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Selective Information Seeking After a Single Encounter

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In 3 experiments, the authors examined whether a single act of testimony can inform children's subsequent information seeking. In Experiment 1, participants saw one informant give a correct and another informant give an incorrect answer to a question, assessed who was *right* (*wrong*), and decided to whom to address a 2nd question. Adults and 7-year-olds but not 4-year-olds selected the previously correct informant. In Experiment 2, after assessing which informant was *(not) very good* at answering, even 4-year-olds selected the previously correct informant. In Experiment 3, in the absence of external demands to evaluate the informants, 7-year-olds and adults still selected the previously correct informant. Thus, a single encounter is sufficient for 7-year-olds and adults to engage in selective information seeking and trait labels enable 4-year-olds to do so too.

Keywords: testimony, trust, first impressions, past accuracy

Questions allow children to actively satisfy their informational needs rather than rely on others to recognize and spontaneously meet these needs (Baldwin & Moses, 1996). However, children who direct questions indiscriminately are more likely to receive inaccurate information than are children who are selective in choosing informants. Recent research shows that past accuracy is a powerful cue in children's assessment of speakers' likely current reliability. By age 4, three or four exposures to an informant's testimony can affect children's subsequent decisions about whom to believe and whom to ask (e.g., Birch, Vauthier, & Bloom, 2008; Jaswal & Neely, 2006; Koenig, Clément, & Harris, 2004; Koenig & Harris, 2005; Nurmsoo & Robinson, 2009; Pasquini, Corriveau, Koenig, & Harris, 2007). Will a single exposure suffice?

A prominent thesis in person-perception research is that people form impressions of others from mere glimpses of behavior (Allport, 1937; Asch, 1946; Goffman, 1959). In the words of Asch, "a glance or a few spoken words" are sufficient to form an impression of character. Although imperfect, "such impressions form with remarkable rapidity and with great ease" and the capacity to form them is "a precondition for social life" (p. 258). Social psychology research strongly supports this thesis. Adults form inferences about others from a single piece of behavioral information (Todorov & Uleman, 2002, 2003), brief (2 s) exposure to "thin slices" of nonverbal behavior (Ambady & Rosenthal, 1992, 1993), and even briefer exposure (33 ms) to a face (Todorov, Pakrashi, & Oosterhof, in press; Willis & Todorov, 2006). These inferences include judgments of attractiveness as well as of cognitive characteristics such as trustworthiness and competence. Although largely unreflective, they are also associated with rational and significant observer behaviors, such as performance evaluations and voting decisions (Ambady & Rosenthal, 1993; Todorov, Mandisodza, Goren, & Hall, 2005). Thus, a mere glimpse can have behavioral consequences for adult observers. Little is known about the role that such minimal information can play in children's behavior and the ontogenetic roots of the acuteness of adult person perception.

Here we examine whether and under what conditions a single act of testimony influences children's subsequent selection of an informant. A single act provides the *smallest* possible number of exposures to informants' past accuracy. In three studies, 4-year-olds, 7-year-olds, and adults observed one informant provide correct and another provide incorrect information about an event. Then they had to decide whom to ask about another point of the same event. If a single observation of informants is sufficient to constrain subsequent information seeking, we expected that participants would be more likely to ask the previously accurate informant.

Despite the evidence that as few as three exposures to informants can influence 4-year-olds' informant selection, a single exposure might not. Although 4-year-olds can form evaluative judgments of others based on a single behavior (Liu, Gelman, & Wellman, 2007; Olson, Banaji, Dweck, & Spelke, 2006), it is not until age 7 that children predict from single observations that an actor's behavior will be consistent with his or her previous behavior (Kalish, 2002; Liu et al., 2007; Rholes & Ruble, 1984). Not being able to form such predictions, 4-year-olds might not show selective information seeking on the basis of single acts of testimony.

Liu et al. (2007) suggested that by focusing children's attention on potentially stable and enduring aspects of behavior, trait labels may enable children to overcome their difficulty in accessing evaluative judgments that they have formed. Indeed, trait labels dramatically affect children's ability to make behavioral predictions (Gelman & Heyman, 1999; Heyman & Gelman, 1999). Therefore, we examined whether the terms in which informants are evaluated are implicated in participants' predictive interpretation of informants' past accuracy. In Experiment 1, after hearing informants' first responses, participants were asked who was right or wrong. In Experiment 2, they were asked who was good or not

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good at answering the question. On the basis of previous research suggesting that children have a traitlike interpretation of *being good* (Cain, Heyman, & Walker, 1997), we expected that the use of this term would facilitate 4-year-olds' selection of the previously accurate informant. In Experiment 3, we removed the explicit judgment question to test whether a single encounter influences subsequent information seeking in the absence of external demands for evaluating informants' accuracy. Taken together, the studies map the development of children's sensitivity to single encounters, as well as the role of language in this process.

Experiment 1

Method

Participants. Twenty 4-year-olds (M = 52 months, range 46–59 months; 9 girls and 11 boys), 20 7-year-olds (M = 90 months, range 85–93 months; 15 girls and 5 boys), and 20 adults (M = 19 years, range 18–26 years; 16 women and 4 men) participated in the study. The children for this and the following studies were recruited from day care centers and schools in communities composed of predominantly middle-class families of Caucasian descent.

Design and procedure. Eight stories were designed around various situations: at school, on the beach, at a birthday party, playing in the park, helping in the kitchen, camping, hiking in the mountains, and playing on the street. Each story featured a different protagonist and consisted of two pictures of distinct but clearly related scenes. For example, the story about one of Jill's days at school first showed Jill drawing at her desk and then Jill at her desk with her teacher next to it. A sticky note occluded part of each picture, for example, Jill's drawing or Jill's teacher. Sixteen clip-art drawings of children were used as informants. A different pair, matched for attractiveness and gender, was presented with each story; thus each informant was seen in only one story. The informants were presented on a computer. Two additional cards and informant pictures were used in practice.

Each story was introduced with its topic (e.g., "This is a story about one of Jill's days at school."). The topic was repeated for each picture (e.g., "This is the first/second card about Jill's day at school.") For the first card, participants were invited to ask both informants about the occluded detail (e.g., what Jill drew) and received a correct and an incorrect response (e.g., a flower and a star). The sticky note was then removed and participants responded to an *explicit judgment question*, "Who was right/wrong?" The *test question* was associated with the second card: "This time you can only ask one child. Which one would you like to ask to find out who Jill was talking to?" Participants heard the answer of the selected informant and the card was revealed. A previously correct informant provided a correct answer and a previously incorrect informant provided an incorrect answer.

The two practice cards were used to familiarize participants with the keyboard buttons used to elicit responses from the informants and with the fact that sometimes they could ask both informants about a card and sometimes just one of them. The eight stories were presented in one of two random orders. If participants erred on the explicit judgment question, the experimenter reminded them who said what and repeated the question. To underscore the goal of obtaining accurate information, children received stickers if the informant they chose for the second card was correct.

Story order and form of the explicit judgment question were independently counterbalanced between subjects. The location of correct and incorrect informants on the screen was counterbalanced across stories.

Results and Discussion

Adults responded correctly to all, 7-year-olds to 99%, and 4-year-olds to 93% of the explicit judgment questions. All children who erred responded correctly to the second explicit judgment probe.

Preliminary analyses in this and the following experiments showed no effect of story, gender, or the order in which the stories were presented. Thus, these variables were not included in the final analyses. The average proportion of trials on which participants selected to ask the previously correct informant are shown in Table 1. The data were submitted to a 3 (age: 4, 7, adult) × 2 (explicit judgment question: right vs. wrong) analysis of variance (ANOVA). There was a significant main effect of age, $F(2, 54) = 30.38$, $p < .001$, $\eta_p^2 = .53$, but no effect of the form of the explicit judgment question, $F(1, 54) < 1$, or an interaction effect, $F(1, 54) < 1$. Adults were more likely to select the previously accurate informant than were either 4-year-olds, $t(38) = 8.64$, $p < .001$, or 7-year-olds, $t(38) = 5.26$, $p < .001$. There was only a marginal difference between 4- and 7-year-olds, $t(38) = 1.82$, $p = .07$. However, as Table 1 shows, 4-year-olds selected the previously correct informant at chance whereas 7-year-olds and adults selected the previously correct informant significantly above chance: $t(19) = 2.2$, $p = .04$ for 7-year-olds; $t(19) = 11.57$, $p < .001$ for adults.

Table 1
Average Proportion of Trials on Which Participants Selected the Previously Correct Informant

	Experiment 1	Experiment 2	Experiment 3
Age group	n = 20/group	n = 12/group	n = 16/group
4-year-olds	.50 (.14)	.67 (.20)*	.52 (.10)
7-year-olds	.61 (.21)*	.77 (.19)**	.69 (.19)**
Adults	.92 (.16)**	.85 (.24)**	.87 (.23)**

Note. Standard deviations are shown in parentheses.
Significance levels indicate whether the correct informant was selected above chance (.50).
* $p < .05$. ** $p \leq .001$.

The accuracy of informants' answers on the test questions was correlated with informants' accuracy about the first cards, and children received stickers for choosing the previously accurate informant. Both of these features may allow for learning to take place over the course of the study. We tested whether the probability of choosing the previously accurate informant increased over the eight trials by analyzing the data of each age group using a first-degree polynomial test and including trial number as an independent variable. The analyses provided no evidence for a significant change in performance in any of the groups, all $F(1, 19) \leq 1$.

Thus, this study demonstrates that a single observation of an informant can influence 7-year-olds' and adults' subsequent information seeking. Although a single encounter warrants only tentative inferences about the knowledge of an informant, 7-year-olds and adults modified their information seeking accordingly. In contrast, 4-year-olds showed no preference for the informant who had been accurate, even though, like the older participants, they had successfully identified informants' previous accuracy.

Experiment 2

Following Koenig and Harris (2005; see also Corriveau & Harris, 2009; Pasquini et al., 2007), in Experiment 2 we asked participants to identify the informant who was "very good" or "not very good" answering the question about the first picture, rather than the informant who was "right" or "wrong." Very young children show a trait interpretation of *being good* and use trait labels to predict behavior (Cain et al., 1997; Heyman & Gelman, 1999). Thus, we hypothesized that this formulation of the explicit judgment question may affect children's predictions about informants' current reliability and enable selective information seeking even in preschoolers.

Method

Participants. Twelve 4-year-olds (M = 56 months, range 50–60 months; 9 girls and 3 boys), 12 7-year-olds (M = 88 months, range 84–94 months; 8 girls and 4 boys), and 12 adults (M = 23 years, range 20–28 years; 8 women and 4 men) participated in the study.

Design and procedure. The explicit judgment question in this study was "One of these children was very good (not very good) at answering the question. Which one was very good (not very good) at answering the question?" Otherwise, the materials, design, and procedure were the same as those in Experiment 1, with the additional exception that no stickers were given.

Results and Discussion

Adults responded correctly to all, 7-year-olds to 99%, and 4-year-olds to 97% of the explicit judgment questions. The data are displayed in Table 1. A 3 (age: 4, 7, adult) × 2 (explicit judgment question: very good vs. not very good at answering) ANOVA on the proportion of trials on which participants selected the previously correct informant showed no significant main effects or interactions. All groups chose the previously correct informant above chance, $t(11) = 2.861$, $p = .015$ for 4-year-olds; $t(11) = 4.914$, $p < .001$ for 7-year-olds; and $t(11) = 5.043$, $p < .001$ for adults. The probability of selecting the previously correct informant did not increase over trials for any of the groups, all $F(1, 11) < 1$. Thus, when the explicit judgment question solicited an evaluation of who had been a good informant, even 4-year-olds showed selective information seeking.

As the participants in Experiments 1 and 2 were drawn from the same populations and there was a minimal difference in the design of the studies, we compared 4- and 7-year-olds' performance in Experiments 1 and 2 to directly assess the effect of the explicit judgment question. The analysis controlled for the accuracy of children's initial responses to the explicit judgment question. The results showed that both groups were significantly more likely to choose the previously accurate informant in Experiment 2 than in Experiment 1: $F(1, 29) = 5.572$, $p = .025$, $\eta_p^2 = .16$ for 4-year-olds; $F(1, 29) = 4.95$, $p = .034$, $\eta_p^2 = .14$ for 7-year-olds.

Experiment 3

The results of Experiment 2 raised the possibility that 7-year-olds' and adults' selective information seeking in Experiment 1 was an artifact of their being asked "who was right (wrong)?" Although this question was literally about informants' accuracy on the particular card, it may have promoted thinking about informants in terms of stable individual tendencies. In Experiment 3, we removed the explicit judgment question to test whether a single encounter influences subsequent information seeking in the absence of external demands for evaluating the informants' statements.

Method

Participants. Sixteen 4-year-olds (M = 53 months, range 48–59 months; 10 girls and 6 boys), 16 7-year-olds (M = 90 months, range 84–96 months; 8 girls and 8 boys), and 16 adults (M = 19 years, range 18–21 years; 14 women and 2 men) participated.

Design and procedure. In this study we eliminated the explicit judgment question. This question, however, extended the lag between the informants' answers about the first picture and participants' choice of an informant for the second picture. Further, it may have served a memory function. Thus, in its place we included memory questions, such as "What did Sandra say Jill drew? What did Susan say Jill drew?" In case of error, the experimenter repeated informants' utterances and the question. Otherwise, the materials and design of the study were the same as those in Experiment 2.

After completing the information-seeking task, the participants were asked about their informant selection strategies, namely, how they chose whom to ask. The goal was to determine whether children spontaneously refer to prior accuracy as a factor in their informant selection.

Results and Discussion

Participants had no difficulty remembering who said what. Adults recalled 100%, 7-year-olds 93%, and 4-year-olds 86% of the informants' responses about the first pictures. All children who erred on the first memory probe responded correctly to the second one.

As Table 1 shows, even in the absence of external evaluative demands, 7-year-olds and adults used a single instance of past

accuracy to select informants. The proportion of trials on which participants selected the previously correct informant was submitted to a one-way ANOVA with age as a between-subject variable. The ANOVA showed a significant effect of age, $F(2, 45) = 13.707$, $p < .001$, $\eta_p^2 = .38$. Adults were significantly more likely to select the previously correct informant than were either 4-year-olds, $t(30) = 5.212$, $p < .001$, or 7-year-olds, $t(30) = 2.6$, $p = .012$. Seven-year-olds were more likely to do so than were 4-year-olds, $t(30) = 2.6$, $p = .012$. Seven-year-olds and adults selected the previously correct informant significantly above chance, $t(15) = 3.930$, $p = .001$ for 7-year-olds and $t(15) = 6.376$, $p < .001$ for adults, but 4-year-olds were at chance, $t(15) = 0.899$, $p = .38$. As in the previous experiments, the probability of selecting the previously correct informant did not significantly increase over trials in any of the groups.

Fourteen adults, four 7-year-olds, and no 4-year-olds pointed to informants' previous accuracy as a factor in their subsequent decisions about whom to ask. Four-year-olds generally reported that they did not know how they made their decisions. Interestingly, the four 7-year-olds who identified informants' accuracy as a factor always selected the previously accurate informant. Excluding these children, the remaining 7-year-olds selected the previously correct informant 62% of the time, which was still significantly different from chance, $t(11) = 2.69$, $p = .02$. Thus, even though 7-year-olds are influenced by informants' past accuracy, they appear unaware of the effect of this factor on their information seeking.

General Discussion

The present studies demonstrate that by age 7 children can selectively seek information after a single previous encounter with informants. It may seem irrational that a single observation can provide children and adults with grounds for selective information seeking (e.g., Liu et al., 2007). What explains the power of a single act of testimony to guide subsequent interactions?

The sensitivity of person-perception processes to minimal information can be attributed to phylogenetic factors. Quick evaluations of conspecifics may be used to rapidly make judgments that enable survival and adaptation to the environment (Ambady & Rosenthal, 1992; Hamlin, Wynn, & Bloom, 2007). Evaluations of trustworthiness in particular may be linked to the automatic responding to others associated with the approach/avoidance system anchored in the amygdala (e.g., Engell, Haxby, & Todorov, 2007). The development of sensitivity to single encounters in information seeking may depend and draw on such biological adaptations.

Our findings, however, call attention to experiential factors, in particular language, that may underlie the development of sensitivity to single encounters. Recent studies suggest that in conditions of multiple encounters, 4-year-olds attend to informants' past accuracy even in the absence of an explicit judgment question (Birch et al., 2008; Corriveau & Harris, 2009; Nurmsoo & Robinson, 2009). In the present research, however, 4-year-olds showed selective information seeking only when their monitoring of informants was framed in dispositional terms. This effect shows that language *can* mediate the effect of informants' past accuracy on children's subsequent informant selection. Furthermore, it is consistent with research suggesting that preschoolers have difficulty making behavioral predictions from single observations of behavior and that trait-relevant labels enable them to overcome this difficulty (Cain et al., 1997; Liu et al., 2007). The presence of trait-relevant labels in ambient language may initially enable children's reliance on single observations. Eventually, they may not be needed.

At a computational level, the sensitivity to differences between informants based on single acts of testimony can be explained by several different algorithms (e.g., Gigerenzer & Goldstein, 1996; Mozer, Pashler, & Homaei, 2008; Vul, Goodman, Griffiths, & Tenenbaum, 2009). In a recent investigation of the mechanism supporting specifically children's monitoring of informant accuracy, Pasquini et al. (2007) showed that 4-year-olds selectively trust an informant who has made fewer erroneous statements on four trials compared to another informant and argued that 4-year-olds monitor the frequency of informant errors. They acknowledged though that their results could also be explained by a mechanism for monitoring the proportion of informant errors. Our findings favor the former interpretation. The difference between our informants represented in terms of proportion of errors was extreme, 100% versus 0%, and 4-year-olds have discriminated informants with ease in this condition in previous studies. In contrast, the difference between our informants represented in terms of number of errors was one, which has never been tested before, and it may be too small for 4-year-olds to discriminate between informants. The framing of behavior in terms of dispositional traits may magnify such small differences.

We should note, however, that Pasquini et al.'s (2007) and our findings are also consistent with a Bayesian updating mechanism, which has been recently applied to other areas of children's cognition (e.g., Gopnik et al., 2004; Xu & Tenenbaum, 2007). Bayesian updating depends on the learners' prior beliefs about a hypothesis (e.g., how probable it is that a person is knowledgeable) and about the diagnosticity of evidence. Thus, it can capture the effects of factors such as testimonial domain on children's inferences about informants, which heretofore have not been directly tested but may be important. Indeed, our use of situational, event-related information contrasts with the focus of previous research on testimony implicating conventional knowledge (e.g., regarding common object labels and functions). One of the potentially important differences is that knowledge regarding common objects is widely distributed. In contrast, knowledge about what a person has done in some specific spatiotemporal context is narrowly distributed. More generally, Danovitch and Keil (2004) suggested that the causal links binding the knowledge of different domains might vary. A Bayesian account of informant monitoring thus could be called for to represent different baseline assumptions about informant knowledgeability and the diagnosticity of evidence in different domains.

In addition, Bayesian updating reflects the change in learners' beliefs about a hypothesis *as evidence accumulates*. Thus, it speaks to what is intuitively the key difference between ours and previous research, namely the number of observations on which participants had to base their selection of an informant. Future studies should examine children's selection of an informant after different numbers of observations keeping the difference in errors the same. This would make it possible to distinguish between an error-frequency-monitoring and a Bayesian-updating mechanism. If children monitor error frequency, their discrimination between informants would be the same regardless of the number of observations of informants. A Bayesian mechanism, however, would

predict that the discrimination between informants would decrease as the number of observations increases.

Interestingly, 3-year-olds' performance in Pasquini et al.'s (2007) study was not affected by the relative number of informants' errors but by whether informants made an error or not. Thus, paradoxically, 3-year-olds might be more likely than 4-year-olds to select an informant who has been correct once over an informant who has been incorrect once. Further research with younger children could help refine our understanding of children's informant monitoring and how informant monitoring changes with age. It should be noted though that in Pasquini et al.'s study, 3-year-olds' performance might have been affected by the fact that informants made highly unusual errors in labeling common objects (e.g., calling a spoon "a duck"). Their sensitivity to the relative accuracy of informants may decrease when informants make less unusual errors. Event reporting errors may be such less unusual errors because events are often fleeting and nonrecurrent. (In contrast, object labeling practices are relatively stable and recurrent.)

In conclusion, we have shown that single encounters enable selective information seeking in children by age 7. It remains to be seen to what extent children believe, are willing to act on, and to spread information obtained from informants chosen on the basis of their accuracy in a single previous encounter. Additional research is also needed to determine whether single encounters create long-lasting traces in memory and influence children's perception of a person in the long term, as they do for adults (Todorov & Uleman, 2004). The answers to these questions will have implications not only for understanding the impact of single encounters on children's knowledge development but also for understanding the foundations of their interpersonal behavior.

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