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The role of external sources of information in children's evaluative food categories

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Abstract

Evaluative food categories are value-laden assessments which reflect the healthfulness and palatability of foods (e.g., healthy/unhealthy, yummy/yucky). In a series of three studies, this research examines how 3- to 4-year-old children ($N = 147$) form evaluative food categories based on input from external sources of information. The results indicate that children prefer to ask a mom and teacher over a cartoon and child for information about the evaluative status of foods. However, children are cautious to accept information about healthy foods from all of the external sources compared to unhealthy, yummy, and yucky foods. The results also indicate that providing information about the positive taste of healthy foods helps to encourage children to select healthy foods to eat. Taken together, these results have potential implications for children's health and nutrition education.

Evaluative food categories are value-laden assessments which reflect the healthfulness and palatability of foods (e.g., healthy/unhealthy, yummy/yucky) (Nguyen, 2008; Nguyen & Murphy, 2003; Nguyen & McCullough, 2009). This research focuses on how children develop their evaluative food categories based on the input they receive from different external sources of information (e.g., parents, teachers). An examination of external sources is especially relevant to evaluative food categories because they are often culturally-defined and socially transmitted between members of a community. For example, foods considered delicious in one culture may be disgusting in another (Fallon, Rozin, & Pliner, 1984; Rozin & Fallon, 1980). Also, the information that external sources provide about food may be important for children's health because they depend on others to make appropriate decisions about their diet. For example, parents are responsible for selecting and feeding children foods that meet their nutritional needs (Cashdan, 1994, 1998).

Children are exposed to a variety of external sources of information about food everyday-children hear about it from parents, learn about it from teachers, talk about it with friends, and see it advertised. For example, parents often encourage children to try different foods (e.g., "Try it; it tastes good") and teachers often tell children the consequences of eating certain foods (e.g., "Milk gives you strong bones") (Birch, Fisher, & Grimm-Thomas, 1999; Tinsley, 2003). Children frequently trade foods with other children during lunch time, conveying messages about the desirability of certain foods (e.g., "I'll trade my carrot sticks

for your cookies”) (Baxter, 2001). Children also too often see television commercials touting the nutritional value of many less than healthy foods such as sugary cereals, candy, and soda pop (e.g., “Part of a well balanced diet”) (Kunkel, Wilcox, Cantor, Palmer, Linn, & Dowrick, 2004). Given this variety of external sources, a challenge for children is to determine which external sources are knowledgeable and trustworthy.

To date, there has not been a systematic investigation of children’s reasoning about external sources of information regarding evaluative food categories, and how these sources affect children’s food category representations and food selection. Much of the existing research on evaluative food categories has tended to focus on documenting what children currently know about these categories. For example, by age 3- to 4 years, children can evaluatively categorize foods as healthy/unhealthy (Nguyen, 2007a, b; Nguyen & Murphy, 2003) and can distinguish these categories from other types of food categories, including taxonomic (e.g., vegetables, fruits) and script (e.g., breakfast, dessert) (Nguyen & Murphy, 2003). Children also understand many of the nutritional effects of eating (Wellman & Johnson, 1982) and are able to make inferences about the human body using evaluative food categories (Nguyen, 2008). Yet, at this age, children will occasionally misclassify foods as healthy/unhealthy (Nguyen, 2007a, b; Nguyen & Murphy, 2003) and still have some misconceptions about food nutrition (Nguyen & Rosengren, 2004a, b; Wellman & Johnson, 1982). Similarly, research has found that young children also know a lot about yummy/yucky foods, including ones that are culturally-defined (Rozin & Fallon, 1980) and are able to distinguish between foods based on this evaluative component (e.g., Fallon et al., 1984; Krause & Saarnio, 1993; Siegal, 1995; Siegal & Share, 1990). Yet, also during this period, children will sometimes misclassify dangerous, disgusting, or contaminated foods as edible or yummy (e.g., Rozin, 1990; Rozin, Fallon, & Augustoni-Ziskind, 1985; Rozin, Hammer, Oster, Horowitz, & Marmora, 1986).

Although this body of research has increased our understanding of what children do and do not know about evaluative categories of food, it does not speak to how young children acquire these categories. As Gelman (2009) has recently noted, researchers in the field of cognitive development commonly focus on children’s knowledge and abilities, as opposed to the factors that contribute to the growth of children’s knowledge and abilities. Thus, the current research is a start to filling the gap between research on what children know about evaluative food categories and research on how children learn this knowledge. This paper includes three studies that aim to understand the role of external sources in 3- and 4-year-olds’ acquisition of evaluative food categories. This is an important issue because it speaks to the nature of evaluative food categories; that is, on what basis do children form their value-laden assessments within a complex domain? Are children’s evaluative food categories simply a reflection of what others say, or a rich product of the differential weighing of information?

The external sources that were tested in these studies were ones that children are commonly exposed to within food-related contexts (e.g., during meals and snack time, while watching television): a cartoon; child; mom; and, teacher. To examine the possibility that these sources may vary in their importance across different evaluative judgments, two evaluative categories were tested in these studies, healthy/unhealthy and yummy/yucky foods. As

previously described, children begin to understand the evaluative dimensions of health and taste early on in development. Each of these evaluative dimensions embodies a complex interplay of information, including objective and subjective. For example, taste, a subjective matter of preference, has also been tied to objective determinants (e.g., foods high in dietary fat are usually very tasty, Birch, 1992; Drewnowski, 1997). Evaluations of health also embody both objective (e.g., nutritional facts) and subjective information related to a variety of cultural, historical, economical, and contextual factors (e.g., as in the evolution of the U.S. Department of Agriculture's food pyramid, Chiuve & Willett, 2007; Nestle, 1993). Indeed, research on epistemological development has shown that the line between matters of fact and opinion can be fairly ambiguous in some situations (Kuhn, Cheney, Weinstock, 2000). However, research has shown that children do grasp this distinction in simple situations that are clearly subjective versus objective (e.g., Banerjee, Yuill, Larson, Easton, Robinson, & Rowley, 2007; Mills & Grant, 2009). For example, children more readily change their initial answer to questions about facts (e.g., the time it takes to cook a dessert) rather than opinions (e.g., which dessert is the most delicious) after receiving discrepant information from an expert (Banerjee et al., 2007). How children respond to more complex situations that involve both objective and subjective elements, as in the case of evaluative food categories, remains an open question (see Banerjee et al., 2007, for discussion).

Specifically, Study 1a of the current research examines who children would prefer to ask if they wanted to learn about the two evaluative food categories of healthy/unhealthy and yummy/yucky foods. It was predicted that if children have preferences, then there should be significant differences between the sources, which could also vary by evaluative food category. Study 1b also provides a control and examines whether children's preferences are specific to the domain of food. Study 2 examines who children would be willing to accept evaluative food information from if directly offered this information by an external source. It was predicted that if children's willingness to accept evaluative food information depends upon the external source, then there should be significant differences between the sources. Also, if children's willingness is influenced by the evaluative food category, then there should be significant difference between the foods.

Research from the social cognition literature provides general support for these studies' predictions. Studies have found that questions are an important conversational strategy that children use with adults in order to seek information, including causal explanations (Chouinard, 2007; Frazier, Gelman, & Wellman, 2009). In word-learning tasks, children show sensitivity to a speaker's level of knowledge, acknowledging that some people are more accurate (e.g., Jaswal & Neely, 2006; Koenig, Clement, & Harris, 2004; Koenig & Harris, 2005a, b; Pasquini, Corriveau, Koenig, & Harris, 2007; Scofield & Behrend, 2008) and have more access to knowledge (Nurmsoo & Robinson, 2009a, b) than others. Research has also shown that children recognize that people can be experts or have specialized domains of knowledge (Lutz & Keil, 2002). Moreover, children also realize that a speaker can have false beliefs (e.g., Bartsch & Wellman, 1995; Wellman, 1992) that can lead to erroneous claims (e.g., Robinson & Nurmsoo, 2009; Wellman, Cross, & Watson 2001). Children can also detect a speaker's lies or deception (e.g., Lee, Cameron, Doucette, & Talwar, 2002; Lee & Cameron, 2000; Siegel & Peterson, 1996).

Finally, Study 3 explores how external sources can effectively guide children's healthy food selection based on the evaluative food information that they offer children. Although there is an extensive literature on how to encourage children to try novel or unfamiliar foods in general (e.g., Addessi, Galloway, Visalberghi, & Birch, 2005; Harper & Sanders, 1975), the current study differs from this research by focusing on how to encourage children's selection of healthy foods in particular. Previous research has found that taste is a powerful guide to children's food selection; children will readily select a food that adults identify as hedonically positive, even if children know that their own hedonic assessments differ from those of the adults (Lumeng, Cardinal, Jankowski, & Gelman, 2008). Thus, by extension, offering children information about both the health and taste of foods may be an optimal way of encouraging children to select healthy foods. In Study 3, if the type of evaluative food information that external sources provide is relevant to children's healthy food selection, then their selection should vary accordingly.

Study 1a

The aim of Study 1a was to identify who children prefer to ask for information about evaluative food categories. It was predicted that if children have preferences regarding which external sources they learn from about evaluative food categories, then there should be significant differences between the sources. Also, if children prefer learning about one kind of evaluative food category versus another from external sources, then there should be a significant difference between health- and taste-related food categories.

Method

Participants—The participants were 16 three-year-olds (8 males, 8 females, $M_{age} = 3.60$, $range = 3.14\text{--}3.98$) and 16 four-year-olds (8 males, 8 females, $M_{age} = 4.50$, $range = 4.00\text{--}5.07$). A separate group of 11 children (4 males, 7 females, $M_{age} = 4.08$, $range = 3.48\text{--}4.74$) also helped with the development of the testing materials. The participants were recruited from a middle-class community located in the Southeastern United States.

Materials—The materials were 24 yes/no questions: four questions about food (healthy, unhealthy, yummy, and yucky) per test source (cartoon, child, mom, teacher), control (chair, rock), and filler (clown, stranger). The controls were included to ensure that children were paying attention to the questions. Since there were only two controls, the fillers were included to equate the number of test and nontest sources. The materials also included two follow-up questions for each test source, control, and filler.

The test sources, controls, and fillers were presented to children verbally as generic labels without any specific information or visual representations. Generic labels were used because they refer to categories broadly (e.g., teachers in general), which could help elicit children's beliefs about external sources in general versus in specific (e.g., one teacher). Several studies have shown that children can appropriately interpret generics versus nongeneric language (e.g., Chambers, Graham, & Turner, 2008; Cimpian & Markman, 2008, 2009; Gelman & Raman, 2003; Hollander, Gelman, & Star, 2002).

To ensure that children between the ages of 3- and 4-years could understand the eight labels used in this study for the external sources, an independent group of 11 children participated in an identification task. In this task, children were presented with eight pairs of pictures, one at a time. Each picture pair included a photograph of an external source and a distracter (cartoon character & real person; child & woman; mom & dad; teacher & baker; chair & table; rock & sea shell; clown & dancer; stranger & Santa Claus). For each picture pair, children were asked to point to the picture that corresponded to a label for an external source (e.g., “Show me a cartoon (child, mom, teacher, chair, rock, clown, stranger).”). The results showed that children pointed to the correct pictures 95% ($SD = 10\%$) of the time, offering evidence that children comprehended the labels.

Procedure—Children were interviewed individually by a female researcher at their preschools for approximately 10 minutes. Children were initially told that “Today we’re going to play a game about foods. To learn how to play the game, I need to first teach you new words. Healthy foods give your body what it needs. They help you grow, give you long lasting energy, and keep you from getting sick. Unhealthy foods do not give your body what it needs. They do not help you grow, do not give you long lasting energy, and do not keep you from getting sick (American Heart Association, 2006; National Institute of Health, 2005; National Institute of Child Health and Development, 2005). Yummy foods are foods that you like to eat because they taste good. Yucky foods are foods that you do not like to eat because they taste bad (Fallon et al., 1984; Rozin & Fallon, 1980).” Afterwards, to check for understanding, children were questioned about these definitions and were provided with corrective feedback if necessary.

Then children were told that “In this game, you’re going to tell me who you would ask if you wanted to find out some information about foods.” During testing, children were asked a series of questions that were inspired by previous research examining children’s understanding of the division of cognitive labor (Danovitch & Keil, 2004, 2007; Lutz & Keil, 2002). Children were asked the following test questions: 1. “If you wanted to know if a food is healthy, who would you ask? A cartoon? A chair? A child? A clown? A mom? A rock? A stranger? A teacher?” 2. “If you wanted to know if a food is unhealthy, who would you ask? A cartoon? A chair? A child? A clown? A mom? A rock? A teacher? A stranger?” 3. “If you wanted to know if a food is yummy, who would you ask? A cartoon? A chair? A child? A clown? A mom? A rock? A teacher? A stranger?” 4. “If you wanted to know if a food is yucky, who would you ask? A cartoon? A chair? A child? A clown? A mom? A rock? A teacher? A stranger?”

Children were also asked two follow-up questions to examine their beliefs about the scope of external sources’ knowledge, particularly whether it includes knowledge of other people’s food-related thoughts and behaviors. For the first question, the researcher told children, “Right now, I am thinking of a food inside of my head. Who would know what kind of food I am thinking of? A cartoon? A chair? A child? A clown? A mom? A rock? A teacher? A stranger?” For the second question, the researcher told children, “I’m going to draw a food on this paper. (Then, the researcher drew an orange out of children’s view). Who would know what kind of food I just drew? A cartoon? A chair? A child? A clown? A mom? A rock? A teacher? A stranger?”

For all of the questions, children were asked to respond with “yes” or “no.” All of the questions as well as the sources and controls within the questions were presented in one of two random orders.

Results

To score the test questions, a 1 was assigned to children’s “yes” responses and 0 to children’s “no” responses. A health summary score was then created for each external source by summing children’s scores on the questions about healthy and unhealthy foods, and then dividing by the number of questions (i.e., dividing by 2). A taste summary score was also created for each external source by summing children’s scores on the questions about yummy and yucky foods, and then dividing by the number of questions (i.e., dividing by 2). A $2 \times 2 \times 8$ (Age Group [3-year-olds, 4-year-olds] x Food Evaluation [health, taste]) x External Source [cartoon, chair, child, clown, mom, rock, teacher, stranger]) ANOVA was conducted with Age Group as the between-subjects variable, and Food Evaluation and External Source as the within-subject factors. The dependent variable was participants’ health and taste summary scores for each external source. The results showed a main effect of external source, $F(7, 210) = 25.76, p < .001, \eta_p^2 = 0.46$. A series of Bonferroni corrected paired sample t-tests were conducted on the test sources (cartoon, child, mom, teacher) to follow-up this main effect. There was a significant difference between all of the sources ($t(31) > 2, p's < .008$), except the mom and teacher, who children preferred the most relative to the other sources. The results did not reveal a main effect of Food Evaluation, nor any other significant effect and interactions.

Children’s responding to the external sources was also compared to chance (50%). Children were significantly above chance on only the mom and teacher, suggesting that children have strong preference to ask these sources about evaluative food categories, $t(31) > 2, p's = .00, .01$. Please see Table 1.

The same scoring procedure for the test questions was used for the follow-up questions, a 1 for “yes” responses and a 0 for “no” responses. A single summary score for each external source was created by summing the scores for the thinking and drawing questions. These scores were then divided by the number of questions. A 2×8 (Age Group [3-year-olds, 4-year-olds] x External Source [cartoon, chair, child, clown, mom, rock, teacher, stranger]) ANOVA was then conducted with Age Group as the between-subjects factor and External Source as the within-subjects factor. The dependent variable was children’s scores for each external source. Similar to the results for the test questions, the results for the follow-up questions showed only a main effect of external source, $F(7, 210) = 11.85, p < .001, \eta_p^2 = 0.28$. This main effect was further examined with Bonferroni corrected paired sample t-tests focusing on the test items (cartoon, child, mom, and teacher). There was a significant difference between the cartoon and mom as well as between the cartoon and teacher, $t(31) > 3, p's < .008$.

Children’s responding to the external sources on the follow-up questions was also compared to chance (50%). The results indicate that children were not significantly above chance on any of the external sources, suggesting that children do not believe that these sources are knowledgeable of the researcher’s food-related thought and action. Please see Table 1.

Taken together, these results show that children prefer to ask a mom and teacher about the health and taste of foods, and that this preference does not vary by food evaluation. Children also realize that external sources are not privy to others' food-related thoughts and actions.

Study 1b

Study 1b was conducted to examine whether the findings from Study 1a are unique to the domain of food. Because Study 1a did not include other domains as a basis for comparison, it is difficult to ascertain whether the findings merely reflect children's general preference to approach certain external sources, namely a mom and teacher, for any kind of information. Thus, in Study 1b, using a similar procedure as Study 1a, children were questioned about who they would be willing to ask about the evaluative status of aliens (whether they are nice/mean) and toys (whether they are fun/not fun). Aliens and toys were selected because they range in familiarity to children, offering an opportunity to see who children would be willing to ask for information about these domains. The prediction was that if the results from Study 1a are unique to the domain of food, then a different pattern of responding should emerge in Study 1b with these other domains. Otherwise, if the results from Study 1a are not unique to the domain of food, then the same pattern of responding should emerge in Study 1b with these other domains.

Method

Participants—The participants were twelve 3-year-olds (3 males, 9 females, $M_{age} = 3.65$, $range = 3.12-3.94$) and twelve 4-year-olds (6 males, 6 females, $M_{age} = 4.47$, $range = 4.11-4.97$). The participants were recruited from the same community as in Study 1a. However, none of these participants had previously participated in Study 1a.

Materials—The materials included 32 yes/no questions: two about aliens (whether they are nice/mean) and two about toys (whether they are fun/not fun) per source (cartoon, chair, child, clown, mom, rock, stranger, teacher).

Procedure—The general procedure was similar to Study 1a with some exceptions. For questions about aliens, children were initially shown a drawing of a planet and told that “In this game, you’re going to tell me who you would ask if you wanted to find out information about aliens that live in this faraway place.” Then, children were asked: 1. “If you wanted to know if an alien is nice, who would you ask? A cartoon? A chair? A child? A clown? A mom? A rock? A stranger? A teacher?” 2. If you wanted to know if an alien is mean, who would you ask? A cartoon? A chair? A child? A clown? A mom? A rock? A stranger? A teacher?”

For questions about toys, children were initially shown a drawing of a toy box and told that “In this game, you’re going to tell me who you would ask if you wanted to find out information about toys in this box.” Then, children were asked: 1. “If you wanted to know if a toy is fun, who would you ask? A cartoon? A chair? A child? A clown? A mom? A rock? A stranger? A teacher?” 2. If you wanted to know if a toy is not fun, who would you ask? A cartoon? A chair? A child? A clown? A mom? A rock? A stranger? A teacher?”

As in Study 1a, for all of the questions, children were asked to respond with “yes” or “no.” Also, as in Study 1a, all of the questions as well as the sources within the questions were presented in one of two random orders.

Results

The approach to the data in Study 1b was similar to Study 1a. To score the data, a 1 was assigned to children’s “yes” responses and a 0 to “no” responses. A preliminary analysis indicated that children’s responses did not vary by domain, and so a single summary score was created for each of the external sources by collapsing across the questions about aliens and toys, and then dividing by the number of questions (i.e., dividing by four).

Next, to compare children’s performance in Study 1a and Study 1b, a $2 \times 2 \times 8$ (Study [1a, 1b], Age Group [3-year-olds, 4-year-olds] x External Source [cartoon, chair, child, clown, mom, rock, teacher, stranger]) ANOVA was conducted with Study and Age Group as the between-subjects variables and External Source as the within-subject factors. The dependent variable was participants’ summary scores for each external source. The results showed a main effect of External Source ($F(7, 364) = 22.08, p < .001, \eta_p^2 = .29$) that was moderated by an External Source x Study ($F(7, 364) = 6.17, p < .001, \eta_p^2 = .10$) interaction. Follow-up independent sample t-tests to this interaction revealed that children in Studies 1a and 1b responded similarly to all of the external sources, except that children had a greater preference for a mom and teacher in Study 1a than in Study 1b, $t(54) > 2, p$ ’s = .005, .033, respectively. Also, children had less of a preference for a chair and rock in Study 1a than in Study 1b, $t(54) > 2, p$ ’s = .036, .033, respectively. There were no other significant findings.

Children’s performance in Study 1b was also compared to chance (50%). Children were not significantly above chance on any of the sources. Please see Table 2.

Thus, in light of Study 1b, it appears that the results from Study 1a do not merely reflect children’s general preference for a mom and teacher, but a specific preference to ask them about evaluative food categories. Overall these results are in line with a number of recent findings showing that children do not simply follow more reliable sources at all times, but instead children’s judgments depend on the domain and how relevant they deem the reliability (e.g., Birch, Akmal, & Framptom, 2010; Koenig & Jaswal, in press; Kushnir, Wellman, & Gelman, 2008; Sobel & Corriveau, 2010).

Study 2

Thus far, Study 1a and Study 1b have examined who children prefer to ask about the evaluative categories of food as well as the evaluative categories of aliens and toys as a point of comparison. An issue that these studies have yet to address is whether children are willing to accept information from external sources when they directly offer information about different evaluative food categories. Study 2 was designed to examine this issue. The prediction for this study is if children’s willingness to accept evaluative food information depends upon the external source, then there should be significant differences between the sources. Also, it is possible that children’s willingness to accept information may depend

upon the evaluative food category, in which case there should also be significant differences between the foods.

Method

Participants—The participants were 20 three-year-olds (11 males, 9 females, $M_{age} = 3.64$, $range = 3.04–3.98$) and 20 four-year-olds (10 males, 10 females, $M_{age} = 4.56$, $range = 4.13–4.97$). The participants were recruited from the same community as in Study 1a and Study 1b.

Materials—The materials included 16 video clips of external sources of information. The materials included video clips so that children could directly experience the sources offering them information and to minimize the risk that children would view the researcher as a source of information (see Koenig & Harris, 2005a; Koenig et al., 2004; Robinson, 1994; Robinson, Mitchell, & Nye, 1995). Specifically, there were four clips for each of the following four sources: a cartoon, child, mom, and teacher. All of the external sources were female to control for any learning effects that may be an artifact of the external source's gender. Also, previous research has revealed that females are most effective in increasing children's food acceptance for both boys and girls (see Hendy, 2002), providing a stringent test of the external sources in this study. In particular, the cartoon was a generic female puppet that had cartoon-like physical features. An elementary school-aged volunteer played the role of the child. Two college student volunteers played the roles of mom and teacher (e.g., the mom held a baby doll in her arms as if it was an infant, the teacher wore glasses and had a pencil behind her ear).

The four clips of each external source varied in the evaluative claim that the source was making about a food hidden inside a 3×3×3 inch opaque box. The food was claimed to be healthy, unhealthy, yummy, or yucky. The foods were hidden in the 16 boxes, and never revealed to children for two reasons. First, this study was interested in how children learn their evaluative categories of food as opposed to what they already know about this domain. Second, previous research suggests that the efficacy of a model is the greatest when the food is novel or unknown to the child (e.g., Addessi et al., 2005; Harper & Sanders, 1975), again providing a stringent test of the external sources in this study.

The materials also included a video clip of the 16 opaque boxes sitting on a table simultaneously as well as a laminated photograph of this array of boxes printed on an 8.5" × 11" piece of paper. The researcher used the video clip of the boxes to explain to children that there were different foods hidden inside each box. The researcher also used the photograph to mark off the different boxes as children progressed through the video clips of the external sources during testing. This way, children could see how far along they were in the study to help maintain their motivation.

Procedure—Children were interviewed individually by a female researcher at their preschools for approximately 25 minutes. Children were initially introduced to the study and the key words of healthy/unhealthy and yummy/yucky as in Study 1a.

Then, to help orient children to the testing phase, children saw a video clip on a laptop computer, along with a corresponding photograph of a table with sixteen opaque boxes. Pointing to the computer screen, children heard the researcher say, “There are 16 different boxes here and each box has a different food inside of it. We put foods inside these boxes so we can play a fun game with them. This is a picture of all of the boxes too. In this game, you’ll see videos of a teacher, child, mom, and cartoon talking about the foods in the boxes. These people are going to say if the foods are healthy, unhealthy, yummy or yucky. Your job is to figure out if you believe them—if you believe what they are saying about the foods. We’ll use this picture to mark off each of the 16 different boxes when we see them in the videos, okay? Are you ready to play? We’re going to see a video about this food box now. Let’s mark it off on this picture.” Then, children saw 16 video clips, presented one at a time on the laptop computer. For example, children were presented with a video clip in which an external source said, “I’m a teacher. This food is healthy (unhealthy, yummy, yucky, on other trials).” Then, the researcher asked children the test question, “Think about whether you believe the teacher. Is this food healthy or unhealthy (yummy or yucky on other trials)?”

In this study, the external sources were presented in blocks and these blocks were presented in one of two random orders. The terms (healthy, unhealthy, yummy, yucky) in the test question were also presented in one two random orders.

Results

To score the data, a 1 was assigned to children’s answers that matched the evaluative food information provided by the external source (e.g., when a source stated that a food is healthy, and the child also answered that the food is healthy). In contrast, a 0 was assigned to children’s answers that did not match the evaluative food information provided by the external source (e.g., when a source stated that a food is healthy, and the child answered that the food is unhealthy). A summary score for health was then created for each external source by summing children’s responses to the questions about healthy and unhealthy foods, and then dividing this score by the number of questions (i.e., dividing by two). A summary score for taste was also created for each external source by summing children’s responses to the questions about yummy and yucky foods, and then dividing this score by the number of questions (i.e., dividing by two).

A $2 \times 2 \times 4$ (Age Group [3-year-olds, 4-year-olds] x Food Evaluation [health, taste] x External Source [cartoon, child, mom, teacher]) ANOVA was then conducted with Age Group as the between-subjects factor and Food Evaluation and External Source as the within-subjects factor. The dependent variable was children’s scores for each external source. The results revealed a main effect of Food Evaluation, $F(1, 38) = 10.72, p = .002, \eta_p^2 = 0.22$. Children were more willing to accept information from external sources about the taste of foods ($M = 78\%, SD = 28\%$) than the health of foods ($M = 65\%, SD = 24\%$), $t(39) = 3.31, p = .002$.

To further examine whether a specific food type was driving this finding, children’s responses to the yummy and yucky foods within the taste summary variable were separated and compared to chance (50%). Children were significantly above chance on the yummy and yucky foods, suggesting that children are willing to accept information about these two

kinds of foods, $t's(39) = 3.90, 6.40, p's < .001$. Children's responses to healthy and unhealthy foods within the health summary variable were also separated and compared to chance (50%). Children were significantly above chance only on the unhealthy foods ($t(39) = 8.01, p < .001$), but not the healthy foods, suggesting that children are willing to accept information about the former, but not the latter foods. Please see Figure 1.

The results did not reveal a main effect of External source, nor any other effect or interactions.

Overall, these results demonstrate that children's willingness to accept evaluative food information depends greatly on the type of evaluative food category. Children are willing to accept information regarding the taste of foods, but less so the health of foods, particularly in regards to healthy foods.

Study 3

Thus far, Studies 1a, 1b, and 2 have examined who children wish to ask and who children are willing to accept information from about evaluative food categories. An important question that emerges from these studies is how might external sources successfully convince children to select healthy foods to eat? The purpose of Study 3 was to explore how external sources can guide children's healthy food selection with the information that they provide about the health and taste of foods. The methodological approach of this study involves the external sources providing health and taste information, which mirrors many of the everyday interactions that children have with others about food. For example, when parents are trying to encourage children to try a healthy food, they will often comment on both its health and taste (e.g., "Try it, it's good for you and tastes good too!"). This methodological approach is different than past studies that have tested how children's eating behaviors can be socially influenced by observing models who do not necessarily comment on the foods (e.g., Addessi, et al., 2005; Harper & Sanders, 1975), just comment on the palatability of a food (e.g., Hendy & Raudenbush, 2000; Lumeng, et al., 2008; Repacholi & Gopnik, 1997), or their own preference for it (e.g., Fawcett & Markson, 2009; Shutts, Kinzler, McKee, & Spelke, 2009). The prediction for Study 3 was that children should tend to select healthy foods versus unhealthy foods, especially when given positive information about its taste.

Method

Participants—The participants were 20 three-year-olds (8 males, 12 females, $M_{age} = 3.60$, $range = 3.0-3.98$) and 20 four-year-olds (11 males, 9 females, $M_{age} = 4.62$, $range = 4.10-4.96$). The participants were recruited from the same community as in the previous studies.

Materials—The materials included a new set of 16 video clips, four per external source (a cartoon, child, mom, teacher), each claiming that a food inside a 3×3×3 inch opaque box was simultaneously healthy and yummy, healthy and yucky, unhealthy and yummy, or unhealthy and yucky. The materials also included the same video clip and photograph of the array of 16 boxes sitting on a table from Study 2.

Procedure—The procedure for Study 3 was very similar to Study 2, except that a new set of video clips and test questions were used in Study 3. In Study 3, children were presented with video clips of external sources providing joint information about the health and taste of foods, and then were asked if they would eat the food to have a healthy body. For example, children saw video clip of an external source saying, “I’m a teacher. This food is healthy and yummy (healthy and yucky, unhealthy and yummy, or unhealthy and yucky, on other trials).” Then, children were asked, “Would you eat this food to have a healthy body? Yes or no?”

Results

To score the data, a 1 was assigned to children’s “yes” responses and a 0 to “no” responses. An initial $2 \times 4 \times 4$ (Age Group [3-year-olds, 4-year-olds] $\times$ Food Evaluation [healthy-yummy, healthy-yucky, unhealthy-yummy, unhealthy-yucky] $\times$ External Source [cartoon, child, mom, teacher]) ANOVA was conducted with Age Group as the between-subjects factor, Food Evaluation and External Source as the within-subjects factor. The dependent variables were children’s scores for each external source. The results of this analysis revealed only a main effect of Food Evaluation, $F(3,114) = 34.81, p < .001, \eta_p^2 = 0.47$. Please see Table 3.

Because this initial analysis did not show an effect of external source on any of the four food evaluations, summary variables were then created for each type (healthy-yummy, healthy-yucky, unhealthy-yummy, and unhealthy-yucky) by summing their respective scores across the external source, and then dividing by the number of sources (i.e., dividing by four). Next, a $2 \times 2 \times 2$ (Age Group [3-year-olds, 4-year-olds] $\times$ Health [healthy, unhealthy] $\times$ Taste [yummy, yucky]) ANOVA was conducted with Age Group as the between-subjects factor, and Health and Taste as the within-subjects factor. The dependent variable was children’s scores on the food evaluations. The results revealed a main effect of Health, in which children were more likely to say “yes” to healthy foods than unhealthy foods, $(F(1, 38) = 4.93, p = .03, \eta_p^2 = 0.115)$. There was also a main effect of Taste, in which children were more likely to say “yes” to yummy than yucky foods, $(F(1, 38) = 65.78, p = < .001, \eta_p^2 = 0.634)$. Please see Table 3. There were no other significant main effects or interactions.

Thus, these results suggest that children taken into account information about both the health and taste of foods when making healthy food choices.

General Discussion

Presently there is a gap in the literature on children’s evaluative food categories; research has documented what children know about these categories, but has not addressed how children learn this knowledge. The overall goal of this research was to discover how children construct evaluative food categories based on the input they receive from external sources. The findings of this research suggest that children’s evaluative food categories are a rich product of the differential weighing of information: children show selectivity towards external sources and evaluative food categories under varying circumstances.

To begin, Study 1a revealed that children have preferences regarding who they turn to for evaluative food information. Specifically, the results showed that children prefer to ask a

mom and teacher, but not a cartoon or child (nor the controls/fillers, including a chair, rock, or stranger) about the evaluative status of foods. These results were similar across all of the external sources tested, namely a cartoon. Study 1b also revealed that this pattern of results did not apply to the evaluative categories of aliens and toys. Overall, these results are consistent with a recent finding by VanderBorgh and Jaswal (2009) who found that children believe that adults are better informants about food nutrition than the function of toys, and that children are better informants about the function of toys than food nutrition. The current study extends this finding by specifying the different types of adult figures that children prefer to ask about the evaluative status of foods; children prefer to ask a mom and teacher, but not a clown or stranger.

Study 2 also revealed that children's willingness to accept information from external sources depends upon the evaluative food category. Specifically, the results showed that children are more willing to accept information about the taste of foods compared to the health of foods. Children are especially reluctant to accept information about healthy foods. The results were true for all of the external sources tested, a cartoon, child, mom, and teacher. A possible explanation for these results may be related to the reliability of the messages that are usually associated with healthy/unhealthy and yummy/yucky foods. For example, "healthy" may not be a very reliable signal because it is relatively noisy in that it signifies not only nutritious foods, but is often used to encourage children to eat foods that taste good and bad. In contrast, "yummy" and "yucky" do signify good and bad-tasting foods, respectively, with little noise. "Unhealthy" may be somewhat different because these foods are often not tasted or because children may assume that any negative nutrition message is a reliable signal of a food's evaluative status. Children's vigilance regarding the reliability of these messages may be highly adaptive because they could have consequences for children's health and well-being. Children may realize that not everyone has their best interest in mind, and that there is much at stake with these foods compared to other foods since they are key to survival, offering essential vitamins and nutrients (see Siegal, 1995). In future research, children should be asked to provide justifications for their responses to help examine the validity of this explanation.

Children's tendency to be more selective of external sources in Study 1a compared to Study 2 warrants further discussion. A possible explanation is related to the different goals of each of these studies. Recall that the goal of Study 1a was to examine who children would prefer to approach when seeking evaluative food information, whereas the goal of Study 2 was to determine who children would be willing to accept evaluative food information from when it is provided. The results from Study 1a suggest that children prefer to seek information from a mom and teacher. It is possible that children may have been especially restrictive when deciding whom to ask because children were selecting, in their view, the most trustworthy and knowledgeable sources. In contrast, the results from Study 2 suggest that children are willing to accept evaluative food information from not only a mom and teacher, but also a child and cartoon. In this study, it is possible that children were less restrictive when deciding whom to endorse because children will accept information from even those who have at least some level of knowledge and those who they at least somewhat trust. Taken together, these two studies may indicate that although children are willing to accept information from a relatively flexible set of sources, they become more selective when they

must choose whom to approach for the information they seek. This possibility should be addressed in future research to help clarify children's varying degrees of selectivity under different circumstances.

Finally, Study 3 demonstrated that when children are asked which foods they would eat in order to have a healthy body, they tend to select healthy and yummy foods. This is a striking finding given that past research has shown that if children know that a food is healthy, they are more likely to refuse to eat the food (e.g., Noble, Corney, Eves, Kipps, & Lumbers, 2003; Wardle & Huon, 2000). Study 3, however, found that children are open to selecting healthy foods to have a healthy body if they know they are both healthy and tasty. This finding is even more striking given that all of the external sources were similarly able to guide children's food selection with this joint information. This finding contrasts with past studies that have shown that peers are more effective models than adults in shaping children's food selection (e.g., Duncker, 1938; Hendy & Raudenbush, 2000). Perhaps receiving information about both the health and taste of healthy-yummy foods is helpful because in the absence of taste information, children automatically and falsely assume that there is an inverse relationship between the health and taste of foods (e.g., the healthier a food is, the worst it tastes, see Robinson, Girgis, Nguyen, 2010).

As we continue to uncover how children's evaluative food categories are a rich product of the differential weighing of information, it will be important to examine additional external sources and categories beyond the ones tested in the present studies. In these studies, children were tested only on four main external sources: a cartoon; child; mom; and teacher. Although it was a good start point to examine external sources that children encounter in their daily lives while controlling for their gender, future research should explore a broader range of sources, including males. Future research should also take into account children's personal relationship with the external sources. Corriveau et al. (2009), for example, recently found that the quality of attachment that a child has with his/her mother affects the child's level of trust in what she says. This finding seems extremely pertinent to the domain of food with regards to the parent-child feeding relationship, and should be explored further.

Also, in these studies, children were tested on only two evaluative food categories, healthy/unhealthy and yummy/yucky foods. For comparison, future research could examine a variety of evaluative food categories such as "fun foods" (Guerin & Thibaut, 2008). Future research could also examine artificial, experimenter-defined evaluative food categories that are not taken from children's environment. This way, novel categories could be created using clearly objective or subjective criteria. Such a design would allow for a more controlled investigation of the connection between children's epistemological reasoning and acquisition of evaluative food categories. By examining these different evaluative food categories, more clarity can be gained regarding how external sources may vary in their significance across each category.

In conclusion, the findings from these studies have potentially valuable implications for children's health and nutrition education. For example, the identification of the specific external sources of information that children rely on can offer insights into the origins of children's misconceptions about food nutrition and provide a foundation for optimal

intervention. Also, the finding that children are cautious about healthy foods could have ramifications for articulating strategies to help children distinguish between reliable and unreliable sources of information about food nutrition. Finally, knowing that children's food selection is affected by the types of evaluative food information that external sources provide may impact health educators' decisions about how to most effectively teach food nutrition.

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Figure 1. Mean percentage of children's answers that matched the evaluative food information provided by the external source in Study 2. *Significantly above chance (50%), p 's < .001.

Table 1

Mean percentage (standard deviation) of children who responded “yes” to the external sources on the test and follow-up questions in Study 1a

	Questions			
	Health	Taste	Health & Taste Combined	Follow-up
External Source				
Cartoon	33 (39)	33 (41)	33 (40) ^b	34 (41) ^c
Chair	9 (24)	7 (22)	8 (23) ^b	16 (32) ^c
Child	50 (46)	45 (45)	48 (46)	44 (45)
Clown	36 (46)	36 (46)	36 (46)	44 (47)
Mom	70 (36)	75 (38)	73 (37) ^a	57 (44)
Rock	6 (21)	11 (25)	9 (23) ^b	11 (28) ^c
Stranger	33 (43)	30 (44)	31 (44) ^b	36 (44)
Teacher	66 (39)	67 (39)	67 (39) ^a	58 (46)
<i>M (SD)</i>	34 (37)	34 (38)	34 (37)	38 (41)

Note.

^aChildren were significantly above chance on the mom and teacher, suggesting that children prefer to ask these sources about the evaluative status of foods, $t(31) > 2$, p 's = .00, .01.

^bChildren were significantly below chance on the cartoon, chair, rock, and stranger, suggesting that children prefer not to ask these sources about the evaluative status of foods, $t(31) > -14$, p 's = .01, .00, .00, .01, respectively.

^cChildren were significantly below chance on the cartoon, chair, and rock, suggesting that children believe that these sources are unknowledgeable about the researcher's food-related thought and action, $t(31) > -8$, p 's = .03, .00, .00.

Table 2

Mean percentage (standard deviation) of children who responded “yes” to the questions in Study 1b

	Domain		<i>M (SD)</i>
	Aliens	Toys	
Source			
Cartoon	29 (39)	29 (41)	29 (40) ^a
Chair	27 (42)	23 (39)	25 (41) ^a
Child	35 (45)	35 (43)	35 (44)
Clown	23 (42)	31 (41)	27 (42) ^a
Mom	46 (46)	46 (44)	46 (45)
Rock	21 (38)	31 (41)	26 (40) ^a
Stranger	25 (36)	25 (39)	25 (38) ^a
Teacher	44 (44)	41 (48)	43 (46)

Note.

^aChildren were significantly below chance on the cartoon, chair, clown, stranger, and rock, suggesting that they do not prefer to ask these sources about aliens and toys, $t's (23) > 2.5$, $p's < .05$.

Table 3

Mean percentage (standard deviation) of children who responded “yes” to the questions in Study 3

Health			
	Healthy	Unhealthy	M (SD)
Taste			
Yummy	86 (20) ^a	74 (26) ^b	80 (23)
Yucky	39 (35)	35 (33)	37 (34)
M (SD)	63 (28)	55 (29)	59 (29)

Note.

^aChildren were more willing to select healthy-yummy foods compared to healthy-yucky unhealthy-yummy, and unhealthy-yucky foods, $t's(39) = 7.11, 2.70, 8.02, p's < .05$.

^bChildren were more willing to select unhealthy-yummy foods compared to unhealthy-yucky and healthy-yucky foods, $t's(39) = 5.99, 5.23, p's < .001$.