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Research Article

Warmth and conformity: The effects of ambient temperature on product preferences and financial decisions☆

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Abstract

Comfortable ambient temperatures can influence consumer preferences for conformity. The results of three laboratory experiments suggest that warm (vs. cool) temperatures dispose consumers toward using others' opinions as the basis for product preferences, stock price forecasts, and betting. Warm temperatures increased the participants' perceptions of social closeness to other decision-makers, thus leading them to consider the opinions of those decision-makers to have greater validity. This enhanced validity, in turn, rendered them more likely to conform to the crowd. This effect was confirmed in an analysis of betting behavior at the racetrack over a three-year period. Bets were more likely to converge on the "favorite" (i.e., the majority-endorsed option) when the temperature at the track was warm.

Keywords: Ambient temperature; Conformity; Social closeness; Product choice; Financial decision making

Introduction

The behavior and opinions of others are among the most pervasive determinants of human decision-making. Conformity and dissension, at opposite ends, have been subjects of investigation in psychology since Asch (1946) and are also a concern in economics (Herding; Bikhchandani & Sharma, 2001 for a review). Conformity draws on the proposition that value is conferred by the mainstream position: if the majority has chosen a particular option, then it must be good. In contrast, dissension or non-conformity draws on the opposing proposition that value is a positive function of the minority position: if an option has been adopted by only a few, then it must be good. Both conformity and non-conformity are frequently used tactics in marketing (Hoyer & MacInnis, 2006). For example, Whiskas, a popular cat food brand, relies on the former in its advertising campaign—"Eight out of ten cats prefer it"—whereas Italia Classics, a clothing brand, emphasizes the latter: "For those who prefer to be scene and not herd."

What factors render consumers more or less likely to conform? Previous studies have identified several moderators. For example, Griskevicius et al. (2009) found conformity to increase with the need for self-protection. Fear-eliciting cues (e.g., a crime drama) can activate this need, and thus induce a disposition to follow the crowd. Other personal factors or personality traits, such as the need for uniqueness, reduce the tendency to conform (Snyder & Fromkin, 1977; Tian, Bearden, & Hunter, 2001). Conformity may also be a function of product category. For example, consumers are less likely to display conformity in behaviors that signal their social identity (e.g., hairstyles), whereas they are more likely to follow others in purchasing products that do not have signaling values (e.g., stereos or toothpaste; Berger & Heath, 2007). The influences of these aforementioned factors are often conscious and deliberate.

In this paper, we propose another moderator of conformity, namely, the ambient temperature that consumers experience

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when making a decision. We restrict our consideration to temperatures within a comfortable range, that is, between 61 °F and 77 °F (Anderson, Anderson, Dorr, DeNeve, & Flanagan, 2000; Baker & Cameron, 1996; Baron & Bell, 1976; IJzerman & Semin, 2009), which are more relevant to business settings than more extreme temperatures. We focus on the domains of financial decisions and preferences for non-social products. We predict that within this fairly narrow temperature range, consumers will display greater conformity when it is warm than when it is cool.

From physical warmth to social warmth

The notion that atmospherics play a crucial role in shopping behavior is widely accepted (Bitner, 1992; Eroglu & Machleit, 2008). As suggested by conceptualizations of sensory marketing, background factors that stimulate any of the five senses can have an important influence on consumer decisions (Krishna, 2012). Previous research has identified the effects of ambient scents (Bosmans, 2006; Krishna, Lwin, & Morrin, 2010; Spangenberg, Crowley, & Henderson, 1996), background music (Hui, Dubé, & Chebat, 1997; Morin, Dubé, & Chebat, 2007), and flooring (Meyers-Levy, Zhu, & Jiang, 2010). However, although ambient temperature is an inherent characteristic of the retail and service settings, relatively few studies have investigated its effects in marketing. The majority of research on ambient temperature in service marketing focuses on identifying the range of temperatures at which shoppers are likely to feel comfortable and which are therefore conducive to a pleasant shopping experience (Baker & Cameron, 1996; D'Astous, 2000). With few exceptions (e.g., Cheema & Patrick, 2012; Hong & Sun, 2012), the actual impact of temperature within the comfortable range on consumer behavior has not been examined.

In a different research paradigm, recent studies in psychology have shed light on the potential effects of ambient temperature. Drawing on emerging evidence of the interplay between body and mind, these studies suggest that bodily experience can influence dissimilar, but metaphorically associated, psychological judgments (Barsalou, 2008; Lakoff & Johnson, 1980). According to this view, people experience bodily sensations through direct interaction with the physical world and learn to label them accordingly (e.g., "heavy"). More abstract psychological concepts (e.g., "importance"), whose referents cannot be seen or touched, are later given meaning by metaphorically mapping them onto a physical experience. Well-established metaphors can thus be tied to the source domain of physical experience, thereby unconsciously influencing the target domain of psychological judgment upon activation (Ackerman, Nocera, & Bargh, 2010).

More relevant to the current research is the association between physical warmth and social warmth that some researchers have documented (IJzerman & Semin, 2009; 2010; Steinmetz & Mussweiler, 2011). For example, Williams and Bargh (2008) found that people judge strangers to be friendlier when holding a warm cup. IJzerman and Semin (2009) found that a high ambient temperature leads individuals to perceive themselves as socially closer to another person, whereas a low ambient temperature leads to perceptions of greater social distance.

Our prediction: from physical warmth to conformity

These findings on temperature's effects on judgment are intriguing, yet they do not necessarily have implications for the effects of ambient temperature on conformity in the studies we report. Our prediction is based on two considerations. First, prior studies focus on people's judgment of a *particular* individual. This effect appears to hold regardless of whether the target individual is a total stranger, someone the participant knows well, or the experimenter (IJzerman & Semin, 2009; Williams & Bargh, 2008). The implication is that temperature's effects may influence the way in which individuals perceive their social world *in general*. That is, warm temperatures (relative to cool temperatures) appear to blur the perceived boundaries between an individual and all salient others, creating a sense of social similarity, closeness (IJzerman & Semin, 2010), and "oneness" (Heider, 1958). To this extent, we predict that the incidental experience of temperature, that is, physical warmth, can increase consumers' perceptions of their closeness to other decision-makers in general, regardless of the nature of those decision-makers.

Second, conformity can occur for two reasons: normative and informative. Past research on the association between physical temperature and social temperature has primarily focused on affiliation-based judgments, such as friendliness, loneliness, helping, or a liking for romantic movies (Hong & Sun, 2012; Williams & Bargh, 2008; Zhong & Leonardelli, 2008). The implication of these studies may be that physical warmth leads individuals to adopt others' opinions for *normative* reasons, as such a conformity to closer others facilitates social affiliation (Baumeister & Leary, 1995) and helps to avoid social disapproval (Wyer, 1966).

However, in the contexts that we examined—financial decision-making and purchases of non-social products—the influences are more likely to be *informational* (monetary payoffs or accuracy). In these contexts, people follow others' opinions when they believe that the information held by others is valid. Any empirical evidence that warm (vs. cool) temperatures lead to this kind of conformity would be interesting.

Previous research has identified a number of determinants of perceived validity. For example, a piece of information is perceived as high (vs. low) in validity when it is delivered by a high (vs. low) credibility source (Kaufman, Stasson, & Hart, 1999). The mere repetition of exposures to a piece of information can also enhance its perceived validity (Hawkins, Hoch, & Meyers-Levy, 2001). Furthermore, people with a disposition to think concretely (vs. abstractly) are more likely to believe that the statements they read are valid (Wright et al., 2012). These statements include marketing claims (e.g., "Burt's Bee is made from all natural ingredients and is more effective than other leading brands.").

In the case we are investigating, we predict that temperature is another factor that influences the perceived validity of others' opinions. This is because people would be more likely to rely on close others' opinions as a reference standard (Mussweiler, 2003), to believe that these opinions are valid (Naylor, Lamberton, & Norton, 2011) and persuasive (Wood, Kallgren, & Preisler, 1985), and to adopt these opinions as a valuable source of information

(Wyer, 1966). If this is so, and if the experience of physical warmth induces feelings of closeness to other decision-makers in general, it should increase perceptions of the validity of these decision-makers' opinions. This enhanced validity would then increase the likelihood that people incorporate others' opinions to form their own.

We performed three laboratory studies to investigate this prediction. Consistent with prior research, conformity in these studies was captured by the extent to which participants adopted the majority-endorsed option (e.g., Berger & Heath, 2007). Study 1 investigated participants' preferences for a number of products in a consumer survey, and found evidence that such an effect was driven by perceptions of social closeness. It also called into question an alternative interpretation of our findings in terms of cognitive resource depletion. Study 2 examined the effects of ambient temperature on participants' stock price forecasting. Study 3 went further to investigate the effects on betting behavior in a hypothetical horse racing situation and provided further evidence of the underlying mechanism. Specifically, we found the feelings of social closeness induced by warm temperatures to lead participants to perceive the opinions of other decision-makers as being more valid, relative to their counterparts exposed to cool temperatures. Such an effect, in turn, led to greater conformity. Finally, our laboratory findings were supported by an analysis of actual betting behavior at the racetrack over a three-year period.

Study 1: product preference

Two sub-experiments examined the effect of ambient temperature on conformity to others' product preferences and its contingency on resource depletion (Cheema & Patrick, 2012). In Study 1a, participants were told that the majority of others in the same decision context had chosen a particular product and that their purchase intentions had been measured. In Study 1b, participants were given information about the relative market share of three products and then asked to indicate their own choice. The results of the two sub-experiments were very similar.

Study 1a

Method. Eighty-one undergraduate students participated in Study 1a in exchange for a payment of approximately US\$5. They were randomly assigned to conditions in a 2 (temperature: warm vs. cool) × 2 (depletion: low vs. high) between-subjects design. Participants were seated in a room in which the temperature was either warm (75–77 °F/24–25 °C) or cool (61–63 °F/16–17 °C). Both temperatures fall within the comfortable range and are comparable to those employed in other studies (Anderson et al., 2000; Baker & Cameron, 1996; Baron & Bell, 1976; IJzerman & Semin, 2009).

To manipulate resource depletion, we used a procedure employed by other researchers (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Wan, Rucker, Tormala, & Clarkson, 2010). That is, participants were told that the study's objective was to check college students' reading skills. They were required to cross off letters on a page of text from a graduate statistics textbook. Participants in the *low-depletion* conditions were asked to simply scan the text and cross off all instances of the letter "e." Those in the *high-depletion* conditions, however, were asked to cross off all instances of the letter "e" in which it was neither adjacent to nor one letter away from another vowel.

Then, as part of an ostensibly unrelated experiment, participants were asked to imagine that they were considering buying a remote control for their television. On this pretense, they were asked to imagine two products, one of which (A) was preferred by 65% of their fellow students and the other of which (B) was preferred by 35%. Participants were asked to indicate their purchase intentions on a scale ranging from 1 (definitely A) to 9 (definitely B). The ratings were reverse-coded prior to analysis, with high values indicating stronger intentions to purchase the product preferred by the majority.

The participants were then asked to report their perceived social closeness to other decision-makers using the Inclusion of Other in the Self Scale (IOS) (Aron, Aron, & Smollan, 1992). They were given nine sets of overlapping circles and asked to indicate the set that best described how close they felt to other students facing the same decision. The greater the overlap, the higher the degree of perceived social closeness. Prior studies on the effect of temperature have used this scale as a measure of social closeness (IJzerman & Semin, 2009), and its psychometric properties match or exceed those of other measures of interpersonal closeness (Aron et al., 1992).

Finally, the participants were asked to report how tired they felt after performing the depletion task on a scale ranging from 0 (not at all) to 10 (very much) and to judge the temperature of the room on a scale ranging from 1 (very low) to 9 (very high).

Results. The participants reported the temperature to be higher when the room was warm ($M = 6.16$) than when it was cool ($M = 3.57$; $F(1,79) = 134.47$, $p < .001$). Moreover, they felt more tired in the high-depletion condition ($M = 7.88$) than in the low-depletion ($M = 6.95$) condition ($F(1,77) = 7.66$, $p < .01$); this difference did not depend on whether the temperature was warm (8.04 vs. 6.95, respectively) or cool (7.65 vs. 6.95, respectively). Neither the effect of temperature nor its interaction with depletion was significant (ps > .50).

Analysis of participants' purchase intentions as a function of temperature and depletion condition yielded only the main effect of ambient temperature ($F(1,77) = 7.33$, $p < .01$). Specifically, the participants reported a greater intention to purchase the option preferred by the majority when the temperature was warm ($M = 6.77$) than when it was cool ($M = 6.11$), and this finding held regardless of whether they were in the high- (6.70 vs. 6.06, respectively; $F(1,77) = 3.22$, $p = .07$) or low-depletion condition (6.85 vs. 6.14, respectively; $F(1,77) = 4.16$, $p < .05$). None of the effects involving resource depletion was significant (ps > .60).

As expected, the participants in the warm temperature condition ($M = 4.72$) reported feeling closer to other decision-makers than those in the cool condition ($M = 3.68$; $F(1,79) = 6.94$, $p < .05$). To examine the mediating effect of social closeness on ambient temperature's influence on the purchase intention, we coded the warm and cool conditions as 1 and 0, respectively. The bootstrapping (Hayes, 2013; Zhao, Lynch, &

Chen, 2010) results showed that participants' perceptions of social closeness to others mediated temperature's positive effect on conformity (based on 5000 samples), with a 95% confidence interval (.0022, .3356), excluding 0.

Study 1b

Method. Seventy-six undergraduate students participated in this experiment in exchange for course credit. They were randomly assigned to conditions in a 2 (temperature: warm vs. cool) × 2 (depletion: low vs. high) between-subjects design. The temperatures and depletion were manipulated in the same manner as in Study 1a.

After the depletion manipulation, the participants were asked to perform an ostensibly unrelated shopping task. They were presented with a pair of products in three product categories: a sofa, a bicycle, and a handheld GPS device. They were told that two options were available in the local market for each product, and provided with the relative market share of each option. For the sofa, product A enjoyed a 71% share of the market and product B a 29% share. For the bicycle, the respective shares of products A and B were 27% and 73%, and those for the handheld GPS device were 68% and 32%. The participants were asked to indicate their choice in each product category, and also to report how tired they were and estimate the temperature of the room, as in Study 1a.

Results. Participants again judged the temperature to be higher when the room was warm ($M = 5.40$) rather than cool ($M = 4.30$; $F(1,74) = 18.55, p < .001$). Those in the high-depletion condition ($M = 6.44$) also reported feeling more tired than their counterparts in the low-depletion condition ($M = 4.63$; $F(1,72) = 13.47$, $p < .001$), regardless of whether the ambient temperature was warm ($M = 6.31$ vs. 4.00, respectively) or cool ($M = 6.58$ vs. 5.25, respectively). Neither temperature nor its interaction with depletion had a significant effect (ps > .10).

The number of conformity-based options that participants chose was analyzed as a function of ambient temperature and depletion condition. A significant effect was found only for ambient temperature ($F(1,72) = 10.02, p < .01$). That is, participants chose more conformity-based options when the temperature was warm ($M = 2.93$) than when it was cool ($M = 2.34$), and this difference was virtually identical in the high- ($M = 2.92$ vs. 2.27, respectively) and low-depletion conditions ($M = 2.94$ vs. 2.40, respectively).

The results were similar across the three product categories: sofa (high-depletion: 92% vs. 65%, $\chi^2 = 3.30$, $p = .07$; low-depletion: 94% vs. 70%, $\chi^2 = 3.48$, $p = .06$), bicycle (high-depletion: 100% vs. 73%, $\chi^2 = 4.27$, $p < .05$; low-depletion: 100% vs. 80%, $\chi^2 = 3.81$, $p = .05$), and handheld GPS device (high-depletion: 100% vs. 88%, $\chi^2 = 1.63$, $p = .20$; low-depletion: 100% vs. 90%, $\chi^2 = 1.78$, $p = .18$). Although the differences in choice were not significant for the handheld GPS device, there was no evidence that temperature had significant effects on the three products. Repeated-measures analysis using the three product choices as the within factor and temperature and depletion as the between factors produced support that product category had no interactive influence on the other factors. Only the main effects of temperature ($p < .01$) and product category ($p < .01$) were observed. No other effects were found (ps > .20).

In summary, using two different dependent variables (purchase intention and choice) and four product categories, Studies 1a and 1b provided converging evidence showing that warm temperatures increase conformity. In addition, temperature's effects cannot be attributed to cognitive resource depletion.

Study 2: stock price forecasting

We carried out a second study to investigate our prediction in a financial context. Participants were asked to predict an increase or decrease in stock prices under conditions in which they would receive a monetary reward if their predictions were accurate. We expected participants to conform to others' predictions to a greater extent when the temperature was warm than when it was cool.

Method

Ninety-seven MBA students were randomly assigned to one of four conditions in a 2 (temperature: warm vs. cool) × 2 (others' decisions: present vs. control) between-subjects design. Temperature was manipulated in the manner described in Study 1. Participants were told that they were participating in a study on stock forecasting. The procedure that we employed was similar to that in other studies in behavioral finance (Asparouhova, Hertzel, & Lemmon, 2009; Bloomfield & Hales, 2002). Specifically, the participants were given six graphs, each depicting changes in the price of a stock over eight time periods, and asked to indicate whether they should buy or *sell* each stock to make a profit in the next period. They were told that if they expected the price to rise in the next period they should buy, whereas if they expected it to decline they should sell. Three of the six sequences were randomly generated by a computer, and the other three were mirror images of the first three.

Participants in the condition with others' decisions available were told that the same experiment had been conducted in an earlier session and, on the basis of this pretense, were shown the majority predictions for each stock. Others had predicted three of the stocks to increase in price and three to decrease. In the control condition, this information was not provided. To give participants a financial incentive to make correct decisions, they were told that the real outcomes would be disclosed at the end of the experiment and that those with more than four correct predictions would receive a prize of approximately US$13.

After indicating their decision to buy or sell each of the six stocks, participants were asked to report how they had felt while performing the task. More specifically, they were asked to complete a 20-item positive and negative affect scale (Watson, Clark, & Tellegen, 1988) and to answer questions concerning their degree of comfort, involvement, relaxation, tiredness, and arousal. All questions were answered on a scale ranging from 1 (not at all) to 9 (very much). They were also asked to judge the temperature of the room, as in Study 1.

Finally, participants were shown the ostensibly real performance of the stocks in the next period, which had in fact been randomly generated by a computer. If their answers matched the "real" performance, they were counted as correct responses. Participants were paid according to their number of ostensibly correct predictions.

Results

The participants again perceived the temperature to be higher when the room was warm (M = 5.78) rather than cool (M = 3.10; $F(1,95)$ = 113.16, p < .001).

Each participant's predictions were compared to those allegedly made by the majority of previous participants. The number of times that each participant chose to buy or sell in conformity with the majority predictions was computed, regardless of whether participants had been informed of others' decisions. Thus, in the control condition, the number of matches was determined by chance.

Table 1 shows the number of times that participants' decisions matched those of others as a function of temperature and others' decisions. Only the interaction of these variables was significant ($F(1,93)$ = 9.46, p < .01) and of the form predicted. When participants had access to others' decisions, their predictions were more likely to conform to those decisions when the temperature was warm rather than cool (M = 3.55 vs. 2.28, respectively; $F(1,93)$ = 11.57, p < .001). Both means were also significantly different from chance, that is, 3 (ps < .05). In the control condition, that is, in the absence of others' decisions, however, the difference between participants' predictions in the warm (M = 2.67) and cool temperature conditions (M = 3.00) became small and insignificant (F < 1), and neither mean differed from chance (ps > .20).

The aforementioned effects were not found to result from other factors. Ambient temperature had no effect on positive affect (M_{warm} = 5.51 vs. M_{cool} = 5.79), negative affect (M_{warm} = 2.35 vs. M_{cool} = 2.02), or comfort (M_{warm} = 5.67 vs. M_{cool} = 5.73), and no differences were observed in involvement (M_{warm} = 7.15 vs. M_{cool} = 7.37), relaxation (M_{warm} = 6.54 vs. M_{cool} = 7.10), tiredness (M_{warm} = 3.87 vs. M_{cool} = 3.45), or arousal (M_{warm} = 5.11 vs. M_{cool} = 5.04; all ps > .10).

In summary, the participants in Study 2 were more likely to follow the majority in stock price forecasting when the ambient temperature was comfortably warm rather than comfortably cool. This effect was not a function of affect or comfort. Furthermore, the failure of ambient temperature to exert an influence on other factors (e.g., tiredness and involvement) provides further evidence to show that resource depletion was not an important contributor to the effects we observed.

Table 1
Study 2: stock forecast as a function of temperature and others' decisions.

	Cool temperature	Warm temperature
Others' decisions present	2.28 (1.24)^{a}	3.55 (1.22)^{b}
Control	3.00 (1.26)^{bc}	2.67 (1.37)^{ac}

Note: Standard deviations are provided in parentheses. Cells with unlike superscripts differ at p < .05.

Study 3: betting on the horses

Study 3 extended the effects of Study 2 to another decision context: horse racing. Horse racing is often used to shed light on behavior in wider financial markets (Asch, Malkiel, & Quandt, 1984; Snyder, 1978). The extension of our findings to this domain was therefore expected to increase their generalizability. This study differed from the previous two in two ways. First, it sought to provide support for the processes we assumed to mediate temperature's effects in this domain. We predicted that a warm ambient temperature would induce feelings of social closeness to other bettors and that these feelings would in turn enhance the perceived validity of those bettors' opinions. We obtained data that permitted this assumption to be evaluated.

Second, we measured participants' risk propensity to explore its potential influence on the effects examined thus far. Attitudes toward risk are commonly examined as a factor in financial decisions (Hirshleifer & Shumway, 2003). If the ambient temperature can change a personal factor such as risk attitude, then it is possible that a warm temperature may lead to a greater preference for a majority-endorsed option owing to a lower risk-taking propensity.

Method

Fifty-two undergraduates participated in exchange for course credit. They were randomly assigned to warm and cool temperature conditions. Ambient temperature was manipulated in the same way as in the previous studies. Upon arrival, the participants were told to imagine that they were at the racetrack and had an opportunity to place bets in seven races, and were provided with information on the horse racing procedure and betting concepts. It was made clear to them that the odds of a particular horse winning were dependent on the amount of money that had been bet on it. Hence, the more money bet on a given horse, the lower its odds. Accordingly, betting on the horse with the lowest odds (called the "favorite" in horse race betting) would reflect conformity with the majority.

The participants were given information on seven races that had recently taken place at a local racetrack. They were shown the winning odds of each of the 14 horses competing in each race and asked to indicate which they would like to bet on in each race. To provide a financial incentive for making the correct decision, participants were told that the three participants who made the most money would receive an extra prize of approximately US$13.

After placing their bets, the participants were asked to report their perceptions of the other bettors. More specifically, they answered three questions concerning the extent to which they believed that others' bets were likely to be *valid* (i.e., "To what extent did you believe that others' bets were likely to be correct?", "To what extent did you believe that other bettors had knowledge about the quality of the horses they bet on?", and "To what extent did you trust other bettors' decisions?"). They also answered three questions pertaining to their *liking* of the other bettors (i.e., "How much do you think you would like other bettors at the track if you got to know them?", "How much do you think you would care for other bettors at the

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track?", and "How much do you think you would become attached to other bettors at the track?"). All of the questions were answered on a scale ranging from 1 (not at all) to 9 (very much). The participants were also asked to indicate their perceived social closeness to the other bettors using the IOS scale used in Study 1a.

The participants then completed the gambling and investment subscales of the risk attitude measure constructed by Weber, Blais, and Betz (2002), which is often used to assess risk attitudes in financial contexts (Goldstein, Johnson, & Sharpe, 2008). This subscale includes eight questions on various gambling/investment scenarios (e.g., "gambling a week's income at a casino"). In each case, participants estimated how risky the situation or behavior described was. They were also asked to report their positive affect and negative affect and degree of comfort, involvement, relaxation, tiredness, and arousal, as in Study 2. Finally, the participants estimated the temperature of the room, as in the other studies. The actual outcome of each race was then announced, and the three winning participants were rewarded.

Results

As in the other studies, the participants judged the temperature to be higher when the room was warm ($M = 5.10$) rather than cool ($M = 3.78$; $F(1,50) = 14.61$, $p < .001$).

The number of times that each participant bet on the favorite was analyzed as a function of temperature. Thus, higher scores indicated a greater preference for conformity. As expected, participants were more likely to bet on the favorite when the temperature was warm ($M = 2.48$) rather than cool ($M = 1.26$; $F(1,50) = 5.33$, $p < .05$).

Their responses to the three items concerning the perceived validity of other bettors' opinions and the three items of liking for other bettors were averaged (αs > .70) to form a single index of each characteristic. As expected, the warm participants viewed others' bets to be more valid than did the cool participants ($M = 5.47$ vs. 4.64, respectively; $F(1,50) = 4.73$, $p < .05$) and they also liked the other bettors more ($M = 5.44$ vs. 4.62, respectively; $F(1,50) = 5.29$, $p < .05$). Finally, the participants in the warm room had greater feelings of social closeness than their counterparts in the cool room ($M = 5.24$ vs. 4.09; $F(1,50) = 5.43$, $p < .05$).

Mediation analyses. To determine the mediating effects of these variables, we coded the warm and cool conditions as 1 and 0, respectively, and examined the mediating role of social closeness, perceived validity, and liking. A model with a set of mediators including social closeness, perceived validity, and liking was run by bootstrapping method (Hayes, 2013; Zhao et al., 2010; based on 5000 samples). These three potential mediators were entered in the model simultaneously and the results of each were reported below. Specifically, consistent with the results of Study 1a, the perception of social closeness to other bettors mediated temperature's positive effect on conformity, with a 95% confidence interval (.1676, 1.3070), excluding 0. Perceptions of the validity of others' bets were also found to mediate temperature's positive effect on conformity, with a 95% confidence interval (.0974, 1.2538), excluding 0. However, liking for other bettors did not, with a 95% confidence interval (−.0588, 1.0726), including 0. Fig. 1 shows the meditational analyses of social closeness and perceived validity, respectively. The coefficients and associated standard errors are clearly labeled.

A sequential mediation analysis then examined the implications of these analyses. That is, we assumed that ambient temperature affected perceptions of social closeness and that these perceptions, in turn, influenced beliefs that others' opinions were valid. The bootstrapping results provided support for this assumption: ambient temperature → social closeness → perceived validity of others' bets → conformity (based on 5000 samples), with a 90% confidence interval (.0011, .2627), excluding 0. Although its marginal significance suggests that the sequential mediation of social closeness and perceived validity be treated with a degree of caution, its implications are consistent with our theoretical assumptions. In contrast, when the liking for other bettors was substituted for the perceived validity of others' bets, this was no longer the case (based on 5000 samples), with a 90% confidence interval (−.0369, .1418), including 0.

Other factors. Consistent with the findings of Study 2, ambient temperature was found to have no effect on positive affect ($M_{warm} = 4.71$ vs. $M_{cool} = 4.36$), negative affect ($M_{warm} = 2.40$ vs. $M_{cool} = 2.34$), or comfort ($M_{warm} = 6.00$ vs. $M_{cool} = 5.65$). Moreover, no differences were observed in involvement ($M_{warm} = 6.93$ vs. $M_{cool} = 6.61$), relaxation ($M_{warm} = 6.41$ vs. $M_{cool} = 6.43$), tiredness ($M_{warm} = 4.41$vs. $M_{cool} = 4.35$), or arousal ($M_{warm} = 4.24$ vs. $M_{cool} = 3.57$; all $ps > .20$). In addition, ambient temperature did not change participants' risk-taking propensity, with the difference in risk attitudes across temperature conditions small and non-significant ($M_{warm} = 2.99$ vs. $M_{cool} = 3.09$, respectively; $p > .50$).

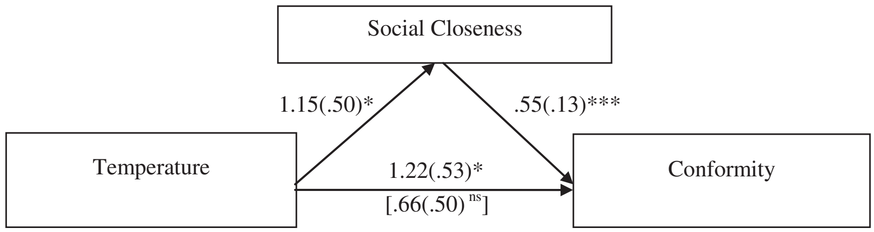
Discussion

Study 3 provided further evidence of temperature's influence on conformity in horse race betting, and showed it to be mediated by feelings of social closeness and the perceptions that others' judgments were valid. However, although warm temperatures were also found to lead to greater liking for others, liking was not a reliable mediator of conformity. The final study provided support for these effects in a natural environment.

Study 4: analysis of actual horse race betting data

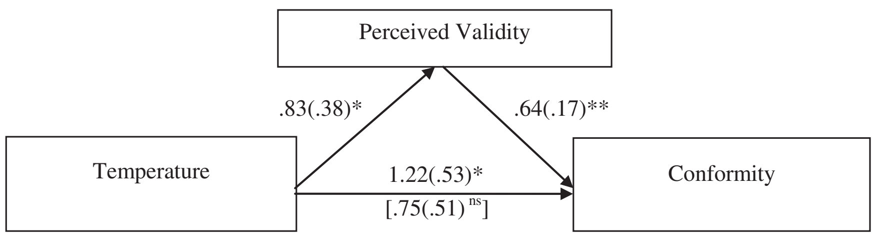
The ambient temperature effects observed in a laboratory setting justified their further examination in a natural environment. Horse racing in Hong Kong provided an ideal situation in which to evaluate our predictions. First, bettors at a racetrack are obviously invested in winning and motivated to make correct predictions. Second, the temperature on horse racing days in Hong Kong is comfortable (races are not held during the hot summer or bad weather days). The races on any given date were held either in the daytime (between 1:00 pm and 6:00 pm) or in the evening (between 7:15 pm and 11:00 pm) but never both.

A) Mediation Analysis in Study 3 (Social Closeness as Mediator)



Note: Unstandardized coefficients with associated standard errors in parentheses are reported. The unstandardized coefficient in brackets indicates the effect of Temperature on Conformity after the inclusion of Social Closeness.
* significant at the .05 level; *** significant at the .001 level.

B) Mediation Analysis in Study 3 (Perceived Validity as Mediator)



Note: Unstandardized coefficients with associated standard errors in parentheses are reported. The unstandardized coefficient in brackets indicates the effect of Temperature on Conformity after the inclusion of Perceived Validity.
* significant at the .05 level; ** significant at the .01 level.

Fig. 1. A: Mediation analysis in Study 3 (social closeness as mediator). B: Mediation analysis in study 3 (perceived validity as mediator).

Method

We tracked people's betting behavior at horse races for three consecutive years, from 2007 to 2009 (for a total of 224 racing days). Racing data were collected from the Hong Kong Horse Racing Database and temperature data from the Hong Kong Observatory. The odds of each horse winning are updated continuously in the hour prior to each race on a board that is prominently displayed at the track. These odds are determined by the relative amount of money bet on each horse. Thus, the horse on which the most money has been bet, i.e., the favorite, has the lowest odds. In other words, the favorite is the majority-endorsed option. The temperatures during the hours in which the races were run on each day were averaged to provide a temperature index for that day.

We used two methods to operationalize temperatures. The average temperature during the hours in which races were run on each day was averaged to provide an index of the temperature on that day. In addition, we used daytime versus nighttime as a proxy for high versus low temperatures, respectively. The average temperature during the daytime races was indeed much higher than that during the nighttime races (M = 77.27 °F [25.15 °C] versus 72.77 °F [22.65 °C]), respectively; $F(1,222) = 12.04$, $p < .001$).

Results

We also used two methods to analyze the tendency of individual bets to converge on a particular horse. In the first, we subtracted the favorite's odds at race time from its odds 1 h before the race to indicate the change in bettors' disposition to put money on the favorite (and thus their disposition to conform to other bettors' preferences). The difference, averaged over the races on each day, was correlated at .20 ($N = 204$, $p < .01$) with the mean temperature on that day, controlling for the total betting amount (there were 20 days on which the horse's odds 1 before were not available). Thus, as the temperature increased, more people preferred to bet on the favorite, leading to a greater reduction in its odds. Moreover, a comparison of daytime and nighttime races showed consistent results. That is, the mean decrease in odds was significantly greater during the daytime (M = 0.45) than at night (M = 0.23; $F(1,202) = 31.01$, $p < .001$).

The second method was based on the assumption that if bets converge on the favorite, its odds of winning should be lower than those of other horses, and thus the distribution of odds over the horses in the race should have a high standard deviation. If, in contrast, a race has no clear favorite(s), bets should be more evenly distributed over the horses, and the

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standard deviation should thus be relatively low. We therefore computed the standard deviation of the final odds for all horses in each race (–horses) and averaged it over the races run on a particular day. As we predicted, this index was correlated at .11 ($N = 224$, $p < .05$) with the mean temperature on each day, controlling for the total amount bet. Moreover, a comparison of daytime and nighttime races provided converging evidence: the mean standard deviation was significantly higher for the daytime races ($M = 26.56$) than for the nighttime races ($M = 19.68$; $F(1,222) = 167.13$, $p < .001$).

Discussion

The results of these field data, using the two aforementioned indicators of conformity and two methods of inferring differences in temperature, supported our prediction. It is worthy of note that the races on any given date were held either in the daytime or in the evening but never both. However, it is nonetheless possible that the race order had an effect within a racing period. That is, as the racing on a particular day approaches to the end, bettors might have lost money and become more likely to bet on the long shot. To examine the potential influence of order effect, we coded the races on a given day from 1 to N (either 7 or 10, depending on the number of races), thus treating each race as an individual data point. After controlling for race order and the total amount bet, the predicted patterns still held. Specifically, the correlation between temperature and the two conformity indicators remained significant: with the change in odds ($r = .05$; N = 1835, $p < .05$) and with the standard deviation index ($r = .07$; N = 2050, $p < .01$). Although these correlations are lower than in the original analyses, this is probably due to the fact that temperatures didn't vary much over the course of the day, so their correlations with the conformity indices were necessarily low.

General discussion

The results of three laboratory experiments and a field study confirm our main hypothesis that consumer preferences for conformity are influenced by the ambient temperature they happen to be experiencing. In Studies 1a and 1b, warm temperatures increased the participants' preferences for products endorsed by the majority, and the effect was mediated by feelings of closeness to other decision-makers. These studies also showed that these effects cannot be attributed to temperature's effect on the cognitive resources available. The results of Study 2 showed that being in a warm (vs. cool) room led to conformity to others' stock price forecasts. Study 3 examined the effects of ambient temperature on betting in a laboratory horse racing situation, and showed that its effects on conformity in this condition were mediated by its influence on feelings of social closeness and the consequent effects of those feelings on perceptions of the validity of others' judgments. Finally, analysis of actual betting behavior at the Hong Kong racetrack produced findings consistent with our prediction: bettors were more likely to converge on the favorite (the majority-endorsed option) when the temperature at the track was warmer.

Temperature effects: assimilative or compensatory?

Our results should be considered in the context of a set of recent studies. For example, Hong and Sun (2012) found that consumers' desire to watch a romantic movie was stronger when they felt *cold*. With respect to our work, a reasonable question is why physical warmth did not weaken the desire for social warmth, thereby decreasing (rather than increasing) participants' conformity. A related question is then this: when do physical temperatures lead to a compensatory effect (i.e., physical coldness enhances social closeness), and when do physical temperatures lead to an assimilative effect (i.e., physical warmth enhances social closeness)?

We have two thoughts. First, a distinction should be made between the *motivation to seek physical warmth* (as in Hong and Sun's (2012) research) and the *consequences of experiencing warmth* (as investigated in our research). Low ambient temperatures may decrease feelings of social closeness (as our research suggests) and thus may increase the desire for it. Correspondingly, high temperatures may make individuals feel close to others and thus may decrease the desire for closeness.

In fact, the difference between temperature's effects on the desire for closeness and its effects on perceptions of closeness is suggested by Hong and Sun's own findings. That is, they found that although participants who experienced warm temperatures had less desire to watch a romantic movie, they perceived that movie to be more "heartwarming" (Hong & Sun, 2012, p. 304). This result is consistent with our finding that those who experience warm temperatures feel close to others and judgment stimuli that exemplify these feelings.

Second, product category matters. The compensatory effects that Hong and Sun (2012) demonstrated may be restricted to the decision domains they investigated, that is, romantic movies, as the consumption of which is a means to satisfy the desire for warmth. They observed no such effects for other film genres, such as action or drama, and no such effects on the participants who did not believe that watching a romantic movie would give them a warm feeling.

Bargh and Shalev (2012) reported a similar compensatory effect. Specifically, they found taking a warm bath to be associated with warm feelings, particularly among those reporting loneliness. Therefore, although the desire for warmth and actual feelings of warmth may theoretically have conflicting implications, this conflict may not be evident when features of the situation are not relevant to the satisfaction of the desire, as was the case in our research.

Theoretical and managerial implications

This research complements previous studies providing evidence of the effects of physical warmth on subsequent social judgments (IJzerman & Semin, 2009; Williams & Bargh, 2008). We found the feelings of social closeness induced by warm temperatures not to be restricted to a specific social target. Rather, they applied to general groups of individuals about whom the participants had no direct knowledge. In addition, such feelings can lead to the opinions of others being generally perceived as valid and can encourage individuals to rely on those opinions when forming their own.

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Our findings call into question other interpretations of the effect of ambient temperature. For example, if temperatures differ in the affect they elicit, then their influence on judgment and behavior may occur for the reasons suggested by Schwarz and Clore (2007). That is, people often confuse their feelings about a stimulus that they are judging with the positive or negative affect they are experiencing for something else (e.g., temperature), and then use that affect to judge the stimulus. However, our manipulations of ambient temperature had no influence on the affect that the participants reported experiencing, which suggests that affect was not an important contributor to our results.

As previously noted, warm temperatures can sometimes deplete cognitive resources (Cheema & Patrick, 2012), and thus might lead consumers to adopt a heuristic basis for judgment (e.g., following others' opinions). Considered in isolation, the results of Studies 2 and 3 could be attributed to this tendency. However, ambient temperatures did not influence such self-reported factors as tiredness and involvement. Furthermore, Study 1, in which cognitive resources were manipulated experimentally, showed no evidence of a depletion-based explanation. Thus, although the resource-based account cannot be completely discounted in our studies, we do not believe that it was a major contributor to our results.

Finally, our evidence showing that comfortably warm or cool ambient temperatures influence the disposition to adopt others' opinions has implications for marketing strategies. For example, relative speaking, warm in-store temperatures may be more effective for promotion appeals that describe a product as "chosen by millions," "a best seller," "in turn with the trend," "particularly popular," or "adopted by the majority." Correspondingly, cool in-store temperatures may be more effective for assertions that a product is "distinctive," "rare or scare," "individually customized," or "one of a kind." Practitioners in the stock market, auction, gambling, and charity arenas may also find ambient temperature to be a useful tool for managing people's tendency to herd. For example, investors may be more likely to imitate other investors' decisions in a trading room with a relatively higher ambient temperature. These and other implications are worthy of further investigation.

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