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Warm-Hearted Conformity: The Effects of Temperature Priming on Social Connectedness
and Mimicry

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Abstract

Recent research has discovered that participants primed with warm temperature (such as holding a warm beverage) report a greater need for social proximity, more positive judgments of a target as generous and caring, and a higher likelihood to give a gift to a friend over themselves than participants primed with cold temperature (Ijzerman & Semin, 2009; Williams & Bargh, 2008). Previous studies have also found that having a goal to affiliate (Lakin & Chartrand, 2003) and thoughts of social interconnectedness (van Baaren et al., 2003) increase mimicry, leading to the argument that mimicry is a strategy that people adopt nonconsciously to enhance social relations (Lakin & Chartrand, 2003). The current study aimed to extend this literature by showing that participants primed with warmth would be more likely than participants primed with cold to engage in nonconscious mimicry, due to the motivation for social connectedness caused by the warm temperature. Believing they were participating in a study on relaxation and spatial cognition, participants (67 American University students) placed their hand on a warm or cold therapeutic pack for two minutes and then completed a mimicry task where they colored in a blank figure. Mimicry was measured for how many colors in the participant's figure matched the example given. Contrary to the hypothesis, statistical tests showed participants in the cold condition had marginally significantly higher scores in one measure of mimicry. This suggests another mechanism at work in temperature priming and mimicry. An alternative hypothesis and directions for future research are suggested.

Introduction

Recent research examining the influence of our physical environment on social behavior has discovered that when participants are primed with warm temperature (such as holding a warm beverage), they report a greater need for social proximity, more positive judgments of a target as generous and caring, and a higher likelihood to give a gift to a friend rather than themselves, compared to participants primed with coldness (Ijzerman & Semin, 2009; Williams & Bargh, 2008). Furthermore, social rejection caused participants to estimate the temperature of the room as lower than participants who were not rejected (Zhong & Leonardelli, 2008). These findings suggest that the linguistic metaphors of “warmth” and “coldness” can manifest themselves in real social intimacy and social distance, respectively. The current study aims to extend this literature by showing that participants primed with warmth will be more likely to engage in mimicry behaviors.

Mimicry serves as a “social glue” that increases liking and improves our social interactions (Chartrand & Bargh, 1999). Previous studies have found that having a goal to affiliate (Lakin & Chartrand, 2003) and thoughts of social interconnectedness (van Baaren et al., 2003) increase mimicry, leading to the argument that mimicry is a strategy that people adopt nonconsciously to enhance social relations (Lakin & Chartrand, 2003). Because physical warmth increases the desire for social proximity, I expect to show that it also increases mimicry.

Temperature Priming

A new body of research is investigating the relationship between physical sensations and abstract psychological concepts. Boroditsky and Ramscar (2002) demonstrated the connection between time and space when participants who had moved farther along in a line were more likely to move a meeting farther along in the week (Friday as opposed to Monday). Schubert

(2005) found that priming concepts of power caused participants to process high power words more slowly if the word was in a lower spatial position from low power words. Zhong and Liljenquist (2006) showed that participants who recalled past moral transgressions felt the need to physically clean themselves. Leung and Cohen (2007) found that Asian Americans (who tend to have a more collectivist and interdependent social view than European Americans) were more likely than European Americans to tell a story from a third party's physical perspective than their own physical perspective. Sanna, Chang, Miceli, and Lundberg (2011) showed that participants who were placed physically higher (such as going up an escalator or being placed higher on stairs) exhibited more prosocial behavior. Similarly, recent research has found a connection between physical sensations of temperature and nonconscious cognitions about social interconnectedness (Ijzerman & Semin, 2009; Williams & Bargh, 2008; Zhong & Leonardelli, 2008).

Williams and Bargh (2008) first hypothesized the connection between physical feelings of warmth and interpersonal warmth. In two different studies they measured the interpersonal responses of participants after they had experienced a warm or cold temperature. In the first study, the experimenter, who was blind to the hypothesis, asked the participants to hold a cup of either hot or iced coffee while the experimenter wrote down their information. The participants were not aware the coffee was part of the experiment. However, those who held the hot coffee later rated a target person as more generous and caring (i.e. "warmer") than did those who held the iced coffee. None of the participants reported being aware of the effects the coffee's temperature had on their judgment.

In a second study, Williams and Bargh (2008) asked participants to evaluate the effectiveness of either a hot or cold therapeutic pack. Participants were then given a choice in

compensation for participating in the study: either a Snapple beverage or a \$1 gift certificate to an ice cream shop. One reward was framed as a personal reward for the participants themselves and the other was framed as a “treat for a friend,” with half of the participants choosing between a Snapple gift for themselves and an ice cream gift for a friend and the other half choosing between an ice cream gift for themselves and a Snapple gift for a friend. Those who evaluated the hot pack were more likely to choose the gift for a friend and those who evaluated the cold pack were more likely to choose the gift for themselves, regardless of the type of gift (either Snapple or ice cream). Again, the participants did not report being aware of the impact the temperature of the therapeutic pack had on their behavior. These results demonstrate that not only does temperature priming subconsciously influence interpersonal judgments of others, but also subconsciously influences prosocial behavior.

Williams and Bargh (2008) drew their hypothesis from three main areas of research on interpersonal warmth. The first is Solomon Asch’s (1946) research on the use of the warm-cold dimension in personality judgments. Research following Asch’s theory has demonstrated the importance of warmth in impressions of others. Together, warmth and competence account for 82% of the variance in people’s assessment of others (Wojciszke et al, 1998) with warmth information having more influence on the assessment than competence information (Fiske, Cuddy, & Glick, 2007). This sense of warmth recognized in someone’s personality is tied to feelings of trust, helpfulness, and friendliness (Fiske et al., 2007). Warmth and competence have also been theorized to be the main two dimensions involved in stereotypes of groups (Fiske et al., 2007). Those stereotyped to be “cold” and incompetent (e.g., the homeless) have been shown to activate brain areas in others that are also activated when viewing nonsocial objects (Harris & Fiske, 2006). To explain this warm-cold phenomenon, Asch (1958) theorized that abstract

psychological concepts are tied to physical experiences. Linguists also contend that internal psychological concepts are understood through metaphorical connections to their physical surroundings (Johnson, 1987; Mandler, 1992; Sweester, 1990; Talmy, 1988). As argued by Lakoff and Johnson (1980) and Bargh (2006), metaphors do not refer to solely one concept. Metaphors create connections between multiple concepts and experiences through interactions in both the physical and social realms. These connections are then later used to understand more complex exchanges.

The second basis for the Williams and Bargh (2008) hypothesis comes from attachment theory. Embodiment theorists have suggested that physical sensations of warmth brought on by warm food or a warm bath may be linked to feelings of trust and comfort through early memories of guardians who provided warmth, security, and the basic necessities of life (Niedenthal, Halberstadt, & Innes-Ker, 1999; see also Williams & Bargh, 2008). Harry Harlow (1958) demonstrated the significance of warmth in early caretaking through his studies on maternal preferences for infant macaque monkeys, who preferred an artificial mother made out of cloth that provided no food to an artificial mother made only out of wire that did provide food. The feelings of warmth and closeness to the mother trumped even nourishment. John Bowlby (1969) also stressed the importance of maintaining physical closeness to the child during early development, stressing that guardian-infant physical contact is key for survival.

The final support for their hypothesis comes from research on the anatomy of the brain. Research on the neurobiology of attachment has found that the insular cortex, located in the cerebral cortex between the temporal lobe and frontal lobe, is active during sensations of touch and thermal intensity (Craig, Chen, Bandy, & Reiman, 2000; Sung, Yoo, Yoon, Oh, Han, & Park, 2007), as well as feelings of trust, empathy, guilt, and embarrassment (Balter, 2007). It

appears to be especially active when one has been rejected (Eisenberger, Lieberman, & Williams, 2003; Kross, Egner, Ochsner, Hirsch, & Downey, 2007). This research provides biological support for the connection between thermal sensation and the judgment of trustworthiness (or interpersonal warmth) in others.

Further research has investigated the connection between the physical sensation of temperature and interpersonal feelings. Zhong and Leonardelli (2008) found that social rejection literally feels cold. In their first study, participants either recalled a time they felt excluded or included in the past. The experimenter then explained that the lab maintenance staff requested that the participants give estimates on the temperature of the room. Those in the excluded condition estimated the room temperature to be lower than the estimates of the participants in the included condition. None of the participants reported suspicion of the hypothesis.

In the second Zhong and Leonardelli (2008) study, the participants actually experienced exclusion or inclusion through a virtual ball-tossing exercise. Believing they were involved in an online ball-tossing exercise with two other participants, the participants in the exclusion condition received the ball twice in the beginning of the experiment and were excluded from the rest of the throws. The participants in the control condition received the ball intermittently throughout the exercise. Afterwards, participants took a marketing survey where they rated how much they desired five different products, two of which were warm (a hot coffee and hot soup). Those in the exclusion condition rated the warm food and drink as more desirable than did those in the control condition. These results suggest that social exclusion induces physical sensations of coldness, resulting in changes in preferences for warm food and drink. Furthermore, these studies considered along with the Williams and Bargh (2008) studies display a bidirectional relationship in the metaphorical association between physical temperature and interpersonal

connection. Warm and cold temperatures affect perceptions of social interconnectedness, and experiences of social inclusion or exclusion affect perceptions of temperature.

Ijzerman and Semin (2009) also investigated the connection between the physical sensation of warmth and social cognition. In their first study, participants were asked to temporarily hold a cup of hot or iced coffee, much like in the Williams and Bargh (2008) study. Afterwards, they chose a person they knew and rated them on the Inclusion of Other in Self (IOS) scale, which measures one's perceived social proximity to another. Those who held the hot coffee rated themselves as significantly closer to this other than those who held the iced coffee.

In experiments 2 and 3, Ijzerman and Semin (2009) tied in the role of language in the relationship between temperature and social proximity. Previous research has shown that people from interdependent cultures who emphasize close social proximity to others tend to use more concrete language than people from independent cultures who tend to distance themselves more from others. Furthermore, people from interdependent cultures tend to focus more on relationships and patterns when describing objects while people from independent cultures tend to categorize more and focus on properties and details. In Ijzerman and Semin's study, participants placed in a warm room described a chess game they had just watched using more concrete language (experiment 2 and 3) and described objects in more relational terms (experiment 3) than did subjects placed in a cold room. The participants in the warm condition also described themselves as having closer social proximity to the experimenter, again using the IOS scale. The results revealed a complex relationship between ambient temperature, social proximity, abstract language, and relational focus. Again, none of the participants in any of the experiments reported suspicion of the hypothesis.

Research on the relationship between physical temperature and cognitions about social interconnectedness is still a fairly new field. While these studies have revealed complex relationships and even drawn in theories from linguistics, personality judgments, attachment theory, the anatomy of the brain, and cross-cultural psychology, there are still many more implications for this research and connections that can be drawn to other areas of psychological research. Since mimicry behavior is strongly influenced by perceptions of social interconnectedness, it is one such area.

Mimicry Behavior

Previous research on mimicry has provided strong evidence that there is a bidirectional relationship between nonconscious mimicry and social interconnectedness. From the beginning of mimicry research, mimicry was described in terms of empathy. Gordon Allport (1968) originally defined empathy as “objective motor mimicry.” Schefflen (1964) found that people nonconsciously and unintentionally communicated messages about liking and understanding in social interactions through their posture and used postural information to orient themselves in a group. Schefflen’s paper led to further research on behavior matching, defined as assuming similar postures and body configurations as the interaction partner. In the research, behavior matching was often linked to measures of rapport, which includes involvedness, togetherness, being “in step,” and compatibility (see also Chartrand & Bargh, 1999). La France (1982) found that children in a classroom tend to mirror the posture of their teacher, and that the level of postural mirroring was positively correlated with the students’ ratings of rapport, involvement, and togetherness. Maurer and Tindall (1983) found that clients perceive their counselors as more empathetic if the counselors mimic the client’s body positions. Bernieri and Rosenthal (1991) suggested that people “hit it off” more when their behavior is more closely matched. Hatfield,

Cacioppo, and Rapson (1994) proposed that behavioral matching creates more emotional convergence in social interactions.

Chartrand and Bargh (1999) performed the first true experiment to show the relationship between nonconscious mimicry and social interconnectedness. They argued that the unintentional tendency to take on the mannerisms of those around you, which they termed the chameleon effect, was the mechanism behind the social facilitation brought on by nonconscious mimicry. They described the perception-behavior link, where the act of perceiving a behavior causes one to perform the behavior, as a “social glue” that facilitates empathy and bonding during social interactions without any conscious intention on the part of the interaction partners to do so. Essentially, the perception of the behavior unintentionally causes similar behavior, which in turn improves liking and rapport between the partners.

Chartrand and Bargh (1999) tested this hypothesis in three studies. In experiment 2, they investigated the adaptive function of mimicry in social interaction. The causal nature in the relationship between mimicry and social liking was not clear in previous research; there was not substantial evidence for whether mimicry could facilitate social interaction and increase liking between interaction partners. In Chartrand and Bargh’s experiment 2, participants were videotaped while completing a task with a confederate that was believed to be another participant. In the experimental condition, the confederate mimicked the mannerisms of the participant. In the control condition, the confederate used neutral, nondescript mannerisms. Afterwards, the participant completed a questionnaire about how much they liked the confederate and how smoothly the interaction had gone. As hypothesized, the participants in the experimental condition reported liking the confederate more and having a smoother interaction with the confederate than did those in the control condition.

In experiment 3, Chartrand and Bargh (1999) drew on previous psychological research that established a connection between empathy and mimicry behavior. Empathy was measured as a personality trait and separated into two major forms: cognitive empathy (e.g. perspective taking) and emotional empathy (e.g. visceral reactions to another's situation). Previous researchers have stressed the importance of perspective taking rather than emotional empathy in positive social interactions. Chartrand and Bargh also found that participants who were high in perspective-taking were more likely to mimic the confederate than participants low in perspective-taking. The measure of emotional empathy had no such effect. Thus, high perspective-taking may be a key personality trait in the use of mimicry to facilitate social interaction. Again, none of the participants in the Chartrand and Bargh studies reported suspicion of the hypothesis, supporting their theory that the mimicry behavior is unintentional on the conscious level.

Similarly, Van Baaren, Maddux, Chartrand, Bouter, and Knippenberg (2003) investigated whether another personality trait, self-construal orientation, moderated mimicry behavior. Self-construal orientation refers to the tendency to define oneself as related to others (interdependent self-construal) or in terms of what makes one unique from others (independent self-construal). While self-construals can be measured as a personality trait, participants can also be primed with either an interdependent or independent self-construal (Markus & Kitayama, 1991; Markus, Mullally, & Kitayama, 1997). In their first two studies, Van Baaren and colleagues primed participants with an independent self-construal, an interdependent self-construal, or a control self-construal (neutral). The results showed that those in the interdependent condition were more likely to mimic the mannerisms of a confederate, followed by the control condition, and then the independent condition. In their third study, Van Baaren et al. found that Japanese participants

(who usually have a chronic interdependent self-construal) were more likely to mimic than American participants (who usually have a chronic independent self-construal). The participants did not report being aware of the mimicry in any of the studies. These results expand upon Chartrand and Bargh's study by showing that not only is perspective-taking important in mimicry behavior, but so is the tendency to define oneself in relation to others. It may be that those high in perspective-taking and those who hold interdependent self-construals are both more adept at facilitating social interaction and more concerned with having positive social interactions. Therefore, even without being aware of it, they are more likely to mimic in order to increase bonding with their interaction partner.

In another experiment on social interaction and mimicry, Lakin and Chartrand (2003) demonstrated that motivation to affiliate with others can drive nonconscious mimicry. In their first experiment, participants were placed into one of three conditions: nonconscious affiliation goal, conscious affiliation goal, and no goal. In the nonconscious affiliation goal condition, participants were primed in a visual acuity task with words relating to affiliation (affiliate, friend, partner, together). In the other two conditions, participants were primed with neutral words. Participants then watched a "live feed" of a confederate they believed to be another participant completing mundane office tasks. Beforehand, they were told they would need to remember the order in which the tasks were completed. Participants in the conscious affiliation goal were also told they would soon complete a cooperative task with the participant on the screen and that it was very important that they get along and work together well. While watching the video of the confederate, participants were secretly videotaped as well and later analyzed by independent raters on how much they mimicked the mannerisms of the confederate. Participants in the two affiliation goal conditions mimicked significantly more than participants in the no goal

condition. There was no significant difference in the amount of mimicry between the nonconscious and conscious conditions, demonstrating that motivations to affiliate can nonconsciously as well as consciously cause mimicry.

In their second experiment, participants were either primed with affiliation words or neutral words. The participants then conducted interviews with two different confederates believed to be participants. The first interview was online, and the confederate responded in either a friendly or unfriendly manner. The second interview was face-to-face, and participants were analyzed for how much they mimicked the confederate. Participants in the nonconscious affiliation goal condition mimicked more when the first interview was unfriendly than when it was friendly. Participants in the no goal condition had no difference in the amount of mimicry whether the first interview was friendly or unfriendly. These results suggest that when someone has a goal to affiliate and they are unsuccessful in that goal, they will mimic more than when they are initially successful.

Further research has also provided more evidence of the adaptive function of mimicry. Van Baaren, Holland, Steenaert, and Knippenberg (2002) found that a waitress who mimicked her customers received a higher tip than when she did not mimic her customers. Van Baaren, Holland, Kawakami, and Knippenberg (2004) showed that being mimicked not only increased liking towards the mimicker, but also towards others unrelated to the mimicker. It also makes the mimicked person's social value orientation more prosocial. Similarly, Ashton-James, Van Baaren, Chartrand, Decety, and Karremans (2007) demonstrated that being mimicked caused the mimicked person to have a more interdependent self-construal, sit physically closer to a stranger, and be more likely to agree to participate in another uncompensated study. Lakin, Chartrand, and Arkin (2008) investigated the connection between mimicry and social exclusion, concluding

that excluded individuals nonconsciously mimic in-group members more than those who have not been excluded, perhaps in order to recover from the exclusion. Stel and Vonk (2010) found that after an interaction in which one person mimicked the other, both mimickers and mimickees were more affectively attuned to one another, felt they had bonded more, and rated the interaction as smoother.

Overall, the research shows that mimicry occurs even between strangers without any awareness or intention on the part of the interaction partners. This mimicry causes more liking, bonding, smoother interactions, and emotional convergence between the two partners and even prosocial perspectives and behaviors towards people in general. It appears that mimicry is employed nonconsciously and unintentionally by those who are motivated to have a positive social interaction.

The Present Study

In the present study, I am looking to extend the research on temperature priming and investigate its effects on nonconscious mimicry behavior. Experiencing physical warmth nonconsciously increases one's need for social proximity, which in turn causes nonconscious mimicry. Similarly to Van Baaren, Maddux, et al.'s (2003) study where participants were primed with interdependence or independence and Lakin and Chartrand's (2003) study where participants were primed with a goal to affiliate, the participants in the current study will be primed with thoughts of social closeness and distance through experiencing warm or cold temperatures. I will then measure the extent to which they nonconsciously mimic a stranger.

My measurement of mimicry comes from Van Leeuwen, Veling, Van Baaren, and Dijksterhuis's (2009) study on the influence of attractiveness on mimicry. Mimicry was measured through a coloring task in which the more the participant's color choices matched the

example given (which the participant was told was created by an art student whose picture was provided), the more the participant was measured as engaging in mimicry. I hypothesize that in the present study, participants who are primed with a warm temperature will match more of the colors from the art student's example than participants who are primed with a cold temperature.

Methods

Participants and Design

The participants were 67 students from American University. They were compensated with their choice of \$10 or one hour of extra credit towards a psychology course. The design was a one-way (temperature condition: warm, cold) between-subjects design. The dependent variable was how many of the colors the participant chose for the figure match the colors of the example provided.

Materials

To prime the participants with cold or warm temperature, therapeutic packs that could either be heated up in a microwave or frozen in a freezer were used. Mimicry was measured using Van Leeuwen et al.'s (2009) coloring task. The same chameleon figure from their first experiment was used in the present study. However, the picture of the art student who supposedly created the example chameleon was changed (see Appendix A). Van Leeuwen et al. purposefully used pictures that were either high or low in attractiveness. A face of average attractiveness was used in the present study, which was based on ratings from 35 American University students (mean rating 4.143, $SD=0.944$) on a 7-point scale, where higher score indicated greater perceived attractiveness. The coloring task came with three markers (red, blue, and green) and instructions that stated only two requirements for coloring: "You must use each of the three colors available at least once", and "You must color every segment of the blank

figure” (see Appendix B), which were the same limitations used by Van Leeuwen et al. The participants were also told that the photo depicted Lisa Herbst, the art student who created the chameleon figure. The coloring task was followed by fifteen questions that rated the participant’s opinion on various aspects of the task (see Appendix C). I was really only interested in four of their responses to questions about Lisa: How friendly do you imagine her to be? How positively do you think of her personality? How attractive do you think she is? How much do you like her overall? The other 11 questions were fillers to prevent suspicion. The participants also completed a filler task, the Perspective Taking Orientation Task (PTOT), consisting of twelve questions used to test spatial cognitive ability, a demographics questionnaire, and a questionnaire consisting of five open-ended questions testing for suspicion of the hypothesis (see Appendix D).

Procedure

The participant entered the lab and was greeted by an experimenter (a white female undergraduate) who was blind to the hypothesis. While the participant read and signed the informed consent form, the experimenter either took a therapeutic pack out of the freezer or cooked a therapeutic pack in the microwave for one minute. After the informed consent was signed, the experimenter placed the therapeutic pack on the table in front of the participant. The participant was told both in the informed consent form and verbally from the experimenter that the study was testing the effects of relaxation on spatial cognition. For the relaxation task, the participant was instructed to place their hand on the therapeutic pack for two minutes, making as little noise and movement as possible (in order to continue the cover story that it was a relaxation exercise). The experimenter sat out of the participant’s view and timed two minutes on a stopwatch. After the two minutes were over, the experimenter gave the participant a folder which

contained the spatial cognition task #1 (i.e. the coloring mimicry task, along with three markers, instructions, and the questionnaire), the spatial cognition task #2 (i.e. the PTOT, also with instructions), a demographics questionnaire, and an experiment questionnaire that tested for suspicion of the hypothesis. The experimenter left the room while the participant completed all tasks in order. When the participant was finished, the experimenter handed them the debriefing form, which revealed the true nature of the study, in a sealed envelope and instructed the participant to relay all questions to the main researcher whose contact information was provided on the debriefing form. This debriefing procedure was used to keep the experimenter blind to the hypothesis.

Results

Two participants, both in the cold condition, were excluded from the data due to one using a cell phone during the relaxation task and the other leaving to go to the bathroom directly after the relaxation task. This gave us a total of 65 participants, 33 in the warm condition and 32 in the cold condition (46 women, 19 men; 54 White, six Asian, three American Indian or Alaska Native, one African-American, one mixed race; six Latino ethnicity). None of the demographic variables proved to be significant in tests of mimicry. Although their coloring did not match significantly more segments to the original, in the questionnaire testing for suspicion, women were more likely to say they explicitly copied the original figure ($t(63)=-1.052, p=0.023$), and men used red ($t(63)=0.956, p=0.044$) and blue ($t(63)=0.483, p=0.014$) more often than women did. There were not significantly more men or women in the warm or cold condition. For all tests of significance, I used an alpha level of 0.05.

Did participants in the warm condition mimic more than participants in the cold condition?

To measure mimicry, I counted how many segments the participant colored the same

color as in the original figure. The original study that used this measure (van Leeuwen et al., 2009) divided the figure into 13 segments. However, many of the participants in their coloring treated the figure as having 15 segments (coloring the hind legs as separate segments and coloring in the pupils). In order to stay true to the original measurement but also not discount the coloring of a substantial amount of participants, I included three measurements of mimicry in the data: counting how many segments matched if I measured the figure as having 13 where the pupils are counted as part of the figure but the hind legs are not, having 13 where the hind legs are counted but the pupils are not, and having 15 where both the pupils and hind legs are counted as part of the figure. I labeled these three variables as *mimic13* ($M=4.88$, $SD=3.457$), *other13* ($M=5.23$, $SD=3.656$), and *mimic15* ($M=5.71$, $SD=4.003$), respectively. Higher scores in each variable reflect higher mimicry of the original figure. All three mimicry variables are highly correlated (*mimic13* and *mimic15* $r=0.988$; *mimic13* and *other13* $r=0.948$; *mimic15* and *other13* $r=0.976$; $p<0.001$ for all correlations).

Contrary to the hypothesis, participants in the cold condition had a higher average in all three mimicry variables than participants in the warm condition. The p-value for *mimic13* (with pupils but not hind legs) was marginally significant ($t(63)=-0.927$, $p=0.054$). The p-values for *other13* ($t(63)=-0.992$, $p=0.091$) and *mimic15* ($t(63)=-0.888$, $p=0.110$) were not statistically significant. To account for outliers, I also ran a Kruskal-Wallis test, which found no significant difference between the warm and cold condition for any of the mimicry variables (*mimic13* $\chi^2(1, N = 65) = 0.158$, $p = 0.691$; *other13* $\chi^2(1, N = 65) = 0.388$, $p = 0.534$; *mimic15* $\chi^2(1, N = 65) = 0.245$, $p = 0.620$).

Participants in the cold condition were more likely to say they explicitly copied or did not copy the original artwork. After reading through the questionnaires testing for suspicion, we

created three variables indicating whether the participant stated they explicitly copied the original, tried not to copy the original, and if they either explicitly copied or did not copy (labeled copied, notcopied, and either, respectively). For each variable, 0 meant no and 1 meant yes. So, if a participant stated they explicitly copied the original, we gave them a 1 in copied, a 0 in notcopied, and a 1 in either. If they stated they purposefully did not copy the original, we put a 0 in copied, a 1 in notcopied, and a 1 in either. If the participant did not mention trying to copy or not copy, they received a 0 in each variable. While there was not a significant difference for copied ($t(63)=-0.690, p=0.169$) or notcopied ($t(63)=-0.943, p=0.062$), participants in the cold condition had a significantly higher average in the variable either ($t(63)=-1.372, p=0.025$), showing they were significantly more likely to say they either explicitly copied or tried not to copy the original. I then created a second set of data where all participants who either explicitly copied or did not copy were removed. That left 40 participants, 23 in the warm condition and 17 in the cold condition. This brought the mimic variable averages between the two conditions closer together and increased all three p-values for the t-tests (mimic13 $t(38)=-0.821, p=0.105$; other13 $t(38)=-0.741, p=0.556$; mimic15 $t(38)=-0.775, p=0.195$). The results for the Kruskal-Wallis tests remained nonsignificant (mimic13 $\chi^2(1, N = 40) = 0.078, p = 0.779$; other13 $\chi^2(1, N = 65) = 0.391, p = 0.532$; mimic15 $\chi^2(1, N = 65) = 0.250, p = 0.617$).

Did participants in the warm condition significantly like the art student Lisa more than participants in the cold condition?

I identified four key questions in the questionnaire following the coloring task that tested for the participant's liking of Lisa: question 8) How friendly do you imagine Lisa Herbst, the art student who created the art piece, to be? ($M=6.95, SD=1.316$), question 9) How positively do you think of Lisa's personality? ($M=6.65, SD=1.230$), question 10) How attractive do you think

Lisa is? ($M=5.97$, $SD=1.334$), and question 11) Overall, how much do you like Lisa? ($M=5.91$, $SD=1.444$). I also highlighted question 5) How much do you like the original art piece? ($M=5.46$, $SD=1.993$), to account for an additional factor that may have caused the participants to mimic the original artwork, just as they did in the van Leeuwen et al. (2009) study. T-tests showed there was not a statistically significant difference in scores between participants in the warm and cold condition for any of these questions (question5 $t(63)=-2.209$, $p=0.074$; question8 $t(63)=-1.818$, $p=0.171$; question9 $t(63)=-1.491$, $p=0.809$; question10 $t(63)=-0.738$, $p=0.184$; question11 $t(63)=-1.737$, $p=0.778$). The results remained insignificant when I removed participants who explicitly copied or did not copy the original artwork (question5 $t(38)=-1.568$, $p=0.114$; question8 $t(38)=-1.764$, $p=0.108$; question9 $t(38)=-1.425$, $p=0.968$; question10 $t(38)=-0.910$, $p=0.149$; question11 $t(38)=-1.200$, $p=0.463$).

I created a new variable, labeled liking, that was an average of the scores for questions 8, 9, 10, and 11. The four scores were found to have high reliability ($\alpha = 0.838$; the alpha would drop below 0.838 if any of the questions were removed). There was still not a significant difference in the new liking variable between the warm and cold condition ($t(63)=-1.771$, $p=0.955$), even when those who explicitly copied or did not copy were removed ($t(38)=-1.597$, $p=0.789$).

Was there a correlation between how much they liked Lisa and how much they mimicked her?

I ran a Spearman correlation test on all dependent variables (mimicry, liking of Lisa, copied/notcopied/either). There was not a significant correlation between any of the mimicry variables and the scores on any of the questions testing for liking of Lisa. However, there was a significant correlation between whether a participant explicitly copied the original artwork and how friendly they found Lisa to be (question 8). The more likely they were to say they explicitly

copied the original, the friendlier they found Lisa to be ($r = 0.311, p=0.012$).

Accounting for Suspicion

While no participants suspected the hypothesis (that a warm pack would make them like Lisa more and then cause them to mimic her artwork), two participants in the cold condition suspected that liking Lisa more would cause them to mimic her artwork more. After these participants were removed, leaving 33 participants in the warm condition and 30 in the cold, the participants in the cold condition had significantly higher scores in the mimic13 variable ($t(61)=-0.919, p=0.021$) and marginally significantly higher scores in the other two mimicry variables (other13 $t(61)=-0.903, p=0.058$; mimic15 $t(61)=-0.838, p=0.058$). Participants in the cold condition were also significantly more likely to say they explicitly copied or did not copy the original ($t(61)=-1.333, p=0.031$). The significance of the results on the difference between the warm and cold condition in scores of liking, on the correlation between liking and mimicry, and on the correlation between explicitly copying and how friendly they find Lisa to be did not change.

Many of the participants (32) reported suspicion that the coloring task was measuring for how closely they copied the original. I removed the participants who reported this suspicion, leaving 20 in the warm condition and 13 in the cold condition. An independent t-test showed that the participants in the cold condition had significantly higher scores in all three mimic variables than participants in the warm condition (mimic13 $t(32)=-2.791, p<0.001$; other13 $t(32)=-3.112, p<0.001$; mimic15 $t(32)=-2.856, p<0.001$). The participants in the cold condition were also significantly more likely to say they explicitly copied the original than participants in the warm condition ($t(32)=-2.443, p<0.001$). The significance of the results on the difference between the warm and cold condition in scores of liking and on the correlation between liking

and mimicry did not change. There was no longer a significant correlation between explicitly copying and how friendly they found Lisa to be ($r=0.321$, $p=0.064$), but there was a significant positive correlation between explicitly copying and question9, how positively they think of Lisa's personality ($r=0.353$, $p=0.041$).

Accounting for the connection between temperature and warm/cold colors

Considering the colors blue and green are often connected with cold and the color red is often connected with warmth, I tested to see if participants in the warm and cold conditions had a significant difference in how often they used each color and whether that had an effect on the difference in mimicry between the two conditions. For each participant, I counted how often they used each color, creating three new variables for red ($M=4.75$, $SD=2.253$), green ($M=4.91$, $SD=1.802$), and blue ($M=5.52$, $SD=1.811$). An independent t-test showed no significant difference in how often participants in the warm and cold conditions used each color (red $t(63)=0.571$, $p=0.914$; green $t(63)=-1.876$, $p=0.521$; blue $t(63)=0.027$, $p=0.931$). The results remained nonsignificant when participants who explicitly copied or tried not to copy were removed (red $t(38)=1.652$, $p=0.124$; green $t(38)=-2.308$, $p=0.202$; blue $t(38)=0.622$, $p=0.930$).

Discussion

Since the average mimicry scores of the participants in the warm condition were lower than the mimicry scores of the participants in the cold condition, I fail to reject the main null hypothesis that the mimicry scores of the participants in the warm condition would not be higher than the mimicry scores of the participants in the cold condition. I also failed to reject the null hypotheses that the participants in the warm condition would not score higher in the questions testing for liking of Lisa than participants in the cold condition and that scores on the questions testing liking of Lisa would not be positively correlated with mimicry scores. Although previous

research has shown that participants primed with warm temperature are more likely to like and positively rate the personality of a specified target and that increased liking of a target leads to nonconscious mimicry of that target, my research failed to support these findings.

The fact that the higher mean score for cold participants in one measure of mimicry was marginally significant suggests that there may be a different mechanism working here from what was originally hypothesized. It could be that cold temperature primes thoughts of social rejection, leading participants to be motivated to mimic more than participants primed with warm temperature. Previous research has found that social rejection causes participants to literally feel colder (Zhong & Leonardelli, 2008). Research on mimicry has also shown that initial rejection causes an increase in mimicry (Lakin & Chartrand, 2003; Lakin, Chartrand, & Arkin, 2008). Future research should look into the connection between cold temperature and rejection and what behavioral effects that has on participants, including mimicry.

My results failed to support previous research showing that participants primed with warm temperatures report liking a target more (Williams & Bargh, 2008). It may be that the temperature of the packs was not consistent or kept at a prime temperature for eliciting the responses found in previous research. In order to receive Institutional Review Board approval before the study, I measured the average temperature of the packs in ten trials of five different cook times (40, 50, 60, 70, and 80 seconds). After corresponding with Dr. Lawrence Williams, one of the authors of the Williams & Bargh (2008) study, my goal was to find a cook time that kept the temperature of the packs between 41 and 43 degrees Celsius. Unfortunately, the microwave could not keep the temperature of the pack that consistent for any of the cook times. I wanted to avoid exceeding 43C, since it was described in the study by Davis, Kwan, Crawley, & Mikulis (1998) as noxious for participants, so I decided on 60 seconds since even its 99.7%

confidence interval did not exceed 42.4C, while 70 and 80 seconds exceeded 43C at least once in the ten trials. However, the 95% confidence interval for 60 seconds was between 35.5 and 41 degrees. Potentially, many of the participants could have put their hand on a hot pack that was only 35C or 36C, while others were above 40C. Furthermore, the average temperature of the cold packs was never tested. I simply kept the temperature of the freezer at the coldest it could go. It may be that the temperature of the cold packs was also not consistent or not a prime temperature for this study. This lack of consistency in temperature of the therapeutic packs is a threat to the internal validity of the study and may be causing the failure to support previous research that shows participants primed with warm temperatures report liking a target more.

The mimicry measurement used also appears to not have been a good test of nonconscious mimicry. Half of the participants suspected that the test was measuring how closely they would mimic the original, and over a third of the participants either explicitly copied the original or tried not to copy the original. It appears that many participants did not believe the cover story that the test was measuring spatial cognition. The current study's cover story was changed from the van Leeuwen et al. (2009) study that originally used the coloring task. The participants in that study were told the task was measuring creativity. While this would have been a believable cover story for the participants, I felt that it encouraged the participants to not copy the original artwork, or to refer more to the original artwork, and decided to not use the same cover story for the current study. While there was a significant correlation between conscious mimicry and how friendly the participants found Lisa to be, there was not support for the nonconscious mimicry that this study was looking for. Perhaps if the cover story would have been more believable, the test would have been better at measuring nonconscious rather than conscious mimicry, and the results may have been more significant.

If the study was repeated, it would first be important to obtain a way of priming the participants with more consistent temperatures, such as using higher quality therapeutic packs and microwave or controlling the temperature of the room like in the Ijzerman and Semin (2009) study rather than using therapeutic packs. Although it would be a large study to take on, it would also be interesting to have many conditions with different degrees of warm and cold and see if small changes in temperature as well as large changes in temperature cause an increase or decrease in mimicry behavior, or perhaps there is a certain threshold for warm and cold temperatures in order for the temperature priming to have a significant effect on mimicry or liking of Lisa. It would also probably be beneficial to use a new test of mimicry as well that would be a better measure of nonconscious mimicry. Studies of mimicry usually videotape an interaction between the participant and a confederate and have multiple judges rate the amount the participant mimics the confederate. This method was not used in the current study due to lack of resources and independent raters. However, if the study was to be repeated, the method of videotaping and rating participants may be a more effective measurement of nonconscious mimicry to use.

Although the results did not support previous research, this study has revealed a new hypothesis about the connection between cold temperature, social rejection, and motivation to mimic. This hypothesis should be explored in future research. Temperature priming and nonconscious mimicry are still important areas of research to continue to explore and expand. Research in temperature priming is extremely new and there are still many discoveries and connections to other research left to be made. Not only does temperature priming provide insight into nonconscious human connections between physical stimuli and psychological concepts, but it also improves methods of psychological experiments, by providing a new way of priming

participants with certain concepts by using actual physical stimuli and by revealing the effects of environmental factors like temperature in laboratory settings. This area of research should continue to be expanded and applied to real behavioral effects, such as the current study attempted to do with mimicry.

References

- Allport, G.W. (1968). The historical background of modern social psychology. In G. Lindzey & E. Aronson (Eds.), *Handbook of social psychology* (2nd ed., Vol. 1, pp. 1-80). Reading, MA: Addison-Wesley.
- Asch, S.E. (1946). Forming impressions of personality. *The Journal of Abnormal and Social Psychology*, 41(3), 258-290.
- Asch, S. (1958). In R. Taguiri & L. Petrullo (Eds.), *Person Perception and Interpersonal Behavior* (pp. 86-94). Stanford, CA: Stanford University Press.
- Ashton-James, C., van Baaren, R.B., Chartrand, T.L., Decety, J., & Karremans, J. (2007). Mimicry and me: The impact of mimicry on self-construal. *Social Cognition*, 25(4), 518-535.
- Balter, M. (2007). Brain Evolution Studies Go Micro. *Science*, 315(5818), 1208-1211.
- Bargh, J.A. (2006). What have we been priming all these years? On the development, mechanisms, and ecology of nonconscious social behaviour. *European Journal of Social Psychology*, 36, 147-168.
- Bernieri, F.J., & Rosenthal, R. (1991). Interpersonal coordination: Behavior matching and interactional synchrony. In R.S. Feldman & B. Rime (Eds.), *Fundamentals of nonverbal behavior* (pp. 401-432). Cambridge, UK: Cambridge University Press.
- Boroditsky, L., & Ramscar, M. (2002). The role of body and mind in abstract thought. *Psychological Science*, 13, 185-188.
- Bowlby, J. *Attachment and Loss*. London, UK: Hogarth Press.
- Chartrand, T.L., & Bargh, J.A. (1999). Chameleon effect: The perception-behavior link and social interaction. *Journal of Personality and Social Psychology*, 76(6), 893-910.

- Craig, A. D., Chen, K., Bandy, D., & Reiman, E.M. (2000). Thermosensory activation of insular cortex. *Nature Neuroscience*, 3(2), 184-190.
- Davis, K. D., Kwan, C. L., Crawley, A. P., & Mikulis, D. J. (1998). Functional MRI study of thalamic and cortical activations evoked by cutaneous heat, cold, and tactile stimuli. *Journal of Neurophysiology*, 80, 1533-46.
- Eisenberger, N.I., Lieberman, M.D., Williams, K.D. (2003). Does rejection hurt? An fMRI study of social exclusion. *Science*, 302(5643), 290-292.
- Fiske, S.T., Cuddy, A., Glick, P. (2007). Universal dimensions of social cognition: Warmth and competence. *Trends in Cognitive Sciences*. 11(2), 77-83.
- Harlow, H.F. (1958). The nature of love. *American Psychologist*, 13(12), 673-685.
- Harris, L.T., & Fiske, S.T. (2006). Dehumanizing the lowest of the low: Neuroimaging responses to extreme out-groups. *Psychological Science*, 17(10), 847-853.
- Hatfield, E., Cacioppo, J.T., & Rapson, R.L. (1994). *Emotional contagion*. Cambridge, UK: Cambridge University Press.
- IJzerman, H., & Semin, G.R. (2009). The thermometer of social relations. *Psychological Science*, 20(10), 1214-1220.
- Johnson, M. (1987). *The body in the mind: The bodily basis of meaning, imagination, and reasoning*. Chicago, IL: University of Chicago Press.
- Kross, E., Egner, T., Ochsner, K. N., Hirsch, J. & Downey, G. (2007). Neural dynamics of rejection sensitivity. *Journal of Cognitive Neuroscience*, 19(6), 945-956.
- La France, M. (1982). Posture mirroring and rapport. In M. Davis (Ed.), *Interaction rhythms: Periodicity in communicative behavior* (pp. 279-298). New York, NY: Human Sciences Press.

- Lakin, J.L., & Chartrand, T.L. (2003). Using nonconscious behavioral mimicry to create affiliation and rapport. *Psychological Science*, 14(4), 334-339.
- Lakin, J.L., Chartrand, T.L., & Arkin, R.M. (2008). I am too just like you: Nonconscious mimicry as an automatic behavioral response to social exclusion. *Psychological Science*, 19(8), 816-822.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago, IL: University of Chicago Press.
- Leung, A.K.-y., & Cohen, D. (2007). The soft embodiment of culture: Camera angles and motion through time and space. *Psychological Science*, 18, 824–830.
- Mandler, J.M. (1992). How to build a baby: Conceptual Primitives. *Psychological Review*, 99(4), 587-604.
- Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, 98, 224–253.
- Markus, H. R., Mullally, P. R., & Kitayama, S. (1997). Self-ways: Diversity in modes of cultural participation. In U. Neisser & D. Jopling (Eds.), *The conceptual self in context* (pp. 13–61). New York: Cambridge University Press.
- Maurer, R.E., & Tindall, J.H. (1983). Effect of postural congruence on client's perception of counselor empathy. *Journal of Counseling Psychology*, 30, 158-163.
- Niedenthal, P.M., Halberstadt, J.B., & Innes-Ker, A.H. (1999). Emotional response categorization. *Psychological Review*, 106(2), 337-361.
- Sanna, L.J., Chang, E.C., Miceli, P.M., & Lundberg, K.B. (2011). Rising up to higher virtues: Experiencing elevated physical height uplifts prosocial actions. *Journal of Experimental Social Psychology*, 47, 472-476.

- Schefflen, A.E. (1964). The significance of posture in communication systems. *Psychiatry*, 27, 316-331.
- Schubert, T.W. (2005). Your highness: Vertical positions as perceptual symbols of power. *Journal of Personality and Social Psychology*, 89, 1–21.
- Stel, M., & Vonk, R. (2010). Mimicry in social interaction: benefits for mimickers, mimicees, and their interaction. *British Journal of Psychology*, 101, 311-323.
- Sung, E.-J., Yoo, S.-S., Yoon, H.W., Oh, S.-S., Han, Y., & Park, H.W. (2007). Brain activation related to affective dimension during thermal stimulation in humans: A functional magnetic resonance imaging study. *International Journal of Neuroscience*, 117(7), 1011-1027.
- Sweester, E. (1990). *From Etymology to Pragmatics: Metaphorical and Cultural Aspects of Semantic Structure*. New York, NY: Cambridge University Press.
- Talmy, L. (1988). Force dynamics in language and cognition. *Cognitive Science: A Multidisciplinary Journal*, 12(1), 49-100.
- van Baaren, R.B., Holland, R.W., Steenaert, B., & van Knippenberg, A. (2002). Mimicry for money: Behavioral consequences of imitation. *Journal of Experimental Social Psychology*, 39, 393-398.
- van Baaren, R.B., Maddux, W.W., Chartrand, T.L. (2003). It takes two to mimic: Behavioral consequences of self-construals. *Journal of Personality and Social Psychology*, 84(5), 1093-1102.
- van Baaren, R. B., Holland, R. W., Kawakami, K., & van Knippenberg, A. (2004). Mimicry and prosocial behavior. *Psychological Science*, 15, 71–74.

- van Leeuwen, M.L., Veling, H., van Baaren, R.B., & Dijksterhuis, A. (2009). The influence of facial attractiveness on imitation. *Journal of Experimental Social Psychology*, 45, 1295-1298.
- Williams, L.E., & Bargh, J.A. (2008). Experiencing physical warmth promotes interpersonal warmth. *Science*, 322, 606-607.
- Wojciszke, B., Bazinska, R., & Jaworski, M. (1998). On the dominance of moral categories in impression formation. *Personality and Social Psychology Bulletin*. 24(12), 1251-1263.
- Zhong, C.-B., & Liljenquist, K. (2006). Washing away your sins: Threatened morality and physical cleansing. *Science*, 313, 1451-1452.
- Zhong, C.B., & Leonardelli, G.J. (2008). Cold and lonely: Does social exclusion literally feel cold? *Psychological Science*, 19(9), 838-842.

Appendix A

Chameleon Coloring Task



Lisa Herbst
AU art student and creator of
Chameleon, shown on the left.



Appendix B

Instructions for Coloring Task

Now we will test your spatial cognition in two short tests. Please complete this task first, answer the follow-up questions, and then let the experimenter know you have completed the first task. The experimenter will come back into the room and explain the instructions for completing Spatial Cognition Task #2.

Your first task will be to complete a coloring exercise. On the following page you will see a colorful figure created by an AU art student. Below that will be the same figure without the colors filled in. You are asked to color in the colorless figure using the three markers (blue, green, and red) that have been provided for you in this packet. If you do not have any markers in your packet or you have been given the wrong colors, please inform the experimenter now.

You are free to color the figure in however you choose. You have only two restrictions:

- 1) You must use each of the three colors available at least once.
- 2) You must color every segment of the blank figure.

Please ask the experimenter now if you have any questions about what you have been asked to do. If not, please continue on to the task.

Appendix C

Questionnaire Following Coloring Task

Now that you have finished coloring in the figure, we are going to ask you questions about the task. Each question asks you to rate an aspect of the task on a scale of 1 to 9. Please remember there is not right or wrong answer. Simply circle the number that most closely reflects your own opinion of the task. Please answer as honestly as possible. All of your answers are confidential.

1) How difficult was this task to complete?

very easy									very difficult
1	2	3	4	5	6	7	8	9	

2) How difficult were the instructions to understand?

very easy									very difficult
1	2	3	4	5	6	7	8	9	

3) How relaxed were you when completing this task?

very tense									very relaxed
1	2	3	4	5	6	7	8	9	

4) How positive was your mood when completing the task?

very negative									very positive
1	2	3	4	5	6	7	8	9	

5) How much do you like the original art piece?

you do not like it at all									you like it very much
1	2	3	4	5	6	7	8	9	

6) Relative to other people, how frequently do you color or paint outside of this experiment?

never									very frequently
1	2	3	4	5	6	7	8	9	

7) How frequently do you interact with artists in your daily life?

never									very frequently
1	2	3	4	5	6	7	8	9	

8) How friendly do you imagine Lisa Herbst, the art student who created the art piece, to be?

very unfriendly									very friendly
1	2	3	4	5	6	7	8	9	

9) How positively do you think of Lisa's personality?

very negatively

very positively

1 2 3 4 5 6 7 8 9

10) How attractive do you think Lisa is?

very unattractive

very attractive

1 2 3 4 5 6 7 8 9

11) Overall, how much do you like Lisa?

you do not like her at all

you like her very much

1 2 3 4 5 6 7 8 9

12) How talented do you think you are artistically?

very untalented

very talented

1 2 3 4 5 6 7 8 9

13) How much do you enjoy coloring?

you do not enjoy it at all

you enjoy it very much

1 2 3 4 5 6 7 8 9

14) How much do you like your own coloring of the figure?

you do not like it at all

you like it very much

1 2 3 4 5 6 7 8 9

15) Overall, how much did you enjoy completing this task?

you did not enjoy it at all

you enjoyed it very much

1 2 3 4 5 6 7 8 9

Appendix D

Questionnaire Testing for Suspicion

Now we will ask a few questions about the study. Space is provided for you to answer the questions in your own words, but you are not expected to use all of the space provided. You are asked to use complete sentences, but you do not need to write more than one sentence if you feel one sentence fully answers the question.

- 1) What do you think this experiment is about?

- 2) Did anything about the experiment seem unusual or strange to you, or were you suspicious of anything?

- 3) Did you think any of the different tasks were related? (If so, how?)

- 4) What did you think the first spatial cognition task on coloring was measuring? Be as specific as possible?

- 5) How did you decide which colors to use to color in the chameleon?