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Effect of Descriptive Social Norms on Implicit and Explicit Responses to Foods

A thesis submitted in partial fulfillment of the requirement for the degree of Bachelor of Arts in Psychology from The College of William and Mary

by

Giselle Ferguson

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(Honors, High Honors, Highest Honors)

Dr. Catherine Forestell, Director

Dr. Constance Pilkington

Dr. Jessica Stephens

Williamsburg, VA
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Effect of Descriptive Social Norms on Implicit and Explicit Responses to Foods

Giselle Ferguson

College of William and Mary
Abstract

Previous research has shown that the social context in which we eat affects our food attitudes and intake. However, the manipulation of one aspect of this context, social norms, has had mixed results. To understand these findings and the mechanisms underlying social norms, the current study investigated the effect of an inferred descriptive social norm on implicit and explicit responses to foods. Using a 2 x 2 between-subjects design, women ($N = 165$) saw a confederate eating either a healthy (apple) or unhealthy food (chocolate), or saw one of these foods by itself at the beginning of the study. They then completed two implicit cognitive tasks: the Flanker Task, which measured implicit wanting of foods as shown by how easily foods distracted participants, and the Affect Misattribution Procedure (AMP), which measured implicit liking of foods. Results showed that when a confederate was present, participants were more likely to be distracted by unhealthy foods than by healthy foods in the Flanker Task. This was especially true for those who were high in trait empathy. In contrast, all participants implicitly liked the unhealthy foods more in the AMP, regardless of experimental condition. Finally, participants explicitly liked and wanted healthy foods to the same degree as unhealthy foods. Although social norms about specific foods did not affect implicit or explicit responses in this study, social priming that results from seeing someone eating affect implicit responses, especially for those who are empathetic, and may have consequences for food choice.
EFFECT OF SOCIAL NORMS ON RESPONSES TO FOOD

Effect of Descriptive Social Norms on Implicit and Explicit Responses to Foods

Eating is rarely experienced in an isolated setting; we are commonly with, or at least in proximity to others when we consume snacks and meals. The presence of others has the power to influence our food choices and intake. As indicated by previous research, our familiarity with co-eaters (Heatherington, Anderson, Norton, & Newson, 2006), the degree to which we engage in self-monitoring around others (Salvy, Jarrin, Paluch, Irfan, & Pliner, 2007), and our sense of social norms about relevant foods (Prinsen, de Ridder, & de Vet, 2013) or consumption habits (Herman, Roth, & Polivy, 2003) all play important roles in determining our eating behavior.

As a result of their impact on our dietary habits in general, social factors can also impact the healthfulness of an individual’s eating habits. For example, Stel and van Koningsbruggen (2015) found that when participants ate with a confederate, they were more likely to choose to eat more of a healthy food (cucumber) when the confederate did so. This phenomenon, referred to as matching, occurs when an individual mimics the food choice of a co-eater. Similarly, the phenomena of social facilitation and social inhibition have the power to affect healthy eating behaviors. Results of studies on this topic show that participants’ food consumption can increase or decrease when a co-eater is present, depending on that co-eater’s characteristics, such as gender and familiarity with the participant (Heatherington, et al., 2006; Salvy et al., 2007).

Lastly, social norms about food, which do not depend on the presence of a co-eater, provide information that describes or prescribes the behaviors, values, and beliefs of a group regarding food (Stok, DeRidder, DeVet, & DeWit, 2014a). These norms can influence eating behaviors, as well, with the perceived social norms within one’s social group being consistent predictors of one’s healthy eating choices (Ball, Jeffrey, Abbott, McNaughton, & Crawford, 2010; Lally, Bartle, & Wardle, 2011).
Previous investigators have attempted to encourage healthy eating by employing one of two types of social norms; injunctive norms, which include information about what behavior others deem an individual should do, or descriptive norms, which communicate the type of behavior that is common in others (Higgs, 2015). Although these norms have been used with the intention of encouraging healthy eating, they have produced inconsistent outcomes. Because injunctive norms can produce reactance, they occasionally cause a reduction in liking and consumption of a healthy food perhaps due to a perceived pressure to eat it (Galloway, Fiorito, Francis, & Birch, 2006). There are some situations in which injunctive norms create the desired increase in liking of the food, but this increase appears to be a result of conformity rather than to a genuine change in evaluation of the food (Higgs, 2015). As a result, this effect is typically short-lived or does not extend to increase intake of the healthy food (Higgs, 2015; DeBruijn, Visscher, & Mollen, 2015; Stok et al., 2014b). Similarly, descriptive norms have not always produced a change in healthy eating in past research (DeBruijn et al., 2015). However, when they have produced a change, the participants increase their consumption of the healthy foods, but their explicit intention to do so does not necessarily also increase (Stok et al., 2014a). This discrepancy suggests that the mechanisms influencing food intake may operate subconsciously.

There are some possible reasons why past investigations of social norms involving food have resulted in inconsistent findings. First, social norm manipulations commonly provide inconsistent information. For example, DeBruijn et al.’s study (2015) aimed to increase fruit consumption by providing participants with descriptive norm information, but this manipulation was unsuccessful. Their manipulation may have failed to change participant’s self-reported fruit intake and intentions to eat fruit because the norm information provided actually contained a mix of norm types. The information given to participants began with a list of benefits or drawbacks
of fruit intake, making a persuasive, injunctive-like statement. This list was followed by only one short sentence containing the descriptive norm, which also used the words “fortunately” or “unfortunately.” This word choice may have given the descriptive norm an injunctive flavor, thus putting forth a message that was not wholly descriptive.

In addition, in that study, as well as in the Stok et al. (2014a) study, the norms were implemented with a paragraph provided by the experimenter, whom the participant may have seen as an authority figure. Consequently, reactance could have been produced if participants perceived the delivery of information from that authority figure as an attempt to control them, leading them to refuse to increase their healthy food consumption. This method of conveying the norm information is additionally problematic due to a lack of ecological validity. In everyday life, social norms, especially descriptive norms, are rarely simply stated to individuals, but instead are inferred from experience when they observe what others actually do or talk about.

Furthermore, previous examinations of the use of eating norms to influence healthy eating have used only explicit dependent measures, such as food intake or the intention to eat a certain food. These measures can easily be plagued by social desirability bias and demand characteristics, as participants may feel pressure to seem enthusiastic about a food that they know is healthy or has been promoted as part of the experimental design. These biases may explain why the norm implementation does not produce lasting changes in eating behavior, as participants may revert to their previous consumption habits once the social pressure is removed.

To address these issues, the present study focused on inferred descriptive food norms that are inferred by the participant instead of stated by the experimenter, in order to reduce reactance and increase the ecological validity of the norm. In response to the imposition of this norm, we assessed implicit cognitive responses to food in addition to participants’ reports of their explicit
liking and wanting of the food. By measuring implicit cognitive responses, which are less readily controlled by the participant, the results are less likely to involve social desirability bias or demand characteristics. With implicit measures, it was also possible to discern the underlying mechanisms that drive liking and wanting of food. This begins to uncover the possible truth to Higgs’s (2015) suggestion that social influence may produce neural changes affecting one’s evaluation of foods through the reward networks that operate in gaining social approval. By investigating whether individuals’ explicit responses aligned with the underlying mechanisms and implicit responses, we hoped to gain insight into why previous studies on this topic have produced mixed results or only short-term effects.

In order to pursue these goals, at the beginning of each experimental session participants were exposed to one of four conditions using a 2 x 2 design. Half of the participants saw a confederate eating a food upon entering the test room, at which point the experimenter expressed a positive sentiment about that food, to which the confederate heartily agreed (imposition of the norm). The other half of the participants simply saw a food sitting on the table upon entering the test room. For half of the participants in each of these groups, the food was healthy (an apple), whereas for the remaining participants, the food was unhealthy (a chocolate bar). This manipulation was intended to establish a descriptive social norm about what foods people generally like to eat. Previous experiments have often focused only on norms about healthy foods, but given the mixed results of these experiments, we decided to investigate norms about unhealthy foods as well to see if evaluations of these foods would be more easily changed by social norms.

Past research has also shown that norms are more likely to be followed when one identifies with the group imposing the norm (Liu, Thomas, & Higgs, 2019; Stok et al., 2014a,
2014b). Given that the participants were female college students, like the experimenter and the confederate, we expected participants would accept the norm. Additionally, we investigated individual differences in empathy to determine whether this characteristic is associated with acceptance of food norms and shifts in responses to foods. The phenomenon of empathy-related mimicry has been found to affect a range of behaviors (Franzen, Mader, & Winter, 2018; Rymarczyk, Żurawski, Jankowiak-Siuda, & Szatkowska, 2016). For example, individuals with higher levels of empathy are more likely than individuals with low levels of empathy to spontaneously mimic others’ specific facial expressions (Balconi & Canavesio, 2016; Rymarczyk et al., 2016). Based on these findings, past authors have suggested that those with higher empathy, who more readily adopt the mindsets of others, may more readily adopt others’ eating behaviors and attitudes (Higgs, 2015; Robinson, Tobias, Shaw, Freeman, & Higgs, 2011), a characteristic that may be utilized to facilitate healthier eating choices.

The tasks used to assess participants’ implicit cognitive responses to foods were the Flanker Task and the Affect Misattribution Procedure (AMP). These tasks have been used in previous studies to measure response conflict to foods and evaluations of foods, respectively. In the Flanker Task, participants are instructed to focus on a target image in the center of the screen and press a key to answer a question referring to this target, while ignoring two flanker images presented on either side of the target. The flankers are either compatible with the target, meaning that they share important characteristics with the target, or incompatible with the target, meaning that they do not share important characteristics with the target. Participants generally respond more slowly on incompatible trials than on compatible trials (Coles, Gratton, Bashore, Eriksen, & Donchin, 1985; Eriksen & Eriksen, 1974). Because the incompatibility induces conflict, participants must use cognitive control in order to maintain their focus on the target cues.
(Verbruggen, Notebaert, Liefooghe & Vandierendonck, 2006). Thus, the production of slower reaction times in incompatible trials than in compatible trials implies decreased cognitive control and increased distraction by the flankers (Husted, Banks, & Seiss, 2016). This task allowed us to evaluate participants’ implicit wanting of foods, as Finlayson and Dalton (2012) found that the extent to which a food grabs attention reflects changes in how much it is wanted.

The second task was the AMP, which we used to measure participants’ implicit liking of foods. In this task, a food image prime appears for a moment before a neutral target image. Participants then press a key to indicate whether they find the neutral image pleasant or unpleasant. These neutral images are ambiguous and do not cause emotional responses independently, so participants’ responses to these targets are likely dependent on their evaluation of the preceding prime (Payne, Cheng, Govorun, & Stewart, 2005). In addition to the Flanker and the AMP, the current study included an explicit rating task to assess participants’ explicit wanting and liking of the foods they saw at the beginning of the task.

Using these methods, we hypothesized that regardless of condition, participants would want and like unhealthy foods more than healthy foods, both implicitly and explicitly. We also expected that, relative to the participants in the no-confederate conditions, participants in the confederate conditions would demonstrate higher implicit and explicit evaluation and wanting of healthy or unhealthy foods, depending on what they saw the confederate eating. Lastly, we hypothesized that the effect of confederate presence would be more pronounced in those with higher levels of trait empathy.
Methods

Participants

Participants consisted of 165 college-age women who were recruited either through poster advertisements around campus or through William and Mary introductory psychology courses. As compensation, they received either cash ($10) or course credit. All participants gave informed consent, and the study’s procedure was approved by William and Mary’s Protection of Human Subjects Committee.

Experimental Tasks

Food Flanker Task. The food Flanker Task, adapted from studies by Forestell, Lau, Gyurovski, Dickter, and Haque (2012) and Meule, Vogele, and KUBLER (2012), was employed to measure participants’ susceptibility to distraction by food stimuli, a proxy for implicit wanting of those food stimuli. As shown in the diagram in the Appendix, in each trial, the participants first focused on a fixation cross in the middle of the screen for 1000 milliseconds and then immediately afterwards were presented with a stimulus array of three images. This array contained one target image flanked by two images that were identical to one another; all three images appeared simultaneously for 250 milliseconds. These images were followed by a blank screen lasting for 1000-2000 milliseconds. All screens were presented on a gray background. Images were randomly selected from a set of healthy foods (H), unhealthy foods (U), and neutral objects (N). The flanking images were always identical to each other and were either a healthy or unhealthy food item. The target image depicted a healthy food, an unhealthy food, or a neutral object. In each experimental block, each of the two neutral target trials (HNH, UNU) were presented 16 times and each of the four food target trials (HHH, UHU, HUH, UUU) were
presented 12 times. Thus, there were 80 image trials in each block, and each block was presented four times with the image arrangements randomized.

At the beginning of the task, participants read the instructions to focus on the center image and to respond as quickly and accurately as possible to indicate whether the center image is a food item or not by pressing either the “x” or “m” key, with mapping counterbalanced across participants. To familiarize them with the task, participants completed a practice block of 10 trials. Between each experimental block of trials, there was a break during which participants could press any key to move to the next block when they felt ready. The entire task took about 20 minutes to complete. Participants’ reaction times in milliseconds for their keyboard responses were recorded to assess differences in speed across the different arrangements of targets and flankers. A slower reaction time suggested that the participant was distracted by the flanker images.

Food images for the Flanker Task were chosen from the food pics database (Blechert, Meule, Busch, & Ohla, 2014). The food in each picture is shown on a white background. These images have been rated by a large sample of American and European adults on various subjective measures, such as arousal and visual complexity. The images did not differ in size, brightness, or contrast. Images were resized to 515 X 325 pixels and consisted of 12 healthy foods (e.g. carrots), 12 unhealthy foods (e.g. cake), and 16 neutral non-food objects (e.g. maple leaf).

Affect Misattribution Procedure (AMP). The AMP was used to measure participants’ implicit affective responses to primes (Payne et al., 2005). In each of 60 trials, a prime (healthy food, unhealthy food, or neutral non-food object) was presented for 75 milliseconds. The prime image was followed by a blank screen for 125 milliseconds, a Chinese character for 100
milliseconds, and lastly a black and white masking screen, which remained on the computer screen until the participant made a response. Using the keyboard, participants indicated whether they felt the Chinese character was pleasant or unpleasant relative to the average Chinese symbol. As participants do not know the meaning of the Chinese characters, their responses are believed to illustrate their implicit liking of the prime that precedes the character. Participants who reported that they were familiar with Chinese characters were excluded from AMP analyses.

The stimuli for the Affect Misattribution Procedure (AMP) consisted of 36 color photographs that were created in our laboratory. For these pictures, items were placed on a square white platform against a black background. Items consisted of 10 healthy food items (fruits or vegetables) and 10 unhealthy food items (foods that are sweet and high in fat content). These types of food were selected so as to correspond to the foods the participants would see at the beginning of the study. In addition, there were 16 neutral non-food items.

**Measures**

Participants provided various demographic information (i.e., age, weight, height, race/ethnicity, income) and completed questionnaires to assess the following characteristics. Exact items for each measure are listed in the Appendix.

**Trait Empathy.** The Interpersonal Reactivity Index - Brief Form (B-IRI; Ingoglia, Lo Coco, & Albiero, 2016) was used to assess trait empathy within the four subscales of fantasy (taking on the mindset of a fictional character from media), empathetic concern for others, perspective taking, and personal distress in tense social situations. Participants rated 16 statements on a scale from 1 (does not describe me at all) to 5 (describes me very well). Their responses were then averaged for a final score between 1 and 5. This measure showed acceptable internal consistency in this study (α values between 0.799 and 0.827, fantasy subscale: α =
0.827). For our purposes, we only included the fantasy subscale in our analyses. We selected this subscale because although it pertains to sharing in the emotions of fictional characters, its items focus on respondents’ spontaneous sharing of the mindsets of others without a specific goal, “tapping into the tendency to identify with others, taking their place as if getting into their body” (Minio-Paluello, Baron-Cohen, Avenanti, Walsh, & Aglioti, 2009). On the other hand, the items of a possible alternative, the perspective taking subscale, only focus on deliberate perspective taking in the context of conflict negotiation. Thus, because we expected any identification with the confederate’s mindset to be passive, spontaneous, and outside the realm of conflict negotiation, we chose the fantasy subscale.

**State Food Craving.** The State General Food Cravings Questionnaire (G-FCQ-S; Nijs, Franken, & Muris, 2007) was used to assess participants’ desire to eat food at the time of measurement. This questionnaire measures craving in five subscales: an intense desire to eat, anticipation of relief from negative states and feelings as a result of eating, craving as a physiological state, obsessive preoccupation with food or lack of control over eating, and anticipation of positive reinforcement that may result from eating. Participants rated 15 items on a scale of 1 (strongly disagree) to 5 (strongly agree), and their scores were averaged for a final score between 1 and 5. This measure showed acceptable internal consistency in this study ($\alpha = 0.92$).

**Dietary Restraint and External Eating.** The Dutch Eating Behavior Questionnaire (Restraint and External subscales only) (DEBQ; Strien, Frijters, Bergers, & Defares, 1986) was used to assess the tendency for dietary restraint and external eating in the participants. In this measure, participants answer questions about their conscious control of food intake (restraint) and the increase they feel in their desire to eat when presented with food (external eating).
Twenty items are rated on a 5 point scale (1=never, 5=very often). These scales showed acceptable internal consistency in this study (restraint: $\alpha = 0.93$; external: $\alpha = 0.84$).

**Explicit Food Rating Task.** To assess explicit wanting and liking of foods, participants all viewed two food photos; one depicted the healthy food that could have been present at the beginning of the study (apple), and one depicted the unhealthy food that could have been present at the beginning of the study (chocolate). Participants indicated on a 100 point sliding scale how much they liked and wanted to eat each of these foods. In a pilot study advertised on a Facebook page for students at the College of William and Mary, women (N=74) between the ages of 18 and 22 rated these food photographs online in the same manner. Results of the pilot study revealed that participants liked the chocolate significantly more ($M = 83.41$, $SE = 2.25$) than the apple ($M = 71.51$, $SE = 2.79$), $F (1,72) = 20.23$, $p<0.001$, $\eta = 0.22$. These results also showed that participants also wanted the chocolate significantly more ($M = 73.76$, $SE = 2.96$) than the apple ($M = 61.97$, $SE = 3.23$), $F (1,71) = 10.36$, $p=0.002$, $\eta = 0.13$.

**Procedure**

On the day before the session, participants received an email asking them to refrain from eating for at least two hours prior to the scheduled time slot. Each participant came into the lab individually and provided consent after being informed about the basic nature of the study. The experimenter then showed her into a room in which a healthy or unhealthy snack was sitting alone on the table, or a confederate was seated eating a healthy or unhealthy snack. The confederate, if present, was another female member of the lab. She communicated that she did not know that the room was booked and left with her snack. As the confederate left, the experimenter commented that the snack looked tasty, to which the confederate agreed and replied that she loves this food. If there were no confederate present, the experimenter
commented that someone must have forgotten the food before removing it from the room and continuing with the study.

Participants then completed the computer tasks, with the AMP first and the Flanker Task second. Afterwards, they took the online Qualtrics survey containing the measures of demographics, trait empathy, dietary restraint, state craving, external eating, and explicit food ratings. Lastly, participants reported when they last ate, and the experimenter measured their height and weight. After this procedure, participants were debriefed on the goals of the study.

Data Analyses. Specific trials in the Flanker Task in which the participant gave an incorrect answer or responded in fewer than 200 milliseconds were excluded, resulting in the exclusion of 4.2% of the total number of trials. Response times for the remaining trials were averaged for each type of trial (e.g. HHH). For the AMP, specific trials in which the participant’s response time was below 200 milliseconds or above 2000 milliseconds were excluded. These criteria excluded 3.74% of all trials.

Results

Participant Characteristics. Out of the 165 participants initially recruited, 164 completed the tasks and were included in the analyses. Participants ranged in age from 18 to 69 years, with a mean age of 19.2 years ($SD = 4.0$). The mean BMI of the participants was 22.9 kg/m$^2$ ($SD = 4.3$). In terms of family incomes, 44.8% of participants reported an income over $100,000, while 1.2% reported an income less than $15,000. The participants were 62.4% White, 6.7% Black, 17% Asian, 3.6% another race, and 9.1% mixed race. In addition, 12.1% of participants were Hispanic or Latina. As shown in Table 1, there were not any significant between-group differences in age ($p > 0.36$), BMI ($p > 0.44$), IRI Fantasy score ($p > 0.15$), restrained eating ($p > 0.57$), external eating ($p > 0.27$), or state craving ($p > 0.74$). However, the between-groups
differences in hours since last ate just reached significance $F(3,156) = 2.66, p = 0.05$, such that the participants who had seen a confederate had eaten more recently.

Table 1:

*Descriptive characteristics of participants in each condition (Mean ± SD).*

<table>
<thead>
<tr>
<th></th>
<th>No Confederate</th>
<th></th>
<th>Confederate</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Healthy (n = 41)</td>
<td>Unhealthy (n = 43)</td>
<td>Healthy (n = 41)</td>
<td>Unhealthy (n = 40)</td>
</tr>
<tr>
<td>Age (y)</td>
<td>19.1 ± 1.17</td>
<td>20.2 ± 7.7</td>
<td>18.9 ± 0.83</td>
<td>18.7 ± 0.95</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td>23.1 ± 4.58</td>
<td>22.1 ± 3.6</td>
<td>23.6 ± 4.85</td>
<td>23.67 ± 4.09</td>
</tr>
<tr>
<td>Last Ate (h)*</td>
<td>7.19 ± 5.75</td>
<td>7.1 ± 5.49</td>
<td>4.5 ± 4.33</td>
<td>5.44 ± 4.78</td>
</tr>
<tr>
<td>IRI Fantasy</td>
<td>3.81 ± 0.80</td>
<td>3.60 ± 0.93</td>
<td>3.42 ± 0.83</td>
<td>3.39 ± 1.13</td>
</tr>
<tr>
<td>Restrained Eating</td>
<td>2.72 ± 1.05</td>
<td>2.48 ± 0.99</td>
<td>2.71 ± 0.82</td>
<td>2.53 ± 0.97</td>
</tr>
<tr>
<td>External Eating</td>
<td>3.41 ± 0.41</td>
<td>3.37 ± 0.58</td>
<td>3.47 ± 0.56</td>
<td>3.23 ± 0.74</td>
</tr>
<tr>
<td>State Craving - Desire to Eat</td>
<td>3.26 ± 1.04</td>
<td>3.03 ± 0.98</td>
<td>3.20 ± 1.04</td>
<td>3.07 ± 1.21</td>
</tr>
</tbody>
</table>

*Last time ate was significantly longer in the No Confederate group relative to the Confederate group, $p < 0.05$*

**Implicit Responses**

*Wanting.* Of the 164 participants, 7 participants were excluded either because they had too many invalid trials due to making mistakes during the Flanker Task ($n = 2$), or because their response times were over 1000 milliseconds on average ($n = 5$), suggesting that they were not following the instruction to respond as quickly as possible.

In order to discern whether the experimental manipulation had an effect on participants’ implicit wanting of foods, we used a 4-way repeated measures ANOVA to analyze the reaction
times on the Flanker Task. The repeated measures variables were flanker (healthy, unhealthy) and target (healthy, unhealthy), and the between-subjects variables were session food (healthy, unhealthy) and confederate presence (present, absent). Trials in which the target was a neutral, non-food item were not included in these analyses because we were interested in comparing participants’ responses to healthy and unhealthy foods.

With this analysis, a significant main effect of target emerged $F(1,152) = 4.37, p=0.038$, $\eta^2 = 0.028$, such that participants were slightly slower to respond when the target was healthy ($M = 597.57, SE = 6.60$) relative to when it was unhealthy ($M = 592.92, SE = 6.12$). This effect implies that participants had a more difficult time staying focused on healthy targets than on unhealthy targets.

There was also significant flanker x confederate presence interaction, $F(1,152) = 7.59, p = 0.007$, $\eta^2 = 0.048$. As shown in Figure 1, simple main effects analyses revealed that when there was a confederate present, participants were slower to respond when the flankers were unhealthy ($M = 608.50, SE = 9.32$) relative to when they were healthy ($M = 599.03, SE = 8.99$). No such difference was found for participants for whom no confederate was present (unhealthy; $M = 585.78, SE = 8.96$, healthy; $M = 587.67, SE = 8.64$). Thus, participants were distracted by unhealthy flankers more easily than by healthy flankers, but only if they had seen a confederate.
Lastly, a significant target x flanker interaction emerged, $F(1,152) = 5.57, p=0.02, \eta^2 = 0.035$. As shown in Figure 2, simple main effects revealed that when the target was healthy, participants were slower to respond when the flanker was unhealthy (i.e., UHU trials; $M = 601.57, SE = 6.80$) relative to when it was healthy (i.e., HHH trials, $M = 593.58, SE = 6.68$). No such difference was observed when the target was unhealthy (HUH, $M = 593.13, SE = 6.14$ vs. UUU, $M = 592.71, SE = 6.39$) trials. This interaction effect suggests that overall, participants were distracted from the healthy targets when they were presented with unhealthy flankers. However, they were not distracted from the unhealthy targets, no matter what type of flanker was presented.
Figure 2. Average reaction times in trials with healthy or unhealthy flankers and healthy or unhealthy targets. * refers to significant differences at $p < 0.05$.

Because we hypothesized that participants’ trait empathy would interact with the confederate’s presence to affect responses to the food, we conducted these analyses again with participants’ score on the Fantasy subscale of the IRI as a continuous between-subjects variable. With this analysis, there was a significant between-subjects main effect of trait empathy, $F(1, 148) = 4.84, p = 0.029$, $\eta^2 = 0.032$, such that participants higher in empathy responded more slowly than those with lower empathy. There was also a significant flanker x confederate presence x trait empathy interaction, $F(1, 148) = 14.40, p < 0.001$, $\eta^2 = 0.089$.

To understand this three-way interaction, we broke it down by the participants’ trait empathy level. In these analyses, we split participants into groups based on whether they were in the top or bottom tertile according to their scores on the IRI Fantasy subscale. Those in the high tertile had trait empathy scores greater than 4.00 ($n = 69$), and those in the low tertile had scores below 3.25 ($n = 59$).
As shown in Figure 3A, for participants with low trait empathy, there were no significant main effects or interactions. However, as shown in Figure 3B, for participants with high trait empathy, there was a main effect of flanker $F(1, 67) = 4.07, p = 0.048, \eta^2 = 0.057$, with the participants responding to the targets more slowly when there were unhealthy flankers ($M = 612.93, SE = 8.78$) than when there were healthy flankers ($M = 607.10, SE = 8.28$). Thus, no matter what the target was, high-empathy participants were more easily distracted by the unhealthy flankers than the healthy flankers. In these participants, there was also a significant between-subjects main effect of confederate presence $F(1, 67) = 4.21, p = 0.044, \eta^2 = 0.059$, with the participants responding more slowly when a confederate was present ($M = 627.10, SE = 12.64$) than when a confederate was not present ($M = 592.76, SE = 11.09$). Lastly, there was a significant confederate presence x flanker interaction $F(1, 67) = 23.63, p < 0.001, \eta^2 = 0.261$. Simple main effects analysis revealed that when a target was presented with unhealthy flankers, participants responded significantly more slowly when a confederate was present ($M = 637.21, SE = 13.20$) than when a confederate was not present ($M = 588.65, SE = 11.58; t(67) = -2.77, p = 0.007$). However, when a target was presented with healthy flankers, there was no difference between the response times of participants who had seen a confederate ($M = 617.10, SE = 12.44$), and those who had not ($M = 596.86, SE = 10.91; t(67) = -1.237, p = 0.22$). This interaction effect implies that when those with high empathy saw a confederate eating a food, they were subsequently more distracted by the unhealthy flankers than those who had not seen a confederate, but that confederate presence did not affect how easily participants were distracted by the healthy flankers.
A. Participants with Low Empathy

![Graph A](image)

B. Participants with High Empathy

![Graph B](image)

* Figure 3. Average reaction times in trials with healthy and unhealthy flankers for low-empathy (A) and high-empathy (B) participants in confederate and no confederate conditions. * refers to significant differences at \( p < 0.05 \).
**Liking.** Participants’ implicit affective responses to healthy foods and unhealthy foods, were calculated as the proportion of each type of stimulus that participants indicated as pleasant during the AMP. Of the 164 participants, 5 participants were excluded because their response times were fewer than 200 milliseconds or over 2000 milliseconds on average. Participants who stated that they were able to read Chinese characters were also excluded (n=17).

In order to discern whether the confederate’s and/or the foods’ presence at the beginning of the study affected participants’ implicit liking of the foods pictured in the AMP, a 2x2x2 repeated measures ANOVA was conducted. In this analysis, food stimulus (healthy, unhealthy) was the repeated measures variable, while session food (healthy, unhealthy) and confederate presence (present, absent) were the between-subjects variables.

With this analysis, a significant main effect of food stimulus emerged, $F(1,137) = 19.56$, $p<0.001$, $\eta^2 = 0.125$ indicating that participants rated a significantly greater proportion of unhealthy foods as pleasant ($M = 0.63, SE = 0.02$) than healthy foods ($M = 0.55, SE = 0.02$).

However, whether or not a confederate or a healthy food was present at the study’s beginning did not interact with the type of food presented. When we conducted this analysis with participants’ IRI fantasy subscale scores as a continuous between-subjects variable, no significant main effects or interactions emerged.

**Explicit Responses.**

**Wanting.** To assess participants’ explicit wanting of foods, we analyzed their responses to the survey’s items concerning how much they wanted to eat the foods in the photographs. We conducted a 2x2x2 repeated measures ANOVA, in which the within-subjects variable was depicted food (healthy, unhealthy), and the between-subjects variables were session food (healthy, unhealthy) and confederate presence (present, absent). With this analysis, no significant
main effects or interactions emerged. The same outcome appeared when we conducted this analysis with participants’ IRI fantasy subscale scores as a continuous between-subjects variable.

We then compared the ratings obtained in the current study to those from the pilot data using independent samples *t* tests. In these tests, chocolate was rated as significantly less wanted by those in the current study (*M* = 52.34, *SD* = 32.06) than those in the pilot study (*M* = 73.44, *SD* = 25.11), *t* (233) = 4.98, *p* < 0.001. There was not a significant difference between wanting ratings of apples in the current study (*M* = 58.03, *SD* = 28.81) and those in the pilot study (*M* = 62.49, *SD* = 27.57), *t* (229) = 1.11, *p* = 0.27.

**Liking.** To assess participants’ explicit liking of foods, we analyzed their responses to the survey’s items concerning how much they liked the foods in the photographs. We conducted a 2x2x2 repeated measures ANOVA, in which the within-subjects variable was depicted food (healthy, unhealthy), and the between-subjects variables were session food (healthy, unhealthy) and confederate presence (present, absent). With this analysis, no significant main effects or interactions emerged. The same outcome appeared when we conducted this analysis with participants’ IRI fantasy subscale scores as a continuous between-subjects variable.

We then compared the ratings obtained in the current study to those from the pilot data using independent samples *t* tests. In these tests, chocolate was liked significantly less by those in the current study (*M* = 76.03, *SD* = 28.04) than those in the pilot study (*M* = 83.41, *SD* = 19.26), *t* (234) = 2.04, *p* = 0.042. There was not a significant difference between the liking ratings of apples in the current study (*M* = 74.10, *SD* = 23.46) and those in the pilot study (*M* = 71.89, *SD* = 23.89), *t* (231) = -0.67, *p* = 0.51.
Discussion

The current study explored how social norms that implied the desirability of healthy and unhealthy foods influenced participants’ implicit and explicit wanting and liking of foods. Half of the participants were exposed to a confederate eating a healthy or unhealthy food, whereas the remaining participants were exposed only to a healthy or unhealthy food. Although this manipulation did not appear to shift participants’ implicit liking of the foods, as demonstrated by the AMP results, the results of the Flanker Task demonstrated that participants who saw a confederate eating were more easily distracted by unhealthy flankers, implying a greater level of implicit wanting. Moreover, the effect of confederate presence was more pronounced for participants who had higher levels of trait empathy. No such effects were observed for explicit responses.

These results suggest that the manipulation employed in the present experiment likely produced social priming rather than an imposition of a social norm. If the inferred descriptive norm had been successful, there would have been implicit and/or explicit evidence that participants’ wanting or liking shifted to reflect the type of food they saw the confederate eating. Instead, we found that regardless of the type of food the confederate was eating, participants responded more slowly to the target stimuli when they were presented with unhealthy flankers than when presented with healthy flankers. It is possible that the imposed norm used in the present study was too weak or ambiguous. Due to the fact that only two others, the experimenter and the confederate, voiced liking for the food, this scenario may not have convinced participants that enjoying this food was a norm. Past research has shown that norm ambiguity such as this leads to decreased adherence (Leone, Pliner, & Herman, 2007).
Instead of causing adherence to a norm, then, these results suggest that the sight of another person eating food (regardless of whether it is healthy or unhealthy) caused participants to attune their attention to food. Unhealthy foods are naturally most appealing, so those are the foods that more easily grabbed the food-directed attention. Thus, participants who saw a confederate were slower to respond on trials with unhealthy flankers than those who did not see a confederate. These results are reminiscent of previous work from our laboratory, in which participants who were hungry were also distracted by unhealthy flankers in this task (Forestell et al., 2012). Moreover, this effect was moderated by the participants’ trait empathy; while participants with high levels of empathy who saw a confederate were distracted by the unhealthy flanker stimuli, participants with low levels of empathy who saw a confederate were not distracted. This intuitively makes sense, as those who are more empathetic can more easily take on and are more affected by the mental states of others (Franzen et al., 2018; Robinson et al., 2011).

In contrast to the data from the Flanker Task, the data from the AMP task did not reveal an effect of the experimental manipulation. Regardless of their experimental group, participants implicitly liked unhealthy foods more than healthy foods. These results likely reflect the participants’ pre-existing evaluations of healthy and unhealthy foods, as unhealthy foods are in most cases simply more palatable and energy-dense than healthy foods. Pliner and Mann (2004) similarly found that the palatability of foods can overpower the effect of social information. In their study, participants almost always chose to eat a palatable food rather than an unpalatable food, even if they had received information that “prior participants” had chosen to eat the unpalatable food. In combination, the findings from these experiments are in line with previous research showing that shifts in liking and wanting do not always change in tandem, and that in
many cases it is easier to change wanting than liking (Forestell & Mennella, 2007; Plummer & Forestell, 2019).

Relative to our findings with implicit responses, our findings with explicit liking and wanting tell a very different story. We found no significant differences between groups or within groups for participants’ explicit ratings of the foods; participants did not report a preference for healthy or unhealthy foods in any of the experimental groups. A possible explanation for the lack of manipulation effects is reactance. As reported in previous studies, when individuals feel pressured to eat or like a certain food, they will often reassert their autonomy by refusing that food (Galloway et al., 2006). However, in the present experiment, this explanation seems unlikely given that we failed to see differences in explicit wanting and liking as a function of the experimental manipulation to which the participants were exposed. Moreover, in debriefing, no participants mentioned suspecting that the confederate was involved in the study, so it is doubtful that participants viewed the confederate’s food choice as an attempt to control them.

It is more likely that ratings for the healthy foods were similar to those for the unhealthy foods due to the demand characteristics of the experimental situation and social desirability motives. By the time participants reached the online survey portion of the study, they likely knew that the study focused on food, as the most of the images in the computer tasks depicted foods. This awareness, as well as the fact that eating healthfully is generally viewed positively, may have encouraged participants to portray themselves as healthy eaters to the experimenter by downplaying their liking and wanting of the unhealthy food or exaggerating their liking and wanting of the healthy food. This possibility would explain why the results of the explicit ratings in the current study do not match up with those from the pilot study, in which the pilot
participants clearly indicated that they liked and wanted the unhealthy food more than the healthy food.

This possibility would also explain why past research has produced short-term effects, but has struggled to produce long-term effects of social norms on healthy eating choices (DeBruijn, et al., 2015; Stok et al., 2014). As Higgs (2015) states, food choice in the moment that is based on demand characteristics or social desirability is a “type of conformity [that] is unlikely to form the basis of an effective, long term intervention on behaviour change.” Our measurements of implicit cognitive responses, with tasks such as the Flanker and the AMP, allowed us to explore participants underlying subconscious responses that are less susceptible to demand characteristics and social desirability. As our results show, although participants may explicitly indicate that they like and want to eat a healthy food as much as an unhealthy food, they still implicitly prefer more palatable unhealthy foods and are distracted by these unhealthy foods, if they are primed by a confederate eating before the task. It is possible, then, that these implicit responses would be stronger predictors of long-term eating choices than explicit responses.

Although the current study has provided important information about the influence of social norms on food attitudes, it was not without its limitations. The study design lacked a control condition in which a confederate was present, but not eating anything. This condition would have allowed us to discern whether it is the mere presence of another person or the fact that the other person is eating that caused the effects of confederate presence. Moreover, the confederate manipulation that we used may have been too weak to sufficiently establish a norm for the participants. A group of confederates expressing enjoyment of a food or statements by confederates that they and others frequently enjoy this food may have provided a stronger
imposition of the norm. In addition, we did not measure participants’ actual food intake, so we can only guess how our manipulation may have affected intake. Lastly, this study utilized a sample consisting almost entirely of women in their early 20s who attend college, so the generalizability of these results is limited.

Beyond these limitations, the current study made several contributions to the surrounding literature. We gathered data not only on participants’ explicit responses to foods, as previous studies have, but also on their implicit responses, thus broadening the understanding of the different forces at play in determining eating behavior. The current study also extended our understanding of social norms by using descriptive norms that were inferred by participants as opposed to presented by the experimenter, thus making the results more ecologically valid.

In the future, investigators should utilize the insights found from the current study. Firstly, we should strive to create an ecologically valid method of imposing social norms in laboratory studies that is not too weak or ambiguous. We should also keep in mind that participants’ explicit responses, which are tied to expectations and external pressures, are often different from implicit responses, which are more closely tied to inner beliefs and processes. Implicit and explicit responses should continue to be investigated together, as each may predict actual food choice in different ways. Also of note, is the possibility that the encouragement of healthy eating with social influence and norms may only be effective for individuals higher in trait empathy, as the low-empathy participants in the current study did not show an effect of confederate presence. Overall, the results of this study add to the evidence supporting the idea that social circumstances, such as the presence of another person eating or the feeling that one’s eating behavior is being scrutinized, influence one’s evaluations of and desires for foods.
References


Appendix

Implicit Wanting: Food Flanker Task

If the center item is a food, press the “x” key; if it is not a food, press the “m” key.
(Counterbalanced)

Implicit Liking: Affect Misattribution Procedure

If the character is pleasant, press the “x” key; if it is unpleasant, press the “m” key.
(Counterbalanced)
**Trait Empathy: Interpersonal Reactivity Index - Brief Form**

Participants rate items from 1 (Does not describe me at all) to 5 (Describes me very well). Items marked with an asterisk form the Fantasy subscale.

1. I often have tender, concerned feelings for people less fortunate than me.

2. I really get involved with the feelings of the characters in a novel.

3. In emergency situations, I feel apprehensive and ill-at-ease.

4. I try to look at everybody’s side of a disagreement before I make a decision.

5. When I see someone being taken advantage of, I feel kind of protective toward them.

6. I sometimes try to understand my friends better by imagining how things look from their perspective.

7. After seeing a play or movie, I have felt as though I were one of the characters.

8. Being in a tense emotional situation scares me.

9. When I see someone being treated unfairly, I feel very much pity for them.

10. I would describe myself as a pretty soft-hearted person.

11. When I watch a good movie, I can very easily put myself in the place of a leading character.

12. I tend to lose control during emergencies.

13. When I’m upset at someone, I usually try to “put myself in his shoes” for a while.

14. When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me.

15. When I see someone who badly needs help in an emergency, I go to pieces.

16. Before criticizing somebody, I try to imagine how I would feel if I were in their place.

**State Food Craving: State General Food Cravings Questionnaire**
Participants rate items from 1 (Strongly disagree) to 5 (Strongly agree).

An intense desire to eat:
1. I’m craving tasty food.
2. I have an urge for tasty food.
3. I have an intense desire to eat something tasty.

Anticipation of relief from negative states and feelings as a result of eating:
4. If I ate something, I wouldn’t feel so sluggish and lethargic.
5. Satisfying my appetite would make me feel less grouchy and irritable.
6. I would feel more alert if I could satisfy my appetite.

Craving as a physiological state:
7. If I ate right now, my stomach wouldn’t feel as empty.
8. I am hungry.
9. I feel weak because of not eating.

Obsessive preoccupation with food or lack of control over eating:
10. My desire to eat something tasty seems overpowering.
11. I know I’m going to keep on thinking about tasty food until I actually have it.
12. If I had something tasty to eat, I could not stop eating it.

Anticipation of positive reinforcement that may result from eating:
13. If I were to eat what I’m desiring, I am sure my mood would improve.
14. Eating something tasty would feel wonderful.
15. Eating something tasty would make things just perfect.

Dietary Restraint and External Eating: Dutch Eating Behavior Questionnaire (Restraint and External subscales only)
Participants rate items from 1 (Never) to 5 (Very often).

Restraint:

1. If you have put on weight, do you eat less than you usually do?
2. Do you try to eat less at mealtimes than you would like to eat?
3. How often do you refuse food or drink offered because you are concerned about your weight?
4. Do you watch exactly what you eat?
5. Do you deliberately eat foods that are slimming?
6. When you have eaten too much, do you eat less than usual the following days?
7. Do you deliberately eat less in order not to become heavier?
8. How often do you try not to eat between meals because you are watching your weight?
9. How often in the evening do you try not to eat because you are watching your weight?
10. Do you take into account your weight with what you eat?

External:

11. If food tastes good to you, do you eat more than usual?
12. If food smells and looks good, do you eat more than usual?
13. If you see or smell something delicious, do you have a desire to eat it?
14. If you have something delicious to eat, do you eat it straight away?
15. If you walk past the baker do you have the desire to buy something delicious?
16. If you walk past a snack bar or a cafe, do you have the desire to buy something delicious?
17. If you see others eating, do you also have the desire to eat?
18. Can you resist eating delicious foods? (Reverse-scored)
19. Do you eat more than usual, when you see others eating?
20. When preparing a meal are you inclined to eat something?
Explicit Food Rating Task

Participants rate on 100 point scales how much they like and want to eat the foods in the following photographs.