

Caring for Sharing: How Attachment Styles Modulate Communal Cues of Physical Warmth

Hans IJzerman

Tilburg University

VU University, Amsterdam

Johan Karremans

Radboud University, Nijmegen

Lotte Thomsen

University of Copenhagen & Harvard University

Thomas Schubert

CIS/ISCTE, Lisbon

**Manuscript in press**

**Social Psychology: Special Issue on the Fundamental Dimensions of Social Perception**

Hans IJzerman, Department of Social Psychology, School of Social & Behavioral Sciences, Tilburg University, The Netherlands; Johan Karremans, Department of Social & Cultural Psychology, Radboud University, Nijmegen; Lotte Thomsen, Department of Psychology, University of Copenhagen & Department of Psychology, Harvard University; Thomas Schubert, CIS/ISCTE, Lisbon. Correspondence concerning this article should be addressed to [h.ijzerman@uvt.nl](mailto:h.ijzerman@uvt.nl). We would like to thank Emma Landstra for her hard work in collecting data and the Tilburg Hardcore Labgroup, the editor Bogdan Wojciszke and two anonymous reviewers for their helpful comments. Addresses of the schools where our data was collected are available upon request from the first author.

## Abstract

Does physical warmth lead to caring and sharing? Research suggests that it does; physically warm versus cold conditions induce pro-social behaviors and cognitions. Importantly, earlier research has not traced the developmental origins of the association between physical warmth and affection. The association between physical warmth and sharing may be captured in specific cognitive models of close social relations, often referred to as attachment styles. In line with this notion and using a dictator game set-up, the current study demonstrates that children who relate to their friends in the manner of a secure attachment style are more generous toward their peers in warm as compared to cold conditions. This effect was absent for children who relate to friends in the manner of an insecure attachment style, but, notably, these children not just *always* shared less: They allocated more stickers to a friend than to a stranger. These findings provide an important first step to understand how fundamental *embodied relations* develop early in life. We discuss broader implications for grounded cognition and person perception.

*Keywords:* attachment, grounded cognition, relational models, physical warmth, interpersonal relations

Caring for sharing: How attachment styles modulate communal cues of physical warmth

Children's experiences with their caretakers differ substantially. Previous research has identified responsiveness of caretakers as an important variable that determines behavior in social relations by contributing to an attachment style developed by the child. The concepts of caretaker responsiveness and attachment styles may suggest a rather abstract and high-level concept. However, what co-varies with responsiveness may often be very concrete behavior such as touching, nursing, and feeding that all co-occur with providing bodily warmth. Such concrete dimensions of social interactions have recently received increased empirical attention in the literature on adult and infant social cognition (e.g., Häfner & IJzerman, 2011). We argue here that attachment styles also have an embodied dimension that tunes social behavior to embodied cues such as warmth.

Subtle manipulations of physical warmth have been linked to pro-social behaviors and cognitions as compared to physically cold conditions. For instance, adult participants in physically warm as compared to cold conditions rated a third party as more sociable and were themselves more generous (Williams & Bargh, 2008; see also Asch, 1946, 1958). Similarly, physically warmer conditions attune adults to focus on communal, affiliate relationships (like that between partners or between caregiver and infant). That is, adults in physically warm conditions use more language associated with relationships, perceive more relationships in their environment, and construe their selves as having greater integration with others (IJzerman & Semin, 2009). Vice versa, the lack of social relationships leads people to perceive their environment literally as physically colder (IJzerman & Semin, 2010; Zhong & Leonardelli, 2009).

The theoretical accounts underlying these experiments typically assume that the link between warmth and pro-social cognition is the result of life-long over-learning facilitated by an evolved proclivity (Williams & Bargh, 2008). Yet, little is known about the developmental

path of this link, and still less about its generality across individuals. In the current work, we trace the causal role of an early cognitive link in children, and find that children who did not develop a secure internal model of relationships towards friends also seem not to show this link.

### **General Relations between Attachment, Touch, and Warmth**

Research linking warmth and communal behavior is based on the idea that from infancy on, physical warmth and experienced affection co-vary. This is argued to lead to a learned association of warmth and communion, possibly facilitated by an evolutionary adaptation (Williams, Huang, & Bargh, 2009). These arguments concur with Harlow's (1958) work on touch. He suggested that close, physical contact throughout infancy is necessary for healthy psychological functioning: Young rhesus monkeys preferred a soft surrogate mother made of terrycloth over a surrogate mother made of wire, and those monkeys raised with a wire mother (as compared to the terrycloth mother) experienced greater stress, were less playful, and were less likely to explore the environment in new situations. This may suggest that close bodily contact with a care-giver, which is often associated with physical warmth, may indeed be an evolved need (cf. MacDonald, 1992).

Experiences of infants with their caregivers, however, can vary considerably. One prominent account on how people learn to interact with close and communal others, attachment theory (Bowlby, 1969), suggests that infants come to learn if their caregiver is likely to be responsive and available to meet their needs. Early interactions with communal others (like the caregiver) inform infants on specific manners in which they are expected to behave towards self and others. Such early interactions are assumed to be the basis for more generalized cognitive models of relationships and are commonly referred to as attachment styles (cf. Ainsworth, Blehar, Waters, & Wall, 1978). Those infants who are securely attached expect their caregivers to be available, and when upset, they are more easily comforted. In

contrast, insecurely attached infants do not trust their caregiver will be reliably available for their comfort and protection and are not easily comforted (Johnson, Dweck, & Chen, 2007).

The development of attachment styles has been linked to embodied cues experienced in infancy early on, especially bodily contact (Bowlby, 1969). Ainsworth (1979) reported that mothers of avoidant babies showed more frequently signs of an aversion to close bodily contact. Such avoidance of bodily contact frustrates the child's attempts to establish secure bodily contact when being motivated to do so, and changes their own approach behavior (Anisfeld, Casper, Nozyce, & Cunningham, 1990; Blehar, Lieberman, & Ainsworth, 1977). This suggests that early embodied cues (in contrast to higher order cognitive cues, like the differentiation between friends and strangers) - such as the inherently related touch and physical warmth – may form critical parts of the meaning of cognitive models of attachment.

In other words, we argue that an evolutionary adaptation to associate warmth and caring is likely to afford the child with a crucial learning opportunity; however, caregiver behavior such as that leading to an avoidant attachment style may be able to disrupt the acquisition of this link. If so, effects of physical warmth on behavior should be modulated by attachment styles.

### **The Present Research: Attachment, Friendship, and Warmth**

In the present work, we focus on one specific communal relation, namely friendship relations. Friendships feature warmth and touch less prominently than the first, crucial parent-infant bond; nevertheless, anthropological and psychological work alike suggests that friendship relationships are often considered as communal or even very similar to kinship relations (Ackerman, Kenrick, & Schaller, 2007; Adams & Plaut, 2003). Indeed, friends are often considered as “intimate associates”; the relations between friends are characterized by commitment, cooperation, affection, and prosocial support (Hartup, 1980). Among adults, secure attachment in general provides a foundation for compassion and care-*giving*

(Mikulincer & Shaver, 2005). Being insecurely attached, in contrast, hampers compassionate caregiving (e.g., Carnelley, Pietromonaco, & Jaffe, 1996; Collins & Feeney, 2000).

Self-reported attachment styles to friends should thus moderate how young children respond to physical warmth in their behavior toward their peers: Children with different orientations to close and communal friend relations, as measured through an adapted measure of their attachment styles to friends, should differ in the way they respond to physical warmth with caring actions, because their experiences with the implied communal friendships differ.

To test this interaction hypothesis, we assessed children's self-reported attachment styles towards friends, manipulated room temperature, and measured how many stickers the children shared in a dictator-game (e.g., Forsythe, Horowitz, Savin, Sefton, 1994) with another, not present, child under these conditions. Note that we thereby manipulated physical warmth independently from touch, around comfortable ranges. Furthermore, communal behaviors with respect to friendship relations do not afford close physical warmth to the same degree as parent-child relations. Together, this assures a strong test of our hypothesis. Whereas securely attached children should respond intuitively to physical warmth by *acting* communally and altruistically to meet other's needs, this should *not* be the case for insecurely attached children who do not share the experience that the needs of self and others are met in (physically) warm, communal relationships. This interaction hypothesis should be absent for known, learned relationships (such as the difference between friends and strangers).

## Method

### Participants

Sixty (43.3% female,  $M_{\text{age}} = 5.08$ ,  $SD_{\text{age}} = .59$ , all native Dutch) children were recruited from Kindergarten classes at two elementary schools in Abcoude, the Netherlands. For all children, we obtained informed consent from their parents/caregivers to participate. All children received ten stickers and twenty balloons at the end of the day of which they

participated. One child was excluded from the final analysis as the task was too difficult for him to complete. All children were randomly allocated to the physically cold (N = 29) or warm (N = 30) condition.

### **Procedure and Design**

The children were accompanied from their classroom to a room, located in their elementary school, which was either cooled down (cold condition; 15-19 °C) or heated up (warm condition; 21-26 °C) beforehand (cf. IJzerman & Semin, 2009). At the beginning of the session, the experimenter, who was blind to the hypotheses, asked them 15 questions from our attachment scale in regards to friendship relations (derived from Bartholomew & Horowitz, 1991). We simplified the original scale for usage with 4-6 year old children. All children were trained in using simplified Likert-scales in advance with intuitive and easy questions (e.g. “Do you like Brussels sprouts?”). The questions were administered orally and the children could point to a 7-point scale, ranging from ‘not at all’ to ‘very much’ (see Figure 1 in Appendix A).

In some cases the children misunderstood; in those cases our experimenter re-explained the questions and the way in which the children could answer. Our scale consisted of four subscales, namely Dismissive Avoidant (4 items, e.g., “Do you feel at ease without having good friends”), Fearful Avoidant (4 items, e.g., “Do you find it difficult to be in need of other children’s help?”), Securely Attached (5 items; “Do you find it easy to become good friends with other children?”), and Anxious Preoccupied (3 items; e.g., “How do you feel without good friends? “). One item was used both for Securely Attached and Fearful Avoidant (but reverse-scored; see Appendix A).<sup>1</sup>

---

<sup>1</sup>Children of the age in our sample might show considerable variance in terms of how to use the scale. We controlled for this in two ways. First, our experimenter explained questions the children might not intuitively understand. Second, we refrained from using the attachment scale to predict responses on physical warmth. Instead, we categorized children on the basis of their highest average score on our attachment scale, reducing the relevance of children’s idiosyncratic use of the scale.

Subsequently, the children were shown ten equally sized stickers (or twenty balloons) and asked how many they wanted to keep for themselves and how many they wanted to share with an ostensible other child next door. In reality (but unbeknownst to the child), this was a fictitious child, of the same age and sex as the participant, not acquainted and would not be met in the future. All children believed that the other child truly existed. Our experimenter told the children that the other child would not get the option to receive stickers (or balloons). She then asked the same question with ten new stickers, but children were now asked if they wanted to keep all ten for themselves or if they preferred to share some with their best friend instead (of which we recorded the name in advance). The order stranger-friend was counterbalanced across children. At the end, children were asked not to tell their classmates about the content of the experiment.

### Results

We classified children as securely or insecurely attached on the basis of their highest averaged score on one of the subscale of our attachment scale (62.7% securely attached). Insecurely attached children were those who scored highest on a subscale other than securely attached (37.3% insecurely attached, this was composed of 8.5% Dismissive Avoidant; 6.8% Fearful Avoidant; 20.3% Anxious Preoccupied; 1.7% scored highest on all three insecure styles). In the case of an equal score in the secure subscale as compared to one of the insecure subscales, we averaged the three insecure subscales and re-compared. This happened in four cases. Subsequently, we analyzed our results according to a 2(between: temperature: cold vs. warm) x 2(between: attachment style: secure vs. insecure) x 2(within: friend vs. stranger) mixed-models design. There was no reliable effect of order on giving to friend or stranger ( $p=.551$ ). In addition, we analyzed whether temperature affected the children's answers to the attachment questionnaire. A logistic regression of temperature on attachment styles showed no effect ( $p=.920$ ).

As we expected, known relationships like differences between friends and strangers showed a simple main effect: Children were more willing to share with their friends ( $M=2.97$ ,  $SD=2.33$ ) than with strangers ( $M=.98$ ,  $SD=1.74$ ),  $F(3, 55)=34.38$ ,  $p<.001$ , Cohen's  $d = .97$ . Notably, no interaction effect emerged between attachment style and friend-stranger factors,  $F<1$ . Insecurely attached children thus also meaningfully adapted their sharing behavior to the known nature of the relationship. Given that there were no further interaction effects involving differences between friends and strangers (all  $ps>.250$ ), we focused on the hypothesized between-participants temperature X attachment style analysis by calculating an average score for stickers given to friends and strangers.

In general, securely attached children gave more stickers than insecurely attached children,  $F(1, 55)=5.34$ ,  $p=.023$ ,  $\eta_p^2=.090$ , confirming the idea that securely attached children are more care-'giving' than insecurely attached children. There was no main effect of temperature,  $F<1$ . Importantly, the main effect of attachment was characterized by a significant interaction of temperature and attachment style,  $F(3, 55)=5.69$ ,  $p=.020$ ,  $\eta_p^2=.094$ . Securely attached children gave significantly more stickers in the warm ( $M=2.89$ ,  $SD=1.70$ ) as compared to the cold ( $M=1.75$ ,  $SD=1.53$ ) condition,  $t(58)=3.35$ ,  $p=.001$ , Cohen's  $d = .71$ . There were no significant differences for insecurely attached children,  $t(58)=-1.23$ ,  $p=.214$  (warm,  $M=.95$ ,  $SD=1.08$ ; cold,  $M=1.77$ ,  $SD=1.59$ ). This confirms our hypothesis that securely attached children should become more pro-social in warm as compared to cold conditions, but that this effect should be absent for insecurely attached children.

### Discussion

We examined altruistic behavior of securely and insecurely attached children in either physically cold or warm ambient conditions. In a dictator game, securely attached children donated more stickers to two other children in physically warm rather than cold conditions. This is remarkable from several perspectives. First, we provide evidence that the link between

warmth and prosociality indeed goes back to early childhood, as assumed in earlier work (IJzerman & Semin, 2009, 2010; Williams et al., 2009). It could have been possible that adults show effects of warmth on prosociality because they learned the metaphor of kindness and warmth, and that experiencing warmth influences kindness-related behavior because of the representation of this metaphor (Landau, Meier, & Keefer, 2011). However, the fact that we find the same effect with young children supports the notion that the effects found in adults are due to the formation of modal knowledge structures during development (IJzerman & Koole, 2011).

Furthermore, our findings add to the literature on embodied cognition, which so far has mainly been concerned with main effects of embodied cues. We show that a higher order concept such as attachment style developed during infancy can moderate the effect of embodied cues (cf. Meier, Sellbom, & Wygant, 2008; Schubert & Koole, 2009). Going beyond previous work showing main effects of warmth, we find that *only* securely attached children's giving behavior was positively affected by physical warmth, while insecurely attached children did not show this pattern. Together, our findings indicate that insecurely attached children do not respond to physical warmth with caring actions to the same degree as securely attached children. In other words, one's experiences with and expectations for a given communal relationship determine how one intuitively responds to embodied or physical communal cues. Moreover, because communal behaviors with respect to friendship relations do not afford close physical warmth to the same degree as parent-child relations, the present findings strongly suggest that the warmth-caring association underpin the meaning of communal relations at large, irrespectively of learned associations in the *specific* social relationship.

We developed our argument based on the assumption that different caregiver behaviors lead to different attachment styles and different associations of caring and

embodied cues like physical warmth, which are of primary importance during early experiences of being cared for (Ainsworth 1979). Infants face the formidable task of learning who has what kind of relationship with one another in their social world. To learn this, they must somehow know *what* basic kinds of social relationships to look for and *how* to recognize them, that is, what are their physical or embodied cues. Basic components of communal relations might help infants to construct meaningful internal working models of attachment on the basis of their early life experiences. Strong learning accounts might underestimate the bodily constraints and social coordination devices people are afforded with (IJzerman & Cohen, 2011; IJzerman & Koole, 2011; Fiske, Thomsen, & Thein, 2009; Thomsen & Carey, 2012).

Recent evidence suggests that people may possess specific systems that link relative size to dominance and physical closeness to communal relations among pre-verbal and just-linguistic infants (Thomsen, Frankenhuys, Ingold-Smith & Carey, 2011; Over & Carpenter, 2009). We propose here that physical warmth also forms part of people's core systems so as to affect behavior in communal friendship relations. Importantly, the fact that children who are insecurely attached to their friends do not respond to physical warmth with communal actions towards friends indicates that the effect of embodied, physical cues is not absolute. Instead, it hinges crucially on the relational meaning a given relation has for the child. This depends on his/her prior experiences with and expectations to the relationship, as indexed by attachment style. In other words, if the child does not experience friendships as secure and successful communal relationships, she/he will not act communally towards friends based on embodied, communal cues.

As far as we know, the present findings are the first to demonstrate that the relationship between warmth and prosocial behavior is present in early childhood, and moderated by attachment style. As such, the findings provide some initial insight into the

origins of the warmth-prosociality link. However, we should acknowledge several limitations and unaddressed issues. First, our findings do not show a simple main effect, as found in other studies (IJzerman & Semin, 2009; Williams & Bargh, 2008). However, these other studies focused on a selected group of college students, whereas our sample may have included a broader range of children. In both samples used by the previous authors, the groups tend to be a relatively selected group of college students. Recent research addresses how these groups of educated students differ substantially from other samples across different tasks (Henrich, Heine, & Norenzayan, 2009). Our research suggests that different samples may differ in attachment styles, which may be the focus of future investigations.

Coming to the issue of differences across groups, one may argue that cross-cultural climatic patterns do not converge with our findings (e.g., Van IJzendoorn & Kroonenberg, 1988). Yet, in our research we were interested in subtle temperature manipulations around comfortable ranges, which seem qualitatively different from climatic differences in temperature. The present research thus does not allow for interpretations of meanings of findings from cross-cultural climatic patterns.

Furthermore, one may argue that mood might have affected our findings. However, studies investigating subtle temperature manipulations consistently fail to find effects on mood, and in fact argue against such a general “halo” effect (IJzerman & Semin, 2009; Williams & Bargh, 2008). Finally, we were interested in a first exploration of attachment style, thereby dividing children into secure and insecure groups. It is an important challenge to discover how different insecure attachment styles may fare towards the experience of physical warmth. Extending these findings to the other attachment styles will directly contribute to the meaning of physical warmth in close relationships.

It is interesting to speculate how these findings play a role in more complex cognitions. Extant research has addressed how people perceive others on an individual and

group level, utilizing the metaphor of psychological warmth to describe how one feels about others (Abele & Wojciszke, 2007; Fiske, Cuddy, & Glick, 2007; Wojciszke & Abele, 2008; Wojciszke, Abele, & Baryla, 2009). Williams and Bargh (2008) confirmed Asch' (1958) early suspicions that the metaphor of psychological warmth is firmly grounded in the physical experience of warmth, by showing how experiencing physical warmth increases how sociable people perceive others to be. Other, recent work, shows that this link is bi-directional, in that reminding people of own and other's positive communal traits increases perceptions of ambient temperature, independent of self-esteem and higher order cognitions of relationships (Szymkow, Chandler, IJzerman, Parchukowski, & Wojciszke, 2012).

But how do people learn to think of others as warm or cold? Also here, one may take a strong learning approach (Lakoff & Johnson, 1999; Landau, Meier, & Keefer, 2010), but as we mentioned above, strong learning accounts overlook the evolved proclivities people become equipped with in order to engage in relationships (Caporael, 1997; Fiske, 1991, 1992; IJzerman, Gallucci, Pouw, Weißgerber, Van Doesum, & Williams, 2012; Thomsen & Carey, 2012). Examining the combinatorial logic of learning accounts scaffolded onto evolved proclivities through physical warmth is vital in understanding *why* psychological warmth has become such an important dimension in perceiving others, and for analyzing *how* the dimension differs across individuals and groups.

To conclude, co-experiencing physical warmth with communal bonds reinforces socially meaningful experiences. The interaction of the body with the social world provides important information for how people learn to engage effectively and adaptively in interpersonal relations. In the current experiment we manipulated room temperature, but in actual situations a temperature cue would be typically instantiated by a warm touch – to which, as we see, securely attached children could adequately respond. Our results therefore

form an important step as to what bodily constraints and social coordination devices are essential in going “beyond the information given” when constructing social relations.

### References

- Abele, A. E., & Wojciszke, B. (2007). Agency and communion from the perspective of self versus others. *Journal of Personality and Social Psychology, 93*, 751 – 763.
- Ainsworth, M. D. (1979). Infant--mother attachment. *The American psychologist, 34*, 932-937.
- Ainsworth, M. D., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment*. Hillsdale, NJ: Erlbaum.
- Anisfeld, E., Casper, V., Nozyce, M., & Cunningham, N. (1990). Does infant carrying promote attachment? An experimental study of the effects of increased physical contact on the development of attachment. *Child Development, 61*, 1617 – 1627.
- Asch, S. E. (1946). Forming impressions of personality. *The Journal of Abnormal and Social Psychology, 41*, 258-290.
- Asch, S. E. (1958). The metaphor: A psychological inquiry. In R. Tagiuri & L. Petrullo (Eds.), *Person perception and interpersonal behavior* (pp. 86-94). Stanford, CA: Stanford University Press.
- Bartholomew, K., & Horowitz, L. M. (1991). Attachment styles among young adults: A test of a four-category model. *Journal of Personality and Social Psychology, 61*, 226-244.
- Blehar, M. C., Lieberman, A. F., & Ainsworth, M. D. S. (1977). Early face-to-face interaction and its relation to later infant-mother attachment. *Child Development, 48*, 182-194.
- Bowlby, J. (1969). *Attachment and Loss*. London: Hogarth Press.
- Carey, S. (2009). *The Origins of Concepts*. Oxford University Press.
- Carnelley, K. B., Pietromonaco, P. R., & Jaffe, K. (1996). Attachment, caregiving, and relationship functioning: Effects of self and partner. *Personal Relationships, 3*, 257 – 278.

- Caporael, L. R. (1997). The evolution of truly social cognition: The core configurations model. *Personality and Social Psychological Review*, *1*, 276–298.
- Collins, N. L., & Feeney, B. C. (2000). A safe haven: An attachment theory perspective on support seeking and caregiving in intimate relationships. *Journal of Personality and Social Psychology*, *78*, 1053 – 1073.
- Fiske, A. P. (1991). *Structures of social life: The four elementary forms of human relations*. New York: Free Press.
- Fiske, A. P. (1992). The four elementary forms of sociality: Framework for a unified theory of social relations. *Psychological Review*, *99*, 689 – 723.
- Fiske, A. P. (2004). Relational models theory 2.0. In N. Haslam (Ed.). *Relational models theory: A contemporary overview* (pp. 3 – 25). London: Lawrence Erlbaum Publishers.
- Fiske, A. P., Thomsen, L., & Thein, S. M. (2009). Differently embodying different relationships. *European Journal of Social Psychology*, *39*, 1294 – 1297.
- Fiske, S. T., Cuddy, A. J. C., & Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*, *11*, 77 – 83.
- Forsythe, R., Horowitz, J. L., Savin, N. E., Sefton, M. (1994). Fairness in simple bargaining experiments. *Games and Economic Behavior*, *6*, 347 – 369.
- Häfner, M., & IJzerman, H. (2011). The face of love: Spontaneous accommodation as social emotion regulation. *Personality and Social Psychological Bulletin*, 1–13.
- Harlow, H. (1958). The nature of love. *American Psychologist*, *13*, 673 – 685.
- Henrich, J., Heine, S. J., & Norenzayan, A. (2009). The weirdest people in the world? *Behavioral and Brain Sciences*, *33*, 61 – 83.
- IJzendoorn, M. H., & Kroonenberg, P. M. (1988). Cross-cultural patterns of attachment: A meta-analysis of the strange situation. *Child Development*, *59*, 147 – 156.

- IJzerman, H. & Cohen, D. (2011). Grounding cultural systems: Body compartment and values in Honor and Dignity cultures. *European Journal of Social Psychology, 41*, 456 - 467.
- IJzerman, H. & Koole, S. (2011). From perceptual rags to metaphoric riches: Bodily, social, and cultural constraints on socio-cognitive metaphors. *Psychological Bulletin, 137*, 355 – 361.
- IJzerman, H., & Semin, G. R. (2009). The thermometer of social relations: Mapping social proximity on temperature. *Psychological Science, 20*, 1214 – 1220.
- IJzerman, H. & Semin, G. R. (2010). Temperature as a ground for social proximity. *Journal of Experimental Social Psychology, 46*, 867 – 873.
- IJzerman, H., Gallucci, M., Pouw, W. J. T. L., Weißgerber, S. C., Van Doesum, N. J., & Williams, K. D. (2012). Cold-blooded loneliness: Social exclusion leads to lower finger temperatures. *In Press at Acta Psychologica*.
- Johnson, S. C., Dweck, C. S., & Chen, F. S. (2007). Evidence for infants' internal working models of attachment. *Psychological Science, 18*, 501 – 502.
- Landau, M. J., Meier, B. P., & Keefer, L. A. (2010). A metaphor-enriched social cognition. *Psychological Bulletin, 136*, 1045 – 1067.
- MacDonald, K. (1992). Warmth as a developmental construct: An evolutionary analysis. *Child Development, 63*, 753 – 773.
- Meier, B. P., Sellbom, M., & Wygant, D. B. (2008). Failing to take the moral high ground: Psychopathy and the vertical representation of morality. *Personality and Individual Differences, 43*, 757–767.
- Mikulincer, M., & Shaver, P. R. (2005). Attachment security, compassion, and altruism. *Current Directions in Psychological Science, 14*, 34–38.
- Over, H., & Carpenter, M. (2009). Eighteen-month-old infants show increased helping following priming with affiliation. *Psychological Science, 20*, 1189-1193.

- Schubert, T. W. & Koole, S. L. (2009). The embodied self: Making a fist enhances men's power-related self-conceptions. *Journal of Experimental Social Psychology, 45*, 828 – 834.
- Szymkow, A., Chandler, J. IJerman, H., Parchukowski, M., & Wojciszke, B. (2012). Warmer hearts, warmer rooms: Focusing on communal traits increases estimates of ambient temperature. *Manuscript submitted for publication.*
- Thomsen, L. & Carey, S. (2012). Core Cognition of Relational Models. In M. Banaji, & S. Gelman, (Eds). *Navigating the Social World: What Infants, Children, and Other Species Teach Us*. Oxford University Press.
- Thomsen, L. Frankenhuys, W., Ingold-Smith, M. & Carey, S. (2011). Big & mighty: Preverbal infants mentally represent social dominance. *Science, 28*, 477 – 480. Van
- Williams, L. E., & Bargh, J. A. (2008). Experiencing physical warmth promotes interpersonal warmth. *Science, 322*, 606 – 607.
- 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.
- 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.
- Wojciszke, B., Abele, A. E., & Barylka, W. (2009). Two dimensions of interpersonal attitudes: Liking depends on communion, respect depends on agency. *European Journal of Social Psychology, 39*, 973 – 990.
- Zhong, C. B., & Leonardelli, G. J. (2008). Cold and lonely: Does social exclusion literally feel cold? *Psychological Science, 19*, 838 – 842.

Table 1

*Prosocial Behavior of Children in Warm and Cold Conditions*

Temperature Condition	Friend		Stranger	
	Secure	Insecure	Secure	Insecure
Cold	1.77 (1.17)	1.64 (1.36)	.50 (.77)	.32 (.64)
Warm	2.16 (1.07)	1.00 (1.12)	1.21 (1.08)	.27 (.47)

*Note.* Means display prosocial behavior amongst the 4-6 year old children in our sample. Analyses in the paper are conducted with the averaged scores between friends and strangers (the analyses yielded no significant interaction effects between temperature and relationship).

## Appendix A

Attachment Scale

In the present Appendix we display the 15 questions we used in our research, as indexed by attachment style. Each question, except one, is used to calculate only *one* attachment style. [Note that question 3 is used for both 'Safely attached' as for 'Fearful avoidant'. Question 3b is thus not repeated, but added to the present list in order to clarify scoring]

S = Securely attached

FA = Fearful avoidant

AP = Anxious preoccupied

DA = Dismissive avoidant

1. **DA** - Do you feel at ease without having good friends?
2. **FA** - Do you find it difficult to be in need of other children's' help?
3. **S** - Do you feel at ease when you can trust other children?
- 3b. **FA** - Do you feel at ease when you can trust other children?\*
4. **S** - Do you feel at ease when other children can trust you?
5. **AP** - Are you, at times, afraid that others don't consider you to be as important as you consider them?
6. **FA** - How does it feel to have good friends? \*
7. **DA** - Do you find it important to have the feeling that you do not need other children?
8. **S** - Are you ever afraid to be alone?\*
9. **S** - Are you ever afraid that other children don't like you?\*
10. **AP** - How do you feel without good friends?\*
11. **AP** - Does it happen to you that you want to become good friends with other children, but that the other children don't want to become such good friends with you?
12. **DA** - Do you need the help of other children?\*
13. **DA** - Do you find it necessary to help other children?\*
14. **FA** - Are you afraid you might get hurt if you become good friends with other children?
15. **S** - Do you find it easy to become good friends with other children?

\*Denotes reverse scoring.

Instructions for using the scale

The confederate spoke to the children in order to explain them how the scale works and in order to train them in using the scale. An example of this may be the following: "I will now ask you some questions about how you feel about, and how you feel with, other children in general. You may answer every question using something called a 'scale'. Let me show you how it works (show illustration of large scale: see Figure 1 below). When you give an answer you choose between seven answers. 1 means 'not at all', 2 means 'no', 3 means 'not really', 4 means 'I don't know', 5 means 'a little', 6 means 'yes' and 7 means 'very much'." At this point, the confederate pointed at each number and explained what each number meant. Dutch children aged 4-6 have not acquired the ability to read yet, but the children did remember where the answers were positioned. The confederate then proceeded to train the children with examples, detailed below through an example with one of the children (who would point to the numbers).

Confederate: Lets try this with an example: do you like the colour pink?

Child: Yes

Confederate: A little, just 'yes', or do you like it very much? (*pointing at scale*)

Child: Very much.

Confederate: And do you like sprouts?

Child: No

Confederate: Not really, just 'no', or not at all?

Child: Not really.

“Very good. Now let’s start with the questions. Remember, there is no right or wrong answer.”

In addition, some questions were more difficult to answer for children. The confederate helped the children by re-explaining and providing additional explanations.

For example, Questions 3 and 4 contained difficult words for the children in our sample: Most of the children do not understand the word ‘trust’ yet. The confederate then helped by giving them some examples:

“When you can trust someone you know you can rely on this person. You know that he/she will always be there for you. When you tell this person a secret he/she will not tell anybody else”. Finally, Questions 5 and 11 could be difficult for some children. The confederate usually used three markers (or other objects) to point at when she mentioned other children and then she pointed at the child when she mentioned the child in the question. By using the markers it made it easier for the children to understand and visualize the question.

Figures

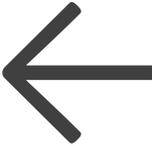
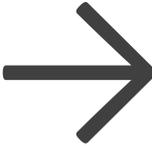
						
Not at all	No	Not really	I don't know	A little	Yes	Very much
O 1	O 2	O 3	O 4	O 5	O 6	O 7

Figure 1. Likert-scale used for 4-6 year old children when answering our attachment scale.