found that use of “we” pronouns increases as people form a stronger group identity in online groups (Bäck et al., 2018). In essence, use of “we” pronouns signals proximity to interacting partners (Goffman, 1981). It is formally stated as follows:

**Hypothesis 1 (H1):** There will be a positive relationship between percentage of “we” pronouns used and subsequently reported feelings of similarity to group members.

Use of assenting language (e.g., agree, yes, OK) can indicate agreement and has been linked to less conflict and a positive group environment (Fischer et al., 2007; Huffaker et al., 2011; Sapru & Bourlard, 2013; Yilmaz & Peña, 2015). Huffaker et al. (2011) found that as negotiators communicating online converged on a similar solution, they used more assenting language. Huffaker et al. (2011) note that in online communication assenting language can replace nonverbals used to indicate agreement. Given the relationship between similarity and group attraction and cohesion, use of assenting language should be higher with a higher perception of group similarity (Good & Nelson, 1973; Hogg et al., 1995). In this regard, some researchers suggest that assenting language could indicate more groupthink-like processes and less critical analysis in the group (Yilmaz, 2016). For example, group members who do not delve into critical analysis of an issue may be less likely to understand its nuances, that is, recognizing fewer details that actually contradict their own view, and maintain a superficial consensus, which could increase perception of similarity (Baron, 2005). Thus, we hypothesize the following:

**Hypothesis 2 (H2):** There will be a positive relationship between use of assenting language and feelings of similarity to group members.

Conversely, critical analysis would lead to more nuanced understanding of an issue and the differences among members’ opinions. This could upset consensus, even superficial consensus, and at the individual level engender feelings of dissimilarity from one another. Thus, use of complex language and language implying cognitive processes could be related to reduced individual perception of group similarity. Within the language software program Linguistic Inquiry Word Count (LIWC; Pennebaker et al., 2015), complex thinking is measured through cognitive processes language, with language categories such as insight (e.g., think, know, consider), causation (e.g., because, effect, hence), discrepancy (e.g., should, would, could), tentative (e.g., maybe, perhaps, guess), certainty (e.g., always, never), inhibition (e.g., block, constrain), inclusive (e.g., with, and, include), and exclusive (e.g., but, except, without). Cognitive process language can indicate reflection, rational argumentation, analysis, and evaluation (Lin et al., 2016; Pennebaker et al., 2003; Tausczik & Pennebaker, 2010) and has been linked to integrative complexity of arguments (Van et al., 2016). For example, Gelfand et al. (2015) found that negotiators who used more facts, logic, and rational persuasion in their tactics used more cognitive processes language than negotiators who used more appeals to emotion. Thus, cognitive process language can indicate more complexity of thought, and participants who are thinking more complexly about an issue are engaging in less superficial consensus and may perceive more differences and nuances in others’ views. It is formally stated as follows:

**Hypothesis 3 (H3):** There will be a negative relationship between use of cognitive process language and feelings of similarity to group members.
Perception of Self-Credibility

People’s perception of their own competence and credibility about an issue is an input factor that is likely related to the language they use when discussing the issue in a group. Past research has found that participants who view themselves as more competent and knowledgeable often talk more in group discussion, which we operationalize as word count (Anderson et al., 2012; Bonito, 2006; Sniezek, 1992; Van Swol, 2009; Van Swol et al., 2016). Thus, we try to replicate and hypothesize the following:

**Hypothesis 4 (H4):** There will be a positive relationship between self-perception of credibility and participant’s word count during a discussion.

Perception of similarity and perception of credibility are related. Often the perception that others agree with us or confirm our initial opinions (Chira et al., 2008; Sniezek & Buckley, 1995) or share similar information to ourselves (Wittenbaum et al., 1999) increases a sense of credibility and confidence. Given our hypothesized relationship between similarity and use of “we” pronouns due to greater group identity, perception of credibility could also be related to use of “we” pronouns.

In addition, researchers have found a strong link between behaviors related to confidence and credibility and status in groups (Anderson et al., 2012). Anderson et al. (2012) found that those who perceived themselves as more knowledgeable on a task managed to achieve more status in a group, often through higher participation rates. Those who perceived themselves as more knowledgeable in Anderson et al.’s studies were not actually more competent than their peers, but their pursuit of status was related to higher self-perceptions of competence and to behaviors in the group like higher participation rates that would increase perception of competence. Relatedly, whereas “we” pronouns are used more by members with higher status because they may attain status by focusing on the group rather than self (Van Swol & Kane, 2019), lower status group members use more “I” pronouns (Pennebaker, 2011; Van Swol & Kane, 2019) for multiple reasons. They may be more focused on themselves or trying to gain the attention of higher status members. Also, given the positive relationship between status and confidence (Anderson et al., 2012; Kennedy et al., 2013), they may refrain from representing the group due to their low confidence. For example, in online discussion boards, Dino et al. (2009) found that lower status members posted less and used more first-person singular pronouns than higher status members (for additional research support, see also Chung & Pennebaker, 2007; Kacewicz et al., 2014; Krifka et al., 2003; Reysen et al., 2010; Sakai & Carpenter, 2011; Scholand et al., 2010; Sexton & Helmreich, 2000). Thus, we hypothesize the following:

**Hypothesis 5 (H5):** There will be a positive relationship between self-perception of credibility and use of “we” pronouns during the discussion.

**Hypothesis 6 (H6):** There will be a negative relationship between self-perception of credibility and use of “I” pronouns during the discussion.

Extremity

One input into a group discussion is members’ differing opinions. Group members with extreme opinions on issues often think and behave differently than more moderate members, and this difference can be reflected in language use. People with extreme opinions rate their opinion on the far end points of a scale, rather than near the middle. Compared with people with more moderate views, people with extreme views often view themselves as more knowledgeable about the issue, view the issue as more important, have more commitment, and are less likely to change their opinion (Eagly & Chaiken, 1993; Ewing, 1942; Judd & Brauer, 1995; Krosnick et al., 1993; Osgood & Tannenbaum, 1955; Van Swol, 2009). Given their perception of their own knowledge and their commitment and confidence, it is not surprising that past research has found that extreme members talk more than non-extreme members (Van Swol, 2009; Van Swol et al., 2016, 2018). Thus, we seek to replicate this past research and hypothesize the following:

**Hypothesis 7 (H7):** Participants with extreme opinions will talk more (have a higher word count) during the discussion than participants with more moderate opinions.

In addition, Van Swol et al. (2016) found that group members with extreme opinions use more “you” pronouns during discussion. In terms of attentional focus, use of “you” pronouns can reflect a speaker’s focus on others, especially a focus on others in comparison or relative to the speaker. Pennebaker (2011) notes that “you” pronouns occur more in interactions that are toxic and have more anger and conflict; he said “you” pronouns are “the equivalent of pointing your finger” (p. 175). Use of “you” pronouns can indicate distancing oneself from others, blaming, and differentiation (Kane & Rink, 2015; Simmons et al., 2008). Given extreme members’ perception of the superiority of their opinion and issue understanding, extreme members may engage in more accusation or more toxic conversations as they focus on others to explain their perceived superior opinion.

Although extreme members have more confidence entering a group discussion, perceive themselves as more credible and knowledgeable, and talk more during a group discussion (Van Swol, 2009; Van Swol et al., 2016), their behavior does not usually translate into status and influence in a group (Van Swol et al., 2018). For example, Van Swol et al. (2016) found...
that extreme members entered a group discussion with higher levels of confidence. However, while moderate group members became more confident after group discussion, extreme members actually became less confident. Van Swol et al. (2016) suggested that extreme opinions can be difficult to explain to more moderate members. In addition, use of “you” pronouns often reduces one’s influence in a group (Van Swol & Carlson, 2017; Van Swol et al., 2016). Thus, while extreme members enter the group discussion with higher perceived credibility and tend to talk more, their perception of credibility is based on their perception of the superiority of their views in comparison to less extreme members. Hence, their use of “you” pronouns might highlight the differences between self and others—“you” in comparison with me. This is different than status and its relationship to perceived credibility, and thus, we do not predict that extreme members will use more “we” pronouns. In conclusion, we seek to replicate Van Swol et al.’s (2016) finding that group members with more extreme opinions use more “you” pronouns:

**Hypothesis 8 (H8):** Participants with extreme opinions will use more “you” pronouns during the discussion than participants with more moderate opinions.

**Perspective-Taking**

Perspective-taking is the tendency to try to understand others’ point of view and thinking (Davis, 1983). Perspective-taking may affect perception of a group discussion and be reflected in language use. When group members try to understand the opinions of other members and take their perspective, their focus of attention is going to be more outward than inward. Use of “we” pronouns reflects a more outward focus for a speaker (Pennebaker, 2011). For example, one reason that leaders in groups may use more “we” pronouns than lower status members is because a leader’s focus is more distributed across the group than concentrated on oneself (Van Swol & Kane, 2019). Kacewicz et al.’s (2014) research on status states that collective pronoun use is related to other-directedness. Thus, we hypothesize the following:

**Hypothesis 9 (H9):** There will be a positive relationship between perspective-taking and use of “we” pronouns.

If a group member is engaging in perspective-taking, they may think more complexly about the issue due to more exposure to others’ viewpoints. Researchers have found a positive correlation between perspective-taking ability and cognitive complexity (Clark & Delia, 1977; Hale & Delia, 1976; Ku et al., 2015). Cognitive complexity can increase perspective-taking (Alcorn & Torney, 1982; Hale & Delia, 1976; Lutwak & Hennessy, 1982; Suedfeld et al., 1992), and also perspective-taking can increase cognitive complexity (Epley et al., 2004; Todd et al., 2012; Vescio et al., 2003). Thus, we seek to replicate this research and extend it by being the first to examine this robust finding by operationalizing cognitive complexity with cognitive process language use:

**Hypothesis 10 (H10):** There will be a positive relationship between reported perspective-taking and use of cognitive processes language.

**Polarization**

An outcome of group discussion is that members may change their opinion. Individuals often polarize and become more extreme in their opinion after group discussion; this has been termed group polarization (Hinsz & Davis, 1984; Myers & Lamm, 1975). Individuals’ attitude polarization after group discussion is often accompanied by increases in confidence in one’s views (Heath & Gonzalez, 1995; Sunstein, 2009). In fact, increases in confidence during discussion created by organizing and elaborating on one’s rationales or by corroboration from fellow group members can drive polarization (Heath & Gonzalez, 1995; Sunstein, 2009). Confidence in discourse can be measured in certainty language which can indicate confidence, competence, and credibility (Corley & Wedeking, 2014). We seek to understand whether an outcome such as attitude polarization is reflected with increased use of certainty language, and our final hypothesis is as follows:

**Hypothesis 11 (H11):** There will be a positive relationship between use of certainty language and opinion polarization.

In this study, participants’ contributions to an online chat about climate change were analyzed using LIWC software program. After the chat, participants reported their perception of group processes and self-credibility, so language use in the discussion could be related to self-reported perceptions of self and the group discussion.

LIWC (Pennebaker et al., 2015) counts and then categorizes words into more than 80 categories and provides a measure of percentage of language use in each category for transcripts analyzed. A validated internal dictionary of words comprises each category. LIWC was rigorously developed in a process in which judges read more than 2,000 words or word stems and then judged their placement to specific categories. When a transcript is put through LIWC, every word in the transcript is compared with LIWC’s “dictionaries.” Then a percentage of the total words falling into each category is calculated. The content and construct validity of LIWC have been established (Francis & Pennebaker, 1992; Stirman & Pennebaker, 2001); interrater reliability in the discrimination of categories varies from 86% to 100%, supporting content validity. Although LIWC provides data on more than 80 different language categories, this study focuses only on pronoun use, cognitive processes language, word count, assenting language, and certainty language because there are
theoretically derived hypotheses for these categories based on previous research.

**Method**

**Participants**

There were 239 undergraduate participants at a large, public Midwestern university in the United States. This exceeded the number of participants \( n = 197 \) suggested to find a significant effect at \( p < .05 \) for a moderate effect size \( .25 \) for a two-tailed \( t \) test. For participation, they received extra credit in a communication class. The study received Institutional Review Board approval from the first author’s university.

**Procedure**

Participants signed up for an experimental time to participate at a computer lab. Depending on attendance rates, there were four to nine people participating in the lab. Experimental times were staggered with participants starting the experiment every 20 min. There were dividers between computers to ensure privacy. Upon arrival for the experiment, participants were seated at a desktop computer and given a paper informed consent form to sign if they desired. First, their attitude about whether climate change is really happening was assessed (see measures). Then, participants were given nine pieces of information in randomized order. Information was manipulated in this study but not analyzed here and reported in Van Swol et al. (2019). This previous paper did not analyze content of participants’ chat responses. Six of the nine pieces supported the view that anthropogenic climate change is real, and three supported the view that anthropogenic climate change is not real. Information was obtained from procon.org (n.d.) and was pilot-tested to guarantee that information on either side of the debate was not significantly different in terms of valence and quality. An example of information arguing against the view that anthropogenic climate change is really happening is as follows:

In testimony to the US Senate, William Gray, PhD, stated that the rising temperatures are caused primarily by water vapor, the most abundant greenhouse gas in the atmosphere, not by CO2. According to a 2010 study by researchers at NOAA, water vapor in the atmosphere was responsible for increasing the rate of warming during the 1990s by 30%.

An example of information arguing for anthropogenic climate change is as follows:

According to the World Glacier Monitoring Service, since 1980, glaciers worldwide have lost nearly 40 feet (12 meters) in average thickness (measured in average mass balance in water equivalent).

After six pieces of the information, participants were given attention check questions (multiple choice or fill-in) to check that they read the information. If they failed the question, they were asked to reread the information.

After receiving the information, participants were told that they would discuss the issue with other participants in an online chat room. The chat room opened in a different internet browser window. Participants were told they had 12 to 15 min to discuss the issue of anthropogenic climate change with four other peers who were participating in the study. They were instructed that they could use the information they had read or any other information they knew about climate change and that they did not have to come to consensus. After clicking “enter the chat room,” the chat window opened and participants waited 25 s for it to “fill.” The chat continued for approximately 12 min and then closed automatically, and participants were instructed to complete a survey.

In reality, there were no other chat members and only the participant was actively participating in the chat; the chat was scripted and contributions of four bots to the chat were inserted at random intervals of 2 to 11 s. Participants’ typed contributions were included with these scripted chat contributions. Thus, the discussion appeared as a real, functioning chat. The scripted chat contributions were written from a real exchange among undergraduate research assistants about climate change, but then more information about climate change was included at fixed places. By keeping the chat the same for participants, we were better able to control variation in chat content, information, and opinions to which participants were exposed. See the appendix for examples of a chat.

Three of the scripted chat members voiced a view that anthropogenic climate change is real, and one expressed skepticism toward this view. This proportion reflects the sample population; in pilot testing \( n = 17 \) and consultation with undergraduate research assistants, we identified that a strong majority of students had the opinion that anthropogenic climate change is really happening. The minority member in the chat mentioned and repeated more information supporting the view that anthropogenic climate change is not real (mention/repeat 75% contrary information), expressed skepticism toward information about anthropogenic climate change (e.g., “But some people were trying to say it is just [natural] changing ocean currents”), and stated that climate change is in fact not due to anthropogenic causes. Majority members, in contrast, did the same for information supporting the anthropogenic view of climate change and expressed this opinion. After the chat, participants completed a questionnaire online (see below). Then, participants were debriefed and thanked. The experimenters were asked to record participants doubting the legitimacy of the chat, but no participants expressed suspicion during or after the conclusion of the experiment. In addition, participants could write comments about the study in an open-ended portion of the questionnaire, but no participants expressed suspicion in
their comments. However, five participants never contributed anything to the online chat, possibly due to suspicion, but their data were by default not analyzed.

**Measures**

**Group similarity.** Three items (e.g., My group is similar to me) were used to measure perception of the group’s similarity to the participant on a scale from 1 (strongly agree) to 5 (strongly disagree). The reliability was good (Cronbach’s α = .84), and the mean was used as a measure of group similarity.

**Self-perception of credibility.** Three items (e.g., I was competent at this task) measured self-perception of credibility on a scale from 1 (strongly agree) to 5 (strongly disagree). Reliability was good (Cronbach’s α = .77), and the mean was used as a measure of self-perception of credibility.

**Attitude toward the climate change.** Before and after the chat, participants rated whether they thought anthropogenic climate change was real on a scale from 1 (strongly disagree) to 7 (strongly agree) with the midpoint labeled as “neither agree nor disagree.” To measure polarization in their opinion after the chat, we measured how much participant’s opinion polarized in the direction of the scale end points. A positive score showed more opinion change in the direction of the scale end points, whereas a negative score showed more opinion change away from the end points of the scale and toward the midpoint. Seven participants rated themselves as neutral before the discussion, and polarization for these participants was measured in either direction. See Table 1 for distribution of opinions before and after the chat and for polarization frequencies. To measure extremity of opinion, participants who rated their opinion before the chat as either 1 (strongly disagree) or 7 (strongly agree) on the scale were coded as extreme (Van Swol et al., 2016). There were 98 participants who used extreme ends of the scale in the pre-chat opinion, and these participants would not be able to polarize any more in their opinion after the chat, as they had already used end of the scale (see Table 2).

**Focus on others’ contributions.** Two items (e.g., I tried to take into consideration all possible perspectives) on a 1 (strongly disagree) to 5 (strongly agree) scale were used to measure how much the participant focused on others’ information, that is, perspective-taking. With only two items, some researchers suggest that Cronbach’s alpha is inappropriate and meaningless (Eisinga et al., 2013; Sainfort & Booske, 2000; Verhoef, 2003) and suggest using Pearson’s correlation. Both items were significantly correlated (r = .40, p < .001) at an acceptable level.

**Language measures.** Transcripts of the participant’s contributions to the chat were analyzed with LIWC software (Pennebaker et al., 2015) to get measures of word count and percentage of language used in the LIWC categories analyzed. Only the participant’s contributions were analyzed. Percentage of words in each LIWC category is determined from total word count from that transcript. Therefore, if a participant uses five “you” pronouns and has a total word count of 200, LIWC will give a perception of 2.5% of use of “you” pronouns.

### Results

When testing relationships among variables, correlations are used. Because some language variables are correlated (see Table 3), their relationship to group processes is tested separately. When testing differences between groups, t tests are used. Significance is tested at p < .05.

**Group Similarity**

We hypothesized that use of “we” pronouns (H1: r = .015, p = .818) and assenting language (H2: r = .139, p = .036) would be positively related to perception of group similarity. Only assenting language was positively related to the perception of group similarity, in support of H2. There was

---

**Table 1. Opinions on Climate Change Before and After Chat.**

| Value | Before chat | After chat |
|-------|-------------|------------|
| 1     | 4           | 1          |
| 2     | 0           | 1          |
| 3     | 4           | 4          |
| 4     | 7           | 7          |
| 5     | 41          | 35         |
| 6     | 89          | 82         |
| 7     | 94          | 104        |
| Missing | 0     | 5          |
| Total  | 239        | 234        |

*a = not at all to 7 = extremely on “I believe that climate change is really happening.”

**Table 2. Amount of After-Task Opinion Polarization on Climate Change.**

| Shift | Frequency |
|-------|-----------|
| −2    | 1         |
| −1    | 24        |
| 0     | 175       |
| +1    | 27        |
| +2    | 7         |

Note. The shift values from −2 to +2 indicate the degree of opinion change by subtracting the absolute value of the before-chat opinion minus 4 (midpoint) from the absolute value of the after-chat opinion minus 4 (midpoint).
Table 3. Means, Standard Deviations, and Correlations.

| Variable                | M    | SD   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  |
|-------------------------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 1. “we”                 | 2.63 | 1.99 | I   |     |     |     |     |     |     |     |     |     |     |
| 2. “I”                  | 3.10 | 2.23 | -0.10 | I  |     |     |     |     |     |     |     |     |     |
| 3. “you”                | 0.77 | 1.37 | -0.61 | -0.08 | I  |     |     |     |     |     |     |     |     |
| 4. Assent               | 2.96 | 4.92 | -1.49* | -0.02 | -0.07 | I  |     |     |     |     |     |     |     |
| 5. Similarity           | 2.94 | 0.72 | 0.02 | -0.01 | -0.09 | 0.14* | I  |     |     |     |     |     |     |
| 6. Cognitive process    | 19.48 | 6.32 | 0.11 | 0.21** | -0.10 | -0.25 | -0.17* | I  |     |     |     |     |     |
| 7. Self-credibility     | 2.99 | 0.78 | 0.21** | -0.15* | -0.06 | -0.00 | 0.27*** | -0.05 | I  |     |     |     |     |
| 8. Word count           | 91.12 | 59.32 | 0.11 | -0.01 | -0.01 | -0.26** | -0.05 | 0.07 | 0.13*** | I  |     |     |     |
| 9. Extremity            | 0.41 | 0.49 | 0.09 | -0.09 | 0.14* | -0.09 | 0.00 | -0.08 | 0.24** | 0.09 | I  |     |     |
| 10. Perspective-taking  | 3.91 | 0.62 | 0.13* | -0.01 | 0.08 | -0.08 | 0.16* | 0.13* | 0.34*** | 0.01 | -0.04 | I  |     |
| 11. Certainty           | 2.60 | 2.26 | -0.02 | 0.03 | 0.06 | -0.02 | -0.02 | 0.36** | 0.04 | 0.01 | -0.03 | 0.04 | I  |
| 12. Opinion polarization| 0.06 | 0.59 | 0.06 | 0.03 | -0.01 | -0.06 | 0.09 | 0.06 | 0.10 | 0.02 | -0.27** | 0.08 | 0.14* |

*p < .05 level (two-tailed). **p < .01 level (two-tailed). ***p = .055.

no relation between use of “we” pronouns and perception of similarity, failing to support H1. H3 predicted that use of more complex language, operationalized as cognitive processes words (e.g., “cause,” “know,” “ought”), would be negatively related to perception of the group as similar to self (r = -.166, p = .012); this supported H3. See Table 3 for means, standard deviations, and correlations of all variables. See Table 5 for a summary of all hypotheses. Perception of similarity was not related to whether participants’ opinion was in the direction of the majority (r = .001, p = .989). Thus, perception of similarity does not seem based on sharing similar opinions with chat members. In addition, although not hypothesized, we found that use of negations (no, not, never) was negatively related to group similarity (r = -.142, p = .031).

Self-Perception of Credibility

H4 predicted that higher word count and H5 predicted that use of “we” pronouns would be positively related to self-perception of similarity, whereas H6 predicted that use of “I” pronouns would be negatively related to perception of being credible. Perception of self-credibility was positively related to word count, although the effect only approached significance (H4: r = .127, p = .055), and use of “we” pronouns (H5: r = .208, p = .002). Perception of credibility was negatively related to use of “I” pronouns (H6: r = -.149, p = .24). Participants’ perception of credibility and perception of similarity in the group were highly correlated (r = .27, p < .001), but while perception of similarity was not related to whether the participant’s opinion leaned toward the majority, perception of credibility was related to being in the majority opinion (r = .24, p < .001).

Extremity

We hypothesized that members with more extreme opinions would talk more (H7) and use more “you” pronouns (H8). We operationalized extremity by participants who rated their opinion about climate change using the end points (1 or 7) of the scale. Participants with extreme opinions (M = 97.16 words, SD = 53.93) did not have a significantly higher word count than participants who did not use extreme ends of the scale (M = 86.91 words, SD = 62.66), t(234) = 1.34, Cohen’s d = .158, p = .095 (one-tailed). H7 was not supported. However, in support of H8, extreme participants (M = 1.00%, SD = 1.80) used a higher percentage of “you” pronouns than non-extreme participants (M = 0.61%, SD = 0.95), t(234) = 2.15, Cohen’s d = .271, p = .016 (one-tailed).

In addition, in support of previous research, members who used extreme ends of the scale (M = 3.22, SD = 0.85) were more likely to perceive themselves as credible than more moderate members (M = 2.83, SD = 0.68), t(231) = 3.82, Cohen’s d = .507, p < .001. We examined whether there was a relationship between how extreme and non-extreme members perceived their credibility based on how much they talked. In a regression, word count, extremity (1 = yes, 0 = no), and their interaction were used to predict self-perception of credibility. See Table 4 for regression results. The model with the interaction was significant, R = .32, SE = .74, F(3, 226) = 8.60, p < .001. The interaction between extremity and word count was significant. To explore this interaction, we found that for non-extreme members, there was no relationship between word count and perceived credibility (r = -.037, p = .674), but the correlation was significant for extreme members (r = .299, p = .003). Thus, extreme members who spoke more perceived themselves as more credible.

Perspective-Taking

We predicted that participants who reported engaging in more perspective-taking would use more “we” pronouns (H9) and would use more complex language (H10). There
was a positive relationship between use of “we” pronouns and reported perspective-taking ($r = .130, p = .048$), in support of H9. There was a significant relationship between reported perspective-taking and use of more complex language ($r = .134, p = .042$), in support of H10. Perspective-taking was highly correlated to perception of credibility ($r = .34, p < .001$), suggesting that a third variable like intelligence might underlie perspective-taking results.

### Discussion

Research and theory examining how granular-level language use in group discourse relates to individual inputs and perception of group processes is developing. This article added to the literature on group processes and language use by examining concepts such as perception of group similarity, self-credibility, and perspective-taking that have not been examined in relation to language use. In addition, the article partially replicated previous research (Van Swol et al., 2016) examining how extreme members use language in a group discussion differently than more moderate members. Results from all hypotheses are summarized in Table 5. Below we discuss these results in more detail.

#### Group Similarity

Perception of similarity to other group members can be reflected in language use. We found a positive relationship between perception of group similarity and use of assenting language. Although we cannot tease apart this relationship because we did not manipulate either variable, participants may use assenting language to show that they agree with the other group members or to validate information another member mentions (Wittenbaum et al., 1999), and hence the agreement may be driving both the feeling of group similarity and the use of assenting language. However, we found no relationship between perception of similarity and whether the participant’s opinion was leaning more toward the majority. Therefore, opinions may not underly feelings of similarity. Or, use of assenting language might engender feelings of similarity. Although not hypothesized, use of negations was negatively correlated to feelings of group similarity. Negations serve the opposite purpose of assenting language, so the negative relationship is not surprising, as participants who feel different than their group members may use more words such as no, not, or never.

In addition, we hypothesized that a group member using more cognitive processes language would perceive less similarity to other group members. We reasoned that participants thinking more complexly about the issue and using cognitive processes language would perceive more nuance in others’ thinking and recognize more differences from their own thoughts, which could reduce perceptions of similarity. Previous research has found that use of cognitive process language is related to having more integrative complex reasoning that emphasizes nuance, multiple perspectives, and differentiation (Van Swol & Carlson, 2017). Although our hypothesis was supported, our study did not explicitly test this reasoning. Future research could measure how use of cognitive process language affects group members’ perception of other members’ argument complexity or understanding of others’ positions and test whether this mediates the relationship between use of cognitive process language and perception of similarity in the group.

Finally, we hypothesized that use of “we” pronouns and perceptions of similarity would be related but did not find support for this. Previous research has found that “we” pronouns are used to integrate members within the group (Kane & Rink, 2015) and that “we” pronouns may signal a more collective focus, identity, and cohesion (Lieberman et al., 2005; Matthews et al., 2015). However, Gonzales et al.
Van Swol et al. (2010) found that groups that had more cohesion used fewer “we” pronouns. We found no relationship. Pennebaker (2011) notes that “we” pronouns can both serve a collective function when they reference group members and also serve a distancing function when used as a royal “we” or a “we” and not you function. Thus, he notes that finding consistent relationships in use of “we” pronouns is difficult. In addition, groups in this study did not have to reach a collective goal or decision, which may have reduced a sense of collective identity.

Perception of Self-Credibility

Based on past research, we hypothesized that participants who viewed themselves as credible would talk more in the group. Our hypothesis was supported, replicating past research finding that people talk more when they perceive themselves as more credible (Bonito, 2006; Ridgeway & Correll, 2006; Sniezek, 1992; Van Swol, 2009), although, in the regression, the relationship between credibility and word count is driven by just extreme members. Only for extreme members did we find a relationship between word count and perception of credibility. In addition, previous research on status has found that people with perceived higher status use more “we” pronouns, and those with lower status use more “I” pronouns. We replicated these results with credibility as participants with higher perceived credibility used more “we” pronouns, and those with lower perceived credibility used more “I” pronouns. Again, we did not directly measure status, so whether those who felt more credible also felt higher status should be tested in future research. Given that those with higher perceived credibility also were more likely to be in the majority, it is possible that their greater use of “we” pronouns related to inclusion in the majority group more than a relationship with status.

Extremity

This study sought to replicate results from Van Swol et al. (2016) about the language that members with extreme opinions use in a group discussion in comparison to more moderate members. First, participants with extreme opinions did perceive themselves as more credible than other members, which is in line with previous research (Van Swol, 2009; Van Swol et al., 2016). We did not replicate the result that participants with more extreme opinions would have a higher word count than other participants, although the results were in the predicted direction. We did find, however, that for extreme members word count was positively related to their perceived self-credibility, but that this relationship was not significant for moderate participants. Extreme members with higher confidence and perception of their own credibility may be more likely than moderate members to act on their views by discussing them. Some research has found that people with extreme political views have an illusion of understanding (Fernbach et al., 2013) which causes unwarranted confidence, compared with moderate members. This may drive extreme members’ greater willingness to talk more when they have higher perceived credibility.

| Table 5. Hypotheses Table. |
|-----------------------------|
| Hypothesis | r (Cohen’s d) | p | Outcome |
| H1: There will be a positive relationship between use of “we” pronouns and feelings of similarity to group members. | .015 | .818 | unsupported |
| H2: There will be a positive relationship between use of assenting language and feelings of similarity to group members. | .139 | .036 | supported |
| H3: There will be a negative relationship between use of cognitive processes language and feelings of similarity to group members. | -.166 | .012 | supported |
| H4: There will be a positive relationship between self-perception of credibility and participant’s word count during the discussion. | .127 | .055 | supported |
| H5: There will be a positive relationship between self-perception of credibility and use of “we” pronouns during the discussion. | .208 | .002 | Supported |
| H6: There will be a negative relationship between self-perception of credibility and use of “I” pronouns during the discussion. | -.149 | .024 | supported |
| H7: Participants with extreme opinions will talk more (have a higher word count) during the discussion than participants with more moderate opinions. | .158 | .095 | unsupported |
| H8: Participants with extreme opinions will use more “you” pronouns during the discussion than participants with more moderate opinions. | .271 | .016 | supported |
| H9: There will be a positive relationship between perspective-taking and use of “we” pronouns. | .130 | .048 | supported |
| H10: There will be a positive relationship between reported perspective-taking and use of cognitive processes language. | .134 | .042 | supported |
| H11: There will be a positive relationship between use of certainty language and opinion polarization. | .140 | .034 | supported |
Finally, participants with more extreme opinions used a higher percentage of “you” pronouns than moderate participants, replicating previous research (Van Swol et al., 2016). Extreme members are likely to perceive their views as more superior, for example, due to an illusion of understanding (Fernbach et al., 2013), than more moderate members. This may lead to more use of “you” pronouns when extreme members, based on their perceived differences in views, differentiate themselves from other members (Pennebaker, 2011; Simmons et al., 2005). Moreover, extreme members’ more frequent use of “you” pronouns may signal a focus of attention on others in comparison with oneself as they focus on others to explain their superior views.

**Perspective-Taking**

Much previous research on perspective-taking has found that it is related to increased complexity of thinking. Research has found that complexity of thinking can increase perspective-taking, but it has also found that perspective-taking can increase complexity of thought (Alcorn & Torney, 1982; Clark & Delia, 1977; Hale & Delia, 1976; Ku et al., 2015; Lutwak & Hennessy, 1982; Suedfeld et al., 1992). Our study is the first to find the linguistic link between perspective-taking and cognitive complexity. Participants who stated they engaged in more perspective-taking during group discussion used more cognitive processes language. In addition, given the outward focus of attention with perspective-taking, we hypothesized that participants with higher perspective-taking would use more “we” pronouns; this was supported. Future research should explore the link between complex language and perspective-taking as they function in group discussion. Perspective-taking was highly correlated with how credible participants perceived themselves on the issue. This suggests that a third variable could be accounting for the results. Participants with higher fluid intelligence may perceive themselves as more credible on the issue of climate change, use more cognitive processes language, and take the perspective of others more frequently.

**Polarization**

Finally, because attitude polarization after group discussion is often accompanied by increases in confidence (Heath & Gonzalez, 1995; Sunstein, 2009), we hypothesized that participants who had polarized in their opinion after the online chat would use more certainty language; this was supported. In addition, although not hypothesized, participants who polarized in their opinion after the discussion used more exclamation marks during the discussion and more negations. Use of negations could indicate disagreement or entrenchment in one’s opinion and has been found to be an indicator of dogmatic thinking (Fast & Horvitz, 2016).

**Implications**

Pennebaker (2011) notes that small words like pronouns occur at the highest frequency in our discourse, often go unnoticed, yet provide a window into our focus of attention and psychological states. By carefully documenting relationships between word use and psychological processes, we develop unobtrusive tools to understand the dynamics in groups and psychological states of members. In essence, language can help us take the temperature of a group, understanding when group members may have more cohesion (e.g., assenting language) or more differentiation (e.g., “you” pronouns). Especially with online groups, where language can be easily monitored by algorithms in real time, monitoring of language may indicate when a group might need more help dealing with conflict or can help assess status relationships among members.

Van Swol and Kane (2019) created a model to describe how group inputs, group processes and emergent states, and group outcomes are exhibited in the language used during a group discussion. This study adds to their model. Similarity and perspective-taking can be emergent states in a group discussion that can both be influenced by the language used (Kane & Rink, 2015; Stout & Dasgupta, 2011) or reflected in language use. Language use then becomes a tool to understand these group processes. In addition, perception of credibility and extremity of opinion may be inputs that individuals bring to the group discussion that then influence language, such as pronoun use and amount of contributions as measured by word count. In essence, a group discussion can reify these individual inputs through language. Finally, group discussion has both group and individual outputs that result from the discussion and that are influenced by the language used during the discussion. This study examined an individual output of opinion polarization. Although much research has examined the topic of polarization in groups (e.g., Sunstein, 2009), little research has examined how language used is related to amount that individuals polarize after a discussion.

This study used an online chat. A large percentage of research on language use in groups has been conducted on online groups—mostly because of ease of access without the costs of transcription (Van Swol & Kane, 2019). However, there are differences between face-to-face and online group communication that bear mentioning. First, nonverbals are more available with face-to-face communication and often replaced with a substitute in online communication. Huffaker et al. (2011) note that nonverbals often provide backchannel communication that have to be reflected more with language in online communication. They note that “assents (e.g., ‘mhmhm’, ‘yes’, ‘right’) let a dialogue partner know that one is in agreement listening and attentive . . . This implies that backchannel cues such as assents can also be conveyed through online conversations and should have similar effects” (as nonverbal cues; p. 69). Walther (1992) theorized...
and received empirical support that, even at the relational or affective level, people adapt to their medium to utilize communication cue systems at their disposal (Walther et al., 2005). Hence, even lacking nonverbal cues, people adapt to the medium to form ties and develop impressions comparable with those of face-to-face communication. Thus, language may take on an additional significance in online chats, as it replaces nonverbal cues to understand emotions. As more and more groups interact online due to COVID-19, how language can be used to replace nonverbal cues, especially as it relates to group constructs like similarity, is important to research. Thus, asserting language or use of negations may be especially important toward taking the emotional temperature of online groups.

Finally, the online chat used in this study did not require participants to complete a task or come to consensus. While this may have reduced the sense that participants were a group with a common goal, previous research examining language use in groups has often studied online groups in which members engage with each other to post information and opinions and respond to each other, but are not completing a designated or explicit task or coming to agreement. These include fan forums, opinion forums, or hobby forums. For example, Huffaker (2010) examined language use in Google groups with topics such as politics, health, hobbies, and technology. Similarly, Burke et al. (2010) examined hobby groups, such as Grateful Dead fans and vegetarian cooking, to analyze language use in online groups. Dino et al. (2009) examined language use and status in fan forums. Results from these studies have been replicated in groups with an explicit goal. For example, findings from Dino et al. (2009) have been replicated with other types of groups (Kacewicz et al., 2014). Thus, although groups in our study did not have a goal to come to consensus, the results likely generalize to groups reaching consensus or having another common goal.

Limitations and Future Research

While adding to the literature on language use in groups, this study has several limitations. As mentioned above, groups were not completing a task, so whether results generalize to teams working on a common goal should be examined. The variables analyzed were not manipulated or controlled in this study, which excludes any causal claims about the use of language and group processes. In future research, either use of certain language features could be manipulated, possibly through confederates, to examine the effect of language on group processes, or group processes could be manipulated to examine changes in language used, for example, a researcher could ask, “Would encouraging more perspective-taking among group members increase the complexity of language used in group discourse?” Given the widespread use of naturally occurring online groups in the study of language and group processes, lack of designs to make causal claims is a widespread problem in this area of study. Finally, with extreme members, there was a ceiling effect on polarization, as extreme members, by definition, could not polarize more in their rated opinion after discussion. Given the limited research on language use and group processes (Van Swol & Kane, 2019), it is important to replicate these results just as this study replicated some effects from past research and observed established effects (i.e., perspective-taking) in a new domain of language use.

This study only examined perception of the group processes for a short online discussion. Van Swol and Kane (2019) note that the effects of language on group dynamics can be dynamic and longitudinal. A longitudinal design could follow discussion groups and their members over a longer period of time to understand processes, like how increases or decreases in status affect pronoun use. For example, Danescu-Niculescu-Mizil et al. (2012) followed online Wikipedia editing groups and examined what happened to the language of members when they were elected to leadership positions or lost status in the group.

Conclusion

In the group interaction model created by Van Swol and Kane (2019), members in a small group enter discussions with certain inputs—such as perceived self-credibility and differing opinions—that affect language use. As people participate in groups, processes emerge—such as feelings of group similarity—that are reflected in language use. Language serves the function to both reflect and help create these perceptions and processes in the group. This study highlighted the importance of language as a means to understand where group members are directing their attention, how group members perceive the group, and how the group discussion can reflect individual inputs brought the group. As groups continue to interact more online, language becomes especially important to take the emotional temperature of the group as nonverbals become less salient.

Appendix

In every chat, Participant_04 (italicized) was the human subject and the other four participants were bots. Throughout the group chat, Participant_01, Participant_02, and Participant_05 were in support of the opinion that global warming is really happening, whereas Participant_03 was not or ambivalent at best. Toward the end of the chat, Participant_02 tries to derive a consensus, asking if all members agree that global warming is really happening.

Participant Online Chat Example 1

Chat session initiating . . . Waiting for other users.
Participant_01 has joined . . . Waiting for other users.
Participant_01: Hello?
Participant_02 has joined . . . Waiting for other users.
Participant_01: Hi, #2
Participant_02: hey
Participant_03 has joined . . . Waiting for other users.
Participant_01: Hi, 3
Participant_03: hello
Participant_04 has joined . . . Waiting for other users.

Participant_04: Hi
Participant_02: Hi participant04.
Participant_01: Hi #4.
Participant_05 has joined . . . BEGIN CHAT SESSION
(~15 min remaining)  
Participant_04: Hi #1 and #2
Participant_04: Hi #5
Participant_01: Hi 5! lol.
Participant_05: hey there
Participant_02: ah, nice
Participant_01: how bout that climate change
Participant_02: I think climate change is bad
Participant_03: lol
Participant_04: Climate change is bad
Participant_05: Humans totally cause global warming. the
planet was obviously better off before we arrived.
Participant_04: lol
Participant_02: I agree
Participant_04: I think humans are causing global warm-
ing as well
Participant_02: I think humans have a huge impact on
global warming
Participant_05: but then again how could we really know?
if we weren’t there . . .
Participant_02: I think we really know because of records
that have been kept
Participant_04: There is evidence of it and its only
increasing due to us
Participant_01: our use of fossil fuels has only increased
and theres evidence of global warming increasing too
Participant_02: so i think that’s kinda some proof
Participant_01: yea the first thing that popped out at me
was that huge list of organizations saying it is caused by
humans
Participant_03: but some people were trying to say that
was evidence of just sea currents changing, not warming
Participant_04: I agree #1!
Participant_03: i mean, I suppose currents could change
Participant_01: Maybe the currents did change, could
there possibly be other factors to global warming besides
humans though? There’s so much to explore
Participant_02: yeah definitely we have records that sup-
port the humans caused argument, and we can see the
changes the glaciers have made
Participant_04: Currents could change, but I think this is
a bigger issue than just currents changing
Participant_05: true
Participant_02: Yeah the national research council thinks
it’s all down to CO2 increase for the 1 to 1.4 degree
increase in global temps
Participant_05: I know CO2, like the national research
council says, decreases the ozone layer, which is a barrier
against the sun’s heat
Participant_03: It could be just a recovery from a little ice
age like the George C. Mars hall institute said
Participant_04: The one thing they didn’t mention is that
maybe it could be factors of both??
Participant_05: Lol
Participant_02: If the temperature was really 1 degree
abnormally low from 1400-1800 like the institute said
then maybe that is part of it, #3.
Participant_01: I think it’s easier to try to make changes if
we have something physical to change
Participant_01: It’s easier to say, okay we’re doing this . . .
how can we fix it? Than to sit back, helpless, as the envi-
ronment oscillates out of our control
Participant_02: Interesting #01, maybe it is easier to take
responsibility no matter what the cause . .
Participant_02: humans produce CO2
Participant_03: Yes those gases hurt the ozone for sure
Participant_02: lol poor little guy
Participant_04: Humans produce CO2 and there is an
ABUNDANCE of evidence for that
Participant_01: Plants use CO2. Let’s just plant lots and
lots of plants.
Participant_02: I wonder what would happen if every
single person on the earth planted 2 plants . .
Participant_04: ^^ Good idea
Participant_05: whether humans “caused” global warm-
ing or not, I think most of these organizations can agree
that humans have contributed to the further depletion of
the ozone
Participant_02: I think the 2010 UN report pinpointed
industrialization as well for a cause
Participant_03: Yes those gases hurt the ozone for sure—I
can see the industrialization thing
Participant_03: There was also that guy who said the
temps are due to water vapor, not necessarily CO2, and
he cited NOAA data—water vapor—humans caused,
really?
Participant_05: Well 03 I don’t really know how humans
could be pinpointed for causing extra water vapor
Participant_03: its just weird that some people think its
because of humans and others dont
Participant_02: like why can’t they all just agree on it
Participant_04: Matter of opinion
Participant_05: we may not be the sole cause but we don’t
help at all
Participant_01: Or maybe we do help in some ways, but
since we didn’t know the earth before we existed, we
can’t tell.
Participant_05: That bullet about industrialization included lots of bad stuff—the others that were similar to it were mentioning deforestation as well.
Participant_02: Humans are also destroying the rainforest, which is a huge reducer of CO₂, like you said bunkers. The deforestation is a compounding factor.
Participant_01: There are a lot of recent peer-reviewed articles all coming to the conclusion we are the leading cause—especially looking at things are really severe, like frequency of hurricanes and such.
Participant_04: Exactly. We may not be the only thing that’s making global warming worse, but we are a big reason for it. There could be other things aiding it like currents but I think ultimately humans are the cause.
Participant_05: There was even that quote from the guy at Lawrence Berkeley Laboratory who said you don’t even need fancy math and models, just look at a graph of CO₂ levels, then a graph of temperatures and the answer is common sense.
Participant_01: Yeah it seems a pretty simple conclusion like you said, just look at the graphs and use your head.
Participant_02: So can we all agree global warming is happening?
Participant_04: Yes.
Participant_01: Yes.
Participant_03: Not sure, lol.
Participant_05: Orly?
Participant_02: Fix with plants and teslas!
Participant_03: But plants can’t stop the ozone from disappearing.
Participant_04: Let’s all just go plant some plants.
Participant_05: I don’t believe we can fix it, because we’re capitalists and we’ll continue to build new things that will just continue to make things worst.
Participant_02: Can’t stop that or from people driving cars.
Participant_01: More public transportation!
Participant_05: ~ i agree.
Participant_01: But people don’t always act on it.
Participant_04: # Bike.
Chat has ended.

Participant Online Chat Example 2

Chat session initiating . . . Waiting for other users.
Participant_01 has joined . . . Waiting for other users.
Participant_01: Hello?
Participant_02 has joined . . . Waiting for other users.
Participant_01: Hi, #2.
Participant_02: Hey.
Participant_03 has joined . . . Waiting for other users.
Participant_01: Hi, 3.
Participant_03: Hello.
Participant_04 has joined . . . Waiting for other users.
Participant_02: Hi participant04.
Participant_01: Hi #4.
Participant_05 has joined . . . BEGIN CHAT SESSION (~15 min remaining)
Participant_01: Hi! lol.
Participant_05: Hey there.
Participant_04: Hi.
Participant_05: Ah, nice.
Participant_01: How bout that climate change.
Participant_02: I think climate change is bad.
Participant_03: Lol.
Participant_05: Humans totally cause global warming. The planet was obviously better off before we arrived.
Participant_02: I agree.
Participant_04: I agree too.
Participant_02: I think humans have a huge impact on global warming.
Participant_05: But then again how could we really know? if we weren’t there . . .
Participant_02: I think we really know because of records that have been kept.
Participant_01: Our use of fossil fuels has only increased and there’s evidence of global warming increasing too.
Participant_02: So I think that’s kinda some proof.
Participant_01: Yea the first thing that popped out at me was that huge list of organizations saying it is caused by humans.
Participant_03: But some people were trying to say that was evidence of just sea currents changing, not warming.
Participant_02: I mean, I suppose currents could change.
Participant_01: Maybe the currents did change, could there possibly be other factors to global warming besides humans though? There’s so much to explore.
Participant_02: Yeah definitely we have records that support the humans caused argument, and we can see the changes the glaciers have made.
Participant_05: True.
Participant_02: Yeah the national research council thinks it’s all down to CO₂ increase for the 1 to 1.4 degree increase in global temps.
Participant_05: I know CO₂, like the national research council says, decreases the ozone layer, which is a barrier against the sun’s heat.
Participant_04: I never knew that the change in ocean currents were caused by human actions.
Participant_03: It could be just a recovery from a little ice age like the George C. Marshall institute said.
Participant_05: Lol.
Participant_02: If the temperature was really 1 degree abnormally low from 1400-1800 like the institute said then maybe that is part of it, #3.
Participant_02: I think it’s easier to try to make changes if we have something physical to change.
Participant_01: It’s easier to say, okay we’re doing this . . . how can we fix it? Than to sit back, helpless, as the environment oscillates out of our control.
Participant_02: Interesting #01, maybe it is easier to take responsibility no matter what the cause . . .
Participant_02: humans produce CO2
Participant_03: Yes those gases hurt the ozone for sure
Participant_04: I guess we have to find another source that can substitute fossil fuels
Participant_02: lol poor little guy
Participant_01: Plants use CO2. Let’s just plant lots and lots of plants.
Participant_02: I wonder what would happen if every single person on the earth planted 2 plants . . .
Participant_05: whether humans “caused” global warming or not, I think most of these organizations can agree that humans have contributed to the further depletion of the ozone
Participant_02: I think the 2010 UN report pinpointed industrialization as well for a cause
Participant_03: Yes those gases hurt the ozone for sure—I can see the industrialization thing
Participant_05: There was also that guy who said the temps are due to water vapor, not necessarily CO2, and he cited NOAA data—water vapor—humans caused, really?
Participant_05: Well 03 I don’t really know how humans could be pinpointed for causing extra water vapor
Participant_03: its just weird that some people think its because of humans and others dont
Participant_02: like why can’t they all just agree on it
Participant_04: yeah but the big oil companies keep on denying that fossil fuels or the greenhouse effect are not the cause of climate change . . .
Participant_05: we may not be the sole cause but we don’t help at all
Participant_01: Or maybe we do help in some ways, but since we didn’t know the earth before we existed, we can’t tell.
Participant_05: That bullet about industrialization included lots of bad stuff—the others that were similar to it were mentioning deforestation as well
Participant_02: humans are also destroying the rainforest which is a huge reducer of CO2, like you said bunkers the deforestation is a compounding factor
Participant_01: There are a lot of recent peer reviewed articles all coming to the conclusion we are the leading cause—especially looking at things are really severe, like frequency of hurricanes and such
Participant_05: There was even that quote from the guy at Lawrence Berkeley Laboratory who said you don’t even need fancy math and models, just look at a graph of CO2 levels, then a graph of temperatures and the answer is common sense
Participant_01: Yeah it seems a pretty simple conclusion like you said 05, just look at the graphs and use your head.
Participant_02: so can we all agree global warming is happening?
Participant_01: yes
Participant_04: yeah. I think there is no doubt about that
Participant_03: not sure, lol
Participant_05: ^^i agree
Participant_01: But people don’t always act on it
Chat has ended.

Author’s Note
The research was approved by the University of Wisconsin–Madison Institutional review board (IRB) 2014-1370 and followed IRB guidelines for the treatment of human participants.

Acknowledgments
The authors thank Annie Hwang and Riley Roehl for help running this experiment and Peter Sengstock for programming the chat software.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was funded by research from the Hamel Family foundation and National Natural Science Foundation of China (71801120).

ORCID iD
Lyn M. Van Swol https://orcid.org/0000-0002-2484-748X

References
Alcorn, L. M., & Torney, D. J. (1982). Counselor cognitive complexity of self-reported emotional experience as a predictor of accurate empathic understanding. Journal of Counseling Psychology, 29, 534–537. https://doi.org/10.1037/0022-0167.29.5.534
Anderson, C., Brion, S., Moore, D. A., & Kennedy, J. A. (2012). A status-enhancement account of overconfidence. Journal of Personality and Social Psychology, 103, 718–735. https://doi.org/10.1037/a0029395
Bäck, E. A., Bäck, H., Sendén, M. G., & Sikström, S. (2018). From I to we: Group formation and linguistic adaption in an online
xenophobic forum. *Journal of Social and Political Psychology, 6*, 76–91. https://doi.org/10.5964/jssp.v6i1.741

Baron, R. S. (2005). So right it’s wrong: Group think and the ubiquitous nature of polarized group decision making. *Advances in Experimental Social Psychology, 37*, 219–253. https://doi.org/10.1016/S0065-2601(05)37004-3

Bonito, J. A. (2006). A longitudinal social relations analysis of participation in small groups. *Human Communication Research, 32*, 302–321. https://doi.org/10.1111/j.1468-2958.2006.00277.x

Brewer, M. B., & Gardner, W. (1996). Who is this “We”? Levels of collective identity and self-representations. *Journal of Personality and Social Psychology, 71*, 83–93. https://doi.org/10.1037/0022-3514.71.1.83

Burke, M., Kraut, R., & Joyce, E. (2010). Membership claims and requests: Conversation-level newcomer socialization strategies in online groups. *Small Group Research, 41*, 4–40. https://doi.org/10.1177/1059712910380890

Chira, I., Adams, M., & Thornton, B. (2008). Behavioral bias within the decision-making process. *Journal of Business and Economics Research, 6*, 11–20. https://ssrn.com/abstract=2629036

Chung, C., & Pennebaker, J. W. (2007). The psychological functions of function words. *Social Communication, 1*, 343–359. https://doi.org/10.1525/js783110874066.fm

Civettini, N. H. W. (2007). Similarity and group performance. *Social Psychology Quarterly, 70*, 262–271. https://doi.org/10.1177/019027250707000305

Clark, R. A., & Delia, J. G. (1977). Cognitive complexity, social perspective-taking and functional persuasive skills in second-to tenth-grade children. *Human Communication Research, 3*, 128–134. https://doi.org/10.1111/j.1468-2958.1977.tb00511.x

Corley, P. C., & Wedeking, J. (2014). The (dis)advantage of certainty: The importance of certainty language. *Law & Society Review, 48*, 35–62. https://doi.org/10.1111/lasr.12058

Danescu-Niculescu-Mizil, C., Lee, L., Pang, B., & Kleinberg, J. (2012). Echoes of power: Language effects and power differences in social interaction. *Proceedings of the International Conference on World Wide Web Conference, 21*, 699–708. https://doi.org/10.1145/2187836.2187931

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology, 44*, 113–126. https://doi.org/10.1037/0022-3514.44.1.113

Deffà, O. J. (2016). The impact of homogeneity on intra-group cohesion: A macro-level comparison of minority communities in Western diaspora. *Journal of Multilingual and Multicultural Development, 37*, 343–356. https://doi.org/10.1080/01434632.2015.1072203

Dino, A., Reysen, S., & Branscombe, N. R. (2009). Online interactions between group members who differ in status. *Journal of Language and Social Psychology, 28*, 85–93. https://doi.org/10.1177/0261927X08325916

Eagly, A. H., & Chaiken, S. (1993). *The psychology of attitudes*. Harcourt Brace Jovanovich.

Eisinga, R., Grotenhuis, M., & Pelzer, B. (2013). The reliability of a two-item scale: Pearson, Cronbach, or Spearman-Brown. *International Journal of Public Health, 58*, 637–642. https://doi.org/10.1007/s00038-012-0416-3

Epley, N., Morewedge, C. K., & Keysar, B. (2004). Perspective taking in children and adults: Equivalent egocentrism but differential correction. *Journal of Experimental Social Psychology, 40*, 760–768. https://doi.org/10.1016/j.jesp.2004.02.002

Ewing, T. N. (1942). A study of certain factors involved in changes of opinion. *Journal of Social Psychology, 16*, 63–88. https://doi.org/10.1080/00222454.1942.9714105

Fast, E., & Horvitz, E. (2016, November). Identifying dogmatism in social media: Signals and models [Conference session]. 2016 Conference on Empirical Methods in Natural Language Processing, Austin, TX, United States. https://doi.org/10.18653/v1/D16-1066

Fernbach, P. M., Rogers, T., Fox, C. R., & Sloman, S. A. (2013). Political extremism is supported by an illusion of understanding. *Psychological Science, 24*, 939–946. https://doi.org/10.1037/e519682015-069

Fischer, U., McDonnell, L., & Orasanu, J. (2007). Linguistic correlates of team performance: Toward a tool for monitoring team functioning during space missions. *Aviation Space and Environmental Medicine, 78*(Supp. 1), B86–B95. https://doi.org/10.1108/15327950810860230

Francis, M. E., & Pennebaker, J. W. (1992). Talking and writing as illness prevention. *Medicine, Exercise, Nutrition and Health, 1*, 27–33.

Gelfand, M. L., Severance, L., Lee, T., Bruss, C. B., Lun, J., Abdel-Latif, A., Al-Mohgazy, A. A., & Ahmed, S. M. (2015). Culture and getting to yes: The linguistic signature of creative agreements in the United States and Egypt. *Journal of Organizational Behavior, 36*, 967–989. https://doi.org/10.1002/job.2026

Goffman, E. (1981). *Forms of talk*. University of Pennsylvania Press.

Gonzales, A. L., Hancock, J. T., & Pennebaker, J. W. (2010). Language indicators of social dynamics in small groups. *Communications Research, 37*, 3–19. https://doi.org/10.1177/0093650209351468

Good, L. R., & Nelson, D. A. (1973). Effects of person-group intra-group attitude similarity on perceived group attractiveness and cohesiveness: II. *Psychological Reports, 33*, 551–560. https://doi.org/abs/10.2466/pr0.1973.33.2.551

Hale, C. L., & Delia, J. G. (1976). Cognitive complexity and social perspective-taking. *Communication Monographs, 43*, 195–203. https://doi.org/10.1080/03637757609375932

Heath, C., & Gonzalez, R. (1995). Interaction with others increases decision confidence but not decision quality: Evidence against information collection views of interactive decision making. *Organizational Behavior and Human Decision Processes, 61*, 305–326. https://doi.org/10.1006/obhd.1995.1024

Hinsz, V. B., & Davis, J. H. (1984). Persuasive arguments theory, group polarization, and choice shifts. *Personality and Social Psychology Bulletin, 10*, 260–268. https://doi.org/10.1177/0146167284102012

Hogg, M. A., Hardie, E. A., & Reynolds, K. J. (1995). Prototypical similarity, self-categorization, and depersonalized attraction: A perspective on group cohesiveness. *European Journal of Social Psychology, 25*, 159–177. https://doi.org/10.1002/ejsp.2420250204

Hogg, M. A., & Williams, K. D. (2000). From I to we: Social identity and the collective self. *Group Dynamics: Theory, Research, and Practice, 4*, 81–97. https://doi.org/10.1037/1089-2699.4.1.81
Sniezek, J. A., & Buckley, T. (1995). Cueing and cognitive conflict in judge-advisor decision-making. *Organizational Behavior and Human Decision Processes, 62*, 159–174. https://doi.org/10.1006/obhd.1995.1040

Stirman, S. W., & Pennebaker, J. W. (2001). Word use in the poetry of suicidal and non-suicidal poets. *Psychosomatic Medicine, 63*, 517–522. https://doi.org/10.1097/00006842-200107000-00001

Stout, J. G., & Dasgupta, N. (2011). When he doesn’t mean you: Gender-exclusive language as ostracism. *Personality and Social Psychology Bulletin, 37*, 757–769. https://doi.org/10.1177/0146167211406434

Suedfeld, P., Tetlock, P. E., & Streufert, S. (1992). Conceptual/integrative complexity. In C. P. Smith (Ed.), *Motivation and personality: Handbook of thematic content analysis* (pp. 393–400). Cambridge University Press. https://doi.org/10.1017/cbo9780511527937.028

Sunstein, C. (2009). *Going to extremes*. Oxford University Press.

Tausczik, Y. R., & Pennebaker, J. W. (2010). The psychological meaning of words: LIWC and computerized text analysis methods. *Journal of Language and Social Psychology, 29*, 24–54. https://doi.org/10.1177/0261927x09351676

Todd, A. R., Bodenhausen, G. V., & Galinsky, A. D. (2012). Perspective taking combats the denial of intergroup discrimination. *Journal of Experimental Social Psychology, 48*, 738–745. https://doi.org/10.1016/j.jesp.2011.12.011

Van Swol, L. M. (2009). Extreme members and group polarization. *Social Influence, 4*, 185–199. https://doi.org/10.1080/15534510802584368

Van Swol, L. M., Braun, M. T., Acosta Lewis, E. E., Carlson, C. L., & Dimperio, G. (2018). Discussion of shared information can increase the influence of divergent members. *Communication Research, 45*, 188–212. https://doi.org/10.1177/0162353215609084

Van Swol, L. M., & Carlson, C. L. (2017). Language use and influence among minority, majority, and homogeneous group members. *Communication Research, 44*, 512–529. https://doi.org/10.1177/001623365021570658

Van Swol, L. M., & Kane, A. (2019). Language and group processes: An integrative, interdisciplinary review. *Small Group Processes, 50*, 3–38. https://doi.org/10.1177/106496418785019

Van Swol, L. M., Prahl, A., & Kolb, M. (2019). The effects of discussion of familiar or non-familiar information on opinions of anthropogenic climate change. *Environmental Communication, 13*, 1128–1142. https://doi.org/10.1080/17524032.2019.1610022

Van Swol, L. M., Prahl, A., Kolb, M., Acosta-Lewis, E. E., & Carlson, C. (2016). The language of extremity: The language of extreme members and how the presence of extremity affects group discussion. *Journal of Language and Social Psychology, 35*, 603–627. https://doi.org/10.1177/0261927x16629788

Verhoef, P. C. (2003). Understanding the effect of customer relationship management efforts on customer retention and customer share development. *Journal of Marketing, 67*, 30–45. https://doi.org/10.1509/jmkg.67.4.30.18685

Vescio, T. K., Sechrist, G. B., & Paolucci, M. P. (2003). Perspective taking and prejudice reduction: The mediational role of empathy arousal and situational attributions. *European Journal of Social Psychology, 33*, 455–472. https://doi.org/10.1022/ejsp.163

Walther, J. B. (1992). Interpersonal effects in computer-mediated interaction: A relational perspective. *Communication Research, 19*, 52–90. https://doi.org/10.1177/009365092019001003

Walther, J. B., Loh, T., & Granka, L. (2005). Let me count the ways: The interchange of verbal and nonverbal cues in computer-mediated and face-to-face affinity. *Journal of Language and Social Psychology, 24*, 36–65. https://doi.org/10.1177/0261927704273036

Wittenbaum, G. M., Hubbell, A. P., & Zuckerman, C. (1999). Mutual enhancement: Toward an understanding of the collective preference for shared information. *Journal of Personality and Social Psychology, 77*, 967–978. https://doi.org/10.1037/0022-3514.77.5.967

Yilmaz, G. (2016). What you do and how you speak matter: Behavioral and linguistic determinants of performance in virtual teams. *Journal of Language and Social Psychology, 35*, 76–97. https://doi.org/10.1177/0261927715577772

Yilmaz, G., & Peña, J. (2015). How do interpersonal behaviors and social categories affect language use? The case of virtual teams. *Communication Quarterly, 63*(4), 427–443. https://doi.org/10.1080/01463373.2015.1058285