

Warmer hearts, warmer rooms: Focusing on positive communal but not agentic traits
increases estimates of ambient temperature

Aleksandra Szymkow¹

Jesse Chandler²

Hans IJzerman³

Michal Parzuchowski¹

Bogdan Wojciszke¹

¹Warsaw School of Social Sciences and Humanities, Sopot Campus, Poland, ²Princeton University, USA, ³Tilburg University, Netherlands

Author Note

We gratefully acknowledge the help of Anna Sacha in carrying out Experiment 1, Agnieszka Imianowska and Magdalena Mikolajczak in conducting Experiment 2 and Emilia Bielecka in conducting Experiment 3. Correspondence concerning this article should be addressed to Aleksandra Szymkow, SWPS, ul. Polna 16/20, 81-745 Sopot, Poland, phone: +48 58 721 46 66. E-mail: aszymkow-sudziarska@swps.edu.pl

Abstract

Conceptual representations of warmth have been shown to be related to people's perceptions of ambient temperature. Based on this premise, we hypothesized that merely thinking about personality traits related to communion (but not agency) influences physical experience of warmth. Specifically, the three studies revealed that (a) perceptions of temperature are influenced by both positive and negative attributes within the communion but not agency dimension, (b) the effect is stronger when traits indicate sociability rather than morality sub-dimension of communion, and (c) communion activation affects temperature perceptions independently of target's or self-perceptions.

Keywords: agency, communion, warmth, temperature, embodiment

Warmer hearts, warmer rooms: Focusing on positive communal but not agentic traits increases estimates of ambient temperature

Across many cultures, people use physical warmth metaphors to describe communal personalities (e.g., “she is a warm person”). Recent research in social cognition has revealed that metaphors such as these are more than linguistic convenience, reflecting a deeper connection between concrete experiences and abstract concepts. As a result of this connection, physical experiences can influence metaphorically related judgments. For example, the experience of physical warmth (e.g., from holding a warm beverage) leads to the perception of interpersonal warmth in others (Williams & Bargh, 2008) and the activation of an array of cognitive structures that support the maintenance of communal relationships (e.g., construe the self as more socially integrated; IJzerman & Semin, 2009).

More recent research has suggested that the relationship between physical warmth and communion is bi-directional. For example, the experience of social exclusion results in the perception of lower ambient physical temperature relative to the experience of social inclusion (Zhong & Leonardelli, 2008, see also IJzerman & Semin, 2010). In the present research we replicate this work by showing that activating the concept of communion influences perceptions of temperature, and extended it in three ways. First, we investigated the specificity of social concept activation on temperature perception by comparing the effect of considering communal traits and the effect of considering agentic traits on ambient temperature perception, and then by comparing the effects of sub-dimensions of communal (sociability and morality) and agentic (competence and dynamism) traits on temperature perception. Second, we examined the directionality of these effects on temperature perception by comparing traits that are high and low in communion to a no-trait control group. Third, we assessed whether the effect of considering trait concepts on ambient temperature perception is mediated by the explicit impressions formed of the target.

Grounded Perspectives on Psychological Warmth

Theories of grounded cognition agree that physical experiences can influence metaphorically related concepts. However, there has been substantial debate about why embodied effects occur (Anderson, 2010; Lakoff & Johnson, 1999; Landau, Meier, & Keefer, 2010; Williams, Huang, & Bargh, 2009), and about the nature of the representational architecture (e.g., Landau et al., 2010; Barsalou, 2008a). Although there are many complex issues within these debates, currently positions are typically conceptualized as belonging to either embodied metaphor or simulation perspectives.

Embodied metaphor perspectives stress that people rely on their experiences with the physical world to make sense of the complexities of social life (Landau et al., 2010; Lakoff & Johnson, 1999). The underlying idea is that experiences with source domains (concrete experiences) are transferred to target concepts (abstract targets) through associations that function similarly to linguistic metaphors. For instance, people can discuss *love* as a *journey* and draw upon their knowledge of journeys when reasoning about more abstruse questions about the nature of love (Lakoff & Johnson, 1980). Following a similar logic, knowledge of physical warmth is applied when reasoning about relationships with others, thereby guiding the interpretation of subsequent social interactions (Williams & Bargh, 2008; IJzerman & Semin, 2010).

Recent analyses (e.g., IJzerman & Koole, 2011; IJzerman & Semin, 2010) stress that although *metaphoric transfer* strategies may be used to understand some abstract ideas, this theory cannot account for many recent findings in the growing literature on embodiment. Metaphoric transfer strategies are unidirectional (Lakoff & Johnson, 1980), or at least change their meaning when the source and target concepts are transposed (Glucksburg, McGlone, & Manfredi, 1997). Consequently, while this explanation can account for why physical temperature influences social perception, it cannot account for why priming interpersonal

concepts (e.g., by inducing feelings of exclusion) can similarly parallel changes in perceptions of temperature (Zhong & Leonardelli, 2008; IJzerman & Semin, 2010), or why many other abstract concepts influence similar effects on associated perceptual experiences (e.g., Giessner & Schubert, 2007; Sherman & Clore, 2009; Zhong & Liljenquist, 2006).

In order to understand bi-directional metaphor-consistent changes, researchers have turned to simulation theories (Barsalou, 1999, 2008a), which offer a somewhat different explanation of the relationship between abstract concepts and physical experience. Simulation theories claim that associations emerge as a consequence of perceptual and representational systems relying on a common neural substrate. In fact, thinking about a concept necessarily involves simulating the relevant perceptual, proprioceptive, and introspective states (Barsalou, 2008a; Hauk, Johnsrude, & Pulvermüller, 2004) rather than merely retrieving amodally stored information.

To date the majority of research on embodied phenomena has focused on demonstrations that embodied experiences can influence metaphorically related judgments, with theoretical attention devoted to the issue of directionality. However, relatively little is known about the boundary conditions by which embodied inputs influence judgments, despite the importance of these considerations for the understanding of how the process by which embodied judgments operate (e.g., Chandler, Reinhard, & Schwarz, 2012; for a discussion see Meier, Schnall, Schwarz, & Bargh, in press). Consequently, much remains unanswered by each of these perspectives as to when and how these associations influence thinking and feeling. In our research we focus on specific person perception dimensions and examine boundary conditions and mediation models.

Warmth, Communion, and Agency

Communion (also referred to as “warmth” by social scientists; Asch, 1946) is primarily related to the interests of others, and includes qualities such as friendliness,

helpfulness, kindness and honesty (Wojciszke & Abele, 2008). Solomon Asch (1946) first showed empirically that psychologically “warm” and “cold” traits have a strong impact on how people judge others. Indeed, psychological warmth is recognized as central to person perception (see Abele & Wojciszke, 2007; Fiske, Cuddy, & Glick, 2007) and is closely connected to perceptions of the intentions, motives and trustworthiness of others (Reeder, Pryor, & Wojciszke, 1992; Fiske et al., 2007). The labels psychological warmth and communion are generally used interchangeably by social scientists, the latter of which we will use from here on.

The association between communion and warmth begins early in life, where being able to judge another on trustworthiness is vital to survival (Bowlby, 1969), and physical warmth occurs concurrently with expressions of interpersonal warmth. Indeed, people’s knowledge about relationships may actually be formed initially through the presence or absence of physically warmth onto which later knowledge structures are scaffolded (Harlow, 1957; IJzerman & Koole, 2011; Williams & Bargh, 2008; Williams, Huang, & Bargh, 2009).

The second fundamental dimension in person perception is agency, which in contrast to communion is not interpersonal in nature. It is primarily related to effectiveness in goal attainment (Wojciszke & Abele, 2008) and includes traits like activeness, efficiency and intelligence (Peeters, 1992). Thus, although valenced like communion, agency is generally defined in terms a focus on an active self, individuation, and self-expansion (Bakan, 1966) rather than the degree of connectedness and relatedness to others.

Previous research has shown that the degree of social inclusion influences the experience of physical temperature, and for the theoretical reasons discussed above, we expected that considering traits that vary in communion should have a similar effect. Past research has not examined whether considering agentic traits has similar effects, however it was demonstrated that the influence of physical temperature on impression formation does not

influence perceptions of competence (Williams & Bargh, 2008). As such, we expected that priming traits unrelated to communion (specifically agentic qualities) would not affect perceptions of temperature, despite their positive valence.

Subdimensions of Communion and Agency

Another important issue in addressing boundary condition is examining the specific content of what it is in being communal. Indeed, what was not investigated in previous research is whether the whole content of the communal dimension is grounded in physical warmth. This is important as the communal dimension has been shown not to be homogeneous. In fact, communion and agency constitute a two-dimensional framework that has been successfully adapted to investigating processes both on the individual and group level but each of them can be further divided into dissociable sub-dimensions.

Communion comprises characteristics like sociability, cooperation and fairness (see Leach, Ellemers, & Barreto, 2007; see also Brambilla, Rusconi, Sacchi & Cherubini, 2011; Osgood, Suci, & Tannenbaum, 1957) that can be organized by clustering into traits that imply sociability (e.g., friendliness; Fiske, 1991) and morality (e.g., honesty; Rai & Fiske, 2011). Agency comprises characteristics like competence, strength, and activity that can be organized as clustering into traits that imply competence (e.g., intelligence; Wojciszke, 1994) and traits that imply dynamism (e.g., dominance and activity; Osgood et al., 1957; Cuddy, Fiske, & Glick, 2008). Analyzing ratings of 300 traits on several criteria, Abele and Wojciszke (2007) found that communal traits can be conceptualized as varying in both sociability and morality, while agentic traits vary in both competence and dynamism. Thus, one may find traits perceived as sociable and moral at the same time (e.g., good). However, some traits are perceived as relatively more moral than sociable (e.g., honest) and vice versa (e.g., cooperative). Thus, although morality and sociability are correlated, people treat them as distinct concepts (e.g., Anderson & Sedikides, 1991), and with some thought people can

generate examples of people they consider to be moral but unsociable (e.g., puritans) or immoral but sociable (e.g., a Casanova).

It is unclear whether sociability and morality are represented by the same or separate perceptual simulations. Although they constitute a single basic level of person perception, they may be simulated differently: Sociability likely includes embodiments reflecting physical closeness with others (e.g., hugs, kisses, touch), while it seems less likely that morality involves similar sensations. Indeed, studies investigating the relation between physical and interpersonal warmth focus merely on traits highly associated with forming close relations with others which would cover the sociability sub-dimension of communion.

As such, we expected that activating sociability traits would activate higher temperature perceptions than moral traits (and, again, than agentic traits, both related to competence and dynamism). However, one can expect moral traits to trigger changes in temperature perceptions because of the interconnectedness of these two sub-dimensions. People can infer morality from sociable traits and sociability from moral qualities. Thus, we expected that morality could activate higher temperature perceptions than agentic traits, however, the effect should be weaker than for sociability-related traits.

Research Overview

In line with earlier research on the bi-directionality of temperature and close relations, we predicted that making positive communal traits salient should increase perceptions of ambient temperature, relative to focusing on agentic traits (Study 1) or negative communal traits (Study 2). Extending this work, we also predicted that focusing on positive and negative agentic traits would not influence temperature perception (Studies 1–3). Moreover, we explored whether communal traits that emphasize sociability exert a stronger influence on temperature perception than communal traits that emphasize morality (Study 3). To provide further insight into the specificity of the associations between trait concepts and physical

temperature, we also examined the extent to which positive and negative traits differed from a neutral control condition (Study 2), and whether the relationship between considering communal traits and estimates of ambient temperature are mediated by the impression people form of the target's interpersonal warmth (Studies 1 and 3).

Study 1

In Study 1 we aimed to replicate previous findings that have supported a link between psychological and physical warmth (IJzerman & Semin, 2010; Zhong & Leonardelli, 2008). To do so, we asked participants to focus on the communal (vs. agentic) qualities of the target person and then asked them to estimate the ambient temperature of the room as a part of an unrelated task.

Method

Participants. Undergraduate students ($n = 80$; 46 women; $M_{\text{age}} = 21.02$, $SD = 1.42$) from Sopot Campus of Warsaw School of Social Sciences and Humanities voluntarily participated in a study on person perception as a part of a larger package of questionnaires. Participants were run individually and were randomly assigned to the agency or communion condition before completing an ostensibly unrelated task that included the dependent measures of interest.

Procedure. Participants read a short story presenting "Mark" or "Marta" (randomly assigned) emphasizing his/her communion or agency-related traits. In our communion condition participants read a short story indicating that the target person was a caring, sensitive, loyal, friendly, unselfish and helpful person. In the agency condition the target person was presented as competent, effective, active, creative, precise, efficient and resolute. These traits have been confirmed to be highly communal and highly agentic, respectively (Abele & Wojciszke, 2007).

Participants answered the following questions about the vignette: “What is your overall evaluation of presented person?” (1 = *very negative*, 7 = *very positive*), “Do you find the person likable?” (1 = *not at all likable*, 7 = *very likable*), “Do you perceive the person to have rather cold or warm personality?” (1 = *very cold*, 7 = *very warm*), and “Do you feel that a person is close or distant to you?” (1 = *very distant*, 7 = *very close*). Finally, under the guise of feedback about a recent school renovation, participants were asked to estimate the current room temperature.

Results and Discussion

Person perception. Participants in the communion condition perceived the target person as having a warmer personality ($M = 5.65$, $SD = .80$) than those in the agency condition ($M = 4.65$, $SD = .97$), $t(78) = 5.01$, $p < .001$, $d = 1.12$, indicating that our manipulation worked as intended (the inclusion of participant gender and target gender does not influence any of the analyses reported here and are thus dropped for simplicity).¹

The experimental manipulation did not influence general evaluation ($M_{\text{communion}} = 5.85$, $SD = 0.95$ vs. $M_{\text{agency}} = 5.75$, $SD = 0.95$, $t < 1$), liking ($M_{\text{communion}} = 5.12$, $SD = 0.88$ vs. $M_{\text{agency}} = 5.20$, $SD = 0.82$, $t < 1$) or perceived closeness of the target person ($M_{\text{communion}} = 4.50$, $SD = 1.22$ vs. $M_{\text{agency}} = 4.15$, $SD = 1.33$, $t(78) = 1.23$, $p = .22$). This indicates that the experimental conditions differentially influenced perceptions of warmth, but did not differentially influence global evaluations of the target.

Temperature estimates. As predicted, participants in the communion condition perceived the ambient temperature as higher ($M = 20.95$, $SD = 2.24$) than those in the agency condition ($M = 18.95$, $SD = 2.41$), $t(78) = 3.85$, $p < .001$, $d = .86$.

¹ The one interaction between gender and the variables of interest to this study was a significant interaction between type of traits and target gender on overall evaluation of a target person, $F(1, 72) = 5.81$, $p < .02$, $\eta_p^2 = .07$, indicating that communal women were evaluated more positively ($M = 6.15$, $SD = .67$) than agentic women ($M = 5.55$, $SD = 1.00$; $p < .05$), while agentic men were viewed slightly more positively ($M = 5.95$, $SD = .89$) than communal men ($M = 5.55$, $SD = 1.10$). This effect, however, did not reach significance, $p = .213$. This pattern of results is consistent with findings on gender stereotypes indicating that perceivers generally assume that men are oriented toward agentic goals and women toward communal goals (e.g., Bern, 1974; Williams & Best, 1990).

Relationship between person perception and temperature perception. In aggregate, perceptions of target's warmth and estimates of ambient temperature were related to each other, $r(78) = .28, p < .02$, but within each condition perceptions of target warmth and estimates of ambient temperature were uncorrelated ($r_s < .2, p_s > .3$). Mediation analysis using bootstrapping (Preacher & Hayes, 2008) revealed that the direct effect of considering communal traits on temperature estimates was not mediated through evaluations of target's warmth, as reflected by an indirect effect that was not significantly different from 0, with a point estimate of .27 (BCa 95% CI -.27;.93; see Efron, 1987). Likewise, the direct effect of considering communal traits on perceptions of target's warmth was not mediated through ambient temperature perceptions, as reflected by an indirect effect that was not significantly different from 0, with a point estimate of .08 (BCa 95% CI -.09; .29). We discuss potential interpretations of the lack of mediation in the general discussion.

Study 2

Our first study revealed that those who considered communal terms estimated the ambient temperature as higher than those who considered agentic terms. This effect cannot be explained by differences in global evaluation, because global evaluations did not differ across conditions. This finding mirrors prior research that has found that physical warmth increases perceptions of interpersonal warmth, but does not change the global positivity of evaluations or evaluations on unrelated dimensions (Williams & Bargh, 2008; IJzerman & Semin, 2009).

Study 2 sought to replicate this basic effect with attention to communal attributes manipulated through self-perception rather than other perception. To the extent that communion is grounded in temperature, the mere salience of it should evoke the same results independently of whether the target considered is the self or another person. Once again, participants were primed to think of communion-related or agency-related qualities. Extending Study 1, we added two additional experimental conditions in which people

considered *negative* communal and agentic traits. In line with previous research (Zhong & Leonardelli, 2008), we predicted that considering negatively valenced communion traits (related to, although not the same as, being socially isolated) should lead to lower estimates of ambient temperature. Finally, we added a no-trait control group to gain a clearer understanding of the extent to which previously observed differences in temperature perception following inclusion and exclusion primes are a result of positively or negatively valenced communal information.

Method

Participants. Undergraduate students ($n = 80$; 50 women; $M_{\text{age}} = 23.48$, $SD = 4.56$) from the Sopot Campus of the Warsaw School of Social Sciences and Humanities were recruited for experimental sessions. Participants were run individually and were randomly assigned to four experimental conditions based on 2 (Type of traits: agency vs. communion) \times 2 (Valence of traits: positive vs. negative), between-subjects experimental design. An additional hanging control group included 15 participants (9 female) who estimated room temperature without any experimental manipulation.

Procedure. Participants were randomly assigned to consider one of four different sets of 8 traits that reflected positive agentic (e.g., “intelligent”, “efficient”), negative agentic (e.g., “foolish”, “lazy”), positive communal (e.g., “honest”, “friendly”), or negative communal qualities (e.g., “rude”, “unfriendly”, Abele & Wojciszke, 2007). Participants were told that everyone has both good and bad qualities and that it is beneficial to be aware of these. They were instructed to read the list carefully, imagine situations and behaviors which represent each trait in everyday life and select four traits that were most characteristic of them. After completing this task, under the guise of feedback for the recent school renovation, participants were asked to estimate the current room temperature.

Results

First we conducted a 2 (Type of traits: communal vs. agentic) \times 2 (Valence of traits: positive vs. negative) analysis of variance that revealed the predicted interaction between the type of traits and the valence of traits, $F(1, 76) = 18.24, p < .001, \eta_p^2 = .19$. As can be seen in Figure 1, temperature perception did not differ between participants who focused on positive agentic traits ($M = 19.05, SD = 3.59$) or negative agentic traits ($M = 19.35, SD = 3.66$), $p = .74$ for the simple effect. In contrast, temperature perception differed between participants who focused on positive communal traits ($M = 23.25, SD = 1.62$) and negative communal traits ($M = 17.98, SD = 2.27$), $F(1, 79) = 32.65, p < .001, \eta_p^2 = .29$ for the simple effect.

Additionally, there was a main effect of the type of traits, $F(1, 76) = 4.68, p = .03, \eta_p^2 = .06$, indicating that participants estimated temperature higher after focusing on communion ($M = 20.61, SD = 3.31$) than agency ($M = 19.20, SD = 3.58$), and a main effect of valence, indicating that participants estimated temperature as higher after focusing on positive traits ($M = 21.15, SD = 3.48$) than on negative traits ($M = 18.66, SD = 3.09$), $F(1, 76) = 14.53, p < .001, \eta_p^2 = .16$. As can be seen (Figure 1) these main effects are primarily a result of the influence of positive communal traits on temperature estimates.

In order to gain further insight into which conditions influenced temperature perception, we compared room-temperature estimates of each experimental condition to the control group ($M = 19.53, SD = 3.89$) using planned comparisons. People in the positive and negative agentic trait conditions produced temperature estimates that were virtually identical to the control group, ($F_s < 1$). In contrast, positive communal traits increased the perceived temperature compared to the control group, $F(1, 90) = 12.40, p < .001$, while focusing on negative communal qualities slightly, but not significantly, decreased temperature perception compared to the control group, $F(1, 90) = 2.18, p = .14$.

Study 3

In the previous studies, we observed that focusing on other (Study 1) and self-relevant (Study 2) communion-related traits influenced temperature perception. However, as discussed earlier communal traits conflate both sociability and morality. In this study we examined the effect of considering communal traits that differ in the extent to which they emphasize morality and sociability and agentic traits that differ in the extent to which they emphasize competence and dynamism. For reasons discussed earlier, we expected that concepts related to sociability are particularly likely to be grounded in physical warmth. As previous studies suggested that agency does not influence perceptions of physical warmth we predicted that agency (both competence-related and dynamism-related qualities) will lead to lowest temperature estimates. Given that morality and sociability are correlated (and thus any moral information has some implications for social information) we expected that morally relevant traits may have a significant, but weaker effect on temperature perception.

Method

Participants. Undergraduate students ($n = 160$; 132 women)² from the Sopot Campus of the Warsaw School of Social Sciences and Humanities were recruited for experimental sessions. Participants were run individually and randomly assigned to one of four experimental conditions (type of traits: sociability vs. morality vs. competence vs. dynamism), in a between-subjects experimental design.

Procedure. Upon arrival to the laboratory, participants were informed that the study investigated self-perception. For the purpose of focusing on a specific type of traits participants were given 7 positive traits that were either sociable (e.g., “caring”, “friendly”), moral (e.g., “honest”, “moral”), competent (e.g., “clever”, “bright”) or dynamic (e.g., “active”, “persistent”). Their task was to indicate to what extent each trait describes them on 10-point scale from 1 (*not at all*) to 10 (*very much*).

² In this study, due to an oversight, we did not record age but the population is the same as in Studies 1 and 2.

All traits were selected from a database of 300 traits (Abele & Wojciszke, 2007) where all dimensions were rated on 10-point scales ranging from -5 to 5. For the purpose of our study, communal traits that were relatively more social than moral ($M_{sociability} = 4.43$, $SD = 0.27$ vs. $M_{morality} = 1.61$, $SD = 0.73$, $t(6) = 9.53$, $p < .001$) and more moral than social ($M_{morality} = 3.98$, $SD = 0.50$ vs. $M_{sociability} = 2.44$, $SD = 0.90$, $t(6) = 5.98$, $p < .005$) were selected from this pool, as were agentic traits that were relatively more competent than dynamic ($M_{competence} = 4.53$, $SD = 0.11$ vs. $M_{dynamism} = 3.53$, $SD = 0.42$, $t(6) = 6.53$, $p < .005$) and more dynamic than competent ($M_{dynamism} = 4.35$, $SD = 0.22$ vs. $M_{competence} = 3.65$, $SD = 0.78$, $t(6) = 2.96$, $p < .05$).

In an ostensibly unrelated consumer study, participants were given an empty paper coffee cup and were told that the company that provides the university with automatic coffee machines was investigating the tactile perception of the cups they use. To this end, they were asked to give an estimate of the cup's temperature using the 6-point scale ranging from 1 (*very cold*) to 6 (*very warm*). Finally, participants were probed for suspicion and debriefed.

Results

Temperature estimates. A univariate ANOVA (type of traits: sociable vs. moral vs. competent vs. dynamic) yielded a significant main effect of the type of traits on temperature perception, $F(3, 155) = 30.89$, $p < .001$, $\eta_p^2 = .37$. Post-hoc tests with a Bonferroni correction for multiple comparisons revealed that the perceived temperature of the cup was significantly higher after focusing on sociability ($M_{sociability} = 4.80$, $SD = .56$) than on morality ($M = 4.13$, $SD = .61$), competence ($M = 3.73$, $SD = .85$) or dynamism ($M = 3.50$, $SD = .68$; Figure 2), all $ps < .001$. Perceived temperature of the cup in the moral condition was significantly higher than in the dynamic condition, $p < .001$ and marginally higher than in the competent condition, $p = .058$. There was no difference in temperature estimates between the dynamic and competent conditions, $p = .86$.

Relationship between person perception and temperature perception. In Study 1 we found that focusing on communal traits influenced both perceptions of the target's interpersonal warmth and perceptions of ambient temperature, but that these two variables were unrelated to each other. A conceptually similar test was conducted with these data by correlating trait ratings with perceptions of ambient temperature within the sociability and morality conditions. As in Study 1, we found no correlation between the extent to which people perceived the temperature of the cup as warm, and their ratings of their own sociability ($r = .22, p = .18$) or morality ($r = .08, p = .64$), suggesting that it is the mere activation of communality what determines the perception of ambient temperature but not the extent to which people ascribe the single trait to themselves.

General discussion

In the present research we found that considering positive communal traits increased perceptions of ambient temperature, relative to considering negative communal traits (Study 2), replicating earlier demonstrations of the influence of communion relevant experiences on the perception of temperature (IJzerman & Semin, 2010; Zhong & Leonardelli, 2008). Importantly, we extended this finding by demonstrating that temperature judgments are uniquely influenced by the activation of communal (as opposed to agentic) concepts (Studies 1–3). Our findings highlight the specificity of the link between physical and social warmth and mirrors Williams and Bargh's (2008) finding that the experience of physical warmth affects perceptions of interpersonal warmth, but not perceptions of non-communal traits.

As further emphasis of this specificity, communal traits that highlight sociability have a comparatively greater effect than communal traits that emphasize morality (Study 3). However, our exploratory findings indicate that considering moral traits also had a small influence on temperature relative to considering agentic traits. One interpretation of this finding is that moral concepts also involve the simulation of warmth, albeit to a lesser extent

than social concepts. Our own preliminary interpretation is that in the absence of other information, morality often implies sociability (cf. Rai & Fiske, 2011), and that differences in temperature perception reflect incidental activation of sociability related concepts.

Regardless, the differing influence of sociability and morality relevant traits on temperature estimates compliments existing research that demonstrates that although highly correlated, these sub-dimensions of communality are distinct from each other (e.g., Brambilla et al., 2011; Leach et al., 2007).

We further find that positive communal traits increase estimates of ambient temperature more than negative communal traits decrease ambient temperature (Study 2), despite the emphasis of early research on temperature and sociability that emphasized a link between coldness and exclusion (e.g., Zhong & Leonardelli, 2008). This finding is particularly surprising given the greater salience and diagnosticity of negative communion-related information (Skowronski & Carlston, 1987) and thus merits further exploration. One possible explanation is that the experience of physical warmth is more diagnostic of positive interpersonal experiences than the absence of physical warmth of negative interpersonal experiences. Alternatively, negative information may be highly diagnostic for information that implies immorality, but not a lack of sociability. Future studies could fruitfully address these possibilities.

These preliminary results differences further attest to flexible scaffolding of interpersonally relevant information onto the experience of physical temperature, which was supported by research demonstrating that attachment style moderates the interpretation of physical temperature cues (IJzerman, Karremans, Thomsen, & Schubert, this issue), and is compatible with the more general claim that associations between concepts and experiences may be learned flexibly and dynamically (Chandler & Schwarz, 2009; Topolinski, 2011; for a review see Santiago, Román, & Oullet, 2011).

Finally, these studies provide a hint about what representations may be embodied and how they may be useful for interpersonal coordination. Our research yielded substantial direct effects of communal trait primes on both evaluations of a target's interpersonal warmth (Study 1) and temperature estimates (Studies 1–3), with no evidence that inferences made about the target of judgment mediated this relationship (Study 1 and 3). This finding occurs in the context of a general absence of mediational analysis of the relationship between physical warmth and interpersonal warmth (or between physical experiences and associated concepts more generally) within embodiment research. On the surface, this finding may seem inconsistent with grounded cognition perspectives on knowledge representation, but only if one assumes that the representation of the target of judgment itself is grounded in temperature perception, an assumption that has not been tested by previous research.

While there are many methodological reasons why mediation may not have been detected in these studies (see Bullock, Green, & Ha, 2010), the lack of mediation can also be explained if one assumes that something other than the representation of the target itself is grounded in the experience of physical temperature. This could include either the coordination of the relationship itself (see also Vacharkulksemsuk & Fredrickson, 2011), or generalized representations of trait concepts, either of which may lead to inferences about the presence of communal traits.

There is some evidence to suggest that temperature is closely related to the coordination of interpersonal relationships. Indeed, being disconnected from a social group leads to a drop in skin temperature of the finger, while holding a warm cup afterwards alleviates participants' negative affect typically experienced after social exclusion (IJzerman, Gallucci, Pouw, Weissgerber, Van Doesum, & Williams, 2012; Bargh & Shalev, 2012). Conversely, the administration of oxytocin (a hormone typically related to trust; Uvnäs-Moberg, 1998) leads to increased skin temperature for rats feeding their pups (Eriksson, Lundeberg, & Uvnäs-

Moberg, 1996). In other words, specific social situations may activate relational simulations, possibly evolutionarily scaffolded onto basic physiological responses (cf. Anderson, 2010; Caporael, 1997; IJzerman & Cohen, 2011). People learn to implement this knowledge based on “evolved simulators” flexibly through strategies closely related to metaphoric transfer (see also Landau et al., 2010), which one may conceive of as metaphoric *integration*. Indeed, through scaffolding, people may integrate physically warm feelings into how they perceive others as being communal or not.

An additional possibility is that the concept of communion is grounded in the physical experience of temperature, rather than beliefs about the communality of the target itself. Simulation theories allow for either possibility (Barsalou, 2008b) and which of these occurs may depend not only on the nature of the representation, but also the specific simulation that is conducted using these representations (Simmons & Barsalou, 2003). Indeed, one of the central points of Barsalou’s (1999) influential paper was to demonstrate that in theory, perceptual systems can represent abstract concepts that allow the production of meaningful inferences rather than merely simulating examples of targets that possess these concepts.

Regardless of whether the coordination of relationships, or the abstract concept of communion is grounded in the experience of temperature, the pathway from the accessibility of this information to its application to trait and temperature inferences is far from direct. The influence of accessible information on related trait judgments is determined by both the information’s meaning in the context of other accessible information (Smith, 1996), and the deliberative processing that occurs when reconciling activated concepts into an explicit impression (cf. Gawronski & Bodenhausen, 2011; Nisbett & Wilson, 1977; cf. Barsalou, 1999). Thus, explicit evaluations of others may depend not only on activated trait concepts, but also their interplay with other associations that are evoked by the vignette (e.g., people the participant knows who resemble the target), or exogenous to it (e.g., whether the participant

had a lousy day), all of which must be reconciled into a coherent impression (e.g., Asch & Zukier, 1984). Likewise, evaluations of temperature are a function of not only specific simulations that may occur to interpret the social situation, but also perceptual inputs of temperature itself, associations that come to mind from other contextual cues (e.g., the temperature of that day), and the strategy that is used to reconcile this information into a single numeric estimate. Had we used measures of implicit activation, we may have observed different mediational results.

In closing, our findings provide important insights into how people perceive others. Perceptions of temperature provide people with important information in the way that they know whether they can trust another or not. Alongside IJzerman et al.'s (2012) findings on skin temperature, our work seems to suggest that people coordinate their relationships in part through physical temperature. Further, they highlight the specificity of concepts and when concepts do and do not influence temperature perceptions, and the dissociability of moral and social trait concepts. However, in doing so, our studies also highlight how little is known about the specific processes that underlie the more general claim that thought is tightly coupled to our embodied experiences and identify several promising directions that will clarify the relationship between representation, perception, and experience.

References

- Abele, A. E., & Wojciszke, B. (2007). Agency and communion from the perspective of self versus others. *Journal of Personality and Social Psychology, 93*(5), 751–763. doi: 10.1037/0022-3514.93.5.751
- Anderson, M. L. (2010). Neural reuse: A fundamental organizational principle of the brain. *Behavioral and Brain Sciences, 33*, 245–313. doi: 10.1017/S0140525X10000853
- Anderson, C. A., & Sedikides, C. (1991). Contributions of a typological approach to associationistic and dimensional views of person perception. *Journal of Personality and Social Psychology, 60*, 203–217.
- Asch, S. E. (1946). Forming impressions of personality. *The Journal of Abnormal and Social Psychology, 41*(3), 258–290. doi: 10.1037/h0055756
- Asch, S. E., & Zukier, H. (1984). Thinking about persons. *Journal of Personality and Social Psychology, 46*, 1230–1240.
- Bakan, D. (1966). *The duality of human existence; an essay on psychology and religion*. Chicago: Rand McNally.
- Bargh, J., & Shalev, I. (2012). The substitutability of physical and social warmth in daily life. *Emotion, 12*(1), 154–162. doi: 10.1037/a0023527
- Barsalou, L. W. (1999). Perceptual symbol systems. *Behavioral and Brain Sciences, 22*, 577–660. doi: 10.1.1.4.5511
- Barsalou, L. W. (2008a). Grounded cognition. *Annual Review of Psychology, 59*, 617–645. doi: 10.1146/annurev.psych.59.103006.093639
- Barsalou, L.W. (2008b). Grounding symbolic operations in the brain's modal systems. In G. R. Semin & E. R. Smith (Eds.), *Embodied grounding: Social, cognitive, affective, and neuroscientific approaches* (pp. 9–42). New York: Cambridge University Press.

- Bem, S. L. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology*, *42*, 155–162. doi:10.1037/h0036215
- Bowlby, J. (1969). *Attachment and Loss*. London: Hogarth Press.
- Brambilla, M., Rusconi, P., Sacchi, S., & Cherubini, P. (2011). Looking for honesty: The primary role of morality (vs. sociability and competence) in information gathering. *European Journal of Social Psychology*, *41*, 135–143. doi: 10.1002/ejsp.744
- Bullock, J. G., Green, D. P., & Ha, S. E. (2010). Yes, But What's the Mechanism? (Don't Expect an Easy Answer). *Journal of Personality and Social Psychology*, *98*, 550–558. doi: 10.1037/a0018933
- Caporael, L. R. (1997). The evolution of truly social cognition: The core configurations model. *Personality and Social Psychology Review*, *4*, 276–298. doi:10.1207/s15327957pspr0104_1.
- Chandler, J., Reinhard, D., & Schwarz, N. (2012). To judge a book by its weight you need to know its content: Knowledge moderates the use of embodied cues. *Manuscript in press for publication in Journal of Experimental Social Psychology*.
- Chandler, J., & Schwarz, N. (2009). How extending your middle finger affects your perception of others: Body movements as primes. *Journal of Experimental Social Psychology*, *45*, 123–128. doi: 10.1016/j.jesp.2008.06.012
- Cuddy, A. J. C., Fiske, S. T., & Glick, P. (2008). Warmth and competence as universal dimensions of social perception: The Stereotype Content Model and the BIAS Map. In M. P. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 40, pp. 61–149). New York: Academic Press.
- Efron, B. (1987). "Better bootstrap confidence intervals". *Journal of the American Statistical Association*, *82*, 171–185. doi:10.2307/2289144

- Eriksson, M., Lundeberg, T., Uvnäs-Moberg, K. (1996). Studies on cutaneous blood flow in the mammary gland of lactating rats. *Acta Physiologica Scandinavica*, *158*, 1–6.
doi: 10.1046/j.1365-201X.1996.487226000.x
- Fiske, A. P. (1991). *Structures of social life: The four elementary forms of human relations*. New York: Free Press.
- Fiske, S. T., Cuddy, A. J. C., & Glick, P. (2007). Universal dimensions of social cognition: warmth and competence. *Trends in Cognitive Sciences*, *11*(2), 77–83. doi: 10.1016/j.tics.2006.11.005
- Gawronski, B., & Bodenhausen, G. V. (2011). The associative-propositional evaluation model: Theory, evidence, and open questions. *Advances in Experimental Social Psychology*, *44*, 59–127. doi: 10.1016/B978-0-12-385522-0.00002-0
- Giessner, S. R., & Schubert, T. W. (2007). High in the hierarchy: How vertical location and judgments of leaders' power are interrelated. *Organizational Behavior and Human Decision Processes*, *104*, 30–44. doi:10.1016/j.obhdp.2006.10.001
- Glucksberg, S., McGlone, M. S., & Manfredi, D. A. (1997). Property attribution in metaphor comprehension. *Journal of Memory and Language*, *36*, 50–67. doi: 10.1006/jmla.1996.2479
- Harlow, H. F. (1957). Experimental analysis of behavior. *American Psychologist*, *12*, 485–490. doi: 10.1037/h0047351
- Hauk, O., Johnsrude, I., & Pulvermüller, F. (2004). Somatotopic representation of action words in human motor and premotor cortex. *Neuron*, *41*, 301–307.
doi:10.1016/S0896-6273(03)00838-9
- IJzerman, H., & Cohen, D. (2011). Grounding cultural syndromes: Body comportment and values in Honor and Dignity cultures. *European Journal of Social Psychology, Special Issue: Social Image*, *41*, 456–467. doi: 10.1002/ejsp.806

- IJzerman, H., Gallucci, M., Pouw, W. T. J. L., Weissgerber, C. S., Van Doesum, N. J., & Williams, K. D. (2012). Cold-blood loneliness: Social exclusion leads to lower skin temperatures. *Manuscript in press for publication in Acta Psychologica*.
- IJzerman H., Karremans, J. C., Thomsen, L., & Schubert, T. W. (2013). Caring for sharing: How attachment styles modulate cues of physical warmth. *Manuscript in press for publication in Social Psychology: Special Issue on Warmth and Competence*.
- IJzerman, H., & Koole, S. L. (2011). From perceptual rags to metaphoric riches--bodily, social, and cultural constraints on sociocognitive metaphors: comment on Landau, Meier, and Keefer (2010). *Psychological Bulletin, 137*, 355–361. doi: 10.1037/a0022373
- IJzerman, H., & Semin, G. R. (2009). The thermometer of social relations: mapping social proximity on temperature. *Psychological Science, 20*, 1214–1220. doi: 10.1111/j.1467-9280.2009.02434.x
- IJzerman, H., & Semin, G. R. (2010). Temperature perceptions as a ground for social proximity. *Journal of Experimental Social Psychology, 46*, 867–873. doi: 10.1016/j.jesp.2010.07.015
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.
- Lakoff, G., & Johnson, M. (1999). *Philosophy in the flesh: The embodied mind and it's challenge to western thought*. New York: HarperCollins Publishers.
- Landau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin, 136*, 1045–1067. doi: 10.1037/a0020970
- Leach, C. W., Ellemers, N., & Barreto, M. (2007). Group virtue: The importance of morality (vs. competence and sociability) in the positive evaluation of in-groups. *Journal of Personality and Social Psychology, 93*, 234–249. doi: 10.1037/0022-3514.93.2.234

- Meier, B. P., Schnall, S., Schwarz, N., & Bargh, J. A. (in press). Embodiment in social psychology. *Topics in Cognitive Science*.
- Nisbett, R., & Wilson, T. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, *84*, 231–259.
- Osgood, C. E., Suci, G. J., & Tannenbaum, P. H. (1957). *The measurement of meaning*. Urbana, USA: University of Illinois Press.
- Peeters, G. (1992). Evaluative meanings of adjectives in vitro and in context: Some theoretical implications and practical consequences of positive-negative asymmetry and behavioral-adaptive concepts of evaluation. *Psychologica Belgica*, *32*, 211–231.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, *40*, 879–891. doi: 10.3758/BRM.40.3.879
- Rai, T. S., & Fiske, A. P. (2011). Moral psychology is relationship regulation: Moral motives for unity, hierarchy, equality, and proportionality. *Psychological Review*, *118*, 57–75. doi: 10.1037/a0021867
- Reeder, G. D., Pryor, J. B., & Wojciszke, B. (1992). Trait-behavior relations in social information processing. In G. Semin and K. Fiedler (Eds.), *Language and social cognition* (pp. 37–57). Beverly Hills: Sage.
- Santiago, J., Román, A., & Ouellet, M. (2011). Flexible foundations of abstract thought: A review and a theory. In A. Maass & T. Schubert (Eds). *Spatial dimensions of social thought* (pp. 39–108). Leipzig, Germany: de Gruyter Mouton.
- Sherman, G. D., & Clore, G. L. (2009). The color of sin: White and black are perceptual symbols of moral purity and pollution. *Psychological Science*, *20*, 1019–1025. doi: 10.1111/j.1467-9280.2009.02403.x
- Simmons, K., & Barsalou, L. W. (2003). The similarity-in-topography principle: Reconciling

- theories of conceptual deficits. *Cognitive Neuropsychology*, 20, 451–486. doi: 10.1080/02643290342000032
- Skowronski, J., & Carlston, D. (1987). Social judgment and social memory: The role of cue diagnosticity in negativity, positivity, and extremity biases. *Journal of Personality and Social Psychology*, 52, 689–699. doi: 10.1037//0022-3514.52.4.689
- Smith, E. R. (1996). What do connectionism and social psychology offer each other? *Journal of Personality and Social Psychology*, 70, 893–912. doi: 10.1037//0022-3514.70.5.893
- Topolinski, S. (2011). I 5683 you: dialing phone numbers on cell phones activates key-concordant concepts. *Psychological Science*, 22, 355–360. doi: 10.1177/0956797610397668
- Uvnäs-Moberg K. (1998). Oxytocin may mediate the benefits of positive social interaction and emotions. *Psychoneuroendocrinology*, 23, 819–835. doi: 10.1016/S0306-4530(98)00056-0
- Vacharkulksemsuk, T., & Fredrickson, B. L. (2011). Strangers in sync: Achieving embodied rapport through shared movements. *Journal of Experimental Social Psychology*, 48, 399–402. doi: 10.1016/j.jesp.2011.07.015
- Williams, J. E., & Best, D. L. (1990). *Sex and psyche: Gender and self viewed cross-culturally*. Newbury Park, CA: Sage
- Williams, L. E., & Bargh, J. A. (2008). Experiencing physical warmth promotes interpersonal warmth. *Science*, 322(5901), 606–607. doi: 10.1126/science.1162548
- Williams, L. E., Huang, J. Y., & Bargh, J. A. (2009). The scaffolded mind: Higher mental processes are grounded in early experience of the physical world. *European Journal of Social Psychology*, 39, 1257–1267. doi: 10.1002/ejsp.665

- Wojciszke, B. (1994). Multiple meanings of behavior: Construing actions in terms of competence or morality. *Journal of Personality and Social Psychology*, *67*, 222–232. doi: 10.1037//0022-3514.67.2.222
- Wojciszke, B., & Abele, A. E. (2008). The primacy of communion over agency and its reversals in evaluations. *European Journal of Social Psychology*, *38*, 1139–1147. doi: 10.1002/ejsp.549
- Zhong, C. B., & Leonardelli, G. J. (2008). Cold and lonely: does social exclusion literally feel cold? *Psychological Science*, *19*, 838–842. doi: 10.1111/j.1467-9280.2008.02165.x
- Zhong, C. B., & Liljenquist, K. (2006). Washing away your sins: Threatened morality and physical cleansing. *Science*, *313*, 1451–1452. doi: 10.1126/science.1130726

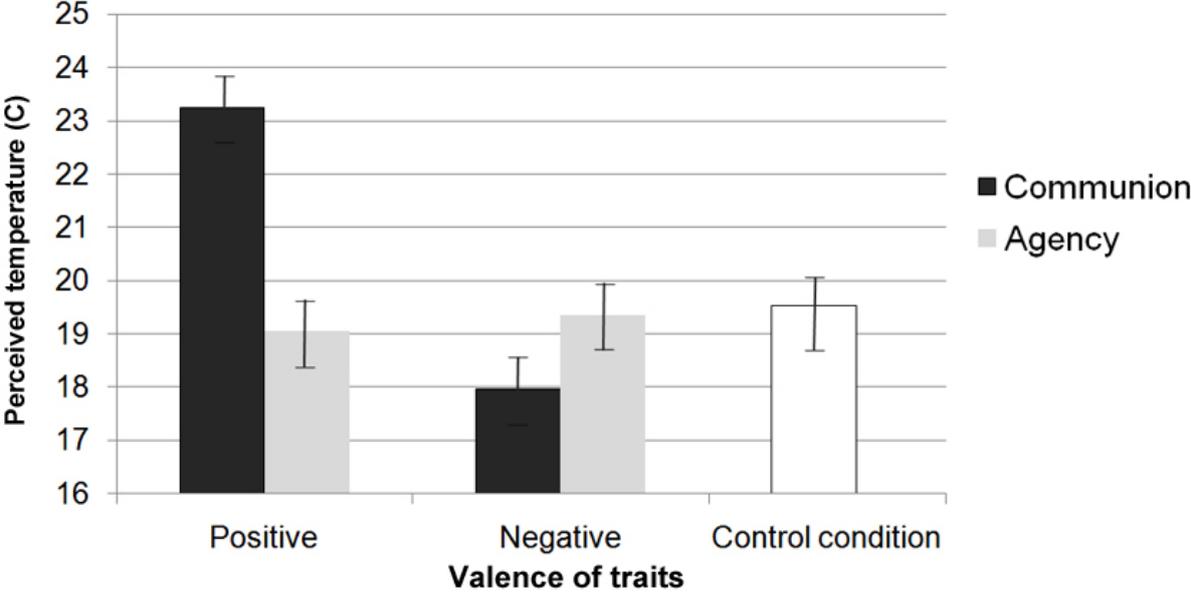


Figure 1. Perceived temperature (in degrees Celsius) as a function of valence and type of trait activated (Study 2).

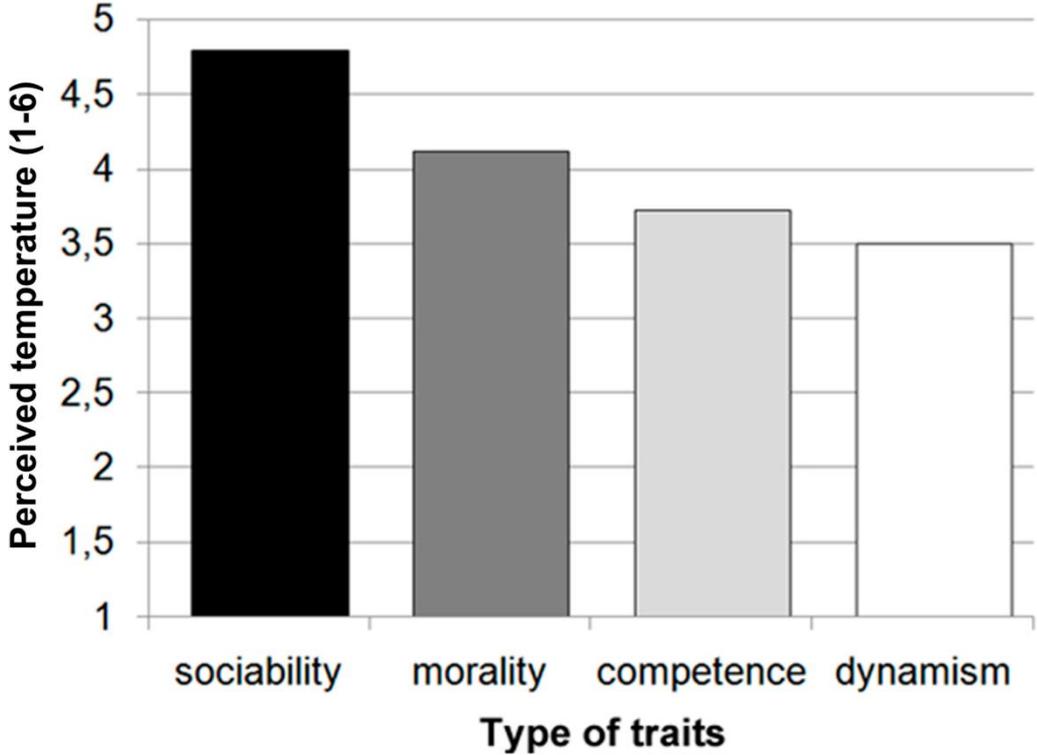


Figure 2. Perceived temperature of the paper cup as a function of type of trait activated (Study 3).