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Children's Use of Adult Testimony to Guide Food Selection

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Abstract

We hypothesized that children's reliance on adults' testimony regarding food choices would diminish when adults were shown to be unreliable informants by expressing liking for foods the children disliked. In 3 studies, 3- to 6-year-old children observed an adult expressing liking for food and non-food items that were either the same as or opposite the child's stated hedonic assessments. Even after having observed an adult express liking for stimuli the children disliked, children still selected the item which the adult identified as hedonically positive. Children were more likely to select the stimulus identified as hedonically positive by the adult when the stimulus was food (as opposed to non-food), and when the adult's hedonic assessment was provided as an absolute ("I think this is yummy.") as opposed to a comparative statement ("I like this one better."). The results imply that an adult's identification of a food as hedonically positive serves as an important guide to children's food selection, even when children recognize that adults have very different hedonic assessments of foods from themselves. Providing information to children that a food is palatable in absolute terms also appears to shape children's food selection more powerfully than providing the information in comparative terms.

Keywords

eating behavior; modeling; food; nutrition; child development

Transmission of knowledge within a culture relies in large part on the willingness to accept testimony from another person, even when the basis for the testimony is unclear. Domains of knowledge which classically require the acceptance of others' testimony as opposed to first hand observation include religion, history, and science (e.g. "George Washington was the first president," or "The earth is round.") (Harris & Koenig, 2006). Another domain of knowledge in which children may be particularly apt to trust the information provided by others is food. As omnivores, humans are faced with the dilemma of selecting a variety of foods from the environment, while avoiding the ingestion of something poisonous (Rozin, 1976). Knowledge about which substances are edible, safe, and palatable is in large part culturally transmitted via accepting information provided by knowledgeable others. A primary question is therefore

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whether food, as opposed to non-food items, represents a privileged domain in which children are particularly apt to accept the report of others as truth and use it to guide their choices.

Information provided by others, however, is not always reliable. People are often motivated to provide false information, and the ability to accurately discriminate reliable from unreliable information is advantageous. A second central question therefore regards how willing children are to accept testimony when it directly conflicts with their own personal experience. Children recognize that adults are generally more knowledgeable than themselves and rely on information provided by adults to guide their behavior in ambiguous or unfamiliar situations (Taylor, Cartwright, & Bowden, 1991). However, by age 3 years children recognize that adult testimony is not always reliable, in that it may diverge from their own perceptions (Clement, Koenig, & Harris, 2004; Koenig & Harris, 2005). By age 4 years, children are less likely to use information provided by an unreliable adult (compared to a reliable adult) in making a choice about something which they themselves have not yet seen or experienced (Koenig & Harris, 2005).

The parent-child feeding relationship is perhaps one of the clearest examples of the intentional provision of false testimony to children to shape behavior. Parents frequently tell children that foods are palatable when in fact they are not (e.g. “This spinach is yummy!”) with the laudable goal of encouraging the child’s consumption of nutritious foods. By age 18 months, children recognize that an adult may like a food (e.g. broccoli) that the child does not (Repacholi & Gopnik, 1997). On this premise, children should theoretically begin to recognize that if adults frequently express liking for foods the children themselves dislike, adults may not always be reliable informants about a food’s palatability. Children may therefore be less willing to accept an adult’s report that a food is palatable if the adult has proven to be an unreliable informant in the past. After years of a mother telling a child, “This vegetable is yummy!”, followed by the child sampling and disliking the bitter vegetable, one would anticipate that the child would eventually begin to view the mother as an unreliable informant about food palatability, and stop trusting the information that she provides about food.

If this were true, then one would hypothesize that adults modeling eating specific vegetables would not be a particularly effective method of getting children to eat those vegetables. This would be particularly true in the context of children’s developing ability to appreciate that adults can experience different sensations or feelings from themselves (Bretheron & Beeghly, 1982), as well as their developing ability to become skeptical or critical consumers of testimony (Clement et al., 2004). The data, however, indicate that adults modeling eating novel foods is a remarkably effective method of persuading children to eat those foods (Addessi, Galloway, Visalberghi, & Birch, 2005; Harper & Sanders, 1975). It is worth noting that these studies focused on adults eating a food before a child (after which the adult may or may not comment upon it). The question at hand is, regardless of whether the adult eats the food in front of the child, what impact does the adult’s testimony about either the food’s palatability or their preference for one food over another have on the child’s willingness to eat the target food? One study that separated the effects of modeling and testimony provides some evidence on this point: eating a food in front of a child while also proclaiming that it is very palatable is more effective than simply silently eating the food in front of the child (Hendy & Raudenbush, 2000).

The studies presented here therefore sought to address several central questions that will shed light on children’s use of adult testimony in guiding food selection, as well as current claims about the efficacy of modeling in shaping eating behavior. The questions these studies sought to address were: (1) *Do children select food based on adult testimony?* This question is unique compared to prior work in that it focuses on adult testimony about food as opposed to modeling eating the food. (2) *Are children skeptical consumers of adult testimony about food?* In other

words, when adults have proven to be unreliable informants about food in the past (i.e. "These Brussels sprouts are yummy!"), are children less apt to rely on their testimony about food? (3) *Is children's willingness to accept adults' testimony about food mediated by the language with which that testimony is presented?* Since testimony is delivered, by definition, via language, are variations in the verbal presentation of the testimony predictive of its efficacy? In other words, how sensitive are children to subtle variations in the manner in which testimony is presented? (4) Finally, *Are children less skeptical of adults' testimony about food than they are of adults' testimony about non-food stimuli?* Food has been posited to be a privileged domain in cognitive development (Macario, 1991). Children may be particularly apt to accept without skepticism adults' testimony about food compared to non-food stimuli because the stakes with food are higher: ignoring an adult's testimony that a substance is inedible or poisonous could have dire consequences. Children may therefore be particularly apt to accept adults' recommendations for food.

The present set of experiments first sought to test the hypothesis that children would readily select food based on adult testimony when they observed the adult to have opinions about specific foods' palatability that are congruent with the child's own opinions. The outcome when children observed the adult to have very different opinions about specific foods' palatability from themselves was more difficult to predict. Prior reports that 4-year-old children are able to discriminately use testimony of reliable versus unreliable informants (Clement et al., 2004; Koenig & Harris, 2005) would suggest that children in this age range would recognize the adult informant as unreliable, and therefore, when faced with a choice between two foods, would correctly select the food opposite the food identified as more hedonically positive by the adult. The literature on modeling in eating behavior (Addessi et al., 2005; Harper & Sanders, 1975) would suggest that children would readily follow the adult's lead and simply select the food identified by the adult as more hedonically positive. We sought to evaluate these two competing hypotheses.

We pause here to clarify our use of the terms preference versus liking. As reviewed by others (Rozin & Zellner, 1985), one food may be preferred over another for reasons other than "liking" or "palatability". An adult, when given a choice between two items, may prefer broccoli over French fries because of the superior nutritional content of the broccoli. This does not mean, however, that the adult would assess the broccoli as more "hedonically positive" than the French fries. In the present series of studies, the adult experimenter repeatedly identifies (using a variety of language) one food as "hedonically positive" and the other as "not hedonically positive", or one food as "liked more" than the other. The distinctions between the "hedonically positive" and "not hedonically positive" foods were embellished with congruent facial expressions. Thus, the implication to the child is not that the adult is presenting one food as "preferred" for any reason other than pure palatability. We therefore refrain from using the relatively imprecise term that the child or adult "preferred" one item over another, in favor of the more precise terminology "hedonically positive", which focuses on a response to the stimulus driven purely by hedonics and not, for example, nutritional content.

We focused on the age range 3–6 years for several reasons. First, there is rapid development of children's understanding that an adult may have different hedonic assessments, or mental states, than themselves during this age range (Wellman, Cross, & Watson, 2001), and including children with ages broadly across this window of development would allow exploratory analyses into whether results differed by age. Secondly, there are data to suggest that the preschool years may be a critical period for food preference formation (Skinner, Carruth, Bounds, & Ziegler, 2002), and a better understanding of the developmental underpinnings of behavior in this age range would have important clinical implications.

Overview of Methods

Participants

Three- to six-year-old healthy, English-speaking children without a history of food allergies were recruited from the community. Mothers provided basic demographic information and written informed consent. Each of the three studies to be described was conducted with a unique set of participants.

Materials

Twelve jelly beans (Jelly Belly ™) (six 'palatable' and six 'unpalatable') were used as stimuli. The six 'palatable' flavors (apricot, berry blue, Dr. Pepper, grape, kiwi, and plum) were identified from 50 commercially available flavors based on ratings in prior work with the same age range involving 166 children, each of whom tasted 20 different jelly bean flavors (Lumeng & Cardinal, 2007; Lumeng, Zuckerman, Cardinal, & Kaciroti, 2005). The six 'unpalatable' flavors (dirt, garlic, mango, sardine, spaghetti, and spinach) were selected from a line of 14 commercially available novelty jelly beans intended to elicit disgust reactions from children (e.g. "vomit-flavored"). Of these 14 jelly beans, 5 were identified during pilot testing with 2 children and 7 adults as hedonically negative, but not so aversive as to cause children to refuse further participation. The mango jelly bean was selected as an unpalatable stimulus based on our experience using these stimuli in our prior studies described above; children consistently responded with negative affect to this jelly bean flavor. In all protocols, both the adult and the child tasted each jelly bean simultaneously. The jelly bean flavors were never named for the children, and children did not spontaneously identify them. Parents of children in our two prior studies using jelly beans as stimuli with children drawn from the same population were queried regarding their child's familiarity with jelly beans. The vast majority of parents reported that their child had previously eaten jelly beans (Lumeng & Cardinal, 2007; Lumeng et al., 2005). Children tasted one quarter of each jelly bean.

General Procedure

After children assented to participation, they sat with the experimenter at a child-sized table in a quiet room. Although the identity of the experimenter differed across the three studies, the experimenter was always female. In the *Adult Hedonic Response Demonstration Phase*, the experimenter and child first together tasted 12 flavors, presented sequentially in random order. The child was first asked to rate the palatability of each flavor. The experimenter followed this by rating the palatability of the flavor as assigned in the protocol. In the *Prize Selection Phase*, the experimenter next presented the child with two opaque food containers (hereafter, 'jelly bean boxes') and explained that a different flavor of jelly bean was in each. The adult experimenter presented this information in a tone which conveyed clear and confident knowledge of the content of the boxes. No child questioned the adult's knowledge of the box contents. The experimenter then told the child that she found jelly beans in one box to be more hedonically positive (using varied language) than those in the other box. The child was told that he/she was free to select jelly beans (still hidden from view) from either jelly bean box to have to take home as a prize. The jelly bean box each child chose was set aside until the study ended. 'Correct' performance on the Prize Selection task was defined as selecting the more palatable jelly beans. By design, 'correct' performance of the task thus required that the child choose the same jelly bean box as the experimenter when the child's and experimenter's assessments of each jelly bean's palatability were congruent, and the opposite of the experimenter's choice when the child's and experimenter's assessments of each jelly bean's palatability were incongruent.

Study 1

Study 1 sought to test the hypotheses that children would: (1) select the jelly bean box prize that was identified by the experimenter as containing "yummy" jelly beans after the experimenter had consistently provided the same palatability ratings as the child; and (2) accurately report whether the experimenter liked the same or different jelly beans as themselves. Two competing hypotheses were evaluated for the scenario in which the experimenter consistently provided the opposite palatability ratings as the child. If children were discerning consumers of adult testimony, they would correctly select the jelly bean box prize identified by the experimenter as containing "yucky" jelly beans. If, however, children simply accepted adult testimony at face value, without considering the prior reliability of the information provided by the adult, the children would incorrectly select the jelly bean box prize identified by the experimenter as containing "yummy" jelly beans. If this behavior dominated, the findings would suggest that the powerful influence of modeling in guiding eating behavior can easily overcome children's growing recognition that models are at times unreliable guides for selecting palatable foods.

Methods

Participants—Forty-three children participated, with a mean age of 4.72 years (*SD* = 0.76) (10 three-year-olds, 14 four-year-olds, and 19 five-year-olds). The sample was 53% male, 46% white, and 30% black. Children were randomly assigned, matched for age, to one of two conditions. In the Reliable Informant Condition, the experimenter rated each jelly bean's palatability the same as the child (n = 20). In the Unreliable Informant Condition, the experimenter rated each jelly bean's palatability the opposite of the child (see below) (n = 23). Ages of the children did not differ between conditions (*M* = 4.81 years, *SD* = 0.82 v. *M* = 4.65 years, *SD* = 0.73 years, respectively), *t* (41) = 0.64, n.s.).

Procedure—Children rated their liking for each of the 12 jelly bean flavors during the Adult Hedonic Response Demonstration Phase using a 4-face scale (Birch, Zimmerman, & Hind, 1980), described to the child as representing 'really yucky,' 'kind of yucky,' 'kind of yummy,' and 'really yummy.' Responses were recorded as 1 ('really yucky') to 4 ('really yummy'). The experimenter responded to the child after the child had stated his/her liking for each jelly bean by stating, "I think that tastes [yummy/yucky]!" and pointing to the appropriate face on the scale as assigned in the protocol. In the Unreliable Informant Condition, when children rated a jelly bean as 'really yummy,' the experimenter rated it as 'really yucky.' When children rated a jelly bean as 'kind of yummy,' the experimenter rated it as 'kind of yucky.' The opposite occurred when children rated a jelly bean as 'really yucky' or 'kind of yucky.' The experimenter expressed pleasure and disgust along with standard facial expressions and vocal tone (Ekman & Friesen, 1975). The children did not appear reluctant to continue expressing their own likes and dislikes even when the experimenter had disagreed with them by expressing discrepant assessments of palatability. This phase lasted approximately 10 minutes.

The Prize Selection Phase then began. The experimenter presented two jelly bean box prizes to the child, stating, "I'm going to have the jelly beans in this box [pointing] because I think they taste really yummy, and I think the jelly beans in this box [pointing to other container] taste really yucky." Children were then asked which box contained the jelly beans they would like to take home. In a subsample of 21 children (divided randomly between the two conditions), children were asked after they had selected a jelly bean box (but before opening it) whether the experimenter liked the same or different jelly beans from themselves, and answers were recorded.

Results

The jelly beans elicited the intended hedonic response: we performed a cumulative logistic regression accounting for repeated measures and with proportional odds modeling the probability that the *a priori* categorization of the jelly bean as "palatable" would result in a higher probability of the child giving it a more palatable rating. A "palatable" jelly bean was more likely to have a more palatable rating compared to an "unpalatable" jelly bean with an odds ratio of 1.94 (95% confidence interval 1.51–2.49; $X^2 = 39.5$, $df = 1$, $p < .001$). The specific mean (*SD*) palatability ratings given to the jelly beans were: grape 3.85 (0.85); berry blue 3.65 (0.75); plum 3.48 (1.00); Dr. Pepper 3.26 (1.24); apricot 3.28 (1.11); kiwi 3.18 (1.11); spinach 2.93 (1.24); dirt 2.86 (1.32); mango 2.77 (1.20); spaghetti 2.77 (1.34); sardine 2.61 (1.48); and garlic 2.48 (1.39).

Children were more likely than chance to choose the same jelly bean box as the experimenter in both the Reliable Informant Condition (16/20; $X^2 = 7.2$, $df = 1$, $p < .01$), and the Unreliable Informant Condition (17/23; $X^2 = 5.26$, $df = 1$, $p < .05$). The likelihood that children would choose the same jelly bean box as the experimenter did not differ by gender in either condition ($X^2 = 0.22$, $df = 1$, p = n.s. for the Reliable Information Condition and $X^2 = 0.34$, $df = 1$, p = .n.s. for the Unreliable Informant Condition). The likelihood that the child would choose the same jelly bean box as the experimenter did not differ by condition ($X^2 = 0.22$, $df = 1$, n.s.). T-tests demonstrated that children who correctly performed the Prize Selection task were not significantly older than those who did not perform it correctly in either condition ($t(18) = .71$, p = n.s. for the Reliable Informant Condition, and $t(21) = 1.24$, p = n.s. for the Unreliable Informant Condition).

Children were more likely to report that the experimenter liked different jelly beans from themselves in the Unreliable Informant Condition (10/11 reported the experimenter had different preferences) compared to the Reliable Informant Condition (4/10 reported the experimenter had different preferences) ($X^2 = 6.11$, $df = 1$, $p < .05$). Children were not significantly more accurate in reporting whether they liked the same or different jelly bean flavors as the experimenter in the Unreliable Informant Condition (10 of 11 children accurately responded that the experimenter liked different jelly beans from themselves) compared to the Reliable Informant Condition (6 of 10 children accurately responded that the experimenter liked the same jelly beans as themselves) ($X^2 = 2.76$, $df = 1$, p = n.s.). Children who correctly reported that the experimenter liked the same (or different) jelly beans from themselves were not significantly older than children who responded incorrectly in either condition ($t(8) = 0.41$, p = n.s. for the Reliable Informant Condition, and $t(9) = 1.46$, p = n.s. for the Unreliable Informant Condition).

Discussion

The results provided support for one of our two competing hypotheses. The results supported the hypothesis based on the modeling in eating behavior literature that adult behavior would prove to be a powerful predictor of children's jelly bean box selection. The results were contrary to the hypothesis that children would prove to be discerning consumers of adult testimony and correctly select the jelly bean box prize opposite the adult's choice. When the adult had proven to be an unreliable informant about food palatability, 3-, 4-, and 5-year-olds all continued to indiscriminately trust the adult's testimony about jelly bean palatability to guide their food selection. Consistent with prior work by others, however, children throughout the age range (3-, 4- and 5-years) accurately identified whether the experimenter was a reliable or unreliable informant (Clement et al., 2004).

There are at least two potential explanations for the surprising findings in the Unreliable Informant Condition. First, it is possible that children would be more discerning consumers of

adult testimony if the discrepancy between child-experimenter opinions regarding palatability were more robust or obvious. The cognitive processing of adjectives is scaffolded on their polar opposites (Deese, 1964) and meaning is interpreted in relation to these reference points (Ryalls, Winslow, & Smith, 1998). Adults process the relationship between two adjectives more slowly when they are not direct antonyms (e.g. "strong – frail" is processed more slowly than "strong – weak") (Gross, Fischer, & Miller, 1989). We thus hypothesized that presenting the contrasting opinions about palatability as direct polar opposites would allow children to more easily recognize the difference. This easier processing may allow them to focus their attention more readily on the fact that the adult testimony was unreliable when making their choice of jelly bean boxes. Secondly, the language content of the adult's testimony in Study 1 being presented as an absolute hedonic assessment also may have influenced the results. Children more easily understand concepts in absolute as opposed to relative terms during this age range. For example, children easily understand "big" and "little" as young as age 2 years, but have somewhat greater difficulty identifying which of two objects is "bigger" (Ebeling & Gelman, 1988; Ryalls et al., 1998). Thus, a hedonic assessment presentation that is absolute may be more readily acted upon by a child who grasps it immediately, as opposed to a hedonic assessment that is presented in more relative, or comparative terms, and requires more time or effort for the child to interpret. We therefore hypothesized that presenting the adult's hedonic assessment as comparative ("I like this one better than that one.") as opposed to absolute ("I think this one is yummy.") would cause children to be less likely to simply accept the unreliable adult informant's testimony at face value, as they had done in Study 1.

We also hypothesized that children may rely more on an adult's hedonic assessment when they are choosing between food items, as opposed to non-food items. Food selection beyond weaning is fraught with potential hazards (e.g. poisoning or undernutrition), and humans and other mammals therefore model their eating behavior closely after conspecifics (Rozin, 1990; Rozin & Kennel, 1983; Rozin, 1976). For this reason, the "default" behavior may be for children to indiscriminately trust adult testimony regarding which foods to eat longer than they might do for non-food stimuli.

Study 2

Study 2 sought to test the hypotheses that: (1) children would select the 'correct' jelly bean box opposite that of the adult's choice when they had learned that the adult was an unreliable informant about food palatability through paired comparisons of jelly bean flavors; (2) children would select the 'correct' stimulus opposite that of the unreliable adult's choice more often when the stimulus was a non-food, compared to a food; and (3) children would select the 'correct' stimulus opposite that of the unreliable adult's choice more often in Study 2, compared to Study 1, when the experimenter's hedonic assessment was presented as a comparative as opposed to an absolute hedonic assessment, as had been done in Study 1. Presentation of the hedonic assessment as a comparison as opposed to as an absolute should lessen the likelihood that children will immediately accept the adult's hedonic assessment at face value and incorrectly act upon it be selecting the same Prize Selection as the experimenter.

Methods

Participants—Twenty-two children participated, with a mean age of 4.69 years (*SD* = 0.93) (6 three-year-olds, 7 four-year-olds, and 9 five-year-olds). The sample was 59% male and 55% white.

Materials—The 12 jelly bean flavors were presented as six pairs, each containing one palatable and one unpalatable flavor (dirt versus Dr. Pepper, spinach vs. grape, mango vs. plum, spaghetti vs. berry blue, sardine vs. apricot, and garlic vs. kiwi). Stickers were selected as the

non-food stimuli because they: (1) are familiar objects to children of this age; (2) are available in a wide variety that could be selected to elicit both positive and negative hedonic responses; (3) could be easily taken home by the children as a simple prize following the Prize Selection phase. Twelve stickers were presented as six pairs, each containing one 'child sticker' (e.g. shooting stars with sparkles) and one 'adult sticker' (e.g. small white square label). Stimulus pairs were presented in random order, with the restriction that jelly beans and stickers alternate, and the order of presentation of 'palatable' versus 'unpalatable' jelly beans and 'child' versus 'adult' stickers within a pair was randomized.

Procedure—In contrast to the adult in Study 1, the adult in Study 2 was always an Unreliable Informant. After the child and experimenter either tasted both jelly beans or viewed both stickers in a pair, the experimenter held up both jelly beans (or stickers) to the child and asked the child which one he/she liked better. The experimenter then replied, "I liked [the opposite jelly bean or sticker from the child] better," while holding it [the opposite jelly bean or sticker of the child's selection] up. This procedure took about 15 minutes.

Prize selection occurred after the presentation of all the jelly beans and stickers was complete. Jelly bean box selection was always completed first, as this was our central question and we did not want the child's jelly bean box selection to be affected by their sticker selection. When the two jelly bean boxes were presented, the experimenter told the child, "I like the jelly beans in this one [pointing to one box] better than the jelly beans in that one [pointing to the other box]." The experimenter then presented two identical envelopes, explaining that each contained a different type of sticker, and that the experimenter and the child could each choose a sticker from either envelope to take home. The experimenter told the child, "I like the stickers in this one [pointing to one envelope] better than the stickers in that one [pointing to the other envelope]." The child was then asked to select which envelope contained the stickers he/she would like to take home. Jelly bean boxes and sticker envelopes were not opened until the study ended. Lastly, children were asked (before opening the jelly bean boxes and sticker envelopes) whether they liked the same or different jelly beans and stickers as the experimenter; answers were recorded.

Results

Children performed the Prize Selection task correctly for the jelly bean boxes (16/22) (X^2 = 4.54, df = 1, $p < .05$), and the likelihood that correct performing exceeded chance approached significance for the sticker envelopes (15/22) (X^2 = 2.91, df = 1, $p < .10$). Logistic regression accounting for repeated measures within subjects was used to model the probability of performing the task correctly by stimulus type, and there was no difference for the food versus non-food stimulus (X^2 = 0.14, df = 1, p = n.s.). The main effect of gender was tested and was not significant in this model (X^2 = 0.64, df = 1, p = n.s.); however, there was a significant interaction between gender and stimulus type ($p < .05$). Girls were more likely to choose the opposite selection from the experimenter when the stimulus was a sticker, compared to a jelly bean (odds ratio for correct responding with non-food stimulus, compared to food stimulus 3.97, 95% confidence interval 0.33–48.4; X^2 = 1.18, df = 16, p = n.s.), though this did not reach statistical significance. In contrast, boys were more likely to correctly choose the opposite selection from the experimenter when the stimulus was a jelly bean, as opposed to a sticker (odds ratio for correct responding with food stimulus, as compared to non food stimulus, 2.86, 95% confidence interval 0.53–15.49; X^2 = 1.48, df = 24, p = n.s.), though this also did not reach statistical significance. Examined in the alternative manner, for the jelly bean stimuli, boys were more likely than girls to respond correctly, but this did not reach statistical significance (odds ratio for boys responding correctly compared to girls, 1.67, 95% confidence interval 0.25–11.02, X^2 = 0.28, df = 1, p = n.s.). For the sticker stimuli, girls were more likely than boys to respond correctly, and this only approached statistical significance (odds for girls responding

correctly compared to boys, 6.86, 95% confidence interval 0.65–71.5, $X^2 = 2.58$, $df = 1$, $p = .11$).

Children in Study 2 specifically performed significantly better on the jelly bean Prize Selection task than children in the Unreliable Informant Condition of Study 1 (16/22 in Study 2 versus 6/23 in Study 1; $X^2 = 9.57$, $df = 1$, $p < .01$). Children who performed the Prize Selection task correctly were not significantly older than those who performed the task incorrectly for either the jelly beans (t (20) =.08, p = n.s.) or stickers (t (20) = 1.75, p = n.s.).

Children correctly identified the adult as an unreliable informant at a rate greater than chance for both the jelly beans ($X^2 = 11.6$, $df = 1$, $p < .001$) and the stickers ($X^2 = 8.0$, $df = 1$, $p < .01$), and performance did not differ by stimulus type (food v. non-food) ($X^2 = 0.23$, $df = 1$, n.s.). Children who correctly identified the adult informant as unreliable were not significantly older than children who did not, for either jelly beans (t (20) = 1.97, p = n.s.) or stickers (t (19) = 0.22, p = n.s.).

Discussion

As predicted, children in Study 2 correctly selected the choice opposite that of the unreliable informant more often than children in Study 1. The improved performance in Study 2 may have been a result of one or more of our manipulations: (1) the discrepancy between adult-child opinions may have been more robust in Study 2 as a result of the use of paired comparisons, and therefore allowed children to focus more readily on the reliability of the adult's testimony; (2) the presentation of adult testimony in the form of a comparison (e.g., "I like this one better than that one.") as opposed to as an absolute (e.g., "I think this one is yummy.") may have required more cognitive effort on the part of the children to comprehend, and may have therefore lessened the likelihood that children would immediately act upon the hedonic assessment provided by the adult without considering its reliability; (3) the omission of the term "yummy" from the language in Study 2 may have resulted in a less affectively-laden presentation, and therefore may have also lessened the likelihood that children would act immediately upon the adult's testimony without considering its reliability; (4) the children were presented with a broader representation of the adult's unreliable testimony, given that they observed it for both jelly beans and stickers as opposed to jelly beans alone.

Contrary to our hypothesis, children were not significantly better at performing the task correctly with non-food compared to food stimuli. It is possible that the presentation of non-food stimuli alternating with food stimuli in the Adult Hedonic Response Demonstration Phase may have "primed" the children to perform the task correctly for the food stimuli.

Study 3

Study 3 sought to test the hypothesis that children would be more likely to correctly select a stimulus opposite that identified as most liked by the adult with discrepant opinions: (1) when the stimulus was a non-food (compared to a food), and (2) when the experimenter presented her hedonic assessment as a comparative (e.g., "I like this one better than that one.") as opposed to an absolute (e.g., "I think this one is yummy.") assessment. Study 3 directly evaluated the effects of stimulus type and hedonic assessment presentation type as well as their interaction, on correct responding using a Latin square design. The order of presentation of the conditions in Study 3 was performed to allow direct evaluation of a potential order effect, thus addressing our hypothesis that presentation of non-food stimuli prior to food stimuli results in improved performance.

The children in Study 3 were significantly younger (primarily 3-year-olds) than the children in Studies 1 and 2 (primarily 4- and 5-year-olds). The younger age of these subjects was not

by design, but was a result of recruitment patterns. The younger age of the cohort in Study 3 thus allowed us to test the hypothesis that the children in Study 3 would be less adept at correct responding than the children in Studies 1 and 2 as a result of their younger age. Such an observation would suggest that children's ability to discriminately use adult testimony to guide food choice emerges between ages 3 and 4 years.

Methods

Participants—Thirty-five children participated, with a mean age of 3.89 years (*SD* = 0.78) (23 three-year-olds, 9 four-year-olds, and 3 five-year-olds). About half (54%) of the sample was male, 50% was white, and 29% was black.

Materials—Participants were presented with the same stimuli (jelly beans and stickers) as in Study 2.

Procedure—Stimuli were presented in a paired fashion as in Study 2, but in four conditions, crossing stimulus type (non-food versus food) with hedonic assessment presentation type (absolute versus comparative) in both the Adult Hedonic Response Demonstration Phase and Stimulus Selection Phase. We note that Study 3 was the first protocol in which stickers were presented with an absolute (as opposed to comparative) hedonic assessment, meaning that we needed wording to label the stickers as "good" or "bad" (because "yummy" and "yucky" would not apply). In pilot testing, we found that when the stickers were presented, the most common spontaneously uttered comments from the children of both genders and all ages were, "Cool!" (for the "good" stickers) or, "That's nasty!" (for the "bad" stickers). The terms "cool" and "tasty" were therefore adopted as the labels for the stickers presented by the adult experimenter in the protocol. The identification of the stickers by the experimenter with either label was also accompanied by congruent facial expressions (liking for the "good" stickers and dislike for the "bad" stickers).

Specifically, the 4 conditions were: (1) jelly bean presented with an adult hedonic assessment using absolute language: "I think this one tastes yummy and that one tastes yucky."; (2) stickers presented with an adult hedonic assessment using absolute language: "I think this one is cool and that one is nasty."; (3) jelly beans presented with an adult hedonic assessment using comparative language: "I like this one better than that one."; and (4) stickers presented with an adult hedonic assessment using comparative language: "I like this one better than that one." The first of these 4 conditions presented to each child was randomly assigned. The order of presentation of the remaining 3 conditions was: same stimulus type as first condition and opposite hedonic assessment presentation type, opposite stimulus type as first condition and same hedonic assessment presentation type, and opposite stimulus type as first condition and opposite hedonic assessment presentation type. This order was used because the task needed to be explained uniquely for each stimulus type, and completing the two conditions using the same stimulus type together was felt to make the task more straightforward for the child to understand.

During each condition, the Adult Hedonic Response Demonstration Phase occurred first, followed immediately by the Prize Selection Phase. The 6 sticker pairs were randomly assigned to either of the two conditions in which the stimulus type was stickers (3 pairs per condition). The 6 jelly bean pairs were likewise randomly assigned to either of the two conditions in which the stimulus type was jelly beans (3 pairs per condition). Each condition began with these 3 stimulus pairs presented in the Adult Hedonic Response Demonstration with the assigned hedonic assessment presentation type (absolute language versus comparative language).

The Prize Selection Phase followed immediately within each condition. During this phase, 4 pairs of jelly bean boxes or sticker envelopes were presented in each of the 4 conditions. We

elected to use 4 prize selections as this was felt to potentially provide more valid information regarding children's performance than the single prize selection protocol used in Studies 1 and 2. The children did not become fatigued: of the 35 participants, 30 completed all 16 prize selections. Of the 5 who did not complete the protocol, 3 of these children did not respond to 2 of the 8 jelly bean box Prize Selections. One child refused to complete either of the 2 sticker conditions after completing both jelly bean conditions. One child completed only one jelly bean condition; this child's data were retained in the analyses. Thus, given that 35 children could have each completed 4 Prize Selections in each condition, of the potential 140 trials per condition, the total number of participants and trials in each condition were as follows: absolute hedonic assessment of the jelly bean condition: 34 participants (32 with complete data) contributing 130 trials; absolute hedonic assessment of the sticker condition: 33 participants (all with complete data) contributing 132 trials; comparative hedonic assessment of the jelly bean: 35 participants (32 with complete data) contributing 134 trials; comparative hedonic assessment of the sticker: 33 participants (all with complete data) contributing 132 trials. The experimenter presented the child with her own preference for each jelly bean box or sticker envelope using the hedonic assessment presentation type assigned in that condition (absolute language versus comparative language). The entire procedure took about 15 minutes.

Results

Logistic regression accounting for repeated measures was used to model the probability that a child would correctly choose the opposite stimulus from that identified as most hedonically positive by the unreliable adult, and tested whether the probability was predicted by either of two main effects: stimulus type (food vs. non-food) or hedonic assessment presentation type (absolute vs. comparative), as well as their interaction. We obtained main effects of stimulus type (odds ratio for correct responding = 2.09 (95% confidence interval 1.40–3.12) for non-food versus food; $X^2 = 12.1$, $df = 1$, $p < .001$) and hedonic assessment presentation type (odds ratio for correct responding = 1.92 (95% confidence interval 1.19–3.10) for comparative versus absolute language; $X^2 = 15.0$, $df = 1$, $p < .01$). As predicted, children were more likely to correctly select the stimulus opposite that identified as most hedonically positive by the unreliable adult when the stimulus was a non-food compared to a food, and when the adult's hedonic assessment was presented as a comparison of the two stimuli as opposed to an absolute hedonic assessment. There was no significant interaction between the two factors (Figure 1). There was also no main effect of gender, nor a significant interaction between gender and either stimulus type or hedonic assessment presentation type. Given that the children in Study 3 were significantly younger than the children in either Study 1 or Study 2, we repeated the Study 3 analyses restricting the sample to include only the 12 children who were 4 years or older and the results did not differ.

Discussion

Study 3 confirmed our hypotheses. First, children were more likely to select a stimulus identified by an unreliable adult as 'hedonically positive' (via either hedonic assessment presentation) when the stimulus was a food compared to a non-food. Simply put, when a 'spinach-liking' adult pointed to a box containing food and told the child that the food in the box was hedonically positive (expressing this either with absolute language – "I think this one is yummy," or comparative language --"I like this one better than that one") the child (regardless of the fact that the adult likes spinach) followed the adult's lead and selected the box of food designated by the adult as 'hedonically positive' to take home. When the stimulus was not food, the child used his/her knowledge that the adult's hedonic assessments were opposite his/her own to more often select the opposite envelope from the adult. A significant body of literature documents the proclivity of humans and other mammals to select food from the environment through modeling the food selection of others (Birch, 1980; Galef, 1989; Rozin & Kennel, 1983; Rozin, 1976). It has been hypothesized that this behavior is innate and

adaptive in guiding the selection of 'safe,' non-poisonous items from the environment (Cashdan, 1994). The present study extends these findings by indicating that children are also more likely to indiscriminately trust adult testimony when the stimulus is a food compared to a non-food.

The second major finding of Study 3 was that children were more likely to perform the task correctly when the adult's hedonic assessment was presented as a comparison (e.g., "I like this one better than that one."), as opposed to using absolute language (e.g., "I think spinach is yummy."). The fact that children performed the task correctly more often when the hedonic assessment was presented as a comparative as opposed to absolute statement may be due to the earlier development of children's ability to understand absolute, versus relative terms, as described earlier (Ebeling & Gelman, 1988; Ryalls et al., 1998). Their presumably more immediate comprehension of the adult's hedonic assessment when presented in absolute terms may have led them to rapidly accept this testimony and act upon it (and as a result perform incorrectly on the Prize Selection task). When presented in comparative terms, due to the greater challenge involved in interpreting the hedonic assessment, the children's Prize Selection may have been more likely to be correct as they were forced to pause and consider in more detail the meaning of the adult's comment and reliability of the adult's testimony. It is important to note that the effect of the absolute versus comparative language on Prize Selection may also be confounded by the use of the affectively-laden terms "yummy" or "yucky" in the absolute statements, and not the comparative statements. Adult (particularly maternal) affect regarding a stimulus can powerfully affect child behavior with ambiguous stimuli (Hornik, Risenhoover, & Gunnar, 1987; Sorce, Emde, Campos, & Klinnert, 1985), and the simple presentation of an affectively laden description may have overwhelmed children's appreciation that the adult had different hedonic assessments from their own, and was an unreliable informant.

Finally, the younger age of the children in Study 3 compared to the children in Studies 1 and 2 did not lead to a higher prevalence of incorrect responding. This was contrary to our hypothesis. While prior work has indicated that children will discriminately use adult testimony about non-food items by age 4 years (Koenig & Harris, 2005), the present findings reveal no age difference between 3- and 4-year-olds. The findings suggest that the discriminate trust of adult testimony arises particularly early in the food domain. This would be an important area for future research.

General Discussion

This series of studies found that children are more likely to indiscriminately trust adult testimony regarding food, compared to non-food stimuli. Secondly, children are more likely to select a stimulus identified by an unreliable adult as 'hedonically positive' when the adult's hedonic assessment is presented in absolute, as opposed to comparative terms.

The results are congruent with the literature dating back to the 1930's on the robust effect of adult modeling on children's food selection (Duncker, 1938), in that adult behavior has a powerful influence over children's food selection. Prior work has shown that an adult modeling eating a food without commenting on it does not effectively shape children's consumption. When the adults modeled eating the food while also commenting on it (with apparently a mix of hedonic assessments presented as absolute and comparative statements), children increased consumption significantly (Hendy & Raudenbush, 2000). The present study extends this literature by demonstrating that an adult simply stating that a food is hedonically positive (without actually modeling eating the food) is also remarkably powerful in shaping children's selection of a food to sample.

It is notable that adults' hedonic assessment presentation in absolute, as opposed to comparative, terms strengthened the power of adult testimony. Adults attempting to encourage a child's consumption of a food during a meal usually seem to present the child with a hedonic assessment in absolute terms (e.g., "I think these artichoke hearts are really yummy.").Adults may naturally do so, having learned over time that the hedonic assessment presentation in absolute terms seems to be more effective in getting the child to sample the food than a hedonic assessment presentation that is merely compartive. An important area for future study would be to determine if during a naturally occurring meal, verbal prompts to eat consisting of hedonic assessments that are absolute as opposed to comparative are more effective.

We considered that children may have indiscriminately used adult testimony to select the same stimulus as the unreliable adult because they felt obligated to be "polite" towards the adult experimenter, and to therefore follow what may have seemed to have been her implicit recommendation. However, children did choose the selection opposite that of the adult more often with the stickers than with the jelly beans, and one would surmise that if a child simply selected the same stimulus as the adult to be polite, that this would have occurred equally for foods and non-foods. Others have also noted that when children believe adults are making erroneous assessments about a stimulus, they will readily reject an adult's assertion if they believe it to be false (Clement et al., 2004; Jaswal, 2004). Indeed, children in the present study often observed the adult expressing a positive hedonic assessment for hedonically negative stimuli with visible surprise, and then confidently selected the prize opposite that identified by the adult as hedonically positive.

It is also important to note that the present studies involved jelly beans as the primary food stimulus. Since jelly beans are candy, and therefore relatively inherently palatable, it cannot be certain that the findings extrapolate to foods that are not candy, such as the vegetables that are generally the focus of parents' presentation of often unreliable testimony. In Study 3, the children also participated in a large number of Prize Selections, and although the vast majority of children completed the protocol, it is possible that some children became fatigued near the end of the protocol and their responses became less reliable. The randomized order of presentation of conditions helps to obviate this concern, and it is noteworthy that significant findings were still identified even with this potential introduction of error. Finally, the present studies have focused on the behavior that occurs preceding the child actually taking the first bite (selection of the food to sample). The children never actually had an opportunity to taste the foods they had chosen, which would arguably have "raised the stakes" of the paradigm and therefore may have been a truer measure of the effect of adult testimony on children's eating behavior.

Peer child models appear to be more powerful than adult models in shaping food selection (Duncker, 1938; Hendy & Raudenbush, 2000). It is unclear how children might have responded differently to a child's hedonic assessment presentation, as opposed to that of an adult. Children may view other children as generally more reliable informants than adults, given that children as a group have different taste hedonic assessments from adults, particularly for sweet and salty (Desor, Greene, & Maller, 1975). Even when another child's hedonic assessment has been different from the child's own in the past, a child may still be more likely to select the same food as another child as opposed to the same food as an adult. Alternatively, the fact that children typically view adults as more reliable informants than children (Taylor et al., 1991) might suggest that they would select food relying more on an adult's hedonic assessment presentation as opposed to a child's hedonic assessment presentation. These hypotheses are testable and potentially the foci for future studies.

Finally, we considered that there may have been gender differences in the children's responses to adult testimony, particularly since the experimenter was a female. In general, children's

performance did not differ by gender, though we may have had limited power to detect a difference. Notably, the findings in Study 2 suggested that girls tended to be relatively more discriminate consumers of testimony for non-food, while boys tended to be relatively more discriminate consumers for food. This might suggest either that children may more readily accept testimony about food from a same-gendered adult, or that girls are more likely to readily accept testimony about food than boys. These findings, however, were not replicated in Study 3. This is an area that deserves further investigation.

In conclusion, our study has a number of implications. First, even when children recognize that adults often like "yucky" foods, adult testimony that a food tastes good still would appear to be remarkably effective in persuading the child to sample it. Second, children seem to be particularly predisposed to select a stimulus identified by an adult as hedonically positive when the stimulus is a food, as opposed to a non-food, which may reflect previously described innate tendencies to model eating behavior after conspecifics. Third, children appear to be more likely to select a stimulus identified as hedonically positive by an adult when the hedonic assessment is presented in absolute, as opposed to comparative, terms. This observation may have rather straightforward implications for the manner in which parents and caregivers talk to children about food: adult hedonic assessments that are presented as absolutes may be much more effective than those presented as comparisons. Simply put, it would be more effective to tell a child, "I think this spinach is yummy," than "I like this spinach better than green beans.".

The results of this study inform interventions to shape children's eating behavior. Research in this area to date has presented adult (particularly maternal) modeling as a central method of shaping children's food preferences. The results of this study have identified the provision of adult testimony regarding food palatability as a potentially important modifier of children's food selection, which may well act independently of modeling. Given that the effects of modeling and testimony have not been previously disentangled, developing a more sophisticated understanding of how each functions to shape food selection would allow for the development of more effective and targeted eating behavior interventions in the future.

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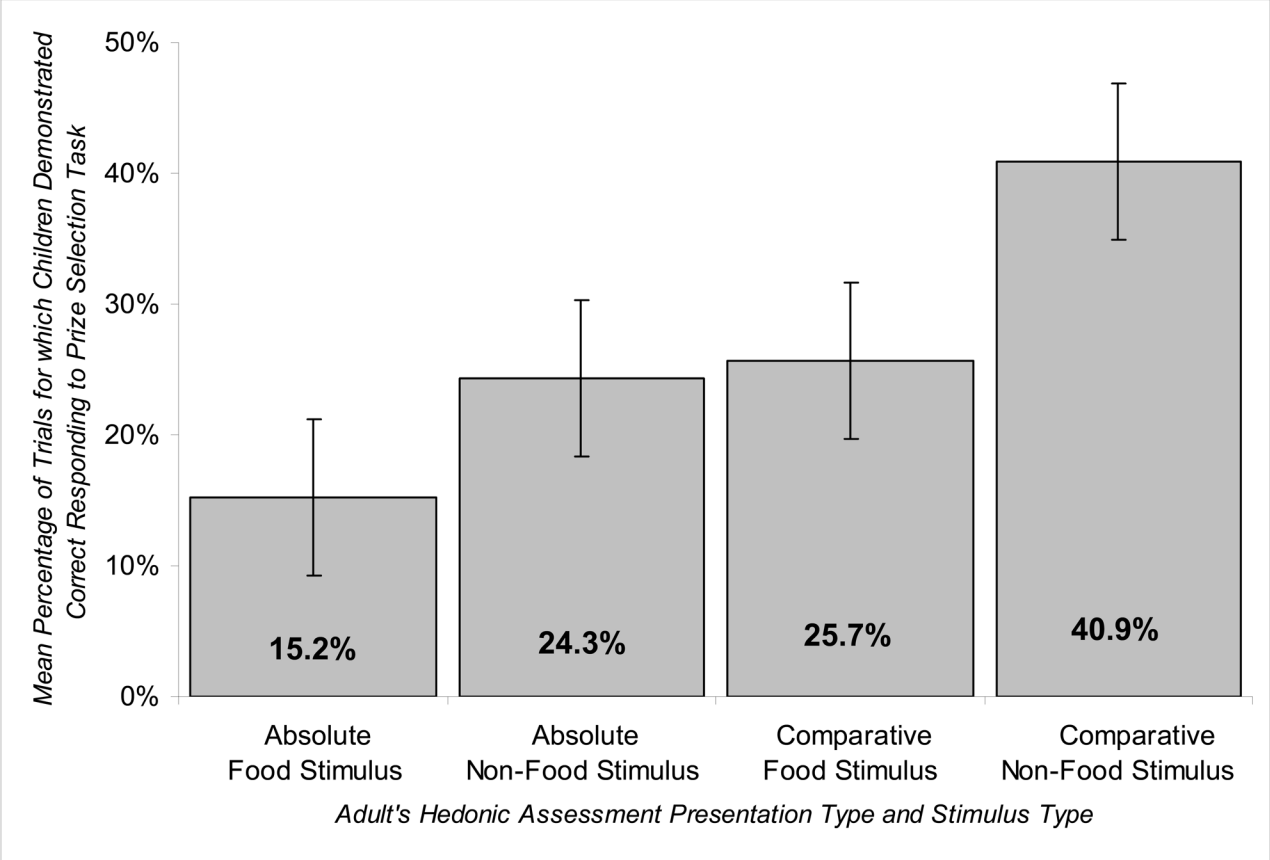

FIGURE 1. Mean percentage of trials for which child 'correctly' chose the opposite stimulus from that identified as hedonically positive by the adult experimenter in Study 3

Error bars represent standard error measurements.