Properties of the Continuous Assessment of Interpersonal Dynamics across sex, level of familiarity, and interpersonal conflict

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Abstract

The Continuous Assessment of Interpersonal Dynamics (CAID) is a method in which trained observers code individuals' dominance and warmth continuously while they interact in dyads. This method has significant promise for assessing dynamic interpersonal processes. The purpose of this study was to examine the impact of individual sex, dyadic familiarity, and situational conflict on patterns of interpersonal warmth, dominance, and complementarity as assessed via CAID. We used six samples with 603 dyads, including 2 samples of unacquainted mixed-sex undergraduates interacting in a collaborative task, 2 samples of couples interacting in both collaborative and conflict tasks, and 2 samples of mothers and children interacting in both collaborative and conflict tasks. Complementarity effects were robust across all samples, and individuals tended to be relatively warm and dominant. Results from multilevel models indicated that women were slightly warmer than men whereas there were no sex differences in dominance. Unfamiliar dyads and dyads interacting in more collaborative tasks were relatively warmer, more submissive, and more complementary on warmth but less complementary on dominance. These findings speak to the utility of the CAID method for assessing interpersonal dynamics and provide norms for researchers who use the method for different types of samples and applications.

Keywords: Interpersonal circumplex, sex, gender, familiarity, conflict, dynamics

Interpersonal interactions are the medium through which first impressions are formed, romantic relationships are deepened or dissolved, and parenting enhances or inhibits a child's development. Inasmuch as social behavior is the nexus in which personality meets psychologically important situations (Pincus, Lukowitsky, Wright, & Eichler, 2009), the dynamic behavioral processes that occur when individuals interact with one another is a critical focus of investigation for understanding processes related to individual differences in personality and psychopathology. However, assessing dynamic interpersonal behaviors is challenging for at least two reasons. First, the variety of psychological factors embedded in a social exchange (e.g., speech content, affect, motivation) makes it difficult to identify the most important and informative variables to assess. In this study, we use interpersonal theory (Leary, 1957; Pincus, 2005; Sullivan, 1953) to constrain our measurement to variation in behavioral warmth and dominance. Interpersonal theory has a 60+ year history as a theoretical framework for investigating interpersonal processes, firm ties to both the individual differences and social psychological traditions, and a well-developed measurement framework with validated tools for assessing interpersonal behaviors.

Having identified the variables on which to focus, a second challenge involves assessing behavioral variation. Despite calls for supplementing methods focused on "self-reports and finger movements" with assessments of "actual behavior" (Baumeister, Vohs, & Funder, 2007), the field continues to rely primarily on methods that are somewhat distal to behavioral process (Nave, Feeney, & Furr, 2018). In this study we focus on a relatively new observational coding technique, the Continuous Assessment of Interpersonal Dynamics (CAID; Sadler et al., 2009) that samples actual behavior between interactants relatively continuously as they interact in interpersonal situations (Lizdek et al., 2012). Our specific goal is to examine three factors that could impact social behavior as assessed with CAID: individual sex, dyadic familiarity, and situational conflict.

Interpersonal Theory

Contemporary interpersonal theory is rooted in the work of Harry Stack Sullivan (1953), who conceptualized personality and psychopathology in terms of the recurrent pattern of interactions individuals have with others throughout their lives. Sullivan's ideas were operationalized by researchers

studying individual behaviors in a group psychotherapy context (Leary, 1957). A measurement model was developed that could account for assessments from multiple levels of analysis, including self-report, patient narratives, and behavioral observations of real-time behavior. This model was refined by the work of Wiggins (e.g., 1979; 1991), who connected interpersonal assessments to more general concepts in the philosophical and psychological literature and provided a platform for contemporary research on individual differences in interpersonal tendencies as well as dynamic interpersonal processes. The interpersonal model has now been empirically connected to a variety of traditions in personality and social psychology, including attachment (Bartholomew & Horowitz, 1991), social cognition (Locke, 2003), psychodynamics (Lukowitsky & Pincus, 2011), trait theory (Ansell & Pincus, 2004), and evolutionary psychology (Zuroff, Moskowitz, & Cote, 1999). It continues to be a highly generative system for conceptualizing interpersonal behavior across multiple levels of analysis including studies of traits, motives, values, sensitivities, efficacies, and specific behaviors in the laboratory and the field (Locke, 2011).

The fundamental variables of interpersonal theory are agency and communion, which can take different forms depending on which level of analysis is being focused upon. At the level of behavior, agency and communion are conceptualized as the bipolar dimensions dominance vs. submission and warmth vs. coldness, respectively. These variables are typically arranged as the vertical and horizontal axes of the Interpersonal Circumplex (IPC; Figure 1; Kiesler, 1996; Leary, 1957). In this scheme, individual behaviors can be plotted as blends of dominance and warmth (Pincus, 2005; Wiggins, 1982), such that the distance from the center of the circle connotes its intensity (e.g., warm glance vs. warm hug) and the angular projection from the circle indicates its quality or style (e.g., dominant or warm-dominant). Both individual and dyadic parameters can be extracted from an interpersonal assessment and connected to specific hypotheses about social dynamics. In this study, we focus on three parameters that have received significant theoretical and empirical attention to date.

Level of Dominance. Interpersonal dominance, the vertical dimension on the IPC (Figure 1) is a fundamental organizing variable in interpersonal perception (Olivola, Funk, & Todorov, 2014) and

behavior (Sadikaj, Moskowitz, & Zuroff, 2011) that is generally associated with exerting one's own interests and will in order to take charge of others and "get ahead" (Cheng, Tracy, Foulsham, Kingstone, & Henrich, 2013). People tend to vary in their level of dominant behavior depending on individual attributes (Sadler & Woody, 2003), the role expectations of the situation they are in (e.g., Overall et al., 2016), and the person with whom they are interacting (Tost, Gino, & Larrick, 2013). An individual's average level of dominance during a social interaction conveys important information about her or his personality, social role, relationship to the other person, and situation.

Level of Warmth. Interpersonal warmth, the horizontal dimension on the IPC (Figure 1), signals the desire to be close and attached as opposed to reserved and disconnected (Horowitz et al., 2006). Warm behaviors are associated with gratitude for minor acts of kindness by unfamiliar people (Williams & Bartlett, 2015), a stronger alliance in psychotherapy dyads (Altenstein, Krieger, & Grosse-Holtforth, 2013), and effective parenting (Burt, Klahr, Neale, & Klump, 2013). Individual (e.g., Sadler & Woody, 2003), dyadic (e.g., Chong, Ruhl, & Buhrmeister, 2013), and situational factors (e.g., Wright, Simms, & Hopwood, 2015) have been found to influence warm behavior in social interactions. As with dominance, an individual's average level of warmth during a social interaction conveys important information about her or his personality, social role, relationship to the other person, and situation.

Complementarity. In interpersonal theory, the concept of complementarity provides a baseline prediction regarding patterns of warmth and dominance between individuals (Carson, 1969; Horowitz et al., 2006; Kiesler, 1996; Pincus & Ansell, 2013; Sadler et al., 2009). In complementary interactions, individuals are similar on warmth such that one individual's warm behavior invites or elicits warm behavior in the other, whereas cold behavior in one person is associated with coldness in the other. In contrast, complementarity on dominance is reciprocal such that dominant behavior is met with submission and submission with dominance.

While research using a variety of methods suggests that interactions generally follow the principle of complementarity on both dimensions with few exceptions (Sadler, Ethier, & Woody, 2011), the degree of complementarity may vary across situations (Pincus et al., 2014). Some research suggests

that greater levels of complementarity indicate a more positive interaction (Altenstein, et al., 2013; Rosen, Miller, Nakash, Halperin, & Alegria, 2012). Other data implies that too much complementarity is unrelated to the quality of the interaction (Cundiff, Smith, Butner, Critchfield, & Nealey-Moore, 2014). Still other studies have suggested that complementarity can be associated with negative interactions (Orford, 1986). Individual (e.g., personality traits; Bluhm, Widiger, & Miele, 1990), dyadic (e.g., relationship quality; Dryer & Horowitz, 1997), and situational (e.g., work vs. home; Moskowitz, Ho, Turcotte-Tremblay, 2007) attributes have been shown to moderate complementarity.

Interpersonal Assessment

The IPC is not a single measurement tool, but a flexible system around which a number of different assessment approaches have been organized (Locke, 2011; Pincus et al., 2014). The IPC can be used to assess stable traits (e.g., Wright, Pincus, & Lenzenweger, 2012), but it has also been a popular framework among researchers using ecologically-sensitive devices to capture the dynamics of social behavior across interactions or days in ambulatory studies (e.g., Moskowitz et al., 2007; Sadikaj et al., 2014; Wright et al., 2015). Multiple self, partner, and observer rating scales have been developed to measure the interpersonal behavior of two interactants in a specific situation (e.g., Benjamin, Rothweiler, & Critchfield, 2006; Kiesler, 1983; Moskowitz & Zuroff, 2005; Sadler & Woody, 2003). The most common approach has been to have the interactants or trained observers rate the average behavior of each person in an interpersonal situation in terms of their overall level of dominance and warmth after participating in or observing the interaction.

This relatively straightforward method has been used to test a variety of interpersonal hypotheses, including the relative influence of person and situation on behavior during an interaction (Sadler & Woody, 2003). However, it has two specific limitations. First, because all of the behaviors that occur during an entire interaction are aggregated by the rater, the method is prone to primacy, recency, or other biases that may obscure the objective level of dominance or warmth during an interaction (Stone & Shiffman, 1994). Second, this method is limited for investigating complementarity, which is generally construed as a momentary process in that people are thought to complement one another dynamically as a

situation unfolds, rather than in terms of their overall level of behavior (Sadler et al., 2009). Although some researchers have found complementarity effects for ratings of a behavioral average over the course of an interaction, these findings are less consistent and weaker than findings in which behaviors are assessed more continuously (Tracey, 2004).

An approach that addresses these limitations is the coding of the level of warmth and dominance within a given speaking turn (e.g., Benjamin, 1979). However, this approach is limited by an assumption that interesting interpersonal dynamics occur between but not within speaking turns. An individual's warmth or dominance could vary while they are speaking, such as when an irritated parent becomes progressively more aggressive while talking to her increasingly contemptuous adolescent, or a romantic partner becomes increasingly warm and close as he feels listened to in a moment of vulnerability. A related issue with assessments based on speaking turns is that they assume all speaking turns are equal, even though there may be more potential for psychologically meaningful information in a 5 minute soliloquy than in a single sentence. Finally, when applied to transcripts, this approach misses potentially informative non-verbal behavior that could occur outside of speaking turns (e.g., eye rolling, warm smiling). For this reason, it has been recommended that this approach be applied to video recordings (Skowron, Cipriano-Essel, Benjamin, Pincus, & Van Ryzin, 2013).

In this study, we used the recently developed CAID system (Lizdek et al., 2012; Sadler et al., 2009), an observational method that provides relatively continuous assessments of warmth and dominance as they occur during social interactions. The CAID approach overcomes some of the limitations of methods that require observers or participants to aggregate data over interactions or speaking turns. In a CAID assessment, trained coders watch a videotaped interaction while manipulating a joystick apparatus to plot a single individual's warmth and dominance as it unfolds in real time. Coders then observe the other person in the same interaction separately. Multiple coders typically assess the behaviors that unfold within an interaction and their time series data are aggregated to enhance reliability.

Average levels of each time series provide an assessment of the overall level of warmth and dominance. Complementarity can be estimated as the correlation between the warmth or dominance time

series of the two interactants. This correlation is expected to be positive for warmth, indicating that as one

person becomes warmer so does the other. It is expected to be negative for dominance consistent with the

principle of complementarity. Although there are other, somewhat more complicated approaches to

estimating complementarity, such as the computation of coherence values in a spectral analysis (e.g.,

Sadler et al., 2009; Thomas et al., 2014), these approaches tend to yield highly similar results, and the

correlation is easier to interpret and avoids constraining the time series to be any particular shape.

However, two issues arise when estimating complementarity with CAID data. First, at least two

sources of variation can impact the correlation between two time series: linear trends and dynamic

changes. Linear trends occur when both time series increase or decrease over the course of an entire

interaction, such as when two strangers who realize they don't like one another make less of an effort to

be polite as their initial encounter unfolds. While linear trends may be of some interest, they have been

the subject of relatively little theoretical or empirical work at this point, and serve to complicate the

interpretation of complementarity as it is more typically construed. Researchers are more often interested

in dynamic changes, or the degree to which the interactants' behaviors are related to one another across

particular moments. CAID time series can be detrended via regression prior to analyses in order to

provide for a more direct interpretation of correlated dynamic changes.

Second, it is possible that there are lagged interpersonal processes. For instance, if a husband's

transition to a more dominant or submissive position was always dependent on his partner, and that

transition took a few seconds, then a stronger correlation would be observed between the couples'

dominance time series if his data were delayed by a few seconds than if contemporaneous changes were

assessed. However, previous research examining this issue has found that complementarity effects are

consistently strongest in unlagged data, meaning that systematic changes in individuals' interpersonal

behavior tend to track together (Sadler et al., 2009).

Although it is a relatively new technique, researchers have used the CAID to assess social

dynamics in several different types of dyads, including unacquainted undergraduates (Markey,

Lowmaster, & Eichler, 2010; Sadler et al., 2009), therapists and patients (Altenstein et al., 2013), patients

and romantic partners (Ross et al., 2017), mothers and children (Klahr, Thomas, Hopwood, Klump, & Burt, 2013), and married couples (Lizdek et al., 2016; Thomas, 2014). This research has provided rich insights into the dynamics that occur in these kinds of samples in a way that has not been possible with previous methods. However, researchers have not yet compared CAID parameters across these different kinds of samples, in order to test hypotheses about what kinds of factors influence interpersonal dynamics. Understanding the sensitivity of CAID parameters to these kinds of factors provides a validity test and offers important information to guide the expectations of researchers using the method. Testing the impact of individual, dyadic, and situational factors on CAID parameters is the goal of the present study.

What impacts CAID parameters?

In order to capture possible influences on interpersonal dynamics from each of the levels of analysis described above, we selected variables from each level based on their plausibility given existing theory and research and testability given the samples that have been coded using CAID thus far: individual sex, dyadic familiarity, and situational conflict.

Individual Sex. Sex has been among the most extensively studied of all the potential individual-level influences on interpersonal dynamics. Several threads of research provide the basis for hypotheses regarding the impact of sex on levels of interpersonal warmth and dominance during social interactions.

First, while biological sex is different than gender identity (Carothers & Reis, 2013), there is a strong correlation between these variables (Burke, 1996; Delphy, 1993). Thus, research on the connection between gender and interpersonal dynamics is relevant for making hypotheses about sex effects on social dynamics. This research consistently connects dominance with masculine roles/behavior and connects warmth with feminine roles/behavior (Gurtman & Lee, 2009; Wiggins, 1982). These findings suggest that men will tend to be relatively more dominant than women whereas women will tend to be relatively warmer than men.

Second, both evolutionary (Buss, 1995; Gangstead & Simpson, 2000) and sex role (Eagly, 1995; Eagly & Wood, 1999) theories also make this general prediction. From an evolutionary perspective,

survival was most likely when women were effective at caring for offspring through warm behaviors such as gestation and nursing. In contrast, men were more likely to pass on their genes through dominant behavior such as mate-finding and fighting off competitors. It follows from this theory that women would tend to be attracted to men who could procure resources, whereas men would be attracted to women who would be likely to effectively care for children. In social role theory, sex differences in social behavior are understood as roles that are reinforced and socialized from early childhood (Koestner & Aube, 1995). In this model, warm behaviors such as caregiving, emotional expression, and responsiveness with others are associated with stereotypically feminine roles such as homemaker and mother and therefore more likely among women. Men, on the other hand, are more likely to exhibit dominant behaviors, such as assertiveness, independence, and initiation, stereotypically associated with roles such as provider and worker. In accordance with these reinforced roles, men may be relatively more dominant in social interactions, whereas women may tend to be relatively warmer (Feingold, 1994; Sagrestano, Heavey, & Christensen, 1998).

Despite theory and research suggesting a connection between sex and interpersonal styles, empirical evidence has been mixed. Questionnaire data suggest that women tend to be warmer than men, although the results are more ambiguous for dominance (e.g., Gurtman & Lee, 2009; Lambert & Hopwood, 2015; Park et al., 2016). Ambulatory designs have yielded similarly mixed results, with some finding sex differences for both warmth and dominance in certain situations (Suh, Moskowitz, Fournier, & Zuroff, 2004) and others finding differences only for warmth (Moskowitz, Suh, & Desaulniers, 1994).

Many of the studies using continuous interpersonal assessments have not examined sex differences because they have sampled same-sex pairs (Markey et al., 2010), regressed out sex differences in order to test other hypotheses (Klahr et al., 2013), or sampled dyads in which sex and other role variables were conflated (e.g., male therapists with female patients, Thomas et al., 2014). In the only CAID study to examine this issue, women were warmer than men but there were no differences in dominance (Sadler et al., 2009). Nevertheless, based on the overall body of research associating both

interpersonal dimensions with sex, we hypothesized that men would tend to be more dominant than women and women would tend to be warmer than men.

     Dyadic Familiarity. It is intuitive that individuals behave differently with people they know than they do with strangers. Interpersonal research suggests that strangers tend to be relatively warm with one another (Sadler et al., 2009) and have relatively high levels of dominance and warmth complementarity (Markey, Funder, & Ozer, 2003; Sadler & Woody, 2003) whereas familiarity can breed the tendency to be annoyed (e.g., Hopwood et al., 2011) although explicit tests comparing familiar and unfamiliar dyads have not been conducted using continuous assessments of warmth and dominance.

     Social cognition theorists assert that different motivations underlie interactions with familiar and unfamiliar people (Frith & Frith, 2012). Unfamiliar interactions are associated with the *emergence* of social status, whereas familiar interactions are associated with the *maintenance* of social status (e.g., Berscheid & Reis, 1998; Coie & Kupersmidt, 1983). In first encounters, social cognition is more strongly influenced by warmth (i.e., the intentions of this other person) than dominance (e.g., the person's ability to carry out these intentions; Fiske, Cuddy, & Glick, 2007). Additionally, when portraying oneself to another individual for the first time, there is a strong motivation to connect, cooperate, and appear approachable (Locke, 2014).

     Unfamiliar people may therefore interact in a way that is warm and interpersonally responsive, since high warmth and attunement tend to be perceived as positive social characteristics that elicit positive emotions and behavioral responses, such as admiration and affiliation (Hatcher & Rogers, 2009; Locke, 2003). Additionally, because unfamiliar people may have a stronger investment in appearing agreeable and avoiding awkward moments, they may be more willing to share power within an interaction. For instance, if one interactant speaks, the other may be more likely to listen politely and less likely to interrupt in unfamiliar relative to familiar pairs. Behaviors that validate both interactants are likely to be followed by reciprocations of these behaviors. Therefore, it is expected that unfamiliar dyads will reciprocate dominance behaviors in a complementary manner to a stronger degree than familiar dyads.

Alternatively, people who are familiar with one another may be relatively less concerned about being warm, cordial, and responsive. They might presume that their attachment will survive minor ruptures. Familiar interactants may also expect that, given previous exposures to the other, they are less likely to be perceived a certain way (e.g., because of attribution errors or correspondence biases; Gilbert & Jones, 1986; Ross, 1977). Thus, familiar interactants may have fewer reservations about behaving coldly or not reciprocating dominance-related behaviors in a socially normative manner. Familiar interactants are likely to have fewer qualms about voicing controversial opinions, debating with one another, interrupting, or even refusing to communicate or cooperate in a tense interaction. In fact, evidence suggests that individuals are more likely to express aggression and coldness toward the people they interact with more frequently, such as family members or significant others (Richardson, 2014). We therefore predict that familiar interactants will be colder overall and show less dominance complementarity.

Situational Conflict. One of the most important interpersonal capacities involves the ability to avoid or manage interpersonal conflict, because patterns of interpersonal conflict have implications for personal well-being and relationship stability (Bradbury & Fincham, 1990; Brehm, Miller, Perlman, & Campbell, 2002; Carrere & Gottman, 1999; Heyman, 2001). However, some situations are conflictual by nature. Interpersonal research implies that warmth and complementarity within certain interactions differ depending on whether the task is collaborative or competitive (Markey et al., 2003; Nowicki, Fost, & Naik, 1997). In collaborative environments, interactants are likely to be more cordial and warm with one another and to share power via interpersonal complementarity. We would accordingly expect that collaborative interactions would be characterized by higher warmth and stronger dominance complementarity.

Conversely, we would expect interactions that are more conflictual to be colder. Interactants may be less willing to share power and thus less likely to reciprocate a dominant behavior with a submissive behavior. Orford (1986) argued that, in conflictual interactions, cold-dominance is likely to evoke cold-dominance (i.e., counter-argument, as opposed to passive compliance), and cold-submission is likely to

evoke warm-dominance (i.e., caretaking rather than competition). In other words, interactants are likely to exhibit less dominance complementarity in conflictual compared to non-conflictual interactions.

The Present Study

In the present study, mean levels and complementarity of dominance and warmth as assessed using CAID are examined across six samples: two each of unacquainted undergraduate students interacting in a collaborative task, couples in tasks that varied in terms of conflict, and mothers and children in tasks that varied in terms of conflict. These samples allowed us to test how the sex of the interactants, familiarity between the interactants, and conflict within the task impact CAID data. With respect to sex differences, we hypothesize that women will be warmer than men and men will be more dominant than women. With respect to familiarity, we hypothesize that unfamiliar acquaintances will be warmer overall and show more dominance complementarity than family members. With respect to conflict, we hypothesize that interactants in conflictual tasks will be colder overall and show less dominance complementarity relative to interactants in collaborative tasks.

Methods

Participants

We used six samples of dyads who interacted in face-to-face encounters which were coded using the CAID system to test these hypotheses. Four of these samples involved primarily mixed-sex (i.e., male-female) peers or couples, two were unfamiliar whereas the other four were familiar, and there was variation in the level of conflict vs. collaboration in the tasks (see Table 1).

Sample 1: student dyads. Unfamiliar college students (183 mixed-sex dyads) were recruited from psychology courses at a public university in the southern United States (Hopwood, 2008). Participants interacted as dyads to collaborate on a task that involved discussing a third person's personality based on her responses to selected cards from the Thematic Apperception Test (Sadler & Woody, 2003). The mean age of participants was 19.21 years ($SD = 2.45$); 78% of the participants identified as White; 11% identified as Hispanic; 4% identified as African American; 4% identified as Asian; and 3% identified as other ethnicities. This interaction was recorded for 20 minutes; however, the first few minutes consisted

of warm-up, looking at the cards, and reading the responses (this time varied across dyads). To ensure that the assessment was of an actual interpersonal process, only the last 10 minutes of the interaction was coded.

Sample 2: student dyads. Unfamiliar college students (50 mixed-sex dyads) were recruited from psychology courses at a public Canadian university to interact in the same task as sample 1 (Sadler et al., 2009). The mean age of participants was 18.72 years (SD = 2.10); 72% of the participants identified as White; 20% identified as Asian; 3% identified as Middle Eastern; 2% identified as East Indian; and 3% identified as other ethnicities. As in sample 1, only the last 10 minutes of this 20-minute interaction was coded. Mean levels of warmth, dominance, and complementarity were reported for this sample in Sadler et al. (2009), but these results have not been compared to those from other samples as we will do in this study.

Sample 3: couple dyads. Romantic couples (74 dyads) who were recruited via flyers and selected if one partner was in outpatient treatment for psychopathology, the couple had been in a relationship for at least a month, and they had regular contact with one another were recruited via flyers to participate in this study (Ross et al., 2017). The couples discussed a mutually-identified area of conflict for 10 minutes. Most couples (84%) were in an opposite-sex relationship; 16% (11 female and 1 male) were in a same-sex relationship. Couples had been intimately involved for an average of 56.80 months (SD = 51.71) and 47 were cohabitating. Participants were 30.25 years old (SD = 5.79) and significant others were, on average, 31.34 years old (SD = 7.53). The majority of participants were White (75%) or Black (15%) and the remainder was Asian American (2%) or more than one race (8%). The average age was 31.19 (SD = 7.20).

Sample 4: couple dyads. Married heterosexual couples (134 dyads) with young children were recruited from the community in a study designed to examine personality and interpersonal processes in parents (Stroud, Durbin, Wilson, & Mendelsohn, 2011). Overall, 76% of both men and women identified as White; 11% of the men and 10% of the women identified as Hispanic/Latino; 9% of both men and women identified as African-American/Black; 4% of the men and 5% of the women identified as other

ethnicities. Mean age of the women was 36.91 years (SD = 5.17); mean age of the men was 38.27 years (SD = 5.79). Participants were asked to discuss four topics, including two that were coded as collaborative (planning a vacation, 5 minutes; discussing best things in their relationship, 5 minutes) and two that were coded as conflict (an area of each partners' relationship dissatisfaction, 8 minutes each).

Sample 5: mother-child dyads. Mothers and their 12-16 year old children (99 dyads) who were recruited from the community discussed a conflict issue and were asked to discuss the issue and mutually arrive at a solution for 10 minutes in a study originally designed to examine interpersonal mechanisms of stress (Chaplin et al., 2012). 56% of the adolescents identified as male. 67% of the participants identified as White, and 33% identified as other ethnicities. Mean age of the adolescents was 13 years (SD = 2.02) and mean age of mothers was 45 years (SD = 6.48).

Sample 6: mother-child dyads. Mothers and children (63 dyads) were recruited through either community advertisements or a clinical trial for depressed mothers of children with an internalizing disorder (Amole et al., 2017; Swartz et al., 2016). Dyads participated in three dyadic interactions, including a) a three-minute discussion of an event they enjoyed together, b) a three-minute discussion planning a fun activity to do together, and c) a six-minute discussion of a child-focused issue on which they disagree. The majority (79%) of dyads were White; 20% were Black/African-American, and (2%) reported being mixed race. Ten of the adolescents were boys and 53 were girls. The average age of mothers was 45.46 (SD = 6.75) and the average age of children was 14.64 (SD = 2.53).

Coding Procedure

Videos of the dyadic interactions were coded using a manual based on the protocol summarized in Sadler et al. (2009). Coders used a computer joystick to continuously plot interactants' dominance and warmth using software that displays a Cartesian plane, wherein the x-axis represents warmth and the y-axis represents dominance (Girard & Wright, in press, Sadler et al., 2009). The scales of these axes range from 1000 to -1000, so that 1000 on each axis represents the most extreme warmth and dominance, and -1000 represents the most extreme coldness or submissiveness. A dot on the Cartesian plane represents how an interactant is behaving at any given time in terms of dominance and warmth. By using the

joystick to move this dot, coders indicate various shifts in behaviors. Scores assessing dominance and warmth are captured every .5 seconds.

Assessments for each interaction were provided by multiple coders. Each coder received at least 8 hours of training, which consisted of coding several training videos until the coders achieved alphas that reflected satisfactory inter-rater reliability (Sadler et al., 2009). Coders were trained to consider aspects of behavior including the content of speech but also vocal tone, vocal volume, hand position, head gaze, facial expression, torso position, and so on. Once coders showed adequate inter-rater reliability using CAID methods, they began scoring interactions. Data were then examined for each time series, aggregated across reliable coders. All following analyses used two key summary statistics based on these aggregated time series as outcome variables. The first summary statistic was the individual's mean across the entire time series. The second was the detrended Pearson correlation between the dominance and warmth time series for each dyad. These correlations were then standardized using Fisher's z transformation for analyses.

Data Analysis

To examine whether sex, familiarity, and conflict predict mean levels of individuals' dominance and warmth, multilevel modeling was used to account for the nonindependence due to dyads. Individual within dyad was treated as a repeated factor so that nonindependence was estimated as a covariance. Thus, the dyadic ICC was estimated as a function of the covariance between the two individuals' residuals divided by the pooled residual variance. In each analysis, the effect of one predictor variable was examined separately such that the fixed effects part of the model included either the individual's sex, dyadic familiarity, or situational conflict as categorical predictors, predicting either the individual's average dominance or average warmth. In terms of random effects, the first set of models included a repeated effect for dyads to model the residual correlation between dyad members' warmth or dominance as a covariance, which is necessary given that complementarity in dominance implies the possibility of a negative correlation between interactants' average behavior.

Unlike average warmth or dominance, which vary at the level of the individual, complementarity correlations vary at the level of the dyad. In these models the z-transformed Pearson correlations between the two interactants' warmth or dominance were predicted to be a function of dyad familiarity or situational conflict. Because the correlations are computed at the dyad level, analyses testing for differences as a function of familiarity or conflict both dropped the repeated effect of dyad from the random effects. In effect, this changes the analysis into a between-group t-test model. Data and syntax for this project can be found at https://osf.io/f6yh6/.

Results

Tables 2-4 give multilevel model results for sex, familiarity, and conflict hypotheses, respectively. Table 5 presents mean levels of warmth and dominance for men and women across samples, whereas Table 6 shows average levels and complementarity in dominance and warmth across samples and tasks. Figure 2 presents a general summary of the results. As can be seen in the top left quadrant of Figure 2, individuals in dyadic interactions coded with the CAID system tended to have positive levels of warmth and dominance across all samples, meaning that the majority of interaction time is spent in the top right quadrant of the IPC (Figure 1). Cross-correlations were relatively strong and universally positive for warmth and negative for dominance, consistent with the principle of complementarity (Tables 3 and 4). Dyadic ICCs indicate that, based on individual average scores, if one person was relatively high in average warmth across the interaction, the other person was as well, and if one person was relatively high in average dominance across the interaction, the other person was relatively low in average dominance. This suggests that complementarity occurs at both momentary and interaction-level windows of time.

Sex Differences

We predicted that, on average, women would be warmer than men whereas men would be more dominant than women. Given power differences in the mother-child interactions that would confound the interpretation of these results, we did not include these samples in examinations of sex differences. Table 2 presents the aggregated results from the multilevel analyses. While the hypothesized sex difference in warmth was observed, it was small (Figure 2). Table 5 indicates that this effect was driven primarily by

the student samples and one task in the second couples sample, perhaps suggesting that the tendency for women to be warmer than men does not generalize across all situations. Contrary to our hypothesis, there was no evidence of a sex difference in dominance in general or in any task (Table 5, Figure 2).

Familiarity

We predicted that unfamiliar acquaintances would be warmer on average, and would show stronger dominance complementarity than familiar dyads. As can be seen in Table 3 and Figure 2, average warmth was significantly higher in unfamiliar dyads as hypothesized. Dominance was also higher in familiar dyads. Positive complementarity for warmth was significantly higher in unfamiliar dyads as compared to familiar dyads. That is, across the interaction, in unfamiliar dyads the two interactants' warmth scores covaried more consistently than in familiar dyads. Greater complementarity for dominance emerged for familiar dyads relative to unfamiliar dyads, in contrast to our hypothesis. In other words, in familiar dyads negative covariation was stronger than in unfamiliar dyads such that for familiar dyads, in moments during which one partner was relatively dominant, the other person was relatively submissive. However, in unfamiliar dyads the momentary dominance of one person was less consistently associated with submission on the part of the other person.

Situational Conflict

We expected that dyads in conflict tasks to be colder on average and show less dominance complementarity relative to dyads in collaborative tasks. Table 4 and Figure 2 present the multilevel results comparing collaborative and conflict tasks. As hypothesized, conflict was strongly associated with lower warmth (although because the mean is positive, average behavior was still on the warm side of the circumplex), and dyads in a conflict task were also significantly more dominant than dyads in a collaborative task. In contrast to our hypothesis, there was significantly higher positive complementarity for warmth in collaborative tasks and there was significantly stronger complementarity for dominance in conflict tasks.

Discussion

This study reported scores from the Continuous Assessment of Interpersonal Dynamics (CAID) across six independent samples (603 total dyads). Two general findings are relevant to interpersonal assessment. First, interactants tended to be relatively warm and dominant across all tasks (Figure 2). In other words, 0 is not the expected midpoint in interpersonal interactions when standard CAID instructions are applied, and it may not be remarkable to find that someone was warm or dominant relative to this absolute value. This speaks to the importance of comparing any results to norms, such as those provided in this study (Tables 5 and 6). Second, a relatively strong complementarity effect was observed across all samples. This finding is consistent with previous research using CAID and other methods in suggesting that complementarity is a reliable heuristic for interpersonal processes. Even when it varied as a function of familiarity or situational conflict, it was always the case that dominance was negatively correlated across partners whereas warmth was positively correlated across partners, on average.

The main goal of this study was to examine the impacts of sex, familiarity, and conflict on level of dominance and warmth and complementarity as assessed with CAID. Results also pointed to important differences as a function these factors.

Sex Differences

We had hypothesized that women would tend to be warmer than men and that men would tend to be more dominant than women, based on social role and evolutionary theories of sex differences in mixed-sex social behavior. We also noted that previous results were more equivocal for dominance differences than warmth differences (Sadler et al., 2009). We found that women were significantly warmer than men, on average. However, the warmth effect is qualified by the fact that results were small and inconsistent across samples (Table 5). The only individual samples where the effect was observed were in the two unfamiliar student dyads working on a collaborative task and in one of the four couples tasks in which the dyad discussed the best things in their relationship. When couples planned a vacation or discussed relationship problems, sex differences in warmth were very modest (Figure 2). Overall, these results are consistent with previous research and theory suggesting that women tend to be somewhat

warmer than men, but also suggest that this effect likely varies as a function of interactants and situation, indicating the need for more research on mechanisms and moderators.

Examinations of individual samples revealed no reliable trend suggesting that men are more dominant than women. Indeed, in two of the samples, women were somewhat more dominant than men (Table 5). For one of these samples, the discussion centered around problems a wife identified in a relationship, suggesting that situational factors including the focus of the conversation affects dominance behavior. In general, the nature of the tasks or samples in this study could have impacted this result. Several other factors might explain the more general finding. CAID might not be sensitive to the kind of dominance behaviors that are more likely to show sex differences. It is also possible that trends in dominance behavior vary across culture or time, such that dominance differences may be more likely in societies or times with more traditional and fixed sex roles.

Dyadic Familiarity

We expected unfamiliar dyads to be warmer and to have higher levels of dominance complementarity than familiar dyads, because of the different social cognitive and attachment-related motives associated with familiar and unfamiliar interactions. Results indicated that unfamiliar dyads were warmer than familiar dyads, consistent with our hypothesis. However, dominance complementarity was actually stronger in familiar dyads. Results also suggest that familiar dyads may be somewhat more dominant and less complementary with respect to warmth than unfamiliar dyads.

Overall, this pattern suggests that interactions with strangers are quite different than interactions with people in established relationships. With strangers there is a relatively low attachment risk, but also a lack of attachment security coupled with a motivation to make a certain kind of impression. In such interactions, people may tend to be warm and low in dominance in order to test the interpersonal waters, avoid offending the other person or coming across as arrogant, over-confident, or bossy, and collect data about the other person's interests and behavioral style. In such interactions, warm behaviors from strangers might be matched relatively promptly, in essence accepting a friendship bid, whereas cold behaviors might be interpreted as disinterest. Because it can be somewhat disruptive to relationship

growth to be interested in someone who is not interested in you, behaviors low in warmth might thus be met with similar behaviors to a greater degree when attachment has not been established.

It was somewhat surprising that dominance complementarity was stronger in the familiar dyads. It could be that there is a more natural rhythm and smoothness to interactions in familiar dyads in which both people know what to expect with regards to relative social status (Berscheid & Reis, 1998; Coie & Kupersmidt, 1983) and can anticipate the others' actions and reactions. The nature of the tasks in the unfamiliar dyads may also have influenced dominance complementarity. Both samples of unfamiliar dyads involved a collaborative task in which the general pattern was for one interactant to take the lead while the other sat back and followed. However, there were several instances where both interactants engaged and disengaged at the same time in a rhythmic way (e.g., they would discuss the task together, then grow silent to contemplate the next steps, then re-engage by sharing ideas). Additionally, the task required interactants to read materials and write down answers, so there were times when both participants were simultaneously disengaged from one another. For these reasons, the specific nature of the task may have attenuated dominance complementarity in the unfamiliar samples.

Situational Conflict

Results indicated lower warmth in conflict relative to collaborative tasks, supporting the study's hypotheses. This was the strongest effect in the study. It can be presumed that conflict tasks will tend to elicit feelings of anxiety and frustration (e.g., Nowicki et al., 1997), which may take the form of colder behaviors. Contrary to hypotheses, however, dyads in collaborative tasks did not show stronger dominance complementarity than those in conflict tasks; in fact, the results suggested the opposite interpretation. Conflict tasks were also associated with greater dominance complementarity and less warmth complementarity. We expected more power struggles in colder and more conflictual interactions (Orford, 1986), leading to lower estimates of dominance complementarity. In contrast, these results may suggest that both familiarity and conflict have similar effects on social behavior in that both of these factors are associated with more dominance complementarity, along with lower warmth, less warmth complementarity, and more dominance. These findings indicate the need to reconsider the notion that

dominance complementarity is a feature of smooth social interactions. We also note that behaviors tended to be on the warm half of the circumplex for most participants even in conflictual tasks (Figure 2).

Non-hypothesized differences in warmth complementarity imply that individuals interacting in familiar or conflictual situations may be more likely to let their guard down a bit and allow other motives to outweigh the impact of politeness and social viscosity. They may be less concerned about appearing distant or bossy, and feeling secure in their attachment may tend to focus more on winning the argument of the moment. There is less of a need, perhaps, to respond to the other person's warmth or distance with complementary behavior because there is relatively less concern about developing a positive relationship or maintaining a fragile bond.

Implications for Interpersonal Assessment

This study demonstrates the ability of the CAID method to assess interpersonal dynamics across a range of samples and tasks. Results also provide useful information about some of the factors that may impact CAID data. As such, they could be used as normative benchmarks against which to compare the results of future studies. For instance, these results make it clear that zero is not a normative expected value for average interpersonal behavior in the CAID system. Most interpersonal behaviors as coded by CAID raters, even in conflict tasks, tend to be warm and dominant. As such inferences about the relative impacts of different factors on interpersonal behavior would benefit from considering how behaviors under different conditions differ from the averages observed in this study. These results similarly provide normative benchmarks for complementarity cross-correlations.

Overall, these results suggest that CAID provides a rich data source about interpersonal dynamics that is connected to a highly generative and integrative model of human behavior. It has already been used to produce a number of novel insights involving the cyclicity of interpersonal patterns within interactions (Sadler et al., 2009), variability in interpersonal style within the same patient across therapists (Thomas et al., 2014), and parallel processes between supervision and therapy (Tracey, Bludworth, & Glidden-Tracey, 2012). The current results speak to the validity of the CAID method in a range of samples, and should encourage researchers to continue using CAID to study interpersonal processes.

A more general recommendation is to expand our armamentarium of assessment tools to include methods, like CAID, which get beyond global self-reports (Hopwood & Bornstein, 2014; Bornstein, 2017). Having used various approaches to assess interpersonal behavior, we have been impressed by how much is missed in highly global data collected from the perspective of one individual, but also how challenging continuous, multimethod assessment data can be. The latter lesson leads us to the limitations of this study and future directions for dynamic interpersonal assessment using CAID and other approaches.

Limitations and Future Directions

One limitation with this study involved the availability of data from different kinds of samples. For instance, only close dyads participated in conflict tasks, and all of the unfamiliar dyads completed a similar kind of task (analyzing a third person's TAT stories). Furthermore, all of the unfamiliar dyads were college students, and some of the individuals in the close dyads were known to have psychopathology. While we are generally confident in the overall patterns found in this study, sampling dyads across more diverse situations (e.g., different kinds of collaborative or conflictual tasks), compositions (e.g., same and mixed-sex dyads), and levels of relationship (e.g., strangers, acquaintances, friends, and couples) would allow for more buoyant inferences about the role of these factors in interpersonal behaviors. It would also be informative to test other factors, including individual differences such as age, ethnicity, personality, contextual factors such as culture or setting, coding differences across labs, rater drift, and the influence of both actor and partner effects on momentary interpersonal behavior. Given that all of these studies were conducted in psychological laboratories, it would be interesting to test whether the results generalize to more ecologically valid situations (see Gottman, 1979). Future studies should also build on this descriptive work by examining the mechanisms that explain the effects observed in this study.

A second limitation is that we only examined mean levels and complementarity coefficients for warmth and dominance. Other parameters could be extracted from CAID data, including the rhythmicity of interactions (Sadler et al., 2009), the correlations of dominance and warmth within people (Thomas et

al., 2014), or the slope of the warmth and dominance time series over the course of the interaction. We did not focus on these parameters given the lack of literature with which to base any predictions as a function of sex, familiarity, or conflict, but it would be interesting to explore sample differences on these aspects of the interactions. CAID could also be combined with other coding systems to more fully capture the nuances of social dynamics (e.g., Gottman, 1996; Hahlweg et al., 1984; Heyman, 2001; see Ross et al., 2017). In general, much could be done to go beyond the current results by leveraging the continuous nature of CAID time series to test hypotheses about interpersonal dynamics.

A number of other future directions would also be of interest. For instance, it is common practice to delete the first few moments of CAID data. However, it is possible that there is important information in the first few moments that is missed because of this practice, and which would be worthy of future investigation. The surprising results with respect to complementary on dominance from this study leads to some interesting possibilities for future research. For instance, it follows from Orford's (1986) critique that warmth may moderate dominance complementarity, and this issue could be explored using CAID data. Another potentially fruitful idea for further research has to do with distinguishing the various signals that are integrated by CAID coders. Such signals include verbal content, facial expression, tone, and body movement. CAID could be applied to other kinds of interpersonal interactions, including groups (Pennings et al., 2018), to help identify potential moderators of effects identified here. Finally, CAID could be a rich source of information about idiographic patterns that deviate from normative results. For instance, it is intuitive that complementarity would tend to lag, although normatively, complementarity effects tend to be strongest in non-lagged data (Sadler et al., 2009). It is possible that this is because various lags are averaged across moments and dyads, and that interesting lags would be uncovered if individual cases were the focus (e.g., Thomas et al., 2014).

Conclusion

In summary, this study demonstrated the utility of CAID for assessing interpersonal dynamics and provided evidence regarding the impacts of sex, familiarity, and conflict on levels and complementarity of warmth and dominance in dyadic interactions as assessed using CAID. We

specifically found warmth is more likely among women, strangers, and collaborative situations. People were also more dominant in conflictual as opposed to collaborative discussions and when interacting with someone who was familiar. There was less complementarity on warmth in familiar dyads relative to unfamiliar dyads and in conflict tasks. Contrary to study hypotheses, dominance complementarity is higher among familiar interactants and in conflict tasks. These findings establish some benchmarks regarding the impact of different factors on interpersonal dynamics assessed continuously, confirm some general propositions from interpersonal theory (e.g., complementarity, sex differences in warmth) but challenge others (e.g., the role of dominance complementarity in social interactions, sex differences in dominance), and point to useful directions for the development of dynamic interpersonal assessment tools.

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Table 1. *Study Samples.*

	Dyads	Tasks	Sex	Familiarity	Conflict
Students	183	Collaboration	Mixed	-	-
Students	50	Collaboration	Mixed	-	-
Couples	74	Mutual problem	Mixed	+	+
Couples	134	Plan vacation	Mixed	+	-
		Best things	Mixed	+	-
		Wife problem	Mixed	+	+
		Husband problem	Mixed	+	+
Mother-Child	99	Mutual problem	NA	+	+
Mother-Child	63	Past positive experience	NA	+	-
		Future positive experience	NA	+	-
		Mutual problem	NA	+	+

Note. NA = not applicable.

Table 2. *Sex Differences in Level of Warmth and Dominance across Undergraduate and Couples Samples.*

	Women		Men				
	Mean	*SE*	*Mean*	*SE*	*t*	*df*	Dyadic *ICC*
Warmth	126.17	4.81	110.90	4.89	4.10*	840.4	.71*
Dominance	28.25	5.48	26.78	5.58	0.16	899.3	-.45*

Note. * $p < .01$. Random intercept ICCs estimating systematic variation by study were not significant (*p*s > .23).

Table 3. *Differences in Average Warmth and Dominance Level and Complementarity Correlations as a Function of Familiarity.*

	Differences in Mean Levels						
	Familiar		Unfamiliar				
	Mean	*SE*	*Mean*	*SE*	*t*	*df*	Dyadic *ICC*
Warmth	83.65	4.47	172.78	8.73	9.09*	1119	.69*
Dominance	54.15	2.90	-5.85	5.67	9.41*	1119	-.47*

	Differences in Complementarity Correlations					
	Familiar		Unfamiliar			
	Mean z	*SE z*	*Mean z*	*SE z*	*t*	*df*
Warmth	.42	.35	.59	.36	6.86*	1119
Dominance	-.62	.45	-.45	.37	5.35*	1119

Note. * $p < .01$. Random intercept ICC was not significant ($p > .17$ for level, $p > .18$ for complementarity). Detrended correlations were used for analyses of complementarity, which are presented in the metric of Fisher's z.

Table 4. *Differences in Average Warmth and Dominance Level and Complementarity Correlations as a Function of Situational Conflict.*

	Differences in Mean Levels						
	Collaboration		Conflict				
	Mean	*SE*	*Mean*	*SE*	*t*	*df*	Dyadic *ICC*
Warmth	159.61	4.91	31.42	5.347	17.43*	1119	.65*
Dominance	23.90	3.52	63.83	3.92	7.57*	1119	-.46*

	Differences in Complementarity Correlations					
	Collaboration		Conflict			
	Mean z	*SE z*	*Mean z*	*SE z*	*t*	*df*
Warmth	.50	.37	.39	.34	5.29*	1119
Dominance	-.54	.44	-.64	.43	3.65*	1119

Note. * $p < .01$. Random intercept ICC was not significant ($p > .12$ for level, $p > .14$ for complementarity). Detrended correlations were used for analyses of complementarity, which are presented in the metric of Fisher's z.

Table 5. *Sex Differences in Warmth and Dominance Level in Individual Samples.*

Sample	Sex	Mean	SD
	Warmth		
Combined	Female	125.58	142.61
	Male	111.58	137.86
Students 1	Female	175.48	81.16
	Male	149.59	86.96
Students 2	Female	232.25	132.13
	Male	187.24	140.93
Couples 1	Female	11.61	182.83
	Male	14.91	154.15
Couples 2 Vacation	Female	162.28	123.72
	Male	155.24	109.09
Couples 2 Best Things	Female	172.02	112.68
	Male	143.53	137.74
Couples 2 His Problem	Female	65.19	153.88
	Male	57.49	157.03
Couples 2 Her Problem	Female	68.08	125.20
	Male	58.01	129.71
	Dominance		
Combined	Female	28.10	159.04
	Male	26.90	163.54
Students 1	Female	-35.25	138.28
	Male	-8.41	152.87
Students 2	Female	70.34	185.59
	Male	31.74	190.59
Couples 1	Female	54.88	140.40
	Male	50.43	142.50
Couples 2 Vacation	Female	-2.06	152.98
	Male	2.94	155.98
Couples 2 Best Things	Female	65.73	167.69
	Male	64.81	167.26
Couples 2 His Problem	Female	35.82	176.15

	Male	48.47	179.62
Couples 2 Her Problem	Female	66.05	133.49
	Male	25.93	152.40

Table 6. *Sample differences in Level of Dyadic Warmth and Dominance.*

	Level				Complementarity					
	Warmth		Dominance		Warmth			Dominance		
	Mean	SD	Mean	SD	Mean z	SD z	r	Mean z	SD z	r
Combined	102.27	149.14	41.79	170.11	.45	.36	.42	-.58	.44	-.52
Unfamiliar (N = 466/233)	172.66	100.44	-6.20	158.77	.59	.36	.53	-.45	.37	-.42
Familiar (N = 1776/888)	83.79	154.26	54.38	170.79	.42	.35	.40	-.62	.45	-.55
Collaboration (N = 1242/621)	159.42	109.52	23.70	150.80	.50	.37	.46	-.54	.44	-.49
Conflict (N = 1000/500)	31.28	160.90	64.27	189.09	.39	.34	.37	-.64	.43	-.56
Students 1	162.53	84.99	-21.83	146.18	.59	.38	.53	-.43	.39	-.41
Students 2	209.74	137.77	51.04	188.15	.59	.29	.53	-.50	.28	-.46
Couples 1	13.04	170.47	52.96	140.85	.29	.34	.28	-.80	.37	-.66
Couples 2 Vacation	158.76	116.46	0.44	154.21	.50	.38	.46	-.88	.49	-.71
Couples 2 Best Things	157.77	126.40	65.27	167.16	.52	.33	.48	-.56	.39	-.51
Couples 2 His Problem	61.34	155.22	42.15	177.68	.49	.37	.45	-.73	.46	-.62
Couples 2 Her Problem	63.05	127.34	45.99	144.40	.47	.34	.44	-.63	.47	-.56
Mother-Child 1	3.69	200.69	114.04	282.31	.30	.24	.29	-.48	.33	-.45
Mother-Child 2 Past Fun	160.46	97.87	46.53	77.51	.35	.33	.33	-.36	.36	-.34
Mother-Child 2 Future Fun	114.22	86.65	71.25	83.24	.30	.33	.29	-.33	.33	-.32
Mother-Child 2 Conflict	-39.95	116.35	86.71	140.72	.29	.29	.28	-.50	.38	-.46

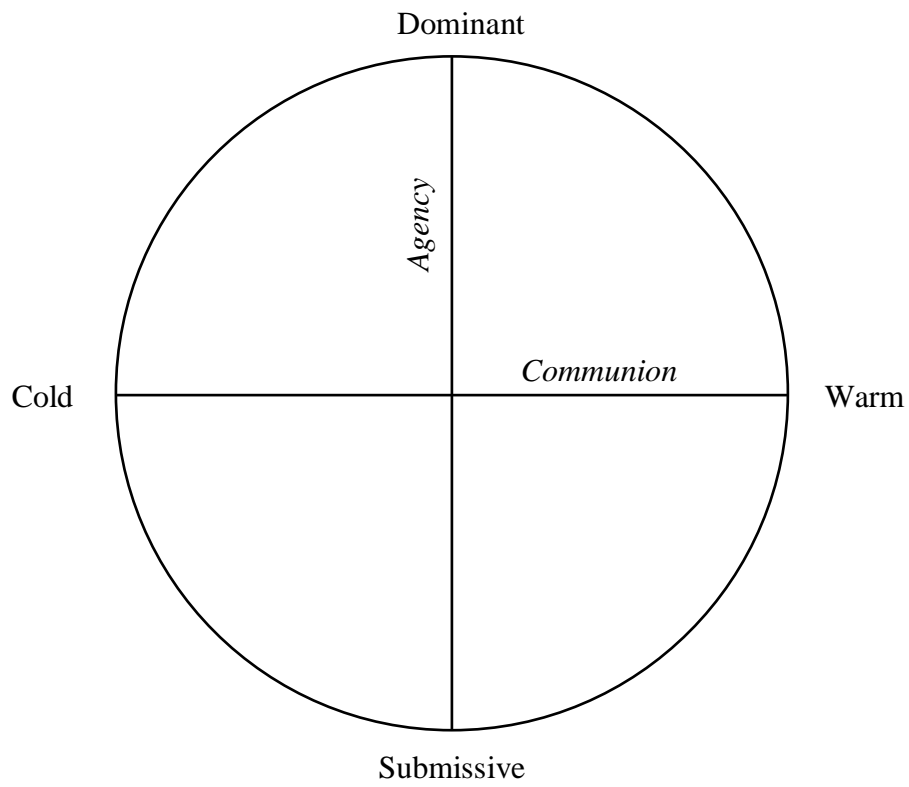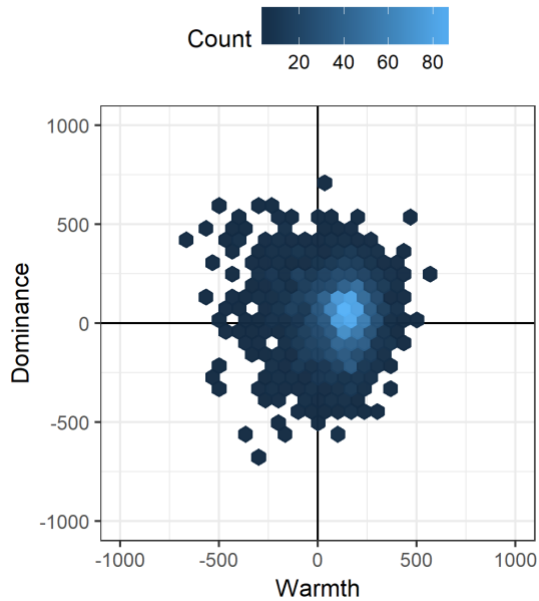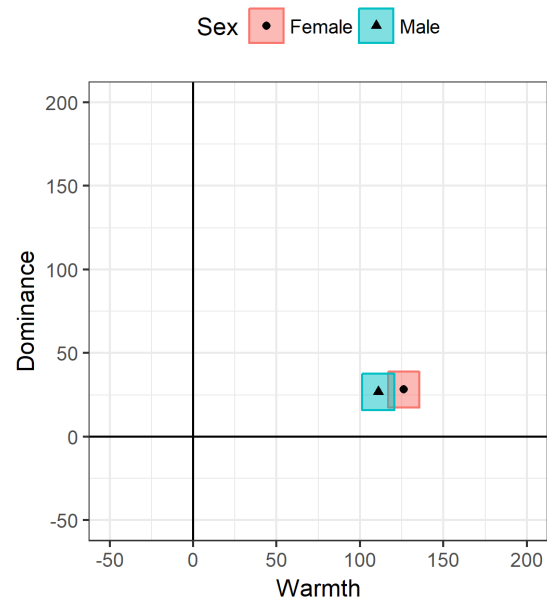*Figure 1.* The Interpersonal Circumplex.

Figure 2
Data visualizations. Shaded regions in panels (b) through (d) represent 95% confidence intervals.
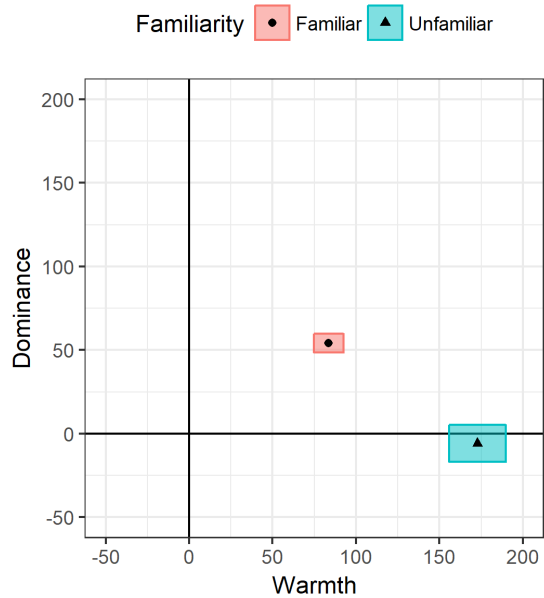
a) Density distribution for all data points

b) Mean ratings by participant sex

c) Mean ratings by familiarity

d) Mean ratings by situational context