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Shape or substance? Children’s strategy when labeling a food and its healthfulness

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A R T I C L E I N F O

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A B S T R A C T

The goal of this research was to examine which properties children use to identify a food and its healthfulness when its appearance and substance do not match. In Study 1 (N = 40), 3- to 6-year-olds saw a drawing of a food (its shape, e.g., apple) with a flap that opened to a different food (its

unhealthy. Yet, do we base these decisions on a food's appearance or its internal properties? This is similar to investigations in children's strategies in other domains as well; if we see an animal that looks like a skunk, we assume it is a skunk. However, if we were told that this skunk has the insides of a raccoon, then we say it is a raccoon because its insides define its category membership (Keil, 1992). Interestingly, even within the body of research on children's broader knowledge of food, a thorough review of the existing literature has revealed very few empirical studies specific to how children are identifying foods: whether it is by its shape or by its substance. Using terms from the core knowledge perspective, please note that our use of the term 'substance', 'internal properties' and 'ingredients' all refer to the same items, which are the non-obvious insides of the food as opposed to the outsides or physical appearance of the food. The substance refers to the essence of the item, the "nonvisible part… or quality in each individual or category member… [which] is inherent" (Gelman, 2003, p. 306).

2. Current research

Previous research reveals that under certain circumstances, children can use internal properties to categorize a food and its healthfulness when its shape and substance match. Preschoolers used color, texture, and smell (internal properties) rather than shape (external property) to categorize novel objects labeled food, but did not for novel objects labeled toys, instead using their shape (Lavin & Hall, 2001; Marcario, 1991; Santos, Hauser, & Spelke, 2002). Nguyen and McCullough (2009) found that 4-year-olds could accurately identify a food's healthfulness using a single modality, such as touch (e.g., food's texture), smell, or recordings of another person eating it. In a simple, but clever study, Krause and Saarnio (1993) examined preschoolers' ability to accurately identify deceptive non-foods (e.g., lollipop shaped pen, candy shaped magnet) as both a non-food and inedible. Using an appearance-reality task, children were asked 1) what the deceptive non-food looked like, 2) if it really and truly was the object's appearance or something else, and 3) could the researcher eat it if he/she was very hungry. The authors found a majority of 3-year-olds did not answer the questions correctly, though about half of the 4-and 5-year-olds did.

Building on the extant appearance-reality literature (e.g., Deák, 2006; Flavell, Green, Flavell, Watson, & Campione, 1986; Moll & Tomasello, 2012; Siegal & Share, 1990), this research focuses on whether children consider a food's external properties (i.e., shape) or internal properties (i.e., ingredients) when identifying a deceptive food. This is the first investigation we are aware of to examine children's strategies specific to categorizing a food by its label and healthfulness. Therefore, we also tested the possibility that children's strategies varied by a food's healthfulness. For example, children may be more likely to pay attention to internal properties for unhealthy foods if they think these are more likely to be human-made (e.g., processed) as compared to healthy foods, which are more likely to be natural. Alternatively, it could be that children are more likely to pay attention to internal properties for healthy or natural foods as they do natural kinds, understanding that internal properties define its category membership as opposed to unhealthy or processed foods.

To test whether children use a food's y

their explanations that referenced shape, *p* had participated in Study 1.

6.1.2. Materials

The materials were identical to Study 1 except for three new drawings of a chef taking the substance (e.g., candy) and turning it into the food's shape (e.g., apple). These drawings consisted of: 1) a chef holding a knife over the shape of the food (e.g., apple), 2) the chef slicing the food shape in half, (e.g., the chef slicing the apple in half), and 3) the chef placing the substance food into the halves of the food shape (e.g., the chef putting candy into both halves of the apple). All images were taken from internet sites (e.g., Google Images) and Microsoft Paint was used to manipulate them. See Appendix C for sample stimuli and protocol.

6.1.3. Procedure

The procedure was identical to Study 1 except for the simplified description of the foods and the drawings of the chef's transformation of the food's substance into its shape.

For each trial, the researcher pointed to and explained what the chef was doing in each of the three drawings (e.g., "Here is the cook with an apple. Here is the cook cutting open the apple. Here the cook is filling it inside with candy!"). Following the three drawings, the researcher showed the same picture of the food shape with the flap opening to the food substance from Study 1. When labeling the food's shape and substance, the researcher stated the food's name and healthfulness only once instead of multiple times (e.g., "See this. It looks like a healthy apple on the outside" and "Now let's look inside and see what this is made up of inside. But it has unhealthy candy"). The label question was changed to, "So is this really and truly (shape, e.g., an apple) or (substance, e.g., candy)?" The health question was changed to, "Should people eat this food to have a healthy body?" We replaced the term 'you' with 'people' and 'healthy body' was placed at the end of the sentence to emphasize the healthfulness of the food. Children were also asked, "Why?" to explore the rationale for their answers to the health question. Shape and substance terms were counterbalanced across trials.

7. Results

The data were scored and analyzed in the same manner as in Study 1 for both the separate and combined analyses.

7.1. Label question

The ANOVA revealed a main effect of Age, $F(1, 44) = 4.61$, $p = .03$, $\eta_p^2 = .09$, such that the older age group was more likely to use the food's substance to label it as compared to the younger age group. No other effects were found. Participants' performance was compared to chance. A one sample *t*-test (test value = 50%) revealed younger and older children were at chance in their substance responses to healthy foods and unhealthy foods, p's > .06. See Fig. 1 for substance responses to the label question by age for Study 1 and 2.

7.2. Health question

The ANOVA revealed a main effect of Age, $F(1,44) = 5.04$, $p = .03$, $\eta_p^2 = .10$, such that the older age group was more likely to use the food's substance to identify its healthfulness compared to the younger age group. No other effects were found. Participants' performance was compared to chance. A one sample *t*-test (test value = 50%) revealed that younger children were at chance in their substance responses to healthy foods and unhealthy foods, p's > .3, while older children were above chance in using substance to identify both healthy foods, $t(19) = 4.95$, $p < .001$, and unhealthy foods, $t(19) = 5.53$, $p < .001$. See Fig. 2 for substance responses to health question by age for Study 1 and 2.

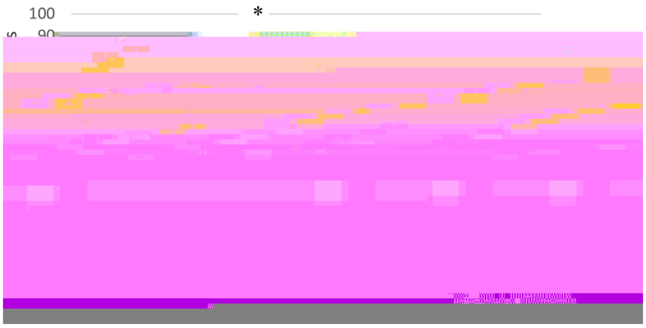

Fig. 1. Percent of substance responses for the label question by age for Study 1 and 2. Error bars represent standard error of the mean. Asterisks (*) refer to above chance performance.

Fig. 2. Percent of substance responses for the health question by age for Study 1 and Study 2. Error bars represent standard error of the mean. Asterisks (*) refer to above chance performance.

7.3. Label and health questions

As we did in Study 1, we examined the combined responses to the label and health questions based on the food's substance. Participant responses were compared to chance. A one-sample *t*-test (test value = 50%) revealed the younger age group used a food's substance at above chance levels for healthy foods, $t(25) = 3.13$, $p = .004$, and for unhealthy foods, $t(25) = 2.26$, $p = .03$, and the older age group's substance responses were at above chance levels for both healthy, $t(19) = 4.95$, $p < .001$, and unhealthy foods, $t(19) = 5.53$, $p < .001$. See Fig. 3 for substance responses to both the Label and Health question (combined) by age for Study 1 and 2.

7.4. Explanation responses

A one way ANOVA revealed older participants were more likely to reference substance in their explanations than younger participants, $F(1, 44) = 5.30$, $p = .02$. Older participants were less likely to make irrelevant explanations for their answers to health question compared to younger participants, $F(1, 44) = 6.41$, $p = .01$. There were no differences between the age groups in their explanations that referenced shape, $p = .91$. Participant responses were compared to chance as well. A one-sample *t*-test (test value = 33%) revealed the younger age group was at above chance levels when referencing the food's substance for their explanations, $t(25) = 2.57$, $p = .01$ and at chance when explaining their responses to the health questions by the food's shape and for irrelevant explanations, *p's* > .22. Older children's substance explanations were at above chance levels, $t(19) = 5.97$, $p < .001$, their irrelevant explanations were at below chance levels, $t(19) = -12.60$, $p < .001$ and their shape explanations were at chance, $p = .24$. See Fig. 4 for Explanation Type responses by age for Study 1 and Study 2.

Lastly, we examined whether participants who selected the substance of the food for its healthfulness were also more likely to reference the substance of the food to explain their responses to the health question (e.g., 'it's unhealthy' was most likely explained by referencing properties of the candy). A Pearson's correlation revealed a moderate positive correlation for substance responses to the health question and substance based explanations for younger participants, $r = .48$, $p = .01$. Older participants' positive correlation between their substance responses to the health question and their substance explanations was trending towards significance, $r = .43$, $p = .05$.

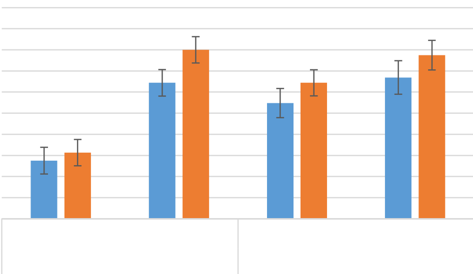

Fig. 3. Percent of substance responses for both the label and health questions (combined analysis) for Study 1 and Study 2 by age. Error bars represent the standard error of the mean. Asterisks (*) refer to above or below chance performance.

7.5. Comparison between Study 1 and 2 for the younger age group

The goal of this second study was to investigate whether changes in our procedure (i.e., trial wording and visual transformation of substance into shape) would increase the likelihood of the younger age group selecting the food's substance for its label and healthfulness as compared to Study 1. For the label question, we ran an independent *t*-test, which revealed no differences in the

(healthy), but are really something else (unhealthy) to increase healthy food choices. We acknowledge that the present findings are not specific to reducing poisonings or to decreasing unhealthy food choices, but we do believe that findings on children's categorization strategies may be helpful in understanding one small part of children's decisions in these areas.

10. Limitations and future directions

Thus far, based on the findings from the separate and combined analysis in both studies, we have suggested that older children use substance when determining food's label and healthfulness. However, an alternative explanation may be that we influenced older children's substance responses by both showing and labeling the substance of the food immediately before asking the test questions.

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Appendixes. Supplementary data

Supplementary material related to this article can be found in the online version at doi:10.1016/j.cogdev.2018.08.003.

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