Epistemic states and traits: Preschoolers appreciate the differential informativeness of situation-specific and person-specific cues to knowledge

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Abstract

Previous research has demonstrated that preschoolers can use situation-specific (e.g., visual access) and person-specific (e.g., prior accuracy) cues to infer what others know. The present studies investigated whether 4- and 5-year-olds appreciate the differential informativeness of these types of cues. In Experiment 1 (N=50), children used others' prior labelling accuracy as a cue when learning labels for, but not the visual identity of, hidden objects. In Experiment 2 (N=64), with both cues present, children attended more to visual access than prior accuracy when learning the visual identity of, but not labels for, hidden objects. These findings demonstrate that children appreciate the difference between situation- and person-specific cues and flexibly evaluate these cues depending on what information they are seeking.

Epistemic states and traits: What preschoolers know about different knowledge cues

Making inferences about what others know is a critical facet of human interaction. These inferences enable us to anticipate, understand, and influence the actions of others; they affect our impressions of others; allow us to communicate efficiently with others; and guide our judgements of what and when to learn from others. Investigating children's knowledge assessment abilities is therefore essential for furthering our understanding of both their cognitive and social development.

Investigations of children's mental state understanding have predominantly focused on *situation-specific cues* to knowledge, such as whether someone had visual access to information or was present or absent during an event (e.g., Buttelmann, Carpenter, & Tomasello, 2009; Chandler, Fritz, & Hala, 1989; Onishi & Baillargeon, 2005; O'Neill, 1996; Pillow, 1989; Piaget & Inhelder, 1969; Pratt & Bryant, 1990; Taylor, 1996; Wimmer & Perner, 1983; see Robinson, 2000, and Wellman, Watson, & Cross, 2001 for reviews). These investigations report that *at least* by age 4, and possibly much earlier, children appreciate something about how knowledge, as a mental *state,* is acquired; however they tell us little about children's understanding of more *trait-like* knowledge (i.e., knowledge that generalizes across situations).

Recently, there has been increased attention on preschoolers' understanding of these more trait-like or *person-specific* differences in knowledge (e.g., Harris, 2007; Heyman, 2008; Miller, 2000). Many findings suggest that children are sensitive to differences in others' prior accuracy (e.g., Birch, Vauthier & Bloom, 2008; Clement, Koenig & Harris, 2004; Corriveau & Harris, 2009; Jaswal & Neely, 2006; Koenig & Harris, 2005; Scofield & Behrend, 2008). For example, when presented with two individuals, one accurate and one inaccurate at labelling familiar objects, preschoolers subsequently prefer to learn new labels from the previously accurate informant (e.g., Koenig, Clément, & Harris, 2004).

Despite such evidence indicating that preschoolers understand at least some situation-specific and person-specific cues to knowledge, it remains unclear how they weigh and evaluate these two types of cues when both are available, and whether they appreciate that the informativeness of these cues depends on the learning context. There are many important distinctions between these two types of knowledge cues. Situation-specific cues hold true across all individuals (e.g., everyone who sees inside a box will acquire knowledge of the box's contents), whereas cues such as prior accuracy vary across individuals (i.e., some people will have better track records of accuracy than others). Also, situation-specific cues (as the name implies) are only informative about someone's knowledge in a particular situation: The fact that Sally looks inside a box and knows what is inside tells us nothing about how knowledgeable she will be on other occasions, even a very similar one (e.g., knowing the contents of another box). In contrast, person-specific cues, such as prior accuracy at labelling objects, tend to be at least somewhat informative about how knowledgeable someone will be in similar situations (e.g., labelling other objects). Another distinction between these types of cues pertains to the nature of their relationship with knowledge: Situation-specific cues are *causally* related to knowledge (i.e., looking in a box causes one to know its contents), whereas, person-specific cues *correlate* with knowledge (e.g., one's prior accuracy correlates with one's future accuracy) but they are not perfectly correlated, nor are they causally related.

Two sets of studies by Nurmsoo and Robinson (2009a; 2009b) yielded contradictory findings regarding children's weighting of these cues. In one series of studies (2009a), 3- to 7-year-olds learned from previously accurate informants and did not differentiate between inaccurate informants who were visually-informed versus visually-uninformed at the time of their inaccurate statements. In the other series of studies (2009b), 3- to 5-year-olds excused past inaccuracy that resulted from being visually uninformed. The authors proposed that one reason

for this difference may be that, in the first series of studies, children were learning object labels, which they have no way of finding out except from other people, and therefore they may be especially vigilant of past accuracy when learning information that can only be gleaned in a social context. In contrast, the second series of studies required children to learn information about properties of hidden objects, something they could find out on their own with appropriate visual access. While the present studies were not specifically designed to address the hypothesis raised by Nurmsoo and Robinson (2009a), their findings nonetheless highlight the need for further research in this area.

The issue of weighing various cues to knowledge also relates to a current controversy surrounding the interpretation of children's sensitivity to others' prior accuracy. As mentioned above, studies have shown that children are more likely to learn new information from previously accurate individuals. Yet precisely *how* children interpret others' history of accuracy (or *in*accuracy) is an open question. A common interpretation is that children prefer to learn from previously accurate individuals because they infer that a previously accurate person is more *knowledgeable*. However, researchers have called for more rigorous testing of alternative explanations (e.g., Birch et al., 2008; Nurmsoo & Robinson, 2009a; 2009b). One alternative account, for example, posits that children are simply attending to the individual's 'output' without inferring any underlying psychological states. Under this account, past inaccuracy is treated similarly to unfavourable outcomes for non-social objects. That is, children might ignore a person who continually makes mistakes much like they become uninterested in a broken toy. Other alternative explanations have included the prospect that children view a person's past inaccuracy as indicative of that person being uncooperative, deceptive, silly, or unconventional (although with regard to unconventionality a recent study by Diesendruck, Carmel and Markson (2010) suggests that children treat an accurate but unconventional source similarly to a source

who is both accurate and conventional, and differently from an inaccurate source). Under these alternative accounts children's interpretation may be psychological in nature without involving a knowledge-based attribution. Alternatively, children might imagine that the inaccurate individual is visually impaired (i.e., she mislabelled the objects because she could not *see* them properly). Although the latter may seem unlikely, prior research has shown that children of this age often place *too much* emphasis on the relationship between seeing and knowing (see Robinson, 2000 for a review). For example, Ruffman (1996) showed that 4- to 6-year-olds refused to grant knowledge of the color of an object to a doll who did not see it but possessed enough information to infer it correctly. Thus, it is conceivable that children think that the inaccurate individual was mistaken because of visual impairment.

Under all of the aforementioned alternative accounts, children are not thought to be interpreting the informants' prior accuracy as person-specific differences in *knowledge*, but in terms of more global characteristics (e.g., being uncooperative) that should apply across contexts. If this were the case, children should disfavour information from a previously inaccurate person regardless of the type of information sought. In contrast, if children are interpreting prior accuracy as indicative of a person's underlying knowledge, they would be wise to also consider *situation-specific* evidence that bears on that person's knowledge when such evidence is available. For instance, if Sarah did not witness where you put your sweater, she is unlikely to know where it is regardless of how accurate she has been about other information in the past. Conversely, if Anne did witness where you put your sweater she is likely to know the location of your sweater regardless of how inaccurate she has been about other information in the past. The present research will thus also help clarify the nature of children's interpretations of others' prior accuracy by asking whether children will take into account situation-specific knowledge rather than indiscriminately disfavouring a previously inaccurate individual.

In short, the goal of the present research was two-fold: To determine whether preschoolers' use of situation-specific and person-specific cues to knowledge varies when learning different types of information, and to further clarify the nature of their interpretation of others' prior accuracy. To assess whether preschoolers vary in their weighting of knowledge cues depending on the learning situation, we manipulated the type of knowledge being acquired in otherwise identical situations. We used a paradigm similar to that used in the aforementioned 'prior accuracy' studies, but with a twist: the novel objects the children learned about were hidden inside boxes. In Experiment 1, two informants (one previously accurate and one previously inaccurate at labelling common objects) provided conflicting information about novel objects. No information was provided about visual access but we manipulated the type of information being provided by the informants—either the visual identity of the hidden objects (*Pointing Condition*) or the labels for the hidden objects (*Labelling Condition*). Prior accuracy at labelling is useful for inferring future accuracy at labelling but not one's ability to visually identify an object by pointing; if children are sensitive to this, they should favour the information provided by the previously accurate informant when learning an object's label, but show no such preference when they want to know the object's visual identity (unless, of course, they think the inaccurate labeller is inaccurate because she is visually-impaired). In Experiment 2, the informants differ in *both* past accuracy and visual access to the contents of the boxes and children must track and integrate situation- and person-specific cues and assess their informative value depending on the type of information being learned. Here, we expect children to favour the information provided by the visually-informed individual, regardless of past accuracy, when they want to know the object's visual identity. Yet, when learning labels they should attend to both past accuracy and visual access.

Experiment 1

Method

Participants. Fifty children (3,11 – 5,11; *M* = 4,10) were recruited from a database of interested parents (*n* = 29) and local daycares (*n* = 21). Twenty-five children participated in each condition: *Pointing* (3,11 – 5,6; *M* = 4,10; 13 males) and *Labelling* (4,1 – 5,11; *M* = 4,10; 12 males). Information on participant ethnicity and SES was not systematically collected, but the majority of participants were middle- to upper-middle-class and of Caucasian or East Asian descent.

Material. Two female child-like puppets served as informants. The *History Phase* involved four common objects (ball, horse, spoon, and car). Four test trials each involved a different coloured box containing an unfamiliar object. The *Pointing Condition* involved four pairs of pictures of unfamiliar objects.

Procedure. In the *History Phase,* four common objects were placed in front of the participants. Each puppet labelled all 4 objects; one correctly, the other incorrectly (e.g., calling the ball "a book"). The puppets always interacted with the objects in the same order, but whether the first puppet was accurate or inaccurate was alternated across participants. Then, in the *Test Phase*, participants were shown the 4 boxes and told that each contained "one toy". The boxes were set aside and brought out one at a time. In the *Pointing Condition,* the experimenter brought out two pictures of novel objects with each box and told the child, 'See this box? There's one toy inside and it's one of these two (showing the pictures). Let's ask [the puppets] what's inside the box.' No information was provided about either puppet's visual access to the contents of the boxes. Thus, here, the only difference between the two informants was their prior accuracy and the question of interest was whether children would regard the prior accuracy of their informants differently depending on the type of information the child was learning. When asked, each puppet

pointed to one of the two pictures, providing contradictory answers on every trial. The experimenter then asked the child: "What do *you* think is inside the box?"

In the *Labelling Condition*, the experimenter brought out one box and said: 'See this box? There's one toy inside. Let's ask [the puppets] what's inside the box.' When asked, each puppet provided a different novel label. For instance, on the first trial, one puppet said the box contained a "mirp" while the other said that it contained a "preek". Participants were asked to repeat each novel word, and then asked what they thought was inside.

In both conditions, participants were encouraged to guess if they did not answer immediately. Following the last trial, children were asked if they remembered which object each puppet pointed to (or which label each provided), then asked to label the common objects used in the *History Phase* (all children did this without difficulty), and finally to recall which puppet had correctly labelled the common objects.

Results

The number of trials in which children selected the same picture or label as the previously accurate puppet served as the dependent variable, with chance being 2/4 (50%). Preliminary analyses ruled out any effects of order, gender, or 'place-of-experiment' (lab vs. daycare). A Condition (Pointing or Labelling) x Age (4 years or 5 years) between-subjects ANOVA revealed a main effect of Condition: As hypothesized, children were more likely to give the same answer as the previously accurate puppet in the *Labelling Condition* (M = 2.80 or 70.0%) than in the *Pointing Condition* (M = 2.04 or 51.0%), $F(1,46) = 5.41$, $p = .024$. There was no main effect of Age, $F(1,46) = .24$, ns, nor any interaction between Condition and Age, $F(1,46) = .06$, ns. One-sample t-tests confirmed that children sided with the previously accurate puppet above chance in the *Labelling Condition*, $t(24) = 3.70$, $p = .001$, but were no different from chance in the *Pointing Condition*, $t(24) = .18$, ns. See Figure 1. Children's success across the memory questions was

equivalent in the *Pointing* (94.7%) and *Labelling* (90.7%) conditions, $t(48) = .78$, ns. Moreover, removing children who failed even a single memory question did not change the pattern of results.

Discussion

The present results reveal that, as predicted, children are more likely to use an informant's history of accuracy at labelling common objects to decide whom to learn from in subsequent *labelling* situations than in situations involving only *visual identification* of objects. In Experiment 1, children appeared to reason that in the absence of direct evidence about the puppets' information access, an indirect, person-specific cue (in this case, prior accuracy at labelling is a useful indicator of whose claims to favor, but only for certain types of information (e.g., object labels not object identity). These results suggest that how children value or utilize a person-specific knowledge cue such as past accuracy varies depending on the type of information they are learning.

In many naturalistic contexts (e.g., outside the lab) children are faced with multiple knowledge cues and need to navigate through a maze of potential cues by deciding which cues are relevant in a given context, when and how to properly weigh or integrate cues, and how to resolve potentially competing cues. Here, we were specifically interested in how preschoolers would handle the presence of both a person-specific and a situation-specific cue in different learning contexts and in situations where cues were sometimes in potential conflict.. We predicted that, when given information about both prior accuracy and visual access, children will attend preferentially to visual access for visual identification of objects, but when learning labels will also utilize the informants' past accuracy. We tested this hypothesis in Experiment 2.

In addition, since a skeptic might argue that the null result in the *Pointing Condition*, although predicted and significantly different from the *Labelling Condition*, is open to

interpretation (e.g., perhaps children did not understand the puppets' pointing gestures), Experiment 2 will also serve to determine whether children *will* follow the puppets' pointing gestures when it is appropriate.

Experiment 2

In Experiment 2, children were presented with two cues to the puppets' knowledge: past accuracy and visual access to the boxes' contents. On "convergent" trials, the previously *accurate* puppet also looked in the boxes, therefore both cues converged to indicate that individual as the most knowledgeable. On "divergent" trials, the previously *inaccurate* puppet looked inside the boxes, therefore the cues diverge, and children are left with the difficult choice of learning from a previously accurate informant who is lacking pertinent information or a visually-informed individual with a history of being inaccurate.

Experiment 1 demonstrated that children disregard past accuracy in the *Pointing Condition*. We thus expected that in the *Pointing Condition* children would believe whoever looked inside the boxes: the previously *accurate* person on convergent trials, and the previously *inaccurate* person on divergent trials. In the *Labelling Condition*, we expected children to take *both* cues into account. On convergent trials, children should prefer to learn new labels from the previously accurate speaker since both cues suggest that she is the most knowledgeable. On divergent trials, with two important yet conflicting cues, we expect children *not* to have any clear preference for either informant and therefore perform at chance. See Figure 2.

Method

Participants. Sixty-four children (4,0 – 5,10; *M* = 4,11) were recruited from a database of interested parents (*n* = 36) and local daycares (*n* = 28). Thirty-two children were tested in each condition: *Pointing* (4,1 – 5,10; *M* = 4,11; 16 males) and *Labelling* (4,0 – 5,10; *M* = 4,11; 17 males).

Material. Same as Experiment 1.

Procedure. The *History Phase* was identical to that of Experiment 1. The *Test Phase* was similar to that of Experiment 1, except that visual access was also manipulated such that on each trial when the box was placed in front of the child, the puppets interacted with the box (one looking inside, the other standing on it). The puppets' interactions with the box ensured that both performed actions on the box but only one was informed about its contents. For half the children, the previously accurate puppet looked on trials 1 and 3 and stood on trials 2 and 4, and vice versa for the other children. At the end, children were asked two additional memory questions about who had looked and stood on the last trial.

Scoring. Children's performance was calculated separately for the "convergent" and "divergent" trials. On all trials a score of 1 was given for choosing the same picture or label as the previously *accurate* puppet.

Results

Preliminary analyses did not reveal any effects of gender, identity of accurate puppet or 'place-of-experiment', but did reveal an effect of order: this variable was thus kept in subsequent analyses. Children's performance was analyzed with a mixed ANOVA with Trial Type (convergent or divergent) as a within-subjects variable and Condition (Pointing or Labelling), Age (4 or 5) and Order (Accurate puppet looks on first trial or Accurate puppet stands on first trial) as between-subject factors. There was a significant main effect of Trial Type, $F(1,56) = 13.29$, $p<.001$: Overall, children were more likely to side with the previously accurate informant on convergent ($M = 1.34$ or 67.2%) than divergent ($M = .83$ or 41.4%) trials. This effect was moderated by a significant interaction between Trial Type and Order, $F(1,56)=5.91$, $p=.018$: The difference between convergent and divergent trials was significant only for children for whom the accurate puppet looked on the first trial ($t(31)=3.82$, $p<.001$) and not for children for whom the

inaccurate puppet looked on the first trial ($t(31)=.90$, ns). Since this effect was not of any theoretical interest and it did not interact with Condition, it was not investigated further.

The only other significant effect was the predicted Trial Type by Condition interaction, $F(1,56) = 8.51$, $p=.005$. Figure 2 illustrates performance on convergent and divergent trials by condition. Performance on each trial type within each condition was compared to chance (50%) using one-sample t-tests. In addition, since it is possible to obtain a 50% average if children were consistently following one or the other of two different strategies (for instance, if on divergent trials half the children consistently sided with the accurate puppet and the other half consistently sided with the one who looked), non-significant t-tests were followed by chi-square goodness-of-fit tests. In the *Pointing Condition*, children were more likely to side with the previously accurate puppet on convergent trials ($M = 1.41$ or 75.0%) than on divergent trials ($M = .56$ or 28.1%); one-sample t-tests showed that children sided with the previously accurate puppet *above* chance when she had looked in the box, $t(31)=4.55$, $p<.001$, but *below* chance when she had stood on the box, $t(31)=-3.46$, $p=.002$. Children in the *Labelling Condition,* in contrast, were equally likely to side with the previously accurate puppet on both types of trials (convergent: $M = 1.19$ or 59.4% vs. divergent: $M = 1.09$ or 54.7%, $F(1,62)=.96$, ns). Their performance was not significantly different from chance on either convergent trials, $t(31)=1.44$, ns, or divergent trials, $t(31)=.65$, ns. Chi-square goodness-of-fit tests reveal that responses follow a uni-modal chance distribution rather than a bi-modal distribution reflecting two different response strategies, Convergent: $\chi^2(2, N=32)=2.75$, ns. Divergent: $\chi^2(2, N=32)=3.69$, ns.

While children's chance performance on divergent trials in the *Labelling Condition* was predicted, their chance performance on convergent trials was somewhat unexpected. One possible explanation is that children consider both past accuracy and visual access as relevant, but find it more difficult to hold in mind and integrate two informative cues than to choose between two

cues and discount the uninformative one. In the *Pointing Condition*, children may have completely disregarded past accuracy and treated the situation as if only one knowledge cue was available. In the *Labelling Condition*, if children considered both cues as relevant, they then had to keep in mind past accuracy, which was constant across trials, while keeping track of information access, which varied between trials. This may have proved too difficult. Indeed, work on children's developing executive function has shown that younger preschoolers have more difficulty performing tasks that require integrating two separate rules or processes (e.g., Carlson, 2005; Gordon & Olson, 1998). If processing difficulties could explain this unexpected finding, then these difficulties should be less pronounced as children get older. Although the ANOVA performed above did not reveal an effect of age, this possibility prompted us to look separately at the performance of 4-year-olds (N=32; M age = 4,6; 16 males) and 5-year-olds (N=32; M age = 5,4; 17 males). Both age groups were *above chance* in the *Pointing Condition* – convergent trials (4-year-olds: M = 1.44 or 71.9%, $t(15)=2.78$, p=.014; 5-year-olds: M = 1.56 or 78.1%, $t(15)=3.58$, p=.003); *below chance* in the Pointing Condition – divergent trials (both age groups identical: M = .56 or 28.1%, $t(15)=-2.40$, p=.030); and *at chance* in the *Labelling Condition* – divergent trials (4-year-olds: M = 1.06 or 53.1%; $t(15)=.33$, $\chi^2(2, N=16)=.38$, *ns*; 5-year-olds: M = 1.13 or 56.3%; $t(15)= .57$, ns; $\chi^2(2, N=16)=4.50$, *ns*). However, on *Labelling* – convergent trials, 4-year-olds were at chance (M = 1.00 or 50.0%; $t(15)= .00$, $\chi^2(2, N=16)=.00$, *ns*) but 5-year-olds were marginally above chance (M = 1.38 or 68.8%; $t(15)=2.09$, p=.054, $\chi^2(2, N=16)=5.50$, p=.064). , the unexpected result in the convergent trials appears driven by the poor performance of the 4-year-olds, while 5-year-olds trend (p = .054, two-tailed) in the predicted direction.

Success on memory questions was not different across conditions (Pointing: 79.4%, Labelling: 81.3%, $t(62) = .27$, ns). Moreover, removing children who failed even a single memory question did not change the pattern of results.

Discussion

The results of Experiment 2 demonstrate that preschoolers appreciate that visual access and prior accuracy provide different information about who is the most knowledgeable depending on the nature of the information being learned (i.e., an objects' label versus visual identity). As in Experiment 1, children disregarded prior accuracy when learning about the visual identity of the object (i.e., the *Pointing Condition*), suggesting that they deemed it irrelevant to the informants' knowledge of the objects' *visual* identity, but they wisely paid attention to visual access. Overall, children in the *Labelling Condition* did not preferentially attend to either cue: they performed at chance, with 5-year-olds showing a strong trend towards preferring the previously accurate informant on convergent trials. These results are largely consistent with our predictions, the only exception being the chance performance of 4-year-olds in Convergent Trials in the Labelling Condition. Simultaneously tracking two cues that alternated across trials and integrating them to assess who was most knowledgeable on a specific trial thus proved too difficult for the younger children in our sample. Interestingly, the fact that they faced processing difficulties here and not in the *Pointing Condition* (nor in either Condition in Experiment 1) suggests (albeit indirectly) that they were attempting to process more information in the Labelling Condition in Experiment 2.

Although the mixed performance on convergent trials is open to interpretation, it is important to point out that chance performance on divergent trials is exactly what is expected if children are tracking and equally weighting both cues. One could argue that, since the inaccurate individual repeatedly mislabels things that she can see, the labels that she provides should never

be trusted. However, given that past accuracy is only *correlated* with knowledge, while visual access directly *causes* one to acquire knowledge, one may argue that the "best" choice here would be to go with the previously inaccurate but visually-informed individual. Future research could shed light on when children begin to appreciate these more fine-grained or nuanced distinctions in the informativeness of these cues.

Recall that two sets of studies by Nurmsoo and Robinson (2009a; 2009b) found potentially contradictory findings regarding children's weighting of these cues. To explain their results they hypothesized that children may be more attentive to past accuracy (and/or less forgiving of inaccuracy) when learning information that generalizes beyond the immediate situation where the cost of learning something false is higher (Nurmsoo & Robinson, 2009a). This hypothesis is intriguing. While it alone could not fully account for our results (i.e., children would also need to be sensitive to which cues are relevant depending on the learning context), the hypotheses is not inconsistent with our results. It may be that the cost of learning inaccurate information, and our reliance on others for learning some types of information more than other types of information is part of what distinguishes the utility of different knowledge cues across learning contexts. Further research manipulating the type of information being acquired, the cost of inaccurate learning, and the 'social dependence' of the information would help elucidate how these characteristics influence children's evaluations of epistemic cues.

General Discussion

The findings presented in this article integrate two areas of research that have traditionally been investigated separately but that, when combined, provide a more complete picture of children's understanding of knowledge in its different forms and what children think about the corresponding antecedents and succedents of these types of knowledge. Previous research has importantly shown that preschoolers appreciate some person-specific and situation-specific cues

individually (e.g., Koenig & Harris, 2005; Pillow, 1989) and appropriately select among cues when some cues are clearly superior knowledge indicators (e.g., Jaswal & Neely, 2006; Pillow & Weed, 1997; VanderBorght & Jaswal, 2009). Our experiments extend this previous research, and demonstrate that children appreciate, at least to some degree, that prior accuracy and visual access provide different information about an informant's knowledge, and that therefore the informativeness of these cues varies across learning situations. Across two experiments we have shown that 4- and 5-year-olds appreciate that the type of cue to favour depends on which type of information one is trying to acquire. Interestingly, the youngest children seemed to struggle with the trials that involved tracking and integrating two *informative* cues simultaneously to predict the better of the two informants in a given situation (although this difficulty may have been exaggerated by the experimental design where one cue, prior accuracy, was held constant but the second cue, visual access, varied by trial). We recognize that unexpected chance performance is hard to interpret, although the fact that it is specific to the *Labelling Condition* of Experiment 2 suggests that they are considering both cues, but are prevented from successfully integrating them, perhaps because of the additional processing demands or possibly because of a still fragile developing understanding of how to evaluate and integrate multiple epistemic cues.

This research is an important advancement in our understanding of children's social and epistemic reasoning. In the 'real-world', outside contrived laboratory experiments, children will rarely encounter these cues in isolation. More often than not children will need to evaluate multiple cues to people's current level of knowledge. Their decisions to accept or reject others' information will impact their decisions on what information to believe both for situation-specific information (e.g., who knows the whereabouts of their lunchbox) and for information that generalizes across contexts (e.g., when learning about properties of the physical world, or when learning social conventions like language and social norms). Importantly, cues differ in their

value as predictors of knowledge of these two types of information. Fortunately, the present research demonstrates that preschoolers flexibly (and quite appropriately) used situation-specific and person-specific knowledge cues depending on the type of knowledge they were seeking. Overall, when they wanted to know the *visual* identity of an object they did not utilize the informants' past accuracy but rather placed emphasis on an individual's visual access. In contrast, when they wanted to learn the label for objects they did utilize one's history of accuracy at labelling, while still attempting to integrate visual access when this information was available (e.g., Experiment 2, Divergent Trials). The present research is, to our knowledge, the first to demonstrate that preschoolers can utilize situation-specific and person-specific knowledge cues differently depending on the type of information being offered.

The present results also bear on the debate in the literature about the nature of children's interpretations of others' prior accuracy. Previous research was largely consistent with a knowledge-based interpretation of others' prior accuracy, but also with other non-epistemic explanations. Some research has indirectly provided evidence towards an epistemic interpretation (e.g., Koenig & Harris, 2005; Brosseau-Liard & Birch, 2010) while some provided evidence towards leaner interpretations (e.g., Nurmsoo & Robinson, 2009b). The current findings show that children do not indiscriminately disfavour information from a previously inaccurate individual, as would be predicted under non-epistemic accounts: they wisely disfavour *label* information from a previously inaccurate labeller but are equally likely to accept information about an object's *visual identity* from a previously inaccurate labeller as they are from a previously accurate labeller. Consequently, these results suggest that children do not assume that a previously inaccurate person is generally uncooperative, deceptive, unconventional, visually impaired, or a provider of 'bad output'. Instead, the present results favour an epistemic account of children's interpretation of others' accuracy. Moreover, the present results seem to go one step

further, suggesting that not only is preschoolers' interpretation of prior accuracy epistemic in nature but their attributions of knowledge based on prior accuracy appear 'trait-like' (i.e., they assume this kind of knowledge generalizes to knowledge of other information that is not situation-dependent, perhaps akin to perceiving the previously accurate informant as more 'intelligent' than the other). This is interestingly juxtaposed with the 'state-like' (i.e., non-generalizable) manner in which they treat visual access cues.

In conclusion, our findings build on a large body of research showing that preschool children are attentive to person-specific, or trait-like, and situation-specific, or state-like, cues to knowledge, and show that children at this age are also able to evaluate the informativeness of these cues depending on the learning context, rather than using them in a rigid rule-like manner (e.g., 'visual access is always more important than past accuracy'). The present research, therefore, demonstrates a remarkable flexibility in children's assessment of others' knowledge. The different pattern of responding that children show depending on the type of information being sought shows that they appreciate and can capitalize on the differential informativeness of knowledge cues to facilitate the accuracy of their own learning.

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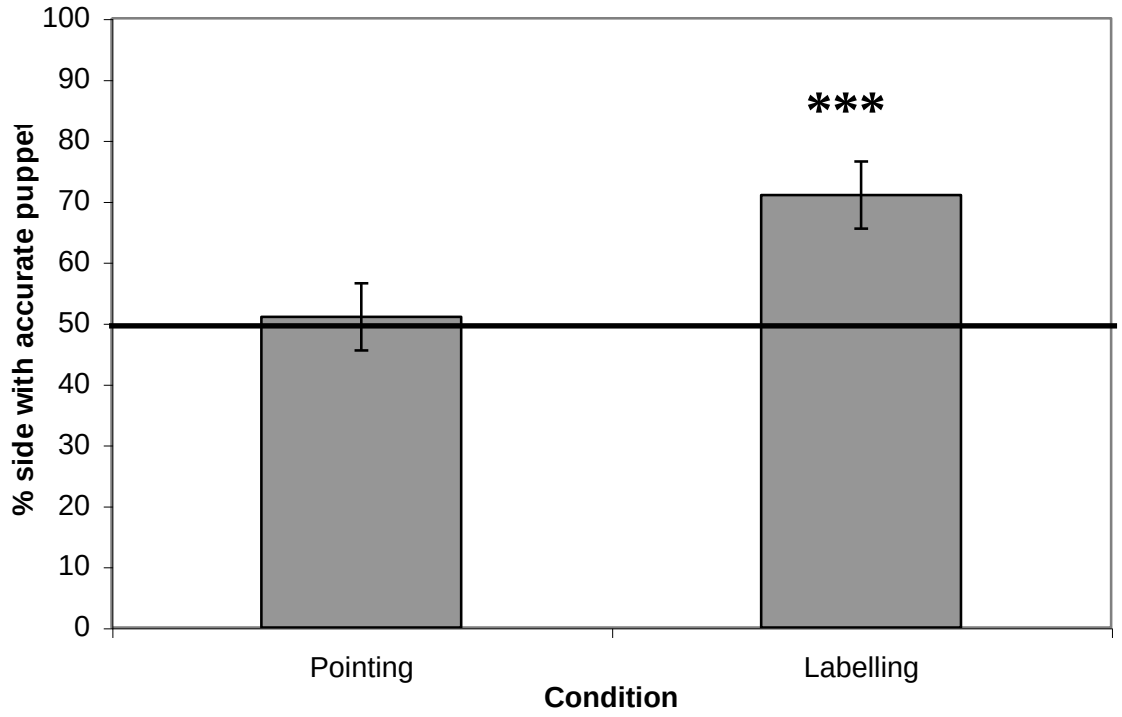
Figure Captions

Figure 1. *Results – Experiment 1*.

Figure 2. R*esults – Experiment 2. The first panel shows the obtained results for both age groups combined. The second panel shows these same results with separate bars for 4- and 5-year-olds*.

Figure 1

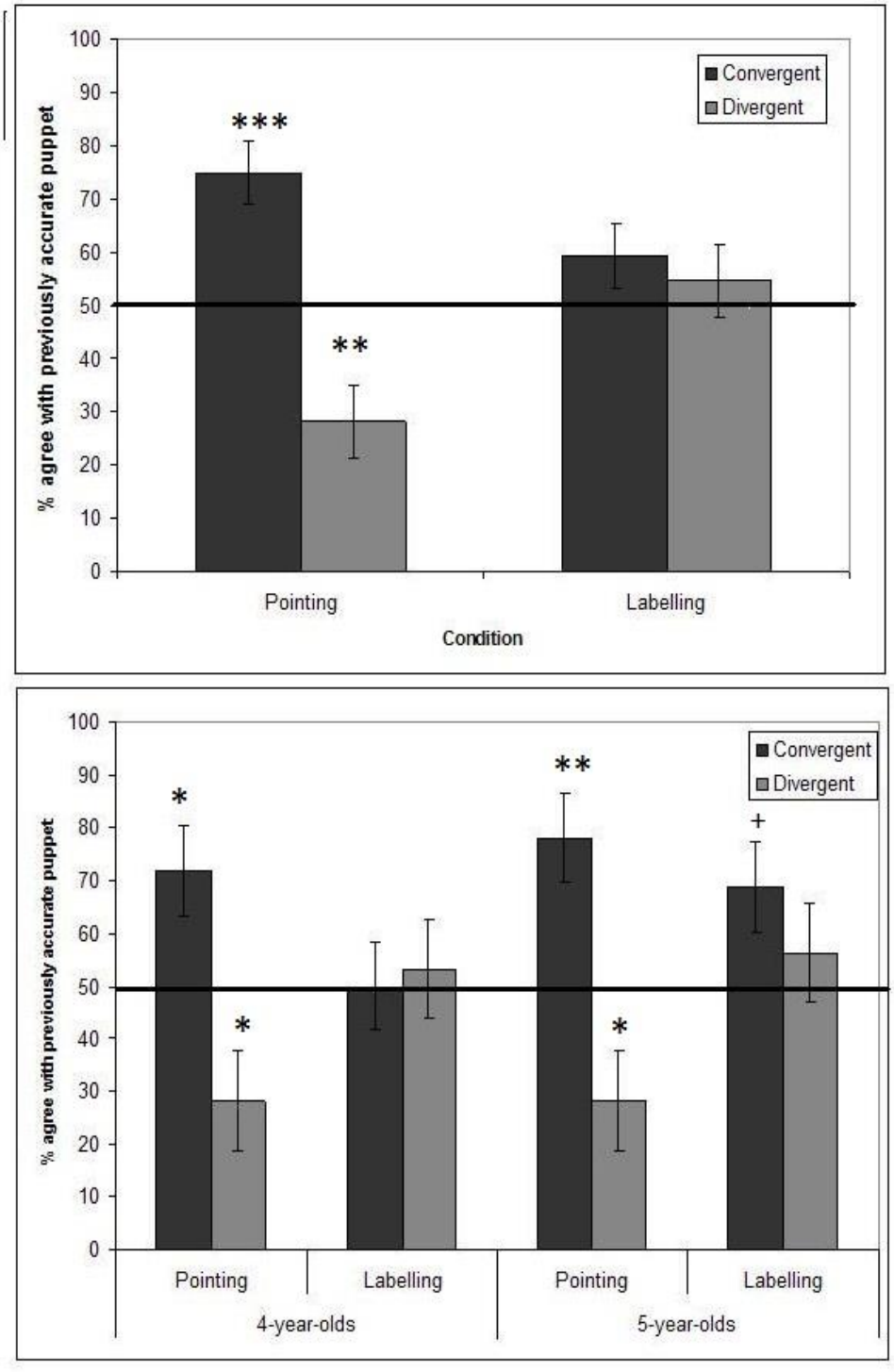
Results – Experiment 1



Note. ***: $p < .001$

Figure 2

Results – Experiment 2.



Note. The first panel shows the obtained results for both age groups combined. The second panel shows these same results with separate bars for 4- and 5-year-olds.

+: $p<.10$; *****: $p<.05$; ******: $p<.01$; *******: $p<.001$