PRESCHOOL CHILDREN'S INTERPRETATION OF OTHERS' HISTORY OF ACCURACY

by

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Abstract

Over the past 25 years, there has been tremendous interest in the development of children's ability to reason about others' mental states, or "theory of mind". Much research has explored children's understanding of situational cues that lead to knowledge, but only recently has research begun to assess children's understanding of person-specific differences in knowledge. A number of studies (Birch, Vauthier & Bloom, 2008; Jaswal & Neely, 2006; Koenig, Clément & Harris, 2004) have recently demonstrated that at least by age 3 children pay attention to others' history of accuracy and use it as a cue when deciding from whom to learn. However, the nature and scope of children's interpretations of other's prior accuracy remains unclear. Experiment 1 assessed whether 4- and 5-year-olds interpret prior accuracy as indicative of knowledge, as opposed to two other accounts that do not involve epistemic attributions. This experiment revealed that preschool children can revise their tendency to prefer to learn from a previously accurate informant over an inaccurate one when presented with evidence regarding each informant's current knowledge state. Experiment 2 investigated how broadly a person's history of accuracy influences children's subsequent inferences, and showed that 5-year-olds (but not 4-year-olds) use information about an individual's past accuracy to predict her knowledge in other related domains as well as her propensity for prosocial or antisocial behaviour. Overall, children's performance in these experiments suggests that both 4- and 5-year-olds interpret others' history of accuracy as indicative of knowledge; however, 4-year-olds make a more restricted attribution of knowledge while 5-year-olds make a more stable, trait-like attribution. These findings are discussed in terms of their implications for research on theory of mind and more broadly on children's social and cognitive development.

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I. Introduction

For young children, learning is an integral part of daily interactions with parents, peers and other social partners, who frequently convey information either incidentally or by direct teaching. However, children are not passive sponges absorbing all the information that others provide them. The efficacy of learning depends heavily on children's willingness to learn, and research suggests that this willingness varies depending on who is conveying the information and the potential credibility of the information they provide.

It is advantageous for children to be selective in their learning, because not all communication consists of accurate information. People joke, lie, take wild guesses, make honest mistakes, and sometimes lack relevant knowledge. Thus, children's learning will be more efficient if they notice and use cues that indicate whether their social partners are providing veridical information.

While it is possible for children to notice and use cues that are correlated with knowledge and credibility (e.g., age, prestige) without reasoning about the person's underlying mental states, early social-cognitive skills that allow them to reason about others' knowledge, intentions, motivations, and other mental states will undoubtedly facilitate such learning. The past 25 years have seen the emergence of an entire field of study dedicated to assessing children's (and adults') ability to reason about other people's mental states, or "theory of mind". Scientific interest in children's reasoning about others' minds is by no means recent and was pursued among others by early psychological theorists such as Jean Piaget (1929) and James Mark Baldwin (1895). However, the study of mental state reasoning spread after the publication of an article by Wimmer and Perner (1983) showing that young preschool children have difficulty ascribing to another individual a belief that is inconsistent with reality. Ever since, a plethora of studies have delineated the development of different aspects of theory of mind and the relation between these abilities and other aspects of social and cognitive development, but most of these studies focused on the understanding of temporary, situation-specific mental states.

Recently, however, some researchers have started investigating children's

understanding of more stable, person-specific differences in mental states. In this wave, a number of studies have demonstrated that preschoolers track their social partners' history of accuracy and use this cue when deciding from whom to learn (Birch, Vauthier & Bloom, 2008; Koenig, Clément & Harris, 2004; Koenig & Harris, 2005). In these experiments, children are presented with two informants, one who proceeds to accurately label familiar objects (such as a spoon) and the other who mislabels the same familiar objects. Afterwards, not only can children explicitly state which informant was right and which was wrong, but they also show a preference to learn new object labels from the informant who displayed accuracy. This preference to learn from a previously accurate speaker is present even when children are not asked first which informant is right or wrong, suggesting that preschoolers spontaneously make this accuracy assessment (Birch et al., 2008). However, this spontaneous inference may require children to witness multiple instances of accuracy or inaccuracy (Dunfield & Fitneva, 2007). One study found that 4-year-olds can predict that an accurate person is likely to remain accurate in the future, at least in a related domain of knowledge, and that an inaccurate person should likewise remain inaccurate (Koenig & Harris, 2005). The same study revealed that children also explicitly choose a previously accurate informant over a previously inaccurate one when they are given the option to ask for similar information from one of them, and prefer to ask the previously accurate informant if the other admitted ignorance instead of confidently proposing wrong labels for the objects.

Yet, precisely how children interpret their partners' history of accuracy (or inaccuracy) is still an open question. Past research on history of accuracy had more or less assumed that children paid attention to this history because they interpreted it as evidence of knowledge and preferred to trust a knowledgeable informant for future learning. This had however not been demonstrated convincingly, and some have questioned this interpretation (Birch et al., 2008; Nurmsoo & Robinson, in press).

Children could be making one of several possible interpretations. First, it is possible that children are simply attending to the person's "output" without inferring any psychological states driving the accurate or inaccurate output. In this "non-psychological" account, past accuracy is interpreted as it would be for any mechanical or physical object: Children begin to ignore a person who continually makes mistakes in

much the same way as they become uninterested in a toy that continually fails to work the way they expect. A second possibility is that children view a person's past inaccuracy as indicative of that person being uncooperative or deceptive. Under this "uncooperative account", the child's interpretation of the person's past accuracy is psychological in nature but does not involve an epistemic attribution. Here the child is making a more global attribution that this person is ill-disposed. Under both of these aforementioned accounts, children would be unlikely to trust information provided by a previously inaccurate person regardless of the type of information in question and even if that person definitely has access to credible information.

A third possibility is that children consider previous accuracy to be indicative of knowledge. This interpretation can be broken down into two separate accounts depending on the scope of the attribution of knowledge. First, children may interpret past accuracy as indicative of knowledge in one circumscribed situation or range of situations, and therefore largely irrelevant for broader knowledge assessment. Under this "restricted epistemic" account, children may infer, for example, that a speaker who consistently mislabels objects is not knowledgeable about words, and thus the speaker's prior inaccuracy is relevant when making inferences about their future knowledge of words but not indicative of their knowledge in other domains. There is evidence that at least by 4 years of age children generalise a speaker's past knowledge in one domain (functions of common objects) to another, closely related domain (words for common objects) and vice versa (Birch & Vauthier, in prep.; Koenig & Harris, 2005), but no research has assessed knowledge generalisation from prior accuracy across more dissimilar domains.

Alternatively, children could infer that a speaker who consistently mislabels objects is not as "smart" as another speaker who labels the same objects correctly. Under this "global epistemic" interpretation, they would likely trust the previously accurate person more across a number of domains and contexts but, crucially, would also consider other situational cues to decide who is knowledgeable in a given situation. For instance, regardless of how credible someone has been in the past, if that person has not witnessed where I put my shoes he is unlikely to know that information.

Determining the nature and scope of the interpretation children make of their social partners' prior accuracy will contribute to a better understanding of both their

social and epistemic reasoning; it also has important implications for children's social learning and development. The objective of the experiments described below was to determine which of the accounts outlined above best represents preschool children's interpretation of others' past accuracy by investigating how forgiving children are of past inaccuracy and the extent of its influence on their subsequent judgments. Before describing these studies, I will review the large body of research that has assessed what exactly young children know about knowledge.

II. Literature Review

2.1 Children's ability to use different cues to knowledge

A person's knowledge state can be inferred from both situational and person-specific cues. Situational cues are most often signs that the person has had access to key information. These cues are person-independent and restricted to a given situation, providing no information about a person's knowledge state if the situation changes. These knowledge cues are causal rather than correlational: They are directly informative about a person's acquisition of relevant knowledge. Such cues include access to information directly through the senses, indirectly by means of inference, or via third-person testimony. For instance, someone who has looked at a present before it was gift-wrapped or has been told what the present contains possesses knowledge about the identity of the present; conversely, someone who has not had access to any of these modes of information will not know what the gift-wrapped box contains.

In the absence of any data regarding the acquisition of information, one must use heuristics to decide whether the informant should be trusted. These heuristics are often based upon characteristics of the individual that remain constant across situations, such as social status, past accuracy, age and expertise. For example, a physician is more knowledgeable about human health than a car mechanic, and an adult is more knowledgeable than a 3-year-old child about a variety of topics. These cues are by no means perfectly indicative of knowledge: it is possible, for example, for a car mechanic to be extremely informed about a personally relevant aspect of human health, and children often know much more than adults about toys, children's television characters, school friends, and so on. However, these are cues that are normally correlated with knowledge, and when limited information about individuals' access to information is provided they allow one to make inferences about individuals' knowledge that have a reasonable probability of being accurate.

Fortunately, even very young children take a number of knowledge cues into account when learning. Let's first consider situational knowledge cues. Sensitivity to another person's information access begins very early in life, and children rapidly learn to use information access cues in their interactions with others, although not without

displaying some striking weaknesses and errors. Children appear most competent at understanding visual access. Precursors to this ability can in fact be observed during the first few months of life. Infants are remarkably sensitive to other people's gaze direction. For instance, gaze-following appears as early as 3 months of age (D'Entremont, 1997). In the second year of life, infants' sensitivity to the precise direction of the eyes improves, and they can take into account the presence of barriers to visual access. By 12 months of age, infants are more likely to follow the "gaze" of someone with eyes open than someone with eyes closed, and, at 14 months, are less likely to follow the gaze of a person wearing a blindfold than one with unobstructed sight (Brooks & Meltzoff, 2002).

Above and beyond merely attending to eye gaze direction, infants in their second and third years can use information about visual access to determine an agent's perspective. For instance, children 2 years and older can infer that another person is seeing something different than what they themselves see (Masangkay et al., 1974). Infants can also keep track of an agent's presence during critical events and use this information to aid perspective-taking. Fifteen-month-olds look longer at an agent who grasps for an object at the correct location than at the incorrect one if the object switched location while that agent was out of sight (Onishi & Baillargeon, 2005). Similarly, 2- and 3-year-old children are more likely to indicate the location of a toy or a tool to an adult if the adult was absent when the object of interest was hidden, suggesting that they appreciate, at least implicitly, that someone who was absent cannot know the location of the object (Nayer & Graham, 2006; O'Neill, 1996; Viranyi, Topal, Miklosi & Csanyi, 2006). Even 12-month-olds appear to keep track of a person's visual access when assessing that person's goals (Luo & Baillargeon, 2007), and 16-month-olds can take another individual's visual perspective into account when predicting their actions (Luo & Beck, 2008). These findings do not, in themselves, indicate that infants fully appreciate how visual access leads to knowledge. However, this early sensitivity may set the stage for the development of this understanding in the subsequent years.

Preschool children are quite savvy about the relation between sight and knowledge. Even 3-year-olds can correctly attribute knowledge to a protagonist who has had relevant visual access and attribute ignorance when the protagonist has had no visual

access (Pillow, 1989; Pratt & Bryant, 1990).[1] Diverse experimental paradigms have revealed that, across many types of situations, young children possess the understanding that looking leads to knowing. For instance, preschool children who have not had visual access to the contents of a box tend to modify their guess about the box's contents so that it agrees with the statements of an adult who has had visual access to the box's contents (Robinson, Champion & Mitchell, 1999). Vision as a source of knowledge is relatively well-understood by preschoolers (see Robinson, 2000, for a review), at least in comparison to their understanding of other sensory modalities as sources of knowledge (O'Neill & Chong, 2001). Children between 3- and 5-years-old who are relatively competent at understanding the information gained by visual access underestimate the informative value of touch (O'Neill, Astington & Flavell, 1992). Although the understanding of the relationship between sight and knowledge is present early on, it continues to improve during the early school years (Ruffman & Olson, 1989).

In the absence of direct cues to information access, other indices of potential knowledge are available to children. Knowledge, or at least the ability to provide information that is both accurate and socially sanctioned, is correlated with a number of person-specific attributes, such as past accuracy, age, expertise, and social conformity.

The investigation of children's attribution of knowledge as a person-specific, temporally-stable trait has not received as much attention in research as children's sensitivity to information access. This may be partly due to findings indicating that young children tend not to make trait-like attributions until mid-childhood (e.g. Kalish, 2002; Rholes & Ruble, 1984). However, even 4-year-olds can, in some circumstances, attribute ability as a trait (Heyman, Glee & Giles, 2003), especially when evidence of behavioural regularity is overwhelming (Boseovski & Lee, 2006).

As the following literature review will demonstrate, children are remarkably sensitive to some person-specific indicators of knowledge and use them spontaneously in learning situations. Age and expertise are examples of such indicators. Age tends to correlate with knowledge and accuracy, and research suggests children notice this correlation and make assessments of knowledge based on age in some situations (e.g.

[1] There is ample research indicating that 3-year-olds have difficulty ascribing a false belief to a misinformed protagonist (e.g. Wellman, Cross & Watson, 2001). Ascribing ignorance seems somewhat easier for them.

Jaswal & Neely, 2006; Taylor, Cartwright & Bowden, 1991). For instance, Jaswal and Neely (2006) presented 3- and 4-year-olds with both an adult and a child protagonist, each labelling a series of unfamiliar objects with different labels. When asked for the name of these objects, children were more likely to repeat the labels proposed by the adult than the child, suggesting that they believe adults to be better informants than children as a general rule.

It has also been demonstrated that 3- to 5-year-olds have some understanding, albeit fairly rudimentary, of domain-specific expertise. They can infer whether someone should ask domain-relevant questions to a doctor or a car mechanic, but not to a specialist whose domain of expertise is less stereotyped, such as an "eagle expert" (Lutz & Keil, 2002). Children may also use conformity as a cue to decide whom to learn from: They are more likely to accept labels from a person whose previous labels elicited head nods and smiles than from someone whose information has elicited head shaking and frowns (Fusaro & Harris, 2007).

So far, the evidence reviewed suggests that preschool children can use both person-specific and situational cues in isolation to correctly assess another person's knowledge, albeit not without some limitations. However, in real life (i.e., outside of the laboratory), children will rarely be faced with isolated cues, but will often have to choose from an array of potential knowledge indicators. Often, these different indicators converge, yielding the same conclusion and complementing each other. For example, a person who has not had relevant information access will probably provide a guess in a manner suggesting lack of confidence and is likely to produce an inaccurate statement. In such a case, there is no ambiguity in whether to trust the person or not, and the child could use any of the cues that are available (e.g., lack of visual access, inaccurate answers, lack of confidence) to arrive at the same conclusion. However, in some situations, cues conflict. Children can be faced with conflicting person-specific cues, such as in the case of an adult who is labelled an "expert" on a topic and yet has made several mistakes in the past. Children could also encounter conflicting situational cues, such as in a situation where a person has limited visual information but adequate tactile information. In some situations, person-specific and situation-specific cues may also conflict, for instance if someone has a history of inaccuracy and yet possesses relevant

perceptual information.

What happens when children have a choice of cues to derive their evaluations of knowledge and accuracy? Most past research regarding children's handling of multiple or conflicting knowledge cues presented them with multiple situational indicators of knowledge. This research indicates that, at least early in development, children may prefer some cues that are more salient or easier to grasp. Young children appear to put more weight on visual access than on other situational cues; if anything, they are too willing to attribute knowledge strictly based on visual access, therefore committing systematic errors when visual access is uninformative or when other cues provide better information. In one study, young preschool children who had seen a video displaying both visual and audio information about a protagonist attributed to their mother knowledge from both the visual and audio portion even if their mother had seen the video with the sound off (Mossler, Marvin & Greenberg, 1976). This specific error is mostly observed in 2- and 3-year-olds, but older children commit equally striking errors. Until well into elementary school, children will believe that someone who sees a very small and uninformative part of an image (for instance the tip of the tail of an elephant) has enough information to determine the identity of the entire picture (Taylor, 1988; Taylor et al., 1991). Similarly, preschoolers tend to attribute knowledge systematically to a protagonist who has visual access even when the knowledge (e.g., knowledge of an object's texture) is more appropriately acquired by feeling (O'Neill et al., 1992). Conversely, children ages 4 to 7 refuse to acknowledge that someone who has not had visual access to the contents of a box may nevertheless correctly infer the contents when provided with unambiguous verbal information (Ruffman, 1996).

The tendency to prefer visual access over other modes of information gathering is not always flawed, however. It has been shown that children will trust the evidence of their own eyes rather than believe a contradictory statement from an informant, however accurate the informant was in the past (Clément, Koenig & Harris, 2004). Preschoolers also expect others to trust visually-acquired information over testimony. Indeed, one study demonstrated that children predict that if a person looks inside a container and states that it contains orange juice, that person is unlikely to change their mind when another protagonist insists that the container is filled with milk; however, children

understand that, if the person has not first looked inside the container, he or she is likely to believe the utterance that it contains milk (Mitchell, Robinson, Nye & Isaacs, 1997; Robinson, Mitchell & Nye, 1995).

There are also studies showing that children can use person-specific cues in a flexible manner when assessing knowledge. Although preschoolers can use age as a cue to knowledge, they appropriately disregard age if information is available about history of accuracy or expertise (Jaswal & Neely, 2006; VanderBorght & Jaswal, 2007). Similarly, 3- to 5-year-olds can navigate through conflicting cues of age, expertise, and familiarity in a quite sophisticated manner: While children generally deem that adults are more knowledgeable than children, they will trust a child over an adult for information that is generally more familiar to children, such as the function of toys (VanderBorght & Jaswal, 2007).

Data on children's use of person-specific cues in conflict with information-access cues are scarce. If children really do understand which cues are most relevant in different contexts, they should prefer cues about information access whenever these are available because these cues are more directly indicative of knowledge than person-specific cues which are merely correlated with knowledge. The literature that does exist suggests that young children indeed pay more attention to information access than person-specific attributes when given the choice. For example, although children generally believe that adults are more knowledgeable than children, they do not believe that an adult gains more knowledge than a child from the same amount of visual access to a picture (Taylor et al., 1991). Children also disregard age as a correlate of knowledge when it directly conflicts with perceptual access (Pillow & Weed, 1997).

Of specific interest to the present research is how children weigh a person's past accuracy when it is in conflict with direct visual access. Such a situation provides a nice test of children's interpretation of others' prior accuracy. In contrast to other person-specific cues to knowledge, prior accuracy has a certain evaluative aspect, in that a previously accurate person is 'right' and provides good output, while an inaccurate one is 'wrong' and provides bad output. Children's global impression of partners may be strongly influenced by such evaluative information. If children make a very global good / bad attribution when witnessing evidence of accuracy, or if they believe that an

inaccurate speaker is being uncooperative, then they should be unlikely to trust a previously inaccurate speaker regardless of evidence about current information access. In contrast, if children consider past accuracy as a useful indicator of knowledge as a trait, then they should keep information about past accuracy in mind for future learning situations but be willing to revise their judgment about a previously accurate or inaccurate speaker when better (i.e., causal) indicators become available.

2.2 Scope of children's attributions

If children's behaviour in the situation described above suggests that they indeed interpret past accuracy as an indicator of knowledge, there remains the issue of how broadly children ascribe such knowledge and whether their attributions are limited to knowledge or extend to other evaluative judgments as well.

Do young children attribute traits such as "smart" or "intelligent" to their social partners? There is evidence that children infer that individuals knowledgeable in one domain are likely to be knowledgeable in other related domains. As mentioned above, findings from Birch and Vauthier (in prep.) and Koenig and Harris (2005) suggest that 4-year-olds faced with an informant that is knowledgeable about one of either object labels or object functions infer that the same informant will be knowledgeable in both domains. Similarly, Taylor et al. (1994) have found that 4-year-olds (but not 5-year-olds) faced with a domain-specific expert are likely to infer, in the absence of any other information, that this "expert" is more knowledgeable than the norm in domains unrelated to their expertise field, by expecting for instance a child labelled an "animal expert" to also know how a carburetor works.

Generalizing knowledge across fields does not in itself constitute a trait attribution. The capacity of young children to make stable trait-like attributions and to predict future behaviour based on past behaviour has been questioned by a number of studies. It has been demonstrated many times that preschool children are less likely to attribute consistent traits than older children and adults. Indeed, children younger than 9 years old do not make consistent predictions about a person's future behaviour if they

witness a single instance of nice or mean behaviour from that person[2] (Rholes & Ruble, 1984). Overall, the tendency to predict behavioural consistency increases from early childhood to school age (Kalish, 2002). However, even in children of elementary school age, the propensity to make trait attributions differs by domain and valence, emerging a few years earlier in the social domain than in the academic domain and earlier for positive than negative behaviour (Benenson & Dweck, 1986).

There are indications, though, that children as young as 4 years old expect consistency over time for certain psychological traits such as "grumpy" or "mean" (Yuill, 1997), and that, given 5 repeated instances of positive or negative behaviour instead of a single instance, even 3-year-olds will predict similar behaviour in the future (Boseovski & Lee, 2006). Even in infancy, precursors of these expectations can be observed: 6- and 10-month-olds are more likely to reach for an agent that has displayed helping behaviour towards a third party than to another agent that has hindered the same third party (Hamlin, Wynn & Bloom, 2007). Such findings suggest that, given sufficient evidence, young children should be able to attribute a trait such as intelligence or ability to social partners.

If children do attribute such a trait based on evidence of accuracy, one can expect their evaluation of their partners to be influenced by this attribution outside of strict assessments of intelligence or credibility. In children's daily lives, learning is not an isolated situation in which general socially-relevant processes are suspended. Children bring to a learning situation their expectations from other aspects of their lives, and take away more than just additional knowledge. It is therefore probable that children do not draw strict boundaries between their social partners' knowledge and their other attributes, such as their personality or characteristics and possibly even their talents at various activities (e.g., sports, arts, etc.).

Different aspects of the relationships between children and their social partners are likely to both influence and be influenced by children's perception of their social

[2]It is worth noting that young children's reticence to attribute traits based on limited behavioural evidence is not objectively inaccurate. In fact, adults are excessively prone to trait attributions, often failing to take into account situational determinants of behaviour, a well-known social cognition bias called the "fundamental attribution error" (Ross, 1977). It is interesting that this error appears to emerge relatively late in development; however, our main concern here is that young children are less prone to trait attribution than older children and adults, whether or not such attributions correspond to reality.

partner's knowledge. Specifically, trust and liking may moderate how willing children will be to attend to information provided by a social partner; in turn, children's perception of a social partner's knowledge may colour their perception of, and attitude towards, this individual. Being smart is a desirable trait, and the perceived presence or absence of such a trait may affect whether an individual is perceived in a generally positive or negative light.

A well-known finding in adult social psychological literature is that people tend to have more positive expectations towards those who possess desirable attributes. The aspect of this "halo effect" that has been most studied is positive prejudice towards attractive individuals, an effect that can be observed quite reliably in adults (e.g., Dion, Berscheid & Walster, 1972), school-age children (Rumsey, Bull & Gahagan, 1986), and preschoolers (Dion, 1973; Ramsey & Langlois, 2002). There are also findings indicating that other traits can cause a similar halo effect. Adults' perception of the attractiveness of a target is influenced by that target's personality (Gross & Crofton, 1977), and teenagers' perception of attractiveness is also influenced by perceptions of ability (Felson & Bohrnstedt, 1979).

Studies have shown that 4- and 5-year-olds generalise from positive or negative psychological attributes to other valued traits. When read a story about either familiar fairytale characters or novel characters displaying consistent moral goodness or evilness, children predicted that "good" characters would be more likely than "evil" ones to display future prosocial behaviour, and in addition, although to a lesser extent, expected greater intellectual and athletic ability in the "good" character (Cain, Heyman & Walker, 1997). Conversely, just like adults, preschool- and school-age children tend to display negative prejudice towards people perceived as lacking intelligence or ability, expecting them to display less desirable traits (see for instance Nabors & Keyes, 1995; Nowicki, 2006). It is therefore possible that, if children make attributions of knowledge based on a person's prior accuracy or inaccuracy, they will also tend to make other positive or negative evaluations based on this attribute. Yet, precisely which kinds of attributions preschoolers will make based upon someone's brief history of accurately or inaccurately labelling common objects remains an open question.

The following experiments aimed to clarify the nature and scope of the

interpretation that children make about others' history of accuracy. Experiment 1 addresses the nature of this interpretation, teasing apart a knowledge-based interpretation from a purely behaviourist, non-psychological account or an interpretation based on interpersonal cooperation. Experiment 2 assesses the scope of children's interpretation, delineating how broadly an individual's past accuracy influences children's subsequent expectations of different individuals.

III. Experiment 1

3.1 Method

3.1.1 Participants

A sample of 32 4- and 5-year-olds (*M* age = 4,11; age range = 4,1 – 5,10; 16 males and 16 females) was recruited from the Greater Vancouver Area, through a database of families having expressed an interest in research and through local daycares. These children had not participated in any pilot version of this study. Parent report of language exposure and family socioeconomic status (SES) was collected for a portion of this sample: the 15 children with language data available were reportedly exposed to English on average 91% of the time, and the 14 children with SES data came from families with an estimated average income near $102,500. Ethnicity data was not systematically collected, however the very large majority of children in the Greater Vancouver Area are of Caucasian or East Asian background, and casual observation suggests that this was true for our sample as well. No monetary incentives were given for participation in either the present study or the following one, but children were given a small present at the end of the laboratory visit (e.g., a t-shirt, book, and/or stickers) and parents were reimbursed for parking fees.

3.1.2 Material

Two female child-like hand puppets ("Charlotte" and "Lucy") were used as informants in this study[3]. The 4 test trials each involved a different colourful box containing an unfamiliar object, and a pair of pictures of unfamiliar objects (the one located in the box and a different object). Previous studies using these pairs of unfamiliar objects had not found any systematic preference in children of this age for either member of the object pairs (Birch et al., 2008; Birch & Vauthier, in prep.). Pictures of the unfamiliar objects can be found in Appendix A.

[3] History of accuracy paradigms have used both real people and puppets as informants. While no study has systematically investigated whether this variation has an impact on the results, other research has found that preschool children appear willing to attribute mental states to puppets, at least for the purposes of experimental situations. In fact, a meta-analysis by Wellman et al. (2001) reviewing several hundred false belief tasks did not find a significant difference in mental state attribution between studies using puppets or dolls as protagonists and studies with real people, live or videotaped.

3.1.3 Procedure

A single female experimenter tested all participants. This experimenter first introduced the child to the two puppets. Participants were exposed to a history phase, followed by 4 experimental trials each consisting of a visual access phase and a test question. An example of the experimental script is found in Appendix B, and the certificate of ethical approval for the procedure is found in Appendix C.

The history phase parallels that which was used in the literature on children's sensitivity to prior accuracy (e.g., Jaswal & Neely, 2006; Koenig & Harris, 2005), but was specifically modelled after Birch et al. (2008). 4 common objects (a toy basketball, plastic horse, baby spoon, and car) were placed in front of the child. Each puppet in turn proceeded to label all 4 objects; one of them labelled all objects correctly, while the other labelled all objects incorrectly (calling the ball "a book", the horse "a cat", and so on). The puppets always interacted with the objects in the same order, but the identity of the accurate and inaccurate puppets was counterbalanced across participants.

After the history phase was the first experimental trial. The visual access phase was modelled after Pillow (1989), with some modifications in order to better address our research questions. The experimenter put one box in front of the child and said that the box contained one toy. She then put pictures of two common objects in front of the child (alternating the side of the pictures between children), saying that one of the two pictures depicted the object inside the box. Next, the experimenter brought out each puppet in turn and had one interact with the box in a way that leads to information acquisition (i.e., looking in the box) and the other interact with the box in an uninformative way (i.e. standing on the box). Each puppet was then asked what the box contained, and they each pointed to a different picture. The child was then asked to indicate what s/he thought was inside the box by pointing to one of the pictures him/herself. On the subsequent experimental trial, this series of actions was repeated but the puppet who had looked inside the box on the first trial stood on the box on the second trial and vice versa. 4 such trials were conducted for each child, alternating the identity of the informed puppet each time so that the previously accurate puppet was the most informed about the box's contents on two trials and the least informed on two trials.

At the end, there were control questions regarding both the history phase and the

actions of the puppets on the last trial. One of these questions was used to determine whether or not to retain an individual child's data in the following experiment. Overall, the rate of correct responding on the control questions was good, with a mean of 4.75 correct answers out of 6 control questions (*SD* = 1.30). Participants were administered Experiment 2 (described later) immediately at the end of the present procedure. Only at the very end of both experiments were they allowed to look inside the boxes.

3.2 Results

For each child, two scores were calculated: the percentage of trials in which the child agreed with the puppet who looked when this puppet was accurate in the history phase, and the percentage of trials in which the child agreed with the puppet who looked when this puppet was previously inaccurate. The results are summarised in Table 1. Preliminary analyses did not reveal any differences based on age, gender, or any of the counterbalanced variables; results were therefore analysed as a whole. One-sample t-tests indicated that children were more likely than chance to choose the same objects as the puppet who looked, both when that puppet was previously accurate (*M* = 75.00%, *SD* = 31.11%, $t(31) = 4.55$, $p < .001$) and when that puppet was previously inaccurate (*M* = 71.88%, *SD* = 35.81%, $t(31) = 3.46$, $p = .002$). A paired-samples *t*-test indicated that there was no difference between children's responses in these two types of trials ($t(31) = .44$, $p = .662$, ns) [4].

3.3 Discussion

The present results confirm that children understand that visual access to information is a better cue to one's knowledge of that information than one's past accuracy when both cues are available. These results support the epistemic account of children's interpretation of history of accuracy: Children do not weigh previous inaccuracy as heavily as they do causal, situation-specific knowledge cues, an outcome which cannot easily be predicted by the non-psychological or uncooperative accounts

[4] Given that data obtained in the present experiment and the one that follows are not of continuous nature and that assumptions such as normality are very likely to be violated, there may be concern that using *t*-tests or ANOVAs is unwarranted. However, it has been demonstrated that, unless degrees of freedom are less than 20 or the proportions are more extreme than an 80-20 split, these tests yield results that are equivalent to non-parametric statistics (see for instance Lunney, 1970; Hsu & Feldt, 1969).

outlined above. If children's interpretation were best described by either of these accounts, children should have relied strictly on history of accuracy and not on visual access. Indeed, under these accounts, the knowledge state of the informants is irrelevant and willingness to learn from an informant is not dependent on access to information, but rather on permanent characteristics of the informants (i.e., being "uncooperative" or providing "bad output"). Instead, children in this experiment demonstrated that their willingness to learn from an informant is dependent on the perceived knowledge state of the informants that they are exposed to.

It is of course possible that these results were obtained for a much less interesting reason, namely that children forget the history phase by the time the test trials are administered. I deem this unlikely for several reasons. First, numerous studies mentioned above have used similar paradigms with children of this age group and younger, and found that children had no problem remembering individuals' accuracy. In fact, one study found that children still prefer to learn from a previously accurate informant over an inaccurate informant 1 full week after witnessing the difference in accuracy (Corriveau & Harris, 2007). Second, after the test phase, children were asked to remember which puppet had correctly labelled the objects in the history phase, and only 3 of the 32 participants failed this question. Third, results from Experiment 2 (discussed below) clearly show that, at least by 5 years, children take the history of accuracy into account to form expectations about each puppet's characteristics. It therefore seems more plausible that children remember the informants' history of accuracy but do not take it into account because they consider it to be less relevant to the informants' current knowledge state than the informants' visual access to the contents of the boxes.

Still, these results do not address the more subtle distinction between a restricted interpretation of knowledge that is limited to certain circumscribed situations and an attribution of knowledge as a trait that is relevant for the evaluation of the person. The next study aimed to address this second question.

IV. Experiment 2

4.1 Method

4.1.1 Participants

A sample of 22 4-year-olds (*M* age = 4,6; age range = 4,1 – 4,11; 12 males and 10 females) and 26 5-year-olds (*M* age = 5,3; age range = 5,0 – 5,10; 13 males and 13 females) participated in Experiment 2. Of these participants, 28 children participated in the present experiment after Experiment 1, and the remaining 20 children were administered this experiment at the end of a pilot version of Experiment 1 with an identical history phase[5]. An additional 4 children were administered the present experiment, but their data were not included in the analyses because they failed to remember which informant was accurate at the end of Experiment 1 ($N = 3$) or because of procedural changes ($N = 1$). Parent report of language exposure and family socioeconomic status (SES) was collected for a portion of this sample: the 23 children with language data available were reportedly exposed to English on average 91% of the time, and the 20 children with SES data came from families with an estimated average income near $105,000. Ethnicity data was not systematically collected, however the very large majority of children in the Greater Vancouver Area are of Caucasian or East Asian background, and casual observation suggests that this was true for our sample as well. No monetary incentives were given for participation in either the present study or the following one, but children were given a small present at the end of the laboratory visit (e.g., a t-shirt, book, and/or stickers) and parents were reimbursed for parking fees.

4.1.2 Material

Children were presented with a picture divided into quadrants. In two of the quadrants, there were pictures of each of the puppets used in Experiment 1; in one quadrant was a picture of both puppets; and the fourth quadrant was blank. A series of 24 questions were administered to the participants. These questions came from six different categories: knowledge of word labels, knowledge of facts, talents, prosocial/antisocial behaviour, and two categories of distracters (preferences and possessions, and knowledge

[5] There was no significant difference in performance between these two groups of children ($F(1,46) = .024$, $p = .879$, ns).

gained from information access[6]). Two versions of the list of questions were constructed. Each question item was formulated in a positive way (e.g. "Who has a cat?") in one version, and in a negative way (e.g. "Who doesn't have a cat?") in the other version. Both versions of the list included two items in each category framed in a negative way and two items framed in a positive way. The order of the questions was constant for both lists. The lists of questions can be found in Appendix D, and the certificate of ethical approval for the procedure is found in Appendix C.

4.1.3 Procedure

After the end of Experiment 1 (in which the history phase was administered as described in § 3.1.3), children were asked to "guess some things" about the puppets. In a warm-up phase, the experimenter demonstrated how to use the response sheet for the children with a few initial items relating to the puppets' appearance (e.g., "Who has red shoes?" "Who is a boy?"). She explained that, if the answer to the question is only Charlotte, to point to Charlotte's picture; if the answer is only Lucy, to point to Lucy's picture; if the item applies to both puppets, to point to the picture with both puppets; and if the item applies to none of the puppets, to point to the blank quadrant. One demonstration was given for the one-puppet quadrants, and two examples for the "both" and the "none" quadrants, because these were expected to be slightly harder for children to grasp. Any mistakes made during the warm-up phase were corrected and feedback was provided (i.e. "Actually, both Charlotte and Lucy have red shoes, so you should point to both of them, like this"). The 24 experimental questions were then administered.

4.2 Results

All items that are positive in valence and attributed to the previously accurate puppet, as well as all items that are negative in valence and attributed to the inaccurate puppet were scored as 1. Items that are negative in valence and attributed to the previously accurate puppet, as well as items that are positive in valence and attributed to

[6] The category of "knowledge gained from information access" was included for two reasons. First, these questions included the word "know" just like the "word knowledge" and "fact knowledge" questions. If children only paid attention to the superficial wording of the questions, there should be no difference in performance between these categories. Second, knowledge that is gained from information access should not be person-dependent, and therefore we expected that, consistent with Experiment 1, children would not to ascribe this type of knowledge based on a person-specific characteristic such as history of accuracy.

the inaccurate puppet, were scored as -1. Items attributed to both puppets or neither puppet were scored as 0. A score between -4 and 4 was thus calculated for each of the six question types. For example, a score of -4 for word knowledge meant that the participant always attributed word knowledge to the previously inaccurate puppet, while a score of 4 meant that the participant always attributed word knowledge to the previously accurate puppet.

The results are summarised in Table 1. Preliminary analyses ruled out any gender, puppet, list or study effects, but revealed a main effect of age. This variable was therefore kept in the main analysis. A 6 (category) × 2 (age) mixed-design ANOVA with category as a within subject variable and age as a between-subject variable was performed on the resulting scores. This ANOVA revealed main effects of category (with Hyunh-Feldt correction for sphericity: $F(4.6, 213.5) = 2.37$, $p = .045$) and age, $F(1,46) = 4.18$, $p = .047$. The interaction between age and category was not significant, $F(4.6, 213.5) = 1.30$, $p = .269$, ns. Planned one-sample t-tests were conducted comparing each category to chance (0 on a scale between -4 and 4). These comparisons were done separately with 4- and 5-year-olds given the significant age effect, and a Sidak-Bonferroni correction for multiple comparisons was applied[7]. For 4-year-olds, none of the categories were different from chance (all p values >.10). For 5-year-olds, children were more likely to attribute word knowledge ($t(25) = 3.70$, p=.001), fact knowledge ($t(25) = 3.22$, p=.004) and prosocial/antisocial behaviour ($t(25) = 3.51$, p=.002) to the previously accurate puppet, but not talents, and as expected not for either distracter category (all p values >.05).

A secondary hypothesis for this study was that children would be more likely to generalise evidence about knowledge to other types of knowledge rather than to abilities and traits. In order to explore this, I created a combined "knowledge" score by adding scores for word knowledge and fact knowledge, and a combined '"other evaluative attributes" score by adding the scores for talents and prosocial/antisocial behaviour. I then conducted paired-samples t-tests to compare these combined scores. The difference between knowledge and other evaluative attributes was not significant either with both age groups combined ($t(47) = 1.64$, $p = .108$, ns) or in individual age groups (for 4-year-

[7] The critical α was set at .004 for the family-wise Type I error rate to be less than .05 across all 12 comparisons to chance.

olds: $t(21) = .57$, $p = .578$, ns; for 5-year-olds: $t(25) = 1.63$, $p = .115$, ns). This failure to find significance may be due to lack of experimental power, as the observed mean differences were quite small in magnitude (for 4-year-olds: Cohen's $d = .12$; for 5-year-olds: Cohen's $d = .28$).

4.3 Discussion

The obtained results suggest that 4- and 5-year-olds hold different expectations about an individual's knowledge and behaviour following a history of accuracy or inaccuracy. While there is no evidence that 4-year-olds expect this accuracy to be in any way relevant to future behaviour, 5-year-olds expect a knowledgeable informant to continue to be knowledgeable in more than one domain, and are influenced in their predictions of individuals' prosocial or antisocial dispositions.

The age trend that is found in this experiment is consistent with the body of literature on trait attribution in childhood where, in general, younger children are less prone to predict behaviour to remain stable across time and situations. Importantly, though, 4-year-olds have been shown in several studies to be capable of such trait attributions. It is not clear why they do not do so in the present study. I will discuss this point further below.

One may remark that, even for 5-year-olds, the amount of bias in favour of the previously accurate puppet was fairly small in magnitude, with at most an average of 1.58 on a scale going from -4 to 4 (where 0 equals chance). This small magnitude can, however, seem very different in light of the experimental design used. The informants were puppets and not real human beings; children were asked to infer attributes on which they had no information, and for which there was no right or wrong answer; they were encouraged to guess if they did not know the answers; they had the option of picking none or both puppets; they were given two examples of the "both" and "none" options in the training phase rather than a single example to make sure that they understood these options; and the "both" and "none" quadrants were physically closer to the children than the individual puppets' quadrants. All these factors may have increased the rate of chance responding, and therefore it is understandable that the observed effects are quite small.

It is interesting to note, actually, that had the mean scores been very close to 4,

we might have been concerned that children were either putting too much weight on past accuracy or particularly good at picking up on demand characteristics of the experiment. After all, even adults would acknowledge that prior accuracy is only a partially useful indication of future knowledge and by no means a perfect indicator. It is possible that children's low mean ratings reflect a tacit awareness of this, and that, were better indicators of future knowledge provided, the mean ratings would be much higher.

V. General Discussion

In summary, the results of the experiments described above clarify previous research indicating that preschool children pay attention to history of accuracy and reveal an interesting developmental trajectory in the types of judgments children make based upon an informant's prior accuracy.

Although there was no doubt in past research that preschool children notice and pay attention to the prior accuracy of informants in a learning situation, it was uncertain whether children were interpreting this prior accuracy as an indicator of each informant's level of knowledge. The results of the first experiment are consistent with such a knowledge-based interpretation and in fact appear to rule out a non-psychological interpretation or a cooperation-based account, both of which predict a strategy of indiscriminately distrusting the previously inaccurate informant. Both 4- and 5-year-olds were willing to disregard past accuracy when presented with new and more causal information about knowledge acquisition, and did not show any reticence to learn from an individual who had demonstrated repeated and consistent inaccuracy when that individual was now better informed. Children indeed seem to be interested in keeping track of individuals' knowledge, although their judgments may not be limited to attributions of knowledge, as I will turn to next.

The results of the second experiment indicate that a developmental transition in children's attributions of knowledge occurs between 4 and 5 years of age. Younger children attribute knowledge in a more limited way, consistent with the "restricted epistemic" account discussed above: They do not appear to use past evidence about knowledge to predict future knowledge or make broader inferences about individuals, or they do so in a very limited way that was not detected in the current experiment. This finding is consistent with literature on young children's limited ability to attribute stable and consistent traits to individuals. In contrast, the 5-year-olds' responses are more reminiscent of adults' and older children's tendency to not only attribute a trait but also to show a halo effect, with evaluations of knowledge affecting expectations of prosocial and antisocial behaviour. The 5-year-olds therefore appear to make a "global epistemic" interpretation of informants' history of accuracy. However, just how broadly 5-year-olds

expect others' knowledge to generalise remains to be tested. This experiment only included two categories of knowledge, namely words and facts. Had the test phase also included questions about knowledge of math, geography or car mechanics, we may have found that 5-year-olds do show appropriate limits to their knowledge generalisation.

Why the 4-year-olds did not develop broader expectations about the informants in this study is unclear. Although young children are generally less likely to attribute stable traits than older children, there is plenty of evidence suggesting that 4-year-olds can develop behavioural expectations in some paradigms, especially when multiple instances of consistent behaviour are provided (e.g., Boseovski & Lee, 2006). It is possible that the 4-year-olds really do not judge history of accuracy as relevant in predicting broader attributes. However, there are other plausible explanations for these results. For example, given that the mean scores are positive (albeit very close to 0) in all categories, it is possible that there is a very weak effect present in the results but much too small in magnitude to be detected with this sample size. In such a scenario, the difference between the 4- and 5-year-olds would be one of degree rather than being indicative of completely different psychological processes. The estimated effect sizes for all non-distracter categories for 4-year-olds vary between a Cohen's *d* of .12 for prosocial/antisocial behaviour and .29 for word knowledge (see Table I). Some of these effects appear negligible, but, in the case of word knowledge, a real albeit small effect may be present. By comparison, 5-year-olds' results yield a Cohen's *d* of .73 for word knowledge, .63 for fact knowledge, and .69 for prosocial/antisocial behaviour, all effects of medium-to-large magnitude.

Another possibility is that the memory and attention demands of the present paradigm are just too great for the younger children. This is a novel paradigm developed for the purpose of this study, and it may not be well suited for children under the age of 5. Among other potential difficulties, the experimental session required several minutes of attention, and included a large number of questions with phrasing that may have been quite convoluted, especially for the questions that were framed negatively. Children were also encouraged to "guess", which some may have interpreted as "pick randomly".

In spite of the potential drawbacks mentioned above, the present paradigm has many strengths. One of the advantages is that the paradigm does not force children to

attribute characteristics exclusively to one puppet or the other, but instead allows children to choose both or none of the informants. It is therefore possible to assert with confidence that children choose to favour one informant, as opposed to being forced to do so. Furthermore, by presenting children with both affirmative and negative questions, this study controlled for a simple tendency to pick the previously accurate puppet. It is true, though, that by directly asking children to attribute evaluative characteristics we were eliciting such evaluative attributions in a way that is perhaps not representative of children's everyday experiences. It would be interesting for future research to investigate whether 5-year-olds would be influenced by history of accuracy in their perception of others' mental states in a more naturalistic setting. For instance, if children spontaneously use others' prior accuracy to predict prosocial and antisocial behaviour, an action with an ambiguous intent may be more likely to be interpreted as malevolent when performed by a previously inaccurate protagonist.

More generally, a potential limitation of the present experiments is that children were faced with characters about whom they possessed very little information and with whom they could not really interact. This limited the information that children could use to draw inferences about these characters and their knowledge. In a naturalistic context, children possess a large amount of information about most people that they interact with. Thus, it is not warranted to use the present results to directly draw conclusions about children's expectations and trait attributions in more naturalistic settings where multiple factors may interact. However, using these more simplistic situations has the benefit of allowing evaluation of the emphasis that children give to specific criteria when assessing their partners' knowledge, while controlling for the plethora of variables that exist in natural relationships.

The present findings not only help resolve the narrow question of how children interpret history of accuracy paradigms, but also contribute to and expand the field of theory of mind research more generally. Over the years, this field has gradually expanded its scope to include an increasing diversity of mental state reasoning situations; however, there are important bridges between children's understanding of others' mental states and other aspects of their social cognitive development, which researchers have only begun to examine. The present studies explore two such bridges, namely children's learning and

the development of trait attribution.

What to learn, when to learn and whom to learn from are all aspects of learning that are influenced by children's perceptions of their social partners' mental states. The studies reported above add to the numerous findings regarding children's sensitivity to others' knowledge in learning situations (see Bloom, 2000, for a review). While the knowledge state of an informant is an obvious factor to take into consideration when learning, other mental states, including intentions, are also potentially relevant. In the present studies, I contrasted an account where children trust previously accurate people because they are knowledgeable versus one where children believe that informants differ in cooperative intent. Although I ruled in favour of a knowledge account in the present case, there certainly are times when children will look for others' willingness to cooperate, and use this information in order to decide who is likely to provide useful and accurate information. Indeed, it may be interesting to assess how children behave in a situation where an informant has cooperative intentions but is misinformed, or conversely when an informant is well-informed but portrayed as having deceptive intentions.

The obtained findings also have broad implications regarding the development of trait attribution and the results of such attributions on early social interactions. When children learn, they are often faced with informants with whom they have interacted multiple times. The obtained results would suggest that past instances of learning are likely to influence children's willingness to learn or even their preference for certain partners in activities unrelated to learning. Adults regularly utilize others' mental states to infer their broader traits and dispositions and predict their behaviour; the present results show that such processes are at work early in life, and therefore that children's interpretation of others' mental states is an important factor in their developing interactions with their social partners.

More broadly, an important point to keep in mind is that theory of mind is not separate from other aspects of social reasoning, and in fact is just one aspect of social cognition. Thus, research that relates theory of mind with other aspects of social cognition, such as person perception, provides important insights into both the development of social interaction and the many roles of mental state reasoning.

An interesting area for future investigations would be to examine whether children pay attention to the context in which previous accuracy was demonstrated in order to decide whether or not to infer a knowledge trait. Results from Experiment 1 suggest that children can discriminate which cues to knowledge are most relevant in a given situation, but do they use their understanding of sources of knowledge in trait attribution? Consider the following situation. Two individuals are asked to label common objects, but the objects are hidden from sight inside boxes. One individual is allowed to look inside the boxes, and therefore labels the objects correctly. The other individual is not allowed to look inside the boxes, and therefore mislabels the objects. In this context, it would be more appropriate to discount the inaccuracy of the second informant as merely circumstantial, in which case it should not have any bearing on subsequent judgments of knowledge or trait attributions.

I aim to assess whether children will display this sophisticated understanding in such a situation. Two different studies by Nurmsoo and Robinson that attempted to address this question have obtained contradictory findings. In one set of studies (Nurmsoo & Robinson, 2008), 3- to 5-year-olds were indeed more likely to trust a previously inaccurate informant whose past mistakes were due to lack of information access than another who was mistaken despite having full access to relevant information, suggesting that children can, in some circumstances, take into account the reasons underlying an informant's inaccuracy. However, a different series of studies (Nurmsoo & Robinson, in press) revealed that 3- to 5-year-olds trusted information provided by a previously accurate informant over that provided by another who had displayed inaccuracy while blindfolded. Furthermore, even up to 7 years of age, children did not behave differently towards two informants who displayed equal amounts of inaccuracy although one was blindfolded during the instances of inaccurate labelling and the other was not. There are many differences between the two sets of studies that might explain the discrepant results: For instance, the presence of a blindfolded informant in one study may have caused some confusion about whether the informant could see or not. In addition, the studies in which performance differed for excusable and inexcusable inaccuracy gave children the option of trusting one individual or guessing for themselves, while the study where no such difference in performance was observed asked children to

trust one of two informants. I plan to investigate the conditions that cause children to excuse inaccuracy arising from situational factors, and assess whether such situational inaccuracy will colour their judgments of informants' attributes despite their knowing that the inaccuracy is situational.

In conclusion, the experiments reported above fill gaps in the current literature by providing a detailed look at preschool children's use and interpretation of individuals' history of accuracy and at the contexts in which this accuracy influences children's judgments. In addition, these experiments expand our understanding of how young children make trait attributions and form impressions. The present studies will therefore allow the branch of research on children's understanding of knowledge as a stable, person-specific attribute to continue to move beyond mere demonstration that children notice other people's accuracy, and instead peek inside children's minds to discover what they really think about it.

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Table 1

Summary of Results

	Mean	Standard Error	Cohen's d
Experiment 1 (N = 32)			
% trusting puppet with visual access when previously accurate puppet has visual access	75.00	5.50	.80
% trusting puppet with visual access when previously inaccurate puppet has visual access	71.88	6.33	.61
Experiment 2 – 4-year-olds (N = 22)			
Word knowledge	.45	.33	.29
Fact knowledge	.23	.39	.13
Talents	.18	.31	.13
Prosocial / antisocial behaviour	.18	.32	.12
Knowledge gained from information access	.27	.37	.16
Preferences and possessions	.09	.36	.05
Experiment 2 – 5-year-olds (N = 26)			
Word knowledge	1.58	.43	.73
Fact knowledge	1.38	.43	.63
Talents	.69	.34	.40
Prosocial / antisocial behaviour	1.27	.36	.69
Knowledge gained from information access	.54	.29	.36
Preferences and possessions	.27	.30	.18

Appendix A

Pictures of Unfamiliar Objects Used in Experiment 1

Appendix B

Experimental Script

In this script, Charlotte is the accurate informant and Lucy the inaccurate informant.

INTRODUCTION:

I have some fun things to show you, and my two puppet friends, Charlotte and Lucy, want to play with us.

This is Charlotte. Let's wave to Charlotte. Hi, Charlotte!

This is Lucy. Let's wave to Lucy. Hi, Lucy!

HISTORY PHASE:

Ok, Let's see what I have here. (Show the child a ball, a horse, a spoon and a car). Let's show these to Charlotte and Lucy. We'll let Charlotte and Lucy talk now and we'll just watch and listen, ok?

Ball Charlotte: I think that's a ball. Yeah, that's a ball.

Horse Charlotte: I think that's a horse. Yeah, that's a horse.

Spoon Charlotte: I think that's a spoon. Yeah, that's a spoon.

Car Charlotte: I think that's a car. Yeah, that's a car.

Ball Lucy: I think that's a book. Yeah, that's a book.

Horse Lucy: I think that's a cat. Yeah, that's a cat.

Spoon Lucy: I think that's a cup. Yeah, that's a cup.

Car Lucy: I think that's a shoe. Yeah, that's a shoe.

VISUAL ACCESS + TEST PHASE – EXPERIMENT 1:

Now let me show you some fun things. I have boxes, and inside each box there's one toy.

Trial 1

See this box? (show 1st box) There's one toy inside the box, and it's one of these two (show pictures).

Now Charlotte is going to look in the box. See, now Charlotte is looking.

Now Lucy is going to stand on the box. See, now Lucy is standing.
Now let's ask Charlotte what's inside the box. Remember, Charlotte looked in the box.
Charlotte, what's inside the box? (Charlotte points to object A)
Now let's ask Lucy what's inside the box. Remember, Lucy stood on the box.
Lucy, what's inside the box? (Lucy points to object B)
So, _____, what's inside the box? Can you point? (Probe(s) needed: Do you think it's this one or this one? It's okay to guess.)

(Repeats for 3 more trials – Lucy looks inside the box on Trials 2 and 4)

POST-TEST QUESTIONS

Who knows what's in that box? Who got that right? Was it Charlotte or Lucy? (Can you point?)
Do you remember who looked inside that box? Was it Charlotte or Lucy? (Can you point?)
Do you remember who stood on that box? Was it Charlotte or Lucy? (Can you point?)
Which of the two toys did Charlotte point to?
Which of the two toys did Lucy point to?
Now let me show you these toys again. What's this? (ball, horse, shoe, car)
Who knew what these things were called? Who knew that the car was called a car, who got that right? Was it Charlotte or Lucy?

FAMILIARISATION – EXPERIMENT 2

Now before we look in the boxes, I want to ask you to guess some things about my puppet friends Charlotte and Lucy. This is how we play this game: I'll ask you questions, and you have to point to one of the pictures here to answer. You can point to Charlotte, or Lucy, or both of them, or nobody (demonstrating while saying this).

If I ask you: Who has black hair, who should you point to?
If I ask you: Who is a girl? (Who should you point to?)
Who has a blue shirt? (Can you point?)
Who is a boy? (Can you point?)

Who is wearing red shoes?
Who has a pink shirt?

TEST PHASE – EXPERIMENT 2

Good job! Now I'm going to ask you to guess some more things, and some of them are really hard, others are really silly, but it's okay to guess if you don't know.

(List of questions is asked here – See Appendix C)

Wow, you did a great job answering my questions. Now do you remember, at the beginning, when I showed Lucy this car, she called it a shoe? And she called the horse a cat? Why do you think she said that? Why do you think she kept saying the wrong words?

Appendix C

Certificate of Approval – Behavioural Research Ethics Board

The University of British Columbia
Office of Research Services
Behavioural Research Ethics Board
Suite 102, 6190 Agronomy Road,
Vancouver, B.C. V6T 1Z3

CERTIFICATE OF APPROVAL- MINIMAL RISK RENEWAL

PRINCIPAL INVESTIGATOR:	DEPARTMENT:	UBC BREB NUMBER:
Susan Birch	UBC/Arts/Psychology, Department of	H04-80616

INSTITUTION(S) WHERE RESEARCH WILL BE CARRIED OUT:

Institution	Site
UBC	Vancouver (excludes UBC Hospital)

Other locations where the research will be conducted:
Out-of-school care centres, daycare centres

CO-INVESTIGATOR(S):
Negar Amini
Erika Penner
Sophie Vauthier
Naz Akmal
Patricia Brosseau-Liard
Jamie Chen

SPONSORING AGENCIES:
Natural Sciences and Engineering Research Council of Canada (NSERC) - "The Role of Knowledge Assessment in Children's Social Judgments and Interpersonal Learning"
Social Sciences and Humanities Research Council of Canada (SSHRC) - "The Role of Knowledge Assessment in Children's Social Judgments and Interpersonal Learning" - "The role of knowledge assessment in children's social judgments and interpersonal learning"
UBC Human Early Learning Partnership (HELP) - "Social Learning and Knowledge Attribution"

PROJECT TITLE:
The Role of Knowledge Assessment in Children's Social Judgments and Interpersonal Learning

EXPIRY DATE OF THIS APPROVAL: September 10, 2008

APPROVAL DATE: September 10, 2007

The Annual Renewal for Study have been reviewed and the procedures were found to be acceptable on ethical grounds for research involving human subjects.

Approval is issued on behalf of the Behavioural Research Ethics Board

Appendix D

Test Questions – Experiment 2

LIST 1

(The numbering of the questions indicates the order of the questions in the experiment.)

Words

11. Who knows the names for a lot of insects?
13. Who knows that this (show picture of stethoscope) is called a stethoscope?
22. Who doesn't know words for lots of different machines?
23. Who doesn't know that this (show picture of alligator) is called an alligator?

Facts

17. Who knows that cats can see at night?
2. Who knows a lot about stars and planets?
7. Who doesn't know that birds eat seeds?
9. Who doesn't know a lot about trees and plants?

Talents

8. Who can swim?
14. Who can bake cookies?
6. Who cannot run fast?
18. Who cannot draw pretty pictures?

Prosocial / antisocial behaviour

21. Who always shares her toys?
20. Who never calls people names?
12. Who always yells?
3. Who never says thank you?

Preferences and possessions

19. Who has a cat?

1. Who likes potatoes?

5. Who doesn't have a sister?

24. Who doesn't like spaghetti?

Knowledge gained through visual access

4. Who knows what my favourite animal is?

15. Who knows where I bought my shoes?

16. Who doesn't know where I put my books?

10. Who doesn't know the name of my brother?

LIST 2

Words

11.Who doesn't know the names for a lot of insects?

13. Who doesn't know that this (show picture of stethoscope) is called a stethoscope?

22. Who knows the words for lots of different machines?

23. Who knows that this is (show picture of alligator) called an alligator?

Facts

17. Who doesn't know that cats can see at night?

2. Who doesn't know a lot about stars and planets?

7. Who knows that birds eat seeds?

9 . Who knows a lot about trees and plants?

Talents

8. Who cannot swim?

14. Who cannot bake cookies?

6. Who can run fast?

18. Who can draw pretty pictures?

Prosocial / antisocial behaviour

20. Who never shares her toys?

21. Who always calls people names?

12. Who never yells?

3. Who always says thank you?

Preferences and possessions

9. Who doesn't have a cat?

1. Who doesn't like potatoes?

5. Who has a sister?

24. Who likes spaghetti?

Knowledge gained through information access

4. Who doesn't know what my favourite animal is?

15. Who doesn't know where I bought my shoes?

16. Who knows where I put my books?

10. Who knows the name of my brother?