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LEARNING FROM OTHERS: CHILDREN'S CONSTRUCTION OF CONCEPTS

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Abstract

Much of children's knowledge is derived not from their direct experiences with the environment but rather from the input of others. However, until recently, the focus in studies of concept development was primarily on children's knowledge, with relatively little attention paid to the nature of the input. The last 10 years have seen an important shift in focus. This chapter reviews this approach, by examining the nature of the input, and the nature of the learner, to shed light on early conceptual learning. These findings argue against the simple notion that conceptual development is either supplied by the environment or innately specified, and instead demonstrate how the two work together. The implications for how children reconcile competing belief systems are also discussed.

Introduction

In a classic passage, Jean Piaget described a young child playing with pebbles and in so doing, discovering principles of mathematics:

“[H]e lined them up in a row, counted them from left to right, and got ten. Then, just for fun, he counted them from right to left to see what number he would get, and was astonished that he got ten again. He put the pebbles in a circle and counted them, and once again there were ten. He went around the circle in the other way and got ten again. And no matter how he put the pebbles down, when he counted them, the number came to ten. He discovered here what is known in mathematics as commutativity, that is, the sum is independent of the order.”(Piaget 1970)

By reorganizing, counting, and exploring— all self-directed, all derived from his own actions-- the child apparently discerned basic mathematical laws. This humble yet remarkable example illustrates the power of self-directed discovery and learning. Just as Plato's *Meno* argued for an intuitive grasp of the principles of geometry in the absence of any mathematical instruction, so too Piaget's compelling example illustrates the intuitive logic and structure of the child's untutored mind, attempting to organize experience into a coherent system.

Many years of research following on Piaget's original insights confirm the active, self-directed nature of childhood cognition (Bruner 1973; Gopnik & Meltzoff 1997; Wellman & Gelman 1998). Moreover, having an opportunity to explore the world actively seems to have direct benefits on interactions and learning. For example, Needham et al. (2002) find that 3-month-old infants that receive special experience picking up toys with “sticky mittens” (mittens with Velcro, enabling them to pick up objects at any earlier age than they can do otherwise) show more sophisticated engagement with and exploration of objects than infants without the extra

experience. Similarly, 3-month-olds with first-hand experience with reaching learn more rapidly than infants who only observe reaching (without actively engaging in this behavior; Sommerville et al. 2005). It appears, then, that children's own actions lead to new insights (Kushnir et al. 2008). The self-directed, active nature of early learning is appropriately appreciated, emphasized, and made the focus of study.

Much research on cognitive development focuses *exclusively* on children's knowledge, without asking where such knowledge comes from (Maratsos 2007). This focus reflects an implicit model of the child as a lone scientist, forming and testing hypotheses on her own. It also reflects a 3-fold assumption that: (1) development concerns structural change, (2) input from others concerns content, and (3) structure is more interesting (i.e., consequential, non-contingent) than content. Certainly, much of the content that children learn from others is relatively contingent or inconsequential (e.g., one's phone number; the color of barns).

Yet even the most self-directed learning has a hidden level of cultural input, often invisible because it is so pervasive, and thus taken for granted. In the example of pebble-counting above, this input includes a previously learned, culturally sanctioned symbolic system that permits counting (1, 2, 3...), as well as a conventional language system that may have encouraged treating the objects as interchangeable (as all are classified as "pebbles"). Moreover, recent studies of the domain-specificity of children's theories (e.g., theory of mind; theory of physics) make apparent that content knowledge is integral to structure and development (Wellman & Gelman 1998; Carey 1985, in press).

Clearly, then, children learn a tremendous amount about the world from the people around them. Moreover, this simple observation sheds light on concept development more broadly when we consider the following questions: What is the nature of that input, and what is the nature of the human mind that allows it to take advantage of that input? How do biases in the child and cues in the environment work together to enable learning?

In this chapter I focus on how children's concept learning entails learning from others. By "concepts" I mean mental representations that organize experience. Even infants make use of concepts—when smiling at a human face, pointing to the family pet and saying "Kitty!", or reaching eagerly for a spoonful of applesauce. Although some theorists equate concepts and categories, and consider concepts to be the mental representations that correspond to categories of things in the world, such as dogs or chairs (Margolis 1994), I would broaden the set to include properties (green, happy), events or states (jumping, wet), individuals (Daddy, Lassie), and abstract ideas (goodness, liberty) (see also Medin et al. 2000 regarding the diversity of human concepts). Although concepts are generally understood to be the building blocks of ideas (e.g., the thought "Lassie is a happy dog" requires possession of the constituent concepts), concepts are also embedded in larger knowledge structures (Gelman 1996). Concepts therefore cannot be understood wholly as isolated components.

Importantly, the view that children learn from those around them does not mean that children simply, passively take in what they are exposed to (Harris & Koenig 2006; Callanan 2006). Any account that presumes children's concepts are simply the byproduct of what they are exposed to—without active processing or constraints—is problematic in failing to explain how concepts are so similar over individuals and contexts. It also fails to explain how adults (those providing the input) come to have the knowledge they do. One could propose that adults learned their concepts from the input of their own parents, who learned them from their input of their parents, etc., but this simply pushes back the problem to an infinite regress.

Treating children as passively taking in input also would not predict the well-demonstrated phenomenon that children resist counterevidence. A classic example comes from Piagetian training studies, in which children persist in supplying incorrect answers to seemingly simple

questions, even following instruction (Ginsberg & Oppen 1969). In the realm of stereotyping, children and adults distort recall to conform to prior assumptions and expectations (Liben & Signorella 1987). Similar memory and processing biases are found in children's folk theories of physics, biology, and psychology (Schulz et al. 2007). Clearly, then, young children actively process the information around them, and are not passive conduits into which information pours.

Thus, I take as a starting assumption that both child biases and environmental input are critical, and that it is important not to characterize concept acquisition processes as exclusively *either* learned *or* innate (Callanan 2006). Marler (1991) provides clear evidence from the development of bird-song that innate skeletal frameworks do not preclude learning from experience (see also R. Gelman & Williams 1998). Parental input and child biases are argued to work together toward a common goal (Markman 1992), with children's interpretive biases and parents' input acting in consistent and mutually reinforcing ways.

The chapter is organized as follows. I begin by sketching out the scope of the problem, arguing that a wide array of concepts require social input, beyond the information children can acquire directly from their senses. I then review several ways that language serves a particularly important role in conveying conceptual information to children: through testimony, through naming, and through covert categories. Childhood essentialism is reviewed as a belief system that is informed by explicit and implicit language input. This brings us to the critical issue of children's credulity and skepticism, where the research evidence indicates a mixture of sensitivity and selectivity to the social information that surrounds them. From here I address the question of how children come to distinguish between reliable vs. unreliable information, how and when children distinguish fiction and pretense from fact, and the extent to which different, seemingly competing explanatory systems co-exist in early childhood. Finally, I consider a number of open questions, before summarizing and concluding.

The Scope of the Problem

According to empiricism, knowledge derives from our senses. Concepts are therefore either direct representations of perceptual/sensory experience, or combinations of such experiences. This is an old idea, but one with a lot of tread still on it. Many find an empiricist approach to learning attractive because it offers the possibility that one can understand mental processes by building up from simple building blocks. Current-day examples of this would include the argument that high-level cognition results from low-level associations among sensory cues, built up gradually and over many lived examples: "... [D]umb forces on selective attention—that is, associative connections and direct stimulus pulls—underlie the seeming smartness of children's novel word interpretations." (Smith et al. 1996, pp. 145–146)

Empiricist approaches have had a resurgence in recent years, in part due to the demonstration that infants can track low-level statistical cues with much greater accuracy than had been previously realized (e.g., Saffran et al. 1996; Xu & Tenenbaum 2007; Gopnik et al. 2004), and in part due to new empiricist models that provide a more detailed and realistic appreciation of children's concepts (Yoshida & Smith, 2003; Sloutsky & Fisher, 2004).

Yet knowledge is not just derived from sensory input. Harris & Koenig (2006) note that testimony not only augments knowledge acquired through first-hand experience, but also that testimony may be the only plausible source of information for concepts that are not readily accessible by direct observation, such as how the brain works (Gottfried et al. 1999), the shape of the earth (Vosniadou 1994), and the life-cycle of animals (Gimenez & Harris 2002)—all concepts that children develop rich, extended beliefs about during the preschool and early elementary school years.

Generally, concepts for which cultural input is vital include at least *scientific concepts* (germs, hearts, oxygen; Harris et al. 2006), *classification of the natural world* (whales, eels, and other organisms that don't look at all like typical species members; Gelman, 2003), *social concepts* (race, caste, ethnicity, personality traits, for which one often cannot determine membership based wholly on appearances; Dunham et al. 2006; Hirschfeld, 1996), and *supernatural concepts* (God, witchcraft; Boyer 2003). In reflecting on this list, one is likely to agree that "[p]robably most of what we believe or know past the level of rather basic cognition is a result of social transmissions from our superiors in status and knowledge" (Maratsos 2007; p. 122).

Moreover, three recent approaches in the field of psychology emphasize that learning is not a solitary act, but one that is embedded in social and cultural understandings: theory of mind, cultural psychology, and comparative research. Studies of *theory of mind* tell us that certain kinds of fundamental learning require attending to others as a crucial source of information (Baldwin 2000). The typically developing child interprets, assesses, and evaluates the surrounding social input (Wellman 1990); disruptions to these capacities can be devastating (Baron-Cohen et al. 1993). In a long tradition influenced by Vygotsky (1978), *cultural psychologists* from a broad range of areas within psychology have come to the conclusion that cultural contexts play a significant role in the nature of concepts (Medin & Atran 2004; Rogoff 2003; Nisbett et al. 2001). Finally, *comparative studies* with humans and non-human species suggest that certain forms of social learning—imitative learning, instructed learning, and collaborative learning—may be unique to humans (or if not unique, then at least particularly well-developed) (Tomasello et al. 1993; but see Whiten et al. 2005). The work I review regarding children draws on findings and concepts from all these fields.

Language as a Means of Modifying Children's (and Adults') Concepts

Children make use of several distinct kinds of informational sources when constructing concepts, in addition to their own observations and actions. These include: perceptual cues (which things look most alike; Quinn & Eimas 1997; Rakison & Oakes 2003), others' actions on the world (how others group objects in the environment, or how they use objects functionally; Brand et al. 2002; Bigler et al. 2001; Meltzoff 2007), explicit assertions (Harris & Koenig 2006), and implicit cues from language (Gelman et al. 1998). Importantly, adult input need not be didactic or explicitly instructional—and indeed typically is not (Harris & Koenig 2006; Callanan 2006).

We focus here on cues transmitted via language -- both explicit assertions and implicit cues—as language is early acquired, and one of the most powerful means of expressing and imparting cultural beliefs, knowledge, and values in humans. Certainly I do not wish to claim that concepts require a conventional language system; note the impressive conceptual abilities of preverbal infants, non-human primates, and deaf children with no language input (Cohen & Cashon 2006; Goldin-Meadow 2003; Hauser 2000). I also wish to side-step the so-called "Whorfian" question regarding whether language shapes the pattern and structure of thought (e.g., Gleitman & Papafragou 2005). Instead, my focus is on what kinds of information are conveyed to children by means of language. I divide this section into the following: testimony, lexicalization, and covert and implicit categories.

Testimony

Language enables one to express assertions that provide new information, either explicit (e.g., "The earth is round") or implicit (e.g., objects can be divided into animate ("he", "she") and inanimate ("it")) (Harris & Koenig 2006). The assertions of others can thus provide important conceptual information. This notion was articulated by Vygotsky (1934/1962), who distinguished between spontaneous and scientific concepts, and observed that scientific

concepts require information beyond first-hand experience. Harris et al. (2006, p. 94) more generally noted the pervasive influence of testimony on all aspects of everyday thought and beliefs: "... we are obliged to swim in a veritable ocean of testimony. ... We are dependent on testimony for information about the historical past, our current whereabouts and potential threats to our well-being in the future."

Sperber (1996) provided a hypothetical example of a girl learning about plant reproduction who hears from a reliable authority (such as a teacher) that there are both male and female plants. The relation of gender to plants may at first make little sense to the child. Yet she can understand certain implications of this statement (that plants come in different types, and that reproduction is somehow relevant). Furthermore, the initial, fragile connections encourage the child to further theory development and ultimately more elaborated concepts. The testimony thus provides a placeholder for more learning to come.

Empirical studies bear out the reality of this proposal. Ganea et al. (2007) note that one important function of testimony via language is to enable one to update knowledge and beliefs in the absence of any direct contact with an object. For example, if someone tells me that my favorite coffee cup fell to the floor and broke, I can readily alter my representation of the cup. Although this may seem like a simple and straightforward step, it takes time to develop. Ganea et al. provided young children with a name for a toy, then later told each child that the toy became wet (when it was out of view). Could the child then identify the toy, when given its name? Although 22-month-olds succeeded on the task, 19-month-olds did not—even though they did fine when the same information was given to describe a *present* object. It is this capacity to revise a mental representation of an *absent* object that develops over this period. Interestingly, young children have even more difficulty using other symbolic media (e.g., pictures, 3-dimensional replicas) on the same sort of task (Harris et al. 1997), suggesting that verbal testimony (i.e., language) is particularly informative for young children.

Harris and Koenig point out, as evidence of this trust, children's acceptance of unobservable facts (e.g., round shape of earth) and incorporation of such facts into a coherent new understanding (Gottfried & Jow 2003; Vosniadou 1994), children's acceptance of religious and supernatural claims that in fact have no observable basis whatsoever (Bering 2006), and children's persistent questioning of adults when encountering anomalous events in need of explanation (e.g., Frazier et al. 2008).

Paradoxically, the pervasive, ubiquitous nature of testimony can at times make it difficult to assess its effects. If all children are bathed in testimonial language about mental states, for example, then how is one to determine whether this language influences development? On rare occasion, however, access to ordinary kinds of testimony is blocked, permitting a glimpse into its effects. Studies with deaf children suggest that experience with rich home conversations, including discussion of needs, desires, beliefs, and other mental states, may have a profound influence on children's theory of mind development (Peterson & Siegal 2000). Children who are born deaf into a hearing family and have no opportunity to converse with a fluent speaker perform consistently worse on theory-of-mind tasks than children who are born deaf but have a parent or other family member who signs fluently. It would be valuable to conduct more detailed analyses of the input, to determine the extent to which explicit testimony plays a role.

Although testimony can be direct and highly revealing, often it is incomplete and fragmentary (Gelman et al. 1998; Jipson & Callanan 2003; Keil 1998, 2003). It is unlikely to be a full road-map for children as they construct complex understandings. It need not be didactic, and the messages need not be literally stated. Instead, testimony can be quite subtle in its implications. For example, in a study of how parents talk to children during a visit to a science museum, parents provided more explanations of science concepts to boys than to girls, even controlling

for amount of overall talk (Crowley et al. 2001). This differential focus on explanatory talk could subtly suggest that an in-depth and probing curiosity about science is more appropriate in boys than girls. Another example of subtle implications is suggested by Harris's (2007) idea, that the manner in which testimony is provided may suggest an "implicit epistemology" (p. 118) to children. For example, a child who tends to hear confident, full responses to her questions may come to believe that knowledge is more certain and complete, as compared to a child who hears tentative, incomplete responses.

Lexicalization

There is a rich empirical literature showing that children's initial, non-linguistic concepts are affected by the labels they hear (e.g., "a bird", "a wug"). Labels can be considered a form of testimony, but I consider them separately, because there is a large literature on lexicalization effects, and they raise a distinct set of issues.

First, what do I mean by "lexicalization"? Lexicalized concepts are those that correspond to a word in a person's language (e.g., "cup"), as contrasted to those concepts that do not (e.g., "objects that are smaller than a breadbox"). Lexicalized concepts generally have cultural significance: they are shared within a community, are relatively stable, and are passed down from one generation to the next. Non-lexicalized concepts may also have these features; for example, there typically is no single word for "living thing" in the world's languages, despite the significance of the concept (Waxman 2005). However, lexicalized concepts have special significance, particularly for children.

From their earliest use, words—especially count nouns—seem to serve as "placeholders" for children (Waxman 2004). Studies conducted with children ranging from 13 months through the preschool years demonstrate that children treat objects that receive the same noun label as if they have common, non-obvious properties (Gelman & Coley 1990; Gelman & Markman 1986; Jaswal & Markman 2007; Graham et al. 2004). They do so in two respects: first, labels enable dissimilar objects to be treated alike, as having properties in common (e.g., upon learning that a blackbird feeds its young mashed-up feed, children are more likely to extend that property to another bird [e.g., a flamingo] than to a superficially more similar non-bird [e.g., bat]), and second, labels promote inferences regarding non-obvious features, such as internal parts, functions, and other non-visible behaviors (see Gelman 2003 for review). Waxman & Markow (1995) propose that count nouns are "invitations" to children to form categories and look for deeper correlates: common labels lead even infants to search for commonalities; distinct labels lead children to search for differences (see also Waxman & Lidz 2006). Even 9-month-olds (who are not yet producing speech) are more likely to attend to relevant within-category similarities when they hear two different items labeled with the same word (Balaban & Waxman 1997). Relatedly, Xu (2002) found that 9-month-old infants were more likely to treat to objects as the same kind of thing when they received identical labels, and to treat them as two different kinds of things when they received two different labels (see Plunkett et al. 2006, for related findings). Thus, for young children, lexicalization implies that the items named have common properties that extend well beyond those that were previously known.

Lexicalization exerts especially powerful effects with atypical or anomalous category instances (e.g., learning that a penguin is a bird), for which perceptual features might be misleading. By 12 months of age (i.e., when they are first starting to talk), infants make use of category labels to redirect their attention (Graham et al. 2004). By 20 months of age, infants can use naming as a cue to categorize objects (Nazzi & Gopnik 2001). By 24 months of age, children can use label information to reclassify an atypical instance (e.g., learning that an object that looks like a cat is actually a dog, and making appropriate novel inferences, accordingly; Jaswal & Markman 2007).

Lexicalization also implies a more stable, enduring, unchanging construal, as compared to other form of expression (Markman & Smith, cited in Markman, 1989). For example, children 2–6 years of age are more likely to invent a single lexical item (e.g., “pencil-tree”) to express an intrinsic object-property relation (e.g., a tree with pencils growing on the branches) than a momentary object-property relation (e.g., a tree with pencils next to it; Gelman et al. 1989). By 5 years of age, when children hear a person referred to with a novel lexical item (e.g., “carrot-eater”), they judge that this property being expressed is especially stable (e.g., the person eats eat carrots more persistently than someone who “eats carrots whenever she can”; Gelman & Heyman, 1999). Similar naming effects have been found with adults (Yamauchi 2005; Reynaert & Gelman 2007), and even when making judgments about one’s own traits or characteristics (Walton & Banaji 2004).

In the realm of social categories, lexicalization has broad implications, in part due to the relevance of such labels to identity and to in- versus out-groups. Labels have powerful effects for children’s social categories, both familiar and novel (Diesendruck & haLevi 2006; Baron et al. 2007; Patterson & Bigler 2006). Negative labels (e.g., “learning-disabled”) can result in children being stigmatized by peers, and to behave in a way that maintains negative peer interactions (Milich et al. 1992). Labeling does not exert a simple, automatic associative effect, but instead interacts with the child’s prior causal beliefs. A negative label can have not only negative implications, but positive ones as well (e.g., someone labeled as “hyperactive” is viewed as less likely to change, but also as correspondingly less likely to be blamed for their behavior; Heyman & Legare, 2007). Conversely, a positive label can have negative effects (e.g., someone labeled as “gifted” may have decreased motivation to persist in the face of failure; see Mueller & Dweck 1998). Similarly, Heyman & Legare (2007) found that when characters were described with labels such as “math whiz,” children tended to view the character’s ability as more innately determined, and less likely to change with a change in effort. Furthermore, Cimpian et al. (2007) found that 4-year-old children who were praised with a label (e.g., “You are a good drawer”) versus a descriptive phrase (e.g., “You did a good job drawing”) showed lower self-evaluations, more sad feelings, and less persistence after making an unsuccessful drawing. Cimpian et al. report (p. 315): “When asked what he would do after the teacher’s criticism, one child said, ‘Cry. I would do it for both of them [both drawings with mistakes].’”

Lexicalization effects are not limited to nouns, and extend to other parts of speech. One well-studied example concerns a comparison of English and Korean spatial terms. Whereas English expresses a distinction between containment and support (with the prepositions “in” vs. “on”), Korean expresses a distinction between loose- and tight-fitting containment (with the verbs “nehta” vs. “kkita”). Children’s earliest language use reflects these distinctions, with English- and Korean-speaking children using spatial terms in cross-cutting ways (Bowerman & Choi 2003). A key question is whether these different language patterns have conceptual consequences. It is possible, for example, that speakers in both languages may have access to both ways of conceptualizing spatial relations, but choose to use only the conventional ones when talking, because language is a conventional system (a weaker claim, according to which language influences “thinking for speaking”; Slobin 1996). Contrary to this view, however, English-speaking adults have difficulty solving a task that requires grouping spatial relations in the Korean way (i.e., loose- vs. tight-fitting; McDonough et al. 2003). Interestingly, 5-month-old infants exposed to English successfully categorized both contrasts (Hespos & Spelke 2004). Thus, it appears that children are initially more open to a wider range of conceptual possibilities, which become narrowed as a function of language experience (see Werker & Desjardins 1995, for an analogous finding in speech perception). This finding also suggests that the lexicalization effect is not one of words creating concepts where none had belonged, but rather involves words serving as tools to emphasize particular ways of thinking that were already available (Gelman 2003).

Covert and implicit categories

Whorf (1956) introduced the notion of “covert categories” in language --categories that are not explicitly marked but rather inferred on the basis of the contexts of language use. For example, the female proper names in a language (e.g., Sally, Elizabeth, Rachel) form a covert category, because each individually is co-referential with the pronoun “she”, even though there is nothing overtly marking them all as alike. (This is in contrast to the explicit marking of gender in French, for example.) Similarly, verbs that cannot take “un-” in English form a covert category (e.g., break, separate, spill), because they are treated as alike and have certain semantic features that bind them together.

In this section I include not only “covert categories” in Whorf’s sense, but also what I call “implicit” categories-- those cases in which a meaningful category is *implied* by speakers’ language use (including overt morphological markers), but does not receive a common label. For example, I consider gender in French to be an implicit category, because items that receive the same gendered pronoun (e.g., table, soup, bank) are not explicitly labeled as instances of a common category (e.g., they are not overtly considered “female”). Instead, a link among these kinds is implied by means of their participation in a common linguistic frame (“la + X”; “une + X”). My interest in whether and how the use of such devices communicates meaningful information to children.

A number of researchers have demonstrated attention to covert or implicit categories among adult speakers of a language (Hill & Mannheim 1992; Lucy, 1997). For example, Boroditsky et al. (2003) found that speakers of a language with grammatical gender (e.g., German, Spanish) implicitly group together same-gendered instances, as assessed by memory tasks, object descriptions, and picture similarity ratings; see also Martinez & Shatz (1996). One thorny question with this work concerns the broader issue of the nature of linguistic influence in these studies. Does language influence thought or instead just direct speakers’ attention? For example, can language create concepts that weren’t there to begin with? Or does language serve to draw attention and highlight available concepts? An illustration of the issue involves the finding that adult speakers of Chinese and English seem to conceptualize time concepts differently from one another, in ways that correspond to differences in how English and Chinese speakers talk about time (either horizontally or vertically, respectively; Boroditsky 2001). However, these differences can be readily reversed with a simple priming task, thus suggesting that the language effects are not deeply entrenched.

Of interest in the current context is whether covert or implicit categories guide children’s reasoning. Lucy & Gaskins (2003) have studied how speakers of different languages notice different aspects of experience, and categorize the world differently. Specifically, speakers of Yucatec Mayan use a classifier system in which different-shaped things can receive the same name but with a different classifier attached. In Yucatec, the word for banana, banana leaf, and banana tree are all the same root word, varying only according to which classifier is used. This pattern contrasts with the English system of naming, for which shape is a fairly good predictor of how a count noun is used (e.g., bananas are all crescent-shaped; trees are all roughly a certain shape; and so on). Interestingly, when asked to group objects on the basis of either shape or substance in a non-linguistic sorting task (i.e., none of the items are labeled), English speakers are more likely to sort on the basis of shape whereas Yucatec Mayan speakers are more likely to sort on the basis of substance. Surprisingly, however, this differentiation does not appear until somewhere between 7 and 9 years of age, suggesting that metalinguistic awareness of the language patterns may be required for the effect.

Covert and implicit categorizations in language often are language-specific, with some languages including distinctions that are unavailable (or not readily available) in other languages (Danziger 2005; Slobin 2006). One such example is the distinction between the

verbs *ser* and *estar* (“to be”) in Spanish, which roughly corresponds to a distinction between inherent and accidental properties (Sera 1992). Heyman & Diesendruck (2002) studied how use of *ser* and *estar* influence judgments of human traits and characteristics (such as “shy”), using a task that assessed children’s interpretations of story characters. For bilingual children ranging in age from 6 to 10 years, describing a person’s psychological characteristics with “*ser*” led children to treat the traits as relatively more stable than when the same characteristics were described with “*estar*.” For example, after hearing that Maria is shy (Maria *es/esta* penosa), the “*estar*” form led children to rate the characteristic as less stable, as compared to both the “*ser*” form (in Spanish) and the “to be” form (in English). One important question is whether children first honor the conceptual distinction between inherent and accidental properties before learning its formal linguistic expression, or whether the language distinction precedes and encourages the conceptual distinction. Future studies examining the *ser/estar* distinction in younger children may help address this question.

Another example of language-specific covert categories is found in English, which honors a distinction between count nouns (roughly corresponding to object shape; e.g., “a ball”; “a duck”) and mass nouns (roughly corresponding to object substance; e.g., “water”; “rice”). English consistently distinguishes these two kinds grammatically, throughout the lexicon, whereas Japanese treats all inanimate nouns as alike. Consistent with these structural differences between English and Japanese, young Japanese-speaking children (2 to 4 years of age) draw the boundary between objects and substances differently than English-speaking children (Imai & Gentner 1997; Yoshida & Smith 2003). Whereas both English and Japanese speaking children agree that a complex object (such as a clock) is an individual and a continuous boundless mass (such as milk) is a substance, they differ in their assessment of simple objects. A molded piece of plastic, for example, would be an object for the English speaker but a substance for the Japanese speaker. These findings do not suggest radically different ontologies for speakers of English and Japanese, but rather subtle effects at the margins.

Childhood Essentialism as a Case Study

I turn now to a specific conceptual understanding that develops in childhood, psychological essentialism, to work through in more extended detail how a combination of explicit testimony, implicit cues in language, and child expectations and capacities work together to guide conceptual learning.

I focus on essentialism for two reasons. First, it is a pervasive bias and thus of central interest to understanding concepts (Gelman 2003). Second, competing theoretical accounts regarding the origins of essentialism vary widely. One suggestion is that essentialism is an innate, domain-specific modular capacity (e.g., Atran 1998); another is that particular explicit cultural inputs, especially detailed knowledge of modern science, is required (e.g., Fodor 1998). Still others have suggested that essentialism derives from assumptions about naming. For example, hearing the word “fish” for a range of distinct animals (clown fish, eels, sharks, minnows) may imply that these varied instances share something other than their outward appearances (Mayr 1991; Hallett 1991), thereby motivating children to look for underlying shared similarities. Given the nature of these debates, investigation of the input is central.

What is psychological essentialism?

Before turning to the issue of input, I first briefly review what is meant by “psychological essentialism.” Essentialism is a doctrine that has been discussed by scholars for thousands of years, in fields as diverse as biology, philosophy, linguistics, literary criticism, and psychology (James 1890/1983; Locke 1671/1959; see Gelman 2003). It is important to note that there are serious problems with essentialism as a metaphysical doctrine, and that the characterization

below applies to implicit beliefs about the world, rather than the world itself. It is thus most aptly considered a reasoning heuristic.

Psychological essentialism is the idea that members of certain categories have an underlying, unchanging property or attribute (essence) that determines identity and observable features. Despite outward changes in appearances over the lifetime of an individual (e.g., from infant to adult) and despite outward variation in appearance across members of a category (e.g., from typical to atypical instances), people believe that category members share an immutable feature or substance (essence) that causes category members to be what they are and have the properties that they do. For example, “birds” are outwardly very variable (hummingbird, eagle, toucan...) and undergo enormous changes over the life cycle (egg to chick to mature bird), yet many believe that all birds have a bird-essence that makes them what they are and directs their development. Although some adults may have specific ideas of what the category essence is (perhaps DNA in the case of birds, for example), in many cases there is only a “placeholder”—the idea that there is *some* causal essence, without knowing what that might be (Medin & Ortony 1989).

In brief, certain categories are treated as if they have the following: non-obvious properties, inductive potential, stability over transformations, sharp boundaries, innate potential, and causal features (Gelman 2003). Prentice & Miller (2006, p. 129) review some of the extensive evidence for essentialism in children and adults as follows:

“...a wolf remains a wolf even if it is wearing sheep’s clothing (Gelman & Markman, 1986, 1987), even if a doctor performs an operation that makes it look like a sheep (Keil, 1989), and even if it eats something that turns it into an object resembling a sheep (Rips, 1989). Moreover, a wolf will develop wolflike characteristics even if it grows up in a community of sheep (Gelman & Wellman, 1991).”

Essentialist beliefs have implications for a broad range of concepts, including social categories (Haslam et al. 2000), evolutionary theory (Evans 2000; Shtulman 2006; Kelemen 2004; Mayr 1991; Gelman 2003), and causal reasoning (Rehder 2007; Ahn 1998). See also Malt (1994), Braisby et al. (1996), and Strevens (2000) for arguments against essentialism, as well as Gelman (2003) and Ahn et al. (2000) for discussion.

Language cues to essentialism

The question of developmental origins is complex, but it seems that both biases in the child and cues in the environment are important influences on essentialist reasoning. Children and adults from widely different environments show essentialist effects, including: children in impoverished neighborhoods in Brazil (Diesendruck 2001; Sousa et al. 2002), Torguud adults in Western Mongolia (Gil-White 2001), Vezo children in Madagascar (Astuti et al. 2004), Yucatec Mayan children in Mexico (Atran et al., 2001), a Native American community in the U.S. (Waxman et al. 2007), and middle-class children and adults in the U.S. (Gelman 2003). The variability in cultural contexts suggests that children have some sort of predisposition to look for essences.

However, environmental cues also undoubtedly convey important information. Cultures vary from one another in the degree to which individuals essentialize, which categories are essentialized (e.g., ethnicity, caste, occupation are essentialized in some cultures but not others), and how essentialism is instantiated (e.g., whether essence is believed to be in the DNA, in the blood, or ingested in mother’s milk, for example) (Waxman et al. 2007). In Madagascar, for example, the Zafimaniry rarely essentialized human groups (though they did essentialize non-human animal kinds; Bloch et al. 2001). They judged, for example, that a person of one ethnic/racial group adopted by members of another group would take on the identity of the adoptive parents—not the birth parents. Even within a culture, degree of

essentializing varies. For example, in the Indian caste system, mode of reasoning depends on one's own position in the hierarchy (Mahalingam 1998): higher-caste individuals in India are more likely to endorse essentialism than lower-caste individuals, suggesting that essentialism is more often employed when to do so has political benefits. There is also individual variation, with some individuals consistently endorsing essentialist beliefs more than others (Bastian & Haslam 2006; Gelman et al. 2007).

Recent studies have begun to look at the kinds of testimony and implicit cues in language that parents may use to express essentialism to children. Detailed examination of parent-child conversations during picturebook-reading sessions reveals that parents provide little *direct* essentialist talk to young children (e.g., rarely if ever discussing internal commonalities, innate properties, defining characteristics, or explicit stereotypes; Gelman et al. 1998; Gelman et al. 2004). In contrast, however, implicit essentialist talk about categories is pervasive in parents' child-directed speech. Parents frequently make use of several indirect strategies that imply that categories are stable and have a non-obvious basis. These include: labeling (e.g., this is a bird; "That is a lady sewing a dress, right?"), appearance-reality statements (e.g., "Well, that looks like a kangaroo but it's called an aardvark"), contrasting distinct categories (e.g., "Do you think that's more of a girl job or a boy job?"), and responding approvingly to essentialist statements that children produce. For example, in one study of gender-related talk in a book-reading context (Gelman et al. 2004), 64% of mothers contrasted distinct gender categories (male and female) at least once, and 89% of mothers engaged in gender labeling at least once, in conversations with children 2 to 6 years of age.

Furthermore, one of the most interesting and pervasive implicit strategies that parents use is to make a broad statement about the category as a whole (e.g., "Bats live in caves"; "Girls play with dolls"), thereby implying that the category (e.g., bats, girls) can be considered as a group. These general statements are known as "generics" (Carlson & Pelletier 1995). Whereas non-generic utterances refer to particular members of a kind (e.g., one bird, some birds), generics refer to a kind construed more broadly (birds in general).

Generic noun phrases are expressed in English with multiple formal devices, including bare plurals (e.g., "Bats live in caves"), indefinite singulars (e.g., "A hammer is a tool"), and definite singulars (e.g., "The elephant is found in Africa and Asia"). What all these expressions have in common is a conceptual basis: they refer to a kind as a whole. Generics embody several essentialist assumptions. Bohan (1993), discussing essentialist views of gender, noted that essentialism characterizes a category (such as "women") as natural, timeless, and universal, thereby failing to acknowledge social, historical, or political contexts that might lead to variation within the category. Generics likewise characterize a category as universal and abstract away from any particular or situated context. Whereas specific nouns can refer to particular points in time or space (My cat caught a mouse; Those ballet dancers are graceful), generics cannot. Cats catch mice; Ballet dancers are girls—these are statements that characterize a category as timeless, universal, and devoid of context.

In order for generic noun phrases to be a plausible mechanism for transmitting essentialism, they must be available in the input to young children, they must be used in ways that map onto relevant conceptual distinctions (distinguishing essentialized kinds from other categories), and they must be appropriately understood by young children. In addition to being frequent in parental speech to children in diverse cultural and linguistic contexts (U.S., China, Peru; Gelman & Tardif 1998), they are produced by children exposed to minimal linguistic input (deaf children not exposed to sign language; Goldin-Meadow et al. 2005), understood appropriately by children (Hollander et al. 2002), and stored by children in long-term memory (Gelman & Raman 2007). Children understand the semantic implications of generics as kind-referring (Gelman & Raman 2003; Cimpian & Markman, in press), and as extending beyond

current context (Gelman & Bloom 2007). These component pieces all suggest that generics are available in the input, semantically important and early-acquired, and have the potential to influence children's conceptual representations.

At times explicit and implicit messages about categories conflict with one another, perhaps because speakers are more consciously aware of the messages they present explicitly than those they present implicitly. For example, in a study of parental input regarding gender categories (Gelman et al. 2004), mothers were more forthcoming in implicit essentializing messages (e.g., generics, labeling, gender contrasts) than in their explicit stereotyping and essentializing statements. Similarly, contexts that provoked explicit expressions of gender *equality* (e.g., a picture of a female firefighter elicited more egalitarian talk than a picture of a male firefighter) were also more likely to result in an upsurge in implicit focus on gender (e.g., the female firefighter elicited more generics, labeling, and contrasts involving gender than the male firefighter). It is ironic that attempts to counter children's stereotypes by means of egalitarian examples have the unintended consequence of heightening parents' attention to gender as a dimension on which to classify people.

This distinction between implicit and explicit expressive devices in language is consistent with other research demonstrating a distinction between explicit and implicit attitudes, in both adults (Lemm & Banaji, 1999) and children (Baron & Banaji 2006). Explicit stereotypes and attitudes are typically assessed by verbal self-report measures (e.g., "Do you agree that men and women ought to have equal opportunities for employment?"), whereas implicit stereotypes and attitudes can be assessed by means of response speed on a simple judgment task (e.g., how quickly a participant judges that "Jenny" is female, when following the word "bold" vs. when following the word "gentle"; Blair & Banaji 1996; see also Greenwald & Banaji 1995, for the IAT). Implicit attitudes can differ from explicit attitudes in magnitude and valence (Lemm & Banaji 1999). For example, participants' explicit attitudes toward women in leadership roles (e.g., managers, politicians) were by-and-large unrelated to their implicit attitudes. Lemm & Banaji suggest that implicit attitudes and beliefs are endorsed at an unconscious level, and are only tangentially related to conscious judgments. An important question for the future is the extent to which explicit and implicit essentialist language influence children's judgments and inferences.

Evidence for Early and Selective Sensitivity to Input from Others

Although I have emphasized that knowledgeable others provide important information to children, a crucial point is that this information by itself does not provide all the answers. First, children need to be able to take in and interpret the evidence and information that others supply. Meltzoff (1995) outlines how young children (even babies) are exquisitely prepared to imitate other humans (though not to imitate machines), thereby gaining new information. Similarly, Tomasello et al. (1993) has demonstrated a uniquely human capacity, present in early childhood, to learn by imitation (i.e., precisely copying the means by which an action is carried out) rather than emulation (i.e., achieving the same ends, but by different means). These important lines of research make clear that learning by observation requires special capacities on the part of the learner.

Furthermore, children must be able to evaluate the cues they receive—to believe some of the information provided, but show appropriate skepticism as well (Harris & Koenig 2006). Both credulity and skepticism are adaptive. Credulity is adaptive in that it allows children to learn new things. Children are constantly faced with new technology (airplanes fly, despite what common sense tells us), new cultural belief systems (religious, historical), etc. Credulity can also be considered having an open mind. As the bumper sticker goes: Minds are like parachutes: they only function when open. On the other hand, skepticism is adaptive, given the many ways

in which adult input misleads, intentionally or not, by means of deception, fiction, metaphor, and just plain old mistakes (more on fiction in the next section). A capacity for skepticism shields children from misleading input (Koenig et al. 2004). The trick is to get the right balance, to deploy both credulity and skepticism in the right contexts. I illustrate this point first in the realm of word-learning, and then extend to conceptual input more broadly.

Word-learning and the division of linguistic labor

A seemingly straightforward, paradigmatic example of children learning from parental input is the process of word-learning: a child requires input from others in order to acquire a conventional label, such as “dog”. As noted earlier, children have an early openness to the labels of others, even when the labels compete with children’s perceptual groupings. This deference to cultural experts reflects a “division of linguistic labor” (Putnam 1975). An intriguing extension of the idea that children seek adult authority in naming is that concepts need not be wholly stored in the mind of an individual child, but can be placeholders with pointers to others in the community. Recently several researchers have proposed that children may be quite sensitive to a division of labor—both linguistic and cognitive—such that some concepts are merely placeholders that point to knowledge that is accessible only to experts (Lutz & Keil 2002; Markman & Jaswal 2003). Putnam (1975) illustrates by noting that he does not know anything about how elms and beeches differ—he only knows *that* they differ, and the knowledge of precisely how they differ (i.e., the meanings of “elm” and “beech”) is stored in the minds of experts. This fundamental principle seems in place at the start of word-learning (Graham et al. 2004).

An example of this distinction between possessing conceptual knowledge and having a conceptual placeholder can be found in a study by Coley et al. (1999) examining biological categories in U.S. college students and the Itzaj Maya of Guatemala. U.S. college students showed a discrepancy between their knowledge and expectations: they had strong expectations that a middle taxonomic level (which Coley et al. call the “generic-species level”, not to be confused with the use of the word “generic” in the earlier section; here, “generic” is in the biological Linnaean sense of “genus”) would be most informative when making inductive inferences about novel properties—yet had surprisingly little knowledge about the biological categories at this level. (Interestingly, the Itzaj Maya had much more detailed knowledge base about these categories, and correspondingly no evidence for a distinction between knowledge and expectations.) At first this result may seem mysterious: How could people know that the generic-species level is especially informative, without knowing much about these categories? However, this pattern of results makes sense when one considers the naming system in these taxonomies: generic-species categories are named with a single label (e.g., squirrel, trout, oak). Levels below that (in English and universally) are typically labeled as subtypes, with compound names (e.g., “gray squirrel,” “rainbow trout,” “red oak”; Berlin et al. 1973). Adults (and young children; Gelman et al. 1989) interpret compound nouns as reflecting subordination in a hierarchy. The category level that is lexicalized receives privileged status:

(Coley et al. 1999, p. 214):

“labels may ‘stake out’ a category, despite lack of specific knowledge about members of that category ... This may include the assumptions that the category will be coherent, category members will share many underlying properties beyond what meets the eye, and that in effect, there is ‘where the conceptual action is.’ In other words, labels may signal categories that are believed to embody an essence...”

We can therefore think of labels as embodying expert knowledge, which is then transmitted from experts to novices. Of course this whole system works only if the novices are willing to accept the wisdom of the experts.

Both adults and children defer to experts on experimental tasks involving naming (Malt 1990; Kalish 1998; but see Kalish 1995). Children seem to accept even surprising or counter-intuitive labels (Gelman & Coley 1990; Gelman & Markman 1986; Graham et al. 2004; Jaswal & Markman 2007). Mervis et al. (2003) refer to this as the “authority principle.” By 20 months of age, the child in their study (Ari) accepted new labels even for items that already had a name. For example, when Ari’s father said, “That birdie’s a cardinal,” Ari accepted that it was a type of bird (p. 265).

Some have proposed that the learning that goes on in such cases is merely a passive incorporation of the input: automatic, associative, and unreflective (Smith et al. 1996). For example, Sloutsky & Fisher (2004) proposed that words are at first associated with perceptual features in the input. On this view, the lexicalization effects reviewed earlier are automatic consequences of the fact that the label per se serves as an automatic cue (to attention, or to judgments of similarity) that directly influences children’s judgments. The word becomes in effect just another feature of the object.

Yet even the case of mapping a word to a referent is incomplete without considering children’s evaluation and judgment of the situation. Notably, there are key contexts in which the child hears a word in the direct presence of its referent but *fails* to learn it: when the speaker is looking elsewhere from where the child is looking (Baldwin 1991); when the speaker has proven to be unreliable in prior naming instances (Koenig et al. 2004) or uncertain during the naming act (Sabbagh & Baldwin 2001); or when the speaker has an unreliable naming history and is distracted (Jaswal & Malone 2007).

Tomasello & Akhtar (2000, p. 181) list several ways in which children’s word-learning reflects their assumptions about the intentions of the speaker, and not simply automatic, associative linking of a auditory input with a visual percept. By 24 months of age, children override spatio-temporal contiguity and perceptual salience when learning words, in several respects: (a) They assume that words refer to intentional actions, even if the target novel word is immediately followed by an accidental action and only later followed by an intentional action (see also Diesendruck et al. 2004, for related findings). (b) They determine which aspect of the context is novel for the (adult) speaker, and use that information to determine the referent of a word—even when what is novel for the speaker differs from what is novel for the child. (c) They learn new action words for actions that they anticipate an adult *will* do, even when the adult has not actually performed the action. (d) They use adult gaze direction rather than perceptual salience to determine reference.

A compelling series of studies that demonstrates this point was conducted by Jaswal (2004). In this work, 3- and 4-year-old children were shown anomalous category instances (a cat that looked like a dog) and were asked to make inferences about various properties (e.g., would it drink milk or eat bones?). When the pictures were unlabeled, the children nearly always based their inferences on perceptual similarity (e.g., the catlike dog would drink milk), whereas when the pictures were labeled, children were less likely to base their inferences on perceptual similarity (e.g., they less often judged that the cat-like dog would drink milk). Importantly, however, children were even *less* likely to use similarity when the experimenter prefaced the label with an additional phrase that clarified that the label was intentional and not merely a slip of the tongue (“You’re not going to believe this, but this is actually a dog”). Even a more subtle indicator that the label was intended (modifying the label) was sufficient to encourage children to use the label the majority of the time. As Jaswal notes, children used their assessment of the speaker’s communicative intent in order to decide whether or not to make use of the label. The power of labels comes from their intentional use, not from simple association with an object.

The evidence thus argues that labels yield their effects by activating other assumptions, such as a belief that items sharing a label belong to a common natural kind (Gelman 2003). When children have reasons to doubt the sincerity, attention, or capability of the speaker, then labels no longer have their effect.

Skepticism and credulity regarding adult testimony

The evaluative stance we see on the part of children occurs not just with word-learning, but with learning from testimony more generally. Studies show that children are highly sensitive to the intentions of an adult speaker, in deciding whether or not to trust his or her assertions. Koenig & Harris (2005) review a developmental sequence, starting at about 16–18 months, when infants first show evidence of distinguishing between true and false statements and rejecting false claims, and gradually displaying more sophisticated selective mistrust of others, with developmental changes through the preschool years.

Harris & Koenig (2006) emphasize the “constructive role” children play in “reworking and organizing the various pieces of testimony that they receive.” In other words, children show healthy skepticism of expert input. By 4 years of age, children are skeptical of statements made by a speaker who previously said untrue things (Clément et al. 2004) – an ability all the more remarkable when one considers how difficult it is for children and adults monitor the source of a piece of information (Lindsay et al. 1991). They are less likely to accept functional information provided by a speaker who was inaccurate at labeling in the past (Koenig & Harris 2005a). Kushnir et al. (in press) find that 3- and 4-year-old children also use information about a speaker’s knowledge and expertise in a causal learning task. They discriminate between informative and uninformative sources of information, and further they distinguish between knowledge *possession* and knowledge *use* (in other words, it is not enough for a person to be knowledgeable; he or she must also take effective steps to use that knowledge). Thus, when choosing among causal factors, preschool children know that a knowledgeable but blindfolded person will be no more informative than an unknowledgeable person. Preschool children (4–5 years) also make use of a speaker’s motive to decide whether or not their self-descriptions are truthful (Gee & Heyman 2007).

Another important way in which children play an active role in this process is by *eliciting* testimony by means of questions (Chouinard 2007). Chouinard posits that children are more receptive to testimony that they themselves elicit, and that children’s questions serve as a mechanism to further cognitive development. In natural language conversations as well as more controlled laboratory contexts, she finds that preschool children ask many information-seeking questions from others (more than one per minute), that even preverbal infants seek such information non-verbally by one year of age, that they typically obtain the information they seek, that they are persistent in seeking the information they are looking for, and that they make use of the responses they get in order to solve problems at hand (e.g., to figure out what toy is hidden in a closed box). Altogether, then, these studies demonstrate that children make use of an Information-Requesting Mechanism (IRM) to learn about the world (Chouinard 2007). This mechanism includes a variety of information-recruiting methods, particularly including verbal questions, but also gestures, vocalizations, etc., that elicit information from others. Frazier et al. (2008) furthermore find that children expect informative responses to their questions. Thus, when asking a causal question, children 2 to 4 years of age expect causal answers, and are more likely to re-ask their question or provide their own explanation when they do not receive a causal response from the adult.

Some open questions

These findings raise a variety of questions that remain open for future research. I briefly sketch out a few of them here.

1. What is the relative power of social information (testimony) vs. evidence from children's own observations? Although one might expect children to be deep-down empiricists, believing most powerfully in what they can see, this is not the case. Testimony at times effectively overrides children's own perceptions (Jaswal & Markman 2007; Lee et al. 2002).
2. What is the developmental pattern? Although some find that skepticism about the testimony of others increases with age (children become increasingly skeptical of another's self-report claims, from ages 6–11 years; Heyman et al. 2007; Heyman & Legare 2005), others find increasing credulity with age (e.g., Bering & Parker 2006; Shtulman & Carey 2007). In any case, there is unlikely to be a stage-like progression, as children as young as 3 years of age show some skepticism (reviewed above), whereas children 7 years of age and older show some credulity. Even adults come to believe in things formerly deemed "impossible" (such as the 4-minute mile, or the possibility of a human voice emerging from a small box (my grandfather's description of his first encounter with a radio)).
3. How firm are children's naïve theories (of physics, biology, psychology)? Wellman & Gelman (1998) proposed that these theories entail deep ontological commitments. Yet children can show surprising credulity. Examples of non-skeptical endorsement of testimony include children's acceptance of a flying, candy-eating witch (Woolley et al. 2004), a glass-breaking ghost (Lee et al. 2002), an invisible princess (Bering & Parker 2006), magical transformations (Subbotsky 2001; deLoache et al. 1997), instant duplications (Hood & Bloom 2008), and monsters (Harris et al. 1991). Why don't such inconsistencies bother children? How far can their theoretical commitments be pushed? Schulz et al. (2007) provide evidence that by preschool age children's beliefs are malleable but not infinitely flexible.
4. How do children gauge when to be credulous vs. skeptical? Perhaps the most challenging question of all is how children know what to believe when. Simple strategies are ruled out: as we have seen, children neither simply incorporate all input nor simply ignore anything they can't see with their own eyes. We turn to this in the next section regarding fiction, deception, and pretense.

Fiction, Deception, and Pretense: Challenges for Learning

What counts as evidence to children's developing theories? How do children sort out reliable from unreliable sources of information? How do they determine which representations serve as the basis of inferences? This is a vast puzzle, further complicated by the fact that even children encounter fiction, lies, and pretense. Stories, TV, and movies are particularly messy, weaving together fictional and real components, and thus provide an apt laboratory for exploring these issues (Gerrig 1993). Consider a Sesame Street skit in which singing muppets recounted which things are alive. There are potentially numerous generalizations a child could reach from this display, both biologically correct (rocks are not alive) and biologically incorrect (puppets talk and sing). Similarly, Woolley & Cox (2007) give the example of a girl in a storybook who flies away on the back of a swan, leaving the reader to wonder whether or not swans are real or fictional.

The complexity of these issues can be seen in a discussion by Skolnick & Bloom of a popular children's animated television show, *SpongeBob SquarePants* (2006, p. 79):

"SpongeBob is an animated, talking, pants-wearing sponge. He lives in a pineapple under the sea in a land called Bikini Bottom. His best friend, Patrick, is a talking starfish. His world has bizarre principles of physics and biology and few constraints on internal logic. For instance, a boring character might start to speak, and a title card

will appear saying ‘Fifty years later’. The character will still be speaking, with his audience now fifty years older. But in the next scene, all the characters will return to their usual age. Although radical changes must be made to our representation of the real world in order to turn it into SpongeBob’s world, it is not anarchy in Bikini Bottom. There are countless real-world facts that are imported in to the world, such as the meanings of English words, the proper interpretation of facial expressions, properties of artifacts (i.e. chairs are still solid objects), and so on.”

Despite this messiness, children are not deeply confused about the ontological status of unclear items. By at least 3 years of age children readily distinguish real from fantasy (Skolnick & Bloom 2006; Taylor 1999; Woolley & Wellman 1990), as well as living things from highly similar yet distinct contrast cases (R. Gelman et al. 1995; Jipson & Gelman 2007; Gelman & Opfer 2002). Clearly children are grappling with the information provided in fictional contexts, and doing the hard work of attempting to sort the real wheat from the fictional chaff.

How do children solve this problem? I first rule out three theoretically possible solutions that fail to fit with the available evidence:

- a. Parents could be vigilantly truthful to their children, shielding them from misleading input, ensuring that they encounter only (or primarily) accurate information, and immediately correcting any misconceptions that might arise. Obviously, however, this is far from the case, as parents happily present Santa Claus, the Tooth Fairy, and other fictions to children (from preschool age through elementary school) as if they were true (Rosengren et al. 1994; Woolley et al. 1999).
- b. Children could adopt a highly conservative stance, and accept only that which they can confirm directly. In other words, they could partition off all evidence coming from potentially fictional sources, such as books, TV, and movies, tagging them all as not-real or (at best) provisional. Although young children do show skepticism about the reality status of storybook characters and events, they are not wholly skeptical, and they especially judge that events in realistic stories are possible (Woolley & Cox 2007). More generally, children need to accept information beyond their senses in order to learn about real-but-distant entities (tigers, dinosaurs, princesses, germs) or even religious entities (God).
- c. Children could determine the truthworthiness of culturally provided input based on its similarity to real examples. On this view, a swan might be accepted (because it shares many features with other animals known to be real), but Superman would not (because children have never seen a person who can fly). This seems unlikely to be a general solution, however, given the limits of similarity for categorization more generally (Murphy & Medin 1985; Murphy 2002), and the need to interpret factual violations within a causal theory. For example, although cube-shaped basketballs and cube-shaped watermelons may be equally unlikely in the child’s prior experience and equally distant from prototypical examples, theories of causation allow us to accept that a watermelon can be grown to assume the shape of a cube (if grown in a cube-shaped, confining crate), whereas a basketball will not function if not round (Medin & Shoben 1988).

This series of negative conclusions implies that even preschool children engage with the difficult issue of distinguishing fact from fiction. It is likely that rather than rely on any single strategy or type of information, children make use of all the interpretive tools at their disposal. This would likely include (though not be limited to): theory-of-mind reasoning (Wellman 1990), pragmatic inferences (Grice 1975; Siegal & Surian 2004), sensitivity to linguistic cues regarding certainty (Matsui et al. 2006), attention to modality (face-to-face interactions vs. videos; pictures vs. objects; Troseth & DeLoache, 1998; DeLoache 1991), narrative cues to

reality (Woolley & Cox 2007), discourse cues (Harris et al. 2006), and naïve theories that enable children to distinguish plausible from implausible causal processes (Wellman & Gelman 1998; Schulz et al. 2007; Woolley et al. 2006).

By 2 years of age, children appear to distinguish among at least some contexts, treating live interactions as more informative than those from television or video (Anderson & Pempek 2005). For example, 9-month-old infants readily acquire Mandarin Chinese phonetic contrasts from live exposure to Mandarin tutors, but fail to acquire these contrasts when the same information is provided by showing Mandarin tutors on television (Kuhl 2007). Kuhl notes that this modality effect could be due either to general motivational factors, including attention and arousal, or to the greater amount of information provided in live interactions (e.g., tutors' visual gaze and pointing). However, even when the amount of information is controlled, young children learn more from face-to-face interactions than video. For example, when given information about where a toy is hidden, 2-year-old children make use of information that they believe they are viewing directly through a window, but not information that they believe is coming from a TV screen (Troseth & DeLoache 1998). Troseth et al. (2006) propose that one reason video may not be used by young children as a reliable source of information is that the people they view are not socially responsive, and that without appropriate social cues children do not treat the information as socially relevant. To test this, they compared a condition in which 2-year-olds viewed a person on pre-recorded video who was not socially interactive with a person on closed-circuit video who engaged in contingent social interactions. Children were much more likely to make use of the information in the socially interactive condition.

Pretense provides another interesting case. Although pretense is ubiquitous in adults' interactions with children, it rarely leads to confusion; a child who sees her mother treating a spoon as if it were an airplane does not get confused about the function of either spoons or airplanes (Nishida & Lillard 2007; Kavanaugh & Harris 1994). Lillard & Witherington (2004) suggest that one source of information that children use to figure out when a non-literal interpretation is warranted comes from implicit cues from parents. For example, when mothers pretend to have a snack with their 18-month-olds, several of their behaviors differ from when they really have a snack, including talking about their behaviors, sound effects, increased smiling, and increased looking at the child. Importantly, children are sensitive to several of these behaviors, and use them to interpret an interaction as pretense (Nishida & Lillard 2007).

Natural language, too, can be misleading to young children as they learn about fundamental ontological distinctions (e.g., living vs. non-living; psychological vs. non-psychological). Metaphors -- including unintended metaphors -- are rampant in everyday talk (Lakoff 1987). We say that computers, cars, and telephones "think", "want", or "need"; that deficits, crystals, and feelings "grow"; etc. We personify computers, ships, and cars with proper names or animate pronouns (Hall et al. 2004; Scheibe & Erwin 1979). Somehow children must sort through this evidence. Jipson & Callanan (2003) studied parent-child conversations about items from various domains (biological and non-biological) that were shown increasing in size. They found that when mothers talked with their preschool children, they at times blurred ontological distinctions, for example, describing crystal accretion as "growing". Nonetheless, for the most part their input honored the appropriate distinctions, and the children also appropriately distinguished biological growth from non-biological increases in size. These results suggest that children's current belief systems place constraints on how they incorporate new concepts. The nature of these constraints is currently largely unknown, and will be fruitful to address in future research.

Co-Existence of Conceptual Systems

How does development proceed when the child is exposed to seemingly incompatible conceptual systems? At the same time that children construct commonsense “theories” of the natural world that correspond, roughly, to scientific principles in the biological, physical, and psychological domains (Wellman & Gelman 1998), they are also encountering non-rational beliefs concerning the supernatural world, including religion and magic. In part this is because adults encourage beliefs that they themselves don’t share (e.g., Tooth Fairy, Santa Claus), but also because non-rational beliefs (astrology; “luck”; God’s will; ghosts) are abundant in adult thought (Hood 2008).

There is now growing evidence that rational and irrational modes of thought “coexist” in human reasoning: an individual can possess both rational (scientific) and non-rational modes of explanation, without viewing them as competing or contradictory (Evans 2000; Inagaki & Hatano 2002; Nemeroff & Rozin 1989; Raman & Winer 2002; Rosengren et al. 2000). Subbotsky (2000, pp. 327–328) explains this perspective as follows:

“... a contemporary Western individual is not an exclusively rational being and ... he or she, living in the world created by science, dwells in the worlds of dreams, art, fantasies, play, and social myths. This means that if the individual is to encounter a certain phenomenon with no established scientific explanation, he or she may be prepared to explain the phenomenon in a number of ways, only some of which are compatible with the vision of modern science”

One controversial issue is whether children truly believe in supernatural events, or instead only seem to endorse such beliefs (Subbotsky 2001; Woolley 1997; Taylor 1999). For example, children may adopt a “play mode” when answering questions about fantasy elements, or may enjoy acting *as if* a fantastical event were possible. On the other hand, both children and adults seem genuinely convinced by fantasies or seemingly magical spells (e.g., in which an inanimate entity is made to “come alive”), making real-life approach or avoidance decisions on the basis of these non-rational modes of thought (Edman & Kameoka, 1997; Harris et al., 1991; Magner, 1992; Phelps & Woolley, 1994; Subbotsky, 2000). Important questions for the future include how genuine such convictions are and in what contexts they emerge.

Illness is a realm that may be especially susceptible to non-rational explanations, given the often-obscure (or even unknown) causes of illnesses, the highly charged emotional contexts in which people reason about illness, the lack of personal control over many illness outcomes, and the multiple belief systems corresponding to historical and cultural variability in the knowledge base (Siegal & Peterson 1999).

Cristine Legare and I studied illness concepts in children and adults in Sesotho-speaking communities in South Africa where HIV infection rates are very high (Legare & Gelman, in press). We found clear evidence for the co-existence of biological and supernatural (witchcraft) explanatory systems. First, although biological causes were favored overall and endorsed uniformly in all age groups, nonetheless over half the participants provided both biological and supernatural explanations at least once. Second, increases with age in understanding the hidden nature of disease did not correspond to decreases in the endorsement of supernatural explanations. Third, one of our communities was less rural and had higher levels of biological knowledge, but again this did not relate inversely to witchcraft explanations. Both of the latter two findings indicate that endorsement of witchcraft does not reflect an absence of accurate biological explanations. Instead, we found that witchcraft beliefs persisted even when participants had ample knowledge of the biological processes involved in illness transmission.

Legare and I also proposed that there are at least three possibilities for how natural and supernatural explanatory frameworks may co-exist with one another (Legare & Gelman, in press): (1) they may remain distinct frameworks recruited to explain distinct phenomena (e.g., natural explanations to explain colds; supernatural explanations to explain AIDS), (2) they may be used jointly to explain the same phenomena, but loosely (without considering how they interact), or (3) they may combine more precisely (e.g., treating natural causes as proximate but supernatural causes as distal). We found most support for the second and third options – that is, that natural and supernatural beliefs are often recruited to explain the same event. Adults' justifications yielded support for both "loose" co-existence (supplying both kinds of explanations without trying to integrate them; e.g., explaining an illness event by saying, "adultery and witchcraft") and more precise co-existence (e.g., explaining an illness event by saying, "Witchcraft can fool you into sleeping with an HIV-infected person" or "A witch can make a condom weak, and break").

Another example of the integrated nature of potentially competing belief systems can be found in religious and scientific beliefs regarding species origins (e.g., creationism; evolution). An important point here is that the persistence of creationist beliefs and rejection or misinterpretation of evolutionary theory derives not just from competing forms of testimony or socialization, but also from cognitive biases on the part of children and adults that compete with the information they are hearing from others (Evans 2000; Shtulman 2006; Kelemen 2004; Mayr 1991; Gelman 2003).

A further point regarding the co-existence of multiple explanatory systems is that context is critical in determining the kind of response provided, for children and adults. This has been found for explanations for illness (Nguyen & Rosengren 2004; Legare & Gelman, in press), explanations for death (Harris & Giménez 2005), judgments about category membership (Walker 1992), and judgments about magical or fantasy events (Subbotsky 2001; Harris et al. 1991, Woolley & Van Reet 2006). In all of these cases, we see markedly different responses as a function of context.

Conclusions

It is a truism that children learn from those around them. Yet what does this mean? On the one hand, children are not solitary learners, independently figuring out the world from first principles, re-inventing the proverbial wheel with each new generation. But on the other hand, neither are children passive sponges, absorbing whatever they see and hear. Along with the importance of the words and testimony of others is the importance of an evaluative child, judging and assessing the nature and relevance of the information coming in. Children's early sensitivity to this information is a testament to the importance of the child's social/psychological understandings, pragmatic and linguistic skills, and theory-building capacities (Carey in press; Gopnik & Wellman 1994; Gopnik & Meltzoff 1997). The observation that children are richly informed by the testimony and evidence of others also does not mean that there are no innate constraints. Innate capacities and environmental evidence work together in development.

Cashing out these rather broad generalizations requires a serious engagement with the evidence at hand, in terms of both the cues available to the child and the child's capacity to make sense of those cues. At this point there is much we still don't know. Fuller characterizations of the input are certainly needed. For example, children's own word productions have been used as indirect evidence regarding what words children hear (Smith 2000), but in future research it will be important to discover how tightly children's productions correspond to the input. Studies of testimony as well at times make assumptions about the input language (Harris et al. 2006), and would be enriched by a closer examination of what children actually hear. The level

of analysis may at time require a powerful microscope, including close analysis of linguistic cues (Gelman et al. 1998) and of perceptual cues (Smith, in press). Microgenetic methods also offer great potential for examining how input from others influences conceptual change (Siegler & Crowley 1991; Opfer & Siegler 2004; Amsterlaw & Wellman 2006). Furthermore, just because a modification is found in the input, this does not necessarily mean that it is used by the child. So, studies of input need to be paired with studies of uptake. Excellent examples of this approach include: Jipson & Callanan (2003); Crowley et al. (2001a); Sandhofer, Smith, & Luo (2000).

This approach raises many new questions. To what extent are social or cultural cues available to other species? When in development do children first show sensitivity to the various social cues outlined in this chapter? How does children's relationship to expertise change with age and, especially, as they enter and proceed in formal schooling? What counts as a reliable source at different points in development? To what extent do those interacting with children modify their language and interactional style to emphasize or support conceptual learning? And to the extent that such modifications are made, to what extent do they influence the learning process? Although there is a broad literature on the effects or non-effects of child-directed speech on language learning, much less is known about the nature and effects of child-directed speech on concepts, or child-directed modifications in action (Brand et al. 2002).

Finally, what are the implications of this research for a portrait of human concepts? The research reviewed in this chapter argue strongly against the idea that children's concepts can be characterized as wholly mechanistic or as wholly perceptually based. Much of what children learn comes from others, and in order to make sense of this information, a complex array of psychological, theory-based, linguistic, and interpretive understandings are required (Bloom 2000).

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LITERATURE CITED

- Ahn W. The role of causal status in determining feature centrality. *Cognition* 1998;69:135–78. [PubMed: 9894403]
- Ahn W, Gelman SA, Amsterlaw JA, Hohenstein J, Kalish CW. Causal status effect in children's categorization. *Cognition* 2000;76:B35–B43. [PubMed: 10856745]
- Amsterlaw J, Wellman HM. Theories of mind in transition: A microgenetic study of the development of false belief understanding. *J Cognition and Dev* 2006;7:139–72.
- Anderson DR, Pempek TA. Television and very young children. *American Behavioral Scientist* 2005;48:505–22.
- Astuti R, Solomon GEA, Carey S. Constraints on conceptual development. *Monographs of the Society for Research in Child Dev* 2004;69(3)
- Atran S. Folk biology and the anthropology of science: Cognitive universals and cultural particulars. *Behavioral and Brain Sci* 1998;21:547–609.
- Balaban MT, Waxman SR. Do words facilitate object categorization in 9-month-old infants? *J of Experimental Child Psychol* 1997;64:3–26.
- Baldwin DA. Infants' contribution to the achievement of joint reference. *Child Dev* 1991;62:875–890. [PubMed: 1756664]
- Baldwin DA. Interpersonal understanding fuels knowledge acquisition. *Curr Dir Psychol Sci* 2000;9:40–45.
- Baron AS, Banaji MR. The development of implicit attitudes: Evidence of race evaluations from ages 6 and 10 and adulthood. *Psychol Sci* 2006;17:53–58. [PubMed: 16371144]

- Baron, AS.; Dunham, Y.; Banaji, MR.; Carey, S. Foundations of social categorization. Presented at Bienn. Meet. Cogn. Dev. Society, 5th; Santa Fe. 2007.
- Baron-Cohen, S.; Tager-Flusberg, H.; Cohen, DJ. Understanding Other Minds: Perspectives from Autism. New York: Oxford University; 1993.
- Bastian B, Haslam N. Psychological essentialism and stereotype endorsement. *J of Experimental Social Psychol* 2006;42:228–35.
- Bering JM. The folk psychology of souls. *Behav Brain Sci* 2006;29:453–62. [PubMed: 17156519]
- Bering JM, Parker BD. Children's attributions of intentions to an invisible agent. *Dev Psychol* 2006;42:253–62. [PubMed: 16569164]
- Berlin B, Breedlove D, Raven P. General principles of classification and nomenclature in folk biology. *American Anthropologist* 1973;74:214–42.
- Bigler RS, Spears Brown C, Markell M. When groups are not created equal: Effects of group status on the formation of intergroup attitudes in children. *Child Dev* 2001;72:1151–62. [PubMed: 11480939]
- Blair IV, Banaji MR. Automatic and controlled processes in stereotype priming. *J of Personality and Social Psychol* 1996;70:1142–63.
- Bloch M, Solomon GEA, Carey S. Zafimaniry: An understanding of what is passed on from parents to children: A cross-cultural investigation. *J of Cogn Culture* 2001;1:43–68.
- Bloom, P. How Children Learn the Meanings of Words. Cambridge, MA: MIT Press; 2000.
- Bohan JS. Regarding gender: Essentialism, constructionism, and feminist psychology. *Psychol of Women Quarterly* 1993;17:5–21.
- Boroditsky L. Does language shape thought? Mandarin and English speakers' conceptions of time. *Cogn Psychol* 2001;43:1–22. [PubMed: 11487292]
- Boroditsky, L.; Schmidt, LA.; Phillips, W. Sex, syntax and semantics. In: Gentner, D.; Goldin-Meadow, S., editors. *Language in Mind: Advances in the Study of Language and Thought*. Cambridge, MA: MIT Press; 2003. p. 61-79.
- Bowerman, M.; Choi, S. Space under construction: Language-specific spatial categorization in first language acquisition. In: Gentner, D.; Goldin-Meadow, S., editors. *Language in Mind: Advances in the Study of Language and Thought*. Cambridge, MA: MIT Press; 2003. p. 389-427.
- Boyer P. Religious thought and behaviour as by-products of brain function. *Trends Cogn Sci* 2003;7:119–24. [PubMed: 12639693]
- Braisby N, Franks B, Hampton J. Essentialism, word use, and concepts. *Cognition* 1996;59:247–74. [PubMed: 8706378]
- Brand RJ, Baldwin DA, Ashburn LA. Evidence for 'motionese': Modifications in mothers' infant-directed action. *Dev Sci* 2002;5:72–83.
- Bruner, JS. *Beyond the Information Given*. New York: Norton; 1973.
- Callanan MA. Cognitive development, culture, and conversation: Comments on Harris and Koenig's 'Truth in Testimony: How Children Learn about Science and Religion'. *Child Dev* 2006;77:525–30. [PubMed: 16686785]
- Carey, S. *Conceptual Change in Childhood*. Cambridge, MA: MIT Press; 1985.
- Carey, S. *The Origin of Concepts*. New York: Oxford University Press; in press
- Carlson, GN.; Pelletier, FJ., editors. *The Generic Book*. Chicago: University of Chicago Press; 1995.
- Chouinard MM. Children's questions: A mechanism for cognitive development. *Monographs of the Society for Research in Child Dev* 2007;72(1) Serial No. 286.
- Cimpian A, Arce HC, Markman EM. Subtle linguistic cues affect children's motivation. *Psychol Sci* 2007;18:314–16. [PubMed: 17470255]
- Cimpian A, Markman EM. Preschool children's use of cues to generic meaning. *Cognition*. in press.
- Clément F, Koenig M, Harris P. The ontogenesis of trust. *Mind & Language* 2004;19:360–79.
- Cohen, LB.; Cashion Cara, H. Infant cognition. In: Kuhn, D.; Siegler, RS.; Damon, W.; Lerner, RM., editors. *Handbook of Child Psychology: Vol 2, Cognition, Perception, & Language*. 6. Hoboken, NJ: Wiley; 2006. p. 214-51.
- Coley, JD.; Medin, DL.; Proffitt, JB.; Lynch, E.; Atran, S. Inductive reasoning in folkbiological thought. In: Medin, DL.; Atran, S., editors. *Folkbiology*. Cambridge, MA: MIT Press; 1999. p. 205-32.

- Crowley K, Callanan MA, Jipson JL, Galco J, Topping K, Shrager J. Shared scientific thinking in everyday parent-child activity. *Sci Education* 2001a;85:712–32.
- Crowley K, Callanan MA, Tenenbaum HR, Allen E. Parents explain more often to boys than to girls during shared scientific thinking. *Psychol Sci* 2001;12:258–61. [PubMed: 11437311]
- Danziger, E. The eye of the beholder: How linguistic categorization affects ‘natural’ experience. In: McKinnon, S.; Silverman, S., editors. *Complexities: Beyond Nature & Nurture*. Chicago: University of Chicago Press; 2005. p. 64–80.
- DeLoache JS. Symbolic functioning in very young children: Understanding of pictures and models. *Child Dev* 1991;62:736–52. [PubMed: 1718666]
- DeLoache JS, Miller KF, Rosengren KS. The credible shrinking room: Very young children’s performance with symbolic and nonsymbolic relations. *Psychol Sci* 1997;8:308–13.
- Diesendruck G. Essentialism in Brazilian children’s extensions of animal names. *Dev Psychol* 2001;37:49–60. [PubMed: 11206433]
- Diesendruck G, haLevi H. The role of language, appearance, and culture in children’s social category-based induction. *Child Dev* 2006;77:539–53. [PubMed: 16686787]
- Diesendruck G, Markson L, Akhtar N, Reudor A. Two-year-olds’ sensitivity to speakers’ intent: An alternative account of Samuelson and Smith. *Dev Sci* 2004;7:33–41. [PubMed: 15323116]
- Dunham Y, Baron AS, Banaji MR. From American city to Japanese village: A cross-cultural investigation of implicit race attitudes. *Child Dev* 2006;77:1268–81. [PubMed: 16999797]
- Evans, EM. Beyond Scopes: Why creationism is here to stay. In: Rosengren, KS.; Johnson, CN.; Harris, PL., editors. *Imagining the Impossible*. New York: Cambridge University Press; 2000. p. 305–33.
- Fodor, J. *Concepts: Where Cognitive Science Went Wrong*. Oxford: Oxford University Press; 1998.
- Frazier B, Gelman SA, Wellman HM. 2008
- Ganea PA, Shutts K, Spelke ES, DeLoache JS. Thinking of things unseen: Infants’ use of language to update mental representations. *Psychol Sci* 2007;18:734–39. [PubMed: 17680946]
- Gee CL, Heyman GD. Children’s evaluation of other people’s self-descriptions. *Social Dev* 2007;16:800–18.
- Gelman, R.; Durgin, F.; Kaufman, L. Distinguishing between animates and inanimates: Not by motion alone. In: Sperber, D.; Premack, D.; Premack, AJ., editors. *Causal Cognition: A Multidisciplinary Debate*. Oxford: Clarendon; 1995. p. 150–84.
- Gelman, R.; Williams, EM. Enabling constraints for cognitive development and learning: Domain specificity and epigenesis. In: Damon, W., editor. *Handbook of Child Psychology: Volume 2: Cognition, Perception, and Language*. Hoboken, NJ: Wiley; 1998. p. 575–630.
- Gelman, SA. Concepts and theories. In: Gelman, R.; Au, TK., editors. *Perceptual and Cognitive Development*. San Diego, CA: Academic Press; 1996. p. 117–150.
- Gelman, SA. *The Essential Child: Origins of Essentialism in Everyday Thought*. New York: Oxford University Press; 2003.
- Gelman SA, Bloom P. Developmental changes in the understanding of generics. *Cognition* 2007;105:166–83. [PubMed: 17094957]
- Gelman SA, Coley JD. The importance of knowing a dodo is a bird: Categories and inferences in 2-year-old children. *Dev Psychol* 1990;26:796–804.
- Gelman SA, Coley JD, Rosengren K, Hartman E, Pappas T. Beyond labeling: The role of parental input in the acquisition of richly-structured categories. *Monographs of the Society for Research in Child Dev*. 1998 Serial No. 253, No. 1.
- Gelman SA, Heyman GD. Carrot-eaters and creature-believers: The effects of lexicalization on children’s inferences about social categories. *Psychol Sci* 1999;10:489–93.
- Gelman SA, Heyman GD, Legare CH. Developmental changes in the coherence of essentialist beliefs about psychological characteristics. *Child Dev* 2007;78:757–74. [PubMed: 17517003]
- Gelman SA, Markman EM. Categories and induction in young children. *Cognition* 1986;23:183–209. [PubMed: 3791915]
- Gelman SA, Markman EM. Young children’s inductions from natural kinds: The role of categories and appearances. *Child Dev* 1987;58:1532–41. [PubMed: 3691200]

- Gelman, SA.; Opfer, JE. Development of the animate-inanimate distinction. In: Goswami, U., editor. *Blackwell Handbook of Childhood Cognitive Development*. Malden, MA: Blackwell; 2002. p. 151-166.
- Gelman SA, Raman L. Preschool children use linguistic form class and pragmatic cues to interpret generics. *Child Dev* 2003;74:308–25. [PubMed: 12625452]
- Gelman SA, Raman L. This cat has nine lives? Children's memory for genericity in language. *Dev Psychol* 2007;43:1256–68. [PubMed: 17723049]
- Gelman SA, Tardif TZ. Generic noun phrases in English and Mandarin: An examination of child-directed speech. *Cognition* 1998;66:215–48. [PubMed: 9689770]
- Gelman SA, Taylor MG, Nguyen SP. Mother-child conversations about gender. *Monographs of the Society for Research in Child Dev* 2004;69(1)
- Gelman SA, Wellman HM. Insides and essences: Early understandings of the nonobvious. *Cognition* 1991;38:213–44. [PubMed: 2060270]
- Gelman SA, Wilcox SA, Clark EV. Conceptual and linguistic hierarchies in young children. *Cogn Dev* 1989;4:309–26.
- Gerrig, RJ. *Experiencing Narrative Worlds: On the Psychological Activities of Reading*. New Haven, CT: Yale University Press; 1993.
- Gil-White FJ. Are ethnic groups biological “species” to the human brain? *Curr Anthropology* 2001;42:515–54.
- Giménez M, Harris PL. Understanding constraints on inheritance: Evidence for biological thinking in early childhood. *British J of Dev Psychol* 2002;20:307–24.
- Ginsburg, HP.; Oppen, S. *Piaget's Theory of Intellectual Development*. Englewood Cliffs, NJ: Prentice-Hall; 1969.
- Gleitman, L.; Papafragou, A. Language and thought. In: Holyoak, KJ.; Morrison, RG., editors. *The Cambridge Handbook of Thinking and Reasoning*. New York: Cambridge University Press; 2005. p. 633-661.
- Goldin-Meadow, A. *The Resilience of Language: What Gesture Creation in Deaf Children Can Tell Us about How All Children Learn Language*. NY: Psychology Press; 2003.
- Goldin-Meadow S, Gelman SA, Mylander C. Expressing generic concepts with and without a language model. *Cognition* 2005;96:109–26. [PubMed: 15925572]
- Gopnik, A.; Meltzoff, N. *Words, Thoughts, and Theories*. Cambridge, MA: MIT; 1997.
- Gopnik A, Glymour C, Sobel DM, Schulz LE, Kushnir T, Danks DA. Theory of causal learning in children: Causal maps and Bayes nets. *Psychol Rev* 2004;111:3–32. [PubMed: 14756583]
- Gopnik, A.; Wellman, H. The theory theory. In: Hirschfeld, LA.; Gelman, SA., editors. *Mapping the Mind: Domain Specificity in Cognition and Culture*. New York: Cambridge University Press; 1994.
- Gottfried GM, Gelman SA, Schultz J. Children's understanding of the brain: From early essentialism to biological theory. *Cogn Dev* 1999;14:147–74.
- Gottfried GM, Jow EE. ‘I just talk with my heart’: The mind-body problem, linguistic input, and the acquisition of folk psychological beliefs. *Cogn Dev* 2003;18:79–90.
- Graham SA, Kilbreath CS, Welder AN. Thirteen-month-olds rely on shared labels and shape similarity for inductive inferences. *Child Dev* 2004;75:409–42. [PubMed: 15056196]
- Greenwald AG, Banaji MR. Implicit social cognition: Attitudes, self-esteem, and stereotypes. *Psychol Rev* 1995;102:4–27. [PubMed: 7878162]
- Grice, HP. Logic and conversation. In: Cole, P.; Morgan, J., editors. *Syntax and Semantics Volume 3: Speech Acts*. New York: Academic Press; 1975.
- Hall DG, Veltkamp BC, Turkel WJ. Children's and adults' understanding of proper namable things. *First Language* 2004;24:5–32.
- Hallett, GL. *Essentialism: A Wittgensteinian Critique*. Albany, NY: SUNY Press; 1991.
- Harris P. Commentary. *Monographs of the Society for Research in Child Dev* 2007;72:113–20.
- Harris PL, Brown E, Marriott C, Whittall S, et al. Monsters, ghosts and witches: Testing the limits of the fantasy-reality distinction in young children. *British J Dev Psychol* 1991;9:105–23.
- Harris PL, Giménez M. Children's acceptance of conflicting testimony: The case of death. *J Cognit Culture* 2005;5:143–64.

- Harris PL, Kavanaugh RD, Dowson L. The depiction of imaginary transformations: Early comprehension of a symbolic function. *Cogn Dev* 1997;12:1–19.
- Harris PL, Koenig MA. Trust in testimony: How children learn about science and religion. *Child Dev* 2006;77:505–24. [PubMed: 16686784]
- Harris PL, Pasquini ES, Duke S. Germs and angels: The role of testimony in young children's ontology. *Dev Sci* 2006;9:76–96. [PubMed: 16445398]
- Haslam N, Rothschild L, Ernst D. Essentialist beliefs about social categories. *British J of Social Psychol* 2000;39:113–27.
- Hauser, MD. *Wild Minds: What Animals Really Think*. NY: Henry Holt; 2000.
- Hespos SJ, Spelke ES. Conceptual precursors to language. *Nature* 2004;430:453–56. [PubMed: 15269769]
- Heyman GD, Diesendruck G. The Spanish ser/estar distinction in bilingual children's reasoning about human psychological characteristics. *Dev Psychol* 2002;38:407–17. [PubMed: 12005383]
- Heyman GD, Fu G, Lee K. Evaluating claims people make about themselves: The development of skepticism. *Child Dev* 2007;78:367–375. [PubMed: 17381778]
- Heyman GD, Legare CH. Children's evaluation of sources of information about traits. *Dev Psychol* 2005;41:636–47. [PubMed: 16060810]
- Heyman, G.; Legare, C. Noun labels and social categories. Presented at Cogn. Dev. Society; Santa Fe. 2007.
- Hill JH, Mannheim B. Language and world view. *Annu Rev Anthropology* 1992;21:381–406.
- Hirschfeld, LS. *Race in the Making: Cognition, Culture, and the Child's Construction of Human Kinds*. Cambridge: MIT Press; 1996.
- Hollander MA, Gelman SA, Star J. Children's interpretation of generic noun phrases. *Dev Psychol* 2002;38:883–89. [PubMed: 12428701]
- Hood B. (in press). [book]
- Hood BM, Bloom P. Children prefer certain individuals over perfect duplicates. *Cognition* 2008;106:455–62. [PubMed: 17335793]
- Imai M, Gentner D. A cross-linguistic study of early word meaning: Universal ontology and linguistic influence. *Cognition* 1997;62:169–200. [PubMed: 9141906]
- Inagaki, K.; Hatano, G. *Young Children's Naïve Thinking about the Biological World*. New York: Psychology Press; 2002.
- James, W. *The Principles of Psychology*. Cambridge, MA: Harvard; 1890/1983.
- Jaswal VK. Don't believe everything you hear: Preschoolers' sensitivity to speaker intent in category induction. *Child Dev* 2004;75:1871–85. [PubMed: 15566385]
- Jaswal VK, Malone LS. Turning believers into skeptics: 3-year-olds' sensitivity to cues to speaker credibility. *J Cognit Dev* 2007;8:263–83.
- Jaswal VK, Markman EM. Looks aren't everything: 24-month-olds' willingness to accept unexpected labels. *J Cognit Dev* 2007;8:93–111.
- Jipson JL, Callanan MA. Mother-child conversation and children's understanding of biological and nonbiological changes in size. *Child Dev* 2003;74:629–44. [PubMed: 12705577]
- Jipson JL, Gelman SA. Robots and rodents: Children's inferences about living and nonliving kinds. *Child Dev* 2007;78:1675–88. [PubMed: 17988314]
- Kalish CW. Graded membership in animal and artifact categories. *Memory and Cognition* 1995;23:335–53.
- Kalish CW. Natural and artificial kinds: Are children realists or relativists about categories? *Dev Psychol* 1998;34:376–91. [PubMed: 9541789]
- Kavanaugh RD, Harris PL. Imagining the outcome of pretend transformations: Assessing the competence of normal children and children with autism. *Dev Psychol* 1994;30:847–54.
- Keil, F. *Concepts, Kinds, and Cognitive Development*. Cambridge, MA: MIT; 1989.
- Keil FC. Words, moms, and things: Language as a road map to reality. *Monographs of the Society for Research in Child Dev* 1998;63:149–57.

- Keil FC. Categorisation, causation, and the limits of understanding. *Lang Cogn Processes* 2003;18:663–92.
- Kelemen D. Are children ‘intuitive theists’? Reasoning about purpose and design in nature. *Psychol Sci* 2004;15:295–301. [PubMed: 15102137]
- Koenig MA, Clément F, Harris PL. Trust in testimony: Children’s use of true and false statements. *Psychol Sci* 2004;15:694–98. [PubMed: 15447641]
- Koenig MA, Harris PL. The role of social cognition in early trust. *Trends Cogn Sci* 2005;9:457–59. [PubMed: 16137918]
- Koenig MA, Harris PL. Preschoolers mistrust ignorant and inaccurate speakers. *Child Dev* 2005a; 76:1261–77. [PubMed: 16274439]
- Kuhl PK. Is speech learning ‘gated’ by the social brain? *Dev Sci* 2007;10:110–20. [PubMed: 17181708]
- Kushnir T, Wellman HM, Gelman SA. The role of preschoolers’ social understanding in evaluating the informativeness of causal interventions. *Cognition*. in press.
- Lakoff, G. *Women, Fire, and Dangerous Things*. Chicago: University of Chicago; 1987.
- Lee K, Cameron CA, Doucette J, Talwar V. Phantoms and fabrications: Young children’s detection of implausible lies. *Child Dev* 2002;73:1688–1702. [PubMed: 12487487]
- Legare CH, Gelman SA. Bewitchment, biology, or both: The co-existence of natural and supernatural explanatory frameworks across development. *Cogn Sci*. in press.
- Lemm, K.; Banaji, MR. Unconscious attitudes and beliefs about women and men. In: Pasero, U.; Braun, F., editors. *Wahrnehmung und Herstellung von Geschlecht (Perceiving and Performing Gender)*. Opladen: Westdeutscher Verlag; 1999. p. 215–233.
- Liben, LS.; Signorella, ML. *New Directions for Child Development*, No. 38: Children’s Gender Schemata. San Francisco, CA: Jossey-Bass; 1987.
- Lillard AS, Witherington DC. Mothers’ behavior modifications during pretense and their possible signal value for toddlers. *Dev Psychol* 2004;40:95–113. [PubMed: 14700467]
- Lindsay DS, Johnson MK, Kwon P. Developmental changes in memory source monitoring. *J Experimental Child Psychol* 1991;52:297–318.
- Locke, J. *An Essay Concerning Human Understanding*. Vol. 2. New York: Dover; 1671/1959.
- Lucy JA. Linguistic relativity. *Annu Rev Anthropology* 1997;26:291–312.
- Lucy, JA.; Gaskins, S. Interaction of language type and referent type in the development of nonverbal classification preferences. In: Gentner, D.; Goldin-Meadow, S., editors. *Language in Mind: Advances in the Study of Language and Thought*. Cambridge, MA: MIT; 2003.
- Lutz DJ, Keil FC. Early understanding of the division of cognitive labor. *Child Dev* 2002;73:1073–84. [PubMed: 12146734]
- Mahalingam, R. Ph.D. Dissertation. University of Pittsburgh; 1998. Essentialism, Power, and Representation of Caste: A Developmental Study.
- Malt BC. Features and beliefs in the mental representation of categories. *J Memory and Language* 1990;29:289–315.
- Malt BC. Water is not H₂O. *Cogn Psychol* 1994;27:41–70.
- Maratsos MP. Commentary. *Monographs of the Society for Research in Child Dev* 2007;72:121–26.
- Margolis E. A reassessment of the shift from the classical theory of concepts to prototype theory. *Cognition* 1994;51:73–89. [PubMed: 8149717]
- Markman, EM. *Categorization and Naming in Children: Problems of Induction*. Cambridge, MA: MIT; 1989.
- Markman, EM. Constraints on word learning: Speculations about their nature, origins, and domain specificity. In: Gunnar, MA.; Maratsos, M., editors. *Modularity and Constraints in Language and Cognition*. Hillsdale, NJ: Erlbaum; 1992. p. 59–101.
- Markman, EM.; Jaswal, VK. Commentary on Part II: Abilities and assumptions underlying conceptual development. In: Rakison, DH.; Oakes, LM., editors. *Early Category and Concept Development: Making Sense of the Blooming, Buzzing Confusion*. New York: Oxford University Press; 2003. p. 384–402.
- Marler, P. The instinct to learn. In: Carey, S.; Gelman, R., editors. *The Epigenesis of Mind: Essays on Biology and Cognition*. Hillsdale, NJ: Erlbaum; 1991. p. 37–66.

- Martinez IM, Shatz M. Linguistic influences on categorization in preschool children: A crosslinguistic study. *J Child Language* 1996;23:529–45.
- Matsui T, Yamamoto T, McCagg P. On the role of language in children's early understanding of others as epistemic beings. *Cogn Dev* 2006;21:158–73.
- Mayr, E. *One Long Argument: Charles Darwin and the Genesis of Modern Evolutionary Thought*. Cambridge, MA: Harvard; 1991.
- McDonough L, Choi S, Mandler JM. Understanding spatial relations: Flexible infants, lexical adults. *Cogn Psychol* 2003;46:229–59. [PubMed: 12694694]
- Medin DL, Atran S. The native mind: Biological categorization and reasoning in development and across cultures. *Psychol Rev* 2004;111:960–83. [PubMed: 15482069]
- Medin DL, Lynch EB, Solomon KO. Are there kinds of concepts? *Annu Rev Psychol* 2000;51:121–47. [PubMed: 10751967]
- Medin, DL.; Ortony, A. Psychological essentialism. In: Vosniadou, S.; Ortony, A., editors. *Similarity and Analogical Reasoning*. New York: Cambridge; 1989. p. 179-195.
- Medin DL, Shoben EJ. Context and structure in conceptual combination. *Cogn Psychol* 1988;20:158–90. [PubMed: 3365938]
- Meltzoff AN. Understanding the intentions of others: Re-enactment of intended acts by 18-month-old children. *Dev Psychol* 1995;31:838–50.
- Meltzoff AN. The 'like me' framework for recognizing and becoming an intentional agent. *Acta Psychologica* 2007;124:26–43. [PubMed: 17081488]
- Mervis, CB.; Pani, JR.; Pani, AM. Transaction of child cognitive-linguistic abilities and adult input in the acquisition of lexical categories at the basic and subordinate levels. In: Rakison, DH.; Oakes, LM., editors. *Early Category and Concept Development: Making Sense of the Blooming, Buzzing Confusion*. New York: Oxford; 2003. p. 242-274.
- Milich R, McAninch CB, Harris MJ. Effects of stigmatizing information on children's peer relations: Believing is seeing. *School Psychol Rev* 1992;21:400–09.
- Mueller C, Dweck CS. Praise for intelligence can undermine children's motivation and performance. *J of Personality and Social Psychol* 1998;75:33–52.
- Murphy, GL. *The Big Book of Concepts*. Cambridge, MA: MIT; 2002.
- Murphy GL, Medin DL. The role of theories in conceptual coherence. *Psychol Rev* 1985;92:289–316. [PubMed: 4023146]
- Nazzi T, Gopnik A. Linguistic and cognitive abilities in infancy: When does language become a tool for categorization? *Cognition* 2001;80:B11–B20. [PubMed: 11274987]
- Needham A, Barrett T, Peterman K. A pick me up for infants' exploratory skills: Early simulated experiences reaching for objects using 'sticky' mittens enhances young infants' object exploration skills. *Infant Behav Dev* 2002;25:279–95.
- Nemeroff C, Rozin P. "You are what you eat": Applying the demand-free "impressions" technique to an unacknowledged belief. *Ethos* 1989;17:50–69.
- Nguyen SP, Rosengren KS. Causal reasoning about illness: A comparison between European and Vietnamese-American children. *J of Cognit Culture* 2004;4:51–78.
- Nisbett RE, Peng K, Choi I, Norenzayan A. Culture and systems of thought: Holistic versus analytic cognition. *Psychol Rev* 2001;108:291–310. [PubMed: 11381831]
- Nishida TK, Lillard AS. The informative value of emotional expressions: 'Social referencing' in mother-child pretense. *Dev Sci* 2007;10:205–12. [PubMed: 17286845]
- Opfer JE, Siegler RS. Revisiting preschoolers' living things concept: A microgenetic analysis of conceptual change in basic biology. *Cogn Psychol* 2004;59:301–32. [PubMed: 15342257]
- Patterson MM, Bigler RS. Preschool children's attention to environmental messages about groups: Social categorization and the origins of intergroup bias. *Child Dev* 2006;77:847–60. [PubMed: 16942493]
- Peterson CC, Siegal M. Insights into theory of mind from deafness and autism. *Mind Lang* 2000;15:123–45.
- Piaget, J. *Genetic Epistemology*. Duckworth, E., translator. New York: Columbia; 1970.
- Plunkett K, Hu J, Cohen LB. Labels can override perceptual categories in early infancy. *Cognition* 2008;106:665–81. [PubMed: 17512515]

- Prentice DA, Miller DT. Essentializing differences between women and men. *Psychol Sci* 2006;17:129–35. [PubMed: 16466420]
- Putnam, H. The meaning of ‘meaning’. In: Putnam, H., editor. *Mind, Language, and Reality*. Cambridge: Cambridge; 1975. p. 215–271.
- Quinn PC, Eimas PD. A reexamination of the perceptual-to-conceptual shift in mental representations. *Rev General Psychol* 1997;1:271–87.
- Rakison, DH.; Oakes, LM. *Early Category and Concept Development: Making Sense of the Blooming Buzzing Confusion*. New York: Oxford; 2003.
- Raman L, Winer GA. Children’s and adults’ understanding of illness: Evidence in support of a coexistence model. *Genetic, Social, General Psychol Monog* 2002;128:325–55.
- Rehder, B. Essentialism as a generative theory of classification. In: Gopnik, A.; Schultz, L., editors. *Causal Learning: Psychology, Philosophy, and Computation*. New York: Oxford; 2007. p. 190–207.
- Reynaert CC, Gelman SA. The influence of language form and conventional wording on judgments of illness. *J Psycholing Res* 2007;36:273–95.
- Rips, LJ. Similarity, typicality, and categorization. In: Vosniadou, S.; Ortony, A., editors. *Similarity and Analogical Reasoning*. New York: Cambridge; 1989.
- Rogoff, B. *The Cultural Nature of Human Development*. New York: Oxford; 2003.
- Rosengren, KS.; Johnson, CN.; Harris, PL. *Imagining the Impossible: Magical, Scientific, and Religious Thinking in Children*. New York: Cambridge University Press; 2000.
- Rosengren KS, Kalish CW, Hickling AK, Gelman SA. Exploring the relation between preschool children’s magical beliefs and causal thinking. *British J of Dev Psychol* 1994;12:69–82.
- Sabbagh MA, Baldwin DA. Learning words from knowledgeable versus ignorant speakers: Links between preschoolers’ theory of mind and semantic development. *Child Dev* 2001;72:1054–70. [PubMed: 11480934]
- Saffran JR, Aslin RN, Newport EL. Statistical learning by 8-month-old infants. *Science* 1996;274:1926–28. [PubMed: 8943209]
- Sandhofer CM, Smith LB, Luo J. Counting nouns and verbs in the input: Differential frequencies, different kinds of learning? *J Child Language* 2000;27:561–85.
- Scheibe KE, Erwin M. The computer as alter. *J Social Psychol* 1979;108:103–109.
- Schulz LE, Bonawitz EB, Griffiths TL. Can being scared cause tummy aches? Naive theories, ambiguous evidence, and preschoolers’ causal inferences. *Dev Psychol* 2007;43:1124–39. [PubMed: 17723040]
- Sera MD. To be or to be: Use and acquisition of the Spanish copulas. *J Mem Lang* 1992;31:408–27.
- Shtulman A. Qualitative differences between naïve and scientific theories of evolution. *Cogn Psychol* 2006;52:170–94. [PubMed: 16337619]
- Shtulman A, Carey S. Improbable or impossible? How children reason about the possibility of extraordinary events. *Child Dev* 2007;78:1015–32. [PubMed: 17517019]
- Siegal, M.; Peterson, CC. *Children’s Understanding of Biology and Health*. New York: Cambridge; 1999.
- Siegal M, Surian L. Conceptual development and conversational understanding. *Trends Cogn Sci* 2004;8:534–38. [PubMed: 15556022]
- Siegler RS, Crowley K. The microgenetic method: A direct means for studying cognitive development. *American Psychologist* 1991;46:606–20. [PubMed: 1952421]
- Skolnick, D.; Bloom, P. The intuitive cosmology of fictional worlds. In: Nichols, S., editor. *The Architecture of the Imagination: New Essays on Pretense, Possibility, and Fiction*. New York: Oxford; 2006. p. 73–86.
- Slobin, DI. From “thought and language” to “thinking for speaking”. In: Gumperz, JJ.; Levinson, SC., editors. *Rethinking Linguistic Relativity*. New York: Cambridge; 1996. p. 70–96.
- Slobin, DI. What makes manner of motion salient? Explorations in linguistic typology, discourse, and cognition. In: Hickmann, M.; Robert, S., editors. *Space in Languages: Linguistic Systems and Cognitive Categories*. Amsterdam: John Benjamins; 2006. p. 59–81.
- Sloutsky VM, Fisher AV. Induction and categorization in young children: A similarity-based model. *J Experimental Psychol: General* 2004;133:166–88.

- Smith, LB. *Becoming a Word Learner: A Debate on Lexical Acquisition*. New York: Oxford; 2000. Learning how to learn words: An associative crane; p. 51-80.
- Smith LB, Jones SS, Landau B. Naming in young children: A dumb attentional mechanism? *Cognition* 1996;60:143–71. [PubMed: 8811743]
- Sommerville JA, Woodward AL, Needham A. Action experience alters 3-month-old infants' perception of others' actions. *Cognition* 2005;96:B1–B11. [PubMed: 15833301]
- Sousa P, Atran S, Medin D. Essentialism and folkbiology: Evidence from Brazil. *J Cognit Culture* 2002;2:195–223.
- Sperber, D. *Explaining Culture: A Naturalistic Approach*. Oxford: Blackwell; 1996.
- Stevens M. The essentialist aspect of naive theories. *Cognition* 2000;74:149–75. [PubMed: 10617780]
- Subbotsky, E. Causal reasoning and behaviour in children and adults in a technologically advanced society: Are we still prepared to believe in magic and animism?. In: Mitchell, P.; Riggs, KJ., editors. *Children's Reasoning and the Mind*. England: Psychology Press; 2000. p. 327-347.
- Subbotsky E. Causal explanations of events by children and adults: Can alternative causal modes coexist in one mind? *British J Dev Psychol* 2001;19:23–45.
- Taylor, M. *Imaginary Companions and the Children who Create Them*. New York: Oxford; 1999.
- Tomasello, M.; Akhtar, N. *Becoming a Word Learner: A Debate on Lexical Acquisition*. New York: Oxford; 2000. Five questions for any theory of word learning; p. 179-186.
- Tomasello M, Kruger AC, Ratner HH. Cultural learning. *Behav Brain Sci* 1993;16:495–552.
- Troseth GL, DeLoache JS. The medium can obscure the message: Young children's understanding of video. *Child Dev* 1998;69:950–65. [PubMed: 9768480]
- Troseth GL, Saylor MM, Archer AH. Young children's use of video as a source of socially relevant information. *Child Dev* 2006;77:786–99. [PubMed: 16686801]
- Vosniadou, S. Universal and culture-specific properties of children's mental models of the earth. In: Hirschfeld, LA.; Gelman, SA., editors. *Mapping the Mind: Domain Specificity in Cognition and Culture*. New York: Cambridge; 1994. p. 412-430.
- Vygotsky, LS. *Thought and Language*. Cambridge, MA: MIT; 1934/1962.
- Vygotsky, LS. *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard; 1978.
- Walker SJ. Supernatural beliefs, natural kinds, and conceptual structure. *Mem Cognit* 1992;20:655–662.
- Walton GM, Banaji MR. Being what you say: The effect of essentialist linguistic labels on preferences. *Social Cognit* 2004;22:193–213.
- Waxman, SR. Everything had a name, and each name gave birth to a new thought: Links between early word learning and conceptual organization. In: Hall, DG.; Waxman, SR., editors. *Weaving a Lexicon*. Cambridge, MA: MIT; 2004. p. 295-335.
- Waxman, SR. Why is the concept 'living thing' so elusive? Concepts, languages, and the development of folkbiology. In: Ahn, W.; Goldstone, RL.; Love, BC.; Markman, AB.; Wolff, P., editors. *Categorization Inside and Outside the Laboratory: Essays in Honor of Douglas L Medin*. Washington, DC: American Psychological Association; 2005.
- Waxman, SR.; Lidz, JL. Early word learning. In: Kuhn, D.; Siegler, RS., editors. *Handbook of Child Psychology: Vol. 2, Cognition, Perception, and Language*. 6. Hoboken, NJ: Wiley; 2006. p. 299-335.
- Waxman SR, Markow DB. Words as invitations to form categories: Evidence from 12- to 13-month-old infants. *Cogn Psychol* 1995;29:257–302. [PubMed: 8556847]
- Waxman S, Medin D, Ross N. Folkbiological reasoning from a cross-cultural developmental perspective: Early essentialist notions are shaped by cultural beliefs. *Dev Psychol* 2007;43:294–308. [PubMed: 17352540]
- Wellman, HM. *The Child's Theory of Mind*. Cambridge, MA: MIT Press; 1990.
- Wellman, HM.; Gelman, SA. Knowledge acquisition in foundational domains. In: Kuhn, D.; Siegler, RS., editors. *Handbook of Child Psychology: Vol. 2, Cognition, Perception, and Language*. 6. Hoboken, NJ: Wiley; 1998. p. 523-73.
- Werker JF, Desjardins RN. Listening to speech in the 1st year of life: Experiential influences on phoneme perception. *Curr Dir Psychol Sci* 1995;4:76–81.

- Whiten A, Horner V, de Waal FBM. Conformity to cultural norms of tool use in chimpanzees. *Nature* 2005;437:737–40. [PubMed: 16113685]
- Whorf, BL. *Language, Thought, and Reality*. Cambridge, MA: MIT; 1956.
- Woolley JD. Thinking about fantasy: Are children fundamentally different thinkers and believers from adults? *Child Dev* 1997;68:991–1011. [PubMed: 9418217]
- Woolley JD, Boerger EA, Markman AB. A visit from the Candy Witch: Factors influencing young children's belief in a novel fantastical being. *Dev Sci* 2004;7:456–68. [PubMed: 15484594]
- Woolley JD, Browne CA, Boerger EA. Constraints on children's judgments of magical causality. *J Cognit Dev* 2006;7:253–77.
- Woolley JD, Cox V. Development of beliefs about storybook reality. *Dev Sci* 2007;10:681–693. [PubMed: 17683351]
- Woolley JD, Phelps KE, Davis DL, Mandell DJ. Where theories of mind meet magic: The development of children's beliefs about wishing. *Child Dev* 1999;70:571–87. [PubMed: 10368911]
- Woolley JD, Van Reet J. Effects of context on judgments concerning the reality status of novel entities. *Child Dev* 2006;77:1778–93. [PubMed: 17107460]
- Woolley JD, Wellman HM. Young children's understanding of realities, nonrealities, and appearances. *Child Dev* 1990;61:946–61. [PubMed: 2209198]
- Xu F. The role of language in acquiring object kind concepts in infancy. *Cognition* 2002;85:223–50. [PubMed: 12169410]
- Xu F, Tenenbaum JB. Word learning as Bayesian inference. *Psychol Rev* 2007;114:245–72. [PubMed: 17500627]
- Yamauchi T. Labeling bias and categorical induction: Generative aspects of category information. *J Exp Psychol: Learn Mem Cogn* 2005;31:538–53. [PubMed: 15910136]
- Yoshida H, Smith LB. Shifting ontological boundaries: how Japanese- and English-speaking children generalize names for animals and artifacts. *Dev Sci* 2003;6:1–34.
- Yoshida H, Smith LB. What's in view for toddlers? Using a head-camera to study visual experience. *Infancy*. in press.