Language in popular American culture constructs the meaning of healthy and unhealthy eating: Narratives of craveability, excitement, and social connection in movies, television, social media, recipes, and food reviews

Bradley P. Turnwald a,b,*, Margaret A. Perry b, David Jurgens c, Vinodkumar Prabhakaran d, Dan Jurafsky d, Hazel R. Markus b, Alia J. Crum b

a University of Chicago Booth School of Business, USA
b Stanford University, Department of Psychology, USA
c University of Michigan School of Information, USA
d Stanford University, Department of Computer Science and Department of Linguistics, USA

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ABSTRACT

Many people want to eat healthier but struggle to do so, in part due to a dominant perception that healthy foods are at odds with hedonic goals. Is the perception that healthy foods are less appealing than unhealthy foods represented in language across popular entertainment media and social media? Six studies analyzed dialogue about food in six cultural products – creations of a culture that reflect its perspectives – including movies, television, social media posts, food recipes, and food reviews. In Study 1 (N = 617 movies) and Study 2 (N = 27 television shows), healthy foods were described with fewer appealing descriptions (e.g., “couldn’t stop eating”; d = 0.59 and d = 0.37, respectively) and more unappealing descriptions (e.g., “I hate peas”; d = -0.57 and d = -0.63, respectively) than unhealthy foods in characters’ speech from the film and television industries. Using sources with richer descriptive language, Studies 3–6 analyzed popular American restaurants’ Facebook posts (Study 3, N = 2275), recipe descriptions from Allrecipes.com (Study 4, N = 1000), Yelp reviews from six U.S. cities (Study 5, N = 4403), and Twitter tweets (Study 6, N = 10,000) for seven specific themes. Meta-analytic results across Studies 3–6 showed that healthy foods were specifically described as less craveworthy (d = 0.51, 95% CI: 0.44-0.59), less exciting (d = 0.40, 95% CI: 0.31-0.49), and less social (d = 0.36, 95% CI: 0.04-0.68) than unhealthy foods. Machine learning methods further generalized patterns across 1.6 million tweets spanning 42 different foods representing a range of nutritional quality. These data suggest that strategies to encourage healthy choices must counteract pervasive narratives that dissociate healthy foods from craveability, excitement, and social connection in individuals’ everyday lives.

1. Introduction

Many Americans are unhealthy eaters, and their poor health reflects it. Less than 10% of adults meet fruit and vegetable intake recommendations (Rehm, Peñalvo, Afshin, & Mozaffarian, 2016) and poor diet accounts for 45% of deaths from heart disease, stroke, and type II diabetes (Micha et al., 2017). Although many Americans say that they want to eat healthier and know how to eat healthier (Pew Research Center, 2016), they also perceive healthy foods as less appealing, tasty, and satisfying than unhealthy foods (Raghu Nathan, Naylor, & Hoyer, 2006; Suher, Raghu Nathan, & Hoyer, 2016). This problematic perception can lead people to view healthy foods as incompatible with choosing a tasty, satisfying meal (Aggarwal, Rehm, Monsivais, & Drewnowski, 2016; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998; Turnwald et al., 2019).

The present research examines the extent to which popular cultural media and social media portray healthy foods in a manner consistent with this unhelpful perception. Since food perceptions and choices are shaped by descriptive language (Bacon, Wise, Attwood, & Vennard, 2019; Raghu Nathan et al., 2006; Turnwald, Boles & Crum, 2017; Turnwald et al., 2019), culture (Cornil & Chandon, 2016; Rozin, Fischler, Imada, Sarubin, & Wrzesniewski, 1999; Werle, Trendel, &
Ardito, 2013), and social influences (reviewed in Higgs & Thomas, 2016), it is important to examine the language used to describe healthy foods in mainstream American culture. Does the normative language in popular cultural media and on social media portray healthy foods as less appealing than unhealthy foods? What specific narratives and themes most commonly appear in speech from institutions and individuals to shape our shared understanding of what it means to eat healthy foods? This question matters because people learn what is “good” and “desirable” from their daily cumulative interactions with family and close others, schools and governments, and an increasingly wide array of cultural “products”. Cultural products are creations of a culture that reflect its perspectives and include media, entertainment, arts, websites, and daily conversations on social media (Cohen & Leung, 2009; Markus & Conner, 2014; Markus & Kitayama, 2010; Swedler, 2003). These products reflect the ideas, values, and norms of those who fund and create them, as well as the desires, beliefs and norms of those who consume them. They also continually instill and elaborate these ideas in their audiences and users to influence behaviors (Cheryan & Markus, 2020; Weisbuch, Pauker, & Ambady, 2009). Understanding whether healthy foods are described as the less appealing choice in these persuasive media has implications for food attitudes, food choice, and marketing and health promotion strategies.

Now, more than ever before, talk of food is a prominent aspect of cultural products. Individuals vividly describe their food experiences to entire social networks, rely on others’ experiences to inform food decisions (e.g., online reviews), and view food-based messaging via televisions and smartphones at all hours of the day. Food is a prominent topic on social media platforms (Blackburn, Yilmaz, & Boyd, 2018), and linguistic analyses of popular American restaurant menus suggests that unhealthy menu items are described with more appealing descriptors (e.g., excitement, tastiness, textures) than items on restaurants’ healthy menus (Turnwald, Conner, Jurafsky, & Crum, 2017). However, we lack a systematic understanding of the language patterns used to describe healthy versus unhealthy foods across the cultural products with which Americans interact daily over their lifetimes. Given the advance in techniques to study psychological tendencies through language (Eichstaedt et al., 2021; Kern, 2016; Pennebaker, 1997; Pennebaker, Boyd, Jordan, & Blackburn, 2015), we compare how healthier and less healthy foods are described in American popular culture via this lens by content coding and quantifying descriptive food language in six prominent cultural products that people of all ages interact with on a daily basis.

We first broadly categorize how the entertainment industry describes healthy and unhealthy foods as appealing, neutral, or unappealing in character speech from 617 movies and episodes from 27 popular television shows. These cultural products are not directly food-related but include food-related language as features of the stories they portray. Using sources with richer descriptive food language, Studies 3–6 categorize descriptive food language into 7 theory-driven descriptive themes: tasty, filling, social, exciting, craveworthy, vaguely positive, and healthy using Facebook posts of America’s most popular restaurants (Study 3; N = 2275 posts), recipe descriptions from the top recipe-sharing website, Allrecipes.com (Study 4; N = 1000 recipes), Yelp food reviews (Study 5; N = 4403 reviews), and user food posts on Twitter (Study 6; N = 10,000 tweets). Finally, we present a number of sensitivity analyses of Twitter data, in which automated text analysis, comparison to established dictionaries, and machine learning approaches confirm our findings by theme and generalize to a new sample of 1.6 million tweets for dozens of foods across a range of nutrition scores. Together, our findings show that these messages, which dissociate healthy foods from excitement, craveability, and social connection, reinforce a widespread, problematic perception that healthy foods are unappealing.

2. STUDIES 1–2: character dialogue in movies and television shows

2.1. Samples

Studies 1 and 2 used existing databases of character speech from 617 movie scripts (Danescu-Niculescu-Mizil & Lee, 2011) and all episodes from an existing data set of 27 popular television shows (Table S1, e.g., Will and Grace, Friends, The Young and The Restless, The Big Bang Theory; data set curated by the third author), respectively. In Study 1, research assistants manually recorded every utterance that contained one of 5 prototypical unhealthy foods (pizza, burger, macaroni and cheese, steak, and tacos) and every utterance containing prototypical healthy foods, operationalized as any of dozens of vegetables listed on the “Vegetables” page of the U.S. Department of Agriculture (U.S. Department of Agriculture, n.d.). This yielded a sample of 444 utterances (N = 214 healthier foods, N = 230 less healthy foods). In Study 2, the televisual text sample was larger, so research assistants manually recorded the text from a randomly sampled 972 utterances (N = 472 healthier foods, N = 500 less healthy foods) that were balanced by food type (i.e., 100 utterances each for pizza, burger, macaroni and cheese, steak, and tacos and up to 20 utterances per vegetable). The sample for healthy foods was slightly less than 500 because some vegetables had few mentions. A power analysis estimating the required sample size using G*Power (version 3.1) for a two-tailed z-test of differences between two independent proportions indicated that N = 398 observations would be required to achieve 80% power to detect a significant difference for a theme occurring in 20% of observations for unhealthy foods vs. 10% of observations for healthy foods. Thus, Studies 1 and 2 were well-powered to detect such a difference. The studies presented in this paper did not require IRB approval because they did not qualify as human subjects research. Data are available on the Open Science Framework (https://osf.io/7szxw/).

2.2. Procedures

Two researchers coded for appealing sentiment (speaker enjoys or wants a food), unappealing sentiment (speaker does not enjoy or want a food), or neutral sentiment (sentiment not directed towards food, neither appealing nor unappealing) in each observation. A three-way coefficient for Cohen’s kappa was calculated to monitor inter-rater reliability. In Study 1, two coders each coded all 444 observations, and in Study 2 (and all subsequent studies), two coders each coded a 20% sample of the data before independently coding the remainder of the data. Disagreements were settled by discussion. Coefficients for inter-rater reliability are presented in Table S2. Inter-rater reliability was K = 0.88 and 0.90 in Studies 1 and 2, respectively, indicating “almost perfect” agreement (Landis & Koch, 1977). In each study, we report the difference between the proportion of healthy and unhealthy food observations containing appealing sentiment and explicitly unappealing sentiment as a standardized effect size (Cohen’s d), calculated using 2 × 2 frequency tables in the online Practical Meta-analysis Effect Size Calculator (Lipsey & Wilson, 2001).

2.3. Results

Results of Study 1 showed that across 616 popular movies, characters used appealing language for healthy foods only half as often as they did unhealthy foods (18.7% vs. 40.0%; Cohen’s d = 0.59, 95% CI: [0.35, 0.83]). Furthermore, characters were 2.5 times more likely to explicitly use unappealing language to describe healthy foods compared with unhealthy foods (15.0% vs. 6.1%; d = -0.55, 95% CI: [-0.91, -0.19]). Study 2 revealed similar patterns. Across episodes from 27 popular television shows, characters used appealing language for healthy foods only two-thirds as often as they did for unhealthy foods (32.6% vs. 48.6%; d = 0.37, 95% CI: [0.23, 0.51]). Moreover, characters were 2.8 times more
likely to use unappealing language to describe healthy foods compared with unhealthy foods (16.1% vs. 5.8%; $d = -0.63$, 95% CI: [-0.87, -0.38]). See Table 1 for examples.

To cross-validate our results, we used an open-source Python-based language analysis infrastructure (dlatk.wwb.org; Schwartz et al., 2017) that compared our hand-coded, sentence-level evaluations of appealing, neutral, or unappealing sentiment (coded as 1, 0, –1) to the Language Assessment by Mechanical Turk (LabMT) word list. The LabMT word list provides the average valence score (rated from “sad” to “happy” by human raters) for the 10,000 most frequent words in the English language (Dodds, Harris, Kloumann, Bliss, & Danforth, 2011). These valence scores, representing the average ‘happiness’ of all words in each sentence that contains a food, yielded consistent results as our hand-coded sentences: LabMT valence score (i.e., the “happiness” of words) was negatively related to food-healthiness ($0$ = less healthy, $1$ = healthier) in character speech in movies ($\beta = -0.083$) and in television shows ($\beta = -0.251$).

In sum, across character speech from the film and television industry and for films and television shows that have received billions of views, healthy foods were less likely to be explicitly described as appealing (e.g., “those are good”, “so excited I forget to breathe”) and more likely to be explicitly described as unappealing (e.g., “can’t stand broccoli”, “hate peas”) compared with unhealthy foods.

3. STUDIES 3–6: descriptive language in social media posts, recipe sharing websites, and food reviews

Beyond communicating that healthy foods are less appealing than unhealthy foods, cultural products may communicate specific ways in which individuals and institutions regard healthy foods as less appealing. Much of the dialogue in Studies 1 and 2 communicated sentiment (e.g., “I like”, “I want”, “My worst enemy, broccoli!”) without revealing speakers’ underlying rationale (why is broccoli her worst enemy?). To capture nuanced attitudes and the assumptions underlying them, Studies 3–6 quantified the types of appealing themes that are preferentially used to describe healthy and unhealthy foods in speech from a number of high-impact cultural products that contained richer descriptive language. This included Facebook posts from 37 of America’s top-selling restaurants (Study 3), recipe descriptions from Allrecipes.com, the most popular recipe-sharing platform on the internet (Study 4), Yelp reviews from six major U.S. cities (Study 5), and tweets about food from Twitter (Study 6). These sources span all hours of the day and contexts by passively exposing individuals during leisure (Facebook and Twitter) and actively influencing individuals in the moment of food choice (food reviews and recipes).

Across Studies 3–6, we compared language for prototypically healthier foods to prototypically less healthy foods and coded for seven linguistic themes that capture prominent reasons for why some foods are appealing, based on findings in the social psychological, public health, and consumer behavior literature. This theoretically derived coding scheme was based on prior content analyses (Emond, Smith, Mathur, & Gilbert-Diamond, 2015; Folta, Goldberg, Economos, Bell, & Meltzer, 2006; Harris, Bargh, & Brownell, 2009; Jurafsky, Chabunew, Routledge, & Smith, 2016; Manganello, Clegg Smith, Sudakow, & Summers, 2013; Turnwald, Conner, et al., 2017) and prominent themes from experimental studies (Raghunathan et al., 2006; Suher et al., 2016; Turnwald, Boles, et al., 2017, Turnwald et al., 2019) and included the following 7 themes: tasty, filling, social, exciting, craveworthy, vaguely positive, and healthy.

The tasty theme included words describing tastiness or specific flavors like smoky, tangy, or sweet. The filling theme included words describing the portion size of the food (e.g., so big, monster, the size of...). The social theme included words describing the social aspects of the food (e.g., party food, food to share). The exciting theme included words describing the excitement or anticipation of the food (e.g., new, unique, novel). The craveworthy theme included words describing the desire for the food (e.g., craving, I want, I need). The vaguely positive theme included words describing a general positive sentiment (e.g., good, nice, delicious). The healthy theme included words describing the healthiness of the food (e.g., healthy, nutritious, diet).

Table 1

<table>
<thead>
<tr>
<th>Study 1: Movies</th>
<th>Study 2: Television shows</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appealing sentiment</strong></td>
<td></td>
</tr>
<tr>
<td>I want pizza.</td>
<td>I’m really, really feeling a cheeseburger.</td>
</tr>
<tr>
<td>Those are good burgers.</td>
<td>My macaroni and cheese casserole you love so much.</td>
</tr>
<tr>
<td>I brung you a little basket of goodies.</td>
<td>He likes his pizza.</td>
</tr>
<tr>
<td>I couldn’t stop eating steak. I felt out of control – like I was making up for all those years being a vegetarian.</td>
<td>Oh – mashed potatoes, mashed cabbage, cut up leeks, all put together. You’re talking heaven.</td>
</tr>
<tr>
<td>This is probably the best hamburger I’ve ever had. I’m serious.</td>
<td>I have a craving for white asparagus that apparently is destined to go unsatisfied.</td>
</tr>
<tr>
<td>You missed out on some great broccoli florets at dinner.</td>
<td>Listens, I am pregnant and I am starving, I just want a slice of pizza.</td>
</tr>
<tr>
<td>I love salad nicoise</td>
<td>I love macaroni and cheese.</td>
</tr>
<tr>
<td>This steak is like butter!</td>
<td>From taco heaven. Just outside agua dulce.</td>
</tr>
<tr>
<td>This salad is delish.</td>
<td>Ooh I love zucchini.</td>
</tr>
<tr>
<td>You missed my shining moment. I won the macaroni sundae binge.</td>
<td>I drove by that taco truck. You know, the one with the great tacos?</td>
</tr>
</tbody>
</table>

| **Neutral sentiment** | | |
| Guess it wasn’t the pizza delivery guy. | Thanks. I’ll go pick the mushrooms. |
| We have tomatoes. | There’s fresh veggies and food out on the deck. |
| We had a choice: steak or fish. | I thought you were the pizza guy. |
| Does red pepper go under R or P? | It sure beats flipping burgers. |
| Can I pay you for our drinks and salad? | We’re not selling his tomatoes on eBay. |
| Like macaroni and cheese. | Uhh, those are tacos. |

| **Unappealing sentiment** | | |
| I hate peas. | Broccoli? Michael can’t stand broccoli. |
| Oh no...I think there’s carrots in here. | So what’ll it be? And please do not say salad because the baby back ribs are calling our name. |
| I don’t eat vegetables. | And I didn’t even tell her that I hate cauliflower. I just hid it in my napkin. |
| You have to eat if you’re drinking. And not just those little salads. | You don’t want those gross, disgusting green beans? |
| I just want a salad. You really think I’m a loser, don’t you? | Why did I just get a salad? |
| I don’t want a steak. | I hate cauliflower! |
| From now on, no more pizza! Get it? Starting right now you can eat real food like a normal human being! | You’re so lucky that I’m not making you eat lima beans or Brussel sprouts. |
| I have to run down to the grocery anyway. All that’s left around here is one frozen pizza. | Dad, I’m really not in the mood for cheeseburgers right now. |
| I hate asparagus. | No Brussel sprouts, ever. |
| This cauliflower is useless to me. | And don’t order the steak. |
Table 2

<table>
<thead>
<tr>
<th>Theme</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filling</td>
<td>Mentions of portion size, fullness, satiety</td>
<td>So big you may be there for a while. Hardly must combo. Eyes are bigger than the size of my face. Bigger is better. Filled me up!</td>
</tr>
<tr>
<td>Social</td>
<td>Mentions of close others, that the food is for social connection or sharing</td>
<td>You can’t spell friends without fries. With my mom and big bro. Perfect for sharing. My wife and friends. Perfect for a picnic or potluck.</td>
</tr>
<tr>
<td>Exciting</td>
<td>High arousal positive words, provocative words, emphatic punctuation (caps, !!!)</td>
<td>You just see fireworks. Oh my God! A+++++++! Insanely. Whole new level. Be advised you will get filled up!</td>
</tr>
<tr>
<td>Craveworthy</td>
<td>Lower arousal but intense; strong desire, wanting, needing, craving</td>
<td>I’m going to be craving for more. The obsession is real, begging for more.</td>
</tr>
<tr>
<td>Vaguely Positive</td>
<td>Words that are positive in valence but vague and do not represent other themes</td>
<td>Great! Fabulous. Excellent. Wonderful. Fabulous. Perfect</td>
</tr>
</tbody>
</table>

3.1. Samples

3.1.1. Study 3

This sample represented all American casual dining/family restaurants (N = 37) ranked in the top 100 in 2015 U.S. restaurant sales (Turnwald, Conner, et al., 2017) that had an official Facebook page. To obtain descriptive language from restaurants’ Facebook posts, in winter 2017 research assistants manually recorded the text from all posts that contained the word “salad” from the entire history of each restaurant’s Facebook page (dating as far back as 2009). Salads were chosen as the healthier option because governmental agencies including the Academy of Nutrition & Dietetics (2019), MyPlate (n.d.), and the American Cancer Society (2020) advocate for choosing a salad when eating out as being among several healthy alternatives. After excluding posts that did not actually describe salad, a total of N = 563 posts comprised the salad corpus. To create the corpus of standard restaurant dishes, which are typically less healthy (An, 2016; Bleich, Wolfson, & Jarlenski, 2016) we gathered each unique post from each restaurant’s Facebook page that contained text (including text within an image) and featured a food item in 2016 (N = 4777 posts). We excluded fine print, duplicate posts, and posts that did not have to do with food (e.g., gift cards). We then randomly selected 50 posts from each restaurant (or all posts for restaurants with fewer than 50 posts) to account for seasonal variations and to balance the sample by restaurant (total standard food posts, N = 1712).

3.1.2. Study 4

Using a private web browser, research assistants manually recorded the name and brief description for the first 500 recipes listed in the “healthy” section of the Allrecipes.com website (representing healthier foods) and the first 500 recipes listed in the “dinner” section (representing less healthy foods) in spring 2019 from Allrecipes.com. Although dinner recipes are not inherently unhealthy, in this context we chose dinner recipes to represent the less healthy option compared with the “healthy” section because many of the healthy recipes were composed meal dishes or hot dishes. This made dinner recipes a better matched and more conservative comparison group than a more overtly unhealthy category, such as desserts. The only text recorded for each dish was the name of the dish and the brief accompanying description in which the person who posts the recipe shares a brief caption or story about the dish. For example, “This dish is easy enough for a Tuesday, but looks pretty enough for company. It has a really fresh flavor and goes great with roasted potatoes or rice.”

3.1.3. Study 5

From a publicly available Yelp dataset of 5.2 million reviews (Yelp, Inc., n.d.), we selected all reviews from the 6 major U.S. cities...
represented (Charlotte, NC; Cleveland, OH; Las Vegas, NV; Madison, WI; Phoenix, AZ; Pittsburgh, PA), collected from 2004 to 2017. Within these reviews, we selected all Yelp reviews mentioning the same five unhealthy foods (burgers, macaroni and cheese, pizza, steak, and tacos) used in Studies 1 and 2, and six prototypical healthy foods (salad, asparagus, broccoli, carrots, cauliflower, and green beans), removed overlapping sentences, and then balanced by city so that all cities were represented equally. We then chose a random sample of 400 five-star reviews for each food, yielding a final sample of \( N = 2004 \) reviews for less healthy foods and \( N = 2399 \) for healthier foods, balanced by food and by city.

### 3.1.4. Study 6

Tweets (messages generated by users and visible to others who “follow” them or are in their social network) were collected from a 10% sample of all 2016 tweets on Twitter. Tweets were required to mention a single food term from our list, be written in English (we relied on Twitter’s proprietary language classification for determining English tweets, which seemed to give the best performance for our task), and not be a re-tweet. This collection ultimately comprised 147,031 tweets that contained the word ‘salad’, and 1,564,026 tweets about unhealthy foods (315,937 taco, 133,665 steak, 894,271 pizza, 176,980 burger, and 43,173 macaroni and cheese tweets). From this corpus, we randomly sampled 5000 tweets containing the word “salad”, and 5000 tweets about less healthy foods (1000 tweets each for pizza, tacos, steak, macaroni and cheese, and burger). Power analyses using the same specifications and parameter as in Studies 1 and 2 indicated that the sample sizes used in Studies 3-6 each had greater than 99% power to detect a significant difference for a theme occurring in 20% of observations for unhealthy foods vs. 10% of observations for healthy foods. To detect a significant difference of 15% vs. 10% in frequency of a theme appearing in unhealthy versus healthy foods, the samples in Studies 3, 4, 5, and 6 had 87%, 67%, 99% and 99% power, respectively.

### 3.2. Procedures

**Studies 3-6.** Two researchers coded each observation for the presence (coded as 1) or absence (coded as 0) of 7 specific themes: tasty, filling, craveworthy, exciting, social, vaguely positive, and healthy. Observation was at the level of post, recipe, review, or tweet and two coders coded each observation for the presence/absence of each of the 7 themes with high inter-rater reliability across themes and studies (range across themes and studies \( K = 0.66-1.00 \), Table S2). Importantly, while a given observation could contain multiple of the themes, a specific portion of an observation that qualified it for a given theme could not also qualify it for a second theme. For example, a word that qualified an observation for the craveworthy theme could not also qualify the observation for the exciting theme, and vice versa, but different portions

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![Fig. 1.](image)

Unhealthy Foods are Described as More Craveworthy, Exciting, and Social Than Healthy Foods in Studies 3-6 (social media posts, recipe sharing websites, and food reviews).

Note. Positive effect sizes (right) represent themes used more frequently for unhealthy foods, and negative effect sizes (left) represent themes used more frequently for healthy foods. Error bars represent 95% CI. Gray circles represent the effect size (Cohen’s d) for a given theme from a given study, and black squares represent the overall effect size for a given theme across studies.
of an observation could qualify the observation for multiple themes. We calculated a Cohen’s $d$ effect size as in Studies 1 and 2 to quantify the extent to which healthy vs. less healthy posts used each of the 7 themes in each study. We then conducted a random effects meta-analysis across Studies 3–6 for each theme using the “metafor” package (Viechtbauer, 2010) in RStudio, presented in the main text. The supplement presents results of individual studies.

3.3. Results

Detailed results for each individual study are presented in Table S3 in the Supplement. Meta-analytics results across Studies 3–6 showed that first, as hypothesized, the appealing themes of craveworthy ($d = 0.51$, 95% CI: [0.44, 0.59]), excitement ($d = 0.40$, 95% CI: [0.31, 0.49]), and social connection ($d = 0.36$, 95% CI: [0.04, 0.68]) were used significantly less often to describe healthy foods than unhealthy foods, with medium effect sizes (Fig. 1). The effects for craveworthy and excitement were particularly robust, significantly favoring unhealthy foods in each cultural product ($d_{range}$ across studies $= -0.84$ to $-1.84$), with a very large effect size across studies ($d = -1.35$, 95% CI: [-1.75, -.95]). Contrary to our hypotheses, the filling theme was not used significantly more to describe unhealthy foods ($d = 0.08$, 95% CI: [-0.07, 0.23]), nor was the tasty theme ($d = -0.10$, 95% CI: [-0.28, 0.09]). There was also no significant difference in use of the vaguely positive theme between healthy and unhealthy foods ($d = 0.06$, 95% CI: [-0.11, 0.24]), indicating that differences in language between healthy and unhealthy foods was not merely due to positive, non-specific language (e.g., awesome, great).

3.4. Sensitivity analyses in study 6 (Twitter)

To test whether our results were robust to sensitivity analyses, we conducted three additional analyses using the Twitter data, our largest sample of hand-coded observations. These sensitivity analyses (a) compared our 7 theory-driven themes to word-level patterns and established sentiment dictionaries using automated text analysis, (b) tested whether healthy foods are described as explicitly not craveworthy, not exciting, and not social more than unhealthy foods (to complement findings for the unappealing theme in Studies 1 and 2), and (c) used machine learning to test whether our findings by theme generalized to a new sample of 1.6 million food tweets for 42 different foods representing a range of nutrition scores. Results are briefly presented in the main text and fully described in the Supplemental text.

3.4.1. Word-level cross validation of themes

As a fully data-driven open-vocabulary approach, we determined which words and phrases from Twitter were most associated with each of the 7 themes using an open-source Python-based language analysis infrastructure (Schwartz et al., 2017). The results, depicted as word clouds in Fig. 2 and listed in Table S4, supported that our 7 themes measured the intended constructs. For example, the most predictive words and phrases captured desire and immediacy for the craveworthy theme (want, I, craving, right now), high arousal positivity for the exciting theme (bomb, excited, !!!, party), and relationships and giving for the social theme (me, bring, mom, someone, dad).

A second exploratory word-level cross-validation showed that the 72 categories of the Linguistic Inquiry and Word Count (LIWC) 2015 (Pennebaker et al., 2015) also mapped on to our coded themes in predictable ways (Table S5). For example, the LIWC dictionaries for “perceptual processes”, “nonfluencies” (like “mmm”), and “ingesting” correlated with the tasty theme; “power”, “quantifiers”, “body”, and “space” correlated with the filling theme; and “family”, “social”, and “affiliation” correlated with the social theme.

3.4.2. Unappealing themes

As detailed in the Supplement, healthy foods on Twitter were explicitly described as not craveworthy ($d = -1.42$, 95% CI: [-1.98, -.86]; e.g., “no one on death row is ordering a house salad as a last meal”), not exciting ($d = -1.55$, 95% CI: [-2.34, -.76]; e.g., “personally I turn down for salads”), not social ($d = -0.62$, 95% CI: [-1.00, -0.25]; e.g., “after declaring I wanted a salad for dinner, my shopping companions abandoned me, high-fiving and saying you don’t make friends with salad”), not filling ($d = -1.28$, 95% CI [-1.62, -.93]; e.g., “I’m not eating a salad for lunch anymore unless I have a big meal beside it. Eating it alone doesn’t even make me full”); and with vaguely negative language ($d = -.93$, 95% CI [-1.05, -.81]; e.g., “I’m not a salad guy”): compared with unhealthy foods in this sample. There was no significant difference in the use of not tasty language ($d = -0.25$, 95% CI: [-0.57, 0.08]; e.g., this salad tastes like hand sanitizer), and unhealthy foods were more likely to be described as not healthy ($d = -1.21$, 95% CI: [0.94, 1.48]; e.g., “just gotta weigh the options of how fat I’ll look if I order this pizza”).

3.4.3. Extending to many types of foods using machine learning

As detailed in the supplement, machine learning methods extended our sample of 10,000 tweets that we coded by hand to computationally detect the presence or absence of each of the 7 themes (e.g., exciting, social) in a random sample of up to 50,000 tweets per food for 42 common foods that span a range of nutrition scores. Overall, the results (Fig. 3) were similar to the results from the hand-coded sample of 10,000 tweets, indicative of generalization. Spearman’s rank correlation coefficient tests with 5000 sample bootstrapped 95% confidence intervals showed that food healthiness was negatively related to craveworthy ($\rho = -0.59$, 95% CI: [-0.75, -0.35]), exciting ($\rho = -0.28$, 95% CI: [-0.53, 0.01]), social ($\rho = -0.66$, 95% CI: [-0.78, -0.47]), and filling ($\rho = -0.57$, 95% CI: [-0.72, -0.35]) language. Food healthiness was positively related to healthy language ($\rho = 0.74$, 95% CI: [0.57, 0.85]) and tasty language ($\rho = 0.28$, 95% CI: [-0.05, 0.56]) and unrelated to vaguely positive language ($\rho = 0.01$, 95% CI: [-0.35, 0.36]). Thus, the overall trends observed in our coded sample extended to a broad range of foods in a new sample of nearly 1.6 million tweets.

Together, these three sensitivity analyses (a) provided additional evidence that the findings are not due to coder artifacts via comparison to automated word-level text analysis, (b) complement Studies 1 and 2 by showing that healthy foods are not only less likely to use certain appealing categories but are also more likely to be explicitly described as not having those appealing qualities, and (c) provided evidence of generalization to foods representing a range of health scores rather than dichotomizing healthy and unhealthy foods.

4. Discussion

Across food-related language from American cultural products representing the entertainment industry, restaurant industry, and individuals on social media platforms, healthy foods were described as less appealing than unhealthy foods. Studies 1 and 2 showed that movie and television characters used fewer appealing descriptions and more unappealing descriptions when talking about healthy foods compared with unhealthy foods. Studies 3–6 probed specific types of appealing themes and showed that while healthy foods were described with a greater emphasis on health qualities (e.g., health, diet, weight, body), they were described as specifically less craveworthy (e.g., want, need, crave, right now), less exciting (e.g., bomb, !!!, party, festival), and less social (e.g., Mom, friends, brought me, share) than unhealthy foods. These patterns generalized across language sourced from diverse authors, including the restaurant industry as well as users in the general public who post food recipes on recipe sharing platforms (Allrecipes.com), review restaurant foods on Yelp, or tweet about food experiences on Twitter.

Study 6 presented three additional sensitivity analyses to provide supporting evidence. First, a data-driven, bottom-up approach that identified the most common words among tweets that were tagged as
Fig. 2. Words Most Positively Correlated with Each Theme on Twitter in Study 6

Note. The size of words captures the relative size of their correlation coefficients between the word and the theme; color indicates relative frequency. (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)
conveying a particular theme provided word-level evidence that our themes measured the meanings that we intended. As an additional word-level cross-validation, correlation of our themes with LIWC2015 dictionaries demonstrated that established LIWC dictionaries mapped onto our coded themes in predictable ways. Second, complementing findings from Studies 1–2 that healthy foods are described as explicitly unappealing, healthy foods were also explicitly described as not craveworthy, not exciting, and not social to a greater extent than were unhealthy foods. Finally, machine learning methods further generalized the findings to a larger range of foods in a new sample of nearly 1.6 million tweets. Surprisingly, the meta-analysis of Studies 3–6 showed non-significant effects for the filling theme and the tasty theme between healthy and unhealthy foods, despite research showing that Americans...
implicitly and explicitly associate healthiness with worse taste (Raghu-
nathan et al., 2006) and decreased satiety (Suher et al., 2016). There are a
few potential explanations. Perhaps when referring to taste experi-
ences for unhealthy foods, speakers used words that encompassed exciting or craveworthy (e.g., mind-blowing, mouthwatering) themes rather than strictly tasty (e.g., delicious). It’s also possible that in-
dividuals who think healthy foods are tasty and filling posted about them more, whereas others may not have posted about them because they avoid them. People may also be aware that others expect healthy foods to be less tasty or filling, and may proactively include language to convince readers that this specific healthy dish is tasty and filling. However, our data cannot speak to these potential explanations for why the tasty and filling themes did not significantly distinguish speech about healthy versus less healthy foods as hypothesized, necessitating future research.

The overarching language pattern of dissociating healthy foods from craveability and excitement supports a linguistic representation of a goal conflict model of eating for long-term health at the expense of eating for immediate pleasure (Metcalfe & Mischel, 1999; Stein & Nemeroff, 1995; Ochs, Pontecorvo, & Pasulo, 1996; Loeb, van Koningsbruggen, Pappies, & Aarts, 2013). This language is rooted in foundational ideas of the Protestant work ethic (Mirvis & Garrett, 1971; Stein & Nemeroff, 1995) and Christian ideology (Covney, 2006), which moralize individual hard work and refraining from indulgences. Consistent with our findings of food language in online cultural products, the tradeoff between health and pleasure, generally, is one of the most prominent themes in studies of naturalistic conversation about food (Mycroft, 2008; Ochs et al., 1996; Roach et al., 2017; Weaver & Stam, 2021). For example, studies of young adults talking about food include speech such as (paraphrased) “It’s so boring eating healthy, but I know that I need to, so I do … eating salad every single day, you’re kind of like, ugh, just do it …”, and “I try to eat as healthy as possible … but sometimes … when I have my cravings like it’s just I really really want them and I have really bad self-control.” (Weaver & Stam, 2021). Analyzing natural conversations of women enrolled in weight loss groups, Mycroft (2008) concluded that members could not orient to food without reference to a moral framework, represented in speech, as such “I’ll have a treat and enjoy it but in between times I’ll be as good as possible.” In natural conversations between parents and children, American parents focus on what children should eat for physiological and moral reasons (Ochs et al., 1996) and talk about monitoring and restriction (Roach et al., 2017), whereas children frequently talk about enjoyment and desiring a food.

Future work is needed to provide an understanding of potential individual-level factors (e.g., demographic factors, personality factors, health factors) that predict the types of individuals who post about healthy versus less healthy foods and who use different themes to describe healthy versus less healthy foods. Prior work on individual differences in eating relevant language suggests, for example, that recovery from anorexia is associated with greater use of language that describes cognitive reflection versus the act of eating (Lyons, Mehli, & Pennebaker, 2006), and that weight loss is associated with using more first person singular pronouns (e.g., I, me) in online food diaries (Chung, 2009). Additional research has used natural language processing methods to identify linguistic markers of food in text from social media that are associated with state- or city-level differences in the U.S. For example, Fried, Surdeanu, Kembrook, Hingle, and Bell (2014) used geocoded Twitter data to examine if descriptive language of tweets to identify the words most predictive of being tweeted by users from a state with high or low rates of diabetes and overweight body mass index. Blackburn et al. (2018) analyzed language from Reddit posts about food and found that users from healthier U.S. cities spoke more about home cooking, food resources, Vietnamese cuisine, meat and dessert compared with users from less healthy U.S. cities, who spoke more about pizza, alcohol, and time. Additionally, Ochs and colleagues (1996) identified nationality as an important variable in how healthy and less healthy foods are talked about in natural conversations between parents and children. American parents prioritize talking about food in terms of nutrition and morality and deprioritize the role of pleasure, whereas Italian families prioritize pleasure over other factors and talk about what children and adults want to eat (Ochs et al., 1996). Future work is needed to better understand how individual-level differences in descriptive food language relate to individual-level factors or outcomes.

Although these studies did not test how exposure to these linguistic themes may impact food choice behavior, prior research suggests that the pattern of descriptive language identified here has the potential to make healthy foods a less attractive choice. People often seek foods to satisfy cravings and provide comfort (Cornil & Chandon, 2016; Evers, MarinStok, & de Rijder, 2010; Wagner, Ahlstrom, Redden, Vickers, & Mann, 2014), excitement represents a highly desired emotional state in American culture (Tsai, Knutson, & Fung, 2006), and food has long-served a social function of solidifying group membership (Locher, Yoels, Maurer, & Van Ellis, 2005; Mintz & Du Bois, 2002; Rozin, 1996; Woolley & Fishbach, 2019). Thus, associating any foods, even vegetables, with craveability, excitement, and social connection can increase appeal and food choice, as demonstrated in findings from large field experiments (Bacon et al., 2019; Turnwald, Boles, et al., 2017, Turnwald et al., 2019). Experiments also suggest that using only health-focused language to describe healthy foods can undermine healthy choices by reinforcing negative associations between healthiness and tastiness (Raghu-nathan et al., 2006; Suher et al., 2016; Turnwald, Boles, et al., 2017, Turnwald et al., 2019; Woolley & Fishbach, 2016). To date, however, experiments have not tested the effects of describing healthy foods with a number of specific themes in isolation (e.g., social, exciting), and future work is needed to understand the impacts of such themes on food choice.

We chose to focus on seven linguistic themes of interest from a social psychological and health perspective. However, our coding scheme did not capture all themes that are potentially important. For example, other sensory themes like textures and aromas may make foods more enticing, and describing foods as more expensive (a quality assumed for healthier foods; Haws, Reczek, & Sample, 2017) may make foods less appealing or attainable. Interviews with mothers and adolescents implicate food cost as an important linguistic theme in low socioeconomic status households but food quality as an important theme in high status households (Fielding-Singh & Wang, 2017). Additionally, food planning and prep-aration was the most prevalent theme in a study of conversations be-tween mothers and young children (Roach et al., 2017), and climate impact and meat consumption have emerged as linguistic themes of growing importance in food conversation in recent years, particularly among young adults (Weaver & Stam, 2021). Future work is needed to understand the contexts and modes of communication in which particular descriptive themes are more or less common and more or less influential.

### 4.1. Limitations

The present research had several limitations. Although we make our arguments about American culture, other cultures may or may not exhibit similar linguistic patterns depending on the degree to which they have similar food systems, eating rituals, and psychological associations between health and pleasure. We expect different results in cultures that hold different group-level construals of the role that foods play in everyday life and assign different meanings to food rituals. For example, research examining the intuition that healthy foods are less tasty finds stronger effects in U.S. populations (Raghu-nathan et al., 2006) than in Indian populations (Dube et al., 2016), and the reverse relationship (that healthier foods are tastier) has been shown in French populations (Wierle et al., 2013). Our data were drawn from American movies, television shows, restaurants, government agencies, and businesses, but there is likely a population of non-American individuals who posted Yelp re-vIEWS or tweets that were included in our analyses. Although prior
research suggests that descriptive language can impact food choices in decision contexts, direct translation of the themes described here to food choice behavior was not tested. The analytic plan also did not control for multiple comparisons of themes within each study, which increases the likelihood of false positive findings. Finally, we often dichotomized foods as healthy or unhealthy, while in reality, foods exist on a spectrum of greater or lesser content of a variety of nutrients. However, evidence suggests that people commonly think of foods as being discreetly healthy or unhealthy (Oakes, 2005), and sensitivity analyses in Study 6 showed similar patterns when analyzing foods spanning a wide range of nutrition scores.

4.2. Conclusion

Many people want to eat healthier but struggle to do so, in part due to a dominant perception that healthy foods are at odds with hedonic goals. The results of the present research demonstrate that this perception is represented and reinforced in language across popular entertainment media and social media that individuals interact with daily throughout their lifetimes. Examining speech from hundreds of movies and television show episodes as well as thousands of posts from social media, recipe-sharing websites, and food reviews, healthy foods were described with fewer appealing descriptions and more unappealing descriptions. Results showed that healthy foods were most commonly characterized in terms of health qualities whereas unhealthy foods were most distinguishable by crave-worthy, exciting, and social connection themes. These data suggest that strategies to encourage healthy choices must counteract pervasive narratives that dissociate healthy foods from crave-ability, excitement, and social connection in individuals’ everyday lives.

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Author statement

All authors have approved the final article. 


Ethical statement

This research did not require IRB approval because it did not qualify as human subjects research.

Stanford University defines human subjects research as when an investigator conducting research (i) obtains information or biospecimens through intervention or interaction with the individual, and uses, studies, or analyzes the information or biospecimens; or (ii) obtains, uses, studies, analyzes, or generates identifiable private information or identifiable biospecimens. The present research did not intervene on or interact with individuals, nor did it collect, study, or analyze private information. Social media posts were publicly available.

Declaration of competing interest

None.

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Appendix A. Supplementary data

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References


