

## Sugar, Spice, and Everything Nice: Food Flavors, Attraction, and Romantic Interest

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**ABSTRACT.** Embodied cognition states that sensory experiences such as temperature, body orientation, or other physical characteristics often influence how the world is thought about, helping to solidify more abstract ideas such as affection, feelings, and morality (IJzerman & Semin, 2009; Ren, Tan, Arriaga, & Chan, 2015). Because words such as *spicy* or *hot* tend to be associated with physical attractiveness, spicy flavor was examined in relation to embodied cognition. Similarly, words such as *honey* or *sweetie* tend to be associated with romantic relationships; therefore sweet taste was also examined in relation to embodied cognition. Eighty-seven women were given 1 of 3 snacks: a sweet, spicy, or a nonsweet/nonspicy snack. As they consumed the snack, they were instructed to look at 3 male faces of high, moderate, and low attractiveness and respond to questions asking about the physical attractiveness and their romantic interest in the men. Two 1-way Analyses of Variance were performed separately on the dependent variables of physical attraction and romantic interest. A significant main effect was found for flavor on both dependent variables. Women in the spicy condition rated the men as significantly more attractive than those in the sweet condition,  $F(2, 84) = 3.59, p = .03, \eta_p^2 = .08$ . Additionally, the women in the spicy condition also rated their romantic interest in the men higher than those in the sweet condition  $F(2, 84) = 3.84, p = .03, \eta_p^2 = .08$ . This work extends the breadth and application of embodied cognition, specifically in regard to relationship and attractiveness research.



Open Materials badge earned for transparent research practices. Materials to replicate this study are available at <https://osf.io/2vhzy/>

For human beings, the sweet sensation of sugar seems to be a natural attractant. Even before the tingling taste emits messages from the tongue to the body, the brain releases a sensation of pleasure from the sole idea of the interaction with the sweetness. Although recent work has looked deeper into this relationship between physiological stimuli and associated interpretations, the mind-body problem originated in 17th century philosophy (Pirenne, 1950). Descartes was one of the first to propose a working definition of this relationship in

1637, suggesting that movements made by the body were a direct result of how visual messages interacted with a person's consciousness, thus activating an assortment of brain structures (Pirenne, 1950). Over centuries, this definition has continued to be altered to more accurately conceptualize how the brain and the body interact with one another to process information.

By 1980, Lakoff and Johnson (1980) proposed a theory addressing this relationship, which has come to be known as embodied cognition. Disgruntled

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with the direction of Western philosophy, they began examining how metaphorical language had pervaded into the human brain. They proposed that the language used to discuss the world was so embedded into the human brain that it ultimately shaped the ways in which information could then be perceived, categorized, and processed. This concept was further developed as it translated from philosophy into social sciences, and continues to develop today.

The social sciences utilize a more pragmatic definition of embodied cognition that emphasizes how sensorimotor functions shape cognition (Foglia & Wilson, 2013). This idea can be observed because prior research has revealed a relationship between reading or hearing an action word and the activation of the brain system executing that action (Coello & Fischer, 2016). By the brain deciphering the simple utterance of an action through the same systems it uses to perform the action, the link between sensorimotor functions and cognition becomes apparent. What becomes less obvious, however, is how and when the brain creates these connections. Embodied cognition continues to explore and solidify this relationship.

### **Embodied Cognition and Relational Interest**

One application of embodied cognition that researchers have examined is the impact of sensory experiences on relational connections. Zhong and Leonardelli (2008), for example, examined the relationship between the physical experience of temperature and the cognitive label of inclusion. They asked participants to recall situations in which they felt socially included or socially isolated, and then to report the temperature at which they remember the room being. As predicted, participants reported the room at a colder temperature in situations of social isolation than when compared to social inclusion. This was expected because the English language often refers to situations of social isolation as colder (e.g., getting the cold shoulder), whereas social inclusion often is warmer (e.g., warm welcome). This link between physical temperature and relational perceptions was also supported by Fay and Maner (2012). More specifically, participants in their study were either seated on a heated chair or on a neutral chair, and were then asked to fill out surveys assessing their need to belong. Participants seated on the heated chairs, as hypothesized, rated significantly higher on their need to belong than participants in the neutral chairs, reinforcing the relationship between the physical experience of

temperature and the intangible, cognitive experience of relational connection.

To further explore the potential romantic application of this experience, Hong and Sun (2012) looked at how a physical temperature would impact a participant's interest in romance movies. Participants received either a hot or cold cup of tea, then were asked to rate their interest in seeing one of four different genres of movies. Participants consuming the cold tea rated their interest in viewing romance movies significantly greater than those participants consuming the hot tea, likely due to their heightened need to belong. This finding again further supports the claim that physical temperature can impact the need for general social connection as well as romantic connection.

With the relationship found between a physical experience such as temperature, and an abstract concept such as a participant's need for romantic connection, it becomes plausible that other physical experiences could also impact a participant's interest in romantic connection. Forest, Kille, Wood, and Stehouwer (2015) addressed this idea by placing participants in either a physically unstable (wobbly desk) or physically stable (standard desk) condition, and asked them to answer a series of relational questions measuring their interest in a potential partner. Participants in the physical instability condition were found to be less interested in the presented profile (because their cognitive processing felt more unstable) than participants in the physical stability condition, continuing to draw attention to the connection between experiencing physical stimuli and cognitive processes. With both temperature and stability shown to have an impact on cognitive processes, it becomes relevant to examine how many other physical experiences may also subtly affect romantic relationship choices.

### **Embodied Cognition and Taste**

Another domain of embodied cognition research has examined the effects that taste has on social perception. Lakoff and Johnson (1980) originally proposed that the relationship between words and cognitive functioning is inextricably interwoven. Although words such as *sweet*, *sour*, *salty*, or *bitter* originated for descriptive purposes of foods, these words have all translated into language often used to describe other human beings. A person who is caring, for example, is often thought of as "sweet," and a person who is grumpy is often thought of as "sour." With this shift in language, it becomes plausible that the physical, concrete experience

of taste could shift abstract concepts or opinions regarding human characteristics.

To investigate this idea, Meier, Moeller, Riemer-Peltz, and Robinson (2012) conducted a study investigating the relationship between participants' sweet taste preferences and their agreeableness. Participants were given a survey in which they rated how much they liked 45 different foods, which were pre-categorized into one of five food flavors (sweet, bitter, sour, spicy, and salty), as well as a Big Five personality assessment. As predicted, participants with higher agreeableness ratings indicated a higher preference for sweet foods because sweetness is often associated with positive, kind emotional states such as agreeableness. This finding continues to support the study of embodied cognition because sweet taste can be interwoven with an abstract construct such as agreeableness or sweet tendencies.

Ji, Ding, Deng, Ma, and Jiang (2013) further examined the relationship between the sensory experience of taste and abstract opinions, this time looking at a spicy flavor rather than sweet. Participants were first asked to rate how much they liked 12 assorted foods, then were asked to fill out a survey measuring how likely they were to engage in an assortment of behaviors. These behaviors were indicative of trait anger, or a proneness to experiencing anger (Ji et al., 2013). A positive correlation was found such that participants who indicated a greater liking of spicy foods also scored higher on trait anger. This finding is consistent with the usage of words such as *spicy* or *hot* to describe feelings of anger (e.g., hot and bothered), which continue to support the proposal that physical experiences shape cognitive perceptions.

### **Taste and Relationships**

Not only has taste been shown to affect abstract perceptions, but other physical stimuli have also been associated with cognitive perceptions, specifically in romantic relationships. With these findings, it becomes plausible that utilizing a physical experience such as taste could then have an effect on a participant's cognitive perceptions, especially in regard to romantic relationships. To examine this, Ren, Tan, Arriaga, and Chan (2015) gathered 142 undergraduate students to complete a study in which they were given either a sweet or nonsweet food and then asked to rate their romantic interest in the profile of a potential partner. Because sweet words such as *honey* or *sweetie* are often utilized as terms of endearment in the English language, it

was suggested that participants in the sweet condition would be more romantically interested in the profiles than participants in the nonsweet condition. This prediction was supported because participants not currently involved in romantic relationships did show significantly higher levels of romantic interest in the sweet condition compared to participants in the nonsweet condition. This finding suggests that sweet taste can have an influence on romantic interest.

However, sweetness is not the only taste-related experience that could impact relational opinions. Because physical attractiveness is one of the key factors in the origination of a romantic relationship (Miller, 2015), Ren et al. (2015) suggested a further examination of spicy flavor. Although words such as *honey* or *sweetie* are often used when referring to a romantic partner, many times a person's physical attractiveness is referred to with words such as *spicy* or *hot*. If a sweet taste has been found to elicit higher feelings of romantic interest, a spicy or "hot" flavor may be just as likely to elicit higher feelings of physical attraction.

### **Current Study**

The purpose of the current study was to examine the effects that sweet taste and spicy flavor have on women's ratings of men's physical attractiveness as well as their romantic interest. Similar to Ren et al. (2015), it was hypothesized that participants in the sweet condition would have higher romantic interest in the men than those in the spicy or nonsweet/nospicy conditions. Extending Ren et al.'s (2015) study, it was also hypothesized that participants in the spicy condition would rate the attractiveness of the men higher than participants in the sweet or nonsweet/nospicy conditions.

## **Method**

### **Participants**

Participants were recruited from a midwestern university via an online SONA system, and from undergraduate psychology courses in which they received extra credit for participating. Participants were also recruited through friends and acquaintances of the researcher in which no extra credit was granted. All participants were also offered entry into a drawing for a \$25 Visa gift card upon completion of the experiment. In total, 89 women participated in the study. However, two participants' data were removed for either not finishing the snack or not filling out the survey correctly. Sixty-six participants identified as White/European American (77%),

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eight as Asian/Asian American (9%), seven as Black/African American (8%), and five as either Latina, biracial, or other (6%). Participants ranged in age from 16 to 61 years with the mean age being 21.13 years ( $SD = 5.26$ ). Participants were also asked whether they were currently in a serious romantic relationship: 54 indicated yes (64%), 30 indicated no (34%), and three preferred not to answer (3%). Additionally, the women were asked about their sexual orientation. Two women identified as lesbian (2%), seven women identified as bisexual (8%), and 78 women (90%) identified as heterosexual. Analyses were conducted with women of all sexual orientations as well as solely with heterosexual women. Because both analyses showed similar effect sizes, responses from women of all sexual orientations were included.

### Design

This experiment was a between-subjects design. The independent variable was flavor, having three levels: sweet, spicy, or nonsweet/nonspicy (control). The dependent variables were participants' ratings of the attractiveness of the men, as well as participants' romantic interest in the men.

### Materials

**Face stimuli.** A computer presentation was devised to present three male faces to each participant. The faces originated from the Chicago Face Database (Ma, Correll, & Wittenbrink, 2015). Because this study took place at a midsize university in the upper Midwest, participants were expected to be predominantly White and in their twenties. For this reason, only White men in their twenties were selected from the database. The original faces were all coded with an attractiveness score as defined by the Chicago Face Database and labeled to correspond with their physical traits (W corresponding with White, M corresponding with Man, and a number following the label which corresponded with a specific face). Of the White men in their twenties, the six most attractive, least attractive, and neutral faces as defined by the Chicago Face Database were selected. These faces were then presented to a group of six undergraduate raters and one professor in an advanced research class who rated "How attractive/handsome do you find this person?" on a 9-point Likert-type scale from 1 (*not at all*) to 9 (*extremely*). Of the 18 faces presented to the group, the most attractive (WM004), most neutral (WM242), and least attractive (WM236) faces were then selected for use in this study. Faces were placed

on individual slides in a PowerPoint presentation. To prevent order effects, six different versions of the presentation were created with all the possible combinations of presentation orders for the three faces. These presentations were self-paced, in that participants were able to click through the slides at their desired speed.

**Flavor stimuli.** Three snacks were selected to create the three levels of the flavor variable: sweet, spicy, and nonsweet/nonspicy (control). Consistent with Ren et al. (2015), the sweet condition consisted of four Oreo Cookies and the nonsweet/nonspicy condition consisted of eight Lay's® Salt & Vinegar Flavored Potato Chips. Because a spicy condition had not yet been validated, a pilot test was conducted to determine a food sample that would be sufficient for the spicy condition. For this, three assorted spicy snacks (Cheez-It® Hot & Spicy crackers, Chex Mix® Hot 'n Spicy, and Cheetos® Crunchy Cheddar Jalapeño Cheese) were selected and presented to a group of six undergraduate raters and one professor in an advanced research course. Raters were presented with a sample of each snack, and each rater tasted the snacks in a randomized order. Raters unanimously agreed that the Cheez-It® Hot & Spicy crackers were not noticeably spicy, although the Chex Mix® Hot 'n Spicy was so spicy that water was needed directly afterward. However, they agreed that the Cheetos® Crunchy Cheddar Jalapeño Cheese were spicy enough to notice the spicy flavor, but not so spicy that water was needed directly afterward. Because the unanimous agreement on the selection of the Cheetos® Crunchy Cheddar Jalapeño Cheese created a high level of face validity, this snack was selected for the spicy condition.

### Measures

**Participant response booklet.** A response booklet was developed to record participants' responses for this study. The first three pages included questions participants answered while viewing the corresponding faces in the computer presentation.

**Attraction.** The first three questions on each page assessed participants' attraction toward the photograph of each man by asking, "How attractive do you find this person?," "How handsome do you find this person?," (Elliot & Niesta, 2008), and "How hot/sexy do you find this person?" (Ren et al., 2015). The questions were answered by participants' responses on a 9-point Likert-type scale from 1 (*not at all*) to 9 (*extremely*). This measure was repeated by participants three times, once per face viewed. These individual scores were then averaged together for a



mean attraction score across faces,  $\alpha = .90$ .

**Romantic interest.** The next three questions on each page assessed participants' romantic interest toward the photograph of the man by asking, "How interested would you be in getting to know this person?" "How interested would you be in going on a date with this person?" (Ren et al., 2015) and "How interested would you be in developing a romantic relationship with this person?" These questions were answered using a 9-point Likert-type scale ranging from 1 (*not at all*) to 9 (*extremely*). This measure was also repeated three times, once per face viewed. These scores were averaged together to create a mean romantic interest score across faces,  $\alpha = .86$ .

**Control measures.** After completing the first three pages assessing attraction and romantic interest in the men, participants then responded to a series of measures to collect data about potential confounds.

**Positive and negative affect.** The Positive and Negative Affect Scale (Watson, Clark, & Tellegan, 1988) included 10 positive affect words (*interested, excited, inspired, strong, enthusiastic, proud, alert, determined, attentive, and active*) and 10 negative affect words (*distressed, upset, guilty, scared, hostile, irritable, ashamed, nervous, jittery, and afraid*) to assess participants' moods. Participants rated how much they were currently feeling each mental state using a 1 (*very slightly or not at all*) to 5 (*extremely*) Likert-type scale. The positive affect score was the average of the 10 positive adjectives, and scores ranged from 1 (*low positive affect*) to 5 (*high positive affect*) and had acceptable reliability ( $\alpha = .63$ ). The negative affect score was the average of the 10 negative adjectives, and scores ranged from 1 (*low negative affect*) to 5 (*high negative affect*) and also had acceptable reliability ( $\alpha = .81$ ).

**Flavor control.** Next, participants answered a series of questions about their snacks. Participants were asked, "How sweet/spicy/salty/sour/bitter is the snack that you are consuming today?" respectively, derived from Ren et al. (2015). Participants responded on a 7-point Likert-type scale ranging from 1 (*not very*) to 7 (*very*) about the snack they were eating (Ren et al., 2015). These questions were employed to ensure the foods were accurately representing the taste they were designed to measure.

**Demographics.** The last page of the Participant Response Booklet included demographics. Participants were asked which race they identified as, how old they are, whether or not they were currently in a serious, committed romantic relationship, and what sexual orientation they identified as.

## Procedure

Before implementation began, Institutional Review Board approval was granted to conduct this study (1605-2031). Before participants arrived, the researcher rolled a die to determine the conditions that each participant would be placed in. The first roll of the die determined which version of the PowerPoint was presented to the participant. The second roll of the die determined which food condition the participant would be placed in: a 1 or a 4 represented the sweet condition, a 2 or a 5 represented the spicy condition, and a 3 or a 6 represented the control condition. In total, 31 participants were included in the sweet condition, 31 were included in the spicy condition, and 25 were included in the control condition.

When participants arrived, they were ushered to an individual experiment room and given a consent form. After consenting to participate, participants were given a 50 ML glass of distilled water to clear their palette as the researcher prepared their snack in a separate room. Participants were then handed their participant response booklet and their snack and verbally instructed to follow the instructions in their booklet for when to advance the slide and when to turn the booklet pages. They were also reminded to eat the food throughout the entirety of the experiment and that the experiment would last about 10 to 15 minutes. The researcher then left the room and allowed participants to complete the survey at their own pace. Participants were instructed to find the researcher upon completion.

After the survey was completed, participants were then debriefed about the study and offered the opportunity to enter their name into a gift card drawing. Participants who chose to enter the drawing then entered their name and e-mail on a slip of paper placed in a jar separate from other research materials. All participants afterward were thanked for their time and left the lab; the experiment took a total of about 15 minutes.

## Results

### Manipulation Checks

To ensure that the food tastes were being accurately manipulated, participants rated the foods they were given on an assortment of different flavors (sweet, spicy, bitter, sour, and salty). The manipulation check revealed significant differences in how sweet the foods were rated,  $F(2, 84) = 163.24$ ,  $p < .001$ ,  $\eta_p^2 = .80$ . Three Tukey's HSD post-hoc tests were performed with a priori alpha level of .05. Participants in the sweet condition ( $M = 5.71$ ,

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*SD* = 1.16) reported their snack as being sweeter than participants in the spicy condition ( $M = 1.42$ ,  $SD = 0.89$ ),  $p < .001$ , and the control condition ( $M = 1.44$ ,  $SD = 1.12$ ),  $p < .001$ . There was no difference in reports of sweetness between the spicy and control,  $p = .99$ .

The manipulation check for the spicy condition suggested that this was an effective manipulation,  $F(2, 84) = 95.49$ ,  $p < .001$ ,  $\eta^2 = .70$ . Participants in the spicy condition ( $M = 4.74$ ,  $SD = 1.75$ ) reported their snack as being spicier than participants in the sweet condition ( $M = 1.06$ ,  $SD = 0.36$ ),  $p < .001$ , and the control condition ( $M = 1.28$ ,  $SD = 0.84$ ),  $p < .001$ . There was no difference in reports of spiciness between the sweet and control conditions,  $p = .77$ .

Additionally, a manipulation check was performed to ensure that participants differentiated between the three levels of attractiveness. A significant difference was found for perceived attractiveness,  $F(2, 172) = 175.48$ ,  $p < .001$ ,  $\eta^2 = .67$ , with the most attractive man being rated the highest ( $M = 5.86$ ,  $SD = 1.67$ ), followed by most neutral man ( $M = 3.59$ ,  $SD = 1.68$ ), and the least attractive man ( $M = 2.52$ ,  $SD = 1.41$ ) being rated the lowest. Each face was rated as significantly different from each other face.

**Descriptive Statistics**

Correlations were conducted to examine relationships between variables and to identify potential covariates. The analysis revealed a strong significant positive correlation between attraction and romantic interest ( $r = .77$ ) because people are often more romantically interested in those to whom they are physically attracted to (Miller, 2015). Another significant positive correlation was found between positive affect and romantic interest ( $r = .25$ ). This

finding was also expected because the broaden and build theory of interpersonal relationships suggests that people in positive moods often are more inclined to continue developing their social connections (Fredrickson & Branigan, 2005). Additionally, significant but moderate negative correlations were revealed between participant race and attraction ratings ( $r = -.27$ ) as well as race and romantic interest ratings ( $r = -.22$ ), indicating that participants of color were less physically attracted to and romantically interested in the men presented than White participants. This finding is consistent with the literature because people have often been found to have higher physical attraction toward others of their same race than cross-racially (Man, Rojahn, Chrosniak, & Sanford, 2006). Finally, a significant but moderate correlation was found between race and relationship status, suggesting that people of color were less likely to be in a relationship than White people ( $r = .34$ ). Because positive affect and participant race were associated with the dependent variables, preliminary analyses were conducted including these variables as covariates. Results did not change when including covariates in the Analysis of Variance (ANOVA) versus not, so in favor of parsimony, they were omitted from the analyses presented below. See Table 1 for correlations and descriptive statistics.

**Attractiveness Ratings**

It was predicted that women in the spicy food condition would rate the men as more attractive than participants in the sweet condition or the control condition. To test this hypothesis, a one-way ANOVA was performed,  $F(2, 84) = 3.59$ ,  $p = .03$ ,  $\eta^2 = .08$ , indicating that the average attractiveness rating of the men varied significantly across the three flavor conditions. To further explore this

**TABLE 1**

**Descriptive Statistics and Correlations Between Attractiveness Ratings, Romantic Interest, and Demographic Variables**

	<i>M (SD)</i> or modal response	1	2	3	4	5	6	7	8
1. Attractiveness	3.99 (1.25)	--							
2. Romantic interest	3.58 (1.32)	.77*	--						
3. Age	21.13 (5.26)	-.04	-.16	--					
4. Race	77% white	-.27*	-.22*	-.11	--				
5. Relationship status	64% in relationship	-.04	.15	-.11	.34*	--			
6. Sexual orientation	90% heterosexual	.12	.15	-.15	-.01	-.10	--		
7. Positive affect	2.68 (0.83)	.18	.25*	-.19	-.14	-.04	.18	--	
8. Negative affect	1.46 (0.51)	-.08	-.11	.06	.12	-.01	.13	-.01	--

*Note.* \* $p < .05$ .

main effect, three Tukey's HSD tests were performed with an a priori alpha level of .05. As anticipated, there was a significant difference between ratings of physical attractiveness in the spicy condition ( $M = 4.46$ ,  $SD = 1.3$ ) compared to the sweet condition ( $M = 3.68$ ,  $SD = 1.23$ ),  $p = .04$ . However, there was not a significant difference between those ratings in the spicy condition and the control condition ( $M = 3.80$ ,  $SD = 1.07$ ),  $p = .12$ . There was also no significant difference between the ratings in the sweet condition and the control condition,  $p = .93$ . These findings suggest that spicy flavor was associated with significantly higher ratings of physical attractiveness than sweet taste.

### Romantic Interest Ratings

It was predicted that participants in the sweet condition would be more romantically interested in the men than participants in the spicy condition or the control condition. A one-way ANOVA revealed that there were significant differences in romantic interest by flavor condition,  $F(2, 84) = 3.84$ ,  $p = .03$ ,  $\eta_p^2 = .08$ . Three Tukey's HSD tests were performed with a priori alpha level of .05 to explore differences between conditions. Surprisingly, romantic interest in the spicy condition ( $M = 4.08$ ,  $SD = 1.34$ ) was significantly higher than in the sweet condition ( $M = 3.20$ ,  $SD = 1.23$ ),  $p = .02$ , even though it was hypothesized that sweet taste would be associated with higher levels of romantic interest. There was not, however, a significant difference in romantic interest between the sweet condition and the control condition ( $M = 3.45$ ,  $SD = 1.24$ ),  $p = .75$ , nor between those in the spicy condition and the control condition,  $p = .17$ . These findings suggest that spicy flavor may be associated with more romantic interest than sweet taste.

## Discussion

### Attractiveness

The purpose of this study was to examine how flavor could further be applied to the embodied cognition literature. Because no study had yet examined the relationship between spicy flavor and perceived physical attractiveness, it was hypothesized that a spicy food would elicit higher attractiveness ratings because the words *hot* and *spicy* are often associated with physical attractiveness. As predicted, a main effect was found such that participants in the spicy condition rated men as significantly more attractive than participants in the sweet condition. This finding suggests that the presence of the hot and spicy flavor affected those participants' cognitions.

However, there was no significant difference found between participants in the spicy condition and the control condition. This finding is likely due to the flavor chosen for the control condition. Consistent with Ren et al. (2015), four Oreo Cookies were used for the sweet condition and eight Lay's® Salt & Vinegar Flavored Potato Chips were used as the control. Although a salt and vinegar flavor does taste dramatically different from a sweet or a spicy flavor, it is not flavorless. Because of this, participants in the control condition might have responded differently according to their personal preferences (e.g., strong aversion to the flavor or a strong liking of the flavor), which might have reduced the control's overall reliability. A difference between the spicy and control conditions might have been observed had a more bland control condition such as plain Lay's® Potato Chips or saltine crackers been used.

Even without a significant difference between the spicy and control conditions, the significant difference found between the spicy and sweet conditions still suggests that flavor contributes to embodied cognition. With women rating men as significantly more attractive when consuming a spicy flavor than compared to a sweet taste, Ren et al.'s (2015) suggestion that spicy flavor could have an influence on physical attraction was supported. This finding strengthens the embodied cognition literature because the relationship between a sensory experience of spicy or hot flavor is connected to the abstract perceptions of hot physical attractiveness.

### Romantic Interest

Because it had previously been found that sweet taste was associated with higher romantic interest in a potential partner (Ren et al., 2015), this study attempted to replicate and extend the literature by examining the effect spicy flavors would have on romantic interest levels. It was anticipated that a sweet taste would elevate participants' romantic interest due to the sweet nature of their food influencing their cognition. Instead, it was found that the spicy flavor significantly elevated feelings of romantic interest when compared to the sweet taste. Additionally, no significant difference was found between the spicy condition and the control condition. This again was likely due to the potent nature of the control condition, as aforementioned.

Although the finding that a spicy or hot flavor elicited higher feelings of romantic interest is inconsistent with much of the previous taste literature, it is supported by previous studies on physical

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temperature. Zhong and Leonardelli (2008) and Fay and Maner (2012) both found that warmer temperatures elicited higher feelings of relational connection. Therefore, a hot experience such as spicy flavor could also increase a participant's feelings of social inclusion. Because social inclusion often heightens desires to develop more personal connections (Fredrickson & Branigan, 2005), an increased interest in a romantic relationship would be expected.

However, the inability of the sweet condition to affect romantic interest in this study was unexpected. Ren et al. (2015) found a link between sweet taste and higher levels of romantic interest. Thus, a similar effect was expected in this study. Instead, the sweet condition resulted in significantly lower romantic interest scores when compared to the spicy condition. However, it is possible that sweet tastes do not influence the type of cognition used to evaluate romantic interest based on photos alone. Ren et al. (2015) utilized hypothetical profiles of potential partners, whereas this study only presented participants with photographs. Because romantic interest utilizes other concepts such as proximity, similarity, and personality characteristics not communicated in a photo (Miller, 2015), measures like Ren et al.'s profiles may provide more opportunities for romantic interest to develop.

### General Discussion

The connection between spicy flavor and ratings of both romantic interest as well as physical attraction suggests that embodied cognition can be applicable when examining both flavor and romantic perceptions. In this study, a spicy flavor was found to increase potential romantic interest as well as physical attractiveness ratings. This relationship between spicy flavor and assorted components of relationship development supports the suggestion that the sensory experiences, in this case taste, can influence cognitive perceptions regarding potential relationships. Additionally, the finding that a spicy flavor impacted both romantic interest as well as physical attractiveness ratings suggests that flavor can influence a range of cognitive perceptions.

However, it is worth noting that significantly lower scores in both romantic interest and physical attraction ratings were observed in the sweet condition compared to the spicy. Although literature does partially support the association between a spicy flavor and high levels of interpersonal interest, the absence of an effect for sweet taste should be investigated further. All previous literature has

found a relationship between sweet foods and higher interest in interpersonal connection, but this study presents no such effects. Further investigation into the difference between spicy and sweet flavors could help to further clarify how the brain utilizes taste experiences to alter cognitive perceptions.

**Limitations.** Although this study does support the influence of embodied cognition on romantic interest and perceived attractiveness, participants' arousal levels might have played a role in their responses as well. Past literature has revealed that a spicy flavor such as red pepper increases physiological processes such as body temperature (Ludy & Mattes, 2011). Because a spicy snack was consumed in this study, physiological processing was likely altered, which could increase arousal levels. In situations of heightened arousal, people often misattribute one stimulus as the cause for arousal rather than another stimulus. Because misattribution of arousal has been linked with an increase in perceived attractiveness (Dutton & Aron, 1974), the higher attractiveness scores in the spicy condition might have been subtly influenced by heightened arousal from eating a spicy food, not the hot nature of the flavor. Future research could add a physiological measure to the procedure such as measuring a participant's heartbeat, skin conductance levels, or even by utilizing a facial EMG to further disentangle the effects of arousal from the effects of spiciness.

Additionally, it is important to note that 62% of participants indicated that they were currently in a serious, committed romantic relationship. There was no prompt during the experiment instructing participants to answer the questions as if they were single, so their commitment to their significant other might have influenced how they rated the men in the study. Participants in serious, committed, romantic relationships might have indicated lower romantic interest in a potential partner because they theoretically had no need to pursue other romantic interests. Had participants in a relationship been given a prompt to imagine that they were single, or had only single participants been recruited for the study, a stronger effect of flavor might have been observed.

**Future directions.** Because this study took place at a midwestern university, it would be of interest to replicate this study in a different region of the United States. Taste norms can vary dramatically from region to region, so the effects of spicy flavor may present differently in regions that often utilize more potent spices in their cuisine. Additionally, examining non-English speaking populations could



also be of interest. Because the English language often utilizes words such as *spicy* or *hot* to describe both food flavors and physical attractiveness levels, the embodiment of the spicy flavor can contribute to cognitive processing to view men as more attractive. In non-English speaking populations that do not use variations of a hot or spicy food term to describe physical attractiveness, the effects of spicy food would likely not affect the cognitive processing of attractiveness levels.

Because sweet taste and spicy flavor have both been shown to impact cognitive processing in relational contexts, other applications of sensory stimuli should also be explored. Embodying the experience of a bitter or sour taste may result in decreased relational interest because bitter and sour people are often associated with negative affect, in contrast to what is typically sought after in relationships (Miller, 2015). Additionally, exploring other sensory stimuli such as smell could further enhance the application of embodied cognition. Although much work has already looked at the effects of subliminal scent on initial physical attraction (Miller, 2015), not much work has focused on an overt experience of scent such as ripe jalapeños or fresh-baked cookies. Using specific, targeted scents such as these and then assessing participants' romantic interest levels or physical attraction would likely yield similar results because the scent of the spicy flavor or sweet taste could become embodied into cognition.

**Conclusions.** Because the current study found that spicy flavors elicited higher levels of physical attraction as well as romantic interest, it was supported that words such as *spicy* and *hot* can become embodied into a person's cognitive processing of relationships. Additionally, the observation of sweet taste resulting in significantly lower romantic interest ratings than spicy flavor should be of further investigation. Ultimately, the effects of embodied cognition on relational processes such as romantic interest or physical attraction can help to further understand the ways in which the physical world impacts cognitive functioning every day. Thus, because a spicy, savory flavor sends sensations through the body, examining the subtle shifts in sensorimotor processing can ultimately help to further understand how relationships are derived, developed, and deepened.

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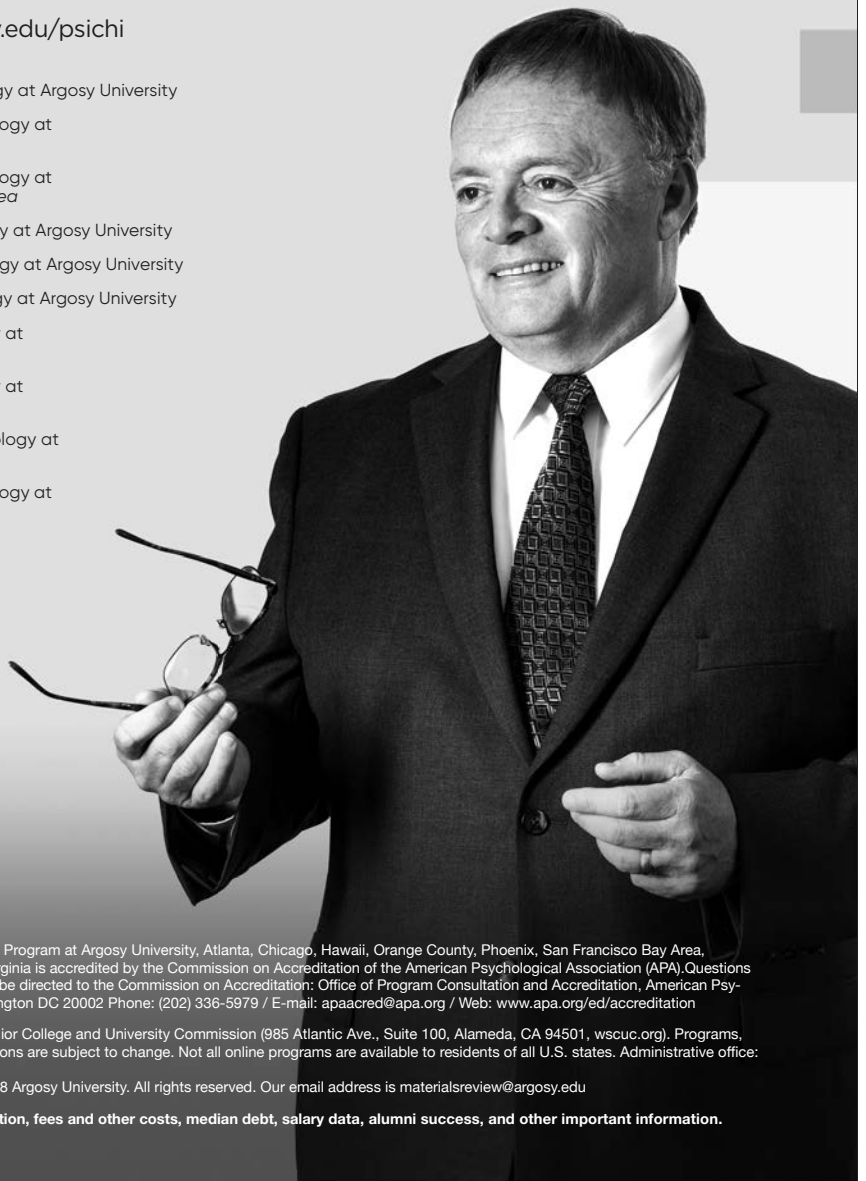
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