

Developmental Psychology

Understanding Infants' and Children's Social Learning About Foods: Previous Research and New Prospects

Kristin Shutts, Katherine D. Kinzler, and Jasmine M. DeJesus

Online First Publication, March 5, 2012. doi: 10.1037/a0027551

CITATION

Shutts, K., Kinzler, K. D., & DeJesus, J. M. (2012, March 5). Understanding Infants' and Children's Social Learning About Foods: Previous Research and New Prospects. *Developmental Psychology*. Advance online publication. doi: 10.1037/a0027551

Understanding Infants' and Children's Social Learning About Foods: Previous Research and New Prospects

Kristin Shutts
University of Wisconsin—Madison

Katherine D. Kinzler and Jasmine M. DeJesus
University of Chicago

Developmental psychologists have devoted significant attention to investigating how children learn from others' actions, emotions, and testimony. Yet most of this research has examined children's socially guided learning about artifacts. The present article focuses on a domain that has received limited attention from those interested in the development of social cognition: food. We begin by reviewing the available literature on infants' and children's development in the food domain and identify situations in which children evidence both successes and failures in their interactions with foods. We focus specifically on the role that other people play in guiding what children eat and argue that understanding patterns of successes and failures in the food domain requires an appreciation of eating as a social phenomenon. We next propose a series of questions for future research and suggest that examining food selection as a social phenomenon can shed light on mechanisms underlying children's learning from others and provide ideas for promoting healthy social relationships and eating behaviors early in development.

Keywords: food selection, eating, social learning, infants, children

Food selection is one of the most important tasks any animal faces. Making safe, palatable, and nutritious food choices is critical for survival, and animals—including humans—spend a significant portion of each day on diet selection and consumption. Food selection is especially challenging for humans and other generalist animals: Unlike specialist animals (e.g., koalas), generalists can eat a variety of substances (Rozin, 1976). The food domain therefore presents a significant learning problem. Given the diversity of options, how do infants and young children determine which substances are best to eat?

Despite the significance and complexity of food selection, developmental psychologists have devoted surprisingly little attention to studying how infants and young children perceive, learn about, and reason about foods (Birch, 1990; Rozin, 1980, 1990). The available literature indicates that children have several useful mechanisms that support their ability to evaluate foods from an early age. These capacities suggest that children may be able to learn by themselves what things are good to eat and what things are not. However, research also reveals that infants and young children show serious limitations in the food domain. For example, infants and toddlers willingly ingest dangerous—and sometimes deadly—substances (Cashdan, 1994; Rozin, Hammer, Oster, Horowitz, & Marmora, 1986).

Our goal in the present article is to explore this apparent paradox and to reconcile evidence that children have both early successes and early failures in the food domain. To do so, we emphasize the

significant role that social learning plays in guiding children's eating. Considering food selection as a social phenomenon makes theoretical contributions to our understanding of children's learning from others and provides suggestions for how to promote healthy eating practices early in life.

Successes and Failures in the Food Domain

Given the importance of effective food selection for survival, one might expect children to be adept at evaluating foods early in development. In accordance with this expectation, infants possess several adaptive mechanisms in the food domain. For example, neonates prefer sweet substances and reject those that are sour or bitter (see Birch, 1999, for a review). Additionally, like other animals (Garcia & Koelling, 1966; Garcia, McGowan, Ervin, & Koelling, 1968), children seem predisposed to acquire taste aversions to foods consumed around the time of nausea (Bernstein, 1978, 1994; Garb & Stunkard, 1974). Infants also exhibit preferences for familiar foods and flavors (see Aldridge, Dovey, & Halford, 2009, for review). For example, one study found that infants who were exposed to carrots in their mothers' diets either prenatally or while breast-feeding exhibited fewer negative facial emotions when first trying a carrot-flavored food themselves (compared with a control group: Mennella, Jagnow, & Beauchamp, 2001; see also Hausner, Nicklaus, Issanchou, Mølgaard, & Møller, 2010). Innate taste biases, learned taste aversions, and familiarity preferences likely evolved to encourage consumption of safe, calorie-rich foods early in development.

Although young children appear to possess several learning mechanisms that support successful food selection, there are also limitations to their performance in the food domain. Two limitations in particular stand out as warranting explanation. First, although infants and toddlers are sensitive to how foods taste on the tongue, they are remarkably unskilled at classifying foods and making a priori decisions about what to ingest. Adults, older

Kristin Shutts, Psychology Department, University of Wisconsin—Madison; Katherine D. Kinzler and Jasmine M. DeJesus, Psychology Department, University of Chicago.

Correspondence concerning this article should be addressed to Kristin Shutts, Psychology Department, University of Wisconsin—Madison, 1202 West Johnson Street, Madison, WI 53706. E-mail: kshutts@wisc.edu

children, and nonhuman primates classify foods primarily by their colors, textures, and odors, and classify artifacts primarily by their shapes and rigidity (Lavin & Hall, 2001; Macario, 1991; Santos, Hauser, & Spelke, 2001, 2002). Infants, on the other hand, do not weigh food-relevant properties (e.g., color) over less-relevant properties (e.g., container shape) when reasoning about foods (Shutts, Condry, Santos, & Spelke, 2009). This finding casts doubt on the idea that infants possess a domain-specific system for detecting and categorizing foods.

Second, children do not seem to achieve a mature food acceptance and rejection taxonomy until middle childhood (Fallon, Rozin, & Pliner, 1984; Rozin, Fallon, & Augustoni-Ziskind, 1985). During the preschool and early elementary school years, children begin to evaluate and reject foods (prior to tasting them) on the basis of sensory features (e.g., odor) and information about toxicity (e.g., when something described as “poison” falls into juice; Fallon et al., 1984). Infants and toddlers, however, are willing to put almost anything in their mouths, including items that are inedible, dangerous, and disgusting (e.g., Play-Doh, soap, feces; Rozin et al., 1986). Tellingly, children under 2 years of age are more likely than other age groups to accidentally poison themselves by ingesting toxic substances (Cashdan, 1994).

Considering the importance of food selection for survival, psychologists—especially those who are sympathetic to evolutionary perspectives on the origins of human knowledge—may find infants’ and children’s early difficulties in the food domain quite surprising. One way of resolving this paradox, however, is by noting that infants and toddlers have historically relied on caregivers to provide them with safe and nutritious diets. Because children’s early caloric intake consists primarily of milk, and because caregivers provide milk and other sources of sustenance to children, humans may not have evolved innate mechanisms dedicated to careful analysis and unguided self-selection of foods early in life.

Once children become more involved in their own food selection, they often exhibit more selectivity. Food neophobia (intolerance of new foods) emerges and peaks during early childhood (Addessi, Galloway, Visalberghi, & Birch, 2005; Cashdan, 1994; Cooke, Wardle, & Gibson, 2003). “Picky” eating—characterized by the rejection of some familiar foods—also increases dramatically from infancy to toddlerhood (Carruth, Ziegler, Gordon, & Barr, 2004). Selectivity in the food domain can be a useful strategy. For example, neophobic tendencies could protect children from consuming untested foods that might be dangerous (Cashdan, 1998; Cooke et al., 2003). However, intense selectivity can also negatively impact dietary variety and health. Children who score high on scales measuring pickiness and neophobia consume fewer vegetables than children who are neither picky nor neophobic (Galloway, Lee, & Birch, 2003). Additionally, neophobic and picky eaters consume fewer vitamins than non-neophobic and nonpicky children (Falciglia, Couch, Gribble, Pabst, & Frank, 2000; Galloway, Fiorito, Lee, & Birch, 2005).

Taken together, past research suggests that infants and children possess several effective strategies for evaluating foods. As described above, however, infants and very young children also show surprising limitations in the food domain: They know little about which properties are relevant for food and do not show significant selectivity until toddlerhood (when their newfound selectivity can sometimes have negative health consequences). Below, we argue

that understanding patterns of successes and failures in the food domain requires an appreciation of eating as a social phenomenon.

A Solution: Social Influences on Food Selection

Left to their own devices, infants and young children may show limitations when evaluating potential foods and choosing diets for themselves. However, humans at any age rarely face the challenge of food selection alone. People collaborate to acquire and prepare foods, and eating often occurs in social contexts. Adults report more food sharing with closer social partners (e.g., friends, family members, romantic partners) and infer closeness and intimacy from watching people share food with one another (Miller, Rozin, & Fiske, 1998). Infants and young children therefore have numerous opportunities to watch members of their culture choose, cook, eat, and react to different kinds of foods in social settings. The social context of eating also affords opportunities for direct instruction about food selection and other food-related behaviors.

The idea that social information and contexts influence behaviors in the food domain is not new. Researchers from many disciplines—ranging from psychology (Rozin, 2004), to anthropology (Fox, 1994), to sociology (Fischler, 1988; Germov & Williams, 2008), to philosophy (Kass, 1994)—have emphasized the social and cultural nature of human eating. Studies of nonhuman animals also provide evidence for social influences on food selection across a variety of species. Both rats and dogs display preferences for foods previously eaten by conspecifics, whether the foods vary in subtle, palatable ways (e.g., foods enhanced with cinnamon vs. cocoa or basil vs. thyme: Galef & Whiskin, 1995; Lupfer-Johnson & Ross, 2007) or in ways that animals typically find aversive (e.g., foods enhanced with cayenne pepper: Galef, 1989). Nonhuman primates engage in social referencing to guide food selection early in life: Infant chimpanzees glance toward their mothers when approaching novel foods but not when interacting with familiar foods (Ueno & Matsuzawa, 2005).

Experimental research provides evidence that social influences on food selection are apparent early in human ontogeny as well. For instance, young children are more likely to ingest an unfamiliar food if they watch an adult eat the food first (Addessi et al., 2005; Harper & Sanders, 1975). Additionally, both infants and children increase their consumption when foods are presented in positive, highly social contexts. Infants eat more formula when caregivers provide social interaction during feeding (Lumeng, Patil, & Blass, 2007), young children consume more pizza when they are in larger versus smaller peer groups (Lumeng & Hillman, 2007), and preschoolers eat more of an unfamiliar food after hearing positive endorsements by peers compared with negative messages or no social information (Greenhalgh, et al., 2009).

In addition to influencing children’s food acceptance and consumption, social contexts also affect children’s food preferences. Presenting a familiar food (e.g., goldfish crackers) paired with social attention from an adult increases how much children report liking that food (Birch, Zimmerman, & Hind, 1980). Moreover, social modeling can change how much children like foods they do not prefer initially. In a classic study, Birch (1980) seated target children at tables with peers who liked the target children’s non-preferred vegetable. Over the course of 4 days, target children became more positively disposed toward the vegetables their peers liked.

A handful of studies suggest that children do not just mindlessly copy others' behavior; rather, the social characteristics of models impact children's food acceptance, choices, and consumption. Toddlers are more likely to accept unfamiliar foods offered by their mother than those offered by strangers (Harper & Sanders, 1975), and children eat more in the presence of siblings than in the presence of strangers (Salvy, Vartanian, Coelho, Jarrin, & Pliner, 2008). Studies that have directly compared the influence of peers versus adults find that peers exert a more powerful influence on children's food preferences and choices (Duncker, 1938; Frazier, Gelman, Kaciroti, Russell, & Lumeng, 2012; Hendy & Raudenbush, 2000). Young children also preferentially select foods endorsed by people who match their own gender but not by those who match their own race (Frazier et al., 2012; see also Shutts, Banaji, & Spelke, 2010).

The research reviewed thus far provides evidence that young children use social information to guide their eating. However, potential social influences on infants' food selection and preferences have received less attention. Studies of infants are particularly critical in that they test whether social influences on food selection exist even at an age when infants show limitations in the food domain and engage in promiscuous eating. In a recent study, we tested whether infants are sensitive to social characteristics of those who endorse different foods (Shutts, Kinzler, McKee, & Spelke, 2009). Twelve-month-old infants were offered foods by a speaker of their native language (English) and by a speaker of a foreign language (French). In exposure trials, infants were willing to try both the "English" and the "French" foods (as would be predicted by past research on infants' willingness to put a wide array of substances into their mouths; Rozin et al., 1986). However, when subsequently given a choice between the two foods they had just sampled, infants preferentially reached for the food that had been modeled and endorsed by the native speaker of their native language. Though infants may lack knowledge about foods *per se*, they show selectivity in the food domain when foods are presented in a social context with social information.

Open Questions Concerning Social Learning About Foods

Despite the studies described above investigating social influences on young children's food selection, many areas of research remain relatively unexplored. Here we highlight three. One line of inquiry concerns the scope and strength of social influences on infants' and children's food selection and preferences. Beyond speakers' language (Shutts, Kinzler, et al., 2009), what other kinds of social factors might influence infants' food selection, and how do infants' early social experiences with foods impact their selection later in life? Previous research suggests that flavor experiences in infancy influence children's later food acceptance and preferences (e.g., Cashdan, 1994; Mennella & Beauchamp, 2002). Do social experiences in infancy have similar long-term effects on children's eating? Moreover, for both infants and children, which kinds of social experiences and information have the most profound effects on food selection and preferences? Our own hypothesis is that social information indicative of cultural differences—in particular, the accent and language with which people speak—will have a profound impact on food selection. Three factors motivate this hypothesis: (a) children attend to others' accent and language

from an early age (Kinzler, Dupoux, & Spelke, 2007); (b) cultures differ radically in their eating rituals and patterns of consumption (Rozin, 2007); and (c) accent and language provide reliable information about people's social identity (Labov, 2006). Nevertheless, the hypothesis that speakers' linguistic group membership is especially important in guiding children's food selection awaits further empirical attention.

A second question concerns whether there is anything special about how social information affects children's consideration of foods compared with other kinds of entities (e.g., artifacts). Previous research provides evidence that other people influence children's food selection, but of course other people's actions, emotions, social identity and testimony influence children's thinking about nonfood objects as well. Research that directly compares young children's social learning about foods and nonfoods is sparse. Some literature suggests significant overlap between factors guiding how children learn about and evaluate foods compared with nonfoods. For example, preschool-age children preferentially select items that are endorsed or modeled by people who match their own age and gender, regardless of whether the modeled items are foods or toys (e.g., Frazier et al., 2012; Martin, Eisenbud, & Rose, 1995; Ruble, Balaban, & Cooper, 1981; Shutts et al., 2010). Additionally, as is the case for other knowledge domains (Danovitch & Keil, 2004; Sobel & Corriveau, 2010), children are sensitive to likely expertise when seeking complex information about foods (e.g., nutritional value: VanderBorghet & Jaswal, 2009).

One study suggests that children weight social information differently for foods and nonfoods: Lumeng and colleagues presented preschool-aged children with scenarios in which adults provided positive testimony about foods and stickers during a learning phase (Lumeng, Cardinal, Jankowski, Kaciroti, & Gelman, 2008). In some cases, adults' testimony aligned with children's own evaluations; in other cases, it did not. During free choice test trials featuring unfamiliar foods and stickers, participants were more likely to select a novel food endorsed by a previously unreliable adult than they were to select a sticker endorsed by a previously unreliable adult. One interpretation of this effect is that children's food selection is more susceptible to social endorsement than is children's selection of artifacts.

To the best of our knowledge, no studies have directly compared infants' social learning about foods versus nonfoods. Nevertheless, the available literature on infants' social learning suggests potential similarities between factors guiding infants' behavior toward foods and artifacts. For example, as reviewed earlier, infants preferentially reach for foods modeled and endorsed by speakers of their native language (Shutts, Kinzler, et al., 2009). Yet infants also selectively take toys that have been offered by, or previously associated with, speakers of their native language (Kinzler, Dupoux, & Spelke, 2007, 2012). Additionally, though researchers have not tested how others' emotions impact infants' food selection, positive and negative emotional displays do guide infants' behavior toward novel artifacts (e.g., Hornik, Risenhoover, & Gunnar, 1987; Mumme & Fernald, 2003). It seems likely that similar emotional displays would affect infants' food selection. More research is necessary to understand how infants' and children's social learning about foods and nonfoods might differ. Studies in which the same methods are used to test learning about foods and nonfoods (e.g., Lumeng et al., 2008) would be especially illumi-

nating. One possibility is that infants' and children's social learning about foods and nonfoods does not differ systematically. Another possibility is that similar principles guide infants' and children's social learning about foods and nonfoods, but social learning is more robust or long-lasting for foods versus nonfoods. Yet a third possibility is that infants' and children's social learning about foods and nonfoods differs qualitatively according to several principles that have yet to be discovered.

A third line of inquiry for future research concerns the developmental origins of connections between emotions related to food—in particular, disgust—and social cognition. For adults, disgust reactions are not limited to foods and are intimately related to evaluations of people's social actions, personal characteristics, and social group membership (see Kelly, *in press*, for a review). For example, adults' reactions to a broad range of nonfood social disgust elicitors (e.g., wearing Hitler's sweater) are similar to facial expressions and muscular movements in response to disgusting (e.g., spoiled) food (Haidt, Rozin, McCauley, & Imada, 1997; Rozin, Lowery, & Ebert, 1994). The connection between food-related disgust and social disgust relates to intergroup contact and conflict as well: Adults are more likely to evaluate actions of outgroup rather than ingroup members as being disgusting (Cottrell & Neuberg, 2005; Harris & Fiske, 2006; Pizarro, Detweiler-Bedell, & Bloom, 2006). While the experience of disgust may have emerged to protect humans from toxic and potentially disease-causing foods, some researchers have proposed that disgust reactions have been co-opted more recently in human evolution to evaluate social behavior and subserve a system of moral reasoning (Haidt et al., 1997; Kelly, *in press*; Oaten, Stevenson, & Case, 2009; Rozin, Haidt, & Fincher, 2009).

Relatively little is known about when and under what circumstances the links between disgust and social cognition emerge in childhood. There is some evidence that, like adults, school-aged children map a variety of social behaviors to facial expressions of disgust, including events involving food (e.g., smelling rotten food) and moral violations (e.g., cheating on a test; Danovitch & Bloom, 2009). In general, though, disgust and contamination seem to be difficult concepts for young children. This difficulty may arise because the ability to evaluate disgusting items (both foods and nonfoods) relies on a set of fairly advanced cognitive processes, including the ability to imagine nonvisible entities such as germs (Fallon et al., 1984; Rozin et al., 1985). It is possible that social information may help young children achieve an understanding of contamination and disgust. However, more research is necessary to determine the extent to which social messages about disgust could be transmitted to infants or young children and whether even very young children might be able to use disgust reactions they observe from others to guide their own evaluations of foods, nonfood objects, and people.

Conclusions: Why Study Food?

Studying social influences on young children's food selection is important for both theoretical and practical reasons. From a theoretical perspective, understanding whether different principles guide how children learn about foods versus nonfoods from other people sheds light on the nature of mechanisms underlying children's social learning. Is children's social learning accomplished by a set of domain-general mechanisms that apply to all objects

and learning contexts? Alternatively, do separate mechanisms support social learning in different domains? Several properties of the food domain—including its inherent sociality, cultural variability, complexity, and ties to emotions and morality—make food an interesting contrast to domains typically studied by researchers interested in children's social learning. We encourage researchers to consider using foods as stimuli in their studies of infants' and children's social learning and social cognitive development more generally.

Studies of children's food selection may also be relevant to another topic of interest to developmental psychologists—namely, the development of social identity and intergroup processes. Ethnic groups often differ substantially in their patterns of food acceptance: Foods that are considered disgusting and prohibited by one group of people (e.g., shellfish and pork for some observant Jews) can be common dietary staples or delicacies for other groups of people. The cultural variability of food acceptance, together with the fact that food practices are enduring and hard to fake, led Cashdan (1998) to propose that food may be an honest signal to group identity. Just as it is difficult to learn a new language with a native accent later in life (e.g., Flege, Yeni-Komshian, & Liu, 1999), research suggests that some foods introduced in adulthood are rejected even after repeated exposure (e.g., tripe, halvah: Peryam, 1963; see Cashdan, 1994, for a review). Consequently, efforts to successfully adopt the food practices of another group might be an especially fruitful method for establishing connections with particular cultural groups (Guendelman, Cheryan, & Monin, 2011; Rozin & Siegal, 2003). Little attention has been devoted to how children come to understand and appreciate the connection of food to social identity, relationships, or group membership, beyond liking others who share their own food preferences (Fawcett & Markson, 2010; Hamlin & Wynn, 2009). When do these tendencies emerge in ontogeny? It could be the case that children use food as one of many possible strategies to affiliate with people they view as members of their own cultural group. Alternatively, children could view food as a privileged medium for cultural or social exchange.

Understanding the broad range of factors that guide young children's eating is also of practical benefit to the promotion of children's health and wellbeing. One in three children in the United States is overweight or obese (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010), and being overweight in early childhood is associated with increased body fat in older children and adults (Freedman et al., 2005; Nader et al., 2006). In addition to contributing to poor health, being overweight or obese is also socially stigmatized, which in turn leads to further negative health consequences (Puhl, Andreyeva, & Brownell, 2008). Accordingly, interventions aimed at improving children's food choices are growing in number and popularity.

Of particular relevance to the topic of the present article are studies suggesting that healthy eating interventions with a social component may be more effective than interventions focused on biological concepts and consequences. For example, interventions that promote healthy food consumption by increasing preschool-aged children's knowledge about the composition of different foods (e.g., vitamins, fat content) have achieved only mixed results: Such lessons can increase children's knowledge about nutrition, but improvements in actual patterns of consumption are limited (Blom-Hoffman, Kelleher, Power, & Leff, 2004; Murphy,

Youatt, Hoerr, Sawyer, & Andrews, 1995). In fact, promoting the healthfulness of foods can even backfire, resulting in even less acceptance of healthy foods (Wardle & Huon, 2000). Interventions that approach eating and food selection as social phenomena, however, have reported success at manipulating children's eating behaviors (Birch, 1980; Greenhalgh et al., 2009; Hendy & Raudenbush, 2000; Rozin, 1980, 1988).

Another issue of practical import is the role of marketing in guiding children's food preferences and consumption. When advertising foods to children, marketers commonly use social images such as pictures of popular celebrities or familiar cartoon characters (Chapman, Nicholas, Banovic, & Supramaniam, 2006; Ellison & Adamy, 2005; Federal Trade Commission, 2008; Institute of Medicine, Food and Nutrition Board, 2006). This practice may have arisen because social information and positive contexts are potent influences on children's food preferences and consumption (e.g., Birch, 1980). Indeed, a handful of studies suggest that children are more likely to prefer or select foods when packages show familiar cartoon characters (Jayne, 2009; Levin & Levin, 2010; Roberto, Baik, Harris, & Brownell, 2010). Although cartoon characters can affect children's willingness to try both healthy and unhealthy foods (Jayne, 2009; Levin & Levin, 2010; Roberto et al., 2010), the vast majority of food advertising to children features unhealthy, processed substances (Batada & Wootan, 2007; Cairns, Angus, & Hastings, 2009; Chapman et al., 2006; Moore & Rideout, 2007). Advertising strategies that integrate food products into games and other interactive media are becoming increasingly accessible to young children, yet we know little about the possible effects (either positive or negative) that these types of promotions may have for children's food preferences and health outcomes (Lee, Choi, Quilliam, & Cole, 2009; Moore & Rideout, 2007). It would be useful for developmental psychologists to conduct research on whether and how different kinds of advertising might affect children's preferences and behaviors in the food domain (see also Moses & Baldwin, 2005). Such research—together with more general investigations of the factors that guide children's eating—stands to make both theoretical and practical contributions to our understanding of development in the food domain across the life span.

References

- Addessi, E., Galloway, A. T., Visalberghi, E., & Birch, L. L. (2005). Specific social influences on the acceptance of novel foods in 2–5-year-old children. *Appetite*, *45*, 264–271. doi:10.1016/j.appet.2005.07.007
- Aldridge, V., Dovey, T. M., & Halford, J. C. G. (2009). The role of familiarity in dietary development. *Developmental Review*, *29*, 32–44. doi:10.1016/j.dr.2008.11.001
- Batada, A., & Wootan, M. G. (2007). Nickelodeon markets nutrition-poor foods to children. *American Journal of Preventive Medicine*, *33*, 48–50. doi:10.1016/j.amepre.2007.02.035
- Bernstein, I. L. (1978, June 16). Learned taste aversions in children receiving chemotherapy. *Science*, *200*, 1302–1303. doi:10.1126/science.663613
- Bernstein, I. L. (1994). Development of food aversions during illness. *Proceedings of the Nutrition Society*, *53*, 131–137. doi:10.1079/PNS19940016
- Birch, L. L. (1980). Effects of peer model's food choices and eating behaviors on preschoolers' food preferences. *Child Development*, *51*, 489–496.
- Birch, L. L. (1990). Development of food acceptance patterns. *Developmental Psychology*, *26*, 515–519. doi:10.1037/0012-1649.26.4.515
- Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition*, *19*, 41–62. doi:10.1146/annurev.nutr.19.1.41
- Birch, L. L., Zimmerman, S. I., & Hind, H. (1980). The influence of social-affective context on the formation of children's food preferences. *Child Development*, *51*, 856–861. doi:10.2307/1129474
- Blom-Hoffman, J., Kelleher, C., Power, T. J., & Leff, S. S. (2004). Promoting healthy food consumption among young children: Evaluation of a multi-component nutrition education program. *Journal of School Psychology*, *42*, 45–60. doi:10.1016/j.jsp.2003.08.004
- Cairns, G., Angus, K., & Hastings, G. (2009). *The extent, nature, and effects of food promotion to children: A review of the evidence to December 2008*. Geneva, Switzerland: World Health Organization.
- Carruth, B. R., Ziegler, P. J., Gordon, A., & Barr, S. I. (2004). Prevalence of picky eating among infants and toddlers and their caregivers' decisions about offering a new food. *Journal of the American Dietetic Association*, *57*–64. doi:10.1016/j.jada.2003.10.024
- Cashdan, E. (1994). A sensitive period for learning about food. *Human Nature*, *5*, 279–291. doi:10.1007/BF02692155
- Cashdan, E. (1998). Adaptiveness of food learning and food aversions in children. *Social Science Information*, *37*, 613–632. doi:10.1177/053901898037004003
- Chapman, K., Nicholas, P., Banovic, D., & Supramaniam, R. (2006). The extent and nature of food promotion directed to children in Australian supermarkets. *Health Promotion International*, *21*, 331–339. doi:10.1093/heapro/dal028
- Cooke, L., Wardle, J., & Gibson, E. L. (2003). Relationship between parental report of food neophobia and everyday food consumption in 2–6-year-old children. *Appetite*, *41*, 205–206. doi:10.1016/S0195-6663(03)00048-5
- Cottrell, C. A., & Neuberg, S. L. (2005). Different emotional reactions to different groups: A sociofunctional threat-based approach to "prejudice." *Journal of Personality and Social Psychology*, *88*, 770–789. doi:10.1037/0022-3514.88.5.770
- Danovitch, J., & Bloom, P. (2009). Children's extension of disgust to physical and moral events. *Emotion*, *9*, 107–112. doi:10.1037/a0014113
- Danovitch, J. H., & Keil, F. C. (2004). Should you ask a fisherman or a biologist? Developmental shifts in ways of clustering knowledge. *Child Development*, *75*, 918–931. doi:10.1111/j.1467-8624.2004.00714.x
- Duncker, K. (1938). Experimental modification of children's food preferences through social suggestion. *The Journal of Abnormal & Social Psychology*, *33*, 489–507. doi:10.1037/h0056660
- Ellison, S., & Adamy, J. (2005, December 7). Panel faults food packaging for kid obesity. *Wall Street Journal*, p. B1.
- Falciiglia, G. A., Couch, S. C., Gribble, L. S., Pabst, S. M., & Frank, R. (2000). Food neophobia in childhood affects dietary variety. *Journal of the American Dietetic Association*, *100*, 1474–1481. doi:10.1016/S0002-8223(00)00412-0
- Fallon, A. E., Rozin, P., & Pliner, P. (1984). The child's conception of food: The development of food rejections with special reference to disgust and contamination sensitivity. *Child Development*, *55*, 566–575. doi:10.2307/1129968
- Fawcett, C. A., & Markson, L. (2010). Similarity predicts liking in 3-year-old children. *Journal of Experimental Child Psychology*, *105*, 345–358. doi:10.1016/j.jecp.2009.12.002
- Federal Trade Commission. (2008). *Marketing food to children and adolescents: A review of industry expenditures, activities and self-regulation*. Washington, DC: Author.
- Fischler, C. (1988). Food, self, and identity. *Social Science Information*, *27*, 275–292. doi:10.1177/053901888027002005
- Flege, J. E., Yeni-Komshian, G. H., & Liu, L. (1999). Age constraints on second-language acquisition. *Journal of Memory and Language*, *41*, 78–104. doi:10.1006/jmla.1999.2638

- Fox, R. (1994). *The challenges of anthropology: Old encounters and new excursions*. New Brunswick, NJ: Transaction.
- Frazier, B. N., Gelman, S. A., Kaciroti, N., Russell, J. W., & Lumeng, J. C. (2012). I'll have what she's having: The impact of model characteristics on children's food choices. *Developmental Science, 15*, 87–98.
- Freedman, D. S., Khan, L. K., Serdula, M. K., Dietz, W. H., Srinivasan, S. R., & Berenson, G. S. (2005). The relation of childhood BMI to adult adiposity: The Bogalusa Heart Study. *Pediatrics, 115*, 22–27.
- Galef, B. G. (1989). Enduring social enhancement of rats' preferences for the palatable and the piquant. *Appetite, 13*, 81–92. doi:10.1016/0195-6663(89)90106-2
- Galef, B. G., & Whiskin, E. E. (1995). Learning socially to eat more of one food than of another. *Journal of Comparative Psychology, 109*, 99–101. doi:10.1037/0735-7036.109.1.99
- Galloway, A. T., Fiorito, L. M., Lee, Y., & Birch, L. L. (2005). Parental pressure, dietary patterns and weight status among girls who are "picky/fussy" eaters. *Journal of the American Dietetic Association, 105*, 541–548. doi:10.1016/j.jada.2005.01.029
- Galloway, A. T., Lee, Y., & Birch, L. L. (2003). Predictors and consequences of food neophobia and pickiness in young girls. *Journal of the American Dietetic Association, 103*, 692–698. doi:10.1053/jada.2003.50134
- Garb, J. L., & Stunkard, A. J. (1974). Taste aversions in man. *The American Journal of Psychiatry, 131*, 1204–1207.
- Garcia, J., & Koelling, R. A. (1966). Relation of cue to consequence in avoidance learning. *Psychonomic Science, 4*, 123–124.
- Garcia, J., McGowan, B. K., Ervin, F. R., & Koelling, R. A. (1968, May 16). Cues: Their relative effectiveness as a function of the reinforcer. *Science, 160*, 794–795. doi:10.1126/science.160.3829.794
- Germov, J., & Williams, L. (2008). *A sociology of food and nutrition: The social appetite*. Melbourne, Australia: Oxford University Press.
- Greenhalgh, J., Dowe, A. J., Horne, P. J., Lowe, C. F., Griffiths, J. H., & Whitaker, C. J. (2009). Positive- and negative peer modelling effects on young children's consumption of novel blue foods. *Appetite, 52*, 646–653. doi:10.1016/j.appet.2009.02.016
- Guendelman, M., Cheryan, S., & Monin, B. (2011). Fitting in but getting fat: Identity threat and dietary choices among U.S. immigrant groups. *Psychological Science, 22*, 959–967. doi:10.1177/0956797611411585
- Haidt, J., Rozin, P., McCauley, C., & Imada, S. (1997). Body, psyche, & culture: The relationship between disgust and morality. *Psychology and Developing Societies, 9*, 107–131. doi:10.1177/097133369700900105
- Hamlin, J. K., & Wynn, K. (2009, April). Sixteen-month-olds match the food preferences of prosocial others, not of antisocial others. Poster presented at the meeting of the Society for Research in Child Development, Denver, CO.
- Harper, L. V., & Sanders, K. M. (1975). The effect of adults' eating on young children's acceptance of unfamiliar foods. *Journal of Experimental Child Psychology, 20*, 206–214. doi:10.1016/0022-0965(75)90098-3
- Harris, L. T., & Fiske, S. T. (2006). Dehumanizing the lowest of the low: Neuroimaging responses to extreme out-groups. *Psychological Science, 17*, 847–853. doi:10.1111/j.1467-9280.2006.01793.x
- Hausner, H., Nicklaus, S., Issanchou, S., Mølgaard, C., & Møller, P. (2010). Breastfeeding facilitates acceptance of a novel dietary flavour compound. *Clinical Nutrition, 29*, 141–148. doi:10.1016/j.clnu.2009.11.007
- Hendy, H. M., & Raudenbush, B. (2000). Effectiveness of teacher modeling to encourage food acceptance in preschool children. *Appetite, 34*, 61–76. doi:10.1006/appe.1999.0286
- Hornik, R., Risenhoover, N., & Gunnar, M. (1987). The effects of maternal positive, neutral, and negative affective communications on infant responses to new toys. *Child Development, 58*, 937–944. doi:10.2307/1130534
- Institute of Medicine, Food and Nutrition Board. (2006). *Food marketing to children and youth: Threat or opportunity?* Washington, DC: National Academies Press.
- Jayne, C. L. (2009). *Elmo eats broccoli: A look at the influence of popular characters on children's food choices* (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (No. 3361177)
- Kass, L. R. (1994). *The hungry soul: Eating and perfecting our nature*. New York, NY: Simon and Schuster.
- Kelly, D. R. (in press). Moral disgust and the tribal instincts hypothesis. In R. Joyce, K. Sterelny, & B. Calcott (Eds.), *Signaling, commitment, and emotion*. Cambridge, MA: MIT Press.
- Kinzler, K. D., Dupoux, E., & Spelke, E. S. (2007). The native language of social cognition. *PNAS: Proceedings of the National Academy of Sciences of the United States of America, 104*, 12577–12580. doi:10.1073/pnas.0705345104
- Kinzler, K. D., Dupoux, E., & Spelke, E. S. (2012). 'Native' objects and collaborators: Infants' object choices and acts of giving reflect favor for native over foreign speakers. *Journal of Cognition and Development, 13*, 67–81.
- Labov, W. (2006). *The social stratification of English in New York City* (2nd ed.). New York, NY: Cambridge University Press. doi:10.1017/CBO9780511618208
- Lavin, T. A., & Hall, D. G. (2001). Domain effects in lexical development: Learning words for foods and toys. *Cognitive Development, 16*, 929–950. doi:10.1016/S0885-2014(02)00070-9
- Lee, M., Choi, Y., Quilliam, E. T., & Cole, R. T. (2009). Playing with food: Content analysis of food advergames. *The Journal of Consumer Affairs, 43*, 129–154. doi:10.1111/j.1745-6606.2008.01130.x
- Levin, A. M., & Levin, I. P. (2010). Packaging of healthy and unhealthy food products for children and parents: The relative influence of licensed characters and brand names. *Journal of Consumer Behaviour, 9*, 393–402. doi:10.1002/cb.326
- Lumeng, J. C., Cardinal, T. M., Jankowski, M., Kaciroti, N., & Gelman, S. A. (2008). Children's use of adult testimony to guide food selection. *Appetite, 51*, 302–310. doi:10.1016/j.appet.2008.03.010
- Lumeng, J. C., & Hillman, K. H. (2007). Eating in larger groups increases food consumption. *Archives of Disease in Childhood, 92*, 384–387. doi:10.1136/adc.2006.103259
- Lumeng, J. C., Patil, N., & Blass, E. M. (2007). Social influences on formula intake via suckling in 7 to 14-week-old infants. *Developmental Psychobiology, 49*, 351–361. doi:10.1002/dev.20221
- Lupfer-Johnson, G., & Ross, J. (2007). Dogs acquire food preferences from interacting with recently fed conspecifics. *Behavioural Processes, 74*, 104–106. doi:10.1016/j.beproc.2006.09.006
- Macario, J. F. (1991). Young children's use of color in classification: Foods and canonically colored objects. *Cognitive Development, 6*, 17–46. doi:10.1016/0885-2014(91)90004-W
- Martin, C. L., Eisenbud, L., & Rose, H. (1995). Children's gender-based reasoning about toys. *Child Development, 66*, 1453–1471. doi:10.2307/1131657
- Mennella, J. A., & Beauchamp, G. K. (2002). Flavor experiences during formula feeding are related to preferences during childhood. *Early Human Development, 68*, 71–82. doi:10.1016/S0378-3782(02)00008-7
- Mennella, J. A., Jagnow, C. P., & Beauchamp, G. K. (2001). Prenatal and postnatal flavor learning by human infants. *Pediatrics, 107*, e88. doi:10.1542/peds.107.6.e88
- Miller, L., Rozin, P., & Fiske, A. P. (1998). Food sharing and feeding another person suggest intimacy; two studies of American college students. *European Journal of Social Psychology, 28*, 423–436. doi:10.1002/(SICI)1099-0992(199805/06)28:3<423::AID-EJSP874>3.0.CO;2-V
- Moore, E. S., & Rideout, V. J. (2007). The online marketing of food to children: Is it just fun and games? *American Marketing Association, 26*, 202–220.
- Moses, L. J., & Baldwin, D. A. (2005). What can the study of cognitive

- development reveal about children's ability to appreciate and cope with advertising? *Journal of Public Policy & Marketing*, 24, 186–201. doi:10.1509/jppm.2005.24.2.186
- Mumme, D. L., & Fernald, A. (2003). The infant as onlooker: Learning from emotional reactions observed in a television scenario. *Child Development*, 74, 221–237. doi:10.1111/1467-8624.00532
- Murphy, A. S., Youatt, J. P., Hoerr, S. L., Sawyer, C. A., & Andrews, S. L. (1995). Kindergarten students' food preferences are not consistent with their knowledge of the dietary guidelines. *Journal of the American Dietetic Association*, 95, 219–223. doi:10.1016/S0002-8223(95)00051-8
- Nader, P. R., O'Brien, M., Houts, R., Bradley, R., Belsky, J., Crosnoe, R., . . . Susman, E. J. (2006). Identifying risk for obesity in early childhood. *Pediatrics*, 118, e594–e601. doi:10.1542/peds.2005-2801
- Oaten, M., Stevenson, R. J., & Case, T. (2009). Disgust as a disease-avoidance mechanism. *Psychological Bulletin*, 135, 303–321. doi:10.1037/a0014823
- Ogden, C. L., Carroll, M. D., Curtin, L. R., Lamb, M. M., & Flegal, K. M. (2010). Prevalence of high body mass index in U.S. children and adolescents, 2007–2008. *Journal of the American Medical Association*, 303, 242–249. doi:10.1001/jama.2009.2012
- Peryam, D. R. (1963). The acceptance of novel foods. *Food Technology*, 17, 33–39.
- Pizarro, D. A., Detweiler-Bedell, B., & Bloom, P. (2006). The creativity of everyday moral reasoning: Empathy, disgust, and moral persuasion. In J. C. Kaufman & J. Baer (Eds.), *Creativity and reason in cognitive development* (pp. 81–98). Cambridge, England: Cambridge University Press. doi:10.1017/CBO9780511606915.006
- Puhl, R. M., Andreyeva, T., & Brownell, K. D. (2008). Perceptions of weight discrimination: Prevalence and comparison to race and gender discrimination in America. *International Journal of Obesity*, 32, 992–1000. doi:10.1038/ijo.2008.22
- Roberto, C. A., Baik, J., Harris, J. L., & Brownell, K. D. (2010). Influence of licensed characters on children's taste and snack preferences. *Pediatrics*, 126, 88–93. doi:10.1542/peds.2009-3433
- Rozin, P. (1976). The selection of food by rats, humans, and other animals. In J. Rosenblatt, R. A. Hinde, C. Beer, & E. Shaw (Eds.), *Advances in the study of behavior*, (Vol. 6, pp. 21–76). New York, NY: Academic Press.
- Rozin, P. (1980). Acquisition of food preferences and attitudes to food. *International Journal of Obesity*, 4, 356–363.
- Rozin, P. (1988). Social learning about foods by humans. In T. Zentall & B. G. Galef, Jr. (Eds.), *Social learning: A comparative approach* (pp. 165–187). Hillsdale, NJ: Erlbaum.
- Rozin, P. (1990). Development in the food domain. *Developmental Psychology*, 26, 555–562. doi:10.1037/0012-1649.26.4.555
- Rozin, P. (2004). Sociocultural influences on human food selection. In E. D. Capaldi (Ed.), *Why we eat what we eat: The psychology of eating* (pp. 233–263). Washington, DC: American Psychological Association.
- Rozin, P. (2007). Food and eating. In S. Kitayama & D. Cohen (Eds.), *Handbook of cultural psychology* (pp. 391–416). New York, NY: Guilford Press.
- Rozin, P., Fallon, A., & Augustoni-Ziskind, M. (1985). The child's conception of food: The development of contamination sensitivity to "disgusting" substances. *Developmental Psychology*, 21, 1075–1079. doi:10.1037/0012-1649.21.6.1075
- Rozin, P., Haidt, J., & Fincher, K. (2009, February 27). From oral to moral. *Science*, 323, 1179–1180. doi:10.1126/science.1170492
- Rozin, P., Hammer, L., Oster, H., Horowitz, T., & Marmor, V. (1986). The child's conception of food: Differentiation of categories of rejected substances in the 1.4 to 5-year age range. *Appetite*, 7, 141–151. doi:10.1016/S0195-6663(86)80014-9
- Rozin, P., Lowery, L., & Ebert, R. (1994). Varieties of disgust faces and the structure of disgust. *Journal of Personality and Social Psychology*, 66, 870–881. doi:10.1037/0022-3514.66.5.870
- Rozin, P., & Siegal, M. (2003). Vegemite as a marker of national identity. *Gastronomica*, 3, 63–67. doi:10.1525/gfc.2003.3.4.63
- Ruble, D. N., Balaban, T., & Cooper, J. (1981). Gender constancy and the effects of sex-typed televised toy commercials. *Child Development*, 52, 667–673. doi:10.2307/1129188
- Salvy, S. J., Vartanian, L. R., Coelho, J. S., Jarrin, D., & Pliner, P. P. (2008). The role of familiarity of modeling of eating and food consumption in children. *Appetite*, 50, 514–518. doi:10.1016/j.appet.2007.10.009
- Santos, L. R., Hauser, M. D., & Spelke, E. S. (2001). Recognition and categorization of biologically significant objects by rhesus monkeys (*Macaca mulatta*): The domain of food. *Cognition*, 82, 127–155. doi:10.1016/S0010-0277(01)00149-4
- Santos, L. R., Hauser, M. D., & Spelke, E. S. (2002). Domain-specific knowledge in human children and non-human primates: Artifact and food kinds. In M. Bekoff, C. Allen, & G. Burghardt (Eds.), *The cognitive animal: Empirical and theoretical perspectives on animal cognition* (pp. 205–216). Cambridge, MA: MIT Press.
- Shutts, K., Banaji, M. R., & Spelke, E. S. (2010). Social categories guide young children's preferences for novel objects. *Developmental Science*, 13, 599–610. doi:10.1111/j.1467-7687.2009.00913.x
- Shutts, K., Condry, K. F., Santos, L. R., & Spelke, E. S. (2009). Core knowledge and its limits: The domain of food. *Cognition*, 112, 120–140. doi:10.1016/j.cognition.2009.03.005
- Shutts, K., Kinzler, K. D., McKee, C. B., & Spelke, E. S. (2009). Social information guides infants' selection of foods. *Journal of Cognition and Development*, 10, 1–17. doi:10.1080/15248370902966636
- Sobel, D. M., & Corriveau, K. H. (2010). Children monitor individuals' expertise for word learning. *Child Development*, 81, 669–679. doi:10.1111/j.1467-8624.2009.01422.x
- Ueno, A., & Matsuzawa, T. (2005). Response to novel food in infant chimpanzees: Do infants refer to mothers before ingesting food on their own? *Behavioural Processes*, 68, 85–90. doi:10.1016/j.beproc.2004.09.002
- VanderBorgh, M., & Jaswal, V. K. (2009). Who knows best? Preschoolers sometimes prefer child informants over adult informants. *Infant and Child Development*, 18, 61–71. doi:10.1002/icd.591
- Wardle, J., & Huon, G. (2000). An experimental investigation of the influence of health information on children's taste preferences. *Health Education Research*, 15, 39–44. doi:10.1093/her/15.1.39

Received June 1, 2011

Revision received January 4, 2012

Accepted January 19, 2012 ■