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Trust and doubt: An examination of children's decision to believe what they are told about food

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ABSTRACT

The domain of food is one that is highly relevant and vital to the everyday lives of children. However, children's reasoning about this domain is poorly understood within the field of developmental psychology. Because children's learning about food, including its evaluative components (e.g., health, taste) is so heavily dependent on information conveyed by other people, a major developmental challenge that children face is determining who to distrust regarding food. In three studies, this investigation examined how 3- and 4-year-olds and adults ($N = 312$) use different cues to determine when to ignore informant information (i.e., distrust what an informant tells them by choosing an alternative) in food- and non-food-specific scenarios. The results of Study 1 indicated that by age 4 years, children are less trusting of inaccurate sources of information compared with sources that have not demonstrated previous inaccuracy. Study 2 revealed that these results are applicable across the domain of objects. The results of Study 3 indicated that by age 4, children trust benevolent sources more often than malevolent ones. Thus, when reasoning about the evaluative components of food, by age 4, children appraise other people's untrustworthiness by paying attention to their inaccuracy and malevolence.

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Introduction

Every day, children receive information about food from other people. Unfortunately, not all of the sources are trustworthy. Some sources may provide inaccurate information about food pertaining to the evaluative component of taste. For example, even parents report that it is acceptable to mislead their children in order to influence their behavior, including eating practices (Heyman, Liu, & Lee, 2009) and will sometimes try to encourage children to eat healthy foods by misrepresenting their taste (e.g., "Try this, it's delicious and it is good for you too!") (see Birch, Fisher, & Grimm-Thomas, 1999; Tinsley, 2003). There are even cookbooks that advocate tricking children into eating their fruits and vegetables—*The Sneaky Chef: Simple Strategies for Hiding Healthy Foods in Kids' Favorite Meals* (Lapine, 2007), *The Sneaky Chef to the Rescue: 101 All-New Recipes and "Sneaky" Tricks for Creating Healthy Meals Kids Love* (Lapine, 2009), and *Deceptively Delicious: Simple Secrets to Get Your Kids Eating Good Food* (Seinfeld, 2008). Sources may also provide inaccurate information pertaining to the evaluative component of health. Many examples can be found among some of the 40,000 television commercials the average child sees each year. These advertisements often use cartoon characters to obscure the truth and persuade viewers of the nutritional value of unhealthy foods that are often high in added sugars, fat, sodium, and/or saturated and trans fats (e.g., sugary cereals are marketed as a "part of a complete/well-balanced/nutritious diet") (see Batada, Seitz, Wootan, & Story, 2008, and Kunkel et al., 2004, for reviews).

Within this milieu, it stands to reason that children likely face considerable difficulty in discerning when it is best to trust or doubt someone's assertions about the evaluative components of food. Although there are two separate bodies of research on children's evaluative food categorization and children's trust in testimony, these areas of research have yet to be examined together in-depth. Thus, it is still an open question how children determine whether or not to trust information provided to them in food-related scenarios. That is, do children assess a person's trustworthiness when considering whether they should be skeptical about the evaluative status of a food? By bridging these two bodies of research in the current investigation, we sought to examine the extent to which children take into account cues that may indicate they should not trust information given to them (inaccuracy and malevolence) when considering testimonies regarding the evaluative components of food. We expect that children will generally trust as a default unless they are aware of an informant's inaccuracy or malevolence, which will theoretically prompt them to override their default trust and become distrustful. This is a timely investigation given that researchers have recently acknowledged the significance of studying children's reasoning about food, and the contributions of social learning, which is an important area of interest among developmental psychologists (e.g., Frazier, Gelman, Kaciroti, Russell, & Lumeng, 2012; Shutts, Kinzler, & DeJesus, 2012).

Children's evaluative categorization

Evaluative food categories include foods that share the same value-laden assessment. The evaluative food category of healthy/unhealthy, for example, is based on a nutritional assessment of the foods. Another example is the evaluative category of yummy/yucky foods, which are based on a taste assessment of the foods (Nguyen, 2008; Nguyen & McCullough, 2009; Nguyen & Murphy, 2003). Research has found that by age 3 or 4 years, children can classify different foods as either healthy or unhealthy (Nguyen, 2007a; Nguyen, 2007b; Nguyen & Murphy, 2003), can make distinctions between edible and inedible objects (Rozin, Hammer, Oster, Horowitz, & Marmora, 1986; Siegal & Share, 1990) and will reject foods based on their distaste (Fallon, Rozin, & Pliner, 1984). Research has also found that children use their evaluative category knowledge to guide their food choices depending on the goals they have in mind (e.g., selecting vegetables to promote their bodies' health) (Nguyen, Gordon, & McCullough, 2011; see also Nguyen, Girgis, & Robinson, 2015).

Although the extant literature has documented children's knowledge of evaluative categories, there is currently a dearth of research on how children learn evaluative information about the health and taste of foods. One study found that by age 3 years, children believe that adults are better informants than children about food nutrition (VanderBorght & Jaswal, 2009). Another study found

that 3- and 4-year-olds prefer to learn about the health and taste of foods from certain sources such as a mom and teacher versus a stranger and clown (Nguyen, 2012). Taken together, these studies have begun to identify *who* children learn from regarding the evaluative aspects of food. However, further research is necessary in order to understand *why* children are likely to trust these sources or what factors may cause them not to trust these sources. That is, what specific cues for distrust are children tuning in to when determining whether to believe a source's evaluative claims about food? Because evaluative food categories are often culturally defined, this information must be socially transmitted between members of a community. For example, which foods are considered to be healthy or tasty may vary greatly depending on one's cultural and historical context (Rozin, 1990; Siegal, 1995). Thus, children must rely on informants (e.g., parents, teachers) to gather information about the evaluative components of food, leaving children potentially vulnerable to suspect sources.

Children's trust in testimony

Extensive research on young children's trust in testimony has demonstrated that children are sensitive to variations in a person's credibility (see Gelman, 2009; Heyman, 2008; Koenig, 2010, and Robinson & Einav, 2014, for reviews). For example, by age 3 or 4 years, children use accuracy as a cue for trust, monitoring a speaker's past accuracy to decide who they should and should not trust when learning the meaning of new words (e.g., Birch, Vauthier, & Bloom, 2008; Clément, Koenig, & Harris, 2004; Corriveau & Harris, 2009a, 2009b; Jaswal & Neely, 2006; Koenig, Clément, & Harris, 2004; Koenig & Harris, 2005; Pasquini, Corriveau, Koenig, & Harris, 2007; Scofield & Behrend, 2008; Sobel & Corriveau, 2010) and when learning about the identity of a hidden object (Nurmsoo & Robinson, 2009) as well as personality traits (Boseovski, 2012). By ages 3 to 5 years, children tend to be more distrustful of those with lower levels of desirable personality traits such as niceness (Landrum, Mills, & Johnston, 2013), morality (Doebel & Koenig, 2013), honesty (Qing-Gong, Heyman, Xu, & Lee, 2014), and intelligence (e.g., Lane, Wellman, & Gelman, 2013).

Cumulatively, this body of research demonstrates that children tend to exercise caution when deciding who to believe (e.g., see Harris, 2012; Koenig & Sabbagh, 2013; Landrum, Eaves, & Shafto, 2015; Mills, 2013). Whether children have similar or different patterns of reasoning across domains, including food, is theoretically important in that it speaks to the nature of children's trust in testimony, that is, the extent to which children's trust is specific or general. As described, past research from the trust in testimony literature shows that children do not have generalized credulity; rather, they attend to characteristics of informants and selectively extend their trust based on this information (Gelman, 2009; Heyman, 2008; Koenig, 2010). However, most research has focused on domains such as object names, in which knowledge is often a matter of convention (Jaswal, 2010). Recent exceptions include studies that have focused on children's reliance on informant testimony within the domains of biology (e.g., Australian marsupial: Boseovski & Thurman, 2014; body parts: Luu, de Rosnay, & Harris, 2013) and the physical world (e.g., location of a ball: Jaswal, 2010).

Food represents a unique domain in that the line between matters of fact and opinion are fairly ambiguous for its evaluative dimensions, which embody both objective and subjective information (see also Kuhn, Cheney, & Weinstock, 2000). This blend of subjectivity and objectivity within the domain of food sets it apart from other domains that have been the focus of studies of trust. For example, although taste is a subjective matter of preference, it is also tied to objective determinants (e.g., tasty foods are usually high in dietary fat) (Birch, 1992; Drewnowski, 1997). Similarly, although health is an objective matter of nutrition, it is also tied to subjective information concerning contextual factors such as cultural, historical, and economical contexts (e.g., as in the evolution of the U.S. Department of Agriculture's food pyramid) (Chiuve & Willett, 2007; Nestle, 1993). Therefore, the domain, in its complexity, offers a strong test case for examining domain similarities/differences.

Examining children's trust in testimony in regard to food is also an especially critical issue given the ecological importance of this domain in children's lives (see Rozin, 1990; Shutts, Condry, Santos, & Spelke, 2009; Shutts et al., 2012; Siegal, 1995). It is estimated that adults make more than 200 food and beverage choices a day (Wansink & Sobal, 2007). Children frequently engage in this decision-making process as well by communicating to parents their preferences, thereby exerting a large influence on the foods that parents purchase and make available in the household (Holsten,

Deatrick, Kumanyika, Pinto-Martin, & Compher, 2012). Indeed, parents often do give in to their children's demands for foods (Isin & Alkibay, 2011; Turner, Kelly, & McKenna, 2006). This ability to recognize that adults can have taste preferences (e.g., liking broccoli) that are in opposition to children's own emerges very early (by 18 months) (Repacholi & Gopnik, 1997). Children's understanding that different people can have different taste preferences and children's ability to influence the foods that are offered to them highlight how children have everyday experience and expertise in the domain of food.

To date, little is known about how children actively appraise other people's untrustworthiness when reasoning about the evaluative components of food (e.g., health, taste) within the context of a categorization decision. Although there is related research from the food selection literature, the current research is distinct in two ways. First, we investigated evaluative food categorization, that is, how children learn from others about which foods belong to the categories of healthy versus unhealthy and yummy versus yucky. Second, we investigated how children's selective distrust in others affects their evaluative category decisions about food. In particular, we examined cues that may stimulate distrust (inaccuracy and malevolence) that young children may use when learning about evaluative food categories from others.

In contrast, past studies from the food selection literature have traditionally measured food preference but not evaluative categorization. Although ostensibly similar, these two kinds of judgments are theoretically different. Evaluative food categorization is based on evaluative assessments of foods, whereas food preference may be a matter of liking, palatability, and so on (see Rozin & Zellner, 1985). In addition, past studies from the food selection literature have usually examined the efficacy of modeling in shaping eating behavior but not the influence of trust in testimony on evaluative categorization. For example, studies have identified characteristics of models that are effective in shaping food preferences. Infants have a tendency to emulate the food preferences of novel prosocial others (Hamlin & Wynn, 2012) and speakers of their native language who have positive affect (Shutts, Kinzler, McKee, & Spelke, 2009; see also Wertz & Wynn, 2014). Children prefer foods endorsed by enthusiastic teachers (Hendy & Raudenbush, 2000), models with positive expressions (Frazier et al., 2012), and individuals who share the same age and gender as the children (Frazier et al., 2012; Shutts, Banaji, & Spelke, 2010). One exception to this literature is a study documenting children's willingness to select jelly beans to sample that adults have identified as hedonically positive. Children will defer to adults even when they know that their own hedonic ratings of the jelly bean flavors differ from those of the adults (Lumeng, Cardinal, Jankowski, Kaciroti, & Gelman, 2008). This initial study offers a springboard to further investigation of how testimony from many sources in addition to adults may guide children's reasoning about different evaluative categories of food beyond candy.

The current research

Through a series of three studies, the current investigation aimed to address this gap in the literature on children's evaluative categorization and trust in testimony. In this investigation, we tested 3- and 4-year-olds' ability to use the cues of inaccuracy and malevolence in both food- and non-food-specific scenarios involving toys to stimulate distrust in an informant's encouragement. Adults were also included as a developmental endpoint. These child age groups were selected based on the existing literature on children's trust in testimony, which has identified developmental differences within this age range. Although 3-year-olds have some ability to discount claims based on past inaccuracy and meanness, 4-year-olds are generally better and more flexible in using these cues to evaluate informants (see Harris, 2012, and Mills, 2013, for reviews).

The first two studies examined whether an informant's tendency toward inaccuracy may stimulate a child's decision to be distrustful of the informant. Study 1 examined this in the domain of food for the reasons outlined above. Study 2 sought to examine whether children may use the same process to arrive at distrust in another domain, namely toys. As discussed in this Introduction, food is a complicated domain where informants frequently try to trick children. In addition, the aversive or even life-threatening experience of eating something distasteful or dangerous may highly motivate a child to discern the relative trustworthiness, or lack thereof, of an informant in the domain of food. Thus, Study 2 was designed to examine whether the same inaccuracy cues children use in the domain of food

generalize to a more innocuous domain (i.e., toys) in order to provide a more conservative test of the process. Whereas Studies 1 and 2 focused on establishing sources' history of inaccuracy in the domains of food and toys, Study 3 focused on establishing sources' history of benevolence/malevolence in the domain of food.

The procedure for all three studies was similar, including familiarization and testing phases. The major difference between studies is that a history of sources' inaccuracy was established in Studies 1 and 2, whereas a history of sources' benevolence or malevolence was established in Study 3. The sources in all of the studies were a mother, a teacher, a cartoon, and a peer, presented one at a time. These sources were selected because they frequently convey messages to children about the evaluative components of food; children often hear and learn about the health and taste of foods from parents, teachers, friends, and advertisements (see Nguyen, 2012). Note, however, that these studies were not designed to test for differences between these sources; rather, they were designed to test children's sensitivity to cues for distrust across a variety of sources that are prevalent in children's daily lives.

During testing trials in all three studies, children saw video clips of the sources from the familiarization phase making claims about the evaluative status of foods (or toys) concealed inside opaque boxes. Children were then asked whether they believed the sources. Therefore, in these studies, children needed to recognize that the sources' lack of trustworthiness (presented in the familiarization video clip) is relevant to their task of inferring the evaluative status of the foods (or toys) presented in the testing video clips. Thus, in Study 1, we predicted that if children take into account the sources' accuracy, then they should be unlikely to trust inaccurate sources regarding food. In Study 2, we predicted that if children reason similarly about food as other objects, then the results for these domains should resemble each other on this task. In Study 3, we predicted that if children take into account the sources' benevolence, then they should be less likely to trust malevolent sources versus benevolent ones regarding food. Although not previously tested in the domain of food, support for these predictions comes from the research within the trust in testimony literature showing that with development 3- and 4-year-olds attend to an informant's accuracy (e.g., Birch et al., 2008; Boseovski, 2012; Clément et al., 2004; Corriveau & Harris, 2009a, 2009b; Jaswal & Neely, 2006; Koenig & Harris, 2005; Koenig et al., 2004; Pasquini et al., 2007; Sobel & Corriveau, 2010) and positive personality traits (e.g., Landrum et al., 2013; Lane et al., 2013).

Study 1

Study 1 examined whether children use inaccuracy as a cue for distrust in the domain of food. This study had two conditions: inaccurate and neutral. There was a familiarization phase in the inaccurate condition in which children initially saw a video clip of a source (cartoon, child, mom, or teacher) providing an inaccurate report of the contents of a bag. During testing, children saw video clips of the source making claims about the evaluative status of foods.

In contrast, there was not a familiarization phase in the neutral condition, and so children did not experience prior inaccuracy from the sources in the test video clips. If children distrust information from inaccurate sources, then they should be less likely to accept the sources' claims in the inaccurate condition compared with the neutral condition.

Method

Participants

A total of 64 children participated in this study: 32 3-year-olds (12 girls; M_{age} = 3.5 years, range = 3.03–3.98) and 32 4-year-olds (10 girls; M_{age} = 4.63 years, range = 4.13–4.94). In addition, 32 adults participated as a developmental comparison (16 women; M_{age} = 19.28 years, range = 18.11–21.19). Half of the participants in each age group were randomly assigned to either the inaccurate or neutral condition. Participants were recruited from preschools and a university located in the southeastern United States. Participants were from predominantly middle-class European American backgrounds.

Materials and procedure

There were two between-participants conditions that used the same testing procedure. The only difference between the conditions concerned the presence of a familiarization phase in which sources provide inaccurate information prior to the testing phase.

Children in both conditions were interviewed individually for approximately 25 min by a female researcher at their preschools. The researcher initially told children that they would be playing a game about foods hidden inside opaque boxes. Then, the researcher introduced children to the terms of "healthy/unhealthy" and "yummy/yucky". Children were told, "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. 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." Children were also asked follow-up questions to check their understanding of these terms (e.g., "Which foods give [do not give] your body what it needs? Healthy or unhealthy foods? Which foods do you like [not like] to eat because they taste good [bad]? Yummy or yucky foods?"). All of the children were able to answer the questions with the appropriate terms (e.g., "yummy foods" in response to the question, "Which foods do you like to eat because they taste good?").

In the inaccurate condition, children were then presented with four familiarization video clips, each featuring a cartoon, child, mom, or teacher providing inaccurate information about the contents of a bag, which was intended to establish a history of general inaccuracy. Food was not mentioned during familiarization in order to avoid any unwitting priming effects. All of the sources were female to neutral for any potential effects that may be an artifact of the source's gender (see Taylor, 2013). The cartoon was a generic female puppet with cartoon-like physical features. The child was a school-aged volunteer. The mom and teacher were two college student volunteers. The setting and sequence for the video clips was always the same. The video clips begin with the source sitting alone behind a table and saying, "I'm a _____ [cartoon, child, mom, or teacher]." Then, the source turns an opaque bag upside down to show that it is empty. Next, the source shows a ball to the camera and places it into the bag. Then, an uninformed researcher (female college student volunteer) sits down in a chair beside the source and says, "Hello. What's in the bag?" The source responds inaccurately by saying, "There's a crayon inside of the bag." The familiarization video clips were 17 s each.

After familiarization, children were presented with four test video clips, one at a time, that corresponded to the source in the familiarization video clip. In these video clips, the source was sitting at table with a $3 \times 3 \times 3$-inch white opaque box positioned in the center. The four video clips per source varied in the evaluative claim that the source made as she was looking and pointing at the food concealed inside the box. The food was claimed to be either healthy, unhealthy, yummy, or yucky (e.g., "Hi. I am a _____ [cartoon, child, mom, or teacher]. This food is _____ [healthy, unhealthy, yummy, or yucky]." The test video clips were approximately 5 s each. Thus, children were tested on each source making each of the four possible evaluative claims. However, it should be emphasized that this study was not designed to test for differences between these evaluative claims; rather, it was designed to test young children's sensitivity to different cues for distrust when reasoning about different kinds of foods. These evaluative properties were specifically selected because previous research indicates that children are knowledgeable of these food categories (e.g., Fallon et al., 1984; Nguyen, 2007a, 2007b; Nguyen & Murphy, 2003; Rozin et al., 1986; Siegal & Share, 1990).

After each test video clip, the researcher asked children, "Think about whether you believe the _____ [cartoon, child, mom, or teacher]. Do you think this food is _____ [healthy, unhealthy, yummy, or yucky]?" Thus, children were given answer choices and could respond with either "healthy," "unhealthy," "yummy," or "yucky."

The familiarization video clip and the four test video clips for each of the sources were presented in blocks. Thus, children saw a familiarization video clip for a source, immediately followed by four test video clips for that source, then a familiarization video for another source, followed by four test video clips for that source, and so on. The test video clips within each block were presented to children in a random order.

In the neutral condition, children were presented with the same test video clips from the inaccurate condition but not with the familiarization video clips.

Results and discussion

To score the test questions ("Do you think this food is healthy/unhealthy/yummy/yucky?"), we assigned a 1 to children's responses that matched the information provided by the source (e.g., when the teacher said a food was healthy, the child also said the food was healthy). In contrast, a 0 was assigned to children's responses that did not match the information provided by the source (e.g., when the teacher said a food was healthy, the child said the food was unhealthy). Thus, matching responses indicate children's willingness to trust a source.

Preliminary analyses revealed that there were no main or interactive effects of source; therefore, this variable was not included in further analyses, which focused on performance across the 16 test trials collapsed together. This was also the case for the subsequent studies.

Thus, a 3 × 2 (Age Group [3-year-olds, 4-year-olds, or adults] × Condition [neutral or inaccurate]) analysis of variance (ANOVA) was conducted on these data with age group and condition as the between-participants variables and matching responses collapsed across the 16 test trials as the dependent variable. There was no main effect of age group. However, there was a main effect of condition, $F(1, 90) = 23.92$, $p < .001$, $\eta_p^2 = .21$, which was moderated by a Condition × Age Group interaction, $F(2, 90) = 5.27$, $p = .007$, $\eta_p^2 = .10$. See Fig. 1.

To follow up this interaction, independent sample *t*-tests were conducted for each age group separately. Recall that the prediction was that if children take into account sources' accuracy, then they should be less likely to trust sources' claims in the inaccurate condition compared with the neutral condition. As predicted, the results indicated that adults were less likely to trust sources in the inaccurate condition compared with the neutral condition, $t(30) = 5.02$, $p < .001$, $d = 1.77$. This was also the case for 4-year-olds, $t(30) = 2.13$, $p = .04$, $d = 0.74$. However, there was not a significant difference between 3-year-olds in these conditions, $t(30) = 1.16$, $p = .25$.

One-way ANOVAs were also conducted for each condition separately to follow up this interaction further. The results indicated that there was not a significant difference among the three age groups in the neutral condition, $F(2, 45) = 2.28$, $p = .11$. However, there was a significant difference among age groups in the inaccurate condition, $F(2, 45) = 3.60$, $p = .03$. Specifically, adults were significantly less likely to trust the sources compared with 3-year-olds, Tukey post hoc, $p = .03$, $d' = 1.01$.

Overall, these results indicate that by age 4 years, children are less likely to trust a source about food who was previously inaccurate compared with someone who does not have a history of inaccuracy.

We also compared each age group's responding with chance (50%). Above-chance responding would indicate that participants are willing to trust the sources and accept their claims about the

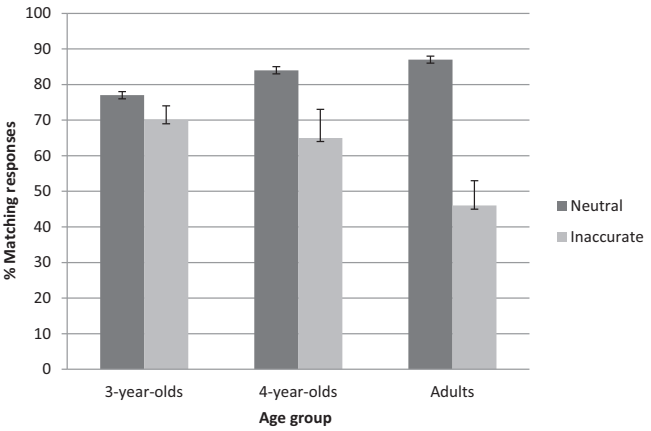

Fig. 1. Percentages of matching responses with sources in Study 1 by age group and condition. Error bars represent standard errors.

evaluative status of the foods. Thus, above-chance responding was predicted for the neutral condition but not for the inaccurate condition. Starting with the neutral group, as predicted, the results showed that adults, 4-year-olds, and 3-year-olds performed significantly above chance, revealing a default tendency to trust sources who do not have a history of inaccuracy, $ts(15) > 7.0$, $ps < .001$, $ds = 2.66$, 2.42, and 1.98, respectively.

The results for the inaccurate condition are a bit more complex. The 3-year-olds' level of responding exceeded chance, $t(15) = 4.82$, $p < .001$, $d' = 1.20$, showing that young children are willing to trust a source even with a history of inaccuracy. However, as predicted, the adults and 4-year-olds did not have above-chance levels of responding; rather, they were at chance, $ts(15) < 2$, $ps = .57$ and .08, respectively.

An interpretation of adults' and 4-year-olds' chancel-level performance in the inaccurate condition is that participants may have attempted to ignore the inaccurate sources and guessed their own answers. This kind of guessing strategy has been documented in past research in response to inaccurate informants (e.g., Einav & Robinson, 2010; Nurmsoo & Robinson, 2009). For example, Nurmsoo and Robinson (2009) found that 4-year-olds performed no differently from chance in response to a puppet who was well informed but inaccurate. Nurmsoo and Robinson concluded that children's chance responding reflected their willingness to dismiss what the puppet said and guess their own answers.

Some participants may have deemed guessing as a reasonable strategy in the current study because food encompasses both objective and subjective information. For instance, although taste is a subjective matter of preference, it is also related to objective factors (e.g., foods high in dietary fat usually taste good) (Birch, 1992; Drewnowski, 1997). Likewise, although health is a matter of objective fact (e.g., nutrition facts), it is still influenced by subjective information related to a variety of cultural, historical, economical, and contextual factors. Thus, for some children and adults to make a conclusive opposite inference from an untrustworthy source, they may need additional information such as objective facts from a book (e.g., Eyden, Robinson, Einav, & Jaswal, 2013; Robinson, Einav, & Fox, 2013).

Future research will be needed to further examine this interpretation as well as the possibility that some individuals may have an inability to overcome a bias to trust sources regarding food. In future research, it will be informative to investigate the extent to which individuals continue to trust sources about food even when they have previously proven themselves to be inaccurate. Perhaps some individuals do not assign a large penalty for inaccurate information and excuse sources of their past inaccuracy about food. Such a challenge to override a bias to believe testimony has been found in past research showing that 3- and 4-year-old children will accept novel labels provided by a single informant who is alone at a level greater than chance (Vanderbilt, Heyman, & Liu, 2014).

Study 2

Whereas Study 1 offers a critical step toward understanding children's sensitivity toward cues for distrust within the domain of food, the next step was to investigate another domain using the same methodology. In particular, children may be highly motivated to distrust informants in the domain of food due to their frequent experience of being misled in this domain (Heyman et al., 2009; see also Birch et al., 1999; Tinsley, 2003) and the highly aversive experience a child has when eating something distasteful. Thus, Study 2 was designed to provide a more conservative test of the process examined in Study 1 by observing children's response to inaccuracy in a more benign domain (i.e., toys). Toys were selected because they are commonly used as stimuli in the trust in testimony literature (e.g., Chen, Corriveau, & Harris, 2013; Kushnir, Vredenburgh, & Schneider, 2013; VanderBorght & Jaswal, 2009). The prediction was that if children use inaccuracy as a cue for distrust across domains, then a similar pattern of responding should emerge in Study 2 with the domain of objects.

Method

Participants

A total of 72 children participated in this study: 36 3-year-olds (16 girls; $M_{age} = 3.49$ years, range = 3.02–3.99) and 36 4-year-olds (15 girls; $M_{age} = 4.64$ years, range = 4.21–4.96). In addition,

36 adults participated as a developmental comparison (18 women; M_{age} = 19.64 years, range = 18.04–34.17). Half of the participants in each age group were randomly assigned to either the inaccurate or neutral condition. Participants were recruited from the same population as Study 1. However, none of the participants in Study 2 had participated in Study 1.

Materials and procedure

The procedure was the same as in Study 1, where there were two between-participants conditions: neutral and inaccurate. The main difference between Studies 1 and 2, however, was the testing videos, which featured toys in Study 2.

The researcher initially told children in both conditions that they would be playing a game about toys hidden inside opaque boxes. Then, the researcher introduced children to the terms of "new/old" and "fun/boring". Children were told, "Fun toys make you smile and laugh. Boring toys do not make you smile and laugh. New toys are clean and shiny. Old toys are not clean and are not shiny." Children were also asked follow-up questions to check their understanding of these terms (e.g., "Which toys [do not] make you smile and laugh? Which toys are [not] clean and shiny?"). All of the children were able to provide correct answers to these questions.

Next, children in the inaccurate condition (but not the neutral condition) saw the familiarization videos from Study 1 in which sources provided inaccurate information regarding the contents of a bag. During testing, children in both conditions saw four video clips per source (cartoon, child, mom, or teacher). The video clips varied in the evaluative claim that the source made about the toy concealed inside the box (e.g., "Hi. I am a _____ [cartoon, child, mom, or teacher]. This toy is _____ [fun, boring, new, or old]"). After each test video clip, the researcher asked children, "Think about whether you believe the _____ [cartoon, child, mom, or teacher]. Do you think this toy is _____ [fun, boring, new, or old]?" Thus, children were given answer choices and could respond with either "fun," "boring," "new," or "old".

Results and discussion

A 3 × 2 (Age Group [3-year-olds, 4-year-olds, or adults] × Condition [neutral or inaccurate]) ANOVA was conducted on these data with age group and condition as the between-participants variables. The results indicated that there were main effects of age group $F(2, 102) = 8.17$, $p = .001$, $\eta_p^2 = .14$, and condition, $F(1, 102) = 28.44$, $p < .001$, $\eta_p^2 = .22$, which were moderated by an Age Group × Condition interaction, $F(2, 102) = 11.48$, $p < .001$, $\eta_p^2 = .18$. See Fig. 2.

To follow up this interaction, independent sample *t*-tests were conducted for each age group separately. The results showed that adults take into account past accuracy and were less likely to trust

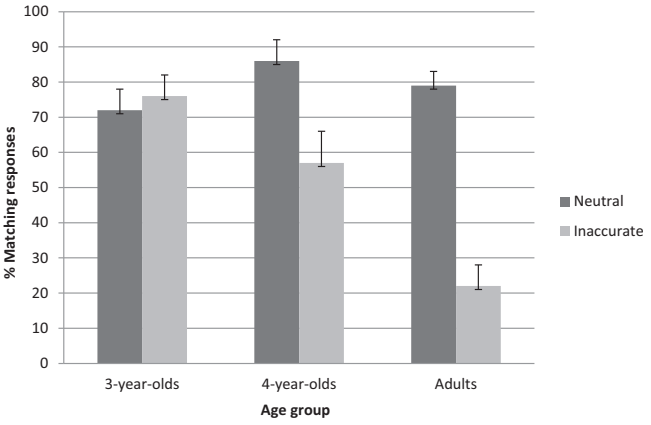

Fig. 2. Percentages of matching responses with sources in Study 2 by age group and condition. Error bars represent standard errors.

sources in the inaccurate condition compared with the neutral condition, $t(34) = 7.70$, $p < .001$, $d' = 2.56$. This was also the case for 4-year-olds, $t(34) = 2.83$, $p = .008$, $d' = 0.94$. In contrast, 3-year-olds were equally trusting of sources in the inaccurate and neutral conditions, $t(34) = 0.43$, $p = .66$.

To explore this interaction, a series of one-way ANOVAs was also conducted for each condition separately. There was not a significant difference among the three age groups in the neutral condition, $F(2, 51) = 1.65$, $p = .20$. However, there was a significant difference among the age groups in the inaccurate condition, $F(2, 51) = 14.83$, $p < .001$. Specifically, adults were significantly less likely to trust the sources compared with 4-year-olds, Tukey post hoc, $p = .003$, $d' = 1.07$. Adults were also significantly less likely to trust the sources compared with 3-year-olds, Tukey post hoc, $p < .001$, $d' = 2.11$.

We further examined the data by comparing each age group's responding with chance (50%). Starting with the neutral group, adults performed significantly above chance, revealing a default tendency to trust sources who do not have a history of inaccuracy about the qualities/characteristics of toys, $t(17) = 6.75$, $p < .001$, $d = 1.59$. This was also the case for 4-year-olds, $t(17) = 6.32$, $p < .001$, $d' = 1.49$, and 3-year-olds, $t(17) = 3.50$, $p = .003$, $d' = .82$.

Turning to the inaccurate condition, 3-year-olds' level of responding exceeded chance, $t(17) = 4.33$, $p < .001$, $d' = 1.02$, showing that young children are willing to trust a source about toys even with a history of inaccuracy. Also as in Study 1, 4-year-olds were at chance, $t(17) = 0.74$, $p = .46$. However, in Study 2, adults were significantly below chance, $t(17) = -4.60$, $p < .001$, $d' = 1.09$, showing active disagreement with sources who have previously been inaccurate.

Next, to compare Study 1 with Study 2, a $2 \times 3 \times 2$ (Study [1 or 2] $\times$ Age Group [3-year-olds, 4-year-olds, or adults] $\times$ Condition [neutral or inaccurate]) ANOVA was conducted with these data. The results showed significant main effects of age group, $F(2, 192) = 8.34$, $p < .001$, $\eta_p^2 = .08$, and condition, $F(1, 192) = 50.99$, $p < .001$, $\eta_p^2 = .21$. There was also a significant Age Group $\times$ Condition interaction, $F(2, 192) = 15.89$, $p < .001$, $\eta_p^2 = .14$. The results of a follow-up one-way ANOVA indicated that there was not a significant difference among the three age groups in the neutral condition, $F(2, 99) = 2.92$, $p = .06$. Yet, there was a significant difference among the age groups in the inaccurate condition, $F(2, 99) = 16.50$, $p < .001$. Specifically, adults were significantly less likely to trust the sources compared with 4-year-olds, Tukey post hoc, $p = .001$, $d' = 0.84$. Adults were also significantly less likely to trust the sources compared with 3-year-olds, Tukey post hoc, $p < .001$, $d' = 1.54$.

Notably, there was not a significant main effect of study or any other interactions, suggesting that children reason similarly across the domains of food and toys. Taken together, Studies 1 and 2 show that across these different domains, by age 4 years, children do not trust a source who has a history of inaccuracy.

However, we recognize that these results must be interpreted with caution given the possible limitations of these studies. The first limitation is that the inaccurate condition included video material that was not matched in the neutral condition, raising the concern that something other than the source's inaccuracy may be responsible for 4-year-olds' and adults' reduced acceptance of the claims made by the sources in the inaccurate condition. For instance, exposure to the additional video material could have led to boredom, disinterest, or frustration in the older children and adults, resulting in the observed differences between the inaccurate and neutral conditions. Although this alternative explanation is unlikely, this explanation indicates how the familiarization sequence itself needs to be manipulated in both conditions.

A second limitation of these studies is the cognitive complexity of the familiarization videos in the inaccurate condition. In previous studies, the familiarization videos simply showed that the source was inaccurate about the contents of a bag. The familiarization videos were originally designed in this way in order to establish a history of general inaccuracy for each source. The test was whether children would know that the inaccuracy was relevant to inferring the trustworthiness of the source. Although the lack of reference to the domain of food in the familiarization videos was not problematic for 4-year-olds or adults, it may have been problematic for 3-year-olds, who may need a video that is more directly related to the test videos. That is, 3-year-olds may need to see a source provide testimony about foods (rather than about crayons in bags) during familiarization in order to understand its relevance to the test video clips.

Thus, Study 3 was designed to address these potential limitations.

Study 3

One factor that may further complicate children's decision whether or not to trust an informant may be the potential confusion caused by the informant's intentions. In particular, in the domain of food, informants often lie to children for benevolent reasons (e.g., trying to convince children that healthy foods are yummy to promote healthy eating). This added complexity may then become a factor that children use to arrive at a decision about whether or not to trust an informant's assertions about food. Thus, Study 3 was designed to reexamine children's trust in testimony within the domain of food by manipulating the familiarization sequence in both the inaccurate and neutral conditions. In particular, we used food-specific familiarization videos to establish the benevolence (or malevolence) of sources. These cues were selected for Study 3 because they are pertinent to the domain of food, in which people may vary in their motivations for offering certain foods to children.

During familiarization, in the benevolent condition, children saw a video clip of a source claiming that an unappetizing vegetable is delicious because she wants people to experience its health benefits. In the malevolent condition, children saw a video clip of a source asserting the cleanliness of a contaminated snack because she wants people to become sick. If children use benevolence as a cue for trust and malevolence as a cue for distrust, then they should be more likely to trust sources in the benevolent condition versus malevolent condition. This prediction is supported by past research, which has found that children as young as 3 years prefer testimony from a benevolent versus malevolent speaker (Landrum et al., 2013; Mascaro & Sperber, 2009, Experiment 1; see also Fu, Heyman, Chen, Liu, & Lee, 2015).

Method

Participants

A total of 72 children participated in this study: 36 3-year-olds (25 girls; M_{age} = 3.46 years, range = 3.03–3.99) and 36 4-year-olds (17 girls; M_{age} = 4.70 years, range = 4.07–5.04). In addition, 36 adults participated as a developmental comparison (21 women; M_{age} = 18.97 years, range = 17.97–24.69). Half of the participants in each age group were randomly assigned to either the benevolent or malevolent condition. Participants were recruited from the same community as in Study 1. None of these individuals participated in Study 1 or 2.

Materials and procedure

There were two different conditions that included two types of familiarization video clips, one for each source: benevolent and malevolent. The same volunteers and puppet from the previous study were used to create these videos. The familiarization video clips were 22 s each.

During familiarization, children in the benevolent condition were initially presented with a video clip of a source holding out a handful of spinach and saying, "I'm a [cartoon, child, mom, or teacher]. This spinach tastes yucky, and no one wants to eat it. But, this spinach is really good for you. So, I'm going to tell people that the spinach is yummy because I want to help people eat it and be healthy." Then, as the video clip continues, children saw an uninformed researcher enter the scene to sit down beside the source. The uninformed researcher asks, "Hello, is that spinach yummy or yucky?" The source responds by saying, "This spinach is yummy. Here, eat it." The decision to have the benevolent source provide information about the "yummy" taste of spinach was based on previous research that young children typically reject spinach because of its bitterness (Turnbull & Matisoo-Smith, 2002).

In contrast, during familiarization, children in the malevolent condition saw a video clip of a source looking into a bowl of popcorn and saying, "Eeek, this popcorn has an icky bug crawling in it. I'm not going to eat this yucky popcorn. But, I'm going to tell people that the popcorn is yummy because I want people to get sick." Then, as the video continues, children saw an uninformed researcher entering the scene to sit down beside the source. The uninformed researcher asks, "Hello, is that popcorn yummy or yucky?" The source responds by saying, "This popcorn is yummy. Here, eat it." Previous research suggesting an early understanding of food contamination in toddlers and preschoolers was the basis for the food contamination in toddlers and preschoolers was the basis for the malevolent

source's claim about the popcorn (e.g., Brown & Harris, 2012; Brown, Harris, Bell, & Lines, 2012). In particular, there is evidence that 3-year-olds have heightened sensitivity to food contaminated by insects, have the ability to evaluate others' responses to the contamination, and infer preventive actions to be taken to avoid illness (Siegal & Share, 1990; see also Siegal, Fadda, & Overton, 2011).

After familiarization, children in both conditions were presented with the same test videos and questions as in Study 1.

Results

The test questions were scored and analyzed similarly to the previous studies. In the current study, the percentage of children's matching responses indicates children's willingness to trust sources as a function of their benevolence or malevolence.

A 3 × 2 (Age Group [3-year-olds, 4-year-olds, or adults] × Condition [benevolent or malevolent]) ANOVA was then conducted on these data with age group and condition as the between-participants variables. This analysis yielded main effects of age group, $F(2, 102) = 11.11$, $p < .001$, $\eta_p^2 = .17$, and condition, $F(1, 102) = 20.83$, $p < .001$, $\eta_p^2 = .17$. These main effects were moderated by an Age Group × Condition interaction, $F(2, 102) = 5.57$, $p = .005$, $\eta_p^2 = .10$. See Fig. 3.

To follow up this interaction, independent sample *t*-tests were conducted for each age group separately. Recall that the prediction was that children should be less likely to trust malevolent versus benevolent sources. The results support this prediction. Adults were less likely to trust sources in the malevolent condition compared with the benevolent condition, $t(34) = 5.26$, $p < .001$, $d' = 1.75$. The same pattern of results was found for 4-year-olds, $t(34) = 2.29$, $p = .028$, $d' = 0.76$. However, there was not a significant difference between 3-year-olds in these conditions, $t(34) = 0.16$, $p = .87$.

One-way ANOVAs were also conducted for each condition separately. Starting with the benevolent condition, the results indicated that there was not a significant difference among the three age groups, $F(2, 51) = 2.62$, $p = .08$. In contrast, there was a significant difference among the three age groups in the malevolent condition, $F(2, 51) = 10.85$, $p < .001$. Adults were significantly less likely to trust the sources compared with 4-year-olds and 3-year-olds, who did not differ from each other, Tukey post hoc, $ps < .001$, $ds = 0.89$ and 1.99, respectively.

We examined the data further by comparing each age group's overall level of responding with chance (50%). Above-chance responding was predicted for the benevolent condition but not for the malevolent condition. Beginning with the benevolent condition, as predicted, adults, 4-year-olds, and 3-year-olds were above chance in their level of responding, indicating a tendency to trust

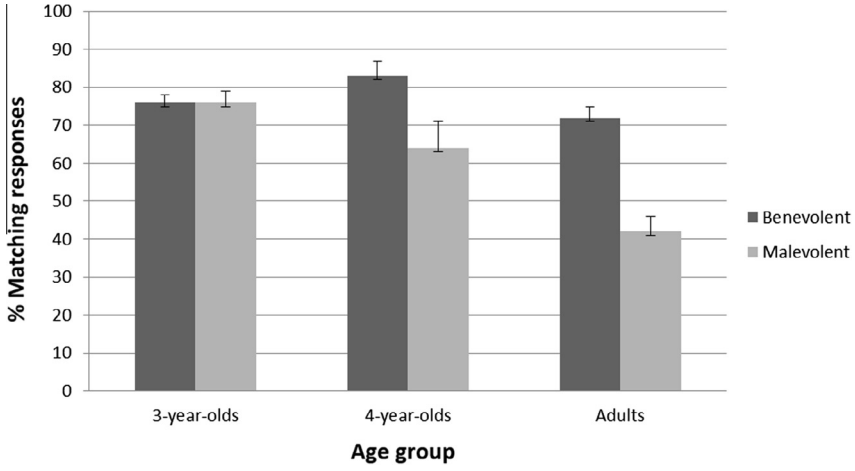

Fig. 3. Percentages of matching responses with sources in Study 3 by age group and condition. Error bars represent standard errors.

benevolent sources, $ts(17) > 6.00$, $ps < .001$, $ds = 1.51$, 1.86, and 2.38, respectively. In addition, as predicted in the malevolent condition, adults and 4-year-olds were not above chance in their level of responding. Rather, they were at chance, $ts(17) = 1.76$ and 2.02, $ps = .09$ and .06, respectively. In contrast, 3-year-olds' level of responding in the malevolent condition exceeded chance, suggesting that 3-year-olds are willing to trust a malevolent source.

In sum, the results of Study 3 reveal a similar developmental pattern as Study 1. Whereas 4-year-olds are less likely to accept evaluative food information from malevolent than benevolent sources, 3-year-olds are likely to accept information from both sources.

On the one hand, this finding with 3-year-olds is congruent with a broader literature demonstrating young children's positivity bias in their judgment of personality traits. This literature has shown that young children tend to maintain optimistic views of other people, where they require more negative behavioral evidence than older children to make a negative personality attributions about people (see Boseovski, 2010, for a review). Thus, 3-year-olds may have been reluctant to view the malevolent sources negatively or as untrustworthy based on the single act of malevolence captured in the familiarization video.

Research has also revealed that when an informant does not provide testimony that conflicts with another informant, 3-year-olds are quite trusting regardless of the informant's repeated deceptive behavior (Heyman, Sritanyaratana, & Vanderbilt, 2013; Jaswal, Carrington, Setia, & Cole, 2010; Mascaro & Sperber, 2009, Experiment 2a), and even 4-year-olds are trusting regardless of the informant's prior history of inaccuracy (Vanderbilt et al., 2014).

On the other hand, this finding with 3-year-olds is somewhat unexpected given that previous research has found that children of this age do give more credence to speakers who are nice versus mean (Landrum et al., 2013; Mascaro & Sperber, 2009, Experiment 1). Methodological differences in these studies, however, may help to explain the differences in the results. In the current investigation, children needed to decide whether to accept a claim made by a single informant who was either malevolent or benevolent depending on condition assignment. In contrast, children in past studies needed to choose between two informant claims (e.g., mean expert vs. nice non-expert: Landrum et al., 2013; kind cow puppet vs. mean frog puppet: Mascaro & Sperber, 2009, Experiment 1).

Of course, there are some situations in which 3-year-olds show skepticism in single informant paradigms, but these situations do not involve deception per se (e.g., learning the names of things from a speaker who provides evidence of uncertainty or of making mistakes: Jaswal & Malone, 2007; when children have high levels of inhibitory control to resist an adult's testimony that conflicts with their firsthand experience: Jaswal et al., 2014).

Given that these different methodologies can lead to different responses when children are deciding whether to trust an informant, it is fair to say that 3-year-olds in the current research tend to trust evaluative claims about food made by a malevolent source who is alone. Yet, it is unknown whether 3-year-olds may be willing to distrust evaluative claims about food made by a malevolent source who is presented alongside a benevolent source. Future research that incorporates both methodologies will be needed to compare young children's selective trust in situations where there are two conflicting testimonies about the evaluative category membership of a food and in situations where there is only one testimony.

Relatedly, future research is necessary to understand how the food context might have influenced 3-year-olds' performance in the malevolent condition in the current study. Although previous research has shown that toddlers and preschoolers understand the principle of food contamination (e.g., Brown & Harris, 2012; Brown et al., 2012; Siegal & Share, 1990), there may be contexts that impact children's sensitivity to contamination and, consequently, children's sensitivity to trust/distrust cues. For instance, popcorn was the target food in the malevolent condition because it is a widely accepted snack for children (Grandjean, Fulgoni, Reimers, & Agarwal, 2008). However, featuring a desirable food in the familiarization video clip might have decreased young children's motivation to distrust the malevolent sources' claims. That is, children may have believed that the popcorn was still "yummy" despite contamination because of its overriding tasty properties. Future studies could feature a less desirable contaminated food such as spinach, which was used in the benevolent condition. By using the same target food and claims about taste in both the malevolent and benevolent conditions, these conditions could be more comparable in future studies.

General discussion

Children are frequently exposed to untrustworthy sources of information about food, especially regarding its evaluative components such as health and taste. The aim of this research was to examine whether children consider cues for distrust when learning about these components of food. Overall, this research revealed that 4-year-olds are sensitive to a source's history of both inaccuracy and malevolence. Specifically, Study 1 revealed that 4-year-olds are less likely to accept claims about the evaluative status of a food from a previously inaccurate source compared with a source who had not displayed inaccuracy. A similar pattern of results was found in Study 2 when toys were the target object. Study 3 revealed that 4-year-olds are less likely to accept claims about the evaluative status of foods from malevolent sources compared with benevolent ones.

The developmental findings here dovetail with those of recent studies that have documented difficulties with 3-year-olds' learning to discount information from untrustworthy sources (e.g., Heyman et al., 2013; Jaswal et al., 2010, 2014; Vanderbilt, Liu, & Heyman, 2011). Of course, this is not to suggest that 3-year-olds are insensitive to cues for distrust. There is indeed evidence for selective trust in 3-year-olds based on past accuracy and niceness/meanness (see Harris, 2012, and Mills, 2013, for reviews). However, as discussed in Experiment 3, the tasks in several of these studies differ in key respects. Although the results of these studies may appear to be contradictory, they are not and point to circumstances under which young children are vigilant against untrustworthy sources of information.

Overall, the current results make contributions to both the trust in testimony literature and the food selection literature. An important contribution that the current results make to the trust in testimony literature is that it extends this body of research to a new domain—food, specifically healthy/unhealthy and yummy/yucky foods. This is one of the few studies along with others (e.g., Boseovski & Thurman, 2014; Jaswal, 2010; Luu et al., 2013) that have examined a domain other than objects or object names. To the best of our knowledge, this is the only study that has examined the domain of food exclusively and extensively, supplementing past work that has mixed together a few trials of food stimuli with a variety of other stimuli (animals, plants, and activities) without an opportunity to separate the food data for analysis (Danovitch & Mills, 2014). The results from the current research, particularly Studies 1 and 2, highlight similarities in children's selective trust across the domains of food and toys. Recall that when the results of Studies 1 and 2 were compared, there was not a significant main effect of study or any other interactions. The results showed that by age 4 years, children distrust sources who have a history of inaccuracy across the domains of food and toys. Thus, these results reveal that children reason similarly about food and toys, suggesting a degree of domain generality when reasoning about these domains.

The contribution to the food selection literature is novel in two ways. First, this literature has traditionally focused on food preference but not on evaluative categorization (which may also be integral to the reasoning behind children's food choices). Second, this literature has traditionally focused on how modeling guides early food preferences (Frazier et al., 2012; Hamlin & Wynn, 2012; Hendy & Raudenbush, 2000; Shutts et al., 2009, 2010) but not on the influence of trust in testimony. An exception is a study that found that children's jelly bean selection is affected by adults' assessments of the jelly bean flavors' palatability (Lumeng et al., 2008). The current study adds to these initial findings by documenting children's sensitivity to specific cues for distrust (inaccuracy and malevolence) in a variety of sources in addition to adults who potentially affect children's category decisions related to both the taste and health of foods beyond candy.

Future directions

In future research, the possibility of source effects should be examined in more detail, especially in light of past research from the food selection literature, which has shown that some models are more effective than others in encouraging children to try new foods (e.g., peer evaluations: Frazier et al., 2012). One might imagine that children would trust peers more about the taste of foods and adults more about the health of foods. Arguably, if young children did entrust adults with matters concerning

taste, then food refusal would not be as much of an issue among children of this age group. Because the current research was not designed to test for such differences, it is no surprise that preliminary analyses for Studies 1 to 3 indicated that there were no main or interactive effects of source or evaluative food property. This was also the case when the data were combined across studies in the event that each study did not have sufficient power on its own to yield significant differences. It may be that these types of differences are difficult to detect in paradigms such as the one used in the current research where children hear many similar statements made by unfamiliar individuals and, therefore, are able to use their response on the first trial to respond analogously on subsequent trials. Now that we know how children react to these sources in general, future research is needed to determine individual differences in children's reactions to familiar examples of these sources from their personal lives (see Corriveau et al., 2009) and from media (e.g., Dora the Explorer and Bob the Builder: Danovitch & Mills, 2014) with potentially varying characteristics (Frazier et al., 2012).

Conclusions and implications

The current findings have potential implications regarding how we could protect young children from predatory food advertising. Each year, children are exposed to an average of more than 40,000 television commercials. The majority of these advertisements use cartoon characters to obscure the truth and persuade viewers of the nutritional value of unhealthy foods that are often high in added sugars, fat, sodium, and/or saturated and trans fats (e.g., sugary cereals are marketed as a "part of a complete/well-balanced/nutritious diet") (see Batada et al., 2008, and Kunkel et al., 2004, for reviews). The results of the current research suggest that 3-year-olds may be easily convinced by individuals who tout the health of unhealthy foods. In addition, 4-year-olds may be susceptible to such advertisements, particularly if the individuals appear to be ostensibly accurate and/or benevolent. These possibilities are especially disconcerting given that children greatly influence their parents' food purchasing decisions, with parents often giving in to their children's demands (Isin & Alkibay, 2011; Turner et al., 2006). To explore these possibilities, in future studies, it will be crucial to frame our current manipulation in terms of advertising motives (e.g., a source making a false claim about a food to encourage purchasing decisions). With approximately a quarter of 2- to 5-year-olds being overweight or obese in the United States (Ogden, Carroll, Kit, & Flegal, 2012), it will also be necessary for future research to investigate how to increase children's vigilance against untrustworthy sources of information and understanding of deceptive marketing practices (e.g., training interventions related to advertising: Buijzen, 2007; Buijzen, 2009).

In sum, the current research aimed to address the gap in the literature on children's evaluative categorization and trust in testimony by investigating the different cues for distrust that children take into consideration when learning about food from other people. The results show that by age 4 years, children do not believe untrustworthy sources (i.e., based on inaccuracy and malevolence) about the health and taste of foods. In conclusion, these findings help to elucidate how children develop sensitivity to cues for distrust, particularly inaccuracy and malevolence, within the domain of food.

Acknowledgments

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