Abstract

Are romance movies more desirable when people are cold? Building on research on embodied cognition, we hypothesize that physical coldness activates a desire for psychological warmth, which in turn leads to increased liking for romance movies. Three laboratory studies and one study using movie rental data provide support for our hypothesis. Specifically, study 1 shows that physical coldness increases liking of romance movies, but not other genres. Study 2 shows that the effect of physical coldness on liking of romance movies only occurs for people who associate romance movies with psychological warmth. Study 3 examines whether people would correct for the influence of physical coldness on their preference for romance movies when physical coldness is made salient. Finally, in study 4, using a dataset of online movie rentals and historical temperature data, we found a negative relationship between weather temperature and consumption preference for romance movies.
The movie industry is characterized by strong seasonality in viewer demand (Eliashberg, Elberse, and Leenders 2006; Radas and Shugan 1998). For example, in the U.S., the majority of total box office revenues are generated around six major holidays (Foutz and Kadiyali 2006).\(^1\) Past research has examined the strategic implications of the seasonality issue in the movie industry. For example, Krider and Weinberg (1998) examined the tradeoff between maximizing revenue and avoiding competition during peak seasons. Radas and Shugan (1998) proposed a time-transformation method that helps to parsimoniously build seasonality into dynamic models of sales. Einav (2007) found that movie studios strategically plan their most important releases in peak seasons and that the seasonality in demand is amplified by such strategic releases by as much as fifty percent. These studies have shed light on studios’ consideration of seasonality in timing the movie releases, which is one of the most important decisions in the movie industry considering the opening weekend typically accounts for 40%, and the first four weekends 80%, of a movie’s box office (Foutz and Kadiyali 2006).

Two interesting questions emerge from this literature on seasonality in the movie industry: First, prior research has typically examined seasonality in terms of holiday seasons versus off-holidays (e.g., Foutz and Kadiyali 2006, Einav 2007). Interestingly, the impact of an important dimension of seasonality – temperature – on consumers’ movie preference has not been examined, and yet temperature is known to influence people’s behavior (e.g., Anderson 1989). Second, researchers have not distinguished among different genres in examining the seasonality issue. Conceivably, consumers should derive distinct experiences from watching different genres. For example, when watching horror movies, viewers experience both strong positive and negative feelings (Andrade and Cohen 2007). Given the uniqueness in individuals’ cinematic consumption experiences, it is likely that the impact of seasonality on consumers’ movie preference varies as a function of genre.

In this research, we examine the influence of one untapped dimension of seasonality – physical temperature – on consumers’ preference for romance movies. Romance movies represent a major Hollywood genre. According to the-numbers.com (2010), from 1995 to 2010, at least 347 romantic comedies (a subset of romance movies) were released, generating a total box office of $10 billion. Drawing on recent research on embodied cognition, we propose that romance movies, which are associated with psychological warmth, are more desirable when people are physically cold. Results from three laboratory experiments and a study examining online movie rental data provide strong support for our hypothesis. Our findings have a number of practical implications, especially for movie studios who are trying to determine the best movie release times to maximize their revenue.

**THEORETICAL BACKGROUND**

*Physical Coldness Activates the Desire for Psychological Warmth*

Our hypothesis that physical coldness might increase people’s preference for romance movies builds on recent research on embodied cognition (Barsalou 2008; Niedenthal et al. 2005). The embodied cognition theory rests on the assumption that the mind and the body are closely

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\(^1\) The six major holidays are: President’s Day/Valentine’s Day, Memorial Day, Independence Day, Labor Day, Thanksgiving, and Christmas/New Year. The four-week time windows that center around these holidays account for 78% of the annual box office and 86% of the annual production budgets in the U.S. motion picture industry.
related. It posits that cognitive representations are grounded in perceptual processes. The perceptual representations of abstract concepts are developed through schematized bodily experiences associated with these cognitive processes (Barsalou 2008). For example, the concept of *nervous* is stored in memory as a multimodal representation that includes the sensory experience of a dry mouth, a rapid heart beat, and sweating, along with the situations and emotions experienced. The close association between abstract cognitive concepts and concrete bodily experiences can also arise from metaphors used in everyday language (Lakoff and Johnson 1980). For example, affective experience can be associated with the perceptual experience with orientation – “happy is up, sad is down” (Lakoff and Johnson 1980).

Recent research in neuroimaging has offered support for the notion that cognition is grounded in perceptual experience. For example, viewing pictures of appetizing food activates brain areas related to gustatory processing (Simmons, Martin, and Barsalou 2005). Reading odor-related words (e.g., cinnamon) elicits activation in the primary olfactory cortex (González et al. 2006). More interestingly, it has been shown that participants who were made to feel rejected in a computerized game exhibited greater activation in the anterior cingulate cortex, an area also implicated in responding to physical pain (Eisenberger, Lieberman, and Williams 2003). Similarly, pure disgust and moral disgust activate the same brain regions, mainly in the frontal and temporal lobes (Moll et al., 2005). These findings provide strong evidence for an overlap between perceptual and conceptual neural processing systems.

The embodiment hypothesis has also received empirical support from behavioral studies. For example, Jostmann, Lakens, and Schubert (2009) showed that holding a heavy clipboard increased judgments of monetary value and perceptions of decision importance. Zhong and Liljenquist (2006) demonstrated an association between physical cleanliness and moral purity such that participants who recalled unethical behaviors exhibited a higher need for physical cleansing (e.g., an increased likelihood of choosing antiseptic wipes over pencils). Of particular relevance to the current research are the findings on the association between physical warmth (coldness) and psychological warmth (coldness). Williams and Bargh (2008) found that participants who held a cup of hot (vs. iced) coffee perceived a fictitious person as having a warmer personality (i.e., generous, caring, sociable). Consistent with this finding, warmer temperatures have been shown to induce a greater perception of social proximity than colder temperatures (IJzerman and Semin 2009). Along similar lines, Zhong and Leonardelli (2008) demonstrated that social exclusion can lead people to feel physically cold. In one study, they showed that participants who recalled a social exclusion experience estimated the room temperature to be lower than those who recalled an inclusion experience. Indeed, evidence from neuroscience suggests that the insular cortex is involved in processing both psychological and physical warmth information (see Williams and Bargh 2008). We argue that since humans have the basic need to keep themselves warm (Austin and Vancouver 1996), the experience of physical coldness should activate a desire for warmth; and given the close association between physical warmth and psychological warmth, this desire for warmth might manifest itself as a greater desire for psychological warmth.

**Romance and Psychological Warmth**

Romantic love is defined as intimacy and passion (Sternberg 1986). The intimacy component refers to the feelings of bondedness and connectedness in romantic relationships. The passion component refers to the physical attraction in romantic relationships. Romantic love is often metaphorically referred to as warmth in our language. For example, William Shakespeare
describes love as “a fire sparkling in lovers’ eyes.” In a 1970s hit song, Van Morrison wrote, “It’s just warm love, and it’s ever present everywhere.” In another song, Irving Berlin wrote, “my heart’s on fire, the flame grows higher.” The association between romance and psychological warmth may come from the physiological changes associated with being in romantic love. Research examining the physiology of love has documented that when people are in romantic love, they may experience sweaty palms, flushing, increased heart palpatations, and accelerated breathing (Fisher 1998), all of which are associated with a sensory experience of warmth. As Lakoff and Johnson (1999) pointed out, the metaphor “warmth is affection” came about because of our coexperience of the psychological feeling of being affectionately held and the physical sensation of warmth when being held as infants.

Consistent with the view that a feeling of warmth is an integral part of the romantic love experience (Sprecher and Regan 1998), empirical studies have documented that people indeed perceive romantic love as closely related to psychological warmth. For example, Shaver, Morgan, and Wu (1996) proposed that love is accompanied by a distinct feeling of warmth and found that warmth was among the top features of love listed by both American and Chinese participants. Research has also shown that people perceive partner warmth as an ideal quality in intimate relationships (Fletcher, Simpson, Thomas, and Giles 1999). Similarly, Barnes and Sternberg (1997) identified two clusters of love in close relationships: a “hot” cluster of passionate love and a “warm” cluster of companionate love, both of which are important to relationship satisfaction. In a semantic analysis of people’s association with the experience of warmth, Fenko, Schifferstein, and Hekkert (2009) found that love and intimacy were strongly associated with the metaphorical meaning of warmth. Given the strong association between romance and warmth, Aaker, Stayman, and Hagerty (1986) argued that a feeling of warmth could even arise from commercials that depict a relationship of love or physical attraction. If that is the case, then romance movies, which usually depict a full-fledged story of romantic love, should be associated with a feeling of warmth; and thus might be more desirable when people are physically cold.

In sum, building on prior research on embodied cognition, we hypothesize that physical coldness (vs. warmth) should activate a need for psychological warmth and thus should increase consumers’ liking of romance movies. We tested our hypothesis in three laboratory experiments and one analysis of online movie rentals. Study 1 tests our basic hypothesis that physical coldness leads to increased liking for romance movies. Study 2 provides evidence for the underlying mechanism by showing that consumers’ perceived association between romance movies and psychological warmth moderates the basic effect. In study 3, we sought to understand the level at which this effect of physical coldness on liking of romance movies occurs. Specifically, we examined the question of whether people believe at an explicit level that psychological warmth can compensate for physical coldness by making their physical coldness salient. Finally, in study 4, we analyzed a set of data from an online movie rental company to provide external validity to our laboratory findings that physical coldness increases liking for romance movies.

STUDY 1: THE EFFECT OF PHYSICAL COLDNESS ON LIKING OF ROMANCE MOVIES

The objective of study 1 was to examine the hypothesized effect of physical coldness on consumers’ liking of romance movies. We manipulated physical coldness by giving participants a warm or a cold drink. To rule out the possibility that physical coldness may increase liking for
movies in general and not just for romance movies, we also included action, comedy, and thriller movies in the stimuli. A 2 (physical temperature: cold vs. warm) × 4 (genre: romance vs. action vs. comedy vs. thriller) × 3 (replicate within genre) mixed design was employed, with physical temperature as a between-subject factor, and genre and replicate as within-subject factors. We predicted that physical coldness would lead to increased liking for romance movies, but not for other genres.

Method

Procedures. Fifty-three undergraduate students participated in the study in exchange for course credit. Participants were first told that they would be taking part in a drink evaluation study. They were randomly assigned to either the warm or the cold condition. Those in the warm condition were given a cup of hot tea and those in the cold condition were given a cup of iced tea. Participants were told to finish the drink slowly while completing another study on movie preference, which was our main dependent measure.

For the movie preference task, we selected movies from four genres (romance, action, comedy, and thriller) based on the genre categorization used by the Internet Movie Database (IMDb.com). To minimize the influence of participants’ prior impression of the movies, we conducted a pretest with 86 participants from the same population and selected a total of twelve movies (three movies from each genre), all of which were unheard of by at least 80% of the participants.

Then participants were given the information of the movies while drinking the tea. For each movie, participants were first presented with the title, a synopsis, a fictitious viewer rating (ranging from 8.5 to 8.8 out of 10), and the genre of the movie (see Appendix A for sample stimuli). They were then asked to indicate how much they would like to watch the movie and how good they think the movie would be on two seven-point scales (1 = not at all, 7 = very much). The order of the movies presented was randomized. At the end of the movie preference task, participants also reported their liking of each of the genres in general (1 = not at all, 7 = very much).

After participants completed the movie preference task, they were asked to indicate how warm or cold they were on a seven-point scale (1 = very cold, 7 = very warm). This serves as a check for our physical coldness manipulation. Afterwards, participants also indicated their mood on a series of seven-point scales (happy, joyful, excited, sad (reverse coded), depressed (reverse coded), nervous (reverse coded)). Finally, they completed a funneled debriefing (Bargh and Chartrand 2000) and were thanked. None of the participants suspected a connection between the drink study and the moving preference task.

Results

Manipulation Check. We first examined whether our manipulation of physical coldness was successful. A one-way ANOVA showed that participants who drank the iced tea indicated that they felt colder (M = 3.90) than those who drank the hot tea (M = 4.54; F(1, 51) = 6.86, p < 0.05), suggesting that our physical temperature manipulation was successful.

Liking of Romance Movies. We first calculated a liking score for each movie by averaging participants’ ratings on the two scales (rs > .63). A 2 (physical temperature) × 4 (genre) × 3 (replicate) mixed ANOVA on movie liking scores showed no significant physical temperature × genre × replicate interaction (F(6, 306) = 1.13, p > .30). Thus, we calculated a romance genre liking index by averaging the liking scores of the three romance movies, an action genre liking index by averaging the liking scores of the three action movies, a comedy genre
liking index by averaging the liking scores of the three comedy movies, and a thriller genre liking index by averaging the liking scores of the three thriller movies. To test our hypothesis that physical coldness increases liking of romance movies, we conducted a 2 (physical temperature: cold vs. warm) × 4 (genre: romance, action, comedy, thriller) mixed ANOVA on participants’ genre liking indices. The analysis indicated a marginally significant main effect of genre ($F(3, 153) = 2.29, p = .08$). Follow-up contrasts showed that participants indicated more liking of action ($M = 4.63; F(1, 51) = 3.84, p < .06$), comedy ($M = 4.54; F(1, 51) = 3.03, p < .09$), and thriller ($M = 4.62; F(1, 51) = 5.78, p < .05$) than romance movies ($M = 4.22$), and their liking of action, comedy, and thriller movies did not differ ($Fs < 1$). The main effect of temperature was not significant ($F(1, 51) = 1.04, p > .30$).

Importantly, consistent with our hypothesis, the interaction between genre and physical temperature was marginally significant ($F(3, 153) = 2.36, p < .08$). To better understand the interaction effect, we conducted separate ANOVAs to examine the effect of physical temperature on each of the genre liking indices. The results showed that physical coldness led to increased liking of romance movies ($M_{\text{cold}} = 4.57$ vs. $M_{\text{warm}} = 3.80; F(1, 51) = 6.14, p < .05$). However, physical coldness did not affect participants’ liking of action ($M_{\text{cold}} = 4.74$ vs. $M_{\text{warm}} = 4.50, F < 1$), comedy ($M_{\text{cold}} = 4.46$ vs. $M_{\text{warm}} = 4.63, F < 1$), and thriller movies ($M_{\text{cold}} = 4.59$ vs. $M_{\text{warm}} = 4.67, F < 1$). These results provide support for our hypothesis that physical coldness increases people’s liking of romance movies, and not just movies in general.

Mood. To examine whether mood could account for the observed effect, we first ran a one-way ANOVA on participants’ mood index ($\alpha = .77$). The results showed a marginally significant effect of physical temperature on mood such that participants in the cold condition were in a better mood than those in the warm condition ($M_{\text{cold}} = 4.95$ vs. $M_{\text{warm}} = 4.48; F(1, 51) = 3.39, p < .08$). However, a regression analysis indicated that participants’ mood did not predict their liking of romance movies ($\beta = .09, p > .50$). These results suggest that the effect of physical coldness on liking of romance movies was not driven by participants’ mood.

Discussion

The results of study 1 provide initial evidence for our hypothesis that physical coldness increases people’s liking of romance movies; and this pattern was not observed for action, comedy, or thriller movies. Moreover, we showed that this effect cannot be accounted for by differences in mood. In the next study, we sought to shed light on the process underlying the observed effect in study 1.

STUDY 2: THE MODERATING EFFECT OF PERCEIVED ASSOCIATION BETWEEN ROMANCE MOVIES AND PSYCHOLOGICAL WARMTH

Study 2 was designed to examine the mechanism underlying the effect observed in study 1 that physical coldness increases people’s liking of romance movies. We argued that the reason that physical coldness increases liking for romance movies is that when people are physically cold, they would seek psychological warmth to compensate for their physical coldness. To provide evidence for this conjecture, we measured the extent to which people associated romance movies with psychological warmth. Although people in general associate romance movies with

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2 In studies 1-3, we also ran similar analyses with participants’ self-reported general liking of the genre as a covariate and the patterns of the results remained the same.
psychological warmth, there should be individual differences in terms of the extent of this
association. We expected that people’s perceived association between romance movies and
psychological warmth would moderate the effect. Specifically, for participants who associate
romance movies with psychological warmth, physical coldness would lead to increased liking for
romance movies; conversely, for those who do not associate romance movies with psychological
warmth, the effect of physical coldness on liking of romance movies should be attenuated.

Method

Procedures. One hundred and forty undergraduate students participated in the study in
exchange for course credit. They were randomly assigned to one of the experimental conditions.
The procedures were similar as in study 1 except for two changes: First, we included only
romance movies in the movie preference task. Second, after participants indicated their liking of
the movies, they were asked to rate the extent to which romance movies in general make them
feel on a seven-point scale (1 = give me a cold feeling; 7 = give me a warm feeling). This served
as our measure of participants’ perceived association between romance movies and
psychological warmth. None of the participants suspected a connection between the drink study
and the movie preference task in the funneled debriefing.

Results

Manipulation Check. We first checked whether our manipulation of physical coldness
was successful. A one-way ANOVA indicated that participants in the cold condition indeed felt
colder (M = 3.42) than those in the warm condition (M = 4.67; F(1, 138) = 43.41, p < 0.001).

Liking of Romance Movies. We first obtained a liking score for each movie by averaging
participants’ ratings on the two scales (rs > .81). A 2 (temperature) x 3 (replicate) mixed
ANOVA with participants’ perceived association between romance movies and psychological
warmth (mean-centered) in the model as a continuous variable showed no significant three-way
interaction (F < 1). Thus, we averaged the movie liking scores to create a romance genre liking
index. To test the moderating effect of participants’ perceived association between romance
movie and psychological warmth, we conducted a regression analysis with physical temperature
(-1 = cold, 1 = warm), participants’ perceived association between romance movies and
psychological warmth (mean-centered), and the interaction term between these two factors in the
model to predict their liking of romance movies. The analysis yielded a significant main effect of
perceived association between romance movies and psychological warmth such that the more
participants associated romance movies in general with psychological warmth, the more they
liked the romance movies (β = .39, p < .001). Replicating our findings from study 1, there was
also a significant main effect of temperature such that physical coldness led to higher liking of
romance movies (β = –.17, p < .05). Central to our hypothesis, the interaction between
temperature and perceived association between romance movies and psychological warmth was
also significant (β = –.20, p < .01). To explore the nature of the interaction, following Aiken and
West (1991), we conducted a spotlight analysis at plus and minus one standard deviation from
the mean of the perceived association between romance movies and psychological warmth
(Figure 1). Planned contrasts showed that at high levels of perceived association between
romance movies and psychological warmth, physical coldness led to increased liking of romance
movies (β = –.40, p < .001); in contrast, at low levels of perceived association between romance
movies and warmth, physical coldness did not make a difference (β = .04, p > .70). These results
provide support for our hypothesis that physical coldness increases liking of romance movies only for those who associate romance movies with psychological warmth.

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Insert Figure 1 about here

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*Mood.* To examine whether mood could account for the observed effects, we ran a regression analysis with physical temperature (-1 = *cold*, 1 = *warm*), perceived association between romance movies and psychological warmth (mean-centered), and the interaction term in the model to predict mood ($\alpha = .73$). The results yielded a marginally significant main effect of the perceived association such that participants who associated romance movies more with psychological warmth were in a better mood ($\beta = .14, p < .10$). No other effects were significant ($ps > .10$). Mood also did not predict participants’ liking of romance movies ($\beta = .12, p > .15$). These results again suggest that the observed temperature effect on liking of romance movies cannot be explained by mood.

**Discussion**

Study 2 replicates the finding from study 1 that physical coldness increases people’s liking of romance movies. More importantly, study 2 extends study 1 by shedding light on the mechanism underlying the observed effect: Consistent with our conjecture that physical coldness increases liking for romance movies because it prompts people to seek psychological warmth and romance movies are associated with psychological warmth, we found that physical coldness increased liking of romance movies only for participants who perceived that romance movies in general give them a warm feeling; in contrast, for participants who did not associate romance movies with psychological warmth, physical coldness did not make a difference.

We argued that the effect of physical coldness on increased liking for romance movies is due to the association between physical warmth and psychological warmth. However, it is unclear whether this association exists at an implicit level or at an explicit level. To our knowledge, prior research on embodied cognition has not examined people’s lay belief about the connection between their cognitive processes and perceptual experiences. Thus, an interesting question is, at an explicit level, do people believe psychological warmth can compensate for physical coldness? We sought to examine this in study 3.

**STUDY 3: THE EFFECT OF THE SALIENCE OF PHYSICAL COLDNESS ON LIKING OF ROMANCE MOVIES**

Study 3 was designed to examine people’s lay belief about the relationship between physical warmth and psychological warmth. That is, whether they believe psychological warmth can compensate for physical coldness. There are two possibilities: If people’s lay belief is that psychological warmth can compensate for physical coldness, then making their physical coldness salient should increase their desire for warmth and thus magnify the effect of physical coldness on their liking of romance movies. On the other hand, if the association between physical warmth and psychological warmth only occurs subconsciously and people actually do not
believe at an explicit level that psychological warmth can compensate for physical coldness, then making their physical coldness salient might lead them to correct for this influence and hence attenuate its effect on liking of romance movies (e.g., Schwarz and Clore 1983). To examine this issue, we manipulated the salience of people’s physical temperature by varying the order of the movie preference task and the measure of physical coldness. Thus, a 2 (physical temperature: cold vs. warm) × 2 (salience of physical temperature: salient vs. nonsalient) × 3 (replicate) mixed design was used.

Method

Procedures. One hundred and ninety-one undergraduate students participated in the study in exchange for course credit. They were randomly assigned to one of the experimental conditions. The procedures were similar as in study 2 except for two changes: First, we did not measure the perceived association between romance movies and psychological warmth. Second, to manipulate the salience of physical temperature, we varied the order of the movie preference task and the measure of physical coldness. In the physical temperature salient condition, we asked participants to indicate how cold or warm they were before they completed the movie preference task; and in the physical temperature nonsalient condition, the order was reversed. Two participants who suspected a connection between the drink study and the movie preference task were excluded.

Results

Manipulation Check. A 2 (physical temperature) × 2 (salience of physical temperature) ANOVA was conducted on participants’ ratings on how cold or warm they were. The results indicated a significant main effect of physical temperature such that participants in the cold condition felt colder ($M = 4.04$) than those in the warm condition ($M = 4.51$; $F(1, 185) = 5.76, p < 0.05$), suggesting that our physical coldness manipulation was successful. Neither the main effect of physical temperature salience nor the interaction was significant ($ps > .25$).

Liking of Romance Movies. As in previous studies, we first obtained a liking score for each movie by averaging participants’ ratings on the two scales ($rs > .84$). A 2 (physical temperature) × 2 (salience of physical temperature) × 3 (replicate) mixed ANOVA on movie liking scores indicated no significant three-way interaction ($F < 1$). Thus, we averaged the movie liking scores to create a romance genre liking index. To examine the effect of the salience of physical coldness, a 2 (physical temperature) × 2 (salience of physical temperature) ANOVA was conducted on participants’ romance genre liking index. The analysis yielded a marginally significant main effect of physical temperature salience such that participants had higher liking of romance movies when their physical temperature was not salient (i.e., measured after the movie preference task; $M = 4.28$) compared to when their physical temperature was salient (i.e., measured before the movie preference task; $M = 3.96$; $F(1, 185) = 3.39, p < 0.07$). The main effect of physical temperature was not significant ($F < 1$). Interestingly, there was a significant interaction between physical temperature and the salience of physical temperature ($F(1, 185) = 4.19, p < .05$). Follow-up contrasts showed that when participants’ physical temperature was not salient, consistent with our earlier findings, physical coldness led to increased liking of romance movies ($M_{cold} = 4.49$ vs. $M_{warm} = 4.01$; $F(1, 185) = 7.25, p < .01$); however, when physical temperature was made salient, there was no difference between the cold and the warm conditions ($M_{cold} = 3.83$ vs. $M_{warm} = 4.04$; $F < 1$). These results seem to suggest that when participants’
physical coldness was made salient, they corrected for this influence when indicating their liking of the romance movies.

**Mood.** A 2 (physical temperature) × 2 (salience of physical temperature) ANOVA on participants’ mood index ($\alpha = .69$) indicated a marginally significant main effect of physical temperature salience ($M_{\text{temperature salient}} = 4.49$ vs. $M_{\text{temperature nonsalient}} = 4.79$; $F(1, 185) = 3.71, p < .06$). Neither the main effect of physical temperature nor the interaction was significant ($Fs < 1$).

Although participants’ mood significantly predicted their liking of the romance movies in this study ($\beta = .21, p < .01$), the lack of a physical temperature × salience of physical temperature effect on mood suggests that mood is unlikely to account for the observed effects.

**Discussion**

By varying the order of the physical temperature measure, study 3 examined the effect of the salience of physical temperature on participants’ liking of romance movies. We found that when participants’ physical temperature was measured after the movie preference task, as we did in studies 1 and 2, we replicated our earlier findings that physical coldness increases liking of romance movies; however, when participants’ physical temperature was made salient by measuring it before the movie preference task, there was no effect of physical coldness on their preference for romance movies. These results seem to suggest that, at an explicit level, participants did not believe that psychological warmth can (or should) compensate for physical coldness and thus corrected for this influence.

**STUDY 4: ANALYSIS OF ONLINE MOVIE RENTAL DATA**

The first three studies provide support for the effect of physical temperature on consumers’ liking of romance movies in laboratory settings. In study 4, to demonstrate the external validity of the observed effect, we tested our hypothesis using detailed rental records from an online movie rental company in the U.S. The data span a period of nearly three years, from August 2002 to May 2005. Online movie rental data usually include detailed information that allows researchers to control for confounding factors such as idiosyncratic preferences for specific movie genres and movie availability, and thus can be used as a testing ground for tracking the dynamics in consumers’ movie preferences (e.g., Milkman, Rogers, and Bazerman 2009). In this study, since we could not manipulate physical temperature, we used weather temperature as a proxy for physical coldness (warmth).

**Data**

The focal company operates on the “movie-in-mail” business model, which is similar to the one created and popularized by Netflix. Specifically a customer starts by selecting from four service plans. Each of the four plans has a fixed monthly subscription fee and a quota, the maximum number of movies that are allowed to be checked out at any single time, which implicitly restricts the number of movies that can be watched by the customer on a monthly basis. After the plan is chosen, the customer browses through the company’s movie inventory online. For each movie, the customer can see a synopsis, cast information, and the average rating provided by previous viewers. The customer requests the movies she would like to watch and the company then ships the requested movies to the customer.
The focal company’s movie pool contains ten genres and we focused on five major genres: romance, action, comedy, drama, and thriller. Collectively these five genres consist of 64.8% of all movies in the company’s inventory at the end of the observation period. The key dependent variable is the percentage of romance movies in all movies watched. Following Milkman et al. (2009), we used the dates when the movies were returned to the company and the standard mailing turnaround times to infer when the consumption occurred. Here, we assumed that the consumer returned the movie immediately after watching, which seems reasonable given that under the online movie rental business model a customer cannot receive new movies until she has returned the old movies.

As mentioned previously, the plan chosen by each customer has a corresponding consumption limit. To control for the potential confounding effect of such a consumption limit on viewer preference, we only focused on viewers who had subscribed to the most popular, standard service plan since their sign-up date based on transaction history data. This plan charges a $19.99 monthly subscription fee and allows two movies to be checked out at the same time. 83.5% of the total customers chose this plan. To control for the availability (both in terms of quantity and quality) of movies of different genres to the consumers, for each genre and at any given time, we computed (1) the number of movies available from the company’s movie pool, and (2) the average rating of the movies given by previous users as a proxy for movie quality. Figures 3a and 3b illustrate the dynamics of the quantity and quality for the five genres: Over time, the number of movies for each genre increased while the quality of movies across genres remained relatively stable.

Next, we matched the movie viewing history with historical temperature data. Ideally, we would match the temperature of the geographic location by each customer’s zip code. However, the only geographic information available in the data was whether the customer was residing in the same city as the focal company. This rendered us an estimation sample of 2,500 customers with known geographic locations. We then obtained the average monthly temperatures of the city where the customers were residing during the observation period from the National Climactic Data Center (2004). To ensure that there were no systematic differences between our sample and the rest of the customers in the data, we compared the two groups on (1) the percentage of customers who selected the standard plan, and (2) the percentage of romance movies in all movies watched. We did not find any significant differences.

**Model**

We used subscripts $i$ and $t$ to denote individual customer and month respectively. The key dependent variable, $Pct_{it}$, is defined as the ratio between the number of romance movies watched by customer $i$ in month $t$ and the number of non-romance movies watched by the same customer. The empirical model is:

$$Pct_{it} = \gamma_1 \cdot CVIEW_i + \beta_0 + \beta_1 \cdot JAN_i + \beta_2 \cdot FEB_i + \ldots + \beta_{11} \cdot NOV_i + \delta_1 \cdot NROM_{it} + \delta_2 \cdot RROM_{it} + \delta_3 \cdot NOTHER_{it} + \delta_4 \cdot ROTHER_{it} + \alpha_1 \cdot TEMP_i + \epsilon_{it}$$
In addition to temperature ($TEMP$), which is the focal independent variable, we included the following variables: First, the variable $CVIEW_i$ captures the idiosyncratic preference for romantic movies and is computed as the percentage of romance movies of all movies viewed by customer $i$ through her entire tenure with the company. Second, to control for any seasonality effect that is independent of temperature (e.g., holidays), we included eleven monthly dummies: $JAN_i, FEB_i, \ldots, NOV_i$ (December is the reference month). Third, we also controlled for the availability and quality of romance movies and other genres. Specifically, $NROM_i$ and $NOTHER_i$ are respectively the numbers of unique titles of romance and other genres that have not been watched by customer $i$ in month $t$. $RROM_i$ and $ROTHER_i$ correspond respectively to the average ratings of the romance and non-romance movies available to the customer. These four variables are updated based on the dynamics in the company’s inventory as well as customer $i$’s rental consumption history.

Results

Preference for Romance Movies. Table 1 summarizes the estimation results of the proposed model. Consistent with our hypothesis, the parameter estimate for the temperature variable was significant ($B = -0.0028; p < .01$), suggesting that, as temperature decreases, consumers are more likely to watch romance movies. The size of the temperature effect on viewing preference was substantial: An increase in temperature from 40°F to 60°F reduces the viewing share of romance movie by about 50% (from 10.7% to 5.3%; Figure 4). Not surprisingly, the control variable of the idiosyncratic preference for romance movies was strongly correlated with the percentage of viewing. Also, the average rating of romance movies had a positive and marginally significant effect on consumers’ preference for romance movies ($B = 0.181; p < .09$); while the effect of the inventory size of romance movies was almost zero and not significant ($p > .75$).

We also estimated four alternative models that (1) excludes temperature, (2) excludes number of romance (non-romance) movies available, (3) excludes average rating of romance (non-romance) movies, and (4) includes the squared temperature to capture any potential nonlinear effect. Comparisons among the adjusted $R$-squares indicated that the model with both the linear term of temperature and the control variables fit the data better than alternative models, and the squared temperature term did not significantly increase the prediction power.

* Insert table 1 about here

* Insert figure 4 about here

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Preference for Other Genres. We also conducted similar analyses for each of the other four genres (action, comedy, drama, and thriller) to examine whether there was a temperature effect. None of the coefficients of the other four genres turned out to be significant (ps > .15; Table 2). Thus, consistent with the findings from study 1, the inverse relationship between temperature and viewing preference is unique to the romance genre.

GENERAL DISCUSSION

This research examines the effect of physical coldness on consumers’ liking of romance movies. In three laboratory studies and one study using online movie rental data, we provide support for the hypothesis that physical coldness increases liking of romance movies (studies 1–4), but not for other major genres (studies 1 and 4). Moreover, consistent with our theorizing that the observed effect arose because physical coldness activates a need for psychological warmth, we showed that the effect of physical coldness on increased liking of romance movies only occurred for participants who associated romance movies with psychological warmth (study 2). Interestingly, we found that the need for psychological warmth to compensate for physical coldness seemed to operate at an implicit level. When participants’ physical coldness was made salient, they actually corrected for the influence of physical temperature, and the effect of physical coldness on their liking of romance movies disappeared (study 3). Finally, we showed that the effect of physical coldness on liking of romance movies cannot be explained by mood (studies 1–3). It should be noted that although our research only examines people’s preference for romance movies, the effect of physical coldness on a greater need for psychological warmth may be manifested in other ways, such as willingness to pay a higher price for products associated with psychological warmth.

The current research adds to the growing literature on embodied cognition. Past research on embodied cognition has demonstrated two types of effects: On the one hand, similar to a semantic prime, a perceptual (cognitive) experience may activate a corresponding cognitive (perceptual) experience in a consistent manner. For example, being physically warm leads people to perceive strangers as having a warmer personality (Williams and Bargh 2008) or being socially more proximate (IJzerman and Semin 2009). Similarly, holding a heavy clipboard causes people to consider the decisions they are making as more important (Jostmann et al. 2009). On the other hand, a perceptual (cognitive) experience may serve as a goal prime and accordingly activate a cognitive (perceptual) experience in a compensatory manner. For example, Zhong and Liljenquist (2006) found that asking participants to recall their past unethical behaviors activated a goal of physical cleanness and hence they were more likely to choose cleansing products. This research adds to the latter stream of work by showing that physical coldness activates a goal of seeking psychological warmth. An interesting avenue for future research is to identify the conditions under which a perceptual or cognitive experience would serve as a semantic prime or as a motivation.

Furthermore, past research on embodied cognition has focused on examining the interrelated nature of cognitive processes and perceptual experiences by demonstrating that an
experience in one system can activate a corresponding experience in the other system. However, it is unclear whether these effects operate at a subconscious level or at a conscious level. We found in study 3 that when participants’ physical coldness was made salient, they corrected for the influence of physical temperature. This seems to suggest that the association between physical warmth and psychological warmth might operate at a subconscious level and that people do not believe that psychological warmth can (or should) compensate for physical coldness at an explicit level. More systematic research is warranted to understand people’s lay beliefs about the association between cognitive processes and perceptual experiences and the level at which embodied cognition effects operate.

The current research is also related to past research on seasonality in the movie industry. Extant literature on movies and seasonality has focused on the weekend (vs. weekday) and holiday (vs. non-holiday) dimensions of seasonality (e.g., Einav 2007; Foutz and Kadiyali 2006). The general finding is that consumer demand on weekends and during holiday seasons is much higher than during weekdays and non-holiday seasons. In this research, we extend this stream of work by examining the impact of another dimension of seasonality – temperature – on consumers’ viewing preference. Moreover, past research has not distinguished among different genres and our finding that physical coldness increases people’s likings for romance movies but not other genres suggests that maybe it is worthwhile to separate the genres and examine whether there are differential effects as a function of genre.

Our results offer some managerial implications. Eliashberg et al. (2006) pointed out that because of the media’s attention on top box office performers in any given week and its impact on the long-term success of a movie, the timing of a movie release is becoming increasingly critical. In the U.S., it is typically thought that the summer and winter holiday seasons are the peak periods and movie studios strategically plan their most important releases in those two seasons (Einav 2007; Krider and Weinberg 1998). Our research suggests that even between these two peak seasons, there may exist another dimension of systematic difference in consumer demand for the romance genre. Specifically, our findings suggest that movie studios might be better off releasing their romance movies in the winter season, when the average temperature is low. A quick look at the release date and opening week box office revenue data of movies between 1995 and 2010 from the-numbers.com shows that romantic comedy movies released in the winter season (December, January, and February) received significantly higher opening week box office revenue than those released in the summer season (June, July, and August), even after excluding those released in the two-week period around Valentine’s Day (mean difference = $3.15 million, \( p = 0.05 \)).

This effect was not observed for other most popular genres (action, comedy, drama, and thriller). Interestingly however, we did not find a seasonal difference in the release times of romantic comedies: among the most popular movie genres, romantic comedies constitute 5.27% of all 1,497 movies released in the winter season and 6.35% of all 1,370 movies released in the summer season. This suggests that currently movie studios may not be factoring in the temperature dimension when timing their releases. Thus, our findings offer a potential way to increase the box office revenue for their romance movie releases by capturing the underlying high demand. Due to the sequential nature of the distribution channels (Lehmann and Weinberg 2000), our research also provides insights for “downstream” distributors and in particular, for movie rental companies that try to manage heterogeneity in consumer demand with limited capacities (Essegai er, Gupta, and Zhang 2002).
APPENDIX A
SAMPLE MOVIE STIMULI

Conversations with Other Women

Sparks fly at a wedding reception when a man and woman with an ambiguous connection are reunited in this stylish romantic drama. As the layers of their past relationship gradually peel back, they rekindle a smoldering flame. Unable to contain their desire, they soon slip away to her hotel room – but will passion give way to regret after the champagne wears off?

Viewer rating: 8.5/10

Genre: Romance
REFERENCES


<table>
<thead>
<tr>
<th>Parameters</th>
<th>Estimate</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average percentage of romance movies viewed***</td>
<td>0.985</td>
<td>0.0193</td>
</tr>
<tr>
<td>January effect</td>
<td>-0.0043</td>
<td>0.009</td>
</tr>
<tr>
<td>February effect</td>
<td>-0.0078</td>
<td>0.0095</td>
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<tr>
<td>March effect</td>
<td>0.029</td>
<td>0.017</td>
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<tr>
<td>April effect**</td>
<td>0.064</td>
<td>0.023</td>
</tr>
<tr>
<td>May effect**</td>
<td>0.082</td>
<td>0.031</td>
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<tr>
<td>June effect**</td>
<td>0.118</td>
<td>0.043</td>
</tr>
<tr>
<td>July effect**</td>
<td>0.150</td>
<td>0.049</td>
</tr>
<tr>
<td>August effect**</td>
<td>0.127</td>
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<tr>
<td>September effect**</td>
<td>0.104</td>
<td>0.038</td>
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<tr>
<td>October effect**</td>
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<tr>
<td>November effect</td>
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<td>Average rating of romance movies*</td>
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<td>Number of other genres</td>
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<td>0.109</td>
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<tr>
<td>Temperature***</td>
<td>-0.0028</td>
<td>0.0010</td>
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Note: ***: p < .01; **: p < .05; *: p < .10.
**TABLE 2**  
ESTIMATES OF TEMPERATURE EFFECT FOR ALL GENRES (STUDY 4)

<table>
<thead>
<tr>
<th>Genre</th>
<th>Adjusted $R^2$</th>
<th>Coefficient Estimate</th>
<th>$p$ value</th>
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<tbody>
<tr>
<td>Action</td>
<td>0.292</td>
<td>0.0026</td>
<td>0.163</td>
</tr>
<tr>
<td>Drama</td>
<td>0.299</td>
<td>-0.0008</td>
<td>0.623</td>
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<tr>
<td>Thriller</td>
<td>0.281</td>
<td>0.00097</td>
<td>0.893</td>
</tr>
<tr>
<td>Comedy</td>
<td>0.302</td>
<td>0.00134</td>
<td>0.355</td>
</tr>
<tr>
<td>Romance</td>
<td>0.286</td>
<td>-0.0028</td>
<td>0.005</td>
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FIGURE 1
LIKING OF ROMANCE MOVIES AS A FUNCTION OF PHYSICAL TEMPERATURE AND PERCEIVED ASSOCIATION BETWEEN ROMANCE MOVIES AND PSYCHOLOGICAL WARMTH (STUDY 2)

NOTE: High is one standard deviation above the mean, and low is one standard deviation below the mean.
FIGURE 2
LIKING OF ROMANCE MOVIES AS A FUNCTION OF PHYSICAL TEMPERATURE AND SALIENCE OF PHYSICAL TEMPERATURE (STUDY 3)
FIGURE 3A
DYANMICS OF MOVIE INVENTORY BY GENRE (STUDY 4)

Number of Movies

Time

08/02 11/02 02/03 05/03 08/03 11/03 02/04 05/04 08/04 11/04 02/05 05/05

0 100 200 300

DRAMA
ACTION
COMEDY
THRILLER
ROMANCE
FIGURE 3B
DYANMICS OF MOVIE RATINGS BY GENRE (STUDY 4)

Average User Rating

08/02 11/02 02/03 05/03 08/03 11/03 02/04 05/04 08/04 11/04 02/05 05/05

Time

ACTION
COMEDY
ROMANCE
DRAMA
THRILLER
FIGURE 4
PREDICTED EFFECT OF TEMPERATURE ON PREFERENCE FOR ROMANCE MOVIES
(STUDY 4)

Predicted Viewing Share for Romance Movies (%)

Temperature

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