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Children's Evaluative Categories and Inductive Inferences within the Domain of Food

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Abstract

Evaluative categories include items that share the same value-laden assessment. Given that these categories have not been examined extensively within the child concepts literature, the present research explored evaluative categorization and induction within the domain of food as a test case. Specifically, two studies examined the categories of healthy and junky foods in children aged 4 and 7 years. Study 1 showed that by aged 4 years, children appropriately apply the evaluative categories of healthy and junky foods to a variety of different foods. Study 2 showed that by age 4 years, children also selectively use the evaluative categories of healthy and junky foods for inductive inferences about the human body, but not for arbitrary or unrelated inferences. Taken together, these results highlight the importance of evaluative processing in young children's categorization and induction.

Keywords

categorization; inductive inferences; evaluative categories; food

INTRODUCTION

Categorization, the ability to classify items together, is a major conceptual ability for young children. Taxonomic and script categories are two forms of categorization that are widely studied within the child concepts literature. *Taxonomic categories* are based on common properties of items (e.g. fruits are sweet/tart, fleshy, etc.), and these properties allow the items to be organized into a hierarchy ranging from specific to abstract (e.g. Fuji apple → apple → fruit) (e.g. Horton & Markman, 1980; Murphy, 2002; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976; Waxman & Gelman, 1988). In addition, *script categories* are based on the roles that items play in an event or routine such as a birthday party or breakfast-time (e.g. Lucariello, Kyratzis, & Nelson, 1992; Nelson, 1986, 1988). For example, the script category of breakfast foods might include pancakes and bacon not because they share common properties, but because they play the same role in a routine, what is eaten at breakfast.

Categories are often learned in the service of broadening the scope of one's knowledge by making inferences about new items. If children did not have categories, then they would not be able to rely on their category knowledge to quickly identify a new item that might be an instance of an already familiar category. Rather, children would have to spend a tremendous amount of time inspecting the item to determine its identity, etc. Thus, an important function

of categories is induction or the process of making generalizations from a known category to a new category member. In particular, inductive inferences involve making a conclusion about a new item based on a known piece of information about a premise category (e.g. given that a robin is a bird and has feathers, it can probably be concluded that another bird, such as an oriole, has feathers as well). Nguyen and Murphy (2003, Experiment 5) found that by age 7 years, children use taxonomic categories of food to make inferences about the biochemical composition of food. They also found that by age 7 years, children use script categories of food to make inferences about the situational contexts in which foods are typically eaten. For example, in this study children were shown a picture of a target food, ice cream, and were presented with two choices, milk (a dairy product, a taxonomic choice) and cake (a birthday party food, a script choice). When children were told that ice cream has biochemical stuff inside and were asked whether milk or cake has the same stuff inside, children chose the milk, the taxonomic choice. In contrast, when children were told that ice cream is eaten during a special time and were asked whether the milk or the cake was also eaten during the same special time, children chose the cake, the script choice.

In order to gain a full understanding of children's conceptual development, it is essential to study a variety of categories that children might form and use. The goal of the present research is to examine a basis for categorization and induction which has been largely overlooked within the child concepts literature, namely evaluation. As children learn about different objects in the world, they not only need to identify an object as belonging to a particular taxonomic or script category, but they also need to be able to evaluate or make assessments about these objects. Such assessments inform children of which objects to approach or avoid. Evaluative processing is pervasive in children's everyday lives and thinking, and thus may serve an important basis for categorization. During the preschool years, children are already frequently making spontaneous evaluative statements within various social contexts about items (e.g. 'That's icky!') and even about human behaviours (e.g. 'That's not nice!') (e.g. Alvarez, Ruble, & Bolger, 2001; Bretherton & Beeghly, 1982). While a number of studies have investigated evaluative processing in children, none of these studies have examined categorization *per se* (e.g. encoding, Cermak, Sagotsky, & Moshier, 1972; reasoning about traits, Heyman & Giles, 2004; and stereotyped beliefs, Bigler, Averhart, & Liben, 2003; Gelman, Taylor, & Nguyen, 2004; Hirschfeld, 1996).

The present research focuses on *evaluative categories* in which items share the same evaluation or assessment (e.g. healthy foods, junky foods) (Nguyen, 2007a,b; Nguyen & Murphy, 2003; Ross & Murphy, 1999). Membership in an evaluative category is determined by the value-laden assessment that individuals make about an item. To make an assessment, individuals might examine an item's value, make content discriminations, relate the item to prior knowledge and experiences, etc. By engaging in this evaluative process, an individual is going beyond simply identifying an item as it is. For example, the evaluative category of healthy foods might include skim milk, carrots, and fish. Although these foods are less similar to one another than what would be expected in taxonomic categories that are defined by a set of common properties (e.g. dairy products, vegetables, and meats), these foods all belong to the same evaluative category because they are evaluated as healthy. Skim milk might have the properties of being high in calcium and low in fat, for instance, but evaluative categorization has not occurred until an individual has taken the extra step to make a value-laden assessment about these properties.

Thus, evaluative categories carry considerable content that goes beyond pure affect or emotion (see Niedenthal, Dalle, & Rothmann, 2002; Niedenthal & Halberstadt, 2000; Niedenthal, Halberstadt, & Innes-Ker, 1999). For example, although brussel sprouts may evoke negative feelings, they can still be categorized as healthy. This is not to say that foods never elicit feelings that are consistent with their evaluations; they certainly can as in the

case of chicken noodle soup, which can be categorized as a healthy food that also elicits positive feelings. However, in all of these cases, what is particularly important in determining evaluative category membership is the evaluation that is made about the healthfulness of the foods as opposed to the affect or emotion that the foods evoke.

Recently, Kalish (2007) proposed that there are both pragmatic and prescriptive aspects of children's categorization. This distinction is especially relevant to the discussion of evaluative categories. Kalish (2007) describes that, on the one hand, pragmatic categories are a matter of degree and can vary by context. Pragmatic categorization decisions reflect judgments that individuals make about the degree to which items share enough similarity to belong to the same category. Evaluative categories of food seem pragmatic in this way. For example, whether foods are classified as healthy or junky may depend upon the dimensions along which an individual decides to evaluate the foods (e.g. caloric density, serving size, sugar content). Kalish (2007) also describes that, on the other hand, prescriptive categories are more conventionalized such that there are clearly correct and incorrect ways to categorize. Thus, categorizing an item is a matter of fact and not a matter of judgment. Hence, an item is either a member or not a member of a particular category (e.g. an apple is a fruit). Given that evaluative categories of food such as healthy and junky foods are more a matter of judgment than fact, they seem less prescriptive, especially since decisions about these foods may vary in different historical, cultural, and social contexts. However, this is not to say that evaluative categories of healthy and junky foods are hopelessly idiosyncratic and do not carry much content since there is often agreement among individuals regarding the evaluations of these foods.

THE PRESENT STUDIES

The domain of food was used as a test case for examining evaluative categories in the present research. This domain was selected because it has been shown by Ross and Murphy (1999) to have strong taxonomic, script, and evaluative relations. In this study, adults were given a list of foods and were asked to generate categories for each of the foods. Ross and Murphy (1999) found that adults spontaneously grouped foods based on three different relations: taxonomic (e.g. vegetables), script (e.g. breakfast foods), and, evaluative (e.g. macronutrients). This has not been documented with other domains. Although there is clearly a limitation in using categories from a single domain, by using the domain of food, in which different types of classification are already well documented with adults, the results can be revealing of children's abilities. If several different domains (e.g. clothing, furniture, animals) were used in this research, and children's use of evaluative categories was not found, it would be unclear whether this was because children lack the ability for using these categories or because these domains lack evaluative category structure.

The evaluative categories of interest in the present research were healthy and junky foods. Although the healthy versus junky dichotomy may appear somewhat oversimplified, emerging research in the child concepts literature is beginning to show that this is a relevant evaluative distinction for children, thus providing an important foundation for the present research. In one study, Nguyen and Murphy (2003, Experiment 1) provided an initial investigation of children's evaluative categories of healthy and junky foods. These researchers tested children on a categorization task, using only four evaluative trials as a part of a larger study on taxonomic and script categorization. For each trial, children were presented with picture triads that consisted of a target food (e.g. banana, a healthy food) and two choices, one that shared an evaluative category relation with the target (e.g. spinach, a healthy food) and the other that did not share an evaluative category relation with the target (e.g. cheetos, a junky food). For each triad, children were asked which choice is the same kind of food as the target (e.g. 'Is a banana the same kind of food as spinach or cheetos?').

The results showed that 4- and 7-year-olds tended to reliably select the choice that shares an evaluative category relation with the target food (e.g. selecting spinach). The results of Nguyen and Murphy (2003, Experiment 1) have also been replicated and extended by Nguyen (2007a), using a classification task. In this study, children were asked to classify 70 foods as either healthy or junky. The results showed that the ability to appropriately classify foods as healthy or junky improved with age. Three-year-olds, 4-year-olds, and 7-year-olds appropriately classified the foods 59%, 73%, and 78% of the time, respectively. Also, by age 7 years, children were able to provide explanations for their classifications, revealing some understanding of what it means for a food to be healthy or junky.

To date, there have not been any studies examining whether children use their evaluative categories for specific inductive inferences. The majority of research examining children's inductive inferences has tended to focus mainly on taxonomic categories; hence, the role of other categories, including evaluative, in induction has not been well documented (see Krackow & Gordon, 1998). The present research explores the possibility that children use evaluative categories of healthy and junky foods as the basis for what is referred to in this paper as *bodily inferences*, which are inferences about the impact that food has on the human body. For example, if children are told that eating a certain food in large amounts over a long period of time leads to a particular bodily consequence, would they infer that eating another food from the same evaluative category will lead to the same consequence?

The examination of children's evaluative categories of food and children's use of these categories for bodily inferences is an important area of research given that it is highly relevant to children's everyday lives, including their health and well-being. The study of evaluative categorization and induction within the domain of food is especially pertinent given that the prevalence of overweight and obese children has become a serious public health concern in the United States. For example, the percentage of children who were overweight nearly tripled in the last 20 plus years. Approximately 10% of children (aged 2–5 years) are overweight. Children who are overweight are at a greater risk for numerous health threats, including heart disease, type 2 diabetes, and poor social–emotional well-being (American Heart Association, 2006; Centers for Disease Control and Prevention, 2006).

The possibility that children use evaluative categories of healthy and junky foods for bodily inferences is supported by past research on children's naive theory of biology (see Gelman & Kalish, 2006; Inagaki & Hatano, 2006; Wellman & Gelman, 1997, for a review). Research has found that children have knowledge and understanding of several different biological phenomena and processes, including human health and illness (e.g. Kalish, 1996; Nguyen & Rosengren, 2004; Raman & Gelman, 2005; Rozin, 1990; Siegal & Peterson, 1999). Thus, children's naive theory of biology may provide a rich context for children's use of the evaluative categories of healthy and junky foods for inferences about the human body.

The present research includes two studies on children's evaluative categorization and induction within the domain of food. Study 1 focused on verifying children's ability to appropriately apply the evaluative categories of healthy and junky foods, which was crucial in order to ensure that children understand the categories used in Study 2 for induction. Study 1 extended the initial work of Nguyen (2007a) and Nguyen and Murphy (2003, Experiment 1) by looking at a variety of foods in order to provide a more extensive documentation of children's evaluative categorization within the domain of food. Although Nguyen (2007a) included 70 foods and Nguyen and Murphy (2003, Experiment 1) included four picture triads, these stimuli did not provide equal representation of different foods groups. In Study 1 of the present research, the stimuli included an equal number of foods that could be considered as belonging to different taxonomic and script food groups. The aim of Study 2 was to examine whether children use evaluative categories of healthy and

junky foods to make bodily inferences. While Nguyen and Murphy (2003) examined the use of taxonomic and script categories of food for biochemical and situational inferences, respectively, they did not look at the use of evaluative categories for a specific type of inference. Thus, Study 2 of the present research is the first to examine the role of evaluative categories in children's induction, particularly bodily inferences. Both Studies 1 and 2 of the present research included children aged 4 and 7 years. These particular ages were selected so that results could be considered in relation to the findings for these age groups in both Nguyen (2007a) and Nguyen and Murphy (2003, Experiment 1). A younger age group was not included because Nguyen (2007a) found that 3-year-olds were just above chance in their level of evaluative categorization.

STUDY 1

The goal of Study 1 was to verify that children can appropriately apply the evaluative categories of healthy and junky foods to the domain of food. When examining children's induction it is extremely important to first establish that children can identify the categories that will be used to make inductive inferences. This way, if children fail to make inductive inferences, then the results can be attributed to a lack of ability for induction, not because of a lack of category knowledge. For example, if children do not know the category of healthy foods and cannot identify foods that belong to this category, then it would be difficult to expect them to make an appropriate bodily inference from one healthy food to another healthy food.

Children in this study participated in a classification task, in which they were asked to evaluatively classify a variety of foods as either healthy or junky. If children appropriately apply the evaluative categories of healthy and junky foods to the domain of food, then their performance on the classification task should be above chance level.

Method

Participants—The participants included: 16 4-year-olds ($M = 4.5$, range = 4.0–4.9, 8 boys and 8 girls); 16 7-year-olds ($M = 7.2$, range = 6.9–7.6, 8 boys and 8 girls); and, 16 adults ($M = 19.5$, range = 18.6–20.5, 9 men and 7 women) as a developmental endpoint. A separate group of 16 4-year-olds ($M = 4.5$, range = 3.9–4.9, 6 boys and 10 girls), 16 7-year-olds ($M = 7.3$, range = 6.9–7.8, 7 boys and 9 girls), and 12 adults ($M = 20.8$, range = 18.2–24.1, 3 men and 9 women) was also included to help with stimuli selection. None of these children or adults participated in the actual study. Children were recruited from schools, whereas adults were recruited from universities located in the Midwestern and Southeastern United States. In order to address the concern that children with food restrictions (e.g. allergies, vegetarian) may have idiosyncratic evaluations, only children who did not have any food restrictions, as reported by parents, were included in this study.

Materials—The stimuli consisted of 24 target foods (see Table 1). To ensure diversity in the foods, special care was taken to select foods that could be considered as belonging to various taxonomic (fruits, vegetables, meats, dairy products, drinks, and grains) and script (breakfast foods, lunch foods, dinner foods, snacks, desserts, and birthday party foods) categories. In particular, there were two target foods (one healthy and the other unhealthy, as determined by a professor of health and food nutrition) from each of the six taxonomic and six script categories. This approach to the stimuli, selecting both healthy and junky foods for each of the taxonomic and script categories to ensure diversity, necessarily placed a constraint on the number of stimuli that could be used in this study compared with Nguyen (2007a). For example, in many cases, in order to have two target foods (one healthy, one

junky) per category, the stimuli often included both adulterated (e.g. fruit and vegetable products and derivatives) and unadulterated foods (e.g. pure fruits and vegetables).

The target foods were selected from a list of foods that a separate group of 32 children (16 four-year-olds and 16 seven-year-olds) generated when asked to provide examples of foods from these various taxonomic and script categories (e.g. banana as an example of a fruit; cake as an example of a birthday party food). Previous research (e.g. Nguyen, 2007; Nguyen & Murphy, 2003) helped guide the item selection as well. A separate group of 12 adults also participated in a classification task to verify the taxonomic and script category membership of the target foods (e.g. banana is a taxonomic fruit; cake is a script birthday party food). The results showed a high percentage of agreement (88%) among the adults.

The stimuli also included various miscellaneous foods (e.g. cereal) that were used as fillers to minimize the likelihood that children in the study would keep track of and base their answers on the one healthy and one junky food pattern per category type. These foods were randomly presented among the target foods. All of the foods were presented as 2.5×3 in colour photographs printed on 8.5×11 in pieces of paper with food labels (e.g. banana, cake) underneath each photograph.

Procedure—Children were tested in a quiet area of their school for approximately 15 min. The categorization task was introduced to children as a game about healthy and junky foods. To establish a common definition, children were told that ‘healthy foods are good for your body if you eat a lot of them for a long time,’ and ‘junky foods are bad for your body if you eat a lot of them for a long time.’ These definitions were adapted from Nguyen (2007a). Additional research on children’s concept of time provided confidence that the 4- and 7-year-olds in the study could understand propositions related to time (e.g. Friedman, 2000, 2002). Children were then presented with foods, one at a time (as opposed to in pairs of taxonomic or script category foods). For example, carrot and French fry were presented on different trials. For each food, children were asked, ‘Is a (insert food) a healthy food or junky food?’ The foods were presented in one of two random orders. The order of the words ‘healthy’ and ‘junky’ were also presented in one of two random orders. Adults participated in a modified paper and pencil version of the study.

Results and Discussion

The goal of Study 1 was to verify that children can appropriately apply the evaluative categories of healthy and junky foods to the domain of food. In order to score the data, a ‘1’ was assigned when children appropriately classified the foods as either healthy or junky. One summary score was then created collapsing across the 24 foods, which was then converted into a percentage. A univariate analysis of variance was then conducted. The results indicated that the appropriate application of evaluative categories of food improved with age, $F(2, 48) = 46.89$, $MSE = 0.27$, $p < 0.05$. Adults ($M = 97\%$; $S.D. = 3\%$) tended to classify more appropriately than 7-year-olds ($M = 79\%$; $S.D. = 9\%$) and 4-year-olds ($M = 72\%$; $S.D. = 8\%$). There was a significant difference between all three age groups, Tukey *post hoc* tests, p ’s < 0.05 , $CI_{95} = 1\text{--}32\%$. Performance was also compared to chance, 50%. All of the participants had above chance level performance, t ’s (15) > 9 , p ’s < 0.05 .

The different taxonomic and script food groups were also separated out in order to examine whether the results were due to one or more groups. Table 1 summarizes the means of each food group. Although there were not enough items from each food group to allow for formal comparisons, there were some apparent differences. For example, Table 1 shows that meats, lunch foods, and dinner foods were relatively difficult for children. It is possible that children have limited knowledge and understanding about the healthfulness of these foods because they are typically prepared by adults, who generally have to insist children to eat

them (e.g. ‘please sit down and finish your dinner’). Thus, since children are typically not involved in the preparation of meats, lunch foods, and dinner foods, they may not be aware of their ingredients, unlike other foods that children may be involved in preparing (e.g. desserts) or foods that may not need any preparation at all (e.g. fruits). Also, children may not have many opportunities to think about and evaluate the ingredients of meats, lunch foods, and dinner foods versus other foods such as snacks. Adults often urge children to eat their meals (e.g. dinner), whereas children may often have to persuade adults to allow them to eat certain foods (e.g. snacks), and in this negotiation, perhaps children have more of an opportunity to consider the ingredients of these foods. Future research should examine these issues.

The results of this study are consistent with Nguyen (2007a) and Nguyen and Murphy (2003, Experiment 1). These results also make a valuable contribution to this previous work by extending the findings on evaluative categories to a variety of taxonomic and script foods. Thus, Study 1 verifies children’s ability for evaluative categorization within the domain of food, providing confidence that children understand the categories used in Study 2 for induction.

STUDY 2

The goal of Study 2 was to examine whether children selectively use the evaluative categories of healthy and junky foods for bodily inferences. In this study, children participated in a match to sample task. In this task, children were presented with triads that included a target food, an evaluative category match and a non-category match. Children were told that eating a target food is associated with a novel bodily property (e.g. ‘Cheetos made Jake’s body daxy.’). Children were then asked to generalize that property to one of the two choices. Therefore, the task required children to spontaneously categorize each target food on their own (since evaluative category labels were not provided) and then use the category for induction. If children use evaluative categories of food for bodily inferences, then they should select the evaluative category choices.

To rule out the explanation that children would have selected the evaluative choices regardless of whether they were making bodily inferences (e.g. perhaps because the evaluative choices are perceived as being more highly associated with the targets than the non-category choices), it was crucial to demonstrate that children do not use these categories for other types of inferences (see Gelman, 1988; Gelman & Markman, 1986 for discussion). Therefore, two control conditions were included in Study 2. Children in one control condition were asked to make arbitrary inferences with non-projectible properties about materials/substances (e.g. ‘The cheetos have dirt stuck to them.’). Novel labels were not used for the non-projectible properties to prevent children from misinterpreting them as ingredients of foods (e.g. peanuts on a sundae, sprinkles on a cupcake). Children in the second control condition were asked to make unrelated inferences about potentially projectible properties involving interactions with foods (e.g. ‘Jake uses a daxy to eat his cheetos.’). Thus, if children use evaluative categories of food for bodily inferences, but not other inferences, then this would suggest that children are paying attention to the category as well as the content of the property.

Methods

Participants—Ninety-six children participated in this study: 48 4-year-olds ($M = 4.6$, range = 4.0–5.2, 27 boys and 21 girls) and 48 7-year-olds ($M = 7.3$, range = 6.8–8.0, 23 boys and 25 girls). Forty-eight adults ($M = 20.6$, range = 18.8–44.9, 11 men and 37 women) also participated as a developmental endpoint. An additional set of 10 adults ($M = 21.5$, range = 19.9–23.7, 3 men and 7 women) also rated the stimulus materials. Child participants were

recruited from local schools and adult participants were recruited from universities located in the Midwestern and Southeastern United States.

Materials—The stimuli included 24 foods derived from Study 1 and previous research (Nguyen & Murphy, 2003; Nguyen, 2007a). These foods were arranged into 12 triads (six healthy food and six junky food triads). Appendix A shows that each triad included a healthy food or junky food target, a category match, and a non-category match (e.g. cheetos: ice cream versus fish). Special care was taken to ensure that the target and the alternatives were not in the same taxonomic category. The choices were counterbalanced such that the category match for the healthy food targets were the non-category matches for the junk food targets and vice versa. The dimensions of the photographs of the individual foods were 2.5 × 3 in. Each photograph was also labelled. Each triad was printed on an 8.5 × 11 in piece of paper.

Five adults provided visual similarity ratings of the photographs to ensure that the targets did not appear more similar to one of the two choices in the triads. To do so, adults rated the visual similarity of each target and its two choices separately (e.g. cheetos and ice cream, cheetos and fish). The scale ranged from 1 (not at all visually similar) to 7 (very visually similar). The overall visual similarity between the targets and their correct choices ($M = 1.61$, $S.D. = 0.49$) as well as between the targets and their incorrect choices ($M = 1.66$, $S.D. = 0.57$) was low and nearly identical.

In order to help select novel words for the properties, an additional group of five adults rated a list of 35 words (e.g. ‘daxy,’ ‘lokiny’) on how positive/negative the words seemed on a scale from 1 to 5 (e.g. 1 = extremely positive, 5 = extremely negative). The purpose of the ratings was to select neutral words that would not influence children’s inferences. Twelve words that received a mean rating of 3 were ultimately selected.

Procedure—Children were assigned to one of three inference conditions: bodily, arbitrary, or, unrelated. For all of the conditions, children participated in the same match to sample task in which they saw a set of 12 triads, presented in one of two orders. The main difference between the conditions was the type of inference children were asked to make. Specifically, children in the bodily inference condition heard that, ‘I’m going to show you some foods and tell you what they did to people’s bodies when they ate a lot of them for a long time. Your job is to pick other foods that would do the same things to their bodies.’ For example, ‘Cheetos made Jake’s body daxy. Would ice cream or fish also make Jake’s body daxy too?’

In contrast, children in the arbitrary inference condition heard that ‘I’m going to show you some foods that have some things stuck on them by accident. Your job is to pick other foods that would have the same things stuck on them.’ A sample test question was, ‘The cheetos have dust on them. Would ice cream or fish also have dust on it too?’

Children in the unrelated inference condition heard that ‘I’m going to show you some foods and tell you about the different things that people use to eat the foods with. Your job is to pick other foods that people eat using the same thing.’ A sample test question was, ‘Lisa uses a daxy to eat her cheetos. Would she also use a daxy to eat fish or ice cream?’

Results and Discussion

The goal of Study 2 was to determine whether children selectively use the evaluative categories of healthy and junky foods for bodily inferences. In order to score the data, evaluative category matches were assigned a 1 and non-category matches a 0. A summary score was then created and converted into a percentage. A 3 (age group: 4-year-olds, 7-year-

olds, and adults) $\times 3$ (inference type: bodily, arbitrary, unrelated) ANOVA was then conducted on these data.

The results were consistent with the prediction that children use their evaluative categories of healthy and junky foods for bodily inferences, but not for arbitrary and unrelated inferences. Although there was not a main effect of age, performance varied by inference type, $F(2, 135) = 69$, $MSE = 1.49$, $p < 0.05$. Evaluative categories were used significantly more often for bodily inferences ($M = 83\%$; $S.D. = 16\%$) than for arbitrary ($M = 50\%$; $S.D. = 15\%$) and unrelated ($M = 54\%$; $S.D. = 15\%$) ones. Arbitrary and unrelated inferences did not differ from each other, Tukey HSD tests, p 's > 0.05 . This same pattern of responding for arbitrary and unrelated inferences suggests that participants in the bodily inference condition were not simply deciding that a property is projectible and then using the only available category relation to project it. Rather, participants appeared to be sensitive to the category as well as the content of the property.

There was also an age group by inference type interaction, $F(4, 135) = 6.0$, $MSE = 0.13$, $p < 0.05$. Figure 1 shows the percentage of evaluative category selection by age and inference type. This interaction was examined by looking at each age group separately. There was a significant difference between the three types of inferences within each age group, F 's (2, 47) > 7.0 , $MSEs = 0.21, 0.49, 1.1$, p 's < 0.05 . In particular, each age group made significantly more bodily inferences compared to arbitrary ones, Tukey HSD tests, p 's < 0.05 , $CI_{95} = 8\text{--}53\%$, but only 7-year-olds and adults made significantly more bodily inferences than unrelated ones, Tukey HSD tests, p 's < 0.05 , $CI_{95} = 12\text{--}56\%$. There was not a significant difference between arbitrary and unrelated inferences within each of the age groups.

This interaction was also examined by looking at each inference type separately. There was a significant difference between the three age groups for bodily as well as unrelated inferences, but not arbitrary ones, F 's (2, 47) > 5.0 , $MSEs = 0.15, 0.10$, p 's < 0.05 . In particular, adults made significantly more bodily inferences than 4-year-olds, Tukey HSD test, $p < 0.05$, $CI_{95} = 7\text{--}31\%$. There was not a significant difference between adults and 7-year-olds or between the two child age groups. In addition, 4- and 7-year-olds made more unrelated inferences than adults, Tukey HSD tests, p 's < 0.05 , $CI_{95} = 3\text{--}24\%$. There was not a significant difference between the two child age groups.

Performance was also compared to chance, 50%. Four-year-olds, 7-year-olds, and adults were all above chance in their ability to use evaluative categories of food for bodily inferences (but not arbitrary or unrelated ones), t 's(15) > 4.0 , p 's < 0.05 .

Overall, the results show that children are not selecting the evaluative choices indiscriminately regardless of the inference type (e.g. based on association strength). Rather, children are paying attention to both the category and the content of the inference type when considering evaluative categories of food. In particular, by age 4 years, children selectively use evaluative categories of healthy and junky foods for inferences about the human body, but not for arbitrary inferences about materials/substances or unrelated inferences about interactions with foods. These results are consistent with past research showing that children typically do not use categories to make inferences about random properties (e.g. Diesendruck & Bloom, 2003; Gelman 1988; Heyman & Gelman, 2000), but also extend those of Nguyen and Murphy (2003, Experiment 5) who focused on biochemical and situational inferences, which are associated with taxonomic and script categories, respectively. To date, the results from Study 2 are the first to show that children use evaluative categories of healthy and junky foods for bodily inferences about the impact that food has on the human body.

GENERAL DISCUSSION

Evaluation as a basis for conceptual organization has been generally overlooked in the child concepts literature. The present research included two studies that used the domain of food as a test case for studying evaluative categorization and induction. Study 1 verified that by age 4 years children form evaluative categories within the domain of food. For example, children can evaluatively classify a carrot as healthy and a French fry as junky. Of course, there are still some groups of foods that are particularly difficult for children (e.g. meats, lunch foods, and dinner foods), which provide ideas for future research regarding children's knowledge and experience within the domain of food, including their eating practices and behaviours. Taken together, the results from Study 1 go beyond the initial findings of Nguyen (2007a) and Nguyen and Murphy (2003, Experiment 1) to show that children can evaluatively categorize foods from a variety of food groups.

The results of Study 1 make an important contribution to the growing body of research on flexibility in children's categories and concepts. Recently, there has been increasing recognition that children have the ability to use different systems of categorization to think about the same items (e.g. Nguyen, 2007b; Nguyen & Murphy, 2003). For example, ice cream can be considered as belonging to both a taxonomic category (dairy products) and a script category (things at a birthday party). Related research has also shown that young children have the ability to refer to a single item with more than one label, for example, saying that a crayon shaped like a dinosaur is both a dinosaur and crayon (Deák & Maratsos, 1998) or that a sponge painted to look like a rock is both a rock and sponge (Hansen & Markman, 2005). The results of Study 1 contribute to this body of research by verifying an additional system of categorization that children can potentially use to flexibly classify and cross-classify a single item. Future research should examine children's ability to use evaluative, taxonomic, and script systems of categorization for cross-classification.

Future research should also examine other evaluative categories within the domain of food. There are potentially many other evaluative categories of food besides healthy and junky, such as delicious and disgusting (see Rozin, 1990; Rozin, Hammer, Oster, & Horowitz, 1986). It would be interesting to examine how children represent and organize foods from different evaluative categories, especially when they are competing. For example, how do children represent foods that are delicious and unhealthy (e.g. birthday cake), delicious and healthy (e.g. strawberry), disgusting and unhealthy (e.g. pork rind), and disgusting and healthy (e.g. spinach)? It would certainly be interesting to examine in future research the extent to which evaluative categories within the domain of food have a hierarchical structure. Perhaps children organize foods hierarchically into broad and specific evaluative categories. For example, children may have a category for delicious foods and then a subcategory of delicious-healthy and delicious-unhealthy foods. Or, perhaps children organize their evaluative categories of food non-hierarchically, wherein foods share different associations or relationships. For example, children may have the idea that there is an inverse relationship between delicious and healthy such that the more delicious a food is, the less healthy it is.

Study 2 showed that children selectively use the evaluative categories of healthy and junky foods for bodily inferences about the impact that food can potentially have on the human body. Study 2 revealed that children as young as age 4 years selectively use their evaluative categories of food for bodily inferences (e.g. 'made his body daxy'). Study 2 also revealed that important developments occur between the ages of 4 and 7 years, particularly an increase in sensitivity to which type of meaningful inference can be best supported by evaluative categories.

Indeed, there is a growing body of evidence suggesting that common, everyday categories have components of goals and ideals that can be used in induction (Barsalou, 1983, 1991; Lynch, Coley, & Medin, 2000; Medin, Lynch, Coley, & Atran, 1997). Such categories can be induced frequently if they promote cognitive economy (Jacob, 2001). Evaluative categories of food seem roughly equivalent to some of these examples, such as Medin *et al.*'s 'weed trees.' This class of trees contrasts with the standard scientific taxonomic organization of trees and contains undesirable trees that grow quickly, have weak wood, and demand routine care (e.g. the weeping willow, box elder, eastern cottonwood).

A major contribution of Study 2 is that it is the first study to date to demonstrate the role of evaluative categories of food for a distinct type of inference. As discussed in the Introduction, much of the research on children's induction has focused on the role of taxonomic categories and little is known about other categories (see also Krackow & Gordon, 1998). However, Study 2 suggests that evaluative categories of healthy and junky foods carry considerable content and serve as an important basis for induction about the human body.

The results of Study 2 also make a contribution to the naive theory of biology literature. Although children's understanding of biology has been the focus of many investigations over the past two decades (see Gelman & Kalish, 2006; Inagaki & Hatano, 2006; Wellman & Gelman, 1997, for a review), to date, there are still very few studies on children's knowledge or understanding of the relationship between food and one's health within this literature. For example, Wellman and Johnson (1982) found that kindergartners know that eating vegetables results in positive health outcomes (e.g. strength, peppiness) whereas eating desserts results in negative health outcomes (e.g. sickness, weakness). Another example is Inagaki and Hatano (2004), who found that preschoolers believe that food and water have a vital power or life force that makes humans healthy and active, and helps them grow. The present research adds to this literature by demonstrating that children can generalize or extend information that they learn about one food, particularly the potential impact that it has on the human body, to another food that belongs to same evaluative category. Given the astounding prevalence of overweight and obese children in the United States (Centers for Disease Control and Prevention, 2006; American Heart Association, 2006), this is an important ability and may be related to children's own health and well-being as they make decisions about what foods to eat. Future research should examine the relationship between children's evaluative categories within the domain of food, children's eating preferences and practices, and health risk behaviours.

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Figure 1.
Study 2: percentage of evaluative category selection by age.

Table 1

Mean percentage (S.D.) of appropriate classification in Study 1

	Stimulus		4-year-olds	7-year-olds	Adults
	Healthy	Junky			
Taxonomic					
Fruit	Banana	Apple pie	75 (32)	91 (20)	100 (0)
Vegetables	Carrot	French fries	69 (31)	81 (25)	100 (0)
Meat	Chicken	Sausage	47 (22)	50 (26)	84 (24)
Dairy	Cheese	Ice cream	88 (22)	81 (25)	97 (13)
Beverages	Water	Soda pop	81 (25)	100 (0)	100 (0)
Grains	Bread	Donut	69 (31)	78 (26)	100 (0)
Script					
Breakfast	Milk	Pop tart	59 (27)	81 (25)	94 (17)
Lunch	Soup	Hot dog	59 (27)	59 (20)	94 (17)
Dinner	Salad	Hamburger	59 (27)	59 (20)	97 (13)
Snack	Raisin	Potato chips	66 (30)	84 (24)	100 (0)
Dessert	Strawberry	Cookies	91 (20)	84 (23)	100 (0)
Birthday	Juice	Cake	81 (25)	94 (17)	100 (0)

APPENDIX A

TRIADS FOR STUDY 2

Targets	Category choice	Non-category choice
<i>Healthy foods</i>		
1. Orange	Yogurt	Ice cream
2. Carrot	Fish	Chocolate
3. Milk	Apple	Potato chip
4. Egg	Pasta	Snack bar
5. Chicken	Grape	Brownie
6. Broccoli	Turkey	Cake
<i>Junky foods</i>		
1. Cheetos	Ice cream	Fish
2. Sundae	Snack bar	Turkey
3. Candy	Brownie	Grape
4. Gum	Cake	Apple
5. Cookie	Potato chip	Pasta
6. Cupcake	Chocolate	Yogurt